Appendix B – City of Winnipeg Southwest Transitway Stage 2 – Functional Design Report
(Revised 2015-10-08)
April 30, 2015

Winnipeg Transit
Service Development Division
421 Osborne Street
Winnipeg, Manitoba
R3L 2A2
Canada

Attention: Björn Rådström, BSc(CE), P. Eng.
Manager of Service Development

Functional Design Report for the Southwest Transitway – Stage 2

Dear Mr. Rådström,

Dillon is pleased to submit the final Functional Design Report for Stage 2 of the Southwest Transitway. The report documents the functional design prepared by Dillon and its sub-consultants (AECOM, McGowan Russell Group, and Landmark Planning & Design Inc.) for the Phase I assignment of City of Winnipeg RFP 685-2013.

The report describes the recommended transitway alignment, summarizes background investigations, fully documents the functional design analysis, includes all functional design drawings, identifies property requirements, outlines construction sequencing considerations, and summarizes stakeholder and public consultation undertaken for the Phase I assignment.

We appreciate the assistance that you and your colleagues at the City provided our consulting team during the course of this project.

Yours sincerely,

Dillon Consulting Limited

[Signature]

Dave Krahn, P.Eng.
Project Manager

DPK: cgc
Our File: 13-8439
Executive Summary

Notice to Respondents to Southwest Rapid Transitway (Stage 2) and Pembina Highway Underpass Project

The functional designs for the Southwest Rapid Transit (Stage 2) and Pembina Highway Underpass project that are described in this report were prepared to generally accepted City of Winnipeg standards. In the preparation of proposals, the information in this report is to be used as a guide only. All designs included in proposals and all required approvals are the responsibility of the proponent.

Introduction

Dillon Consulting Limited, in association with AECOM, McGowan Russell Group, and Landmark Planning & Design Inc., is pleased to submit the Functional Design Report for the Southwest Transitway – Stage 2 project in fulfillment of the Phase I assignment for City of Winnipeg RFP 685-2013.

This Functional Design Report describes the recommended transitway alignment, summarizes background investigations (existing agreements, major institutional stakeholder consultations, deep utilities analysis, geotechnical assessment, and environmental assessment), fully documents the functional design analysis, includes all functional design drawings, identifies property requirements, outlines construction sequencing considerations, and summarizes stakeholder and public consultation undertaken for the Phase I work.

Southwest Transitway - Stage 2 and Pembina Underpass Projects

While the transitway project was the focus of this assignment, the City of Winnipeg plans to combine the Southwest Transitway – Stage 2 project, the Pembina Underpass project, and associated land drainage works in a single Public Private Partnership (PPP) procurement. This City’s official name for the combined project is the Southwest Rapid Transitway (Stage 2) and Pembina Highway Underpass project. In this report, the combined project is referred to as the SWT2-Pembina Underpass project.

In August 2013, Dillon, in association with AECOM, completed the Preliminary Engineering Study for Upgrading the Pembina Highway Underpass (CN Rivers Subdivision Mile 2.65). That assignment provided the City with recommendations on structures, road works, land drainage, and railway works for the Pembina Underpass project. Recommendations from that assignment are incorporated into this functional design report for Stage 2 of the Southwest Transitway. In particular, information in this report related to geotechnical assessment, grade separations and structures, land drainage, railway works, active transportation, and property requirements consider the combined components of the SWT2-Pembina Underpass project, rather than only the transitway ones.

Recommended Transitway Alignment

Based on extensive planning, analysis, and stakeholder consultation undertaken during the Phase I assignment, a recommended specific alignment for the Stage 2 transitway was developed. In Appendix A, an overview drawing of the recommended alignment is shown in Figure 2, with more detailed alignment drawings shown in Figures 14a, 14b, 14c, and 14d.

The recommended alignment extends the Southwest Transitway from the south limit of the Stage 1 transitway near Pembina Highway and Jubilee Avenue through the Parker/Hydro Corridor to the intersection of the CN Letellier right-of-way at Markham Road. A transitway alignment between the CN Letellier subdivision and Investors Group Field/University of Manitoba is recommended via Southpark Drive and the University of Manitoba’s Southwood lands.

The recommended alignment for Southwest Transitway - Stage 2 component of the SWT2-Pembina Underpass project includes:

- A new Transitway Bridge over Pembina Highway;
- New Transitway Underpasses of CN Wye Tracks at the CN Portage Junction;
- A signalized at-grade intersection in the Parker lands at Georgina Street;
- A new Transitway Overpass of McGillivray Boulevard;
- A signalized at-grade intersection at Clarence Avenue;
- A signalized at-grade intersection at Chevrier Avenue;
- A Transitway Tunnel beneath the CN Letellier rail line and spur lines (Letellier Tunnel);
- A new Transitway Bridge over Bishop Grandin Boulevard;
- A new CN Rail Bridge over Bishop Grandin Boulevard;
- A signalized at-grade intersection at Chancellor Drive;
- A signalized at-grade intersection at Markham Road;
- A reconstruction of Southpark Drive between the CN Letellier right-of-way and Pembina Highway (with a “complete street” design that incorporates pedestrian, cycling, transit, and automobile functions);
- A new signalized intersection at Southpark Drive and Pembina Highway; and,
- An alignment through the University of Manitoba’s Southwood lands developed in collaboration with the University. Note that, while the long-term alignment will employ transit-only curb lanes in a future four-lane roadway through the Southwood lands, the SWT2-Pembina Underpass project includes an interim transit-only roadway for use until such time as the four-lane roadway is constructed.
Existing Agreements

Existing agreements that are relevant to the Southwest Transitway include one between the City of Winnipeg and CN regarding the use of the CN Letellier Subdivision for a "busway", and lease agreements on lands owned by Manitoba Hydro within or near the specified alignment for Stage 2 of the Southwest Transitway.

On October 13, 1994, the City and Canadian National Railway Company (CN) concluded an agreement regarding an exchange of properties required for certain of the City’s urban transportation projects, including the Southwest Rapid Transit Corridor. The agreement requires that CN lease to the City, for purposes of a transit corridor, lands in the eastern half of the Letellier subdivision between the north limit of the subdivision (at its intersection with the CN mainline at Portage Junction) and Bison Drive (the lands are referred to as the "Letellier Corridor Lands"). With a term of 99 years that commenced on January 1, 1990, the lease must be executed within 180 days after receipt by CN of notice from the City that possession is required, and vacant possession and control of the Letellier Corridor Lands must be delivered to the City by CN upon completion of the westerly relocation of the Letellier tracks within 24 months of the said notice.

Based on the recommended transitway alignment, only the section of the Letellier Corridor Lands between a point south of the Letellier Tunnel and Markham Road is required for the Southwest Transitway - Stage 2 project.

Within the Manitoba Hydro right-of-way in the north-south portion between Parker Avenue and Bishop Grandin Boulevard, there are approximately ten lease agreements between Manitoba Hydro and private interests for use of Manitoba Hydro land for parking or outdoor storage purposes. Manitoba Hydro has indicated that, while the existing leases can be re-negotiated or terminated to accommodate transitway requirements, the City would be required to indemnify Manitoba Hydro for any costs, claims, and damages that might arise against Manitoba Hydro resulting from the re-negotiation or termination of these leases.

There is an existing agreement between Manitoba Hydro and the City for use of a portion of the Manitoba Hydro right-of-way for the off-leash Brenda Leipsic Dog Park. During the development of the functional design for the transitway, a relocation of the dog park within the Manitoba Hydro right-of-way was identified. Further consultation with the Parks and Open Space Division of the Public Works Department and Manitoba Hydro will be required during final design to determine how requirements for the dog park might be accommodated by the project.

Investigations with Major Institutional Stakeholders

During the functional design study, extensive consultation was undertaken with CN, Manitoba Hydro, and the University of Manitoba to ensure that the recommended transitway alignment is compatible with existing and planned rail and hydro infrastructure and with the University's development plans.

Discussions with CN focused on the development and review of the rail works required to accommodate the SWTZ-Pembina Underpass project and on the planned PPP procurement.

Consultations with Manitoba Hydro identified vertical and horizontal buffers around towers/lines to comply with safety and maintenance requirements, reviewed future development plans for transmission lines in the hydro corridor, and determined "early works" that Manitoba Hydro is to undertake to relocate certain hydro lines prior to construction of the transitway on the recommended alignment.

Consultations were undertaken with the University of Manitoba to determine the integration of the transitway on lands currently owned by the University. The major issues included the alignment of the transitway and active transportation path through the Southwood Lands (former golf course property acquired by the University for long-term development), the conceptual design of a major transit terminal to service events at Investors Group Field, the on-street routing of rapid transit service on the University's Fort Garry campus, the location of an on-campus bus staging area at the end of the rapid transit route path, and the locations of transit stations/stops on University lands.

Deep Utilities Investigation

Based on the deep utilities investigation, the recommended alignment for the transitway does not require relocation of the existing Branch II Aqueduct or of the Fort Garry-St. Vital (FGSV) Feedermain. Anticipated changes to soil covers over top of the pipelines are limited to landscaping and drainage improvements and are not anticipated to negatively impact either of the pipelines. However, several pipeline load protection structures and casings must be constructed to accommodate the repositioning of the CN Letellier rail track and spur lines (CN North Spur Line (WC07 to Manitoba Hydro) and CN South Spur Line (WC21 to Harris Transport)). The repositioning of the CN Letellier rail track over the Lot 16 Drain does not meet CN’s pipeline crossing requirements, and either a relocation of the Lot 16 Drain or a bridging structure for the rail track will be required.

Geotechnical Assessment

A geotechnical investigation program consisting of six test holes was completed in January 2014 to supplement the information gathered from 12 test holes drilled in December 2011 for the Pembina Underpass project. The encountered subsurface condition is typical of the Winnipeg area and generally consists of glacio-lacustrine clay deposit over till over limestone bedrock.

Design and construction approaches used for the Fort Rouge tunnel of Stage 1 of the Southwest Transitway can be adopted with the necessary modifications for the Letellier Tunnel. Technical aspects including, but not limited to, excavation proximity to the existing tracks, temporary shoring system, excavation stability, ground displacement and performance monitoring were successfully addressed in Fort Rouge tunnel construction and can efficiently be applied to this project.

Groundwater control and aquifer depressurization requirements may arise for deep excavations below elevation 224 to 225 m. Raft foundations can be designed to support the Letellier Tunnel. Aspects of soil rebound, settlement, and sea level rise need to be carefully considered in the design and construction staging.

Based on the available information, driven steel H piles are the most cost efficient pile type to support the proposed transitway structures at McGillivray and at Grandin Bishop. Pile dynamic monitoring is recommended to verify design assumptions and confirm mobilized pile capacities during construction.

Shallow foundation and friction piles can be designed to support lightly loaded structures.

MSE wall system is identified as a feasible soil retention system for fill application at bridge approaches. External stability concerns call for the use of light weight fill which is expected to be significant in the vicinity of the bridge abutments. Reinforced concrete wall is identified as a feasible system at tunnel approaches.
Subgrade preparation includes removal and replacement of silt layers, if encountered, and compaction of the subgrade surface. Plain dwelled concrete pavement section comparable to a standard pavement section used for heavily trafficked streets in the City of Winnipeg is expected to perform satisfactorily for this project.

While the existing cut slopes at Bishop Grandin Boulevard can be maintained, stabilization measures including the use of light weight fill, crest unload, and surface and internal drainage improvement will be required.

Environmental Assessment

The Southwest Transitway – Stage 2 project is considered a Class 2 Development under the requirements of the Manitoba Environment Act, and therefore requires submission of an Environmental Impact Statement (EIS) and approval by Manitoba Conservation and Water Stewardship (MCWS) to obtain an Environment Act License (EAL).

Under the Canadian Environmental Assessment Act (CEAA) 2012, the project does NOT require review or approval by the Canadian Environmental Assessment Agency.

The EIS was submitted to MCWS in April 2014 in a report entitled “City of Winnipeg Southwest Rapid Transit Corridor – Stage 2: Environmental Review and Assessment”. On December 18, 2014, the City of Winnipeg was issued Environmental Act License No. 3121 by MCWS for the Southwest Transitway – Stage 2 project.

Functional Design Elements

Transitway Runningway Design

Distinct types of cross-section are recommended for different sections of the transitway. These include an urban cross-section, a rural cross-section, a tunnel/underpass cross-section, a cross-section for Investors Group Field Station, and various cross-sections for transitway connections to the street system.

An urban cross-section is recommended for the following sections of the transitway:

- Through all transitway stations;
- Between the southern limit of the Stage 1 transitway and the Transitway Underpasses of the CN Wye Tracks;
- Through the Transitway Underpasses of the CN Wye Tracks;
- On the Transitway Overpass of McGillivray Boulevard; and,
- Between the Letellier Tunnel and Markham Road.

A rural cross-section is recommended for the following sections of the transitway:

- Between the Transitway Underpasses of the CN Wye Tracks and Parker Station;
- Between Parker Station and McGillivray Station;
- Between McGillivray Station and the Transitway Overpass of McGillivray Boulevard;
- Between the Transitway Overpass of McGillivray Boulevard and Clarence Station;
- Between Clarence Station and Chevrier Station; and,
- Between Chevrier Station and the Letellier Tunnel.

A tunnel/underpass cross-section is recommended for:

- Transitway Underpasses of the CN Wye Tracks at Portage Junction; and,
- Letellier Tunnel.

The recommended cross-section at Investors Group Field Station includes:

- Central platform connected to Investors Group Field by an overhead pedestrian walkway; and,
- Four lanes on each of north and south sides of the platform (three passenger loading lanes, one bus circulation lane).

Transitway connections to the street system are to be provided at Beaumont Street, Georgina Street, Willson Place (for Park and Ride users), Seel Avenue, Waller Avenue (for Park and Ride users), Clarence Avenue, Chevrier Boulevard, Chancellor Drive, Southpark Drive, Markham Road, and University Crescent.

The pavement designs for the transitway are based on American Association of State Highway and Transportation Officials (AASHTO) guidelines, but modified to reflect bus operations volumes, loaded bus axle weights, geotechnical information, local best practices, constructability, and experience gained during the Southwest Transitway - Stage 1 project. In particular, local soil conditions for the Stage 2 project require pavement structures deeper than those outlined in the AASHTO guidelines. This will result in an increased drainable sub-base to keep moisture levels low, to reduce susceptibility to frost, and to maintain structure strength.

Three different types of pavement design are used for different sections of the transitway. These include a concrete pavement structure for the runningways, station lanes, and transitway connections to the street system, a concrete pavement structure for the Letellier Tunnel, and an asphalt pavement structure for parking lots.

Stations

On the high speed portions of the transitway, stations are spaced at intervals of approximately 0.5 to 1.0 km. Within this range, stations are located to provide convenient pedestrian access from nearby developments (both existing and proposed ones), to enable efficient bus access/egress to/from the street system at various points along the transitway, and to provide opportunities for Park and Ride facilities at strategic sites.

On the lower speed portions of the transitway, such as on the University of Manitoba lands, stations are located at shorter intervals of 300 to 500 m to provide good integration of the rapid transit service with the adjacent high-density land uses.

It is recommended that Stage 2 of the Southwest Transitway include seven new stations along the transitway, a stop in each direction on Southpark Drive immediately west of Pembina Highway, a new station or stops in the Southwood lands (to be built in conjunction with future development), a new event-day station at Investors Group Field, upgrades of existing stops on the University of Manitoba campus, and a major upgrade of the University of Manitoba Station on Dafoe Road (including a new bus staging area near the east end of Dafoe Road).

The functional design includes general layouts for typical stations for the transitway. The final designs for the stations are to be based on these layouts and are to use a set of components and materials that are consistent and compatible with those used in the stations for Stage 1 of the Southwest Transitway.
For those sections of the rapid transit routes that operate on-street with other traffic, new or upgraded stops are recommended to be implemented based on designs typically used for Winnipeg Transit’s Bus Stop Upgrade Program.

Park and Ride, Kiss and Ride
Park and Ride facilities are proposed on the west side of the transitway at McGillivray Station (approximately 700 parking spaces) and at Clarence Station (approximately 400 parking spaces) to accommodate commuter travel to/from downtown, commuter travel to/from the University of Manitoba, and travel to/from events at Investors Group Field. These facilities are to include paved parking lots, electrical plugs for block heaters in designated areas, prominent identification signage, prominent wayfinding and conditions of use signage, and improvements to connecting streets to enable convenient vehicular access and egress.

Kiss and Ride facilities, designed to accommodate passengers making a mode change between rapid transit and automobile passenger to complete their trips, are recommended at Parker Station (off-street), McGillivray Station (off-street), Clarence Station (off-street), Chancellor Station (on-street) and Markham Station (on-street). At Chevrier Station and Plaza Station, opportunities for Kiss and Ride have not been identified due to lack of sufficient space at the station or area plans in the vicinity of the station not yet being finalized.

Bus Staging Areas
Bus staging areas are required at McGillivray Station and on the Fort Garry Campus of the University of Manitoba.

The bus staging area at McGillivray Station is required to position standby buses for insertion into regular rapid transit service in either the northbound or southbound direction, to position standby buses for insertion into southbound service for events at Investors Group Field, to provide a turnaround loop to short-turn regular southbound rapid transit buses, and to provide a turnaround loop to short-turn northbound buses operating from Investors Group Field following events at the stadium.

To support its development plans, the University of Manitoba has indicated that two-way transit service is preferred on the portion of Dafoe Road east of University Crescent. To enable two-way operation, a new bus staging area (with a capacity for 12 bus layover spaces) is required at the east end of Dafoe Road.

Street Connections, At-Grade Intersections, and Transit Priority Measures
Connections between the transitway and the street system are required at the following locations to permit transit routes operating on the transitway to be “through-routed” to/from their various destinations in southwest Winnipeg:

- Parker Station with Beaumont Street;
- Parker Station with Hurst Way/Wilkes Avenue/Sterling Lyon Parkway;
- McGillivray Station with Seel Avenue;
- Clarence Station with Clarence Avenue;
- Chevrier Station with Chevrier Boulevard;
- Chancellor Station with Chancellor Drive;
- Transitway with Southpark Drive;
- Markham Station with Markham Road; and,
- IGF Station with University Crescent.

To provide for the street connections, new at-grade intersections between the transitway and the street system are required at:

- Beaumont Street (at Parker Station);
- Georgina Street (at Parker Station);
- Seel Avenue (at McGillivray Station);
- Clarence Avenue (near Clarence Station);
- Chevrier Boulevard (near Chevrier Station);
- Chancellor Drive (at Chancellor Station);
- Southpark Drive;
- Markham Road (at Markham Station);
- Markham Road (in Southwood Lands); and,
- University Crescent/Dysart Road (near Investors Group Field (IGF) Station).

In addition, alterations are required at the following existing at-grade intersections to accommodate the planned rapid transit route paths:

- Southpark Drive at Pembina Highway (reconfigured intersection, new traffic signals with transit signal priority); and,
- Markham Road at Pembina Highway (lengthened northbound left turn storage lane, revisions to signal timing to accommodate eastbound right and northbound left movements by buses).

New traffic signals, incorporating transit signal priority, are required at the following new at-grade intersections of the transitway:

- Georgina Street;
- Clarence Avenue;
- Chevrier Boulevard;
- Chancellor Drive;
- Markham Road (at Markham Station); and,
- University Crescent/Dysart Road (for bus access/egress to/from IGF Station)

At the Chancellor Drive and Markham Road intersections, the transitway crossing of the street system is in close proximity to the CN Letellier track. Flashing warning signals currently operate at these rail crossings to stop on-street eastbound and westbound traffic and pedestrians while a train passes. New CN/City of Winnipeg signals will be required to stop on-street eastbound/westbound traffic, pedestrians, and southbound transitway buses intending to turn right from the transitway onto either Chancellor Drive or Markham Road when a train is passing.
Appendix A

For geographic context, in Figures 38, 39, 40, show more detailed location plans for the individual structures.

The proposed land drainage design considers both the Southwest Transitway – Stage 2 and the Pembina Highway Underpass components of the SWT2-Pembina Underpass project.

The drainage concept for the Southwest Transitway – Stage 2 Project was developed in consideration of existing and planned alignments for Manitoba Hydro and CN infrastructure, of the existing locations of the Branch II Aqueduct and Fort Garry Feedermain, and of the transitway’s structures, grade separations, stations, and street connections.

The drainage concept consists of a combination of new land drainage sewers and ditches along the Southwest Transitway which will drain into existing adjacent land drainage systems. This is standard design practice provided that an analysis has been carried out to show that there is no increase in the peak flow rate to the existing sewers. The adjacent systems include D’Arcy Drive, the University of Manitoba Southwood Lands, Lot 16 Drain, Riviera Crescent, Somerset Avenue and Parker Retention Pond. The proposed pond is part of a separate on-going project, the Cockburn and Calrossie Combined Sewer Relief Works, and has been included in the list of adjacent systems as drainage along Parker Avenue will be routed east toward the pond via ditches. It is also proposed that runoff at the Transitway Underpasses of the CN Wye tracks be pumped into the pond.

With the exception of a few sections near stations where 400 to 600 mm diameter land drainage sewers (LDS) is required, ditching is proposed along the Southwest Transitway between Parker Avenue and Chevrier Boulevard. Drainage near the Letellier Tunnel is restricted due to the wetland areas of numerous conflicts and consists of LDS (ranging from 375 to 700 mm diameter). Between Bishop Grandin Boulevard and Markham Road/IGF Station, a new LDS system is proposed with diameters ranging from 750 mm near IGF Station to 900 mm along the transitway and 1050 mm downstream to a tie-in to the existing D’Arcy Drive system. Depending on future development in the Southwood lands, it may be possible to develop a more optimal drainage plan for the section of the transitway between the CN Letellier right-of-way and IGF Station.

For geographic context, in Appendix A, Figure 2 shows the general locations of the grade separation structures in relation to the recommended transitway alignment, and Figures 38, 39, 40, and 41 show more detailed location plans for the individual structures.

**Land Drainage**

The proposed land drainage design considers both the Southwest Transitway – Stage 2 and the Pembina Highway Underpass components of the SWT2-Pembina Underpass project.

The at-grade drainage design is based on a 5-year MacLaren storm rainfall in accordance with City of Winnipeg design standards. The drainage design for the underpass/tunnel areas is based on a target 50-year MacLaren rainfall total capacity. Due to the flow restriction into the adjacent land drainage sewer systems, the majority of the ditches along the transitway are designed to provide the necessary storage capacity to handle a 100-year MacLaren rainfall. Two pumping stations, at the Letellier Tunnel and at the Transitway Underpasses of the CN Wye Tracks, are included as part of the land drainage concept.

**Railway Works**

The SWT2-Pembina Underpass project requires that the following railway works be undertaken:

- The construction of the new CN Rail Bridge over Pembina Highway that accommodates three existing tracks, a future fourth track, and, on the south side of the bridge, an improved service road;
- The demolition of the existing CN Bridge over Pembina Highway, including all existing retaining walls;
- The relocation of existing tracks within the CN Rivers subdivision to align with the new CN Rail Bridge over Pembina Highway;
- The construction of new transitway underpasses of the CN Wye tracks at Portage J junction;
- The relocation of the two existing wye tracks at Portage J junction to the transitway underpass structures;
- The relocation of the wye tracks at Portage J junction to align with the relocated CN Rivers tracks;
- The construction of the Letellier Tunnel beneath the CN Fort Garry Industrial Leads and the CN Letellier track (requires temporary shoofly to accommodate construction of the tunnel);
- The realignment of two CN Fort Garry Industrial Leads tracks (WC07 and WC21);
- The construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel and immediately west of the existing rail bridge over Bishop Grandin;
- The demolition of the existing CN Letellier Rail Bridge over Bishop Grandin Boulevard (a new Transitway Bridge over Bishop Grandin Boulevard is to be constructed in the current location of the existing rail bridge); and,
- The westerly relocation of existing track, signals and switches within the CN Letellier right-of-way between the south end of the Letellier Tunnel and a point south of Markham Road.

Within the Letellier right-of-way between the Letellier Tunnel and a point south of Markham Road, the relocated track is to be offset 5.7 m to the west of its existing alignment and a CN service road is to be positioned adjacent to the west side of the relocated track. New traffic signals, integrated with railway warning devices, are to be installed at Chancellor Drive and at Markham Road where these streets intersect the transitway and the Letellier track.

Under an existing agreement with the City of Winnipeg, there is a private vehicle crossing of the Letellier track in the vicinity of Plaza Station. This vehicle crossing is to be removed and replaced with an alternative pedestrian/cycling facility that links Plaza Station with the west side of the track.
Utilities
The project requires removal/relocation of hydro infrastructure (including transmission, communication, and distribution lines) along the transitway alignment. Extensive consultation with Manitoba Hydro has been undertaken to develop a plan of hydro-related work that accommodates the project and the safety, maintenance, and long range planning needs of Manitoba Hydro.

New street lighting and cabling is required throughout the entire length of the transit corridor, in all adjacent parking lots, and along new transitway connections to the street system. In addition, existing street lighting where the transitway intersects the street system will be reconfigured.

The transitway alignment crosses three existing natural gas distribution lines: A 200 mm line along Chevrier Boulevard, a 50 mm line along Chancellor Drive, and a 50 mm line along Markham Road. These lines will be required to be lowered where the transitway crosses them.

For lines owned by MTS, Shaw, Telus, and TeraSpan, there are various underground and overhead lines that will require relocation. The Pembina Trails School Division has an existing underground fibre optic line that crosses the transitway alignment at Seel Avenue and will be required to be lowered.

Active Transportation (AT)
The existing active transportation path adjacent to the Stage 1 transitway is to be extended along the Stage 2 transitway. It is to have a sufficient width to accommodate commuter cyclists, recreational cyclists, and pedestrians, with separate lanes for each of cyclists and pedestrians; to connect with existing and planned paths in the active transportation network at several locations along the transitway; to include signal activation by cyclists/pedestrians where the path crosses streets at intersections controlled by traffic signals; to be included in transitway underpass, overpass, and bridge structures; to connect directly to all stations; and to be served by bicycle storage facilities at each station.

Station and Pathway Lighting, Landscaping, Aesthetics, Fencing, Noise Attenuation
While regular street lighting will be installed throughout the length of the transitway, additional lighting is required in station areas and along portions of the active transportation pathways where the transitway street lights do not provide sufficient illumination.

The landscaping and aesthetic design is to be consistent with landscaping and aesthetic treatments (including use of rapid transit logo and colours) for Stage 1 of the Southwest Transitway.

The City of Winnipeg has an agreement with Manitoba Hydro to lease land within the Manitoba Hydro right-of-way for the purposes of an off-leash dog park. As the alignment for Stage 2 of the transitway traverses through the existing Brenda Leipsic Dog Park, a reconfiguration of the dog park will be necessary if the City and Manitoba Hydro determine that a dog park is to be maintained within the Manitoba Hydro right-of-way.

Fencing required for the transitway includes a decorative stainless steel fence (incorporating the rapid transit logo) mounted on the median barrier in stations, decorative fencing between stations and the rail track within the CN Letellier right-of-way, standard fencing between the dog park and the transitway, standard fencing between the transitway runningway and the rail track within the CN Letellier right-of-way, and standard fencing adjacent to the retaining walls of the Letellier Tunnel.

A noise attenuation wall is required to reduce the noise impacts of freight train operations for residents of Waverley Heights. The noise attenuation wall, of concrete construction and incorporating appropriate aesthetics, is to be located on the west property line of the City’s feeder easement between the north end of the residential area (opposite Lake Village Road) and a point south of Markham Road.
The traffic congestion on Pembina Highway that will result during the construction of the new CN Bridge over Pembina Highway, the Transitway Bridge over Pembina Highway, the widening of Pembina Highway, and associated drainage works will require that a rapid transit routing alignment be used to provide reliable service during construction. Such an alignment could include a combination of on-street operation, on-street transit priority measures, and transitway runningway segments between structures built prior to the completion of the structures.

Public Engagement Program

A public engagement program was undertaken to assist with the development of the functional design for the transitway. The program was designed to comply with basic public engagement principles of early, regular, and integrated involvement of key stakeholders and the general public throughout the development of the functional design.

The consultation program was carried out as a two-round process over a period of five months between October 2013 and February 2014. The full “Public Engagement Report” for the Southwest Transitway - Stage 2 project, prepared by Landmark Planning & Design Inc., is attached in Appendix P and describes the consultation methodology and project inputs received for both rounds of the consultation program.

The focus for stakeholder feedback was specifically directed towards the transitway alignment for Stage 2 that had previously been approved by City Council. A substantial amount of useful, project-relevant feedback was received and integrated into decision-making by the functional design team.
# Table of Contents

1.0 Introduction ......................................................................................................................... 1

2.0 Recommended Transitway Alignment .................................................................................. 2

   2.1 Conceptual Transitway Alignment Recommended by the Southwest Rapid Transit Corridor
       Stage 2 Alignment Study ........................................................................................................ 2

   2.2 Recommended Specific Alignment for Stage 2 Transitway .................................................. 2

      2.2.1 Overview of Specific Alignment ................................................................................. 2

      2.2.2 Transitway Bridge over Pembina, Uppers of Wye Tracks of CN Letellier Subdivision ... 3

      2.2.3 Alignment through Parker Lands West of Stage 1 Transitway ................................. 3

      2.2.4 Alignment within Manitoba Hydro Right-of-Way between Parker Avenue and
           Letellier Tunnel ............................................................................................................... 4

      2.2.5 Grade-Separated Crossing of CN Letellier Tracks (Letellier Tunnel) ....................... 5

      2.2.6 Alignment between Letellier Tunnel and Markham Road ......................................... 5

      2.2.7 Alignment between the CN Letellier Subdivision and Investors Group Field/University
           of Manitoba .................................................................................................................... 6

      2.2.8 Alignment Drawings ................................................................................................. 6

3.0 Background Investigations .................................................................................................. 7

   3.1 Existing Agreements .......................................................................................................... 7

      3.1.1 1994 City CN Agreement ............................................................................................. 7

      3.1.2 Existing Lease Agreements .......................................................................................... 7

   3.2 Investigations with Major Institutional Stakeholders .......................................................... 8

      3.2.1 CN ............................................................................................................................... 8

      3.2.2 Manitoba Hydro ......................................................................................................... 8

      3.2.3 University of Manitoba ............................................................................................... 9

   3.3 Deep Utilities Investigation ............................................................................................... 10

      3.3.1 Overview ..................................................................................................................... 10

      3.3.2 Data Collection and Review ....................................................................................... 11

      3.3.3 Applied Loads ............................................................................................................. 11

      3.3.4 Branch II Aqueduct .................................................................................................... 13

      3.3.5 Fort Garry-St. Vital Feedermain ............................................................................... 16

      3.3.6 Fort Garry Feedermain ............................................................................................... 17

      3.3.7 Lot 16 Drain ............................................................................................................... 18

      3.3.8 Railway Crossings ...................................................................................................... 18

   3.4 Geotechnical Assessment .................................................................................................. 21

      3.4.1 Introduction ................................................................................................................ 21

      3.4.2 Available Information .................................................................................................. 21

      3.4.3 Geotechnical Investigation ........................................................................................ 22

      3.4.4 Tunnel Excavations and Temporary Shoring ............................................................. 25

      3.4.5 Foundations for Cut and Cover Tunnel ...................................................................... 29

      3.4.6 Foundations for Bridges and Heavily Loaded Structures ........................................ 30

      3.4.7 Foundations for Lightly Loaded Structures ............................................................... 32

      3.4.8 Lateral Loads and Retaining Walls .......................................................................... 33

      3.4.9 Slope Stability ............................................................................................................ 35

      3.4.10 Subgrade Preparation and Pavement ..................................................................... 35

      3.4.11 Summary and Conclusions ...................................................................................... 36

      3.5 Environmental Assessment ............................................................................................ 36

      3.5.1 Regulatory Requirements .......................................................................................... 36

      3.5.2 Applicable Legislation ............................................................................................... 36

      3.5.3 Study Area ................................................................................................................ 37

      3.5.4 Methodological Approach ......................................................................................... 37

      3.5.5 Mitigation of Environmental Effects ......................................................................... 38

      3.5.6 Environmental Effects Summary .............................................................................. 42

4.0 Transitway Runningway Design .......................................................................................... 43

   4.1 Design Criteria .................................................................................................................. 43

   4.2 Geometric Design .............................................................................................................. 44

   4.3 Pavement Design .............................................................................................................. 46

5.0 Stations ................................................................................................................................. 47

   5.1 Design Criteria .................................................................................................................. 47

   5.2 Spacing between Stations ................................................................................................. 47

   5.3 Station Design ................................................................................................................... 47
Southwest Transitway - Stage 2
Functional Design Report
2015 April Final Report - 13-8439

Table of Contents

5.4 Investors Group Field Station ................................................................. 48
5.5 University of Manitoba Station ............................................................. 48

6.0 Park and Ride

6.1 Design Criteria .................................................................................. 49
6.2 Proposed Park and Ride Facilities ..................................................... 49

7.0 Kiss and Ride

7.1 Design Criteria .................................................................................. 50
7.2 Proposed Kiss and Ride Facilities ..................................................... 50

8.0 Bus Staging Areas

8.1 Design Criteria .................................................................................. 51
8.2 Proposed Bus Staging Area at McGillivray Station ......................... 51
8.3 Proposed Bus Staging Area at the University of Manitoba ............ 52

9.0 Street Connections, At-Grade Intersections, and Transit Priority Measures

9.1 Required Street Connections ............................................................. 53
9.2 Required At-Grade Intersections ..................................................... 53
9.3 Functional Requirements and Transit Priority Measures ................. 53

10.0 Grade Separations and Structures

10.1 Introduction .................................................................................... 54
10.2 Design Criteria ................................................................................ 54
10.3 Geotechnical Investigation ............................................................. 54
10.3.1 Field Work .................................................................................. 54
10.3.2 Subsurface Conditions .............................................................. 55
10.4 Pile Foundation Alternatives .......................................................... 55
10.5 Fill Stability/Settlement ................................................................. 55
10.6 Excavations .................................................................................... 56
10.7 CN Rail Bridge over Pembina ......................................................... 56
10.7.1 Background ................................................................................ 56
10.7.2 Superstructure ........................................................................... 56
10.7.3 Substructure .............................................................................. 57
10.7.4 AT Path Tunnel under Jubilee Ramp .......................................... 57
10.8 Transitway Bridge over Pembina Highway ..................................... 58
10.8.1 Superstructure ........................................................................... 58
10.8.2 Substructure ............................................................................. 58
10.9 Transitway Underpass of CN Wye Tracks (CN Letellier) ............... 59
10.9.1 Superstructure ........................................................................... 59
10.9.2 Substructure ............................................................................. 59
10.10 Transitway Underpass of CN Wye Tracks (WC02 Spur) ............... 60
10.10.1 Superstructure .......................................................................... 60
10.10.2 Substructure ............................................................................. 60
10.10.3 Retaining Walls ....................................................................... 61
10.10.4 Land Drainage ......................................................................... 61
10.11 Transitway Overpass of McGillivray Boulevard ......................... 61
10.11.1 Superstructure .......................................................................... 61
10.11.2 Substructure ............................................................................. 61
10.12 Letellier Tunnel ............................................................................ 62
10.12.1 Tunnel Design Criteria ............................................................. 62
10.12.2 Foundations ............................................................................ 62
10.12.3 Roof Slab ............................................................................... 63
10.12.4 Walls ..................................................................................... 63
10.12.5 Floor Slab ............................................................................... 63
10.12.6 Drainage ................................................................................. 63
10.12.7 Waterproofing ......................................................................... 63
10.12.8 Construction Staging ............................................................... 63
10.13 Transitway Bridge over Bishop Grondin Boulevard ................. 63
10.13.1 Superstructure .......................................................................... 63
10.13.2 Substructure ............................................................................. 64
10.14 CN Rail Bridge over Bishop Grondin Boulevard ....................... 64
10.14.1 Superstructure ......................................................................... 64
10.14.2 Substructure ............................................................................. 65

11.0 Land Drainage

11.1 Introduction .................................................................................... 66
11.2 Model Development ....................................................................... 67
11.2.1 Design Criteria .......................................................................... 67
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.2.2 Subcatchment Delineation and Hydrologic Parameters</td>
<td>68</td>
</tr>
<tr>
<td>11.2.3 Hydraulics</td>
<td>70</td>
</tr>
<tr>
<td>11.2.4 Model Verification</td>
<td>70</td>
</tr>
<tr>
<td>11.3 Adjacent Land Drainage Systems and Impact of Southwest Transitway Flows</td>
<td>70</td>
</tr>
<tr>
<td>11.3.1 D’Arcy Drive</td>
<td>71</td>
</tr>
<tr>
<td>11.3.2 University of Manitoba Southwood Lands</td>
<td>71</td>
</tr>
<tr>
<td>11.3.3 Lot 16 Drain</td>
<td>71</td>
</tr>
<tr>
<td>11.3.4 Riviera Crescent</td>
<td>73</td>
</tr>
<tr>
<td>11.3.5 Somerset Avenue</td>
<td>74</td>
</tr>
<tr>
<td>11.3.6 Parker Retention Pond</td>
<td>74</td>
</tr>
<tr>
<td>11.4 Transitway Underpass at CN Wye Tracks and Pembina Highway Underpass</td>
<td>75</td>
</tr>
<tr>
<td>11.4.1 Pembina Highway Underpass</td>
<td>75</td>
</tr>
<tr>
<td>11.4.2 Transitway Underpasses of CN Wye Tracks</td>
<td>76</td>
</tr>
<tr>
<td>11.4.3 Single Pump Station Servicing Transitway Underpass of CN Wye Tracks and Pembina Highway Underpass Project</td>
<td>76</td>
</tr>
<tr>
<td>11.4.4 Recommendation</td>
<td>77</td>
</tr>
<tr>
<td>11.5 Pumping Station Design</td>
<td>77</td>
</tr>
<tr>
<td>11.6 Summary</td>
<td>77</td>
</tr>
<tr>
<td>Railway Works</td>
<td>79</td>
</tr>
<tr>
<td>12.1 Railway Consultations</td>
<td>79</td>
</tr>
<tr>
<td>12.2 Proposed Railway Works</td>
<td>79</td>
</tr>
<tr>
<td>12.2.1 Portage Junction</td>
<td>79</td>
</tr>
<tr>
<td>12.2.2 Letellier Tunnel</td>
<td>79</td>
</tr>
<tr>
<td>12.2.3 AT Path between Chevrier Station and Plaza Station</td>
<td>80</td>
</tr>
<tr>
<td>12.2.4 Plaza Station</td>
<td>80</td>
</tr>
<tr>
<td>12.2.5 CN Rail Bridge over Bishop Grandin Boulevard</td>
<td>80</td>
</tr>
<tr>
<td>12.2.6 Letellier Subdivision Works (South of Letellier Tunnel)</td>
<td>80</td>
</tr>
<tr>
<td>12.2.7 Crossings of the CN Letellier Track</td>
<td>80</td>
</tr>
<tr>
<td>12.3 Functional Design of Railway Works</td>
<td>81</td>
</tr>
<tr>
<td>12.3.1 Roadbed</td>
<td>81</td>
</tr>
<tr>
<td>12.3.2 Track Structure Requirements</td>
<td>81</td>
</tr>
<tr>
<td>12.3.3 Turnout Requirements</td>
<td>81</td>
</tr>
<tr>
<td>12.3.4 Utilities</td>
<td>81</td>
</tr>
<tr>
<td>12.3.5 CN Letellier Crossing Signals</td>
<td>82</td>
</tr>
<tr>
<td>12.3.6 Crossing Surfaces</td>
<td>82</td>
</tr>
<tr>
<td>12.3.7 Railway Works Related to the Letellier Tunnel</td>
<td>82</td>
</tr>
<tr>
<td>13.0 Utility Works</td>
<td>83</td>
</tr>
<tr>
<td>13.1 Manitoba Hydro Transmission, Distribution, and Communication Lines</td>
<td>83</td>
</tr>
<tr>
<td>13.2 Street Lighting</td>
<td>83</td>
</tr>
<tr>
<td>13.3 Natural Gas Distribution</td>
<td>83</td>
</tr>
<tr>
<td>13.4 Manitoba Telecom Services Communication Lines</td>
<td>83</td>
</tr>
<tr>
<td>13.5 Other Communications Companies’ Lines</td>
<td>83</td>
</tr>
<tr>
<td>14.0 Active Transportation</td>
<td>84</td>
</tr>
<tr>
<td>14.1 Active Transportation Requirements</td>
<td>84</td>
</tr>
<tr>
<td>14.2 Design Criteria</td>
<td>84</td>
</tr>
<tr>
<td>15.0 Lighting for Stations and Pathways</td>
<td>86</td>
</tr>
<tr>
<td>15.1 Design Guidelines for Station Lighting</td>
<td>86</td>
</tr>
<tr>
<td>15.2 Design Guidelines for Pathway Lighting</td>
<td>86</td>
</tr>
<tr>
<td>16.0 Landscaping and Aesthetics</td>
<td>87</td>
</tr>
<tr>
<td>16.1 Landscaping and Aesthetics Requirements</td>
<td>87</td>
</tr>
<tr>
<td>16.2 Design Guidelines for Landscaping and Aesthetics</td>
<td>87</td>
</tr>
<tr>
<td>16.3 Brenda Leipsic Dog Park</td>
<td>87</td>
</tr>
<tr>
<td>17.0 Fencing</td>
<td>89</td>
</tr>
<tr>
<td>18.0 Noise Attenuation</td>
<td>90</td>
</tr>
<tr>
<td>19.0 Communications and Safety Systems</td>
<td>91</td>
</tr>
<tr>
<td>19.1 BUSwatch Display Signs</td>
<td>91</td>
</tr>
<tr>
<td>19.2 Bus Arrival Warning System</td>
<td>91</td>
</tr>
<tr>
<td>19.3 Closed Circuit TV Surveillance System</td>
<td>91</td>
</tr>
<tr>
<td>19.4 Bus Operations Message Display Signs</td>
<td>92</td>
</tr>
<tr>
<td>20.0 Transit and Traffic Operational Requirements</td>
<td>93</td>
</tr>
<tr>
<td>21.0 Property Requirements</td>
<td>94</td>
</tr>
<tr>
<td>22.0 Construction Sequencing Considerations</td>
<td>95</td>
</tr>
</tbody>
</table>
# Public Engagement Program 96

23.1 Overview ................................................................................................................................................. 96
23.2 Consultation Methodology .......................................................................................................................... 96
23.3 Public and Stakeholder Feedback .............................................................................................................. 96
23.4 Follow-Up Adjacent Residents Meetings .................................................................................................. 98

# Conceptual Rapid Transit Route Network Plan 99

Figures (contained in Appendix A)

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1:</td>
<td>Conceptual Alignment 1B – Connection Options to University of Manitoba (U1, U2, U3, U4)</td>
</tr>
<tr>
<td>Figure 2:</td>
<td>Winnipeg’s Southwest Transitway</td>
</tr>
<tr>
<td>Figure 3:</td>
<td>Project Works at Pembina Highway and Jubilee Avenue</td>
</tr>
<tr>
<td>Figure 4:</td>
<td>Transitway Alignment in Parker Lands</td>
</tr>
<tr>
<td>Figure 5:</td>
<td>Cross-Section through Parker Lands</td>
</tr>
<tr>
<td>Figure 6:</td>
<td>Transitway Alignment in Manitoba Hydro Right-of-Way</td>
</tr>
<tr>
<td>Figure 7:</td>
<td>Cross-Section in Manitoba Hydro Right-of-Way</td>
</tr>
<tr>
<td>Figure 8:</td>
<td>Letellier Tunnel</td>
</tr>
<tr>
<td>Figure 9:</td>
<td>Transitway Alignment in CN Letellier Right-of-Way</td>
</tr>
<tr>
<td>Figure 10:</td>
<td>Cross-Section in CN Letellier Right-of-Way North of Markham Road</td>
</tr>
<tr>
<td>Figure 11:</td>
<td>Transitway Bridge and New CN Letellier Rail Bridge over Bishop Grandin Boulevard</td>
</tr>
<tr>
<td>Figure 12:</td>
<td>Transitway Alignment between CN Letellier Right-of-Way and University of Manitoba</td>
</tr>
<tr>
<td>Figure 13:</td>
<td>Southpark Drive Existing and Proposed Cross-Sections</td>
</tr>
<tr>
<td>Figure 14a:</td>
<td>Southwest Transitway - Stage 2: Recommended Alignment</td>
</tr>
<tr>
<td>Figure 14b:</td>
<td>Southwest Transitway - Stage 2: Recommended Alignment</td>
</tr>
<tr>
<td>Figure 14c:</td>
<td>Southwest Transitway - Stage 2: Recommended Alignment</td>
</tr>
<tr>
<td>Figure 14d:</td>
<td>Southwest Transitway - Stage 2: Recommended Alignment</td>
</tr>
<tr>
<td>Figure 15:</td>
<td>Project Impacts on CN infrastructure</td>
</tr>
<tr>
<td>Figure 16:</td>
<td>Manitoba Hydro Corridors</td>
</tr>
<tr>
<td>Figure 17a:</td>
<td>Hydro Tower Locations – Existing</td>
</tr>
<tr>
<td>Figure 17b:</td>
<td>Hydro Tower Locations – Spring 2016 (By Manitoba Hydro)</td>
</tr>
<tr>
<td>Figure 17c:</td>
<td>Hydro Tower Locations – Full Build Out</td>
</tr>
<tr>
<td>Figure 18:</td>
<td>Alignment in University of Manitoba Southwood Lands – Long Term</td>
</tr>
<tr>
<td>Figure 19:</td>
<td>Alignment in University of Manitoba Southwood Lands – Interim</td>
</tr>
<tr>
<td>Figure 20:</td>
<td>University of Manitoba Station – Bus Staging Area</td>
</tr>
<tr>
<td>Figure 21:</td>
<td>Existing Locations of Deep Utilities in Manitoba Hydro Right-of-Way</td>
</tr>
<tr>
<td>Figure 22:</td>
<td>Branch II Aqueduct and FGSV Feedermain – Bridging Structures &amp; Casings – Pipeline Protection</td>
</tr>
<tr>
<td>Figure 23:</td>
<td>Lot 16 Drain Relocation - Pipeline Protection</td>
</tr>
<tr>
<td>Figure 24:</td>
<td>Urban Cross-Sections for Transitway</td>
</tr>
<tr>
<td>Figure 25:</td>
<td>Rural Cross-Sections for Transitway</td>
</tr>
<tr>
<td>Figure 26:</td>
<td>Letellier Tunnel Cross-Section</td>
</tr>
<tr>
<td>Figure 27:</td>
<td>Cross-Section for Investors Group Field Station</td>
</tr>
<tr>
<td>Figure 28:</td>
<td>Stage 2 Station and Stop Locations</td>
</tr>
<tr>
<td>Figure 29:</td>
<td>Standard Station Dimensions</td>
</tr>
<tr>
<td>Figure 30:</td>
<td>Standard Station Layout</td>
</tr>
<tr>
<td>Figure 31:</td>
<td>Large Station Layout</td>
</tr>
<tr>
<td>Figure 32:</td>
<td>Split Station Layout</td>
</tr>
<tr>
<td>Figure 33:</td>
<td>Concept for IGF Station</td>
</tr>
<tr>
<td>Figure 34:</td>
<td>McGillivray Station – Park and Ride</td>
</tr>
<tr>
<td>Figure 35:</td>
<td>Clarence Station – Park and Ride</td>
</tr>
<tr>
<td>Figure 36:</td>
<td>Kiss and Ride Locations</td>
</tr>
<tr>
<td>Figure 37a:</td>
<td>McGillivray Station – Bus Staging Area for Pre-Event Service to IGF</td>
</tr>
<tr>
<td>Figure 37b:</td>
<td>McGillivray Station – Bus Staging Area for Post-Event Service from IGF</td>
</tr>
<tr>
<td>Figure 38:</td>
<td>Grade Separation Structure Locations: Pembina Highway and jubilee Avenue</td>
</tr>
<tr>
<td>Figure 39:</td>
<td>Grade Separation Structure Locations: Transitway Overpass of McGillivray</td>
</tr>
<tr>
<td>Figure 40:</td>
<td>Grade Separation Structure Locations: Letellier Tunnel</td>
</tr>
<tr>
<td>Figure 41:</td>
<td>Grade Separation Structure Locations: Bridges over Bishop Grandin</td>
</tr>
<tr>
<td>Figure 42a:</td>
<td>Proposed CN Rail Bridge over Pembina Highway</td>
</tr>
<tr>
<td>Figure 42b:</td>
<td>Proposed Active Transportation Path Tunnel under Jubilee Ramp</td>
</tr>
<tr>
<td>Figure 42c:</td>
<td>Proposed Retaining Walls in Pembina Underpass Area: 1 of 2</td>
</tr>
<tr>
<td>Figure 42d:</td>
<td>Proposed Retaining Walls in Pembina Underpass Area: 2 of 2</td>
</tr>
<tr>
<td>Figure 43:</td>
<td>Proposed Transitway Bridge over Pembina</td>
</tr>
<tr>
<td>Figure 44:</td>
<td>Proposed Transitway Underpass of CN Wye Tracks (CN Letellier)</td>
</tr>
<tr>
<td>Figure 45:</td>
<td>Proposed Transitway Underpass of CN Wye Tracks (WC02 Spur)</td>
</tr>
<tr>
<td>Figure 46:</td>
<td>Proposed Transitway Overpass of McGillivray</td>
</tr>
<tr>
<td>Figure 47:</td>
<td>Proposed Letellier Tunnel</td>
</tr>
<tr>
<td>Figure 48:</td>
<td>Proposed Transitway Bridge over Bishop Grandin</td>
</tr>
<tr>
<td>Figure 49:</td>
<td>Proposed CN Letellier Rail Bridge over Bishop Grandin</td>
</tr>
<tr>
<td>Figure 50:</td>
<td>Land Drainage Sewer Districts</td>
</tr>
<tr>
<td>Figure 51:</td>
<td>Proposed Land Drainage Plan for Southwest Transitway – Stage 2</td>
</tr>
<tr>
<td>Figure 52:</td>
<td>Proposed Land Drainage – D’Arcy Land Drainage System</td>
</tr>
</tbody>
</table>
### Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Design Vehicle Comparison</td>
</tr>
<tr>
<td>Table 2</td>
<td>Branch II Aqueduct Crossing Locations</td>
</tr>
<tr>
<td>Table 3</td>
<td>Branch II Aqueduct Load Cases</td>
</tr>
<tr>
<td>Table 4</td>
<td>Branch II Aqueduct PCCP Properties</td>
</tr>
<tr>
<td>Table 5</td>
<td>Branch II Aqueduct Allowable Soil Covers</td>
</tr>
<tr>
<td>Table 6</td>
<td>Existing Soil covers on Branch II Aqueduct</td>
</tr>
<tr>
<td>Table 7</td>
<td>Aqueduct Soil Covers at CN Spur Lines</td>
</tr>
<tr>
<td>Table 8</td>
<td>Fort Garry-St. Vital Feedermain Crossing Locations</td>
</tr>
<tr>
<td>Table 9</td>
<td>Fort Garry-St. Vital Feedermain Load Cases</td>
</tr>
<tr>
<td>Table 10</td>
<td>Fort Garry-St. Vital Feedermain PCCP Properties</td>
</tr>
<tr>
<td>Table 11</td>
<td>Fort Garry-St. Vital Feedermain Allowable Soil Covers</td>
</tr>
<tr>
<td>Table 12</td>
<td>Fort Garry-St. Vital Feedermain Soil Covers at CN Spur Lines</td>
</tr>
<tr>
<td>Table 13</td>
<td>Lot 16 Drain Loading Summary</td>
</tr>
<tr>
<td>Table 14</td>
<td>Lot 16 Drain Wall Forces</td>
</tr>
<tr>
<td>Table 15</td>
<td>Summary of Groundwater Monitoring Results</td>
</tr>
<tr>
<td>Table 16</td>
<td>Summary of Sulphate Content Tests</td>
</tr>
<tr>
<td>Table 17</td>
<td>Allowable Pile Capacity for Driven PPC Piles</td>
</tr>
<tr>
<td>Table 18</td>
<td>Proposed Environmental Mitigation Measures</td>
</tr>
<tr>
<td>Table 19</td>
<td>Recommended Transitway Runningway Design Criteria</td>
</tr>
<tr>
<td>Table 20</td>
<td>Urban Cross-Section (See Figure 24)</td>
</tr>
<tr>
<td>Table 21</td>
<td>Rural Cross-Section (See Figure 25)</td>
</tr>
<tr>
<td>Table 22</td>
<td>Tunnel/Underpass Cross-Section (See Figure 26)</td>
</tr>
<tr>
<td>Table 23</td>
<td>Investors Group Field Station Cross-Section (See Figure 27)</td>
</tr>
<tr>
<td>Table 24</td>
<td>Cross-Sections for Transitway Connections to the Street System</td>
</tr>
<tr>
<td>Table 25</td>
<td>Pavement Structure 1</td>
</tr>
<tr>
<td>Table 26</td>
<td>Pavement Structure 2</td>
</tr>
<tr>
<td>Table 27</td>
<td>Pavement Structure 3</td>
</tr>
<tr>
<td>Table 28</td>
<td>Station Locations and Layout Types</td>
</tr>
<tr>
<td>Table 29</td>
<td>Required Station Features</td>
</tr>
<tr>
<td>Table 30</td>
<td>Proposed Kiss and Ride Facilities</td>
</tr>
<tr>
<td>Table 31</td>
<td>At-Grade Intersection Design Requirements</td>
</tr>
<tr>
<td>Table 32</td>
<td>CN Rail Bridge over Pembina</td>
</tr>
<tr>
<td>Table 33</td>
<td>Transitway Bridge over Pembina</td>
</tr>
<tr>
<td>Table 34</td>
<td>Transitway Underpass of CN Wye Tracks (CN Letellier)</td>
</tr>
<tr>
<td>Table 35</td>
<td>Transitway Underpass of CN Wye Tracks (WC02 Spur)</td>
</tr>
<tr>
<td>Table 36</td>
<td>Transitway Overpass of McGillivray Boulevard</td>
</tr>
<tr>
<td>Table 37</td>
<td>Letellier Tunnel</td>
</tr>
<tr>
<td>Table 38</td>
<td>Transitway Bridge over Bishop Grandin</td>
</tr>
<tr>
<td>Table 39</td>
<td>CN Letellier Rail Bridge over Bishop Grandin</td>
</tr>
<tr>
<td>Table 40</td>
<td>Land Use Distribution in Adjacent Land Drainage Systems</td>
</tr>
<tr>
<td>Table 41</td>
<td>Land Uses</td>
</tr>
<tr>
<td>Table 42</td>
<td>Runoff Surfaces</td>
</tr>
<tr>
<td>Table 43</td>
<td>MacLaren 1974 IDF Parameters</td>
</tr>
<tr>
<td>Table 44</td>
<td>Typical Conveyance Parameters</td>
</tr>
<tr>
<td>Table 45</td>
<td>Design Criteria for AT Paths</td>
</tr>
<tr>
<td>Table 46</td>
<td>Requirements for Buswatch Display Signs</td>
</tr>
<tr>
<td>Table 47</td>
<td>Requirements for Bus Arrival Warning System</td>
</tr>
<tr>
<td>Table 48</td>
<td>Summary of Property Requirements for SWT2-Pembina Underpass project</td>
</tr>
</tbody>
</table>

### Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 53</td>
<td>Proposed Land Drainage - Lot 16 Land Drainage System</td>
</tr>
<tr>
<td>Figure 54</td>
<td>Proposed Land Drainage - Riviera Land Drainage System</td>
</tr>
<tr>
<td>Figure 55</td>
<td>Proposed Land Drainage - Somerset Land Drainage System</td>
</tr>
<tr>
<td>Figure 56</td>
<td>Proposed Land Drainage - Parker Retention Pond</td>
</tr>
<tr>
<td>Figure 57</td>
<td>Conceptual Pump Station at Letellier Tunnel</td>
</tr>
<tr>
<td>Figure 58</td>
<td>Conceptual Pump Station at Transitway Underpass of CN Wye Tracks</td>
</tr>
<tr>
<td>Figure 59</td>
<td>CN Portage Junction - Railway Works</td>
</tr>
<tr>
<td>Figure 60a &amp; 60b</td>
<td>Letellier Tunnel - Railway Works</td>
</tr>
<tr>
<td>Figure 61</td>
<td>Letellier Sub-Division South of Bishop Grandin - Railway Works</td>
</tr>
<tr>
<td>Figure 62</td>
<td>Active Transportation Paths</td>
</tr>
<tr>
<td>Figure 63</td>
<td>Rapid Transit Route Network Concept Plan</td>
</tr>
<tr>
<td>Figure 57</td>
<td>Conceptual Pump Station at Letellier Tunnel</td>
</tr>
<tr>
<td>Figure 58</td>
<td>Conceptual Pump Station at Transitway Underpass of CN Wye Tracks</td>
</tr>
<tr>
<td>Figure 59</td>
<td>CN Portage Junction - Railway Works</td>
</tr>
<tr>
<td>Figure 60a &amp; 60b</td>
<td>Letellier Tunnel - Railway Works</td>
</tr>
<tr>
<td>Figure 61</td>
<td>Letellier Sub-Division South of Bishop Grandin - Railway Works</td>
</tr>
<tr>
<td>Figure 62</td>
<td>Active Transportation Paths</td>
</tr>
<tr>
<td>Figure 63</td>
<td>Rapid Transit Route Network Concept Plan</td>
</tr>
</tbody>
</table>
## Table of Contents

### Appendices

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Figures</td>
</tr>
<tr>
<td>B</td>
<td>Southwest Transitway - Stage 2: Construction Record Drawings for Deep Utilities</td>
</tr>
<tr>
<td>C</td>
<td>Southwest Transitway - Stage 2: Original Lock Joint and Hyprescon Design Notes for Deep Utilities</td>
</tr>
<tr>
<td>D</td>
<td>Southwest Transitway - Stage 2: Original Lock Joint and Hyprescon Laying Schedules for Deep Utilities</td>
</tr>
<tr>
<td>E</td>
<td>Southwest Transitway - Stage 2: Branch II Aqueduct - Design Graphs</td>
</tr>
<tr>
<td>F</td>
<td>Southwest Transitway - Stage 2: Fort Garry - St. Vital Feedermain - Design Graphs</td>
</tr>
<tr>
<td>G</td>
<td>Southwest Transitway - Stage 2: Lot 16 Drain Wall Forces - Design Calculations</td>
</tr>
<tr>
<td>H</td>
<td>SWT2 - Pembina Underpass Project: Geotechnical Information</td>
</tr>
<tr>
<td>I</td>
<td>Southwest Transitway - Stage 2: Geotechnical Information: Test Hole Location Plan and Test Hole Logs</td>
</tr>
<tr>
<td>J</td>
<td>Southwest Transitway - Stage 2: Environmental Review and Assessment Report</td>
</tr>
<tr>
<td>K</td>
<td>Southwest Transitway - Stage 2: Railway Consultation Meeting Minutes</td>
</tr>
<tr>
<td>L</td>
<td>Southwest Transitway - Stage 2: Proposed Traffic Signal Operations at Transitway/Railway/Street Intersections</td>
</tr>
<tr>
<td>M</td>
<td>Southwest Transitway - Stage 2: Proposed Layout for Crossings of CN Letellier Track</td>
</tr>
<tr>
<td>N</td>
<td>SWT2 - Pembina Underpass Project: Railway Works - Functional Design Drawings</td>
</tr>
<tr>
<td>O</td>
<td>SWT2 - Pembina Underpass Project: Property Requirements</td>
</tr>
<tr>
<td>P</td>
<td>Southwest Transitway - Stage 2: Public Engagement Report</td>
</tr>
</tbody>
</table>
Notice to Respondents to Southwest Rapid Transitway (Stage 2) and Pembina Highway Underpass Project

The functional designs for the Southwest Rapid Transit (Stage 2) and Pembina Highway Underpass project that are described in this report were prepared to generally accepted City of Winnipeg standards. In the preparation of proposals, the information in this report is to be used as a guide only. All designs included in proposals and all required approvals are the responsibility of the proponent.

1.0 Introduction

Stage 1 of the Southwest Transitway, the initial phase of the City of Winnipeg’s rapid transit network, was constructed during 2009-2011. The Stage 1 Transitway (3.6 km in length, located between downtown and Pembina Highway & J ubilee Avenue, with four highly developed stations at Harkness, Osborne, Fort Rouge, and J ubilee) opened for service in April 2012 and is used by a BRT network of 13 routes, providing fast, frequent, reliable service throughout the day on all days of the week. Rapid transit routes access the transitway at four locations to provide trips without transfer for most passengers travelling between the southwest part of the City and downtown.

The City’s next rapid transit project is Stage 2 of the Southwest Transitway. This project will extend the transitway southerly from Pembina Highway & J ubilee Avenue to the University of Manitoba using land within Manitoba Hydro and CN Rail rights-of-way for most of its alignment. This alignment, recommended in the Southwest Rapid Transit Stage 2 Alignment Study completed and subsequently approved by City Council in 2013, provides an opportunity to deliver rapid transit service directly to the University of Manitoba, downtown, and several neighbourhoods in the southwestern and western parts of the city.

This report documents work for an assignment for Phase I – Functional Design of Stage 2 of the Southwest Transitway awarded to Dillon and its sub-consultants (AECOM, McGowan Russell Group, and Landmark Planning & Design Inc.) for City of Winnipeg RFP 685-2013.

This Functional Design Report describes the recommended transitway alignment, summaries background investigations (existing agreements, major institutional stakeholder consultations, deep utilities analysis, geotechnical assessment, and environmental assessment), fully documents the functional design analysis, includes all functional design drawings, identifies property requirements, outlines construction sequencing considerations, and summarizes stakeholder and public consultation undertaken for the Phase I work.
2.0 Recommended Transitway Alignment

2.1 Conceptual Transitway Alignment Recommended by the Southwest Rapid Transit Corridor Stage 2 Alignment Study

As shown in Figure 1, the conceptual alignment 1B through the Parker/Hydro Corridor, as recommended in the Southwest Rapid Transit Stage 2 Alignment Study (2013) and as adopted by City Council, included a southerly extension of the transitway from the south limit of the Stage 1 transitway near Pembina Highway & J ubilee Avenue to the intersection of the CN Letellier right-of-way at Bison Drive near Pembina Highway & Bison Drive.

In addition, the study outlined four alignment options, without recommendation, for the transitway between the CN Letellier subdivision and Investors Group Field/University of Manitoba:

- U1 - Via Bison, Chancellor Matheson;
- U2 - Via Markham, University Crescent;
- U3 - Via Thatcher, University Crescent; and,
- U4 - Via Pembina J ug handle, University Crescent.

2.2 Recommended Specific Alignment for Stage 2 Transitway

2.2.1 Overview of Specific Alignment

Based on extensive planning, analysis, and stakeholder consultation undertaken during the Phase I assignment, a recommended specific alignment for the Stage 2 transitway was developed. An overview drawing of the recommended alignment is shown in Figure 2.

The recommended alignment extends the Southwest Transitway from the south limit of the Stage 1 transitway near Pembina Highway & J ubilee Avenue through the Parker/Hydro Corridor to the intersection of the CN Letellier right-of-way at Markham Road. A transitway alignment between the CN Letellier subdivision and Investors Group Field/University of Manitoba is recommended via Southpark Drive and the University of Manitoba’s Southwood lands.

The recommended alignment for Stage 2 includes:

- A new Transitway Bridge over Pembina Highway;
- New Transitway Underpasses of CN Wye Tracks at the CN Portage Junction;
- A signalized at-grade intersection in the Parker lands at Georgina Street;
- A new Transitway Overpass of McGillivray Boulevard;
- A signalized at-grade intersection at Clarence Avenue;
- A signalized at-grade intersection at Chevrier Avenue;

1 In conjunction with the Southwest Transitway - Stage 2 project, Pembina Highway is to be widened at the J ubilee Underpass. To accommodate an additional northbound lane on Pembina Highway, the existing CN Bridge over Pembina Highway will be replaced by a new and longer rail bridge at a location north of the existing rail bridge.

2 As part of the Southwest Transitway - Stage 2 project, a new Transitway Bridge over Bishop Grandin Boulevard is to be sited in the location of the existing CN Letellier rail bridge. Consequently, a new CN Rail Bridge over Bishop Grandin Boulevard will be constructed parallel to and immediately west of the existing rail bridge.

This recommended specific alignment differs from the conceptual alignment recommended in the Southwest Rapid Transit Stage 2 Alignment Study in two major respects:

1. The southern limit of the Stage 2 transitway is at Markham Road rather than at Bison Drive. This is recommended for the following reasons:
   a. The current and future levels of traffic congestion at the Pembina Highway/Chancellor Matheson Road/Bison Drive intersection and the proximity of that intersection to the CN Letellier right-of-way at Bison Drive would make bus access/egress to/from the transitway at Bison Drive operationally difficult and subject to significant delays;
   b. Transit users travelling to/from Victoria General Hospital would be better served by rapid transit routes accessing the street system at Markham Road rather than at Bison Drive; and,
   c. The University of Manitoba expressed a preference that rapid transit routes not use the Bison Drive – Chancellor Matheson path to access the campus.

2. The transitway alignment between the CN Letellier subdivision and Investors Group Field/University of Manitoba is via Southpark Drive and the University’s Southwood lands rather than via one of the four identified conceptual options. This is recommended for the following reasons:
   a. Of the four conceptual options:
      i. U1 - Via Bison Drive and Chancellor Matheson was not preferred by the University due to its inconsistency with long-term plans for Chancellor Matheson Road;
ii. U2 - Via Thatcher and University Crescent would require costly acquisition of major built properties west of Pembina Highway; and,

iii. U4 - Via Pembina Jughandle and University Crescent was not preferred by the University or by Winnipeg Transit due to physical constraints and the high level of traffic congestion on that path.

b. Although the U3 alignment via Markham Road was considered the most feasible of the four conceptual options, it would result in congested bus movements on Markham Road between the CN Letellier right-of-way and Pembina Highway and through the skewed Markham Road and Pembina Highway intersection;

c. The use of the Southpark Drive alignment for rapid transit routes operating to the University in combination with the use of Markham Road for rapid transit routes destined to Fort Richmond, St. Norbert, Richmond West and South Pointe would distribute bus operations through two intersections (i.e., University-oriented routes via the Southpark Drive & Pembina Highway intersection, Fort Richmond and St. Norbert routes via the Markham Road & Pembina Highway intersection) rather than through a single intersection at Markham Road & Pembina Highway.  This will result in better operation of the intersections and improved on-time performance for rapid transit service; and,

d. In comparison to the Markham Road alignment, the Southpark Drive alignment would improve rapid transit coverage through the University’s planned Southwood development, and would address concerns of the residents of the condominium complex immediately south of Markham Road and east of Pembina Highway about the proximity of the transitway to their homes.

The remainder of this section documents the design constraints, analysis, and recommended specific alignment for each section of the Stage 2 transitway.

### 2.2.2 Transitway Bridge over Pembina, Underpasses of Wye Tracks of CN Letellier Subdivision

In a report prepared for the City, Preliminary Engineering Study for Upgrading the Pembina Highway Underpass (2013), the recommended Option 3 included:

- Widening of Pembina Highway through the Jullie Avenue Underpass to include three northbound and three southbound lanes;
- Replacement of the existing CN bridge with a new bridge on a new alignment north of the existing bridge;
- New active transportation facilities on both sides of Pembina Highway;
- A new active transportation tunnel beneath the west ramp of the Jullie Overpass;
- Construction of a land drainage sewer and pump station;
- A new transitway/active transportation bridge over Pembina Highway; and,
- New transitway/active transportation underpasses of the CN Wye Tracks at the CN Portage Junction.

The alignments of these facilities are shown in Figure 3 and it is recommended that they be retained and included in SWT2-Pembina Underpass project that includes the Southwest Transitway – Stage 2, the Pembina Highway Underpass, and associated land drainage works.

The relative merits of underpass and tunnel options for the grade separations of the wye tracks were assessed. While the tunnel option would require less land to be acquired from CN, it would be more costly to construct and would require an at-grade diversion of the active transportation path across the railway tracks. The underpass option would permit the active transportation path to be grade-separated from railway tracks and to be constructed adjacent to the transitway through the underpass. CN has indicated that its property needs can be accommodated with the underpass option.

Based on these considerations, the recommendation of the preliminary engineering study for underpasses of the wye tracks was confirmed.

### 2.2.3 Alignment through Parker Lands West of Stage 1 Transitway

The specific alignment of the transitway through the Parker lands was developed within the context of a complex set of design constraints, including:

- Multiple public and private property ownerships in the area (City of Winnipeg, Manitoba Hydro, CN, GEM Equities, and others);
- Existing Manitoba Hydro transmission, distribution and communications lines;
- Future planned Manitoba Hydro transmission lines;
- A planned land drainage retention pond to be constructed by the City at the east end of the Parker lands as part of an on-going project separate from the SWT2-Pembina Underpass project, the Cockburn and Carrossie Combined Sewer Relief Works;
- The existing Brenda Leipsic Dog Park on land owned by Manitoba Hydro at the west end of the Parker lands;
- Slope and grade requirements for the transitway on the west side of the underpass of the westerly CN wye track (WC02) at the CN Portage Junction;
- Expectations of the Beaumont community about buffer distances between the transitway and existing residential properties;
- Community concerns about project elements that might affect the amount of through-traffic in the Beaumont community; and,
- Potential environmental issues in the undeveloped portions of the Parker lands.

The recommended alignment through the Parker lands, shown in the plan view in Figure 4 and in cross-section in Figure 5, is characterized by the following:

- A location immediately adjacent to the City’s planned retention pond at the east end of the Parker lands so that a minimum buffer of 30 m is provided between the transitway and existing homes on Heatherdale Avenue;
- Siting of the transitway to minimize the displacement of existing treed areas in the Parker lands;
- Siting of the transitway to accommodate existing and future locations for Manitoba Hydro towers and lines between Daniel Street and Hurst Way (see cross-section in Figure 5 for transitway alignment in relation to Manitoba Hydro infrastructure);
• A transitway station (Parker Station) located immediately west of Beaumont Street to provide convenient access to rapid transit service for residents of the Beaumont community and of a future development planned in the Parker lands;
• A relocated Brenda Leipsic Dog Park at the west end of the Parker lands, including an improved vehicular access and parking area for the dog park; and,
• An extension of the Stage 1 active transportation path along the Stage 2 transitway with several connections to the existing active transportation network and adjacent developments; note that sufficient space is provided for the path on the Transitway Bridge over Pembina Highway and through the Transitway Underpasses of the CN Wye Tracks.

The recommended alignment through the Parker lands includes the following changes to the street network:

• To provide for a transit feeder route connection between Parker Station and the Beaumont community, a transit-only roadway extension of Beaumont Street from Parker Avenue to the transitway at Parker Station is to be provided. This transit-only roadway will include a single lane in each direction to accommodate northbound and southbound buses;
• To provide for a transit routing link between Parker Station and areas west of Waverley Street, to provide for an active transportation link between Parker Station and Waverley Street, to provide for a traffic link between the Beaumont community and areas west of Waverley Street, and to provide a Kiss and Ride facility at Parker Station:
  a. A widening of Hurst Way from two lanes to four lanes between Waverley Street and a point near the west end of the proposed Brenda Leipsic Dog Park;
  b. A two-lane easterly extension of Hurst Way from a point near the west end of the proposed Brenda Leipsic Dog Park and a point north of Parker Station;
  c. A new north-south roadway, Georgina Street, between the end of the easterly extension of Hurst Way and Parker Avenue that crosses the transitway at a signalized at-grade intersection;
  d. A new active transportation path, adjacent to Georgina Street and Hurst Way, between Parker Station and Waverley Street;
  e. An upgrade of Parker Avenue from a point approximately 110 m east of Beaumont Street to Planet Street to accommodate bus operational requirements;
  f. The closure of the portion of Hurst Way between a point near the west end of the proposed Brenda Leipsic Dog Park and Parker Avenue; and,
  g. The closure of Parker Avenue between Hurst Way and Planet Street.

These changes to the street network will enable:
• Efficient transit route links between Parker Station and surrounding areas;
• The extension of rapid transit routes from Parker Station to Lindenwoods, the Seasons of Tuxedo Shopping Centre, and Charleswood via Sterling Lyon Parkway;
• A new active transportation link between Parker Station and the existing path adjacent to Waverley Street; and,
• An improved traffic link between the Beaumont community and Waverley Street via Hurst Way, Georgina Street, Parker Avenue, and Beaumont Street. This path is at-grade and somewhat indirect and addresses concerns from Beaumont area residents about traffic levels through their community.

2.2.4 Alignment within Manitoba Hydro Right-of-Way between Parker Avenue and Letellier Tunnel

The specific alignment of the transitway within the Manitoba Hydro right-of-way between Parker Avenue and the Letellier Tunnel was developed within the context of a complex set of design constraints, including:
• Existing Manitoba Hydro transmission, distribution and communications lines;
• Future planned Manitoba Hydro transmission lines;
• Existing City of Winnipeg utilities located within the Manitoba Hydro right-of-way, including an aqueduct, a water feedermain, and land drainage sewers;
• Existing areas within the Manitoba Hydro right-of-way leased by other interests for parking and outdoor storage purposes;
• Expectations of nearby residential areas about buffer distances between the transitway and existing properties;
• Feasibility of transitway construction within the constraints of other infrastructure in the Manitoba Hydro right-of-way;
• Requirements for transitway connections to the street system; and,
• Clearance and geometric requirements for the Transitway Overpass of McGillivray Boulevard.

The recommended alignment within the Manitoba Hydro right-of-way, shown in the plan view in Figure 6 and in cross-section in Figure 7, is characterized by the following:
• Siting of the transitway to accommodate existing and future locations for Manitoba Hydro towers and lines between Parker Avenue and the Letellier Tunnel (see cross-section in Figure 7 for transitway alignment in relation to Manitoba Hydro infrastructure);
• Siting of the transitway that requires no relocations of the City’s aqueduct and water feedermain lines;
• An alignment that permits construction of the Transitway Overpass of McGillivray Boulevard;
• Transitway stations (McGillivray Station, Clarence Station, Chevrier Station) to provide convenient access to rapid transit service for adjacent areas;
• New Park and Ride facilities at McGillivray Station and at Clarence Station, including connections to and upgrading of streets for automobile access/egress to/from the parking lots;
• Reconfiguration of the Buhler Industries parking lot on leased Manitoba Hydro property to maintain the existing number of parking spaces and to provide automobile access/egress to Clarence Avenue and Chevrier Boulevard;
• Signalized at-grade intersections for the transitway at Clarence Avenue and Chevrier Boulevard;
2.2.5 Grade-Separated Crossing of CN Letellier Tracks (Letellier Tunnel)

South of Chevrier Boulevard, the transitway is required to cross the CN Letellier track and the CN Fort Garry Industrial Leads (tracks WC07 and WC21) to transition the transitway within the Manitoba Hydro right-of-way from the west side of the CN Letellier tracks to the east side of the tracks. The transitway needs to be aligned on the east side of the CN Letellier subdivision to provide rapid transit access to existing high-density development between Chevrier Boulevard and Markham Road, and to provide efficient transitway access to Investors Group Field/University of Manitoba.

Options considered for a grade-separated crossing of the three tracks included an overpass and a tunnel. An overpass was deemed to be not feasible for the following reasons:

- The vertical clearance requirement over the tracks for the overpass would result in buses on the overpass operating in too close proximity to adjacent Manitoba Hydro transmission lines;
- To accommodate the required overpass grades, a portion of Chevrier Boulevard would be required to be raised and reconstructed where it intersects the transitway;
- An overpass would be subject to icing during winter conditions, which would create unsafe operating conditions for northbound buses descending the overpass into the Chevrier Boulevard intersection; and,
- An overpass would have significant negative noise and visual intrusion impacts on adjacent properties.

Shown in Figure 8, it is recommended that the Letellier Tunnel be constructed beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track. The north end of the tunnel structure would be on the west side of the Letellier subdivision immediately south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 621 m further south on the east side of the Letellier track. The tunnel structure includes a covered tunnel approximately 203 m in length with retaining walls approximately 197 m in length approaching the north tunnel entrance and 221 m in length approaching the south tunnel entrance. During construction, a temporary shofly of the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required. Upon completion of construction, these tracks will be located to their new permanent alignments.

Note that, depending on the design of the spur structures, on shoofly requirements for the temporary relocation of the Letellier track during construction, and on operational requirements for businesses served by the spur lines, the tunnel length may change during the detailed design stage.

2.2.6 Alignment between Letellier Tunnel and Markham Road

The specific alignment of the transitway within the CN Letellier subdivision between the Letellier Tunnel and Markham Road was developed within the context of a complex set of design constraints, including:

- A requirement to reposition segments of the existing track, signals and switches west of their current locations to accommodate the transitway;
- Existing Manitoba Hydro transmission and distribution lines;
- Future planned Manitoba Hydro transmission lines;
- Existing City of Winnipeg utilities including an aqueduct, a water feedermain, land drainage sewers, and the Lot 16 drain;
- Expectations of Waverley Heights residents about buffer distances between a relocated CN Letellier track and existing properties;
- Requirements for transitway connections to the street systems;
- Clearance and geometric requirements for the Transitway Bridge over Bishop Grandin Boulevard; and,
- Access requirements to Investors Group Field/University of Manitoba.

Shown in Figure 9, the recommended alignment of the transitway and the Letellier track between the Letellier Tunnel and Markham Road features the following:

- Siting of the transitway to accommodate existing and future locations for Manitoba Hydro towers and lines between the Letellier Tunnel and Bishop Grandin Boulevard;
- A relocation of the CN Letellier track up to 5.7 m west of its current alignment (and up to 10.0 m west of its current alignment at the new CN Bridge over Bishop Grandin), a CN maintenance roadway on the west side of the relocated track, and a noise attenuation wall on the west property line of the City’s feedermain easement between the north end of the Waverley Heights residential area (opposite Lake Village Road) and a point south of Markham Road (see cross-section in Figure 10);
- A new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel to and immediately west of the existing rail bridge over Bishop Grandin Boulevard (see Figure 11);
- A new Transitway Bridge over Bishop Grandin Boulevard constructed in the approximate location of the existing rail bridge, accommodating both the transitway runningway and the active transportation path (see Figure 11);
- Signalized at-grade intersections for the transitway at Chancellor Drive and at Markham Road;
An at-grade intersection at Southpark Drive for use by rapid transit buses destined to Investors Group Field/University of Manitoba;

Three new stations (Plaza Station, Chancellor Station, and Markham Station) to provide convenient access to rapid transit service for adjacent areas;

An extension of the Stage 1 active transportation path along the Stage 2 transitway with several connections to the existing active transportation network and adjacent developments; note that sufficient space is provided for the path on the Transitway Bridge over Bishop Grandin Boulevard.

Note that, to accommodate northbound rapid transit bus volumes, it is recommended that the northbound left turn storage lane at the Pembina Highway & Markham Road intersection be lengthened to accommodate four standard buses.

Alignment between the CN Letellier Subdivision and Investors Group Field/University of Manitoba

For the reasons outlined in Section 2.2, it is recommended that the transitway alignment between the CN Letellier subdivision and Investors Group Field/University of Manitoba be via Southpark Drive and the University’s Southwood lands.

Shown in Figure 12, this alignment will include:

- The reconfiguration of Southpark Drive (see existing and proposed cross-sections in Figure 13) to provide for one traffic lane in each direction (for use by buses and other traffic), an on-street parking lane on the westbound side, a two-way bicycle path on the north side of the street, and new sidewalks on both sides of the street;

2.2.8 Alignment Drawings

The recommended alignment drawings for the functional design of Stage 2 of the Southwest Transitway are shown in Figures 14a, 14b, 14c, and 14d.
3.0 Background Investigations

3.1 Existing Agreements

Existing agreements that are relevant to the Southwest Transitway include one between the City of Winnipeg and CN regarding the City’s use of the CN Letellier Subdivision for a “busway”, and lease agreements on lands owned by Manitoba Hydro within or near the specified alignment for Stage 2 of the Southwest Transitway. These agreements are described below.

3.1.1 1994 City CN Agreement

On October 13, 1994, the City and Canadian National Railway Company (CN) concluded an agreement regarding an exchange of properties required for certain of the City’s urban transportation projects, including the Southwest Rapid Transit Corridor. The portions of the agreement that pertain to Stage 2 of the Southwest Transitway include Clauses 5, 9, and 10.

Clause 5 requires that CN lease to the City, for purposes of a transit corridor, lands in the eastern half of the Letellier subdivision between the north limit of the subdivision (at its intersection with the CN mainline at Portage Junction) and Bison Drive. This property is referred to as the “Letellier Corridor Lands”. The conditions for the lease are outlined in Clause 9 as follows:

9. The lease to the City of the Letellier Corridor Lands shall be on the following conditions:

a. The term of the lease shall be for ninety-nine (99) years commencing on the 1st day of January, 1990 at a total rental of one ($1.00) Dollar;

b. The lease shall be executed within one hundred eighty (180) days after receipt by CN of notice from the City that possession is required, and vacant possession and control of the Letellier Corridor Lands shall be delivered to the City by CN upon completion of the Letellier tracks, such reconstruction to be completed by CN within twenty-four (24) months of said notice. CN shall use its best efforts to enable the City to enter upon and use said lands, even a part at a time, prior to the expiration of said twenty-four (24) month period. Upon execution of said lease, provision shall be made for payment by the City of all taxes, local improvement levies, assessments and charges or levies, if any made relative to construction of the corridor on the Letellier Corridor Lands;

c. CN shall relocate, at the City’s expense, before possession is delivered up pursuant to sub-clause (b), all ties, rails, poles, signal communication and other materials comprising the Letellier Subdivision and connecting tracks affected by the construction of the Transit Corridor. The designs and schedules for said rail relocation, of all signal systems, and construction of crossings, shall be mutually agreed upon prior to the time of the execution of said lease;

d. The City shall utilize the Letellier Corridor Lands only for public transit vehicles, inter-City buses, and authorized City emergency and maintenance vehicles. The construction proposed by the City within the Letellier Corridor Lands is to provide an unobstructed permanent service vehicle path with a minimum 12 ft width to be used by CN at its discretion for maintenance vehicles at locations to be mutually agreed upon. The setback of the service vehicle path from the tracks must comply with regulatory requirements.

Clause 10 of the agreement grants the City right of first refusal to purchase any Letellier Subdivision right-of-way Land declared surplus to CN requirements within the City limit.

3.1.2 Existing Lease Agreements

Within the Manitoba Hydro right-of-way in the north-south portion between Parker Avenue and Bishop Grandin Boulevard, there are approximately ten lease agreements between Manitoba Hydro and private interests for use of Manitoba Hydro land by the private interests for parking or outdoor storage purposes. These leases have a maximum term of 5 years with provision for annual renewals and are in various stages of the 5-year terms. During the functional design study, neither Manitoba Hydro nor the private parties provided copies of the lease agreements. Manitoba Hydro has indicated that, while the existing leases can be re-negotiated or terminated to accommodate transitway requirements, the City would be required to indemnify Manitoba Hydro for any costs, claims, and damages that might arise against Manitoba Hydro resulting from the re-negotiation or termination of these leases.

As an example, Buhler Industries currently leases land between Clarence Avenue and Chevrier Boulevard in the Manitoba Hydro right-of-way for parking. The eastern portion of this parking lot will be displaced by the project. As part of the project, the western portion of the parking lot would be extended southerly towards Chevrier Boulevard to replace the displaced parking. A revised lease agreement would need to be concluded between Manitoba Hydro and Buhler Industries for the reconfigured parking lot.

There is an existing agreement between Manitoba Hydro and the City for use of a portion of the Manitoba Hydro right-of-way for the off-leash Brenda Leipsic Dog Park. The lands used for the dog park are approximately bounded by the Heatherdale right-of-way on the south, Hurst Way on the west, the northern boundary of the Manitoba Hydro right-of-way on the north, and the Daniel Street right-of-way on the east. During the development of the functional design for the transitway, an alternative location for the dog park within the Manitoba Hydro right-of-way was identified (see Section 16.3 for additional information). Further consultation with the Parks and Open Space Division of the Public Works Department and Manitoba Hydro will be required during final design to determine how requirements for the dog park might be accommodated by the project.
During the development of the functional design, consultations were undertaken with CN to develop and review the railway works required to accommodate the SWT2-Pembina Underpass project.

As shown in the Figure 15, the SWT2-Pembina Underpass project requires rail-related works on four portions of existing rail infrastructure within the CN Rivers and CN Letellier subdivisions. Referred to as the "CN Works", these include:

1. **A New CN Rail Bridge over Pembina Highway and Associated Relocation of CN Rivers Tracks**
   - At the north limit of the SWT2-Pembina Underpass project and within the CN Rivers Subdivision, the existing CN Bridge over Pembina Highway will be replaced with a new rail bridge over Pembina Highway at a location north of the existing rail bridge. This work will include the relocation of existing tracks within the CN Rivers subdivision to align with the new rail bridge. The existing CN Bridge over Pembina Highway, including all existing retaining walls, will be demolished.

2. **New Wye Connections at Portage Junction**
   - The two existing wye tracks at Portage Junction (Letellier track - east leg of wye, and track WC02 - west leg of wye) will be relocated to align with the relocated CN Rivers tracks. The relocated wye tracks and associated structures will initially be constructed at-grade, and once completed, the transitway excavation and construction will take place beneath the two wye tracks through the new underpass structures of the wye tracks.

3. **Letellier Tunnel**
   - The transitway alignment includes a transitway tunnel beneath the CN Fort Garry Industrial Lead (tracks WC07 and WC21) and the CN Letellier track. The north end of the tunnel structure will be on the west side of the Letellier subdivision south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 621 m further south on the east side of the Letellier subdivision. The tunnel structure includes a covered tunnel approximately 203 m in length with retaining walls approximately 197 m in length approaching the north tunnel entrance and 221 m in length approaching the south tunnel entrance. The tunnel will provide a grade-separated transition of the transitway between the alignment in the Manitoba Hydro right-of-way on the west side of the CN Letellier tracks and the planned transitway alignment on the east side of the CN Letellier tracks. During construction, a temporary shorty of the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Lead will be required.

4. **Letellier Subdivision Works**
   - Between the south end of the Letellier Tunnel and a point south of Markham Road, segments of the existing track, signals and switches within the CN Letellier right-of-way will be relocated westerly by up to 5.7 m to accommodate the transitway alignment. This work will include the construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel to and up to 10.0 m west of the existing rail bridge over Bishop Grandin Boulevard. A new Transitway Bridge over Bishop Grandin Boulevard will be constructed in the approximate location of the existing rail bridge.

During the preparation of the functional design, the 1994 agreement between the City and CN and the proposed PPP procurement for the SWT2-Pembina Underpass project was reviewed with CN officials. CN acknowledged its obligations contained in the 1994 agreement and requested that CN be included at appropriate stages during the PPP procurement. With respect to the latter, the City committed to working collaboratively with CN in the planning, design, and construction of the SWT2-Pembina Underpass project and the related PPP process. In particular:

- During the development of the PPP procurement documents (RFQ, RFP, and Project Agreement), the City will work with CN to create a work plan that outlines sufficient time periods for CN to review sections of the documents that relate to the CN Works;

- To ensure that the Specifications adequately outline the requirements for the CN Works and that the Qualified Respondents are correctly interpreting these requirements prior to submitting their proposals, the City proposes to work with CN to enable CN's representatives to participate in bilateral non-binding commercially confidential meetings ("CCMs") with the Qualified Respondents during the RFP proposal period; and,

- To ensure compliance of the designs and construction plans proposed by the Qualified Respondents with CN's requirements in the specifications, the City proposes to work with CN to enable CN's representatives to provide information and input during the RFP process.

**Manitoba Hydro**

A portion of the transitway alignment is located on lands within existing Manitoba Hydro rights-of-way used for transmission, distribution, and communication lines. As illustrated in Figure 16, the affected Manitoba Hydro lands are referenced as three separate "corridors" as follows:

- North of and parallel to Parker Avenue between Daniel Street and Hurst Way ("Parker Hydro Corridor");
- North-South Manitoba Hydro Corridor between Parker Avenue and Letellier Tunnel ("North Hydro Corridor"); and,
- North-South Manitoba Hydro Corridor between Letellier Tunnel and Bishop Grandin Boulevard ("South Hydro Corridor").

During the development of the functional design, consultations were undertaken with Manitoba Hydro to identify vertical and horizontal buffers around towers/lines to comply with safety and maintenance requirements, and to outline future development plans for transmission lines in these corridors.

In consideration of these requirements and plans, the preferred transitway alignment through the hydro corridors was identified in the functional plan. The transitway alignment in relation to existing hydro infrastructure in each of the three hydro corridors referenced above is illustrated in cross-section in Figure 17a.

To accommodate construction of the transitway on the alignment, the City and Manitoba Hydro have agreed to consult and work collaboratively in planning for the replacement and/or relocation of existing hydro lines in the hydro corridors, including:

1. Removal and/or relocation of the existing LT1 transmission line (towers and lines) in Parker Hydro Corridor, North Hydro Corridor, and South Hydro Corridor, shown in blue in Figure 17a, by Manitoba Hydro by the spring of 2016 to accommodate the start of construction of the project in 2016;
2. Relocations of any other hydro infrastructure within or parallel to the transitway alignment by the PPP consortium under the supervision of Manitoba Hydro (including, but not limited to, removal and relocation of the H56 Distribution line in Parker Hydro Corridor and North Hydro Corridor, of underground Communications line in Parker Hydro Corridor, and of the X98 distribution line between French Street and Bishop Grandin Boulevard in South Hydro Corridor);

3. Post-project works and operations;

4. Scheduling of hydro line relocations and other hydro works; and,

5. Approvals required for relocation of Manitoba Hydro infrastructure, including licensing and environmental approvals.

Following completion of the works identified in 1 above by the spring of 2016, the arrangement of transmission/distribution lines within each of the three hydro corridors is shown in Figure 17b. Note that Figure 17b also shows two potential new transmission lines (Y533/XH46 and Y41/YS27) that may be installed by Manitoba Hydro in conjunction with the removals/relocations completed by the spring of 2016.

Following completion of construction of the transitway project (expected by the end of 2019), Manitoba Hydro plans to install, as part of its long-term plans, up to three additional transmission lines through the three hydro corridors. These lines, in combination with the existing ones, would result in up to six transmission lines being routed through the three hydro corridors.

When fully built out, the arrangement of these transmission lines through the three corridors is shown in Figure 17c, and includes:

- In the Parker Hydro Corridor: three transmission lines north of the transitway and three transmission lines south of the transitway;
- In the North Hydro Corridor: four transmission lines west of the transitway and two transmission lines east of the transitway; and,
- In the South Hydro Corridor: three transmission lines west of the transitway and three transmission lines east of the transitway.

The works required to be completed by the spring of 2016 by Manitoba Hydro, including all design, construction, and construction management, are to be undertaken by Manitoba Hydro at its cost. To accommodate the project through the hydro corridors, some incremental costs will be incurred by Manitoba Hydro for these works. These incremental costs are related to:

- The use of tubular towers, rather than lattice towers, for the new transmission lines;
- An increase in tower heights for certain lines in certain locations to ensure sufficient clearance of transitway lighting standards, stations, parking lots, and the Transitway Overpass of McGillivray Boulevard; and,
- Other requirements to meet safety regulations.

The project requires the following lands within the hydro right-of-way to be acquired from Manitoba Hydro:

- The transitway runningway (approximately 10 m in width between stations and approximately 15 m in width within stations);
- The station platforms and structures (area varies by station); and,
- A temporary 6 m easement on either side of the transitway alignment during construction.

Note that, while not to be acquired from Manitoba Hydro, lands proposed for drainage ditches on either side of the transitway alignment in the Manitoba Hydro right-of-way are to be sized to accommodate drainage from both the transitway and Manitoba Hydro lands within the Manitoba Hydro right-of-way.

In addition, lands for the following purposes are required to be leased from Manitoba Hydro:

- A Park and Ride lot (including asphalt pavements and access/egress approaches) at McGillivray Station. Note that this would be a new parking lot on Manitoba Hydro lands with approaches to/from Seel Avenue and Willson Place.
- A Park and Ride lot (including asphalt pavements and access/egress approaches) at Clarence Station. Note that this would be a new parking lot on Manitoba Hydro lands with approaches to/from Clarence Avenue and Waller Avenue.

Following receipt of all approvals for the project by the City, the City’s Real Estate Division will initiate discussions with Manitoba Hydro regarding these and all other lands required for the project.

During the development of the functional design for the transitway, the City committed to working collaboratively with Manitoba Hydro in the planning, design, and construction of the SWT2-Pembina Underpass project and the related PPP process. In particular:

- During the development of the PPP procurement documents (RFQ, RFP, and Project Agreement), a project workplan is to outline sufficient time periods for Manitoba Hydro to review sections of the documents relating to any works that impact Manitoba Hydro; and,
- To ensure that the Specifications adequately outline any Manitoba Hydro requirements and that the Qualified Respondents are correctly interpreting these requirements prior to submitting their proposals, Manitoba Hydro’s representatives are to participate, if desired, in bilateral non-binding commercially confidential meetings (“CCMs”) with the Qualified Respondents during the RFP proposal period.

3.2.3 University of Manitoba

During the development of the functional design, consultations were undertaken with the University of Manitoba to determine the integration of the transitway on lands currently owned by the University. The major issues included:

- The alignment of the transitway and active transportation path through the Southwood Lands (former golf course property acquired by the University for long-term development);
- The conceptual design of a major transit terminal to service events at Investors Group Field;
- The on-street routing of rapid transit service on the University’s Fort Garry campus;
- The location of an on-campus bus staging area at the end of the rapid transit route path; and,
- The locations of transit stations/stops on University lands.

The future development of the Fort Garry campus, including the Southwood Lands, is under study as part of a comprehensive planning exercise being conducted by the University. While specific development plans have yet to be confirmed, the City and the University have agreed that the detailed design of transitway facilities on University lands can be based on the following assumptions:

1. Following construction of the major road network in the Southwood Lands by the University and as shown in Figure 18:
a. Regular rapid transit service will operate through the Southwood Lands on a four-lane divided roadway between the Southpark Drive & Pembina Highway intersection and University Crescent;

b. The curb lanes of the four-lane divided roadway will be reserved for transit buses only between 7:00 am and 7:00 pm on weekdays;

c. Two sets of bus stops for regular rapid transit will be located at sites to be mutually agreed upon (tentative locations are at the new road’s intersection of Markham Drive and on the east-west portion of the new roadway);

d. Should the University decide to include on-street parking on the four-lane roadway, such parking will be accommodated in recessed parking areas between bus stops so as to leave a clear path of travel for buses in the reserved curb lanes;

e. For special transit service for events at Investors Group Field, buses will use the new four-lane divided road to operate to and from a new transit terminal (IGF Station) constructed on the north side of the stadium;

f. Immediately before, during, and after events at Investors Group Field, the new four-lane divided roadway between Southpark Drive & Pembina Highway and University Crescent will be reserved for buses only (for bus access, egress, and staging) and closed to all other traffic;

g. Upon approval by the City’s transit department, IGF Station may be used for other University purposes (such as parking or loading for adjacent development) during times when there are no events at Investors Group Field; and,

h. The transitway’s active transportation path will be extended from the north side of Southpark Drive through the Southwood Lands on alignments to be mutually agreed upon.

2. Until construction of the major road network in the Southwood Lands is completed by the University, the following interim measures, as shown in Figure 19 and included in the transitway project, will be in effect:

a. Regular rapid transit service will operate via a two-lane roadway and via IGF Station between the Southpark Drive & Pembina Highway intersection and University Crescent;

b. The two-lane roadway (including an at-grade intersection at Markham Road) and IGF Station (including an at-grade intersection at University Crescent) will be constructed at the City’s cost as part of the SWT2-Pembina Underpass project;

c. The two-lane roadway and IGF Station will be reserved for buses only, at all times;

d. No bus stops will be located on the two-way roadway until such time as the roadway is expanded to four lanes by the University;

e. For special transit service for events at Investors Group Field, buses will use the two-lane road to operate to and from IGF Station; and,

f. The transitway’s active transportation path will be extended from the north side of Southpark Drive through the Southwood Lands on the general alignment shown in Figure 19.

3. Following operation through the Southwood Lands, regular rapid transit service will operate to the campus via southbound University Crescent, eastbound Dafoe Road, southbound Service Road 7, and eastbound Freedman Crescent to a new bus staging terminal near the east end of Dafoe Road. Rapid transit service will operate from the campus via westbound Dafoe Road, northbound University Crescent, and through the Southwood Lands to Southpark Drive and the main transway;

4. The eastbound section of Dafoe Road between Gilson Street and Alumni Lane will be reserved for transit only;

5. The westbound section of Dafoe Road between Service Road 7 and Gilson Street will be reserved for transit only;

6. As shown in Figure 20, the following will be built at the City’s cost as part of the SWT2-Pembina Underpass project:

   a. A redeveloped University of Manitoba Station located on the north side of Dafoe Road east of the existing station location; and,

   b. A new bus staging terminal near the east end of Dafoe Road that has a capacity for 12 buses and a bus operator washroom. Note that no passenger boarding or alighting will occur in the bus staging terminal;

7. Existing bus stops on westbound Dafoe Road at the School of Music and on northbound University Crescent at Chancellor Matheson Road are to be upgraded as part of the SWT2-Pembina Underpass project;

8. New bus stops for alighting passengers are to be installed on eastbound Dafoe opposite the School of Music stop and in the block between Gilson Street and Alumni Lane; and,

9. The transit terminal at Investors Group Field (IGF Station) is to be designed to support the operation of up to 200 buses (including transit buses and school buses) required to accommodate the travel of approximately 12,000 spectators at the 33,000 seat stadium. Further details about IGF Station are provided in Section 5.3.

3.3 Deep Utilities Investigation

3.3.1 Overview

The preparation of the functional design for Stage 2 of the Southwest Transitway required a consideration of several critical components of the City of Winnipeg’s regional water and land drainage systems.

These components are located within the Manitoba Hydro right-of-way between Parker Avenue and Bishop Grandin Boulevard and within a feedermain right-of-way immediately adjacent to the west property line of the CN Letellier subdivision south of Bishop Grandin.

Within the Manitoba Hydro right-of-way, the project includes a transitway runningway with a rural cross-section approximately 0.5 m to 0.8 m above existing grades, five stations, an active transportation path, a Transitway Overpass of McGillivray Boulevard, the Letellier Tunnel, and landscaping. South of Bishop Grandin, the project includes an urban cross-section for the transitway runningway on the east side of the CN Letellier track, two stations, and an active transportation path.
A loading and impact assessment was undertaken to assess risks to the buried infrastructure in the vicinity of the transitway alignment and to determine the effects of changes in loading caused by construction activities and by on-going transitway operations. The following pipelines were assessed:

- 1650 mm Branch II Aqueduct;
- 750 mm Fort Garry-St. Vital (FGSV) Feedermain;
- 500 mm Fort Garry Feedermain; and,
- 2400 mm Lot 16 Drain.

The removal/relocation of the Manitoba Hydro lines shown in blue in Figure 17a (and described in Section 3.2.2) permits the construction of a transitway alignment that traverses none of these pipelines. Consequently, the project requires no relocations of any of the pipelines.

In the development of the recommended transitway alignment, however, consultations were undertaken with Manitoba Hydro and the Water and Waste Department to ensure that the placements of any new or relocated hydro towers would not increase the lateral loading on the Branch II Aqueduct and on the FGSV Feedermain. Within the Manitoba Hydro right-of-way, Figure 21 shows the positions of the Branch II Aqueduct and the FGSV Feedermain in relation to the recommended transitway alignment and to Manitoba Hydro’s existing and planned tower locations.

As shown in Figure 8, the Letellier Tunnel requires a repositioning of the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and will require bridging structures to accommodate the rail loads above the Branch II Aqueduct and FGSV Feedermain.

Between the south end of the Letellier Tunnel and a point south of Markham Drive, the rail line in the CN Letellier subdivision will be repositioned west of its existing alignment to accommodate the transitway (see Figure 9). This will result in new traverses (by both the Letellier track and the transitway) of the Branch II Aqueduct, the FGSV Feedermain, and the Lot 16 Drain. To provide sufficient protection, the Lot 16 Drain must be relocated and additional casing for the FGSV Feedermain will be required.

The pipeline loading assessment and design recommendations are in the form of maximum and minimum allowable soil covers and live loads. The loading assessments are based on the original minimum specified properties of the pipelines, and assume that the pipelines are in good condition and capable of handling loads consistent with their original designs. During the detailed design phase of the PPP procurement, it is recommended that the successful proponent undertake a condition assessment of these pipelines and submit a report to the Water and Waste Department. This assessment will provide confirmation of the assumptions about the physical condition of the pipelines used during the functional design phase.

Within the Manitoba Hydro and CN Letellier rights-of-way, seven transitway stations are planned (Parker, McGillivray, Clarence, Chevrier, Plaza, Chancellor, and Markham). These station locations were reviewed to ensure that there would be no physical conflicts between the stations’ pile foundations and the City’s pipelines.

The functional design’s land drainage concept includes a combination of ditches and new land drainage sewers (LDS) installed along the transitway alignment and connected to existing adjacent LDS systems.

The operation of heavy equipment and a reduction in soil cover during construction can induce above normal loading on pipelines. It is imperative that proper staging and construction controls be implemented to prevent inadvertent damage to these critical pipeline infrastructures. For example, a loss of service of the Lot 16 Drain would result in overland flooding in Southwest Winnipeg and a potential loss of service of the CN Letellier rail line. A loss of service of the Branch II Aqueduct (which supplies over half of the City’s potable drinking water) would severely limit the City’s ability to supply water to the southwest part of the city. Both the Aqueduct and the FGSV Feedermain are constructed from Prestressed Concrete Cylinder Pipe (PCCP). As PCCP typically fails in a catastrophic manner, any above normal loading on these pipelines would cause flooding and extensive damage to nearby properties and infrastructure.

### 3.3.2 Data Collection and Review

The analysis of deep utilities was based on a review of the following information:

- Alignment drawings for Stage 2 of the Southwest Transitway (see Figures 14a to 14d);
- Original construction record drawings for Branch II Aqueduct (D810 and D811 attached in Appendix B);
- Original construction record drawings for FGSV Feedermain (D850 to D852 attached in Appendix B);
- Bishop Grandin Underpass Relocations (D1641, D1645 to D1647, and D1651 attached in Appendix B);
- AECOM (UMA Engineering) record drawings for the Lot 16 Drain (attached in Appendix B);
- AECOM (UMA Engineering) record drawings for the Fort Garry Feedermain (attached in Appendix B);
- Original Lock Joint and Hyprescon design notes (attached in Appendix C);
- Original Lock J joint and Hyprescon laying schedules (attached in Appendix D);
- American Water Works Association (AWWA) Standards and Manuals:
  a. C301-58;
  b. C301-84; and,
  c. C304-07.
- Misc. American Society for Testing and Materials (ASTM) Standards; and,
- Canadian Standards Association (CSA) A23.3.

### 3.3.3 Applied Loads

#### Soil Loads

PCCP, Asbestos Cement (AC) pipe, bar wrapped cylinder pipe, and monolithic concrete tunnels pipe types are all considered rigid pipe, whose soil loads are a function of the backfill weight, soil properties, installation type and trench width. City of Winnipeg open cut pipe installation methods typically conform to traditional Class B bedding. As trench widths are typically difficult to control in the field and can often exceed the maximum specified width, the current standard practice is to calculate loads on rigid pipes assuming an embankment or positive projection installation. Current
pipe design practice utilizes Heger positive projection embankment loads for determining soil loads on rigid pipes. Heger positive projection loads utilize four standard installation types (SIDD) as outlined in ASCE Standard of Practice 15-98.

Heger positive projection loads are calculated by multiplying the prism load (weight of soil directly above the pipe) by a Vertical Arching Factor (VAF). The VAF is determined by the SIDD installation type utilized for the pipe installation. The installation of all the pipelines referenced in above predates the common use of SIDD installations. However, the traditional City of Winnipeg Class B bedding type roughly equates to a Type 2 or Type 3 SIDD installation. As a conservative measure, a Type 3 SIDD installation has been assumed for all of the rigid pipelines equating to a VAF of 1.40.

A traditional Class B bedding as described above results in a Bedding Factor of 1.9. Bedding Factors are used to convert the loads imparted on the pipe from the installed conditions to an equivalent 3 Edge Bearing (3EB) test load. The three edge bearing test is a standard loading test to determine pipe strength in a factory environment. 3EB loads are used for the PCCP cubic parabola design method and AC pipe design curves.

Where pipelines have been installed using trenchless methods (Lot 16 Drain), Marston Tunnel Loads have been utilized to determine the applied soil loads. Marston Tunnel Loads take into account soil arching of the undisturbed soil above the pipe resulting in reductions in the applied soil loads. For the purposes of this analysis, it has been conservatively assumed that the soils are soft clay with a $k_\mu$ value of 0.11.

Live Loads

Live loads imparted on buried pipelines were calculated using American Association of State Highway and Transportation Officials (AASHTO) HS30 single truck, HS30 passing truck, and a Cooper E90 rail load.

The AASHTO HS30 design truck is a heavier axle load truck than the CL-625 (Canadian Highway Bridge Design Code) design truck used for the project’s bridge design and, as a conservative measure, was employed in the assessment of the buried infrastructure along the transitway. As Table 1 shows, the live loads imparted by an AASHTO HS30 are greater than the CL-625 and reflect heavy construction equipment loads. Where the transitway crosses pipelines, an AASHTO HS30 passing truck loading was used to model the impacts of passing buses.

### Table 1: Design Vehicle Comparison

<table>
<thead>
<tr>
<th>Design Vehicle</th>
<th>Front Axle (kN)</th>
<th>Rear Axle (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL-625</td>
<td>50.00</td>
<td>175.00</td>
</tr>
<tr>
<td>AASHTO HS30</td>
<td>53.38</td>
<td>213.52</td>
</tr>
</tbody>
</table>

All AASHTO loads were calculated in accordance with the 2012 AASHTO LRFD Bridge Design Specifications. Illustration 1 depicts the configuration of AASHTO HS single and passing truck loads.

To accommodate a potential future conversion of the Southwest Transitway to a rail technology, Light Rail Transit (LRT) vehicle loads were assessed for loading implications. The LRT design vehicle contained in Winnipeg Transit’s Busway Planning and Design Manual was used for the assessment.

Illustration 3 shows the truck loads imparted by the LRT design vehicle. A track gauge of 1.435 m (4.7 ft), based on the City of Calgary’s LRT design was assumed. The loads from each tandem truck axle were spread on two 0.5 x 2.0 m pads representing the load distribution from the track structure. This is consistent with the Busway Planning and Design Manual and represents a conservative distribution of forces as only the minimal load distribution by the track structure is accounted for.

A comparison of combined loads for both the LRT and AASHTO HS30 design vehicles are shown in Illustration 4. The AASHTO HS30 design truck loads exceed those from the proposed LRT vehicle and, consequently, govern the design. Therefore, only AASHTO HS30 single and passing truck loads were utilized in the assessment of loads imparted by the transitway on the buried pipelines.

### Internal Pressures

Operating pressures within the Branch II Aqueduct are controlled by water levels in the Wilkes Reservoir, pump operation at the Deacon Booster Pumping Station, and the Branch II surge tower at the Water Treatment Plant (WTP). Under normal operating conditions, the deepest portion of the Aqueduct in the project area operates under a pressure of 108 kPa (15.7 psi). However, the maximum internal pressure that can be observed within the pipe is under full Branch II surge tower head, resulting in an internal pressure of 338 kPa (49 psi). The current version of AWWA C304 requires a minimum transient allowance of the greater of 40% of the working pressure or 275 kPa (40 psi). This results in a transient pressure of 275 kPa (40 psi) and a combined internal pressure of 614 kPa (89 psi) which is consistent with the original combined design pressure of 641 kPa (93 psi). The City of Winnipeg’s regional feedermain system typically operates at higher pressures than the distribution portion of the system. For this analysis, an operating pressure of 552 kPa (80 psi) was assumed. A transient pressure of 275 kPa (40 psi) was selected (based on AWWA C304) which is a conservative transient allowance for this portion of the feedermain network.

### Branch II Aqueduct

#### Overview

The Branch II Aqueduct was constructed in 1959 and consists of a 1650 mm diameter pipeline conveying potable drinking water from the Water Treatment Plant at Deacons Reservoir to the Wilkes Reservoir located at Hurst Way and Waverley Street. The pipeline alignment is adjacent to Bishop Grandin Boulevard, crosses the Red River, and is within the Manitoba Hydro right-of-way between Bishop Grandin and the Wilkes Reservoir. A portion of the Aqueduct was relocated in the vicinity of Bishop Grandin Boulevard and Pembina Highway when that street intersection was grade-separated in 1988. The relocated pipe ties into the Aqueduct north of Bishop Grandin Boulevard near the CN Letellier rail line.

Lock joint pipe was used in the original construction of the Branch II Aqueduct. The pipe is an embedding core PCCP manufactured to AWWA standard C301-58. The original pipeline utilized six different pipe classes (A through F, in order of strength) to accommodate different soil covers, live loads and internal pressures. Within the transitway project area, Class A and B pipe were used were primarily used. However, Class D and E were used for road and rail crossings respectively. As soil covers along most of the Aqueduct are governed by the capacity of the Class A and B pipe, the capacity of the pipes to withstand additional loading were assessed during the functional design study. In particular, additional verifications were completed on the Class E pipe with respect to rail loading at the CN spur line crossings.

The relocated Aqueduct pipe was manufactured by Hyprescon (Canron Inc.). It is an embedded core PCCP built to AWWA Standard C301-84. Two classes of pipe were manufactured for the project, Class 14 and Class 20. Class 20 was utilized for the CN Letellier track crossing with Class 14 installed elsewhere. The recommended alignment for the transitway requires that the CN Letellier rail track be realigned to the west where the relocated Aqueduct crosses the rail line on the north side of Bishop Grandin Boulevard. The existing Class 20 pipe was originally designed for a Cooper E85 rail loading. Therefore, changes in the loading are anticipated with the repositioned rail line. However, the Class 14 pipe may be exposed to additional soil and live loads depending on the final alignment and has therefore, been verified with both AASHTO HS30 truck and Cooper E90 rail loads.

The major crossings of the Branch II Aqueduct are listed in Table 2. These crossings are either new or repositioned crossings with a significant change in condition.
TABLE 2: BRANCH II AQUEDUCT CROSSING LOCATIONS

<table>
<thead>
<tr>
<th>Location</th>
<th>Change in Condition</th>
<th>Applied Live Loads</th>
<th>Pipe Manufacturer</th>
<th>Pipe Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN North Spur Line (WC07 to Manitoba Hydro)</td>
<td>Spur Line repositioned adjacent to existing Class E pipe and casing pipe</td>
<td>Cooper E90 Rail Load</td>
<td>Lock Joint</td>
<td>Class E (Existing), Class A (Proposed)</td>
</tr>
<tr>
<td>CN South Spur Line (WC21 to Harris Transport)</td>
<td>Spur Line repositioned adjacent to existing Class E pipe and casing pipe</td>
<td>Cooper E90 Rail Load</td>
<td>Lock Joint</td>
<td>Class E (Existing), Class A (Proposed)</td>
</tr>
<tr>
<td>CN Letellier Rail Line north of Bishop Grandin Boulevard</td>
<td>Rail line repositioned west to accommodate transitway. Rail line still located overtop of Class 20 Pipe</td>
<td>Cooper E90 Rail Load</td>
<td>Hyprescon</td>
<td>Class 20</td>
</tr>
<tr>
<td>Southwest Transitway north of Bishop Grandin Boulevard</td>
<td>Transitway crosses Class 20 pipe</td>
<td>AASHTO HS30 Passing Truck</td>
<td>Hyprescon</td>
<td>Class 20</td>
</tr>
</tbody>
</table>

PCCP Analysis

PCCP pipes were assessed using both a stress analysis and traditional cubic parabolic design curves. The stress analysis and cubic parabolic design curve methods conform to the AWWA C301 Appendix A and B design methods, included with the specification from 1964 through 1984.

The stress analysis method utilizes the theory of superposition to take into account external and internal forces acting on the pipe wall which include:

- Compressive forces developed during the prestressing process;
- Internal pressure; and,
- External applied loads (dead and live loads).

Material properties for the structural components of the pipe wall, including the concrete core, steel cylinder and prestressing wire are utilized in conjunction with applied prestressing forces to determine the pipe resistance to applied external and internal loads. These allowable supporting strengths are used to determine the allowable external and internal loads. The calculated maximum internal and external forces are plotted on a Load vs. Pressure graph as per the AWWA C301 Appendix B stress analysis design method.

Overlain on the stress analysis Load vs. Pressure graph is the cubic parabola design curves based on the original design notes for the pipe. The original design W0 value has been converted into trench loads using a bedding factor of 1.9 as discussed above. The cubic parabolic design curve is defined by the external load and internal pressure intercepts using:

\[ W = \frac{W_0}{P_0} \sqrt{P_0 - P} \]

Where:

- \( W \) = Maximum combined load at a given internal pressure, lb/ft (3EB)
- \( W_0 \) = 0.9 times the external load that will crush the pipe (Wd) with no internal pressure, lb/ft (3EB)
- \( p \) = Internal pressure, psi
- \( P_0 \) = Internal pressure that will relieve all compressive forces within the pipe wall caused by prestressing, psi

Analysis and Results

The Branch II Aqueduct was analyzed to determine its sensitivity to changes in its loading regime. The analysis of the applied loads on the pipe utilized Heger positive projection soil (dead) loads and AASHTO HS30 single and passing truck loads and Cooper E90 rail loads as outlined in Table 3.

Table 4 lists the material properties for the four pipe classes analyzed. Design curves produced from the analysis are attached in Appendix E.

TABLE 3: BRANCH II AQUEDUCT LOAD CASES

<table>
<thead>
<tr>
<th>Pipe Class</th>
<th>Dead Loads</th>
<th>Live Load Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock Joint Class A</td>
<td>Heger Positive Projection</td>
<td>AASHTO HS30 and Cooper E90</td>
</tr>
<tr>
<td>Lock Joint Class B</td>
<td>Heger Positive Projection</td>
<td>AASHTO HS30</td>
</tr>
<tr>
<td>Lock Joint Class C</td>
<td>Heger Positive Projection</td>
<td>AASHTO HS30 and Cooper E90</td>
</tr>
<tr>
<td>Hyprescon Class 14</td>
<td>Heger Positive Projection</td>
<td>AASHTO HS30 Passing Truck and Cooper E90</td>
</tr>
</tbody>
</table>

TABLE 4: BRANCH II AQUEDUCT PCCP PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Lock Joint Class A</th>
<th>Lock Joint Class B</th>
<th>Lock Joint Class C</th>
<th>Hyprescon Class 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Diameter</td>
<td>In (mm)</td>
<td>66 (1676.4)</td>
<td>66 (1676.4)</td>
<td>66 (1676.4)</td>
<td>66 (1676.4)</td>
</tr>
<tr>
<td>Wall Thickness</td>
<td>In (mm)</td>
<td>6.32 (160.45)</td>
<td>6.32 (160.45)</td>
<td>6.32 (160.45)</td>
<td>6.19 (157.28)</td>
</tr>
<tr>
<td>Core Thickness</td>
<td>In (mm)</td>
<td>5.00 (127.00)</td>
<td>5.00 (127.00)</td>
<td>5.00 (127.00)</td>
<td>5.00 (127.00)</td>
</tr>
<tr>
<td>Mortar Coating Thickness</td>
<td>In (mm)</td>
<td>1.13 (28.58)</td>
<td>1.13 (28.58)</td>
<td>1.13 (28.58)</td>
<td>1.00 (25.40)</td>
</tr>
<tr>
<td>P0 (Original Design Notes)</td>
<td>psi (kPa)</td>
<td>99 (683)</td>
<td>108 (745)</td>
<td>193 (1331)</td>
<td>149 (1027)</td>
</tr>
<tr>
<td>P0 (Calculated)</td>
<td>psi (kPa)</td>
<td>94 (648)</td>
<td>103 (710)</td>
<td>197 (1358)</td>
<td>132 (910)</td>
</tr>
<tr>
<td>W0</td>
<td>lb/ft (kN/m)</td>
<td>7100 (103.62)</td>
<td>7460 (108.87)</td>
<td>11,050 (161.26)</td>
<td>10,890 (158.93)</td>
</tr>
</tbody>
</table>

4 AMERON, Prestressed Concrete Cylinder Pipe Design Manual. 1986
Table 5 summarizes the theoretical allowable minimum and maximum soil covers permitted overtop of the various classes of pipe used in the construction of the Aqueduct. The minimum soil covers shown in Table 5 are based on the analytical analysis completed. For the purposes of construction and protection of the pipeline, soil covers beneath the transitway and rail lines, and overtop of the Aqueduct should be a minimum of 1.2 m.

### Table 5: Branch II Aqueduct Allowable Soil Covers

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Live Load</th>
<th>Minimum Soil Cover (m)</th>
<th>Maximum Soil Cover (m)</th>
<th>Original Design Soil Cover (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock Joint Class A AASHTO HS30</td>
<td>1.00*</td>
<td>2.70</td>
<td>2.44 (8.00 ft)</td>
<td></td>
</tr>
<tr>
<td>Lock Joint Class A Cooper E90</td>
<td>N/A**</td>
<td>N/A**</td>
<td>2.44 (8.00 ft)</td>
<td></td>
</tr>
<tr>
<td>Lock Joint Class B AASHTO HS30</td>
<td>0.90*</td>
<td>2.90</td>
<td>2.74 (8.00 ft)</td>
<td></td>
</tr>
<tr>
<td>Lock Joint Class E AASHTO HS30</td>
<td>0.60*</td>
<td>4.95</td>
<td>5.18 (17.00 ft)</td>
<td></td>
</tr>
<tr>
<td>Lock Joint Class E Cooper E90</td>
<td>N/A**</td>
<td>4.95</td>
<td>5.18 (17.00 ft)</td>
<td></td>
</tr>
<tr>
<td>Hyprescon Class 14 AASHTO HS30 Passing Truck</td>
<td>0.65*</td>
<td>4.60</td>
<td>3.10 (10.00 ft)</td>
<td></td>
</tr>
<tr>
<td>Hyprescon Class 14 Cooper E90</td>
<td>N/A***</td>
<td>4.60</td>
<td>3.10 (10.00 ft)</td>
<td></td>
</tr>
</tbody>
</table>

* Minimum soil cover of 1.2 m should be used beneath roadway and rail lines
** Rail Loading exceeds strength of Lock Joint Pipe
*** Rail Loading does not exceed strength of pipe

Illustration 5 shows both the soil and combined (soil and live) loads applied to the Lock Joint Class A PCCP along with the allowable dead and combined loads as per the PCCP analysis completed. As shown in Table 5, the Class A pipe is unable to support Cooper E90 rail loads at any soil cover. Graphs for the analyzed pipes (Class B, E and 14) are included in Appendix E.

Illustration 5: Applied Loads vs. Soil Cover - Lock Joint Class A PCCP

Existing soil covers overtop of the Class A and B pipe range from 1.45 m (4.75 ft) to 2.25 m (7.4 ft) along most of the affected portion of the pipe with soil covers at some ditch crossings as low as 1.10 m (3.7 ft). Soil covers at several locations along the Branch II Aqueduct are summarized in Table 6.

The transitway alignment is significantly east of the original Aqueduct. Therefore, changes in soil covers overtop of the existing Branch II Aqueduct are expected to be limited to landscaping and drainage works. However, construction of the transitway and associated works as carried out by the PPP consortium will impart short-term construction loads which will need to be assessed during the project’s detailed design stage. As the pipe is very sensitive to changes in soil cover, any proposed grading and construction activity must be reviewed against the pipe class.

The relocated section of the Aqueduct is more robust and correspondingly less sensitive to changes in its loading regime. The transitway alignment crosses the Aqueduct above the existing Class 20 (pipe designed for rail loading) portion of the pipeline.

### Table 6: Existing Soil Covers on Branch II Aqueduct

<table>
<thead>
<tr>
<th>Location</th>
<th>Pipe Class</th>
<th>Existing Soil Cover (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South of the Wilkes Reservoir</td>
<td>Class A</td>
<td>1.50 (4.92')</td>
</tr>
<tr>
<td>McMillan Boulevard</td>
<td>Class D</td>
<td>2.95 (9.68')</td>
</tr>
<tr>
<td>Clarendon Boulevard</td>
<td>Class A</td>
<td>1.10 (3.61')</td>
</tr>
<tr>
<td>Clarence Boulevard</td>
<td>Class B</td>
<td>2.25 (7.38')</td>
</tr>
<tr>
<td>CN Spur Lines at Hopewell Lands</td>
<td>Class E</td>
<td>2.0 (6.56')</td>
</tr>
<tr>
<td>CN Letellier Rail Line @ Relocated Aqueduct Crossing</td>
<td>Class 20</td>
<td>3.49 (11.45')</td>
</tr>
<tr>
<td>Pump Station Access Road North of Bishop Grandin Boulevard</td>
<td>Class 14</td>
<td>3.19 (10.47')</td>
</tr>
</tbody>
</table>

As listed in Table 7, several rail lines cross both the original and relocated portions of the Branch II Aqueduct within the project area. Two spur lines near the Hopewell Lands (CN North Spur Line WC07 to Manitoba Hydro and CN South Spur Line WC21 to Harris Transport) cross the original Aqueduct. The CN Letellier rail track that will be repositioned to the west of its current alignment will cross the relocated Aqueduct north of Bishop Grandin Boulevard. This places the repositioned rail line within the extents of the existing Class 20 pipe and results in no change in loading to the Aqueduct.

The existing CN spur lines at the Hopewell Lands will require repositioning to facilitate construction of the Letellier Tunnel and to improve the geometry of the lines. The existing Aqueduct at the current rail crossings is constructed from Class E pipe (as discussed above) and is capable of supporting the current applied loads. The proposed repositioning of these two spur lines includes eliminating the existing sag in the aqueduct, thus raising the rails as required. The analysis indicates the existing Class E pipe is capable of supporting the additional soil covers (as shown in Table 7).

However, the extents of the Class E pipe is limited to 9.75 m (32 ft or two pipe lengths) below the CN North Spur Line (WC07 to Manitoba Hydro) and 14.6 m (48 ft or three pipe lengths) below the CN South Spur Line (WC21 to Harris Transport). The repositioned spur lines located over top of the existing Class A pipe are not capable of supporting the rail loads. As a result, bridging structures will be required at these crossings to protect the Aqueduct from the increased live loads (see Figure 22).
The four major crossings of the FGSV Feedermain are listed in Table 8. These crossings are either new or repositioned crossings with a significant change in condition. The section of the Feedermain near Bishop Grandin Boulevard was relocated during the construction of the grade separation of Bishop Grandin and Pembina in 1988. The relocated pipe is a lined core PCCP manufactured by the Lock Joint Pipe Company. The Feedermain supplies water to the neighbourhoods of Fort Garry South and St. Vital. The pipeline exits the Hurst Pumping Station (Willies Reservoir) and follows the Manitoba Hydro right-of-way and CN Letellier Rail Line right-of-way to Bishop Grandin Boulevard where it crosses Bishop Grandin Boulevard before turning east towards the Red River.

The Lock joint pipe used in the construction of the FGSV Feedermain is a lined core PCCP manufactured to AWWA standard C301-59. Two 750 mm diameter pipe designs were manufactured for the Feedermain (LJ D3005120 and LJ D3005130) and are designated as Class 120 and 130, respectively. Class 130 (the more robust of the two) was utilized for the road crossings while Class 120 was used elsewhere. The loading capacity of a majority of the pipeline will be governed by the Class 120 pipe and was used for the analysis of the Feedermain. The Class 130 has also been assessed to determine its ability to withstand the rail loading at the spur line crossings near the Hopewell Lands.

The section of the Feedermain near Bishop Grandin Boulevard was relocated during the construction of the grade separation of Bishop Grandin and Pembina in 1988. The relocated pipe is a lined core PCCP manufactured by Hyprescon (Canron Inc.) and built to AWWA Standard C301-84. The four major crossings of the FGSV Feedermain are listed in Table 8. These crossings are either new or repositioned crossings with a significant change in condition.

### Analysis and Results

The FGSV Feedermain was analyzed to determine its sensitivity to changes in its loading regime. Changes in the loading regime will result in changes in soil cover to the application of additional live loads. The FGSV Feedermain is subject to a combination of live and dead loads including both AASHTO truck loads and Cooper rail loads as discussed in Section 3.3.3 above. These load cases are listed in Table 9. Table 10 lists the dimensions and key physical properties used in the analysis of the pipe for the affected portions of the FGSV Feedermain. The analysis of the FGSV Feedermain was based on the PCCP analysis techniques used to assess the Aqueduct and are outlined in Section 3.3.4 The design calculations used in our analysis are attached in Appendix F.

### 3.3.5 Fort Garry-St. Vital Feedermain

**Overview**

The FGSV Feedermain was constructed in 1961 and is composed of 750 mm diameter PCCP manufactured by the Lock Joint Pipe Company. The Feedermain supplies water to the

### Table 8: Aqueduct Soil Covers at CN Spur Lines

<table>
<thead>
<tr>
<th>Spur Line</th>
<th>Existing Soil Cover (m)</th>
<th>Proposed Soil Cover (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN North Spur Line (WC07 to Manitoba Hydro)</td>
<td>2.04</td>
<td>2.67</td>
</tr>
<tr>
<td>CN South Spur Line (WC21 to Harris Transport)</td>
<td>2.16</td>
<td>2.81</td>
</tr>
</tbody>
</table>

### Table 9: Fort Garry-St. Vital Feedermain Crossing Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Change in Condition</th>
<th>Applied Loads</th>
<th>Pipe Manufacturer</th>
<th>Pipe Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN North Spur Line (WC07 to Manitoba Hydro)</td>
<td>Spur Line repositioned adjacent to existing Class 130 pipe and casing pipe</td>
<td>Cooper E90 Rail Load</td>
<td>Lock Joint Class 130 (Existing), Class 120 (Proposed)</td>
<td>Hyprescon Class 16</td>
</tr>
<tr>
<td>CN South Spur Line (WC21 to Harris Transport)</td>
<td>Spur Line repositioned adjacent to existing Class 6 pipe and casing pipe</td>
<td>Cooper E90 Rail Load</td>
<td>Lock Joint Class 130 (Existing), Class 120 (Proposed)</td>
<td>Hyprescon Class 16</td>
</tr>
<tr>
<td>CN Letellier Rail Line south of Bishop Grandin Boulevard</td>
<td>Rail line repositioned west to accommodate transway. Rail line no longer located above cased section of pipe</td>
<td>Cooper E90 Rail Load</td>
<td>Hyprescon Class 20</td>
<td>Hyprescon Class 20</td>
</tr>
<tr>
<td>Transway south of Bishop Grandin Boulevard</td>
<td>Transway crosses Class 20 pipe</td>
<td>AASHTO HS30 Passing Truck</td>
<td>Hyprescon Class 20</td>
<td>Hyprescon Class 20</td>
</tr>
</tbody>
</table>
The project requires that the CN Letellier rail track be repositioned to the west of its current alignment. The repositioned rail track will be near the west end of the existing casing pipe but within the extents of the existing Class 20 pipe, resulting in a negligible increase in loading on the FGSV Feedermain. The proposed transway alignment will be located within the extents of the existing Class 20 pipe.

The repositioning of the CN spur lines at the Hopewell Lands will change the crossing locations for the FGSV Feedermain. At the current spur line crossings, the feedermain is composed of 19.5 m (64 ft) of Class 130 pipe. The Feedermain on either side is Class 120 pipe. The proposed rail geometry involves eliminating the existing sag in the feedermain, thus raising the rails as required, with the impacts on soil cover shown in Table 12. The analysis indicates that both the existing Class 130 and 120 pipe are capable of supporting the proposed soil and rail loads. However, it is likely that CN will require protection for its track structure. Furthermore, the Water and Waste Department will likely favour additional load protection for the feedermain. Load protection may be in the form of a bridging structure or encasement of the FGSV Feedermain. Further discussion regarding pipe/rail line protection is provided below in Section 3.3.8 Railway Crossings.

### Table 11: Fort Garry-St. Vital Feedermain Allowable Soil Covers

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Live Load</th>
<th>Minimum Soil Cover (m)</th>
<th>Maximum Soil Cover (m)</th>
<th>Original Design Soil Cover (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock Joint Class 120</td>
<td>AASHTO H530</td>
<td>0.65* (2.13 ft)</td>
<td>4.40 (14.44 ft)</td>
<td>2.74 (9.00 ft)</td>
</tr>
<tr>
<td>Lock Joint Class 120</td>
<td>Cooper E90</td>
<td>1.00* (3.28 ft)</td>
<td>4.40 (14.44 ft)</td>
<td>2.14 (7.00 ft)</td>
</tr>
<tr>
<td>Lock Joint Class 130</td>
<td>AASHTO H530</td>
<td>0.60* (1.97 ft)</td>
<td>4.80 (15.75 ft)</td>
<td>3.20 (10.50 ft)</td>
</tr>
<tr>
<td>Lock Joint Class 130</td>
<td>Cooper E90</td>
<td>N/A**</td>
<td>4.80 (15.75 ft)</td>
<td>3.96 (13.00 ft)</td>
</tr>
<tr>
<td>Hyprescon Class 16</td>
<td>AASHTO H530 Passing Truck</td>
<td>0.50* (1.64 ft)</td>
<td>5.90 (19.36 ft)</td>
<td>3.10 (10.00 ft)</td>
</tr>
<tr>
<td>Hyprescon Class 16</td>
<td>Cooper E90</td>
<td>0.50* (1.64 ft)</td>
<td>5.90 (19.36 ft)</td>
<td>3.10 (10.00 ft)</td>
</tr>
</tbody>
</table>

* Minimum soil cover of 1.2 m should be used beneath roadway and rail lines

** Rail Loading does not exceed strength of pipe

Based on the PCCP analysis, Illustration 6 shows both the soil and live loads applied to the Lock Joint Class 120 PCCP along with the allowable dead and combined loads. Graphs for the analyzed pipes are included in Appendix F.

### Illustration 6: Fort Garry-St. Vital Feedermain Applied Loads vs. Soil Cover Lock Joint Class 120

Existing soil covers overtop of the feedermain range from 1.74 m (5.7 ft) to 2.41 m (7.9 ft) along most of the affected length. However, soil covers are as low as 1.40 m (4.6 ft) at the bottom of the McGillivray Boulevard Ditch, and as high as 3.17 m (10.4 ft) at Chevrier Boulevard. The transway alignment is located 10 to 18 m east of the original Lock Joint PCCP portion of the FGSV Feedermain. Consequently, no significant changes in the applied long-term loading on the pipe are anticipated. However, construction of the transway and associated works undertaken by the PPP consortium will impart loads on the pipeline which will need to be addressed during the project’s detailed design stage. Final soil covers should conform to the maximum and minimum soil covers outlined above and reviewed in conjunction with each existing pipe class.

### 3.3.6 Fort Garry Feedermain

The Fort Garry Feedermain was constructed in 1965 and is composed of 500 mm diameter Asbestos Cement pipe. The Feedermain supplies water to the University of Manitoba and Fort Garry South. The pipeline ties into the FGSV Feedermain near Bishop Grandin Boulevard and is aligned along the west side of the CN Letellier right-of-way between Bishop Grandin and Bison Drive.

The pipe was manufactured by Johns-Manville to AWWA Standard C400-65. There is conflicting information on the class of the pipeline due to incomplete record keeping at the time of construction. The pipe class is believed to be either a Class 150 or Class 200.

The northern portion of the Feedermain near Bishop Grandin Boulevard was replaced during construction of the grade separation of Bishop Grandin and Pembina intersection in 1988. This portion of the feedermain is a concrete bar wrapped steel cylinder pipe manufactured by Hyprescon (Canron Inc.) in accordance with AWWA Standard C303-B7.

The recommended transway alignment requires that the CN Letellier rail track be repositioned 5.7 m to the west of its current position. The existing offset between the rail line and Feedermain is 19.8 m (65 ft). With the repositioning of the rail line, this offset will be reduced to 9.7 m. At the proposed offset distance, there will not be any additional live loads imparted on the pipeline. Therefore, no analysis of the additional live loads on the Fort Garry Feedermain was undertaken during the functional design study.
Lot 16 Drain

Overview

Constructed in 1967, the Lot 16 Drain services nearly 4940 ha of mixed urban and rural catchment areas in the western portion of Winnipeg. West of the project site, the Lot 16 Drain is an open channel, then transitions into a 2400 mm diameter LDS immediately west of the Manitoba Hydro rights-of-way, and then crosses beneath the CN Letellier rail track and Pembina Highway.

The 2400 mm diameter pipe was hand tunneled and cast-in-place (CIP) as a non-reinforced concrete sewer with approximately 6 m of cover above the top of the pipe. The wall thickness of the 2400 mm concrete pipe is approximately 0.3 m. During construction, 16.5 m (54 ft) of steel tunnel liner was installed beneath the existing CN Letellier rail track. The tunnel liner was likely installed to provide temporary support during construction and to meet CN crossing requirements. The condition of the tunnel liner is unknown but given its age, the analysis assumed that it does not provide any structural support.

The project requires that the CN Letellier rail track be repositioned to the west of its current alignment. As a result, the structural adequacy of the 2400 mm CIP concrete pipe was reviewed to ensure its capacity to support rail loads of the repositioned CN Letellier rail track and the vehicle loads of the transway.

Analysis and Results

The 2400 mm CIP concrete pipe was analyzed to determine its structural adequacy for the proposed repositioning of the CN Letellier Rail Line and the transway crossing. The CN Letellier rail track crossing was analyzed using a Cooper E90 rail, AASHTO HS30 passing truck and a Marston Tunnel soil load.

The applied bending moments, thrusts, and shears in the pipe wall were determined by using moment, thrust, and shear coefficients for grouted jacked pipe as published in the ASCE 27-00 – Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction. Allowable wall forces were calculated in accordance with the CSA A23.3 requirements for non-reinforced concrete. The applied bending moment, thrust, and shear resistances were compared to the allowable forces to determine the Factor of Safety against failure.

Two loading cases were reviewed for the 2400 mm diameter Lot 16 Drain CIP concrete pipe:

- Case 1: Below the CN Letellier Rail Line; and,
- Case 2: Below the Southwest Transitway.

The live loading for Case 1 was based on the Cooper E90 rail loading, while the live loading for Case 2 was based on the AASHTO HS30 design vehicle. As the sewer was constructed using tunneling methods, the soil load for both cases utilized a Marston Tunnel soil load. It was also assumed the pipe was full of water (but not pressurized) for both cases. A summary of the applied loads is provided in Table 13.

The moments and forces in the pipe wall were determined by using grouted jacked pipe coefficients, and were compared to the resistive moments and forces in the 2400 mm pipe wall. Table 14 shows the maximum applied moment, thrust, and shear compared to what is provided in the pipe wall. Appendix G shows the detailed calculations.

### Table 14: LOT 16 DRAIN WALL FORCES

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Moment kN/m</th>
<th>Thrust kN/m</th>
<th>Shear kN/m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case 1: Below CN Letellier Rail Track</td>
<td>60</td>
<td>381</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>170</td>
<td>4458</td>
<td>26.2</td>
</tr>
<tr>
<td>Case 2: Below Southwest Transitway</td>
<td>54</td>
<td>381</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>154</td>
<td>4458</td>
<td>29.0</td>
</tr>
</tbody>
</table>

The minimum Factor of Safety is 2.0 for shear failure under loading Case 1, where the CN Letellier rail track is above the 2400 mm diameter LDS. Since a Factor of Safety of 1.5 is typically the desired minimum value for unreinforced concrete, the 2400 mm concrete pipe will provide adequate structural support under the conditions created by the transway project.

While the pipeline is technically capable of supporting the applied dead and live loads, the repositioned CN Letellier rail track will be near the edge of the existing steel tunnel liner section. As a result, the pipe will no longer have the required 7.62 m (25 ft) of casing pipe on either side of the track, and replacement may be required. Further discussion on the impacts of the repositioned rail line is provided below in Section 3.3.8 Railway Crossings.

3.3.8 Railway Crossings

Overview

The repositioning of the CN Letellier rail track and the Fort Garry Industrial spur lines to accommodate the transway alignment will result in several “new” pipeline crossings. During the PPP consortium’s consultations with CN during the detailed design phase to determine the requirements for each crossing, it is recommended that the modifications described below (i.e., bridging structures and casings) be considered.

The pipeline crossing requirements are outlined in CN’s A Guide to the Pipe and Wire Process. The guidelines reference TC 8-10, the Railway Association of Canada’s Standard – Standards Respecting Pipeline Crossings Under Railways, and the American Railway Engineering and Maintenance-of-way Association’s (AREMA) Manual for Railway Engineering. CN requires that all pipeline crossings be cased unless the line is a gravity feed pipe operating at less than 700 kPa (102 psi). All uncased crossings must be at a minimum Class V reinforced concrete pipe manufactured in accordance with ASTM C76 and CSA A257. If casing pipes are required, the AREMA guidelines state they must extend a minimum of 7.6 m (25 ft) from the centerline of the track.

### Table 13: LOT 16 DRAIN LOADING SUMMARY

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Soil Load kN/m</th>
<th>Live Load kN/m</th>
<th>Pipe Weight kN/m</th>
<th>Fluid Weight kN/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1: Below CN Letellier Rail Line</td>
<td>266</td>
<td>50</td>
<td>62</td>
<td>46</td>
</tr>
<tr>
<td>Case 2: Below Southwest Transitway</td>
<td>266</td>
<td>12</td>
<td>62</td>
<td>46</td>
</tr>
</tbody>
</table>
Branch II Aqueduct

The repositioning of the CN Letellier rail line will result in the track crossing the Aqueduct west of its current crossing location. The existing pipe is a 1650 mm diameter Hyprescon Class 20 pipe originally designed to support a Cooper E85 rail loading. The pipe was installed in 1988 using open cut methods and is not cased. The construction of the pipeline was approved at the time of construction because the aqueduct it typically operates at low pressures (108 kPa) at that location. The PCCP pipe and joints are considerably stronger than the Class V RCP required by CN. Based on the proposed alignment, the rail line will remain above the Class 20 pipe with no change in loading. Therefore, it is not anticipated that additional load protection measures will be required at this crossing.

The repositioning of the CN spur lines at the Hopewell Lands (CN North Spur Line (WC07 to Manitoba Hydro) and CN South Spur Line (WC21 to Harris Transport)) will result in the tracks being located above the existing Class A pipe, which is unable to support the applied rail loads. As a result, bridging structures will be required, one for each spur line. As examples, bridging structures are used to span the Shoal Lake Aqueduct in numerous locations including PR 207 and the GWWD railway at Deacon Reservoir.

FGSV Feedermain

The repositioning of the CN Letellier rail line will result in the track crossing the FGSV Feedermain to the west of its current crossing location. The Feedermain at this location is a Hyprescon Class 20 pipe, which was originally designed for Cooper E85 rail loads. The pipe beneath the rail line was installed within a 15.5 m (50 ft) hand tunneled monolithically cast reinforced concrete casing pipe. The repositioned rail line will be located near the west end of the existing casing pipe and will therefore require an approximate 10.1 m extension of the existing casing pipe. The additional casing pipe would extend to the existing valve chamber west of the tracks. An extension to the casing pipe may be constructed without removing the feedermain from service using segmental pipe or CIP methods.

The repositioning of the CN spur lines at the Hopewell Lands (CN North Spur Line (WC07 to Manitoba Hydro) and CN South Spur Line (WC21 to Harris Transport)) will result in the spur lines being located above the existing Class A 120 pipe. The rail loading on the Class 120 pipe has been verified and the pipe is capable of handling the applied loads. Based on the CN pipeline crossing requirements, however, the pipe will require a casing. A bridging structure at this location may be a more feasible and more economical solution than the construction of a casing pipe around the existing feedermain. The bridging structure over the South Spur Line (WC21 to Harris Transport) may be constructed in conjunction with the bridging structure over the Branch II Aqueduct, while the CN North Spur Line (WC07 to Manitoba Hydro) crossing will require a separate structure. The repositioned rail lines and conceptual location of the bridge structures are shown in Figure 22.

Fort Garry Feedermain

Although the repositioning of the CN Letellier rail track will place it closer to the existing Fort Garry Feedermain, the track will remain outside of the 7.62 m (25 ft) AREMA offset requirement. Consequently, the Feedermain will not require any additional protection.

Lot 16 Drain

The proposed alignment for the transitway will result in a repositioning of the CN Letellier rail track approximately 5.7 m (18.7 ft) to the west of its current crossing of the Lot 16 Drain. The existing 2400 mm diameter monolithically cast non-reinforced concrete tunnel was constructed with 16.5 m (54 ft) of steel tunnel liner. The repositioned rail line will be located at the west end of the existing steel lined section and will not meet the AREMA casing pipe offset requirements. Consequently, an extension of the casing pipe, a replacement of the pipe, or a bridging structure may be required to meet CN’s requirements. Due to the depth of the main and methods of construction (CIP tunnel), an extension of the casing pipe is not considered a viable option. Consequently, either a relocation of the concrete tunnel (as shown in Figure 23) or a bridging structure for the rail track is a feasible option.

3.3.9 Thermal Considerations

With changes in soil cover over pipelines come changes in the soil temperatures surrounding them. Two concerns with a decrease in soil covers over buried pipelines are freezing and frost loading. Freezing and excessive heat loss from water pipelines is a major concern in northern climates, and has resulted in minimum burial requirements in Canadian cities throughout the prairies. Within the City of Winnipeg, watermains are typically buried with 2.4 m (8 ft) of soil cover to prevent freezing. Since feedermains are typically flowing (as opposed to dead end watermains) and contain large volumes of water, freezing is less of a concern and lower soil covers are permitted.

As soil covers overtop of the Branch II Aqueduct and FGSV Feedermain are as low as 1 m (3.3 ft) at some locations, it is expected that the frost front (0° isotherm) reaches the depth of the pipe on an average year although it is unlikely that the soil adjacent to the pipe is frozen. An instrumentation and monitoring program on the Branch I Aqueduct was undertaken by UMA Engineering between 1995 and 1997 to determine the effects of groundwater and soil temperatures on circumferential joint cracks. The program involved the installation of thermistor strings at three locations along the Branch I Aqueduct with soil covers as low as 1.5 m. The study concluded that the water within the pipe cooled the surrounding soils during the winter (while the water within the pipe was cool) and heating during summer months (when water within the pipe was warm). As the water flowing within the pipe is above 0°C, however, it prevents the surrounding soils from freezing. In essence, the water within the pipeline acts to temper the soil temperature fluctuations around the pipeline. Therefore, complete freezing of a feedermain is extremely unlikely given the volume of water and insulating effects of the backfill soils. Illustration 7 shows the thermal profile around the Branch I Aqueduct as measured during the instrumentation program. The monitoring location was located immediately west of the Perimeter Highway in a rural area. It illustrates a slightly depressed 0° isotherm above the pipe as a result of the cooling effect of the pipe while maintaining soil temperature around the pipe above 0°C.

Frost loads on rigid pipelines can also significantly increase applied earth loads. Studies by Smith indicated that the advancement of the frost front can increase loading on rigid pipelines by as much as 100% although with this increase the ultimate loading in the case studies did not exceed the maximum predicted Marston loads. As Heger positive projection loads were used to calculate soil loading on all the open cut installed pipes (a more conservative approach than Marston loading), it is not anticipated that additional frost loading on the pipeline will exceed the capacity of the affected pipelines.

5 UMA Engineering Ltd., “Branch I Aqueduct Capacity Upgrading Study, Work Area 2.05.7, Branch I Aqueduct Monitoring”, 2001
Based on the recommended transitway alignment, no major changes in soil cover overtop of either the Branch II Aqueduct or the FGSV Feedermain are anticipated. Therefore, changes in the thermal regime and frost loading on the pipeline are likely to be minimal.

Where soil covers are reduced to less than 1.8 m, the installation of either box or sheet insulation is recommended. Insulation should be designed based on the depth of soil cover, pipe width, and anticipated frost loading in the Winnipeg region. In addition, where LDS pipes, CB leads and other pipelines exposed to atmospheric conditions cross the Aqueduct and Feedermain, they should be insulated to prevent additional frost penetration and loading of the pipelines. Insulation should be in the form of a “U” shape consisting of the trench bottom and sides as a means of insulating the surrounding soils.

**Recommendations**

**Design Criteria**

The following design criteria are recommended for work near the Branch II Aqueduct and FGSV Feedermain and are consistent with descriptions above:

- Minimum Soil Cover: 1.2 m;
- Maximum soil covers as per Table 5 and Table 11;
- Insulation where soil covers are reduced below 1.8 m; and,
- LDS pipelines crossing the Aqueduct or Feedermain must be insulated.

**Construction Limitations**

During construction, the following controls must be put in place to protect the Aqueduct and Feedermain from damage:

- The Aqueduct and Feedermain must be located and marked out prior to construction;
- Pipelines must be located horizontally and vertically prior to construction near or overtop. This is especially critical where trenchless crossings of the Aqueduct or Feedermain are undertaken;
- No operating of equipment directly over top of the Aqueduct or Feedermain;
- The use of pneumatic breakers is not permitted overtop of the Aqueduct or Feedermain;
- Excavation within 1 m of the pipeline will be undertaken using soft excavation techniques;
- Extreme caution and care should be used when excavating near the Aqueduct and Feedermain to prevent lateral ground movements. Pipelines should be monitored for movement where concern of movement is identified;
- Use extreme caution when excavating near the thrust bearing surface of thrust blocks. Provide temporary thrust support where required;
- No vibratory compaction permitted overtop of the Aqueduct or Feedermain; and,
- Pipeline crossing locations must be keep in a rut free condition.

Thrust blocks, located behind bends in pressure pipelines, are used to restrain bends from the thrust forces produced by the internal fluid pressure. The thrust forces developed in large diameter pressure pipelines can be quite large and result in very large thrust blocks. Excavations behind thrust blocks must be undertaken with extreme caution as they can result in a loss of soil support and may result in movement of the thrust block and bend. Movement of bends on RCCP pipelines can cause leaks or complete failure of the joint causing extensive flooding and damage to nearby properties. Therefore, any excavations undertaken near thrust blocks must be undertaken in a manner which accounts for the applied thrust forces and provides temporary support for the thrust blocks where required.
3.3.11 Summary

Overview

The recommended alignment for the Southwest Transitway does not require relocation of the existing Branch II Aqueduct or of the FGSV Feedermain. Anticipated changes to soil covers overtop of the pipelines are limited to landscaping and drainage improvements and are not anticipated to negatively impact either of the pipelines. However, several pipeline load protection structures and casings must be constructed to accommodate the repositioning of the CN Letellier rail track and spur lines (CN North Spur Line (WC07 to Manitoba Hydro) and CN South Spur Line (WC21 to Harris Transport)). Furthermore, the repositioning of CN Letellier rail track over the Lot 16 Drain does not meet CN’s pipeline crossing requirements, and the Lot 16 Drain will require replacement at the track crossing.

Bridging Structures and Casing Pipes

Bridging structures are required for the repositioned spur lines where they cross the Branch II Aqueduct and FGSV Feedermain. These structures provide both loading protection for the pipeline and protect the rail line from undermining in the case of a joint failure or leak. Due to the configuration of the pipelines, three bridging structures are required with one spanning both the Aqueduct and Feedermain and the other two spanning a single pipe. To accommodate the repositioning of the CN Letellier rail track south of Bishop Grandin Boulevard, an extension of the existing casing pipe protecting the FGSV Feedermain is required at the crossing location. The new bridging structures and extension of the casing pipe are shown in Figure 22.

Lot 16 Drain Relocation

The recommended alignment for the Southwest Transitway requires a repositioning of the CN Letellier rail track west of its current location where it crosses the Lot 16 Drain. The existing 2400 mm diameter monolithically cast non-reinforced concrete tunnel at the downstream end of the Lot 16 Drain was constructed with 16.5 m of steel tunnel liner. As CN crossing guidelines do not permit uncased crossings using non-reinforced concrete pipe and the proposed rail alignment will not meet the requirements for casing pipe as per the American Railway Engineering and AREMA Manual for Railway Engineering, the line must be replaced or a bridging structure for the rail track must be constructed. An offline replacement (or relocation) of the Lot 16 Drain would involve the installation of 77 m of 2400 mm diameter reinforced concrete pipe as shown in Figure 23.

3.4 Geotechnical Assessment

3.4.1 Introduction

The scope of work for the geotechnical assessment component of the functional design included the following tasks:

- Review relevant information from previous geotechnical investigations and published geotechnical data;
- Develop and complete a geotechnical field investigation program including utility locates, test hole drilling, soil and rock sampling, instrumentation installation and monitoring, and laboratory testing of collected samples;
- Undertake engineering studies and analysis to identify geotechnical concerns, develop design features, evaluate alternatives and assess feasibility;
- Provide technical input to support other engineering disciplines in the development of the functional design for the project; and,
- Document the geotechnical investigation, discuss geotechnical concerns, present design alternatives and provide recommendations based on assessed feasibility.

This part of the report documents the 2014 geotechnical field investigation, discusses the geotechnical considerations, identifies design alternatives and provides related geotechnical recommendations in support of the functional design phase. Further geotechnical investigation, comprehensive geotechnical engineering effort and studies may be required to be undertaken by the PPP consortium during the detailed design phase to supplement the geotechnical assessment provided in this report.

3.4.2 Available Information

Regional Geology

The surficial geology of the project area has been compiled from the Geological Engineering Maps and Report for Urban Development of Winnipeg (University of Manitoba, 1983). The subsurface stratigraphy of the upper 60 m in the Winnipeg area generally consists of four distinct soil units which are: the Complex Zone, Glacio-lacustrine silty clay, glacial till, and carbonate bedrock.

The Complex Zone is generally up to 4 m thick and consists of stratified silty clay and silt, with varying amounts of organic soils, alluvial silts and sands, and man-made fill. The glacio-lacustrine silty clay underlies the Complex Zone, and consists of intermediate to highly plastic silty clays up to 21 m in thickness, generally firm to stiff but becoming softer with depth. The glacial till underlies the glacio-lacustrine silty clay and is made up of predominately silt sized particles with highly variable amounts of clay, sand and gravel. The upper portion of the glacial till is frequently loose/soft and water bearing, while the lower till is dense to very dense. Carbonate bedrock underlies the glacial till. The project site is located within an area where the bedrock formation is the Fort Garry Member of the Red River Formation.

Regional Hydrogeology

There are three significant bedrock aquifers beneath the City of Winnipeg. The largest is known as the Upper Carbonate Aquifer which is generally found within the upper 7 m of the carbonate bedrock profile. This aquifer is contained in an extensive network of fractures and karstic solution cavities formed by the dissolution of the upper carbonate rocks. Other aquifers include the Lower Carbonate Aquifer at the base of the carbonate bedrock profile and the underlying Winnipeg Formation sandstones. A Middle Carbonate Aquifer has also been encountered locally.

Prior to the start of development of this aquifer in the late 1800’s, the potentiometric surface was estimated to be approximately 3 to 6 m below ground surface in the central Winnipeg area. Extensive consumptive use of this groundwater resulted in a decline in the potentiometric surface to a depth of 21 to 24 m. Consumptive use has declined since the early 1970’s and since that time the potentiometric surface has been rising. Currently in the downtown area, the potentiometric surface is approximately 7 m below grade. This rise in water level has resulted in groundwater related problems with some deeper foundations in the city and must be considered in the components design for this project.
Project Related Geotechnical Information

Relevant information from previous geotechnical investigations and published geological data was compiled to provide a geological model along the recommended transitway alignment. A list of the relevant geotechnical information reviewed as part of this task is summarized below:

- City of Winnipeg/Dillon Consulting Limited. (2009) – Southwest Rapid Transit Corridor – Stage 1, Contract #4 Transway Tunnel at CN Rivers Subdivision Mileage 1.38 & Associated Works, Released for Construction Drawings;
- National Testing Laboratories (2005) - Slope Failure – Bishop Grandin Boulevard; and,

The most relevant previous geotechnical information for the Southwest Transitway - Stage 2 project is the investigation that was gathered for the Pembina Highway Widening Project. This project was initially undertaken for the City of Winnipeg Public Works Department and has now been included as part of the Integrated Capital Project. The full geotechnical report “AECOM (2013) – Pembina Highway Underpass Upgrade, Preliminary Design, Geotechnical Report” is included in Dillon’s 2013 document entitled “Preliminary Engineering Study of the Upgrading the Pembina Highway Underpass (CN Rivers Sub Mile 2.65)” dated August 2013. For this project, 12 test holes were drilled including seven deep holes into bedrock or refusal into till and five shallow test holes. This information was used exclusively to develop geotechnical recommendations for the design of the CN Rail Bridge over Pembina Highway, the Transway Bridge over Pembina Highway, and the new Transway Underpasses of the CN Wye Tracks (CN Letellier and WC02 Spur) at CN Portage Junction.

The geotechnical information from these test holes is provided in Appendix H.

Geotechnical Investigation

Field Work

During the period from January 15 to 24, 2014, AECOM completed a geotechnical investigation program which consisted of four deep test holes (TH14-02, TH14-04, TH14-08 and TH14-09) and two intermediate test holes (TH14-07 and TH14-10). The approximate location of the test holes are shown on the Test Hole Location Plan in Appendix I.

Drilling of test holes TH14-02 and TH14-04 was advanced 6 m into bedrock. Drilling of test holes TH14-08 and TH14-09 was terminated at auger refusal at 5.8 and 2.3 m into till, respectively. Test holes TH14-07 and TH14-10 were drilled to 6 m below existing grade and terminated in the clay unit. Standard penetration tests (SPT) were completed at regular intervals in all test holes. Disturbed and relatively undisturbed soil samples and rock cores were collected for further visual inspection and testing. Six standpipe piezometers were installed, two in the bedrock, two in the till and two in the clay. Laboratory testing were completed on selected samples and included moisture content, unit weight, Atterberg limits, undrained shear strength and consolidation testing.

Logs have been prepared for each test hole to record the description and the relative position of the soil strata, location of samples obtained, field and laboratory test results, and other pertinent information. The test hole logs are attached in Appendix I.

Subsurface Conditions

Although the project extends over 7 km, the encountered subsurface conditions in the test holes were for the most part uniform and are typical to areas within the limits of the City of Winnipeg. In descending order, the soil stratigraphy consists of:

- Glacio-lacustrine Clay;
- Glacial Till; and,
- Limestone Bedrock.

A schematic of soil stratigraphy is presented in Illustration 8. Each of these units is described further below. Soil properties from field and laboratory test results are presented in Illustration 9.
ILLUSTRATION 9: SOIL TEST RESULTS

Glacio-Lacustrine Clay
Glacio-lacustrine clay up to 12 m thick was encountered in all test holes. A thin topsoil layer about 150 mm thick overlays the clay in most test holes. The presence of a silt layer(s) about 1.0 m thick was observed in the top 2 m of the clay unit. Typically, the clay is silty and brown changing in color to grey with depth, firm to stiff becoming soft with increasing depth, moist and of high plasticity. Standard penetration test (SPT) N value decreases from about 20 to 7 with increasing depth. Moisture contents range from 24 to 58%. The average bulk unit weight of the clay is 16.8 kN/m³. Undrained shear strength measured from unconfined compression tests shows high scatter with values ranging from 28 to 56 kPa.

Glacial Till (Silt)
The clay is underlain by glacial till (silt) that typically contains variable amounts of clay, sand and gravel. Boulders and cobbles are known to be present within the till unit and were encountered during the drilling. Where the drilling advanced into bedrock below the till unit at McGillivray Boulevard and at Bishop Grandin Boulevard, the thickness of the till layer varies from 4 to 6 m. In TH14-08 (at the vicinity of Manahan Avenue), auger refusal was encountered about 6 m into till, therefore till thickness may be greater than 6 m. The till is brown to light grey, soft/loose in the upper zone and become denser with increasing depth. Coring was necessary to advance the drilling through the boulders/cobbles that dominated the lower zone of the till. The till is moist and of low plasticity. Measured moisture contents decreases with depth from 22 to 10%.

Limestone Bedrock
The till is underlain by limestone bedrock, which forms an artesian aquifer. The bedrock surface was encountered between elevations 214 and 215 m in TH14-02 at McGillivray Boulevard and TH14-04 at Bishop Grandin Boulevard. Based on calculated Rock Quality Designation (RQD) values for the recovered rock cores, the rock quality encountered in TH14-02 at McGillivray Boulevard is of very poor to poor quality and TH14-04 is poor to fair quality. Recovered rock cores are shown in Illustration 10 and in Illustration 11.
Groundwater Condition

Measured groundwater levels from Standpipe Piezometers are presented in Table 15. The groundwater levels may fluctuate seasonally, annually or due to construction activities.

Table 15: Summary of Groundwater Monitoring Results

<table>
<thead>
<tr>
<th>Standpipe ID</th>
<th>Approximate Location</th>
<th>Soil Unit Installed in</th>
<th>Ground Surface Elevation (m)</th>
<th>Date</th>
<th>Measured Groundwater Elevation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP14-08</td>
<td>Chevrier Boulevard</td>
<td>Glacial Till</td>
<td>232.22</td>
<td>January 21, 2014 - March 24, 2014</td>
<td>221.67 - 227.79</td>
</tr>
<tr>
<td>SP14-09</td>
<td>Adamar Road</td>
<td>Glacial Till</td>
<td>232.0</td>
<td>January 24, 2014 - March 24, 2014</td>
<td>221.67 - 227.79</td>
</tr>
<tr>
<td>SP14-10</td>
<td>Plaza Drive</td>
<td>Clay</td>
<td>232.32</td>
<td>January 29, 2014 - March 24, 2014</td>
<td>226.51 - 227.79</td>
</tr>
</tbody>
</table>

Soil Corrosivity

Winnipeg soils are known to contain high contents of sulphates, which can be corrosive when in contact with concrete or cast-iron structures. All concrete in contact with the soil should be made in accordance with the recommendations provided in CSA Standard A23.1 and A23.2. Table 16 below presents a summary of sulphate content tests from samples collected within the clay layer.

Table 16: Summary of Sulphate Content Tests

<table>
<thead>
<tr>
<th>Soil Unit</th>
<th>Sample Depth (m)</th>
<th>Test hole No.</th>
<th>Sulphate Content in Soil Sample (mg/kg)</th>
<th>Potential For Sulphate Attach</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLAY</td>
<td>1.5</td>
<td>TH14-02</td>
<td>1030</td>
<td>0.10</td>
</tr>
<tr>
<td>CLAY</td>
<td>3.0</td>
<td>TH14-04</td>
<td>2880</td>
<td>0.28</td>
</tr>
<tr>
<td>CLAY</td>
<td>4.5</td>
<td>TH14-08</td>
<td>1610</td>
<td>0.16</td>
</tr>
<tr>
<td>CLAY</td>
<td>10.6</td>
<td>TH14-08</td>
<td>475</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Seasonal Frost Penetration

Calculations based on a mean freezing index of 1900 °C-days estimate the seasonal frost penetration depth in Winnipeg to be approximately 2.4 m. Factors such as snow cover, vegetation at surface, soil type, and groundwater conditions can all significantly impact the depth of frost penetration.

3.4.4 Tunnel Excavations and Temporary Shoring

Temporary excavations up to 10 m deep will be required to facilitate the construction of the proposed Letellier Tunnel. These excavations will be in close proximity to rail, road, buildings and underground infrastructure. The groundwater conditions, within the bedrock aquifer and the overburden, must be accounted for in the design and construction of the excavations and support systems. Temporary work is the responsibility of the PPP consortium and all necessary measures should be undertaken to protect against adverse impact or undermining the foundation or stability of existing infrastructure. All excavations must comply with the Manitoba Workplace Safety and Health Regulations.

The geotechnical aspects, design approaches and construction methods used in the design and construction of the Fort Rouge Tunnel in Stage 1 of the Southwest Transitway are mostly applicable to the Letellier Tunnel in Stage 2 and can be adopted to develop the excavation plan, design a temporary shoring system and maintain excavation stability.

Excavation Plan and Staging

The proposed Letellier Tunnel crosses beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track as shown on Figure 8. The structure will consist of central covered tunnel 203 m long and two roofless U-shaped depressed sections 197 m and 221 m long on the north and south tunnel approaches, respectively. CN operations shall be maintained during construction period and therefore temporary and permanent track detours will be required to facilitate the tunnel construction which will be completed in two phases as follows:

Phase I
1. Temporary detour of CN Letellier track;
2. Excavation and construction of the covered tunnel section between tracks WC07 and WC21; and,
3. Permanently relocate tracks WC07 and WC21 on top of the completed section of the covered tunnel.

Phase II
1. Excavation and construction of the other sections of the covered tunnel and the U-shaped sections south of the central covered tunnel. The north U-shaped section is independent of the track detour; and,
2. Relocate CN Letellier to permanent alignment over the completed covered tunnel.

The phased excavation approach is an acceptable one to the project’s stakeholders (particularly CN) as a similar approach was successfully used for the transitway’s Stage 1 tunnel. The first phase of the Fort Rouge tunnel excavation during construction is shown in Illustration 12.
Temporary Shoring

The design of all temporary shoring and lateral support systems shall be reviewed and accepted by CN before construction commences.

Open cut sloped excavations can be used where the available space allows particularly between Chevrier Boulevard and Track WC07, typically the maximum open cut height should not exceed 6 m. The location and height of the cut slopes may be further dictated by other considerations such as access, anticipated construction approach and staging. A design objective factor of safety (FS) of 1.30 is considered acceptable for short-term temporary work. The unloading effect of the excavation on clay pore water pressure can be accounted for in the analysis. Railway and construction live load surcharges should be accounted for in the stability assessment where applicable. In addition to open cut excavations, supported and partially supported excavations will be necessary for the proposed construction. A partially supported excavation utilizes a combination of cut slopes and shoring as illustrated in Illustration 14.

The shoring design is expected to include sheet piling and/or soldier pile system with/without internal bracing depending on the retained height and the applicable loadings. The shoring system used for the Fort Rouge tunnel construction consisted of sheet pile walls and multi-level internal bracing as shown in Illustration 15.

Closely spaced soldier piles socketed into the bedrock with timber lagging and internal bracing as shown in Illustration 16 was a feasible alternative for Fort Rouge tunnel. Upon review of the shoring installation effort and space requirements inside the shored excavations, the contractor selected the sheet pile system and large diameter steel pipes for internal bracing to maximize the space inside the excavation and facilitate the construction activities of the tunnel structure.
Recommendations for design earth pressures are shown in Illustration 17.

**ILLUSTRATION 17: EARTH PRESSURE FOR TEMPORARY SUPPORT**

The shoring should be designed to resist lateral earth pressure and lateral forces from live load surcharges including railway loading and anticipated construction activities. Lateral pressure from railway loading should be determined as per the latest CN Guidelines and American Railway Engineering and AREMA using Cooper E90 loading. The active pressure should be extended to the base of the wall system (i.e., the bottom of the piles). The wall must be embedded deeply enough to provide adequate resistance for the portion of the wall below the excavation. Passive resistance below the excavation level should include a FS of at least 1.5. Passive resistance from the soil located in the upper 0.5 m below the excavation level should be ignored.

**Ground Displacements**

Excavation support systems are usually designed to keep movements around the perimeter of the excavation within acceptable limits. Avoidance of ground movements entirely is not possible. For preliminary assessment, settlements of the ground surface adjacent to braced excavation are often estimated using the design chart developed by Peck (1969) as shown on Illustration 18.

**ILLUSTRATION 18: GROUND SETTLEMENT ESTIMATE ADJACENT TO EXCAVATION**

It is recommended that the boundary between Zone II and III be used to estimate vertical ground movements at the site. It should be recognized that the predicted ground movements are associated with standard soldier piles and lagging or sheet piles with cross bracing or tie back anchors, assuming they are installed with a normal quality of workmanship. Good contact between the lagging and retained soil should be maintained throughout the construction period. Free draining sand should be used to fill the voids behind the lagging or sheet piles. Once shoring members are selected and excavation staging are determined, numerical deformation analysis can be completed to provide an estimate of the anticipated ground response and shoring displacement. Monitoring of the shoring system displacement and any potential impact on the adjacent CN tracks shall be performed during the construction to verify design assumptions and protect against development of any critical conditions. Samples of completed stress-deformation analysis and monitoring result for Fort Rouge tunnel are presented in Illustration 19 and Illustration 20, respectively.
Excavation Base Stability

Base instability is a concern for excavations in soft to firm clays. It is analogous to a bearing capacity failure, the difference being that stresses in the ground are relieved instead of increased. Two types of analysis are available for calculating the FS against base instability: the Terzaghi method and the Bjerrum & Eide method. The Terzaghi method is applicable for shallow and wide excavations, whereas the Bjerrum & Eide method is suitable for deep and narrow excavations. The variation of FS with excavation depth should be determined using the applicable method. The live load surcharge from railway loading and construction equipment should be accounted for in this assessment. Where the FS falls below 1.50, shoring wall movement is a concern as a result of yielding in the subsoil. The wall deformation could be reduced effectively where the depth of clay below the excavation base is limited and the wall is driven into a hard layer (i.e., till or bedrock). Results of preliminary FS assessment according to Terzaghi method is presented for a range of excavation depths in Illustration 21.
Excavation Base Heave

The potential for base heave is expressed as the ratio between the total stress and the groundwater pressure acting on the base of the clay layer. For wide excavations similar to the proposed cut and cover Letellier Tunnel, the calculation does not account for shearing resistance from the clay. A minimum FS of 1.5 is recommended against base heave for a long-term condition, a lower FS can be adopted for short term conditions. The calculated FS against base heave corresponding to excavation depth for selected values of GWL in the bedrock aquifer is shown in Illustration 22. The preliminary results indicate that for excavations below elevation 225 m, aquifer depressurization will likely be required to attain design objective FS against base heave.

3.4.5 Foundations for Cut and Cover Tunnel

A floating raft foundation can be used to support the proposed cut and cover Letellier Tunnel, the depressed (below original ground surface) sections of the proposed Transitway, and underground structures such as lift station. Foundations placed at depths where the structural loads equal the weight of the displaced soil usually provides adequate bearing capacity and the expected settlements are related to recompression of the soil. Where the structural loads are more than the weight of the excavated soil, the foundation is considered to be under-compensated. Rafts can be designed effectively based on the concept of floating foundations. Preliminary recommendations for allowable gross bearing capacity are shown in Illustration 23. Allowable gross bearing capacity is corresponding to the maximum foundation contact stress, modified by appropriate factor of safety, before shear failure occurs. Settlement pressure shall be calculated corresponding to tolerable settlement as part of the detailed design phase. An estimate for Modulus of subgrade reaction is in the range 2800 to 3500 kN/m². These preliminary recommendations should be supported by further investigations and analysis during the detailed design phase.
The distribution of foundation pressures over compressible soil varies with time and depends on soil-structure interaction and time-settlement characteristics of the foundation soils. As a conservative approach, rafts should be designed for two limiting conditions:

- Assuming a uniform distribution of soil pressure, and,
- Assuming a pressure that varies linearly from a minimum of zero at the middle to twice the uniform pressure at the edge.

The raft should be designed structurally for whichever foundation pressure distribution leads to the more severe conditions.

The maximum sliding resistance beneath the raft and the retaining wall footings should be taken as the smaller of:

- One half the normal stress at the interface between the concrete and the clay; and,
- The adhesion of the clay (design value = 30 kPa).

Heave in excavations completed in overburden soils is comprised of three components: elastic rebound, swelling due to removal of overburden and creep. Creep effects can be ignored if the construction period is relatively short. Elastic rebound will take place soon after excavation, while swelling is time dependent; more swelling will be realized the longer the excavation is open. An estimate of the anticipated ground heave due to rebound and swell can be provided once additional investigation is completed and structure depth is finalized. Recompression of the elastic rebound will take place immediately during and after construction while recompression of swell is time dependent. Once recompression has occurred settlement will start to take place due to the foundation loading, if it is in excess of in situ effective stress.

The swell potential can be reduced if staged and sequenced construction approaches are utilized. An optimum time lag between stages and phases of construction can be used to protect against differential recompression; otherwise, the design should acknowledge and account for this differential movement.

Raft foundations should be prepared in accordance with the following recommendations:

- Care should be taken during excavation to ensure that the final bearing surface is not disturbed or subjected to freezing, water inundation or excessive drying;
- All loose or disturbed soil should be removed from the final bearing surface;
- Once the bearing surface has been suitably prepared, it should be evaluated by qualified geotechnical personnel to verify the suitability of the bearing soils, confirm that the soils are uniform, not affected by frost or disturbance and to confirm that the soils encountered are consistent with the conditions noted in this document; and,
- As soon as possible, following approval of the bearing surface by qualified geotechnical personnel, the steel reinforcing should be placed and concrete should be poured.

3.46 Foundations for Bridges and Heavily Loaded Structures

Pile foundations bearing on competent very dense till or bedrock will be required to support heavily and moderately loaded structures. Available deep foundation system alternatives include; driven precast prestressed concrete (PPC) piles, driven steel H piles, CIP belled caissons, and CIP rock socketed caissons. Design considerations for these pile types are discussed in the following sections.

Driven Precast Prestressed Concrete (PPC) Piles

Driven PPC piles can be designed to support heavily loaded structures. If used, PPC piles should be driven to bear into the very dense glacial till or on the underlying bedrock. Provided that a hammer with a rated energy of at least 44 kJ per blow is utilized, the piles may be assigned the conventional capacities shown in Table 17. These traditional pile capacities are based on a series of studies and load tests and have been successfully used in the Winnipeg area.

<table>
<thead>
<tr>
<th>Pile Diameter (mm)</th>
<th>Maximum Allowable Capacity (kN)</th>
<th>Final Set (blows/25 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>450</td>
<td>5</td>
</tr>
<tr>
<td>350</td>
<td>625</td>
<td>8</td>
</tr>
<tr>
<td>400</td>
<td>800</td>
<td>12</td>
</tr>
</tbody>
</table>

Final set for driven PPC piles shall be taken as three consecutive counts of the set criteria as defined in the table above. Driven PPC piles will develop the majority of their capacity from toe resistance, and therefore, no reduction in pile capacity is necessary for reasons related to group action. The design capacity of a pile group can be taken as the number of piles in the group multiplied by the allowable capacity per pile.

Pre-construction Wave Equation analysis and dynamic monitoring using Pile Driving Analyzer (PDA) during construction should be utilized to assess the suitability of the pile driving equipment, verify the set criteria, evaluate the mobilized capacity and protect against pile damage.
Further design recommendations for driven PPC piles are summarized below:

- The weight of the embedded portion of the pile may be neglected in the design;
- The above capacities pertain to soil resistance only. The pile cross sections must be designed to withstand the design loads, handling stresses and the driving forces during installation;
- Pile spacing should not be less than three pile diameters, measured center to center;
- Pre-boring can be used to enhance pile alignment, and to reduce the effects of pile heave during driving of adjacent piles. The diameter of the pre-bore should be a maximum of 50 mm larger than the pile diameter;
- All piles located within five pile diameters of another pile location should be monitored for heave during pile installation. Where pile heave is observed, the piles should be re-driven to the refusal criteria outlined above; and,

Where a steel follower is required to install piles below the surrounding ground surface, the refusal criteria should be increased by up to 50% in order to account for additional energy losses through the use of the follower or as determined from PDA monitoring.

Driven Steel H Piles

Driven steel H piles are commonly used to support heavily loaded bridge structures. Steel piles can be designed on the basis of the structural capacity of the pile section provided the piles are driven to practical refusal into/onto bedrock. The structural capacity of the pile can be determined from the steel sectional area and the maximum allowable stresses of 0.3 fy or as specified by AREMA Manual. Practical refusal can be defined as 10 to 15 blows/25 mm pile penetration using a well maintained hammer with rated energy of not less than 50 kJ. The actual refusal criteria and load capacity for specific steel section and pile driving system should be established based on pre-construction Wave Equation analysis and PDA testing.

Steel piles driven to practical refusal will develop the majority of their capacity from toe resistance, and therefore, no reduction in pile capacity is necessary for reasons related to group action. The design capacity of a pile group can be taken as the number of piles in the group multiplied by the allowable capacity per pile.

The following additional recommendations regarding steel piles are provided.

- The pile cross sections must be designed to withstand the design loads, handling stresses and driving forces during installation;
- Piles should be fitted with an appropriate toe or shoe to protect the pile tip during installation;
- Pile spacing should be a minimum of three pile diameters measured centre to centre; and,
- All piles driven within five pile diameters of one another should be monitored for heave and where observed, the piles should be re-driven to the specified refusal criteria.

Cast-In-Place (CIP) Rock Socketed Caissons

Drilled caissons socketed into sound bedrock can be used to support heavy loads. Local practice is to design the drilled shafts based on values of allowable end bearing and shaft adhesion of 3.0 and 1.0 MPa, respectively, provided that down hole inspection and assessment of the rock competency are undertaken. The assessment of the rock competency consists of small diameter proof drilling to at least 2 m below the socket to detect the presence of voids or clay layers of any significance and determine if deeper socket boring is required. In the event that the socket cannot be visually inspected, inspection of the recovered rock core and/or down hole video monitoring can confirm the competency of the bedrock. In this situation, caissons founded in sound bedrock should be designed on the basis of a reduced allowable shaft adhesion of 0.69 MPa with no contribution from end bearing. Safety concerns related to man entry into the boring (e.g., high level of gas) may preclude undertaking the visual inspection.
The socket length should be a minimum of one socket diameter within sound competent bedrock. The minimum shaft diameter of the rock-socket should not be less than 760 mm and the maximum diameter should be selected to suit the locally available coring equipment. The rock sockets should not be spaced closer than 2.5 socket diameters, centre to centre. Groundwater control and tremie placement of concrete is likely to be required. To our knowledge, settlements of rock socketed caissons have never been measured in the Winnipeg area. However, it is anticipated that the settlements would be less than 20 mm excluding elastic shortening of the pile itself.

Inspection of the recovered rock cores and down hole inspection by experienced geotechnical personnel will be required to aid in assessing the competency of the bedrock and determining if longer socket lengths are required. Depths to sound bedrock should be expected to vary within the site and it should be recognized that the presence of the heavily fractured rock and potential infill material above the socket design length may require permanent steel casing left in the ground so that the integrity of the shaft is maintained. In this regard, the basis for measurement and payment for the rock socket installation should be established in the contract preparation stage to recognize that the bedrock conditions at some rock socket locations may require unanticipated extra effort and materials for their completion.

Based on the findings of two test holes advanced into the bedrock (TH14-02 and TH14-04), the top 6 m of the bedrock was dominated by poor to fair quality rock. The thickness of unsound bedrock below the bedrock surface could be in excess of 6 m. Socket length, at least at the location of these test holes, should be expected to be developed below the cored depth and measures to maintain socket bore stability and groundwater control should be anticipated.

If this design alternative is contemplated, a test caisson(s) is highly recommended to verify design assumption, examine the feasibility of construction and assist in the selection of adequate equipment and proper construction practices.

Additional Pile Design Concerns

In cases where pile foundations support retaining walls or other structures experiencing lateral loads, it will be necessary to design the piles such that they provide sufficient lateral resistance. Vertical piles can provide lateral resistance by deflecting against the surrounding soil (i.e., soil-structure interaction). Battered piles can provide lateral resistance equal to the horizontal component of its axial load. Where practical, primary horizontal forces on pile foundation should be resisted by battered piles.

Pile downdrag (negative skin friction) due to settlement of soils surrounding the pile will impose an additional load on piles that must be accounted for in design. The magnitude of this additional load depends on the surcharge load on the surrounding soil, as well as the degree of consolidation at the time of pile installation.

Assessment of Pile Foundation Alternatives

Four pile foundation alternatives are identified to support the proposed Transit and Rail bridges and other heavily loaded structures including:

- Driven precast prestressed concrete piles;
- Driven steel H piles;
- Belled caissons; and,
- Rock socketed caissons.

Numerous structures in the Winnipeg area are supported on foundation systems consisting of one or a combination of the above types. The factors governing the design and performance of these pile types are well understood by the engineering community and the construction industry. Local contractors are familiar with related construction practices and the necessary equipment for installation is available.

Driven steel H piles can be driven to practical refusal into/beneath bedrock surface and designed on the basis of steel section structural capacity. Pile design loads up to 1200 kN can be mobilized for common pile sections. These piles offer easy splicing and can be made in variable lengths. Larger sections can be selected if greater design loads are desired. Adequate driving equipment, good installation experience and reliable testing methods are locally available. Pile caps are anticipated to be of reasonable size. Also, steel H piles are the preferred pile type by CN rail.

Driven precast prestressed piles are common in the Winnipeg area but are limited in manufactured length and the design capacity ranges between 400 to 800 kN. Locally, it is uncommon to splice segments of precast concrete piles, splicing may be required at the Transitway Overpass of McGillivray Boulevard. Pile cap size is expected to be larger than the size required using steel piles to support similar load. Precast piles do not lend themselves to certain structural applications such as integral abutment design.

Belled caissons bearing on competent till can be designed to mobilize loads comparable to steel H piles. However pile cap size would be significantly larger to support a similar load. Based on the findings of two test holes (TH14-02 and TH14-04) drilled at McGillivray Boulevard and at Bishop Grandin Boulevard, the encountered till is not anticipated to mobilize bearing capacity that would make this pile type cost effective. The installation requires base cleaning and down hole inspection. Construction difficulties related to groundwater control, roof stability and boulder removal are not uncommon and may impact project cost and schedule or require design review.

Rock socketed caissons bearing in competent rock formation can be designed to mobilize significant design load. The rock condition encountered at McGillivray Boulevard and at Bishop Grandin Boulevard indicated the top 6 m of the bedrock is generally dominated by poor quality and extensively jointed/broken rock mass. These conditions are expected to result in cost non-efficient design and it is not uncommon to experience serious construction challenges that may adversely impact cost and schedule of the project.

Based on the available information and above discussion, it seems that driven steel H piles are a preferred foundation system to support the proposed three structures at McGillivray Boulevard and at Bishop Grandin Boulevard. Further investigation and assessment should be undertaken to confirm subsurface conditions and review the suitability of the selected foundation type.

3.4.7 Foundations for Lightly Loaded Structures

Lightly loaded structures including low height retaining walls can be supported on shallow footing or CIP friction piles. Design considerations and recommendations are discussed in the following sections.

Shallow Footings

Shallow footings can be used to support and transfer light loads to the underlying soil at a pressure consistent with the loading requirements and the bearing capacity of the soil. Provided the footings are supported on native clay below the frost depth, an allowable bearing pressure up to 75 kPa can be used in preliminary sizing of the footings. Corresponding consolidation settlement is expected to
be in the order of 25 to 50 mm. The bearing capacity of a footing will be influenced by depth, dimension and load inclination. Therefore, structure specific assessment and further analysis should be completed to verify and confirm these preliminary recommendations as part of the detailed design phase. Different configurations of spread footings may result in a potential for load superposition and overstressing of the bearing stratum. Under these circumstances, modification to the footings configuration or a review of the bearing capacity may be required. Total and differential settlement magnitude and rate under spread footings can be estimated using a one dimensional consolidation theory as part of the detailed design phase.

Shallow footings should be located below the frost penetration depth which is estimated at 2.4 m below ground surface. This depth can be reduced if thermal insulation is used to protect against frost penetration. Pile bearing is bearing on competent soil. The potential for movement caused by volumetric changes of the high plasticity clay due to changes in moisture content should be reviewed for its impact on future performance.

Ultimate unit resistance to sliding at the interface of the footing and the soil can be taken as the smaller of one half the normal stress at the interface or the clay cohesion value of 35 kPa. A minimum FS of 1.5 should be applied against sliding.

Soil within the depth of frost penetration can freeze to the foundation developing an uplift force. An adfreeze bond of 65 kPa can be used to estimate the uplift forces. These forces can be resisted by the sustained vertical loads on the footing. A non-frost susceptible material or bond breaker/thermal insulation between the footing and the adjacent soil can be used to protect against adfreeze bond development.

Footings should not be placed on uncontrolled fill, organic or other deleterious soils. The bearing stratum should be cleaned to remove all disturbed or otherwise affected soil and protected from frost, desiccation and the ingress of free water.

**Cast-in-Place Friction Piles**

Straight shaft friction piles founded in the clay can be designed using an allowable unit skin friction of 12 to 15 kPa. Due to anticipated moisture related volume changes, resistance along the top 2 m of the pile shaft should be excluded from the design calculation in determining the pile capacity. The piles should not extend into the soft clay above the till layer to protect against seepage and collapse of the open hole.

Additional recommendations are provided below:

- Pile diameter should not be less than 0.45 m;
- Piles should be adequately reinforced to resist possible tension from clay swelling or frost heave;
- Pile spacing should be at least three pile diameters centre to centre. Group effect should be considered if pile spacing is less than specified;
- Provision for temporary casing shall be made available at site to facilitate cleaning, inspection and protect against seepage and sloughing during construction; and,
- All piles must be taken to completion once they have been initiated.

### 3.4.8 Lateral Loads and Retaining Walls

All retaining walls should be designed to support earth lateral pressure, hydrostatic pressure (if applicable) and lateral forces from live load surcharge including railway traffic as per AREMA Manual and CN guidelines. Retaining walls should include a suitable drainage system to protect against buildup of hydrostatic pressures behind the wall. Wall drainage typically consists of a layer of free-draining sand/gravel mixture in conjunction with a perforated drainage pipe connected to a suitable discharge point. Geo-composite products can be used behind the wall to facilitate drainage. Retaining walls in excess of 1.5 m may also be equipped with weep holes to protect against buildup of hydrostatic pressure. A provision for drainage should be provided to protect against the development of hydrostatic water pressure behind sheet pile and secant pile walls, if used.

**Wall Alternatives**

Reinforced concrete retaining wall applications are the common type locally used in the Winnipeg area. Other wall types including Mechanically Stabilized Earth (MSE) walls, sheet pile and secant pile walls were used on a limited basis. Soldier pile walls are mostly used for temporary work to provide excavation support.

Traditional gravity type walls (i.e., reinforced concrete and MSE wall) are constructed in bottom-up fashion and require considerable space behind the wall. Temporary shoring is often necessary in conjunction with the construction of a gravity wall for cut applications in urban environment. In sites of limited space or when the new cut wall is in close proximity to existing buildings, gravity type walls may not be feasible and embedded type walls are considered more viable alternatives. Embedded walls include sheet pile walls and secant pile walls with/without tie backs. These walls are constructed in top-down fashion and are installed prior to excavation in front of the wall. The construction of embedded walls lends itself for stage construction and can be designed efficiently to reduce temporary shoring requirements.

The following types of retaining wall systems have been identified as feasible alternatives at the subject locations:

- MSE wall system at proposed Transitway Overpass of McGillivray Boulevard;
- MSE or reinforced concrete wall system (low height) at proposed Transitway Bridge over Bishop Grandin;
- MSE or reinforced concrete wall system (low height) at proposed CN Rail Bridge over Bishop Grandin; and,
- Reinforced concrete wall system at approaches to the proposed Letellier Tunnel.

**Lateral Loads**

Lateral earth pressures transferred to retaining walls or to bridge abutments will be a function of backfill/retained material, method of placing and compacting backfill, and amount of horizontal deflection allowed by the wall or the abutment after backfill is placed. It is recommended that abutments and walls be backfilled with a free draining granular material containing no more than 5% fines (finer than #200 sieve). Cohesive soils are not recommended for backfill behind retaining structures.
For free draining coarse granular soils, an active earth pressure coefficient (Ka) of 0.33 can be used in the design of walls that are allowed to translate or deflect horizontally by at least 0.2% of the retained height. For retaining structures which are not free to translate, an at-rest earth pressure coefficient (Ko) of 0.5 should be used, assuming free draining granular backfill. In addition to earth lateral pressure, the walls should be designed to resist lateral loads from other applicable surcharges including railway and construction loading and loads that may arise from interference with foundation of existing building. The passive resistance in front of the wall can be assumed as shown in. Passive resistance should only be accounted for from soils 0.75 m below the final grade in front of the wall. A minimum FS of 1.5 should be applied to the available passive resistance. The lateral pressure distributions on the retained side should be extended to the base of the wall system. The wall must be embedded deeply enough to provide adequate kick out resistance.

Compaction of backfill within about 1.5 m of the wall should be conducted with a light hand operated vibrating plate compactor. Over-compaction of the backfill may result in earth pressures that are considerably higher than those predicted in design. Backfilling procedures should be reviewed during construction to verify that they are consistent with the design assumptions. Further assessment will be required to assess the soil design parameters and design loads as part of detailed design phase.

External Stability for MSE Wall

MSE wall is a proprietary system and the system design features and internal stability is the responsibility of the manufacturer. External stability should be verified for applicable modes of failure outside the stabilized soil mass. External stability evaluation involves sizing the MSE wall or improving the foundation to attain the following design objectives:

- Bearing capacity FS > 2.5;
- Settlement satisfies project required performance;
- Global stability FS > 1.5;
- Sliding FS > 1.5; and,
- Overturning, eccentricity e < L/6.

Preliminary assessment indicated that MSE walls of design height greater than 4 m will not attain design objectives and the anticipated settlement under wall loading will be intolerable. Lengthening the MSE wall reinforcement would significantly increase cost and only partially address the identified concerns. Therefore, alternatives including ground improvement techniques will be required to provide adequate support conditions. Ground improvement techniques include vertical drains, preloading, stone columns or reducing the MSE wall loading using light weight fill. Ground improvement techniques present an inherited level of uncertainty with respect to the anticipated performance and are associated with time requirement or threshold displacement to mobilize its resistance. However, the use of light weight fill reduces the least uncertainty as material properties and placement can be reasonably controlled and the final product is visible for further inspection.

The analysis is carried forward to assess the benefits of using light weight material for MSE wall backfill. A unit weight of 20 and 6 kN/m³ is assumed for conventional granular backfill and light weight fill, respectively. The findings of this assessment are presented below in terms of the combined stress at the base of wall. The combined stress is defined as the sum of vertical stress under a column of light weight and granular backfill of different proportions. For convenience, a combined stress of 65 kPa can be derived from different combinations such as (3 m granular fill plus 1 m light weight, 2 m granular fill plus 4 m light weight, or other possible combinations).

Anticipated total settlement (i.e., 90% of ultimate settlement) under MSE wall corresponding to combined stresses range from 45 to 80 kPa is presented in Illustration 25. Settlement rate and achieved settlement at key post construction dates (1, 2 and 5 years) are presented on Illustration 26. Different proportions for light weight and granular fill can be selected depending on the wall height to reach combined stress corresponding to the desired settlement target.
Bearing capacity preliminary evaluation has been investigated to calculate FS for selected granular light weight fill proportions for a combined stress of 65 and 80 kPa. The preliminary results indicate that FS against bearing capacity is less than 2.0 for 80 kPa combined stress and between 2.0 and 2.3 for 65 kPa combined stress. The arrangement of whether granular fill is placed below or on top of the light weight fill seems to influence the bearing capacity evaluation. Placing the light weight at the bottom of the reinforced mass improves overturning, reduces surcharge lateral pressure and results in less contact pressure at the base of the wall. Detailed assessment should be completed as part of detailed design phase with consideration of other applicable factors including, but not limited to, floatation, structural behavior of the light weight fill and constructability concerns.

Design objective FS against overturning and sliding are achieved for the case of maximum combined stress considered in this assessment (i.e., 80 kPa) which corresponds to a granular fill proportion up to 4 m high. Introducing light weight fill and maintaining the combined stress result in reducing the granular fill and thus improving the FS against sliding and overturning at the base of the wall. The light weight is considered self-supporting once cured with no lateral pressure exerted on any of the wall features.

The results of preliminary stability assessment for MSE loading corresponding to combined stresses range from 45 to 80 kPa indicate that design objective FS against global stability is attained.

The above discussion is based on preliminary analysis and specific assumptions which need to be fully reviewed and verified in the detailed design phase. An important assumption made in the analysis is that the light weight fill will be placed across the full width of the road between wall facing.

The preliminary results suggest that, at tall MSE wall section and in the vicinity of bridge abutments, the light weight fill requirements could be significant (i.e., full height light weight fill) in order to meet the design elevation. The preliminary results of the assessment indicated that current geometry for the cut slope can be completed as part of detailed design phase with consideration of other applicable factors including, but not limited to, floatation, structural behavior of the light weight fill and constructability concerns.

A preliminary review of these documents indicated that soil saturation and poor drainage were contributing factors to the documented instabilities. The stabilization measures included installation of sub drains, replacement of the disturbed soil mass and modification to the grade.

A preliminary stability assessment is completed using typical soil strength values and assumed groundwater condition to investigate stability of the existing 4H:1V cut slope assuming the new crossings will result in additional load at the slope crest in order to attain the design elevation. The results of the preliminary assessment indicated that current geometry for the cut slope can be maintained to attain the design objective FS against instability provided light weight fill is used to construct the new approach fill at each abutment including 1.5 m crest unload (i.e., replacing in situ soil with light weight fill). Subsurface drainage and surface drainage improvement will also be required to improve the stability of the head slope at each bridge.

Further stability assessment including advance soil shear strength testing and ground water condition monitoring will be required to verify and finalize the head slope design as part of the detailed design phase.

### 3.4.9 Slope Stability

An adequate FS against slope instabilities must be achieved for any proposed slopes during the short term during construction and immediately after construction and over the long term. The proposed Transitway and Rail Bridges over Bishop Grandin introduce stability concerns for the head slopes at each bridge. To our knowledge, the current cut slopes along Bishop Grandin are 4H:1V and there are at least two known and documented instabilities for the cut slope within the general area of the proposed bridges. These instabilities were addressed in the following reports:

- National Testing Laboratories (2005) - Slope Failure - Bishop Grandin Boulevard; and,

A preliminary review of these documents indicated that soil saturation and poor drainage were contributing factors to the documented instabilities. The stabilization measures include installation of sub drains, replacement of the disturbed soil mass and modification to the grade.

A preliminary stability assessment is completed using typical soil strength values and assumed groundwater condition to investigate stability of the existing 4H:1V cut slope assuming the new crossings will result in additional load at the slope crest in order to attain the design elevation. The results of the preliminary assessment indicated that current geometry for the cut slope can be maintained to attain the design objective FS against instability provided light weight fill is used to construct the new approach fill at each abutment including 1.5 m crest unload (i.e., replacing in situ soil with light weight fill). Subsurface drainage and surface drainage improvement will also be required to improve the stability of the head slope at each bridge.

Further stability assessment including advance soil shear strength testing and groundwater condition monitoring will be required to verify and finalize the head slope design as part of the detailed design phase.
Areas identified as being weak or soft during proof rolling should be stabilized by additional reworking and compaction or removal and replacement with suitable material. Any softened or weak areas should be bladed aside and the underlying material scarified and re-compacted. The excavated material should then be bladed back and compacted to a minimum of 95% of the Standard Proctor maximum dry density. Cuts across the roadway alignment should be sloped at a maximum (i.e., no steeper than) of 5H:1V to minimize the potential for differential movement beneath the pavement. Once filled to subgrade elevation, proof rolling of these areas should be completed.

The subgrade conditions along the proposed transitway alignment are considered typical for the Winnipeg area. For these subgrade conditions, the City has developed and successfully used a concrete pavement structure for major Regional Streets and Transways. This pavement structure consists of a well compacted subgrade, subdrains and geotextile, a 0.45 m layer of C-Base (150 mm down crushed limestone), a 0.15 m layer of A-Base (50 mm down crushed limestone), a 0.075 m layer of limestone Base Course and a 230 mm plain doweled concrete pavement. This pavement structure has provided acceptable performance for the City of Winnipeg and, as a minimum, a comparable pavement structure should be considered for this project. The final pavement structure shall be designed based on the actual subgrade conditions and the anticipated accumulated axle loads during the project design life. The final design will be required to be approved by the City’s Public Works Department.

3.4.11 Summary and Conclusions

A geotechnical investigation program consisting of six test holes was completed in January 2014 to supplement the information gathered from 12 test holes drilled in December 2011 for the Pembina Underpass project. The encountered subsurface condition is typical of the Winnipeg area and generally consists of glacio-lacustrine clay deposit over till over limestone bedrock.

Two phases of tunnel construction and temporary and permanent railway detours will be required to maintain CN operations during the construction period.

Design and construction approaches used in Fort Rouge tunnel of Stage 1 of the Southwest Transitway can be adopted with the necessary modifications for the Letellier Tunnel. Technical aspects including, but not limited to, excavation proximity to the existing tracks, temporary shoring system, excavation stability, ground displacement and performance monitoring were successfully addressed in Fort Rouge tunnel and can efficiently be applied to this project.

Groundwater control and aquifer depressurization requirements may arise for deep excavations below elevation 224 to 225 m.

Raft foundations can be designed to support the proposed Letellier Tunnel (similar to Fort Rouge tunnel). Aspects of soil rebound, settlement and heave need to be carefully considered in the design and in construction staging.

Deep foundations alternatives were presented and discussed. Based on the available information, driven steel H piles seem to be the more cost efficient pile type to support the proposed transitway structures at McGillivray Boulevard and at Grandin Bishop Boulevard. Pile dynamic monitoring is recommended to verify design assumptions and confirm mobilized pile capacities during construction.

Shallow foundation and friction piles can be designed to support lightly loaded structures.

Alternatives for retaining wall types and temporary shoring systems were presented and discussed. Design recommendations related to temporary shoring systems and permanent retaining wall including lateral forces from earth pressure, live load railway surcharges and construction surcharge were presented and discussed.

The design of all project components fall within CN rights-of-way or interface with CN assets will be required to be reviewed and accepted by CN prior to construction.

MSE wall system is identified as a feasible soil retention system for fill application at bridge approaches. External stability concerns call for the use of light weight fill which is expected to be significant in the vicinity of the bridge abutments. Reinforced concrete wall is identified as a feasible system at tunnel approaches.

Subgrade preparation includes removal and replacement of silt layers, if encountered and compaction of the subgrade surface with subdrains and geotextile. Plain doweled concrete pavement section comparable to a standard pavement section used for heavily trafficked streets in the City of Winnipeg is expected to perform satisfactorily for this project.

While the existing cut slopes at Bishop Grandin Boulevard can be maintained, stabilization measures including the use of light weight fill, crest unload, and surface and internal drainage improvement will be required.

3.5 Environmental Assessment

3.5.1 Regulatory Requirements

The Southwest Transitway – Stage 2 project is considered a Class 2 Development under the requirements of the Manitoba Environment Act, and therefore requires submission of an Environmental Impact Statement (EIS) and approval by Manitoba Conservation and Water Stewardship (MCWS) to obtain an Environment Act License (EAL).

Under the Canadian Environmental Assessment Act (CEAA) 2012, the project does not require review or approval by the Canadian Environmental Assessment Agency. The EIS was submitted to MCWS in April 2014 in a report entitled “City of Winnipeg Southwest Rapid Transit Corridor – Stage 2: Environmental Review and Assessment”. The complete report is attached in Appendix J. A summary of key elements of the report is provided in the sections below.

On December 18, 2014, the City of Winnipeg was issued Environmental Act License No. 3121 by MCWS for the Southwest Transitway – Stage 2 project.

3.5.2 Applicable Legislation

The federal and provincial environmental legislation applicable to the project include:

- Canada
  - a. Canadian Environmental Protection Act;
  - b. Fisheries Act and Regulations;
  - c. Migratory Birds Convention Act;
  - d. Species at Risk Act;
  - e. Transport Canada; and,

Southwest Transitway - Stage 2
Functional Design Report
2015 April Final Report - 13 8439

3.8 Background Investigations
For purposes of the Environmental Impact Statement, the study area was defined at each of the following levels:

**Project Study Area**

The Project Study Area (PSA) is defined as the area that will be physically altered and/or directly affected by the project construction activities and/or project operations and maintenance (O&M) activities. The project activities will take place within the existing CN Rail, Manitoba Hydro right-of-way corridor, and City of Winnipeg-owned land; therefore, the PSA was designated as the area located within the existing CN Rail and Manitoba Hydro right-of-way where project activities will occur.

**Local Study Area**

A Local Study Area (LSA) is selected to include the spatial area in which direct effects from the project are anticipated to occur. To examine the potential environmental effects of the project in the local area, the LSA was designated as the lands, watercourses/waterbodies, residences, businesses, facilities and infrastructure located within 0.5 km of either side of the existing CN Rail and Manitoba Hydro right-of-way.

**Regional Study Area**

A Regional Study Area (RSA) is selected to include the spatial area in which direct and indirect effects from the project are anticipated to occur. To examine the potential environmental effects of the project in the region, the RSA was designated as the City of Winnipeg. This area was selected to:

- Encompass wildlife movements and activities in the area, including Species At Risk;
- Include any affected watercourses, waterbodies or wetlands that extend outside of the PSA and LSA; and,
- Examine potential effects on land use, recreation, development and/or other stakeholder interests in the region.

### Methodological Approach

The methods and analysis used to identify and determine potential environmental effects within the Project area consisted of the following:

- Review of engineering, consultation and environmental information from previous studies;
- Information on land use, topography and location of commercial areas, industrial areas, recreational areas, residential areas, parks, protected areas, watercourses, waterbodies, forests, wetlands, roadways, trails and other infrastructure was determined by a desk-top review and examination of topographic maps, drainage maps, aerial imagery and published information for the area;
- The above-noted features were further examined and ground-truthed by a field survey of the PSA. The field survey provided on-site observations and documentation of the presence and location of the proposed transitway alignment; Manitoba Hydro transmission lines and transmission line right-of-way, CN yards and CN right-of-way; vegetated areas; mowed or cultivated areas; residences, parking lots, businesses and other infrastructure; potential fish and wildlife habitat; protected areas; roads and other human made structures or land use practices. The field survey was conducted on October 1, 2013, by a two person crew consisting of a qualified botanist and a qualified fisheries and wildlife biologist;
- Provincial (Manitoba Conservation Data Centre (MCDC)) and federal (Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Species At Risk Act (SARA)) databases and registries were reviewed and cross-referenced to species distribution maps, habitat preferences, breeding periods and migration times to determine the potential for the presence of any species listed as endangered, threatened or of special concern within the project area;
- Review of information provided in the Manitoba Breeding Bird Atlas, Manitoba Herps Atlas, annual publications released by MCDC on MCDC Rare Plant Surveys and Stewardship Activities and recent EIS completed for projects located within the region;
- Review of the City of Winnipeg Naturalist reports for the project area, including the Parker Lands;
- Contact with the Invasive Species Council of Manitoba (ISCM) to obtain a current list of invasive species for the project area;
- Review of the City of Winnipeg’s “Ecologically Significant Natural Lands Strategy and Policy” (December 2007) and current City of Winnipeg Tree Removal Guidelines;
- A request was submitted to the MCDC for information on the presence of any rare or endangered species in the project area;
- A request was submitted to the Manitoba Historic Resources Branch (MHRB) for information on the presence of any heritage resources in the Project area;
- A review of current First Nations Treaty Lands, Reserves, and/or Community Interest Zones in the Project Area;
- A meeting on November 18, 2013, with MCWS regulatory staff to review the project and determine the requirements for the EIS;
- Review and incorporation of the stakeholder information provided in the Public Consultation program;
- Review of applicable municipal, provincial, and federal environmental regulations, guidelines, and/or policies;
- Potential effects were identified based on knowledge of the project area, previous experience with similar projects, professional experience in conducting environmental assessments, and knowledge of applicable municipal, provincial, and federal environmental regulations, guidelines, and/or policies; and,
CEAA criteria were used to determine the potential environmental effects, the presence of residual effects once mitigation measures have been considered, if the remaining residual effects will have an environmental consequence, and the need for any follow-up or monitoring activities.

Mitigation of Environmental Effects

The City of Winnipeg is committed to conducting all of its construction projects in a manner that will reduce potential effects on the environment wherever possible. As part of this commitment, the City and the PPP consortium will develop a project specific Environmental Management Plan (EMP) for the project. The EMP will outline the environmental protection procedures and mitigation measures to be implemented before, during and after construction to prevent or minimize any adverse effects on the environment. The construction and O&M activities will be conducted in accordance with all applicable City of Winnipeg by-laws and guidelines (e.g., tree removal guidelines, tree protection guidelines) as well as all applicable provincial and federal laws, acts and regulations.

Table 18 provides a summary of the measures proposed to mitigate the potential environmental effects that have been identified for the project:

<table>
<thead>
<tr>
<th>TABLE 18: PROPOSED ENVIRONMENTAL MITIGATION MEASURES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Project Mitigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site management, overall environmental management.</td>
<td>Implementation of Best Management Practices (BMPs) and measures outlined in the Contractor’s EMP as directed by the City of Winnipeg for the Project including water/drainage management and erosion and sediment control measures.</td>
<td></td>
</tr>
<tr>
<td>Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation of the work areas as needed to prevent the release or transport of deleterious substances (e.g., fuel, grease, mud) or debris within the Project area.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety signage and safe work practices will be used at all work areas for the Project as part of site management practices.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Climate | No effects identified; the potential effects of GHG emissions are provided in the Air Quality and GHG section below. | No site required; mitigation measures for the potential effects of GHG emissions are provided in the Air Quality and GHG section below. |

| Air Quality and GHG Emissions | During the Project construction and O&M activities, there will be a temporary air emissions due to exhaust and/or dust from the use of stationary and mobile equipment. | Implementation of BMPs and measures outlined in the EMP for the Project. |
| | The expansion and use of Stage 2 of the Southwest Transitway is expected to have an overall effect of reducing GHG emissions in the City of Winnipeg. | Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. |
| | Mobile and stationary construction equipment will be required to meet appropriate federal emission standards. | Equipment and vehicles will not be left idling whenever possible. |
| | Dust control measures such as spraying access roads/areas with water will be implemented as needed. | Implementation of BMPs and measures outlined in the EMP for the Project. |
| | The overall effect of reduction of GHG emissions has a positive effect and direction. | Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. |

| Terrain and Soils | The construction of the Project will require the permanent alteration of portions of soil and terrain in the PSA, and temporary disturbance to soils and terrain in other areas of the PSA. | The Project O&M activities do not involve any soil removal and therefore not expected to have a significant effect on terrain and soils in the PSA. |
| | Potential for the release of hazardous materials as a result of accidents and malfunctions that may occur during the Project construction or O&M activities. | There were no contaminated sites found within the PSA and therefore no expected effects on terrain and soils in the PSA as a result of contaminated sites or the need for site remediation. |

| Groundwater | Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to the PSA, and temporary disturbance to soils and terrain in other areas of the PSA. | Implementation of BMPs and measures outlined in the EMP for the Project. |
| | Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. | Implementation of BMPs and measures outlined in the EMP for the Project. |
| | Implementation of BMPs and measures outlined in the EMP for the Project. | Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. |

Storage and disposal of dangerous goods will occur according to Workplace Safety and Health Act and its regulations and the Dangerous Goods Handling and Transportation Act and its regulations including the Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001.

Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations.

All spills will be reported to the appropriate authority and remediation will be in accordance with applicable regulations.

All Project material used at the site will be removed and the area will be restored to the pre-existing appearance.

Implementation of BMPs and measures outlined in the EMP for the Project, including erosion and sediment control measures.

Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.

All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.

Existing operating train speeds of 30 to 40 km/hr in the CN Letellier subdivision will be maintained following completion of the Project.

To minimize train noise, continuous welded rail (CWR) with premium ties and fasteners will be used for the relocated CN Letellier track (based on CWR engineering track standards).

A noise attenuation wall is proposed on the west side of the relocated CN Letellier track between Bishop Grandin and Marlaham Road.

Existing train traffic is expected to employ sound attenuation walls along CN Letellier Road.

Noise and Vibration | During the Project construction activities, there will be noise and vibration due to the use of stationary and mobile project equipment (e.g., asphalt pavers, backhoes, bulldozers, dump trucks, excavators, scrapers, packers, etc.). | During the Project O&M activities, there will be noise and vibration due to the operation of the BRT line and O&M activities. |

Southwest Transitway - Stage 2
Functional Design Report
2015 April Final Report - 13-8419
### Project Component: Mitigation Plans

#### Environmental Issue

- **Surface Water**
- **Fish and Fish Habitat**

#### Mitigation Plans

- **Storage and disposal of dangerous goods will occur according to Dangerous Goods Handling and Transportation Act and the Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001.**
- **Groundwater will be analyzed to determine its suitability/approval for sanitary sewer or land drainage system discharge.** As such, the potential effect of changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization is expected to be not significant.
- **Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures.**
- **Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures.**
- **Oil changes, refuelling and lubricating of mobile construction equipment will be conducted a minimum of 100 m from any watercourse, ditches or drainage areas.**
- **Vegetation**
- **Permanent alteration of breed, grassy, wet meadow and cattail stand areas in portions of the PSA.**
- **Oil changes, refuelling and lubricating of mobile construction equipment will be conducted a minimum of 100 m from any watercourse, ditches or drainage areas.**

#### Project Component: Environmental Investigation

- **Groundwater may be removed from the excavation sites by installing temporary wells and pumping the groundwater to the existing City of Winnipeg sewer system for treatment at the South End Water Pollution Control Centre (SEWPCC).**
- **The area of vegetation that will be permanently altered in the PSA is expected to be significant.**
- **Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations.**
- **Changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization is expected to be not significant.**
- **Alteration of the existing drainage regime, flows and/or amount of surface water.**
- **Vegetation**
- **Implementation of BMPs and measures outlined in the EMP for the Project.**
- **Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations.**
- **Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.**
- **Changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization; and Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to PSA or LSA watercourses, ditches or drains.**
- **Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations.**
- **All spills will be reported to the appropriate authority and remediation will be in accordance with applicable regulations.**

#### Project Component: Mitigation Plans

- **Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures.**
- **Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures.**
- **Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations.**
- **Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.**
- **The existing system of combined sewers and/or stormwater drains in the PSA and LSA eventually drain to outfalls located along the Red River. The land drainage system developed for the Project will use this existing system of combined sewers and/or stormwater drains. There will be no additional drainage inputs or amounts in the PSA. As such, the potential effects on fish or fish habitat in the LSA due to changes to the water chemistry of surface water caused by the Project are expected to be not significant.**
- **Oil changes, refuelling and lubricating of mobile construction equipment will be conducted a minimum of 100 m from any watercourse, ditches or drainage areas.**
- **Storage and disposal of dangerous goods will occur according to Dangerous Goods Handling and Transportation Act and the Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001.**
- **All spills will be reported to the appropriate authority and remediation will be in accordance with applicable regulations.**
- **Implementation of BMPs and measures outlined in the EMP for the Project.**
- **Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.**
- **The amount of vegetation affected by construction activities will be minimized as much as possible by having the areas required to be cleared, surveyed and accurately marked prior to construction.**
- **Any areas of exposed soils will be stabilized and revegetated with an approved seed or plant mix.**
- **Replacement of the lost or altered vegetation with new areas of upland vegetation, semi-aquatic vegetation, aquatic vegetation and a pond habitat through Project landscaping and the City’s adjacent development of the Parker Retention Pond.**
- **All construction equipment and footwear mobilized from outside the construction area shall arrive on the right-of-way clean condition to minimize the risk of weed or pest introduction. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species.**
- **The City of Winnipeg guidelines for tree protection, tree removal and tree replacement will be followed.**
- **To maintain compliance with the Manitoba Noxious Weed Act, the locations of the existing invasive plants will be marked and the plants removed prior to construction to prevent the proliferation and expansion of these invasive species in the PSA.**
Temporary disturbance in the PSA during construction and O&M activities.

Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&M areas.

Permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs.

Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.

Some of the treed, grassy, wet meadow and cattail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the City’s Parker Retention Pond. It is expected that the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA will displace some of the wildlife species that may be present in the existing PSA, while other species will remain or return after the completion of the Project construction activities. As such, the potential effect of the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA that may provide wildlife habitat is expected to have a minimal effect on wildlife and wildlife habitat in the PSA.

Temporary disturbance in the PSA during construction and O&M activities.

Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&M areas.

Permanent alteration of grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs.

Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.

Implementation of BMPs and measures outlined in the EMP for the Project.

Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.

The areas of wet meadow and cattail stands that will be permanently altered during construction are required for the transitway expansion.

The amount of wet meadow and cattail stands affected by construction activities will be minimized as much as possible by having the areas required to be cleared, surveyed and accurately marked prior to construction.

Replacement of the lost or altered wet meadow and cattail stands with new areas of semi-aquatic vegetation, aquatic vegetation areas and a pond habitat through Project landscaping development of the AT pathways and the City’s adjacent development of the Parker Retention Pond.

All construction equipment and footwear mobilized from outside the construction area shall arrive on the right-of-way or construction site in clean condition to minimize the risk of weed or pest introduction. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species.

Vehicle and equipment access will be limited to the right-of-way and existing roads and paths whenever possible.

All construction equipment and footwear mobilized from outside the construction area shall arrive on the right-of-way or construction site in clean condition to minimize the risk of weed or pest introduction. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species.

Vehicle and equipment access will be limited to the right-of-way and existing roads and paths whenever possible.

All Project material used at the site will be removed and the area will be restored to the pre-existing appearance.

Some of the treed, grassy, wet meadow and cattail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the City’s Parker Retention Pond. It is expected that the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA will displace some of the wildlife species that may be present in the existing PSA, while other species will remain or return after the completion of the Project construction activities. As such, the potential effect of the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA that may provide wildlife habitat is expected to have a minimal effect on wildlife and wildlife habitat in the PSA.

Implementation of BMPs and measures outlined in the EMP for the Project.

Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.

Temporary disturbance in the PSA during construction and O&M activities.

Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&M areas.

Permanent alteration of grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs.

Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.

Temporary disturbance in the PSA during construction and O&M activities.

Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&M areas.

Permanent alteration of grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs.

Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.

Implementation of BMPs and measures outlined in the EMP for the Project.

Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.

Project construction and O&M activities will occur during daytime hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.

All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.

The noise levels generated during the Project O&M activities are not expected to exceed noise levels generated by typical activities (including traffic) that occur in the area.

The areas of potential Species at Risk habitat (wet meadows, cattail stands, milkweed plants) that will be permanently altered are required for the transitway expansion.

It is expected that affected bird and bat species would only be present in the PSA for feeding or temporary resting needs, and would avoid the noise and disturbance in the PSA during Project construction and O&M activities. However, if nests, roosts, burrows or breeding areas for the affected bird or bat Species At Risk are discovered during construction or O&M activities, the activities will be halted and appropriate set back distances will be implemented.

Mitigation measures that may be used to prevent injury or mortality of Northern leopard frog and/or Monarch butterfly include: conducting a pre-construction survey in the spring to determine the presence and location of any Species At Risk in the PSA, relocating the milkweed plants present in the PSA prior to the construction and O&M activities; capturing and relocating any Northern leopard frogs found within the PSA prior to the construction and O&M activities; and/or scheduling construction and O&M activities to take place in the late summer, fall or winter when these species would not be present in the PSA.

Some of the treed, grassy, wet meadow and cattail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the Parker Retention Pond. It is expected that the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA will displace some of the wildlife species that may have returned to these areas of the PSA in the spring, while other individuals may...
### Project Component: Environmental Issue

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary disturbance due to noise, dust, equipment and crews working in the PSA.</td>
<td>Implementation of BMPs and measures outlined in the EMP for the Project.</td>
<td></td>
</tr>
<tr>
<td>Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA.</td>
<td>Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
<td></td>
</tr>
<tr>
<td>Permanent alteration of the treed, grassy, wet meadow and cattail stand areas in sections of the PSA.</td>
<td>Stakeholders will be notified in advance of the commencement of Project start-up activities.</td>
<td></td>
</tr>
<tr>
<td>Permanent alteration of sections of the Brenda Leipsic Dog Park and community gardens located on Manitoba Hydro owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McGillivray Boulevard.</td>
<td>Safety signage and safe work practices will be used at all work areas for the Project as part of site management practices.</td>
<td></td>
</tr>
<tr>
<td>Creation of AT pathways in the PSA.</td>
<td>Project construction and O&amp;M activities will occur during daytime hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.</td>
<td></td>
</tr>
<tr>
<td>The Project benefits outlined in Section 5, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions.</td>
<td>All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile and stationary construction equipment will be required to meet appropriate federal emission standards. Equipment and vehicles will not be left idling whenever possible.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dust control measures such as spraying access roads/areas with water will be implemented as needed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Project material used at the site will be removed and the area will be restored.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alteration of land areas in the PSA due to the Project was perceived as a positive effect by some stakeholders, and as a negative effect by others.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>During the Public Consultation activities, stakeholders indicated that the provision of an alternative dog park nearby was a reasonable solution to the alteration of the existing Brenda Leipsic Dog Park.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stakeholders indicated support and a positive reaction to the creation of AT pathways in the PSA.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Project benefits outlined in Section 5, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions, are considered to be positive effects of the Project.</td>
<td></td>
</tr>
</tbody>
</table>

### Project Component: Environmental Issue

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary disturbance due to equipment and crews working in the PSA.</td>
<td>The Project benefits, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions, are considered to be positive effects of the Project.</td>
<td></td>
</tr>
<tr>
<td>Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA.</td>
<td>There are no First Nations reserve lands, Treaty Land Entitlements or Community Interest Zones located within the PSA.</td>
<td></td>
</tr>
<tr>
<td>Permanent alteration of the treed, grassy, wet meadow and cattail stand areas in sections of the PSA.</td>
<td>There are no Métis organizations or known Métis interests located within the PSA or LSA.</td>
<td></td>
</tr>
<tr>
<td>Permanent alteration of sections of the Brenda Leipsic Dog Park and community gardens located on Manitoba Hydro owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McGillivray Boulevard.</td>
<td>The Project construction and O&amp;M activities are not expected to affect First Nations lands or traditional land use activities.</td>
<td></td>
</tr>
<tr>
<td>Creation of AT pathways in the PSA.</td>
<td>The Project construction and O&amp;M activities are not expected to affect Métis interests or activities in the PSA or LSA.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>There are no First Nations reserve lands, Treaty Land Entitlements or Community Interest Zones located within the PSA.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>There are no Métis organizations or known Métis interests located within the PSA or LSA.</td>
<td></td>
</tr>
</tbody>
</table>

### Aboriginal Interests

- There are no First Nations reserve lands, Treaty Land Entitlements or Community Interest Zones located within the PSA.
- There are no Métis organizations or known Métis interests located within the PSA or LSA.

### Implementation of BMPs and measures outlined in the EMP for the Project.

- Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.
- Stakeholders will be notified in advance of the commencement of Project start-up activities.
- Safety signage and safe work practices will be used at all work areas for the Project as part of site management practices.
- Project construction and O&M activities will occur during daytime hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.
- All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.
- Mobile and stationary construction equipment will be required to meet appropriate federal emission standards. Equipment and vehicles will not be left idling whenever possible.
- Dust control measures such as spraying access roads/areas with water will be implemented as needed.
- All Project material used at the site will be removed and the area will be restored.
- The alteration of land areas in the PSA due to the Project was perceived as a positive effect by some stakeholders, and as a negative effect by others.
- During the Public Consultation activities, stakeholders indicated that the provision of an alternative dog park nearby was a reasonable solution to the alteration of the existing Brenda Leipsic Dog Park.
- Stakeholders indicated support and a positive reaction to the creation of AT pathways in the PSA.
- The Project benefits, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions, are considered to be positive effects of the Project.
### 3.5.6 Environmental Effects Summary

Based on the assessment of the environmental effects that will remain after implementation of the mitigation measures described in Table 18, the residual effects associated with the project for air quality and GHGs, noise and vibration, terrain and soils, vegetation, wetlands, wildlife and wildlife habitat, Species at Risk, stakeholders and land use were found to be minimal or low. As such, the environmental effects of the proposed Project on these components are expected to be not significant.

The project effects of reduced GHG emissions, creation of AT pathways and the project benefits outlined in Section 5 of the Environmental Impact Statement (e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field, reduction in GHG emissions) were found to be positive effects of the Project.

The Project was determined to not likely result in significant adverse environmental effects based on the:

- Available information on the proposed Project and the existing local environment;
- Assessment of effects outlined in this Environmental Review and Assessment report; and,
- Application of proposed mitigation measures and follow-up.

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Use</td>
<td>The Project construction activities are not expected to result in any losses to the existing resource use in the PSA. Some of the land areas will be altered and there will be the additional use of a BRT system, but overall, the resource use will remain the same and the Project construction or O&amp;M activities are not expected to have a significant effect on resource use in the PSA.</td>
<td>None required</td>
</tr>
<tr>
<td>Protected Areas</td>
<td>No effects identified</td>
<td>None required</td>
</tr>
<tr>
<td>Heritage Resources</td>
<td>The MHRB indicated that there were no records of archaeological findings in the PSA. There were no other Heritage Resources or historic sites found to be present within the PSA. As such, there were no potential effects to Heritage Resources identified due to the Project construction or O&amp;M activities.</td>
<td>Implementation of BMPs and measures outlined in the EMP for the Project. Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. If archaeological and/or historical artifacts are discovered during construction, work at the location will cease immediately, and the discovery will be reported to the Project Construction Field Supervisor. The Project Construction Field Supervisor or their designate will contact the MHRB for further information and instruction on an acceptable heritage resource management strategy.</td>
</tr>
</tbody>
</table>
Transitway Runningway Design

4.1 Design Criteria

This section outlines the recommended geometric design and pavement design for the transitway runningway, for the by-pass lanes within the stations, for the transitway connections to the street system, and for associated street improvements.

The geometric and pavement design for the transitway is based on criteria contained in the following:
- Busway Planning and Design Manual, City of Winnipeg Transit Department, September 2004;
- Bus Rapid Transit Runningways - Recommended Practice, American Public Transit Association (APTA) Standards Development Program;
- Geometric Design Manual, Transportation Association of Canada (TAC);
- Geometric and Roadway Design Standards, City of Winnipeg Public Works Department;
- A Policy on Geometric Design of Highways and Streets, AASHTO; and,

Use of these criteria was confirmed by the City’s Public Works and Transit Departments. The recommended design criteria are summarized in Table 19.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed - Mainline and Motorway Ramps</td>
<td>90km/h</td>
</tr>
<tr>
<td>Design Speed - Stations</td>
<td>60km/h</td>
</tr>
<tr>
<td>Design Speed - Absolute Minimum</td>
<td>50km/h</td>
</tr>
<tr>
<td>Design Speed - Arterial Ramps and Access Roads</td>
<td>40km/h</td>
</tr>
<tr>
<td>Stopping Sight Distance: For 90 km/h design speed:</td>
<td>236 m</td>
</tr>
<tr>
<td>For Passenger Comfort, 60 km/h design speed:</td>
<td>84 m</td>
</tr>
<tr>
<td>Passing Sight Distance (station areas only)</td>
<td>TAC Standards</td>
</tr>
<tr>
<td>Horizontal Sight Distance</td>
<td>TAC Standards</td>
</tr>
<tr>
<td>Minimum Horizontal Curve Radius, Mainline</td>
<td>R = 330 m</td>
</tr>
<tr>
<td>Minimum Horizontal Curve Radius, Stations and CBD</td>
<td>R = 120 m</td>
</tr>
<tr>
<td>Minimum Horizontal Curve Radius, Absolute Minimum</td>
<td>R = 80 m</td>
</tr>
<tr>
<td>Minimum Horizontal Curve Radius, Ramps and Access</td>
<td>R = 45 m</td>
</tr>
<tr>
<td>Minimum Turning Radii at Intersections</td>
<td>23 m desirable</td>
</tr>
<tr>
<td>Spirals - all curves less than 870 m radius</td>
<td>TAC Standards</td>
</tr>
<tr>
<td>Maximum Super-elevation (above 50 km/h)</td>
<td>3 %</td>
</tr>
<tr>
<td>Maximum Super-elevation at Stations</td>
<td>-2 % (fall to center)</td>
</tr>
</tbody>
</table>

TABLE 19: RECOMMENDED TRANSITWAY RUNNINGWAY DESIGN CRITERIA

Use of these criteria was confirmed by the City’s Public Works and Transit Departments. The recommended design criteria are summarized in Table 19.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super-elevation Runout: Main Transitway At Stations</td>
<td>1 : 400</td>
</tr>
<tr>
<td>Minimum Tangent at Station Ends (Platform), Desired</td>
<td>20 m beyond</td>
</tr>
<tr>
<td>Maximum Grade, Mainline, Desirable</td>
<td>3 %</td>
</tr>
<tr>
<td>Maximum Grade, Mainline, Normal</td>
<td>5 %</td>
</tr>
<tr>
<td>Minimum Grade, Mainline: Rural Cross-Section: Urban Cross-Section</td>
<td>0.2 % 0.5 %</td>
</tr>
<tr>
<td>Maximum Grade, Stations (Desirable for BRT and LRT) *</td>
<td>0.50 %</td>
</tr>
<tr>
<td>Maximum Grade, Stations (Maximum for BRT and LRT) *</td>
<td>2.0 % (BRT), 0.8 % (LRT)</td>
</tr>
<tr>
<td>Maximum desirable Grade, Access Roads and Ramps</td>
<td>6 % (10 % maximum)</td>
</tr>
<tr>
<td>Minimum Grade (Curbed main Transitway, ramps, access roads and stations)</td>
<td>0.50 % desirable</td>
</tr>
<tr>
<td>Crest Curves: Desirable Minimum, Main Transitway</td>
<td>K = 65</td>
</tr>
<tr>
<td>Absolute Minimum, Main Transitway</td>
<td>K = 40</td>
</tr>
<tr>
<td>Minimum for Passenger Comfort, At Stations</td>
<td>K = 17</td>
</tr>
<tr>
<td>Sag Curves: Desirable Minimum, Main Transitway</td>
<td>K = 59</td>
</tr>
<tr>
<td>Absolute Minimum, Main Transitway</td>
<td>K = 20</td>
</tr>
<tr>
<td>Minimum for Passenger Comfort, At Stations</td>
<td>K = 17</td>
</tr>
<tr>
<td>Minimum Intersection Angle</td>
<td>70°</td>
</tr>
</tbody>
</table>

* Maximum grade at stations for LRT is included in criteria to accommodate a possible future conversion from BRT to LRT.
4.2 Geometric Design

The horizontal alignment of the transitway, as described and illustrated in Section 2, has been determined within the context of many factors, including existing and planned municipal, hydro, and railway infrastructure within the Parker lands, the Manitoba Hydro right-of-way and the CN Letellier sub-division.

Distinct types of cross-section are recommended for different sections of the transitway. These include an urban cross-section, a rural cross-section, a tunnel/underpass cross-section, a cross-section for IGF Station, and various cross-sections for transitway connections to the street system. Each is discussed below in turn in Table 20 to Table 24.

**Table 20: Urban Cross-Section (See Figure 24)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Features</strong></td>
<td></td>
</tr>
<tr>
<td><em>One runningway lane in each direction between stations;</em></td>
<td></td>
</tr>
<tr>
<td><em>One runningway lane and one bypass lane in each direction within stations;</em></td>
<td></td>
</tr>
<tr>
<td><em>Turning lanes, where required, to accommodate bus turns to/from the street system;</em></td>
<td></td>
</tr>
<tr>
<td><em>AT Path parallel to the transitway;</em></td>
<td></td>
</tr>
<tr>
<td><em>Fencing to separate the transitway from the CN Letellier track;</em></td>
<td></td>
</tr>
<tr>
<td><em>Fencing to separate the transitway from the AT Path, where required;</em></td>
<td></td>
</tr>
<tr>
<td><em>Sub-drains in the vicinity of low points for drainage and, drainage inlets to lead to adjacent drainage systems.</em></td>
<td></td>
</tr>
</tbody>
</table>

| Locations Applied | |
|-------------------| |
| *Within all transitway stations;* |
| *Between the southern limit of the Stage 1 transitway and the Transitway Underpass of the CN Wye Tracks;* |
| *Through the Transitway Underpass of CN Wye Tracks;* |
| *On the Transitway Overpass of McGillivray Boulevard and, Between the Letellier Tunnel and Markham Road.* |

| Characteristics Between Stations |
| Total Pavement Width | 10.05 m |
| Runningway Lane Width | 3.5 m |
| Shy Distance | 1.0 m per side |
| Runningway Drainage | LDS |
| Traffic Barrier Width | 525 mm |
| Traffic Barrier Height | 813 mm |

| Characteristics at Standard Stations |
| Total Station Pavement Width | 14.2 m |
| Station Boarding/Alighting Lane Width | 3.15 m |
| Station Boarding lane Width | 3.5 m |
| Centre Median Barrier Curb Width | 0.9 m |
| Station Platform Barrier Curb | SD-203A, 250 mm height* |
| Station Median | SD-226B |

| Characteristics at Split Stations |
| Total Station Pavement Width | 11.675 m |
| Station Boarding/Alighting Lane Width | 3.15 m |
| Station Bypass Lane Width | 3.5 m |
| Station Platform Barrier Curb | SD-203A, 250 mm height* |

**Table 21: Rural Cross-Section (See Figure 25)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Features</strong></td>
<td></td>
</tr>
<tr>
<td><em>One runningway lane in each direction between stations;</em></td>
<td></td>
</tr>
<tr>
<td><em>One runningway lane and one bypass lane in each direction within stations;</em></td>
<td></td>
</tr>
<tr>
<td><em>Turning lanes, where required, to accommodate bus turns to/from the street system;</em></td>
<td></td>
</tr>
<tr>
<td><em>AT Path parallel to the transitway;</em></td>
<td></td>
</tr>
<tr>
<td><em>Fencing to separate the transitway from the AT Path, where required;</em></td>
<td></td>
</tr>
<tr>
<td><em>Ditches on either side of runningway, with side slopes and a ditch bottom that is lower than the runningway subgrade so that the pavement structure does not hold water;</em></td>
<td></td>
</tr>
<tr>
<td><em>Ditches that drain to pipes that connect to adjacent land drainage system without any increase in the existing system’s peak flow rate; and,</em></td>
<td></td>
</tr>
<tr>
<td><em>Piped drainage within stations and for grade separations.</em></td>
<td></td>
</tr>
</tbody>
</table>

| Locations Applied | |
|-------------------| |
| *Between the Transitway Underpass of the CN Wye Tracks and Parker Station;* |
| *Between Parker Station and McGillivray Station;* |
| *Between McGillivray Station and the Transitway Overpass of McGillivray Boulevard;* |
| *Between the Transitway Overpass of McGillivray Boulevard and Clarence Station;* |
| *Between Clarence Station and Chevrier Station; and,* |
| *Between Chevrier Station and the Letellier Tunnel.* |

| Characteristics Between Stations |
| Total Pavement Width | 9.2 m |
| Runningway Lane Width | 4.1 m |
| Runningway Shoulder Width | 0.5 m per side |
| Runningway Drainage | Ditches |
| Runningway Side Slope | 4:1 |

| Characteristics at Stations |
| Total Station Pavement Width | 14.2 m |
| Station Boarding/Alighting Lane Width | 3.15 m |
| Station Bypass Lane Width | 3.5 m |
| Centre Median Barrier Curb Width | 0.9 m |
| Station Platform Barrier Curb | SD-203A, 250 mm height* |
| Station Median | SD-226B |

* SD refers to “Standard Details” in the City of Winnipeg Construction Specifications.
### Table 22: Tunnel/Underpass Cross-Section (See Figure 26)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Features</strong></td>
<td>One runningway lane in each direction;</td>
</tr>
<tr>
<td></td>
<td>Shy distance adjacent to each runningway lane; and,</td>
</tr>
<tr>
<td></td>
<td>Traffic barriers adjacent to tunnel walls.</td>
</tr>
<tr>
<td><strong>Locations Applied</strong></td>
<td>Transway Underpass of the CN Wye Tracks at Portage Junction; and,</td>
</tr>
<tr>
<td></td>
<td>Letellier Tunnel</td>
</tr>
<tr>
<td><strong>Characteristics</strong></td>
<td>Minimum Tunnel Height (for BRT/LRT Clearance) 5.0 m</td>
</tr>
<tr>
<td></td>
<td>Total Pavement Width 11.0 m</td>
</tr>
<tr>
<td></td>
<td>Runningway Lane Width 3.5 m</td>
</tr>
<tr>
<td></td>
<td>Shy Distance 1.5 m per side</td>
</tr>
<tr>
<td></td>
<td>Traffic Barrier Width 500 mm</td>
</tr>
<tr>
<td></td>
<td>Traffic Barrier Height 813 mm</td>
</tr>
</tbody>
</table>

### Table 23: Investors Group Field Station Cross-Section (See Figure 27)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Features</strong></td>
<td>Central platform connected to Investors Group Field by an overhead pedestrian</td>
</tr>
<tr>
<td></td>
<td>walkway; and,</td>
</tr>
<tr>
<td></td>
<td>Four lanes on each of north and south sides of platform (three passenger loading</td>
</tr>
<tr>
<td></td>
<td>lanes, one bus circulation lane).</td>
</tr>
<tr>
<td><strong>Characteristics</strong></td>
<td>Central Platform Width 19.5 m</td>
</tr>
<tr>
<td></td>
<td>Loading Lane Width 3.5 m</td>
</tr>
<tr>
<td></td>
<td>Bus Circulation Lane Width 5.0 m</td>
</tr>
<tr>
<td></td>
<td>Station Platform Barrier Curb (must accommodate passenger step down from</td>
</tr>
<tr>
<td></td>
<td>platform to roadway when boarding buses staged in outside rows) SD-203A, 180</td>
</tr>
<tr>
<td></td>
<td>mm height*</td>
</tr>
</tbody>
</table>

*SD refers to “Standard Details” in the City of Winnipeg Construction Specifications*  

### Table 24: Cross-Sections for Transitway Connections to the Street System

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Features</strong></td>
<td>The connections to the street system are required so that rapid transit buses</td>
</tr>
<tr>
<td></td>
<td>that minimizes the need to transfer;</td>
</tr>
<tr>
<td></td>
<td>The components of the connections include special turning lanes for buses and</td>
</tr>
<tr>
<td></td>
<td>street improvements to provide for efficient traffic and parking operations</td>
</tr>
<tr>
<td></td>
<td>and access/egress to/from Park and Ride lots; and,</td>
</tr>
<tr>
<td></td>
<td>Includes transitway connections to streets of two-lane, three-lane, and four-</td>
</tr>
<tr>
<td></td>
<td>lane configurations.</td>
</tr>
<tr>
<td><strong>Locations Applied</strong></td>
<td>Beaumont Street;</td>
</tr>
<tr>
<td></td>
<td>Georgina Street;</td>
</tr>
<tr>
<td></td>
<td>Hurst Way;</td>
</tr>
<tr>
<td></td>
<td>Willson Place (for Park and Ride users);</td>
</tr>
<tr>
<td></td>
<td>Seel Avenue;</td>
</tr>
<tr>
<td></td>
<td>Waller Avenue (for Park and Ride users);</td>
</tr>
<tr>
<td><strong>Two-Lane Urban Road Connection</strong></td>
<td>Total Pavement Width 8.0 m</td>
</tr>
<tr>
<td></td>
<td>Lane Width 4.0 m</td>
</tr>
<tr>
<td><strong>Three-Lane Urban Road Connection</strong></td>
<td>Total Pavement Width 12.0 m</td>
</tr>
<tr>
<td></td>
<td>Lane Width 4.0 m</td>
</tr>
<tr>
<td><strong>Four-Lane Urban Road Connection</strong></td>
<td>Total Pavement Width 8.0 m in each direction</td>
</tr>
<tr>
<td></td>
<td>Lane Width 4.0 m</td>
</tr>
<tr>
<td><strong>Two-Lane Rural Road Connection</strong></td>
<td>Total Pavement Width 9.0 m</td>
</tr>
<tr>
<td></td>
<td>Lane Width 4.0 m</td>
</tr>
<tr>
<td></td>
<td>Roadway Shoulder Width 0.5 m per side</td>
</tr>
<tr>
<td></td>
<td>Roadway Drainage Ditches</td>
</tr>
<tr>
<td></td>
<td>Roadway Side Slope 4:1</td>
</tr>
</tbody>
</table>

*SD refers to “Standard Details” in the City of Winnipeg Construction Specifications*
Pavement Design

The pavement designs for the transitway are based on AASHTO guidelines, but modified to reflect bus operations volumes, loaded bus axle weights, geotechnical information, local best practices, constructability, and experience gained during the Southwest Transitway - Stage 1 project.

The following loaded bus axle weights, supplied by Winnipeg Transit, were used in the pavement design:

- Front Axle: 14,287 lbs
- Rear Axle: 25,487 lbs
- Gross Vehicle Weight: 39,818 lbs

Note that local soil conditions for the Stage 2 project require pavement structures deeper than those outlined in the AASHTO guidelines. This will result in an increased drainable sub-base to keep moisture levels low, to reduce susceptibility to frost, and to maintain structure strength.

Three different types of pavement design are recommended for different sections of the transitway. Discussed in turn below in Table 25 to Table 27, these include:

- Pavement Structure 1 for the runningways, station lanes, and transitway connections to the street system;
- Pavement Structure 2 for the Letellier Tunnel; and,
- Pavement Structure 3 for parking lots.

**TABLE 25: PAVEMENT STRUCTURE 1**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Locations Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Transitway Runningways;</td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td>Pavement structure for application in locations with high volumes of transit bus operation; and,</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Types and Thicknesses</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Dowelled Concrete Pavement</td>
<td>230 mm</td>
</tr>
<tr>
<td>Base Course</td>
<td>75 mm</td>
</tr>
<tr>
<td>Sub-Base Course (50 mm diameter material)</td>
<td>150 mm</td>
</tr>
<tr>
<td>Sub-Base Course (150 mm diameter material)</td>
<td>450 mm</td>
</tr>
<tr>
<td>Sub-Drains (for urban cross-section only)</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-Woven Geotextile Fabric</td>
<td>Yes</td>
</tr>
<tr>
<td>Geogrid (as required to span poor sub-grade)</td>
<td>Yes</td>
</tr>
<tr>
<td>Total Structural Depth</td>
<td>905 mm</td>
</tr>
</tbody>
</table>

**TABLE 26: PAVEMENT STRUCTURE 2**

<table>
<thead>
<tr>
<th>Location Applied</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runningway within Letellier Tunnel</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel's concrete box structure provides foundation base for the runningway pavement;</td>
<td>Structure composed of sub-base material, base course, and concrete;</td>
</tr>
<tr>
<td>Pavement structure requires a sub-drain to quickly remove water from the sub-base to prevent freezing; and,</td>
<td>Standard transit bus is design vehicle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Types and Thicknesses</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Dowelled Concrete Pavement</td>
<td>230 mm</td>
</tr>
<tr>
<td>Base Course</td>
<td>75 mm</td>
</tr>
<tr>
<td>Sub-Base Course (50 mm diameter material)</td>
<td>300 - 500 mm (varies)</td>
</tr>
<tr>
<td>Sub-Drains Above Tunnel Floor</td>
<td>Yes</td>
</tr>
<tr>
<td>Total Structural Depth</td>
<td>605 - 805 mm</td>
</tr>
</tbody>
</table>

**TABLE 27: PAVEMENT STRUCTURE 3**

<table>
<thead>
<tr>
<th>Locations Applied</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>McGillivray Station Park and Ride lot;</td>
<td>Clarence Station Park and Ride lot;</td>
</tr>
<tr>
<td>Kiss and Ride parking areas; and,</td>
<td>Reconfiguration of existing private parking lots on land leased from Manitoba Hydro.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard automobile is design vehicle.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material Types and Thicknesses</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Pavement</td>
<td>100 mm</td>
</tr>
<tr>
<td>Base Course</td>
<td>75 mm</td>
</tr>
<tr>
<td>Sub-Base Course (50 mm diameter material)</td>
<td>300 mm</td>
</tr>
<tr>
<td>Non-Woven Geotextile Fabric</td>
<td>-</td>
</tr>
<tr>
<td>Total Structural Depth</td>
<td>475 mm</td>
</tr>
</tbody>
</table>
5.0 Stations

5.1 Design Criteria

The spacing between stations and conceptual station designs for the transitway are based on guidelines contained in the following:

- Busway Planning and Design Manual, City of Winnipeg Transit Department, September 2004;
- Bus Rapid Transit Stations and Stops - Recommended Practice, APTA Standards Development Program;
- Southwest Transitway - Stage 1 Station Designs;
- Designing for Sustainable Transportation and Transit in Winnipeg, City of Winnipeg Transit Department; and,
- Accessibility Design Standards of the City of Winnipeg.

5.2 Spacing between Stations

Station spacing varies according to the type of runningway and to the nature of development along the transitway.

On the high speed portions of the transitway, stations are spaced at intervals of approximately 0.5 to 1.0 km. Within this range, stations are located to provide convenient pedestrian access from nearby developments (both existing and proposed ones), to enable efficient bus access/egress to/from the street system at various points along the transitway, and to provide opportunities for Park and Ride facilities at strategic sites.

On the lower speed portions of the transitway, such as on the University of Manitoba lands, stations are located at shorter intervals of 300 to 500 m to provide good integration of the rapid transit service with adjacent high-density land uses.

Based on these guidelines and on consultations with City staff and the public, it is recommended that Stage 2 of the Southwest Transitway include:

- Seven new stations along the transitway (Parker, McGillivray, Clarence, Chevrier, Plaza, Chancellor, Markham);
- A stop in each direction on Southpark Drive immediately west of Pembina Highway;
- A new station or stops in the Southwood lands (to be built in conjunction with future development);
- A new event-day station at Investors Group Field;
- Upgrades of existing stops on the University of Manitoba campus; and,
- A major upgrade of the University of Manitoba Station on Dafoe Road (including a new bus staging area near the east end of Dafoe Road).

The locations of the stations and stops are shown in Figure 28.

5.3 Station Design

The functional design includes general layouts for typical stations for the transitway. While the final designs for the stations are to be based on these layouts and are to use a set of components and materials that are consistent and compatible with those used in the stations for Stage 1 of the Southwest Transitway, the aesthetics for each station are to reflect the local character of the areas and neighbourhoods the stations serve.

While the general dimensions for a “standard” transitway station for Stage 2 are shown in Figure 29, typical layouts for three different types of transitway stations include:

- Standard Layout for stations without Park and Ride facilities (Figure 30);
- Large Layout for stations with Park and Ride facilities (Figure 31); and,
- Split Layout for stations with platforms on either side of an intersecting street (Figure 32).

For those sections of the rapid transit routes that operate on-street with other traffic, new or upgraded stops are recommended to be implemented based on designs typically used for Winnipeg Transit’s Bus Stop Upgrade Program.

Table 28 provides summary information on the locations and layout types recommended for the proposed stations and stops.

<table>
<thead>
<tr>
<th>Category</th>
<th>Station Location</th>
<th>Layout Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transway</td>
<td>Parker Station (between Georgina Street and Beaumont Street, north of Parker Avenue)</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>McGillivray Station (north of McGillivray Boulevard, near Seel Avenue, with Park and Ride)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Clarence Station (between Clarence Avenue and Waller avenue, with Park and Ride)</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td>Chevrier Station (north of Chevrier Boulevard)</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Plaza Station (east side of CN Letellier track at west limit of the Public Road referred to as Plaza Drive)</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Chancellor Station (east side of CN Letellier track at Chancellor Drive)</td>
<td>Split</td>
</tr>
<tr>
<td></td>
<td>Markham Station (east side of CN Letellier track, north of Markham Road)</td>
<td>Standard</td>
</tr>
<tr>
<td>Connection to University of Manitoba</td>
<td>Southpark Drive, west of Pembina Highway</td>
<td>Street Stop</td>
</tr>
<tr>
<td></td>
<td>Southwood Station (exact location and configuration to be determined)</td>
<td>Street Stop</td>
</tr>
<tr>
<td>Investors Group Field</td>
<td>IGF Station (adjacent to north side of stadium; overhead pedestrian walkway and ramps between stadium northwest gate and station’s central loading platform). For regular rapid transit service, bus stops would be located immediately west of the station’s intersection with University Crescent.</td>
<td>Special Purpose</td>
</tr>
<tr>
<td>University of Manitoba Campus</td>
<td>Northbound University Crescent at Chancellor Matheson Stop (existing)</td>
<td>Major Upgrade</td>
</tr>
<tr>
<td></td>
<td>Westbound Dafoe at School of Music Stop (existing)</td>
<td>Major Upgrade</td>
</tr>
<tr>
<td></td>
<td>University of Manitoba Station on Dafoe Road (existing)</td>
<td>Major Upgrade</td>
</tr>
</tbody>
</table>

Table 28: Station Locations and Layout Types
In addition to these recommended station layouts, the final design of the stations will include the station features outlined in Table 29.

**TABLE 29: REQUIRED STATION FEATURES**

<table>
<thead>
<tr>
<th>Item</th>
<th>Transitway Stations</th>
<th>Street Stops</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Two runningway lanes in each direction</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>2. Decorative fence barrier in station median to prevent pedestrian crossings in mid-station area</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3. Crosswalks located at each end of station (approximately 5 m downstream of bus stop pole)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4. Minimum platform width (3.0 m for transferway stations, 2.0 m for street stops)</td>
<td>✓ ✓</td>
<td></td>
</tr>
<tr>
<td>5. Platform curb must be in a straight line (no curve) to minimize horizontal gap between bus doors and platform edge</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6. High level platform curbs (250 mm)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>7. High level platform curbs (250 mm)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8. Plastic warning strip at edge of platforms</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>9. Trueform-style bus stop pole and flag on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10. Wayfinding signage on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>11. Information kiosks for route and schedule information on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>12. Electrical supply and connection mount for BUSwatch signs on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>13. Electrical supply and connection mount for BUSwatch signs on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>14. Enclosed heated shelters on each platform, with benches and interior lighting</td>
<td>✓ ✓</td>
<td></td>
</tr>
<tr>
<td>15. Benches with Canopy on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>16. Bike Lockers</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>17. Bike Racks with Canopy</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>18. Waste Re-cycling Receptacles</td>
<td>✓ ✓</td>
<td></td>
</tr>
<tr>
<td>19. Newspaper Box rings on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>20. Prominent identification signage on shelter/shelter/canopy at stations</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>21. Prominent pylon identification signage at stations</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>22. Prominent identification signage at stops (e.g., T-Man, Totem)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>23. Inbound/Outbound signage on median fence</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>24. Wayfinding signage on each platform</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>25. Conduit for communications lines (e.g., fibre optic cable for CCTV)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>26. Conduit and detector loop for bus arrival warning system (for each of northbound and southbound directions)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>27. High quality pedestrian and cycling connections to station</td>
<td>✓ ✓</td>
<td></td>
</tr>
<tr>
<td>28. Convenient Kiss and Ride drop-off/pick-up area adjacent to station</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>29. Handi-Transit pick-up/drop-off area adjacent to station</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>30. Convenient access for station maintenance staff and vehicles</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>31. Universal design features (automatic door openers for each shelter, paving bands to delineate a clear path of pedestrian travel)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>32. Landscaping of scale used for Fort Rouge Station, including use of native grasses</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>33. Space for future public art (City of Winnipeg requirement)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Note that communications/CCTV systems are to be supplied and installed as separate City initiatives.

5.4 **Investors Group Field Station**

A special purpose station is proposed at Investors Group Field to accommodate buses serving major events at the stadium. Up to 200 buses are used to transport spectators to and from events. Shown in concept in Figure 33 and in cross-section in Figure 27, IGF Station is proposed to be located adjacent to the north side of the stadium. An overhead pedestrian walkway is to be constructed between the stadium’s northwest gate and the station’s large central loading platform to segregate pedestrian movements from bus operations.

Note that, between the south limit of IGF Station and the north limit of the stadium building, sufficient space must be provided beneath the overhead pedestrian walkway to accommodate a single vehicle lane, approximately 3.0 m in width, on stadium property. This lane is required by the Winnipeg Football Club to provide vehicular access to a storage area on the northeast side of the stadium.

The design of the station requires further collaboration with the Winnipeg Football Club and the University of Manitoba.

5.5 **University of Manitoba Station**

To support its development plans, the University of Manitoba has indicated that two-way transit service is preferred on the portion of Dafoe Road east of University Crescent. To enable two-way operation, the following will be required:

- Revisions to the location and layout of University of Manitoba Station;
- Construction of a new bus staging area (with provision for 12 bus layover spaces and a bus operator washroom) near the east end of Dafoe Road; and,
- Installation of two new on-street stops on eastbound Dafoe Road (one opposite the School of Music, one adjacent to Tache Hall).

The approximate location for these works is shown in Figure 20.

Note that the new bus staging area would be used only for bus layovers; no passenger boarding or alighting would take place in the staging area. The final layout of the station, the new bus staging area, and any associated modifications to Dafoe Road requires further collaboration with the University of Manitoba.
6.0 Park and Ride

6.1 Design Criteria

Park and Ride facilities are included at strategic locations to accommodate the following travel movements:

- Commuter travel to/from downtown;
- Commuter travel to/from the University of Manitoba; and,
- Travel to/from events at Investors Group Field.

The following criteria were used to guide the development of Park and Ride locations for Stage 2:

- Siting at locations where motorists can be intercepted prior to points of traffic congestion on the regional street system;
- Availability of open contiguous property to accommodate parking lots for 300 to 700 automobiles;
- Availability of space for Kiss and Ride facilities;
- Excellent automobile access/egress between parking lots and the regional street system;
- Siting of automobile access/egress paths to/from the parking lots that minimizes traffic impacts on nearby residential streets;
- Provision of direct pedestrian paths of 400 m or less between parking spaces and station platforms;
- Segregation of automobile traffic from bus operations; and,
- Landscaping to a standard that complies with the City’s zoning by-laws.

6.2 Proposed Park and Ride Facilities

Park and Ride facilities are included at McGillivray Station and at Clarence Station:

- At McGillivray Station, new parking lots are proposed on the west side of the transitway, south and north of Seel Avenue (with total capacity for approximately 700 vehicles). Street connections are to be provided between the parking lots and Seel Avenue and Willson Place. Between the parking lots and Fennel Street, each of Seel Avenue and Willson Place are to be improved to include one eastbound lane and two westbound lanes to accommodate automobile access/egress between the parking lots and the regional street system. The proposed layout for the McGillivray Station Park and Ride is shown in Figure 34.

- At Clarence Station, a new parking lot is proposed on the west side of the Manitoba Hydro right-of-way adjacent to the station (with total capacity for approximately 400 vehicles). Street connections are to be provided between the parking lot and Clarence Avenue and Waller Avenue. Between the parking lot and Irene Street, Waller Avenue is to be improved to include one eastbound lane and two westbound lanes to accommodate automobile access/egress between the parking lot and the regional street system. The proposed layout for the Clarence Station Park and Ride is shown in Figure 35.

These Park and Ride facilities are to include the following features:

- Paved parking lots;
- Electrical plugs for block heaters in designated areas;
- Prominent identification signage;
- Prominent wayfinding signage for motorists and pedestrians; and,
- Prominent signage of conditions of use.
7.0 Kiss and Ride

7.1 Design Criteria

Kiss and Ride facilities are designed to accommodate passengers making a mode change between rapid transit and automobile passenger to complete their trips. The following criteria were used to guide the development of Kiss and Ride locations for Stage 2:

- Siting of pick-up/drop-off locations in close proximity to station platforms;
- Siting of Kiss and Ride facilities off-street, where space permits;
- Integration of Kiss and Ride facility with Park and Ride facility at stations where Park and Ride is provided;
- Provision of direct pedestrian paths between pick-up/drop-off locations and station platforms;
- Provision of short-term (15 minutes) parking spaces for waiting automobiles at each Kiss and Ride facility;
- Excellent automobile access/egress between Kiss and Ride parking area and the regional street system;
- Siting of automobile access/egress paths to/from the Kiss and Ride parking that minimizes traffic impacts on nearby residential streets; and,
- Segregation of automobile traffic from bus operations.

7.2 Proposed Kiss and Ride Facilities

As listed in Table 30 and shown in Figure 36 Kiss and Ride facilities are to be provided at these stations:

<table>
<thead>
<tr>
<th>Station</th>
<th>Type</th>
<th>Number of Parking Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parker</td>
<td>Off-Street</td>
<td>14 in designated parking area</td>
</tr>
<tr>
<td>McGillivray</td>
<td>Off-Street,</td>
<td>12 in drop-off/pick-up lane adjacent to station platform</td>
</tr>
<tr>
<td></td>
<td>Integrated with Park and Ride</td>
<td>12 in drop-off/pick-up lane adjacent to station platform</td>
</tr>
<tr>
<td>Clarence</td>
<td>Off-Street,</td>
<td>12 in drop-off/pick-up lane adjacent to station platform</td>
</tr>
<tr>
<td></td>
<td>Integrated with Park and Ride</td>
<td>12 in drop-off/pick-up lane adjacent to station platform</td>
</tr>
<tr>
<td>Chancellor</td>
<td>On-Street</td>
<td>Three in recessed parking area on westbound Chancellor,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three in recessed parking area on eastbound Chancellor</td>
</tr>
<tr>
<td>Markham</td>
<td>On-Street</td>
<td>Three in recessed parking area on westbound Markham,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three in recessed parking area on eastbound Markham</td>
</tr>
</tbody>
</table>

At Chevrier Station and Plaza Station, opportunities for Kiss and Ride have not been identified due to:

- Lack of sufficient space at the station; or,
- Area plans in the vicinity of the station are not yet finalized.
8.0 **Bus Staging Areas**

### 8.1 Design Criteria

Bus staging areas are required at two locations:
- At a strategic midpoint on the transitway;
- On the Fort Garry Campus of the University of Manitoba.

A bus staging area is required at a strategic location on the transitway for the following purposes:
- To position standby buses for insertion into regular rapid transit service in either the northbound or southbound direction;
- To provide a turnaround loop to short-turn southbound rapid transit buses; and,
- To provide a turnaround loop to short-turn northbound buses operating from Investors Group Field following events at the stadium.

The following criteria were used to guide the development of the bus staging area at a midpoint on the transitway:
- Siting at a station that enables buses to be inserted in either a southbound or northbound direction to address passenger crowding on rapid transit service in either direction;
- Siting in a location that is not adjacent to a residential area;
- Direct bus access/egress between the staging area and the transitway for buses operating in either direction on the transitway;
- Sufficient bus parking space in the staging area for up to eight standard buses;
- Sufficient runningway space within the staging area to enable independent pull-in and pull-out of buses to/from the bus parking spaces;
- Minimization of crossing conflicts between buses and pedestrians; and,
- Reversible directions of bus travel in the staging area’s runningway to accommodate pre-event and post-event service for events at Investors Group Field.

To support its development plans, the University of Manitoba has indicated that two-way transit service is preferred on the portion of Dafoe Road east of University Crescent. To enable two-way operation, the following will be required:
- Revisions to the layout of University of Manitoba Station; and,
- Construction of a new bus staging area.

To accommodate current and future bus layover volumes for the existing 13 transit routes that operate on campus and potential future additional routes, the bus staging area at the University requires 12 bus layover locations and a bus operator washroom (a single water closet with secure access). The staging area is to be located near the east end of Dafoe Road.

### 8.2 Proposed Bus Staging Area at McGillivray Station

A bus staging area is to be included at McGillivray Station for the following reasons:
- It is a mid-point on the Southwest Transitway and permits standby buses to be inserted into service to address passenger crowding for both inbound service to downtown and outbound service to the University of Manitoba/southwestern suburban neighbourhoods;
- Its proximity to Investors Group Field, in terms of bus running times, permits buses serving events at Investors Group Field to turn around and make multiple trips between Investors Group Field and the Park and Ride lots at Clarence and McGillivray Stations; and,
- There is sufficient space for the bus staging area at the station that is not adjacent to a residential area.

The bus staging area is to function as follows:
- For pre-event service to Investors Group Field, buses would stage in the northbound direction on the west side of the regular southbound platform and in the southbound direction on the east side of the southbound platform (see Figure 37a). Buses destined to Investors Group Field would be loaded from either side of the regular southbound platform, or from only the east side of the platform if buses staged in the northbound direction are to be pulled around to the east side prior to loading. On the east side of the platform, the bus position at the head of the stop would remain open for use by regular southbound rapid transit service;
- For post-event service from IGF, buses terminating at McGillivray Station to return to Investors Group Field for a subsequent trip would make a northbound left turn at the north end of the station to operate in the southbound direction on the west side of the regular southbound platform (see Figure 37b). Passengers would alight onto a platform on the west side of the arriving buses and walk directly to the parking lot without having to cross buses that are exiting the station to return to Investors Group Field or to the garage. Northbound buses from Investors Group Field that are not terminating at McGillivray Station would alight passengers on the regular northbound platform on the east side of the transitway runningway prior to continuing their northbound trips;
- For buses to be inserted into regular northbound rapid transit service, standby buses would stage in the southbound direction on the west side of the regular southbound platform and pull around to the regular northbound stop on the east side of the station to board passengers;
- For buses to be inserted into regular southbound rapid transit service, standby buses would stage in the southbound direction on the east side of the southbound platform and would be loaded from the east side of the platform; and,
For a regular southbound rapid transit bus that is to short-turn at McGillivray Station, the bus would operate in the southbound direction on the west side of the regular southbound platform and alight passengers onto the platform on the west side of the arriving bus, before turning onto the regular runningway to operate northbound.

### Proposed Bus Staging Area at the University of Manitoba

The approximate location for bus staging area is shown in Figure 20. The staging area must be located downstream of the transit routes that operate to the campus (i.e., east of University of Manitoba Station).

Note that:

- The new bus staging area would be used only for bus layovers; no passenger boarding or alighting would take place in the staging area;
- A bus operator washroom must be included within the bus staging area (with a single water closet and secured access); and,
- The final layout of the bus staging area, and any associated modifications to Dafoe Road requires further collaboration with the University of Manitoba.
9.0 Street Connections, At-Grade Intersections, and Transit Priority Measures

9.1 Required Street Connections

The following connections between the transitway and the street system are required to permit transit routes operating on the transitway to be “through-routed” to/from their various destinations in southwest Winnipeg:

- Parker Station with Beaumont Street;
- Parker Station with Hurst Way/Wilkes Avenue/Sterling Lyon Parkway;
- McMillan Avenue with Seel Avenue (and with Willison Place for Park and Ride users);
- Clarence Avenue with Clarence Avenue (and with Weller Avenue for Park and Ride users);
- Chevrier Boulevard with Chevrier Boulevard;
- Chancellor Station with Chancellor Drive;
- Transitway with South Park Drive;
- Markham Station with Markham Road; and,
- IGF Station with University Crescent.

9.2 Required At-Grade Intersections

To provide for the street connections, new at-grade intersections between the transitway and the street system are required at the following locations:

- Beaumont Avenue (at Parker Station);
- Georgina Street (at Parker Station);
- Seel Avenue (at McMillan Avenue);
- Clarence Avenue (near Clarence Station);
- Chevrier Boulevard (near Chevrier Station);
- Chancellor Drive (at Chancellor Station);
- South Park Drive;
- Markham Road (at Markham Station);
- Markham Road (in Southwood Lands); and,
- University Crescent/Dysart Road (near IGF Station).

In addition, alterations are required at the following existing at-grade intersections to accommodate the planned rapid transit route paths:

- South Park Drive at Pembina Highway (reconfigured intersection, new traffic signals with transit signal priority); and,

9.3 Functional Requirements and Transit Priority Measures

Table 31 summarizes the design requirements for the at-grade intersections, including the associated transit priority measures.

<table>
<thead>
<tr>
<th>TABLE 31: AT-GRADE INTERSECTION DESIGN REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>New Transitway At-Grade Intersections</td>
</tr>
<tr>
<td>Beaumont</td>
</tr>
<tr>
<td>Georgina</td>
</tr>
<tr>
<td>Clarence</td>
</tr>
<tr>
<td>Chevrier</td>
</tr>
<tr>
<td>Chancellor</td>
</tr>
<tr>
<td>Southpark</td>
</tr>
<tr>
<td>Markham (in Waverley Heights)</td>
</tr>
<tr>
<td>Markham (in Southwood Lands)</td>
</tr>
<tr>
<td>University Crescent/Dysart</td>
</tr>
<tr>
<td>Markham &amp; Pembina</td>
</tr>
<tr>
<td>Southpark &amp; Pembina</td>
</tr>
</tbody>
</table>

Note the following:

a) At the Chancellor Drive and Markham Road intersections in Waverley Heights, the transitway crossing of the street system is in close proximity to the CN Letellier track. Flashing warning signals currently operate at these rail crossings to stop on-street eastbound and westbound traffic and pedestrians while a train passes. New CN City of Winnipeg signals will be required at these intersections to stop on-street eastbound and westbound traffic, pedestrians, and southbound transitway buses intending to turn right from the transitway onto either Chancellor Drive or Markham Road when a train is passing, and to permit transitway buses to cross the streets and make turns from or to the transitway. The CN flashing warning signals and the traffic signals are required to be integrated to ensure safe operations.

b) Transit Signal Priority (TSP) is proposed to be deployed at several of the intersections. The type of TSP to be used, Active TSP, enables buses to communicate with the traffic signal controllers to provide priority through green extension or red truncation at the intersections. All buses in Winnipeg Transit’s fleet are equipped with an advanced automatic vehicle location and communications system to provide the necessary communications with the traffic signal controllers, the planning and deployment of the TSP system will be managed by Winnipeg Transit and the City’s Traffic Signals Branch. Equipment specifications for the traffic signal controllers and any other required equipment will be supplied by the City during detailed design for the project. The City will manage the implementation of the TSP system during the construction phase of the project.
10.0 Grade Separations and Structures

10.1 Introduction

The following grade separation structures are required for Stage 2 of the Southwest Transitway and the Pembina Underpass components of the SWT2-Pembina Underpass project:

- CN Rail Bridge over Pembina Highway;
- AT Path Tunnel under Jubilee Ramp;
- Transitway Bridge over Pembina Highway;
- Transitway Underpass of CN Wye Tracks (CN Letellier);
- Transitway Underpass of CN Wye Tracks (WC02 Spur);
- Transitway Overpass of McGillivray Boulevard;
- Letellier Tunnel;
- Transitway Bridge over Bishop Grandin Boulevard; and,
- CN Rail Bridge over Bishop Grandin Boulevard and retaining wall south of Bishop Grandin Boulevard.

This section provides detailed documentation of each structure, including descriptions of the foundations, substructure and superstructure components.

For geographic context:

- Figure 2 shows the general locations of the grade separation structures in relation to the recommended alignment for Stage 2 of the Southwest Transitway; and,
- Figures 38, 39, 40, and 41 show detailed location plans for the individual structures.

10.2 Design Criteria

The design criteria for structures must accommodate requirements for:

- Railway operations (for the CN Bridge over Pembina Highway, the Transitway Underpasses of the CN Wye Tracks, the Letellier Tunnel, the CN Bridge over Bishop Grandin Boulevard), and,
- BRT and LRT operations (for the Transitway Bridge over Pembina Highway, the Transitway Underpasses of the CN Wye Tracks, the Transitway Overpass of McGillivray Boulevard, the Letellier Tunnel, and the Transitway Bridge over Bishop Grandin Boulevard).

The design criteria used for the structures related to railway operations (the CN Bridge over Pembina Highway, the Transitway Underpass of the CN Wye Tracks, the Letellier Tunnel, the CN Bridge over Bishop Grandin Boulevard) are based on guidelines contained in the following:

- Cooper E90 plus CN impact for diesel and electrical locomotives.

The design criteria used for the structures related to rapid transit operations (the Transitway Bridge over Pembina Highway, the Transitway Overpass of McGillivray Boulevard, the Letellier Tunnel, and the Transitway Bridge over Bishop Grandin Boulevard) are based on guidelines contained in the following:

- CSA S6 Canadian Highway Bridge Design Code (latest edition);
- Truck Loading CL-625;
- Busway Planning and Design Manual, City of Winnipeg Transit Department, September 2004;
- Bus Rapid Transit Runningways - Recommended Practice, APTA Standards Development Program;
- Geometric Design Manual, TAC;
- Geometric and Roadway Design Standards, City of Winnipeg Public Works Department; and,
- A Policy on Geometric Design of Highways and Streets, AASHTO.

10.3 Geotechnical Investigation

Based on the geotechnical investigation and assessment, deep foundations bearing on competent, very dense till or bedrock are required for all proposed structures. Available deep foundation systems include driven precast prestressed concrete piles, driven steel H-piles, CIP belled caissons and CIP rock-socketed caissons. A significant amount of geotechnical information is available for the project area from construction sites and studies that have been carried out in the area. The most notable locations are in the vicinity of the Pembina Underpass project (conducted during the preliminary engineering study in 2012) and of the CN Rail Bridge over Bishop Grandin (conducted in the late 1980’s). To supplement this information, additional geotechnical investigation was undertaken along the transitway alignment and focused on overpass and underpass locations. The following is a summary of the additional geotechnical work that was undertaken for this functional design study.

10.3.1 Field Work

In January 2014, a geotechnical investigation program consisting of four deep test holes (TH14-02, 14-04, 14-08 and 14-09) and two intermediate test holes (TH 14-07 and 14-10) was undertaken. Drilling of test holes TH14-02 at McGillivray Boulevard and TH14-04 at Bishop Grandin Boulevard was advanced 6 m into bedrock. Drilling of test holes TH14-08 and TH14-09 at the area of the proposed Letellier Tunnel was terminated at auger refusal at 5.8 and 2.3 m into till respectively. Test holes TH14-07 south of McGillivray Boulevard and TH14-10 north of Bishop Grandin Boulevard were drilled to 6 m below existing grade and terminated in the clay unit.
Standard penetration tests (SPT) were completed at regular intervals in all test holes. Disturbed and relatively undisturbed soil samples and rock cores were collected for further visual inspection and testing. Six standpipe piezometers were installed, two in the bedrock, two in the till and two in the clay. Laboratory testing was completed on selected samples and included moisture content, unit weight, Atterberg limits, undrained shear strength, consolidation testing.

10.3.2 Subsurface Conditions

Although the Stage 2 transitway extends over 7 km, the encountered soil stratigraphy in the test holes were practically uniform and are typical to areas within the limits of City of Winnipeg. In descending order the soil profile consists of Glacio-lacustrine Clay, Glacial Till, and Limestone Bedrock.

Glacio-lacustrine silty clay up to 12 m thick was encountered in all test holes. Thin topsoil (about 150 mm) overlies the clay in most test holes. Presence of silt layer(s) about 1.0 m thick was observed in the top 2 m of the clay unit. Typically, the clay is brown changing to grey with depth, firm to stiff becoming soft with increasing depth; moist and of high plasticity. SPT N-value decreases from 17 to 7 with increasing depth.

The clay is underlain by glacial till that typically contains variable amounts of clay, sand, and gravel. Boulders and cobbles are known to be present within the till unit and were encountered during the drilling. The drilling advanced into bedrock below the till unit at McGillivray Boulevard and Bishop Grandin Boulevard, the thickness of the till layer varies from 4 to 6 m. In TH14-07 near Manahan Avenue (north end of Letellier Tunnel), auger refusal was encountered about 6 m into till, therefore, till thickness may be greater than 6 m. The till is brown to light grey, soft/loose in the upper zone and become dense to very dense with increasing depth. Coring was necessary to advance the drilling through the very dense and boulders/cobbles dominated lower zone of the till.

The till is underlain by limestone bedrock, which forms an artesian aquifer. The bedrock surface was encountered at elevation between 214.0 and 215.0 m in both TH14-02 at McGillivray Boulevard and TH14-04 at Bishop Grandin Boulevard. Based on calculated RQD values for the recovered rock cores over the top 6 m of the bedrock, the rock quality encountered in TH14-02 at McGillivray Boulevard is of very poor to poor quality and TH14-04 is poor to fair quality.

10.4 Pile Foundation Alternatives

Three foundation types are identified to support the proposed bridges at McGillivray Boulevard and Bishop Grandin Boulevard including:

- Driven steel H-piles;
- Driven precast prestressed concrete piles; and,
- Rock socketed caissons.

Numerous structures in the Winnipeg area are supported on foundation system consisting of one or a combination of the above foundation types. The factors that govern the design and performance of these pile types are well understood by the local engineering community and construction industry. Local contractors are familiar with related construction practices and the necessary equipment is available.

Driven steel H-piles with pile tips can be driven to practical refusal into/onto very dense till or bedrock surface and are designed on the basis of steel section structural capacity. Pile design loads up to 1200 kN can be mobilized. These piles offer easy splicing and can be made in variable lengths. Larger sections can be selected if greater design loads are desired. Adequate driving equipment, good installation experience and reliable testing methods are locally available. Pile caps are anticipated to be of reasonable size. Steel H-piles are the preferred pile type for CN Rail structures.

Driven precast prestressed piles are common in Winnipeg area but are limited in manufactured length and the design capacity is in range 400 to 800 kN. Locally, it is uncommon to splice segments of precast concrete piles, splicing may be required at McGillivray Boulevard. Pile cap size is expected to be larger than the size required using steel H-piles to support similar loads. Precast piles do not lend easily to certain structural applications such as integral abutment design.

Rock socketed caissons bearing in competent rock formation can be designed to mobilize significant design load. The rock condition encountered at McGillivray Boulevard and Bishop Grandin Boulevard indicated the top 6 m of the bedrock is generally dominated by poor quality and extensively jointed/broken rock mass. Based on the available information and above information, driven steel H-piles are the preferred foundation system to support the three proposed structures at McGillivray Boulevard and Bishop Grandin Boulevard.

10.5 Fill Stability/Settlement

Land availability at the McGillivray Overpass location dictates the use of soil retaining structures to construct approach fill at each end of the proposed overpass. MSE walls are the preferred wall type for fill applications over conventional reinforced concrete walls. Global stability and settlement under the MSE wall loading are of some concern and will need to be addressed to achieve design objectives, factor of safety against instability, and control post-construction settlement within acceptable levels.

Two design approaches are available to attain stability targets and control settlement, namely:

- Ground improvement or increased resistance (i.e., vertical drainage, basal reinforcement, pre-loading and staged construction); and,
- Load / disturbing force reduction (i.e., light weight fill).

The use of ground improvement techniques introduces inherent uncertainty related to ground behaviour and anticipated performance of the selected design and usually impose time requirements to attain the desired resistance increase, pore water pressure dissipation or to achieve substantial settlement. The use of light weight fill significantly reduces the destabilizing forces and also provides protection against settlement as there will be little change in in situ stresses in the foundation soil underneath the new MSE walls. Light weight fill applications offer a higher level of certainty as related stability and settlement involve no underground components and there are no time requirements to attain certain results. Accordingly, light weight fill seems to be the preferred application for approach fill at the proposed bridges. Detailed geotechnical information is provided in Appendices H and I.
Excavations

Deep excavations will be required to construct a transitway tunnel under the CN rail tracks. The excavations are expected to be within the clay unit. The ground conditions seem to be suitable to support a tunnel structure similar to the Stage 1 tunnel at CN Fort Rouge Yards (i.e., floating foundation). A similar cut and cover construction approach can be used and track detours will be required. An extensive temporary lateral support system will also be required to facilitate tunnel construction. Groundwater conditions in the bedrock aquifer introduce base heave concerns which need to be addressed with an aquifer depressurization system during construction and the introduction of specific structural arrangement (U-sections) in deep sections of tunnel approaches.

CN Rail Bridge over Pembina

10.7.1 Background

For the preliminary design of the CN Rail Bridge over Pembina (CN Rivers Sub. Mile 2.65 Railway structure), the following drawings and documents were reviewed:

- 1930 Specifications Governing Construction of the Pembina Highway Subway, Winnipeg, Manitoba;
- 1930s and 1940s Construction Drawings for the Pembina Highway Subway Project;
- 1982 G.R.E.A.T. Unit Installation at Pembina Highway and Harrow Street drawings and Concrete Median Barrier on Pembina Highway between Jubilee Avenue and Harrow Street drawings;
- 1988 Bridge Maintenance Pembina Highway Underpass Building at Jubilee Avenue Drawing; and,
- 1997 Pembina Underpass Pump Station Modifications Drawings.

Built in the 1940s, the bridge, which spans over Pembina Highway, is oriented east-west and has the following characteristics:

- Two-span, simply supported steel girder structure in-filled with concrete, equal spans of 37'-3" (11.35 m) for a total length of 75'-6" (23.01 m);
- Three tracks and two trainman’s walkways on each side of the Structure;
- 48'-10 1/4" (14.89 m) wide at the east end and 54'-7 1/4" (16.64 m) at the west end;
- Two reinforced concrete abutments and one centre pier supported on timber piles. Both the abutments and pier were constructed to accommodate an additional seven tracks to the north; and,
- The underpass was designed to a live loading of Cooper E60.

The Pembina Underpass Widening Study recommended the replacement the existing railway bridge with a new bridge on a new alignment north of the existing structure, as shown in Figure 38. Associated structures include the AT Path Tunnel under Jubilee Ramp and various retaining walls. See Figures 42a, 42b, 42c, and 42d.

10.7.2 Superstructure

Superstructure Alternatives

The following superstructure alternatives were evaluated for the new bridge:

- Structural Steel Plate Girders;
- Precast Prestressed Concrete I - Girders;
- Cast-in-Place Concrete Deck Slab;
- Precast Prestressed Concrete Box Girders; and,
- Structural Steel Through-Plate Girders (TPG).

The first superstructure alternative considered was structural steel plate girders. This alternative is typically associated with a relatively deep superstructure compared to a CIP concrete deck slab or a precast concrete box girder bridge. For this location and loading, however, it was determined that the use of a shallow depth steel plate girder on a tighter spacing would maintain the vertical clearance of Pembina Highway and not significantly affect the grade of the CN tracks. For these reasons and to enable for the staged construction described below, the steel plate girder superstructure is considered the most appropriate for the structure.

The second superstructure alternative was precast concrete I-girders. They have a relatively deep superstructure compared to a CIP concrete deck slab or a precast concrete box girder bridge. The relatively deep superstructure would further reduce the vertical clearance of Pembina Highway or increase the height of the embankment and a potential need for more land requirements. Concrete I-girders also require more time and labour to construct a composite concrete deck on top of them over live traffic on Pembina Highway, when compared to a precast concrete box girder bridge. For these reasons, precast concrete I-girder designs are not considered appropriate for the structure.

The third superstructure alternative considered was a CIP post-tensioned concrete deck slab. This alternative requires the least superstructure depth but would need extensive falsework for construction which could result in significant traffic disruption on Pembina Highway. The deck slab would need to be continuous and post-tensioned which is typically not permitted by CN. For these reasons, a CIP post-tensioned concrete deck slab superstructure was not considered appropriate for the structure.

The fourth superstructure alternative considered was precast concrete box girders. This alternative has the advantages of a relatively shallow superstructure depth. The precast units are fabricated off-site, thereby reducing on-site construction and shortening the overall construction schedule and providing the least interruption to traffic on Pembina Highway. Precast concrete box girders will require lateral post tensioning which is typically not permitted by CN. For this reason, precast concrete box girder designs are not considered appropriate for the structure.

Geometric constraints of the site and the location of existing CN tracks control the final layout of the proposed structure. It resulted in constructing the proposed structure in two stages using steel plate girders (see Figure 42a). Steel plate box girders are more suitable for staged construction because of their flexibility in connecting adjoining members than the TPG concept and therefore the latter was not considered a viable alternative.
Structural Steel Plate Girders

The recommended superstructure is 890 mm deep steel plate girders with a spacing of 750 mm and a 275 mm CIP concrete deck. The structure will be four simple spans in length of 19.8 m – 19.8 m – 19.8 m – 17.1 m for a total length of 76.5 m. The deck width is approximately 18.0 m and will accommodate three tracks (North Mainline Rivers Sub., South Mainline Rivers Sub. and Letellier Sub.), one roadway for maintenance trucks and two trainman’s walkways. The substructure will be constructed to accommodate a fourth track in the future.

Bearsings

Steel reinforced elastomeric bearing pads are recommended for all bearings. These bearings have performed well with steel plate girder superstructures and they are more cost effective than spherical and pot bearings.

10.7.3 Substructure

Shelf-Type Abutments

A reinforced concrete shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal. The front row of the piles will be battered to resist lateral forces.

Piers

A typical pier would consist of 1067 mm diameter columns with a continuous concrete cap across the top of the columns. The recommended foundation support for the pier foundations is a single row of rock socket caissons consisting of seven 1067 mm diameter by 20 mm thick steel casings with a minimum of 3.5 m long socket in to bedrock. During construction of the tunnel, lane closures on the jubilee Overpass will be required to be minimized so that traffic and transit operations on the overpass are not disrupted. The overpass provides a key southbound link in the transportation network to southwest Winnipeg for both traffic and rapid transit.

10.7.4 AT Path Tunnel under Jubilee Ramp

The proposed 4.5 m wide x 3.0 m high x 23.400 m long pre-cast tunnel at jubilee Avenue ramp to accommodate an active transportation path (AT path) is shown in Figure 42b. The roof and floor slabs are 400 mm and 500 mm thick respectively. The total length of tapered wing walls is approximately 80 m and they sit on top of a continuous footing supported by steel H-piles.

10.7.5 Retaining Walls

Retaining walls are required through the Pembina Underpass to accommodate roadway widening and AT as well as to accommodate the elevation differences between Stage 2 Southwest Transitway and the CN railway track embankment. To address the constructability and design challenges posed by geotechnical conditions, existing buildings and infrastructure as well as the construction schedule/staging, the following types of retaining walls are proposed:

Cantilever Wall Type RW-1: This wall is a conventional cantilever retaining wall. It will be installed along the AT path and will be CIP concrete supported on strip footings or on driven hexagonal precast concrete piles. Under the existing jubilee Overpass where the height is restricted for conventional pile driving equipment, other foundation options such as micro piles and concrete caissons will be considered for the retaining walls. Maximum retained height of walls on spread footings will be 1.4 m. Temporary shoring consisting of soldier piles/lagging (designed by the contractor) is proposed with maximum 4.0 m retained soil height. Where the existing embankments are higher than 4.0 m subcutting will be required. The concrete walls will be 300 mm wide at the top and the front face will be tapered at a 1:12 slope to top of footing. The back face of wall will be kept vertical. The exposed front face of wall will have a grooved architectural finish. Installation of piles for the permanent and temporary walls will be carried out from the existing ground surface before the embankment is excavated to construct the footings.

Secant Pile Wall Type RW-3: Secant pile walls will be used where the clearance of the AT path from existing buildings is limited (less than 2 to 3 m) and the retained height is more than 2 m. These walls will have a concrete facing with grooved architectural finish above grade.

A conceptual plan and section of the retaining walls required for the Pembina Underpass are shown in Figures 42c and 42d. Following is a summary of the retaining walls required at various locations:

- Type RW-1 retaining walls along the east side of Pembina Highway starting south of j jubilee Overpass to the parking lot. Total length approximately 212 m;
- A 60 m long section of secant pile wall Type RW-3 in front of the Nurses Union Building along the east side of Pembina Highway;
- Approximately 60 m of Type RW-1 retaining walls in front of the APEGM building along the east side of Pembina Highway;
- Approximately 140 m of Type RW-1 retaining walls along the west side of Pembina Highway starting south of j jubilee Overpass to the north side of CN Underpass; and,
- Approximately 75 m of Type RW-1 retaining walls in front of the Dental Office Building along the west side of Pembina Highway.
**TABLE 32: CN RAIL BRIDGE OVER PEMBINA**

<table>
<thead>
<tr>
<th>No. of Spans</th>
<th>Span Lengths</th>
<th>Total Length</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>19.8 m - 19.8 m - 19.8 m - 17.1 m</td>
<td>76.5 m</td>
<td>18.0 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Piles</th>
<th>No. of Piles/Caissons</th>
<th>Ave. Length* (m)</th>
<th>Pile Size</th>
<th>Pile Tip / Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Abutment</td>
<td>78</td>
<td>17</td>
<td>HP 310 x 110</td>
<td>Tip</td>
</tr>
<tr>
<td>East Abutment</td>
<td>78</td>
<td>17</td>
<td>HP 310 x 110</td>
<td>Tip</td>
</tr>
<tr>
<td>Pier 1</td>
<td>7</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
<td>Socket</td>
</tr>
<tr>
<td>Pier 2</td>
<td>7</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
<td>Socket</td>
</tr>
<tr>
<td>Pier 3</td>
<td>7</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
<td>Socket</td>
</tr>
</tbody>
</table>

* HP 310 x 110 piles are driven to refusal on bedrock and caissons are socketed 3.5 m into bedrock.

**Precast Prestressed Concrete Box Girders**

The recommended superstructure is precast prestressed concrete box girders with lateral post tensioning. The structure will be four-span continuous of 23.2 m - 16.8 m - 16.8 m - 23.2 m for a total length of 80.0 m. The two end span girders are 1500 mm deep and the two shorter interior spans will have 1200 mm deep girders. The deck width is 15.8 m including a 4.5 m wide pathway for AT. There will be a 150 mm thick CIP concrete deck composite with the box girders and 50 mm of high performance concrete on the top of the CIP concrete deck.

**Bearsings**

Steel reinforced elastomeric bearing pads are recommended for all bearings. These bearings have performed well with concrete box girder superstructure and are more cost effective than spherical and pot bearings.

### 10.8 Substructure

The substructure would be similar to the substructure of the CN Rail Bridge over Pembina Highway.

#### Shelf-Type Abutments

A reinforced concrete shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal. The front row of the piles will be battered to resist lateral forces.

#### Piers

A typical pier would consist of 1067 mm diameter columns with a continuous concrete cap across the top of the columns. The recommended foundation support for the pier foundations is a single row of rock socket caissons consisting of five 1067 mm diameter by 20 mm thick steel casings with a minimum 3.5 m long socket into bedrock.

10.8 Transitway Bridge over Pembina Highway

The General Arrangement drawing for the proposed Transitway Bridge over Pembina is shown in Drawing Figure 43. The structure includes a 4.5 m wide path for AT on the south side of the bridge. The proposed structure will be located between the existing Jubilee Avenue Overpass and the new CN Rail Bridge over Pembina Highway.

### 10.8.1 Superstructure

The superstructure would be similar to the superstructure of the CN Rail Bridge over Pembina Highway.
### 10.9 Transitway Underpass of CN Wye Tracks (CN Letellier)

The General Arrangement drawing for the proposed Transitway Underpass of CN Wye Tracks (CN Letellier) is shown in Figure 44.

#### 10.9.1 Superstructure

**Precast Prestressed Concrete Box Girders**

The recommended superstructure is 1500 mm deep precast prestressed concrete box girders with lateral post tensioning with dywidag tie rods. The tie rods at the girder ends are skewed to match the structure skew, and tie rods at the intermediate locations aligned in a row perpendicular to the centerline of the girders. After the intermediate tie rods are tensioned, the skewed tie rods at the girder ends are tensioned only enough to pull the girders together. The structure will be four simple spans of 18.1 m – 18.1 m – 24.1 m – 24.1 m for a total length of 84.4 m. The structure width would be 6.05 m and would include two trainman’s walkways and one main track. There would be a minimum 400 mm ballast and deck waterproofing on top of the box girders.

An alternative superstructure is structural steel through-plate girders (TPG) with floor beams. TPG bridges have been used for railroads in areas where the clearance below the bridge was of concern. Since the groundwater level along the proposed Stage 2 of the Southwest Transitway west of Pembina Highway is relatively high, it would be advantageous to consider a TPG structure which would require less excavation. Furthermore, due to the extreme skew of the proposed bridge, TPG would be suitable at this site. This alternative needs to be considered during the detailed design phase.

**Bareings**

Steel reinforced elastomeric bearing pads are recommended for all bearings. These bearings have performed well and they are more cost effective than spherical and pot bearings.

### Shelf-Type Abutments

A reinforced concrete shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal. The front row of the piles will be battered to resist lateral forces.

#### Piers

A typical pier would consist of 1067 mm diameter columns with a continuous concrete cap across the top of the columns. The recommended foundation support for the pier foundations is a single row of rock socket caissons consisting of two 1067 mm diameter by 20 mm thick steel casings with a minimum of 3.5 m long socket into bedrock.

### Foundation

The depressed section of the proposed Stage 2 Southwest Transitway west of Pembina Highway into the Parker Lands is anticipated to be within the clay unit at elevation 224 m at the deepest point. The clay unit is underlain by a pervious layer of till and bedrock under upward artesian pressure and could impact the structure causing basal heave. One design alternative is to use a U-shaped structure (thick concrete slab with outside lips) to increase the dead weight in resisting the upward artesian pressure. This design alternative is incorporated in the design and is included in the construction cost estimate summary.

To reduce the upward artesian pressure exerted against the bottom of the clay unit, temporary depressurization wells would be installed during construction.

There is also the potential for groundwater seepage to develop along naturally occurring fractures in the subsoils or along installed design components (e.g., caissons) when the piezometric elevation in the till / bedrock is above or close to the excavation level or the underside of the permanent structure. Adequate size sub-drainage system will be incorporated during the detailed design phase.
TABLE 34: TRANSITWAY UNDERPASS OF CN WYE TRACKS (CN LETELLIER)

<table>
<thead>
<tr>
<th>No. of Spans</th>
<th>Span Lengths: 18.1 m - 18.1 m - 24.1 m - 24.1 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length: 84.4 m</td>
<td></td>
</tr>
<tr>
<td>Width: 6.05 m</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Piles</th>
<th>No. of Piles/Caissons</th>
<th>Ave. Length (m)</th>
<th>Pile Size</th>
<th>Pile Tip / Rock Socket</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Abutment</td>
<td>30</td>
<td>17</td>
<td>HP 310 x 110</td>
<td>Tip</td>
</tr>
<tr>
<td>North Abutment</td>
<td>60</td>
<td>17</td>
<td>HP 310 x 110</td>
<td>Tip</td>
</tr>
<tr>
<td>Pier 1</td>
<td>2</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
<td>Socket</td>
</tr>
<tr>
<td>Pier 2</td>
<td>2</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
<td>Socket</td>
</tr>
<tr>
<td>Pier 3</td>
<td>2</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
<td>Socket</td>
</tr>
</tbody>
</table>

* HP 310 x 110 piles are driven to refusal on bedrock and caissons are socketed 3.5 m into bedrock

<table>
<thead>
<tr>
<th>Footings</th>
<th>Size (m)</th>
<th>Pier Cap Beams</th>
<th>Size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Abutment</td>
<td>11.0 x 4.0 x 1.2</td>
<td>Pier 1</td>
<td>8.0 x 1.5 x 1.5</td>
</tr>
<tr>
<td>North Abutment</td>
<td>17.0 x 4.0 x 1.2</td>
<td>Pier 2</td>
<td>8.0 x 1.5 x 1.5</td>
</tr>
<tr>
<td>Pier 3</td>
<td>9.0 x 1.5 x 1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Precast Prestressed Concrete Box Girders</th>
<th>Quantity</th>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Length (m)</th>
<th>C/C Bearings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span 1</td>
<td>4</td>
<td>1200</td>
<td>1500</td>
<td>18.1</td>
<td></td>
</tr>
<tr>
<td>Span 2</td>
<td>4</td>
<td>1200</td>
<td>1500</td>
<td>18.1</td>
<td></td>
</tr>
<tr>
<td>Span 3</td>
<td>4</td>
<td>1200</td>
<td>1500</td>
<td>24.1</td>
<td></td>
</tr>
<tr>
<td>Span 4</td>
<td>4</td>
<td>1200</td>
<td>1500</td>
<td>24.1</td>
<td></td>
</tr>
</tbody>
</table>

10.0 Grade Separations and Structures

10.10 Transitway Underpass of CN Wye Tracks (WC02 Spur)

The General Arrangement drawing for the proposed Transitway Underpass at WC02 is shown in Figure 45.

10.10.1 Superstructure

Precast Prestressed Concrete Box Girders

The recommended superstructure is 1200 mm deep precast prestressed concrete box girders with lateral post tensioning with dywidag tie rods. The tie rods at the girder ends are skewed to match the structure skew, with tie rods at the intermediate locations aligned in a row perpendicular to the centerline of the girders. After the intermediate tie rods are tensioned, the skewed tie rods at the girder ends are tensioned only enough to pull the girders together. The structure will be four simple spans of 15.5 m - 15.5 m - 19.0 m - 19.0 m with a total length of 69.0 m. The structure width would be 6.05 m and would include two trainman’s walkways and one main track. There would be a minimum 400 mm ballast and deck waterproofing on top of the box girders.

An alternative superstructure is structural steel TPG with floor beams. TPG bridges have been used for railroads in areas where the clearance below the bridge was of concern. Since the groundwater level along the proposed Stage 2 of the Southwest Transitway west of Pembina Highway is relatively high, it would be advantageous to consider a TPG structure which would require less excavation. Furthermore, due to the extreme skew of the proposed bridge, TPG would be suitable at this site. This alternative needs to be considered during the detailed design phase.

10.10.2 Substructure

**Shelf-Type Abutments**

A reinforced concrete shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal. The front row of the piles will be battered to resist lateral forces.

**Piers**

A typical pier would consist of 1067 mm diameter columns with a continuous concrete cap across the top of the columns. The recommended foundation support for the pier foundations is a single row of rock socket caissons consisting of two 1067 mm diameter by 20 mm thick steel casings with a minimum of 3.5 m long socket into bedrock.

**Foundation**

The depressed section of the proposed Stage 2 Southwest Transitway west of Pembina Highway into the Parker Lands is anticipated to be within the clay unit at elevation 224 m at the deepest point. The clay unit is underlain by a pervious layer of till and bedrock under upward artesian pressure and would impact the structure by causing basal heave. One design alternative is to use a U-shaped structure (thick concrete slab with outside lips) to increase the dead weight in resisting the upward artesian pressure. This design alternative is incorporated in the design and is included in the construction cost estimate summary.

In order to reduce the upward artesian pressure exerted against the bottom of the clay unit, temporary depressurization wells would be installed during construction. There is also the potential for groundwater seepage to develop along naturally occurring fractures in the subsoils or along installed design components (e.g., caissons) when the piezometric elevation in the till / bedrock is above or close to the excavation level or the underside of the permanent structure. Adequate size sub-drainage system will be incorporated during the detailed phase.
Retaining Walls

This construction option provides a wide separation between the transitway and CN railway embankments and requires no retaining walls on the west side of Pembina Highway. The only retaining wall required for this option is in the southeast corner of the Transitway Bridge over Pembina Highway grade separation structure where a stairway is provided to connect the AT path on the structure with the AT path on the east side of Pembina Highway. This retaining wall will consist of CIP concrete supported on driven hexagonal precast concrete piles. Approximately 20 m of retaining wall will be required.

Land Drainage

For the proposed catchment area for the two grade separation structures west of the Pembina Highway, it is anticipated that a pump station required at this location would be significantly smaller than the one required for the Pembina Underpass. Pump Station location will be based on scheduling of Stage 2 Southwest Transitway and Cockburn-Calrossie Combined Sewer Relief work.

### TABLE 35: TRANSITWAY UNDERPASS OF CN WYE TRACKS (WC02 SPUR)

<table>
<thead>
<tr>
<th>No. of Spans: 4</th>
<th>Span Lengths: 15.5 m- 15.5 m- 19.0 m - 19.0 m</th>
<th>Total length: 69.0 m</th>
<th>Width: 6.05 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piles</td>
<td>No. of Piles/Caissons</td>
<td>Ave. Length* (m)</td>
<td>Pile Size</td>
</tr>
<tr>
<td>South Abutment</td>
<td>33</td>
<td>17</td>
<td>HP 310 x 110</td>
</tr>
<tr>
<td>North Abutment</td>
<td>66</td>
<td>17</td>
<td>HP 310 x 110</td>
</tr>
<tr>
<td>Pier 1</td>
<td>2</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
</tr>
<tr>
<td>Pier 2</td>
<td>2</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
</tr>
<tr>
<td>Pier 3</td>
<td>2</td>
<td>20</td>
<td>1067 Dia. x 20 mm Thick Steel Casing, Conc. Filled and Reinforced</td>
</tr>
</tbody>
</table>

* HP 310 x 110 piles are driven to refusal on bedrock and caissons are socketed 1.5 m into bedrock

Precast Prestressed Concrete Box Girders

The recommended superstructure is 1500 mm deep precast prestressed concrete box girders with lateral post tensioning. The structure will be three-span continuous of 24.0 m – 24.0 m – 24.0 m with a total length of 72.0 m. The deck width is 15.8 m including a 4.5 m wide pathway for AT. There will be a 150 mm thick CIP concrete deck composite with the box girders and 50 mm high performance concrete on top of the CIP concrete deck.

Bearing

Steel reinforced elastomeric bearing pads are recommended for all bearings. These bearings have performed well with concrete box girder superstructures and are most cost effective than spherical and pot bearings.

Substructure

Shelf-Type Abutments

A reinforced concrete semi-integral shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal. The front row of the piles will be battered to resist lateral forces. Due to site constraints, MSE walls at the north and south abutments would be installed for the embankments.

Piers

A typical pier would consist of 1067 mm diameter columns with a continuous concrete cap across the top of the columns. The recommended foundation support for the piers is HP310 x 110 steel H-piles driven to refusal. The outside rows of the piles will be battered to resist lateral forces.

Transitway Overpass of McGillivray Boulevard

The general Arrangement drawing for the proposed Transitway Overpass of McGillivray Boulevard is shown in Figure 46. The structure includes a 4.5 m wide AT path on the east side of the deck.
TABLE 36: TRANSITWAY OVERPASS OF MCGILLIVRAY BOULEVARD

<table>
<thead>
<tr>
<th>No. of Spans: 3</th>
<th>Span Lengths: 24.0 m- 24.0 m- 24.0 m</th>
<th>Total length: 72.0 m</th>
<th>Width: 15.7 m</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Piles</th>
<th>No. of Piles</th>
<th>Ave. Length* (m)</th>
<th>Pile Size</th>
<th>Pile Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Abutment</td>
<td>34</td>
<td>23</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>North Abutment</td>
<td>34</td>
<td>23</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>Pier 1</td>
<td>68</td>
<td>16</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>Pier 2</td>
<td>68</td>
<td>16</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* HP 310 x 110 piles are driven to refusal on bedrock

Footings

<table>
<thead>
<tr>
<th>Size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Abutment</td>
</tr>
<tr>
<td>East Abutment</td>
</tr>
<tr>
<td>Pier 1</td>
</tr>
<tr>
<td>Pier 2</td>
</tr>
</tbody>
</table>

Pier Columns

<table>
<thead>
<tr>
<th>Quantity &amp; Size</th>
<th>Pier Cap Beams</th>
<th>Size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pier 1</td>
<td>4- 1,200 mm Dia x 6 m</td>
<td>Pier 1</td>
</tr>
<tr>
<td>Pier 2</td>
<td>4- 1,200 mm Dia x 5 m</td>
<td>Pier 2</td>
</tr>
</tbody>
</table>

Precast Prestressed Concrete Box Girders

<table>
<thead>
<tr>
<th>Span</th>
<th>Quantity</th>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Length (m)</th>
<th>C/C Bearings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span 1</td>
<td>12</td>
<td>1200</td>
<td>1500</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>Span 2</td>
<td>12</td>
<td>1200</td>
<td>1500</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>Span 3</td>
<td>12</td>
<td>1200</td>
<td>1500</td>
<td>24.0</td>
<td></td>
</tr>
</tbody>
</table>

Letellier Tunnel

A new transitway tunnel (Letellier Tunnel) will be constructed to transition the transitway from the Manitoba Hydro right-of-way on the west side of the CN Letellier tracks to the east side of the tracks. The transitway needs to be aligned on the east side of the CN Letellier Rail Line to provide rapid transit access to existing high-density development between Chevrier and Markham Road, and to provide efficient transitway access to Investors Group Field and the University of Manitoba. The proposed alignment of the Letellier Tunnel is shown in Figure 40.

A Plan and Cross-Section of the Letellier Tunnel is shown in Figure 47. The Letellier Tunnel will be constructed beneath the CN Fort Garry Industrial Leads (CN North Spur Line (WC07 to Manitoba Hydro), CN South Spur Line (WC21 to Harris Transport)) and the CN Letellier track. The north end of the tunnel structure will be on the west side of the CN Letellier Rail Line immediately south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 621 m further south on the east side of the CN Letellier rail track. The tunnel structure includes a covered tunnel approximately 203 m in length with retaining walls approximately 197 m in length approaching the north tunnel entrance and 221 m in length approaching the south tunnel entrance. During construction, a temporary shoofly of the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required.

The design and construction of the proposed Letellier Tunnel would be based on the engineering gained from the design and construction of the Fort Rouge Tunnel in Stage 1 of the Southwest Transitway.

10.12 Tunnel Design Criteria

The proposed tunnel will be able to accommodate both the CL625 design truck loading and LRT loading. Since the tunnel will be constructed beneath the CN Letellier track and the CN Fort Garry industrial tracks WC07 and WC21, the Cooper E-90 plus CN impact for diesel and electrical locomotives live load surcharge will be applied to the tunnel. All reinforcement in the tunnel will be hot-dip galvanized after fabrication to minimize future corrosion potential.

10.12.1 Tunnel Design Criteria

The proposed tunnel will be able to accommodate both the CL625 design truck loading and LRT loading. Since the tunnel will be constructed beneath the CN Letellier track and the CN Fort Garry industrial tracks WC07 and WC21, the Cooper E-90 plus CN impact for diesel and electrical locomotives live load surcharge will be applied to the tunnel. All reinforcement in the tunnel will be hot-dip galvanized after fabrication to minimize future corrosion potential.

10.12.2 Foundations

Tunnel

The geotechnical investigation and assessments of the proposed tunnel site was carried out by AECOM (see Section 3.4). The soil stratigraphy at this site consists of 12 m thick of glacio-lacustrine clay and 4 to 6 m thick of glacial till and limestone bedrock.

A floating raft foundation is recommended for the proposed tunnel. As a conservative approach, floating rafts would be designed to the following limiting conditions:

- Assuming a uniform distribution of soil pressure; and,
- Assuming a pressure that varies form a minimum of zero at the middle to twice the uniform pressure at the edge.

The raft structural design would be based on the more severe condition of the two cases noted above.

The maximum sliding resistance beneath the raft footings would be taken as the smaller of:

- One half of the normal stress at the interface between the concrete and the clay; and,
- The adhesion of the clay, design value of 30 KPa.

Retaining Walls

Retaining walls are required at the approaches to the tunnel as the roadway begins to drop below grade. The walls immediately adjacent to the tunnel portals were designed as a channel shape, with the side walls cantilevered up from a structural slab spanning across the roadway area. This design was selected mainly as a result of the high lateral forces exerted on the wall by the adjacent railway tracks. The channel section eliminated sliding issues experienced with a more conventional retaining wall design.

The maximum sliding resistance beneath the retaining wall footings would be taken as the smaller of:

- One half of the normal stress at the interface between the concrete and the clay; and,
- The adhesion of the clay, design value of 30 KPa.
Roof Slab

The proposed tunnel has an inside width of 10.9 m, providing two runningway lanes and generous shoulders on each side. A tunnel of this width would often have a line of supports running down the center but for operational reasons, the tunnel must be kept free of interior supports. As a result, the roof slab is up to 1500 mm thick. The roof slab is conventionally reinforced, with up to three closely-spaced layers of 35M bars required in critical areas of the tunnel. The critical areas are not the deepest parts of the tunnel but are the areas to each side. Although the deeper sections of the tunnel carry more soil, this extra depth of soil also serves to better distribute the weight of the trains overhead. As a result, the transition areas, where the soil depth is reducing but the train loads remain constant, are the critical locations. To simplify reinforcement detailing, the roof slab is designed as a simple span, with hinges located at the top of each wall.

Walls

The walls range from 900 mm to 1000 mm in thickness and are conventionally reinforced. Because of the fixity with the bottom slab, most of the reinforcement is required at the bottom of the outside face, in order to carry negative moments transferred around the corner from the bottom slab. The walls are designed to have temporary openings to allow the open excavation to be braced across during construction. After the bracings are removed, these openings will be sealed.

Floor Slab

The floor slab experiences loads similar to the roof slab, as all the vertical loads transferred down through the walls must be distributed into the soil below. The floor slab is not quite as thick as the roof slab because it has been designed to be continuous with the side walls. This is required due to the difficulty of designing a hinge at the bottom of the walls; although a simple span design would be preferred to simplify the reinforcement detailing. In addition to the detailing issues, construction sequencing requires the walls to retain earth fill to their full height without the benefit of the top slab being in place to act as a compression strut. Clearly, this cantilever action could not be achieved with a hinge at the bottom of the wall.

Traffic does not travel directly on the floor slab; the slab is topped by a 600 mm thick layer of compacted granular base and concrete pavement. The floor slab is sloped to each side of the tunnel and subdrain is provided to give positive drainage for the base. This arrangement is selected to reduce the tolerance required for construction of the bottom slab; any small deviations in grade can be easily made up within the granular base layer.

Drainage

The tunnel is built on a sag curve, so the low point in the tunnel clearly requires positive drainage measures. A double catch basin is provided at this point to funnel water into the land drainage system. Because the base of the tunnel is below the elevation of the surrounding land drainage system, a dedicated lift station is required to take storm water from the tunnel and pump it high enough to join the existing system under gravity flow.

Waterproofing

The measured water table elevation is near to the proposed elevation of the underside of the tunnel. The ground water elevations may fluctuate seasonally, annually or due to construction activities. Waterproofing of the tunnel is an important consideration. The main waterproofing system is a bituminous waterproofing membrane installed over the top of the roof slab, down both walls and extending to the outside edge of the bottom slab. The bottom slab inside the tunnel is protected from roadway runoff by a similar membrane. In addition to the membrane, construction joints are protected by two levels of waterstop protection – a continuous polyvinyl strip located at the outside face of the tunnel joints and a hydrophilic waterstop (bentonite) located within the concrete itself, along the route that water would have to follow from the exterior surface to the interior of the tunnel.

Construction Staging

The construction staging of the proposed Letellier Tunnel will be finalized during the detailed design phase. CN Rail and the operators of WC21 and WC07 tracks will be consulted during the planning of the construction stages.

<table>
<thead>
<tr>
<th>TABLE 37: LETELLIER TUNNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>South Retaining Wall</td>
</tr>
<tr>
<td>Base Slab</td>
</tr>
<tr>
<td>North Retaining Wall</td>
</tr>
<tr>
<td>Base Slab</td>
</tr>
</tbody>
</table>

Transitway Bridge over Bishop Grandin Boulevard

The general arrangement drawing for the proposed Transitway Bridge over Bishop Grandin Boulevard is shown in Figure 48. The structure includes a 4.5 m wide AT path on the east side of the deck.

Superstructure

The superstructure would be similar to the superstructure of the Transitway Overpass of McGillivray.

<table>
<thead>
<tr>
<th>Precast Prestressed Concrete Box Girders</th>
</tr>
</thead>
<tbody>
<tr>
<td>The recommended superstructure is 1700 mm deep precast prestressed concrete box girders with lateral post tensioning. The structure will be four-span continuous of 20.2 m - 29.5 m - 27.5 m - 20.2 m with a total length of 97.4 m. The deck width is 15.7 m including a 4.5 m wide pathway for AT. There will be a 150 mm thick CIP concrete deck composite with the box girders and 50 mm high performance concrete on top of the CIP concrete deck.</td>
</tr>
<tr>
<td>Bearings</td>
</tr>
<tr>
<td>Steel reinforced elastomeric bearing pads are recommended for all bearings. These bearings have performed well and they are more cost effective than spherical and pot bearings.</td>
</tr>
</tbody>
</table>
The substructure would be similar to the substructure of the Transitway Bridge over Pembina with the exception that the pier foundation would be steel H-piles.

**Substructure**

**Shell-Type Abutments**

A reinforced concrete shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal. The front row of the piles will be battered to resist lateral forces.

**Piers**

A typical pier would consist of 1067 mm diameter columns with a continuous concrete cap across the top of the columns. The recommended foundation support for the piers is HP310 x 110 steel H-piles driven to refusal. The outside rows of the piles will be battered to resist lateral forces.

<table>
<thead>
<tr>
<th>TABLE 38: TRANSITWAY BRIDGE OVER BISHOP GRANDIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Spans: 4</td>
</tr>
<tr>
<td>Total length: 97.4 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nr. of Piles/Caissons</th>
<th>Ave. Length (m)</th>
<th>Pile Size</th>
<th>Pile Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Abutment</td>
<td>34</td>
<td>17</td>
<td>HP 310 x 110</td>
</tr>
<tr>
<td>North Abutment</td>
<td>34</td>
<td>17</td>
<td>HP 310 x 110</td>
</tr>
<tr>
<td>Pier 1</td>
<td>68</td>
<td>14</td>
<td>HP 310 x 110</td>
</tr>
<tr>
<td>Pier 2</td>
<td>68</td>
<td>14</td>
<td>HP 310 x 110</td>
</tr>
<tr>
<td>Pier 3</td>
<td>68</td>
<td>14</td>
<td>HP 310 x 110</td>
</tr>
</tbody>
</table>

* HP 310 x 110 piles are driven to refusal on bedrock

The General Arrangement drawing for the proposed CN Rail Bridge over Bishop Grandin Boulevard is shown in Figure 49.

**10.14 Superstructure**

**Superstructure Alternatives**

The following superstructure alternatives were evaluated for the new bridge:

- Structural Steel Plate Girders;
- Cast-in-Place Concrete Deck Slab; and,
- Structural Steel Through-Plate Girders (TPG).

The first superstructure alternative considered was structural steel plate girders. This alternative has a deep superstructure compared to a CIP concrete deck slab or a steel through-plate girder bridge. The clearance to Bishop Grandin Boulevard cannot be reduced so the deep superstructure would require the track to be raised significantly. The increased track grade and elevation will also increase the height of the embankment and a potential need for more land requirements. Steel plate girder designs also require more time and labour to construct a composite concrete deck on top of them over live traffic on Bishop Grandin Boulevard, when compared to steel through-plate girder. For these reasons, steel plate girder designs are not considered appropriate for the structure.

The second superstructure alternative considered was a CIP post-tensioned concrete deck slab. This alternative has a shallow superstructure depth but would need extensive falsework for construction which could result in significant traffic disruption on Bishop Grandin Boulevard. The deck slab would need to be continuous and post-tensioned which is typically not permitted by CN. For these reasons, a CIP post-tensioned concrete deck slab superstructure was not considered appropriate for the structure.

The third superstructure alternative considered was steel through-plate girders. This alternative has the shallowest superstructure depth and would result in the least traffic disruption on Bishop Grandin Boulevard. Steel through-plate girders are not usually considered for high visibility locations due to their relatively low aesthetic appeal, but can be mitigated with structural steel coatings. For these reasons, the steel through-plate girder superstructure is considered the most appropriate for the structure.
Structural Steel Through-Plate Girders (TPG)
The recommended superstructure would consist of a 2870 mm deep structural steel through-plate girder. The structure will be four simple spans in length of 20.2 m - 29.0 m - 26.6 m - 20.8 m for a total length of 96.6 m. The structure width is 5800 mm and will accommodate a single track.

Bearings
Pot bearings are recommended for all bearings. These bearings perform well and are more cost effective than spherical bearings.

Substructure

10.14.2 Shelf-Type Abutments
A reinforced concrete shelf-type abutment would consist of a concrete footing, continuous concrete bearing seat, with backwall and wingwalls to contain approach fill. The recommended foundation support for the shelf-type abutment is HP 310 x 110 steel H-piles driven to refusal in bedrock. The front row of the piles will be battered to resist lateral forces.

Piers
Solid trapezoidal-shaped concrete pier shafts will be used. The recommended foundation supports for the pier shafts are steel H-Piles driven to refusal in bedrock.

---

### TABLE 39: CN LETELLIER RAIL BRIDGE OVER BISHOP GRANDIN

| No. of Spans: 4 | Span Lengths: 20.2 m - 29.0 m - 26.6 m - 20.8 m | Total length: 96.6 m | Width: 7.6 m |

<table>
<thead>
<tr>
<th>Piles</th>
<th>No. of Piles</th>
<th>Ave. Length* (m)</th>
<th>Pile Size</th>
<th>Pile Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Abutment</td>
<td>20</td>
<td>16</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>North Abutment</td>
<td>20</td>
<td>16</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>Pier 1</td>
<td>30</td>
<td>12</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>Pier 2</td>
<td>30</td>
<td>12</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
<tr>
<td>Pier 3</td>
<td>30</td>
<td>12</td>
<td>HP 310 x 110</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* HP 310 x 110 piles are driven to refusal on bedrock

<table>
<thead>
<tr>
<th>Footings</th>
<th>Size (m)</th>
<th>Pier Cap Beams</th>
<th>Size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Abutment</td>
<td>8.0 x 3.0 x 1.2</td>
<td>Pier 1</td>
<td>5.0 m x 1.5 m x 7.8 m</td>
</tr>
<tr>
<td>North Abutment</td>
<td>8.0 x 3.0 x 1.2</td>
<td>Pier 2</td>
<td>5.0 m x 1.5 m x 7.8 m</td>
</tr>
<tr>
<td>Pier 1</td>
<td>9.0 x 5.0 x 1.5</td>
<td>Pier 3</td>
<td>5.0 m x 1.5 m x 7.8 m</td>
</tr>
<tr>
<td>Pier 2</td>
<td>9.0 x 5.0 x 1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pier 3</td>
<td>9.0 x 5.0 x 1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cast-in-Place Post-Tensioned Concrete Box Girder</th>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Length (m)</th>
<th>C/C Bearings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span 1</td>
<td>5800</td>
<td>2870</td>
<td>20.2</td>
<td></td>
</tr>
<tr>
<td>Span 2</td>
<td>5800</td>
<td>2870</td>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td>Span 3</td>
<td>5800</td>
<td>2870</td>
<td>26.6</td>
<td></td>
</tr>
<tr>
<td>Span 4</td>
<td>5800</td>
<td>2870</td>
<td>20.8</td>
<td></td>
</tr>
</tbody>
</table>
11.0 Land Drainage

11.1 Introduction

This section describes the functional land drainage design for Stage 2 of the Southwest Transitway and references the Pembina Underpass component of the SWT2-Pembina Underpass project. Drainage options which consider these components jointly (i.e., single pump station serving both components) are described in Section 11.4.3. The on-going Cockburn and Calrossie Combined Sewer Relief Works, being undertaken independently by a consortium led by KGS Group, is also related to the SWT2-Pembina Underpass project and will be referenced in subsequent sections in discussions relating to Transitway drainage to the Parker Retention Pond.

The design criteria and the land drainage design concept have been reviewed by the City of Winnipeg Water and Waste Department.

In Figure 50, the alignment for Stage 2 of the Southwest Transitway is shown in relation to existing LDS Districts. The SWT2-Pembina Underpass project includes the following structures:

- CN Rail Bridge over Pembina Highway;
- Transitway Bridge over Pembina Highway;
- Transitway Underpasses of CN Wye Tracks;
- Transitway Overpass of McGillivray Boulevard;
- Letellier Tunnel;
- Transitway Bridge over Bishop Grandin Boulevard; and,
- CN Rail Bridge over Bishop Grandin Boulevard.

The following stations are located on the transitway and will be referenced in the conceptual drawings presented in Section 11.3:

- Parker Station;
- McGillivray Station (includes a Park and Ride lot);
- Clarence Station (includes a Park and Ride lot);
- Chevrier Station;
- Plaza Station;
- Chancellor Station;
- Markham Station;
- IGF Station; and
- University of Manitoba Station.

There are several street connections to the Southwest Transitway. The connections that will be referenced as part of the drainage concept include the Beaumont Street Connection and the Southpark Drive Connection as these have some impact on the drainage concept for the Southwest Transitway. While other connections exist, they do not have a significant impact on drainage requirements and have therefore not been considered.

The stations and connections listed above are important to consider as their impervious areas will result in an increase in stormwater runoff. In some instances, the size of the station areas precludes the construction of ditches and limits the potential drainage options.

Within the Manitoba Hydro right-of-way, the transitway runningway is based on a typical rural cross-section with the roadway raised about 0.5 m to 0.8 m above the existing ground surface. The width of the runningway varies between 9.2 m to 10.05 m. There is also an AT Path which runs along the entire length of the transitway (4.5 m width). The drainage concept assumes some flexibility in the AT Path alignment to provide sufficient space for ditching along the transitway.

The concept consists of a combination of new LDS and ditches along the transitway which would drain into the existing adjacent land drainage systems. This is standard design practice provided that an analysis has been carried out to show that there is no increase in the peak flow rate. Background related to the adjacent land drainage systems is presented in the following sections along with a discussion of the transitway land drainage design.

Figure 51 shows the general drainage patterns and the adjacent land drainage systems along the Stage 2 transitway alignment including:

- University of Manitoba Southwood Lands;
- D’Arcy Drive;
- Lot 16 Drain (Plaza Drive);
- Riviera Crescent;
- Somerset Avenue; and,
- Parker Retention Pond (associated with Cockburn and Calrossie Combined Sewer Relief Works).

Shown in Figure 51, the Southwest Transitway drainage path is conceptual and may change from one side of the transitway to the other (i.e., east to west or north to south) as the project evolves. The exact location of the new ditches and land drainage sewer will be finalized as part of the detailed design carried out by the PPP consortium and will not significantly change the results of the hydraulic assessment presented herein.

As part of the Cockburn and Calrossie Combined Sewer Relief Works, the current design concept for separation involves the construction of a stormwater retention basin (SRB) in the Parker Lands, referred to as the Parker Retention Pond. The Parker Retention Pond has been included in the list of adjacent land drainage systems as it will be considered in the land drainage concept for the Southwest Transitway.

8 KGS Group, Dillon Consulting, CH2M HILL and AECOM
11.2 Land Drainage

Similarly, the University of Manitoba’s Southwood Lands are referenced as an adjacent land drainage system because of the possibility of constructing a new land drainage outfall to the river to provide drainage for new developments in this area.

The adjacent land drainage systems are discussed in more detail in Section 11.3.

11.2 Model Development

Models of the adjacent land drainage systems were created using the InfoWorks CS software to assess the existing hydraulic conditions and determine the impact of additional flows from the Southwest Transitway. The following subsections describe the design criteria for this assessment, as well as the hydrologic and hydraulic model parameters related to the model development.

11.2.1 Design Criteria

City of Winnipeg Stormwater Management Design Requirements

The proposed land drainage system for the Southwest Transitway was designed in accordance with the City of Winnipeg Stormwater Management Design Criteria. This document specifies that new land drainage sewer systems handle a 5-year rainfall while open channel conveyance systems (i.e., ditches) are designed for a 25-year rainfall.

There are typically two options for providing drainage of new developments:

1. Construct a new land drainage system including a new outfall to the river; and,
2. Construct a new land drainage system that connects to an existing land drainage system.

Because the majority of the Southwest Transitway is located relatively far from the river, it is too costly and impractical to construct one or more new land drainage outfalls. For this reason, it is proposed that the new land drainage system for the Southwest Transitway be connected to adjacent LDS districts.

The impacts of adding the Southwest Transitway flows to the adjacent land drainage systems were analyzed by developing hydraulic models of the Southwest Transitway and adjacent systems. Southwest Transitway flows into the adjacent systems were restricted to maintain the existing peak discharge even though there will be an increase in volume into the existing system. Because of the flow restriction, the new land drainage sewers and ditches for the Southwest Transitway will need to be upsized to provide the necessary storage capacity.

For the area near the University of Manitoba, it may be possible to route drainage from the Southwest Transitway to a new outfall constructed for the development of the Southwood Lands. This option will be described briefly in Section 11.3.2. This option will require discussion with the University.

Rainfall

The at-grade drainage design is based on a 5-year MacLaren storm rainfall in accordance with City of Winnipeg design standards. The drainage design for the underpass/tunnel areas is based on a target 50-year MacLaren rainfall total capacity. Due to the flow restriction into the adjacent land drainage sewer systems, the majority of the ditches along the transitway are designed to provide the necessary storage capacity to handle a 100-year MacLaren rainfall.

The design standard for underpasses is more stringent as water accumulation would render the underpass impassable. For this reason, the drainage design for the underpasses was originally based on a target 25-year MacLaren rainfall total capacity which was consistent with the pumping station design for Southwest Transitway - Stage 1. The total capacity to handle the 50-year MacLaren rainfall was also determined as this was the basis for the design of the pumping station for the Pembina Underpass. Based on the relatively small cost increment to increase the total capacity from a 25-year to a 50-year design and subsequent discussions with City staff, the 50-year event was selected as the design criteria for the underpasses required as part the Southwest Transitway - Stage 2 Project.

River Level

Two river level conditions were applied to the model boundaries:

1. Normal Summer Water Level – Also referenced as James Avenue Pumping Station Datum (JAPSD) 6.6 feet; and,
2. June 5-Year Water Level – Current tailwater standard for new developments (equivalent to approx. JAPSD 11.5 feet) with separate LDS and outfall.

The normal summer water level (NSWL) was used to assess the Somerset and Riviera LDS systems as this reflects the design standard of these systems at the time they were constructed. The NSWL slope for the river is based on a James Avenue elevation of 223.8 m (JAPSD 6.6 ft) and assuming a James Avenue Red River flow of 396 cm (14,000 cfs) and an Assiniboine River flow of 90 cm (3,200 cfs).

Because the Lot 16 Drain and D’Arcy LDS systems are newer, the current tailwater design standard was applied (i.e., June 5-year river level). The 5-year June river level will also be referenced in Section 11.3.2 where the possibility of a new outfall at the Southwood Lands is reviewed.

The 5-year June river level has been used as the new tailwater standard since 2005 for all new separate land drainage draining directly into rivers. The rationale for the revised standard is based on current trends over the last 20 years that show normal water levels are frequently exceeded during the summer, as shown in Illustration 27.

Based on Illustration 27, a 5-year June level at James Avenue equates to JAPSD 11.5 ft (225.3 m). Using the James Avenue rating curve, this water level corresponds to a James Avenue flow of 795 cm (28,100 cfs) assuming an average James Avenue Assiniboine River flow of 90 cm (3,200 cfs). The slope of the Red River has been calculated using the 2013 version of the Hydraulic Profile Calculator in the City’s Flood Manual.

9 “Criteria for Stormwater Management”, 2001, Urban Development Institute (UDI) Manitoba Division
10 “Drainage Criteria Manual”, MacLaren, 1974,
11.2.2 Subcatchment Delineation and Hydrologic Parameters

Subcatchment Delineation

As part of the model development of the adjacent land drainage systems, subcatchment boundaries for both urban and rural areas were delineated by reviewing aerial photography and the general drainage patterns of each of the respective systems. Subcatchment configuration is a key component in the determination of runoff as the contributing drainage area is directly related to the amount of runoff generated. The land use type and characteristics such as percent imperviousness and depression storage are also estimated based on the defined subcatchment boundary.

Subcatchment delineation was relatively straightforward for the Southwest Transitway compared to the adjacent land drainage systems. For the Southwest Transitway, subcatchments were defined based on an approximate 30-metre width which includes the Transitway, AT Path and CN Railway tracks (south of Bishop Grandin Boulevard only). The drainage boundaries for the Southwest Transitway are described in Section 11.3 as part of the discussion of the adjacent land drainage systems.

Catchment Width/Dimension

InfoWorks uses the variable “Dimension”, equivalent to the SWMM subcatchment “Width” parameter. The SWMM runoff block divides the area of the catchment by the user defined catchment width to develop a flow length. The larger the catchment width value, the shorter the flow length and, consequently, the greater the peak runoff from the catchment. The catchment widths for the adjacent LDS systems were assigned a standard value of 115 m per hectare which is consistent with past design practice.

Land Use and Runoff Surfaces

The adjacent land drainage systems along the Southwest Transitway consist primarily of urban residential neighbourhoods and parks, with some commercial and industrial areas. There is also a large rural runoff contribution to the Lot 16 Drain which is described further in Section 11.3.3. The land use distribution for each land drainage system is listed in Table 40.

Vacant undeveloped lands also exist within the study boundary including the Parker Lands, the Sugar Beets Lands and the Southwood Lands as shown in Figure 50. These lands and the potential impact on the adjacent LDS systems are described in Section 11.3.

The Land Use IDs used in the Southwest Transitway InfoWorks model are shown in Table 41. These were developed based on typical imperviousness values for the land use type. The Land Use IDs were assigned based on the assessment parcel’s zoning type provided in the City of Winnipeg’s GIS database. The commercial, industrial, park, and residential Land Use IDs were assigned to the majority of the catchments within the Southwest Transitway model. The Winnipeg Rural Land Use ID was assigned to poorly graded catchments within the modelled area, such as rural and undeveloped lands.

<table>
<thead>
<tr>
<th>Drainage System (Plaza Drive)</th>
<th>Residential</th>
<th>Commercial</th>
<th>Industrial</th>
<th>Park</th>
<th>Undeveloped Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset Avenue</td>
<td>66%</td>
<td>11%</td>
<td>15%</td>
<td>8%</td>
<td>-</td>
</tr>
<tr>
<td>Riviera Crescent</td>
<td>37%</td>
<td>0%</td>
<td>59%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Lot 16 Drain</td>
<td>21%</td>
<td>2%</td>
<td>4%</td>
<td>2%</td>
<td>71%</td>
</tr>
<tr>
<td>D’Arcy Drive</td>
<td>80%</td>
<td>20%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

11 While the Parker Retention Pond and University of Manitoba Southwood Lands have been listed as adjacent systems in Section 11.1 (as they are important to consider as part of the Southwest Transitway project), these proposed systems have not been modelled.
### TABLE 41: LAND USES

<table>
<thead>
<tr>
<th>Land Use ID</th>
<th>Description</th>
<th>Runoff Surface 1</th>
<th>Runoff Surface 2</th>
<th>Runoff Surface 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWMM_COMMERCIAL_80%</td>
<td>Commercial land, typically 80% of impervious area</td>
<td>20%</td>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>SWMM_INDUSTRIAL_65%</td>
<td>Industrial land, typically 65% of impervious area</td>
<td>16%</td>
<td>49%</td>
<td>35%</td>
</tr>
<tr>
<td>SWMM_PARK_10%</td>
<td>Park land, typically 10% of impervious area</td>
<td>3%</td>
<td>7%</td>
<td>90%</td>
</tr>
<tr>
<td>SWMM_RESIDENTIAL_35%</td>
<td>Residential land, typically 35% of impervious area</td>
<td>9%</td>
<td>26%</td>
<td>65%</td>
</tr>
<tr>
<td>WINNIPEG_RURAL</td>
<td>Poorly graded land, imperviousness varies per catchment</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The Land Use IDs were assigned percentages for three different types of runoff surfaces. These runoff surfaces represent the cover type, runoff roughness, ground slope, depression storage, and infiltration type, as shown in Table 42. Catchments with the Land Use ID Winnipeg Rural were assigned a ground slope value of zero to represent poorly graded areas.

For the Southwest Transitway catchments, a Land Use ID was not assigned. The catchments were individually delineated based on the pavement geometry and the percent impervious determined accordingly. Of the impervious area, 25% of the value is assigned as Runoff Surface 1 (impervious with no depression storage) and the remaining 75% as Runoff Surface 2 (impervious with depression storage). The remaining area is assigned as a Runoff Surface 3 (pervious with depression storage).

### TABLE 42: RUNOFF SURFACES

<table>
<thead>
<tr>
<th>Runoff Surface ID</th>
<th>Description</th>
<th>Surface Roughness (n value)</th>
<th>Ground Slope</th>
<th>Depression Storage (mm)</th>
<th>Runoff Routing Model</th>
<th>Infiltration Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Impervious with no depression storage</td>
<td>0.015</td>
<td>1.0%</td>
<td>0</td>
<td>SWMM</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Impervious with depression storage</td>
<td>0.015</td>
<td>1.0%</td>
<td>2</td>
<td>SWMM</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Pervious 5 mm depression storage</td>
<td>0.250</td>
<td>1.0%</td>
<td>5</td>
<td>SWMM Horton</td>
<td>k:4.14 hr⁻¹ f₀:75 mm/hr fₐ:13 mm/hr</td>
</tr>
</tbody>
</table>

### Rainfall-Runoff Processes

The runoff surfaces described in the Land Use and Runoff Surfaces Section are used by InfoWorks to convert the rainfall hyetographs for the design storms into inflow hydrographs which enter the land drainage conveyance system (i.e., sewer and/or ditches) at defined locations.

Chicago style design storms were used in the Southwest Transitway drainage assessment to generate the rainfall hyetographs. The rainfall intensity was determined using the following equation:

\[
i = \frac{a}{(t_a + b)^c}
\]

Where:
- \(i\): rainfall intensity, mm/hr
- \(a, b, c\): IDF curve parameters
- \(t\): local time of concentration (min)

The Intensity-Duration-Frequency (IDF) parameters used to develop the rainfall hyetographs are shown in Table 43.

### TABLE 43: MACLAREN 1974 IDF PARAMETERS

<table>
<thead>
<tr>
<th>Return Period (Summer)</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>Total Rainfall (mm)</th>
<th>Peak Intensity (mm/hr)</th>
<th>Duration (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year</td>
<td>823.0</td>
<td>7.0</td>
<td>0.813</td>
<td>35.92</td>
<td>82.23</td>
<td>200</td>
</tr>
<tr>
<td>5-year</td>
<td>1199.0</td>
<td>8.0</td>
<td>0.828</td>
<td>49.92</td>
<td>109.51</td>
<td>250</td>
</tr>
<tr>
<td>25-year</td>
<td>1842.0</td>
<td>9.0</td>
<td>0.828</td>
<td>75.44</td>
<td>154.38</td>
<td>350</td>
</tr>
<tr>
<td>50-year</td>
<td>2083.0</td>
<td>9.0</td>
<td>0.842</td>
<td>86.14</td>
<td>174.57</td>
<td>390</td>
</tr>
<tr>
<td>100-year</td>
<td>2745.7</td>
<td>11.0</td>
<td>0.881</td>
<td>88.65</td>
<td>187.84</td>
<td>340</td>
</tr>
</tbody>
</table>

Two types of rainfall-runoff processes were used in InfoWorks to generate runoff for both urban and rural areas:

1. Urban Rainfall-Runoff Method – SWMM Runoff Block; and,
2. Rural Rainfall-Runoff method – Unit Hydrographs.

The SWMM Runoff Block used to model urban rainfall-runoff employs Horton infiltration parameters and generates runoff by representing the catchment as a rectangular channel, where the channel width is equal to the “dimension” parameter previously discussed.

The unit hydrographs used to model the rural rainfall-runoff were developed to simulate the mean daily discharge and total runoff volumes based on Table 1 of Runoff from Small Rural Watershed by N.J. Harden produced for the Water Resources Branch of the Province. Within the study area, rural runoff contributions are particularly important to consider in the Lot 16 Drain LDS system.

12 Based on 10-minute intervals.
Hydraulics

The following describes the hydraulic parameters used to represent system components in InfoWorks. InfoWorks represents conveyance systems using a series of links and nodes. For the adjacent land drainage systems, links and nodes were imported in InfoWorks using the asset management software InfoNet which allows for a seamless import of the City's GIS sewer and manhole data to InfoWorks. Once the GIS data is imported into InfoWorks, it is verified to ensure that there are no significant issues such as missing or incorrect manhole rim elevations for example.

To complete the model development, more complex hydraulic structures including weirs, pump and SRBs are incorporated into the model. The inclusion of these structures will be described as part of each respective section on adjacent land drainage systems (Section 11.3). This model development approach is similar to past projects undertaken for the City of Winnipeg.

Table 44 provides a summary of the typical conveyance parameters that were applied to the InfoWorks models of the adjacent land drainage systems. They were also used to represent the proposed land drainage system for the Southwest Transitway.

Table 44: Typical Conveyance Parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Sections - Open Channels</td>
<td>Manning's n</td>
<td>0.100 (channel)</td>
</tr>
<tr>
<td></td>
<td>Manning's n</td>
<td>0.050 (overbank)</td>
</tr>
<tr>
<td></td>
<td>Cross-Sections</td>
<td>As per Open Channel Database</td>
</tr>
<tr>
<td>Ditch Sections - Open Channels</td>
<td>Manning's n</td>
<td>0.100 (channel)</td>
</tr>
<tr>
<td></td>
<td>Manning's n</td>
<td>0.050 (overbank)</td>
</tr>
<tr>
<td></td>
<td>River Sections - SRBs</td>
<td>Area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cross-Sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trapezoidal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Varies according to area at NWL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stage-Storage above NWL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TH:1V side slopes</td>
</tr>
<tr>
<td>Weirs</td>
<td>Primary/Secondary Coefficients</td>
<td>0.48</td>
</tr>
</tbody>
</table>

As referenced in Table 44, entrance and exit losses were only considered for larger culverts.

For the river sections, different Manning's n roughness coefficients were applied for the channel (0.050) and the overbank (0.10). The roughness coefficient of 0.050 is representative of a clean channel free of debris and heavy vegetation while 0.100 considers the heavy vegetation common in most channels. These roughness coefficients were applied to the Lot 16 Drain.

For the ditches proposed as part of the Southwest Transitway - Stage 2 Project, different Manning's n roughness coefficients were applied for the channel (0.100) and the overbank (0.050). The channel roughness is typically less than the overbank roughness due to vegetation along the side slopes. However, in this case, the channel roughness will likely be greater as the ditches are used primarily for storage and not for conveyance. The roughness coefficient of 0.100 is representative of a clean channel free of debris and heavy vegetation assuming that the side slopes would be regularly maintained while 0.100 considers the heavy vegetation that could occur if the ditches are not maintained.

The SRBs in the Somerset Avenue land drainage system were also modelled based on the parameters defined in Table 44 to provide a reasonable representation of the stage-storage relationship related to each SRB. This approximation is considered appropriate at the functional design stage.

Finally, a standard weir discharge coefficient of 0.48 was utilized in InfoWorks.

Model Verification

The InfoWorks models developed as part of the assessment of the Southwest Transitway functional drainage design were verified based on general knowledge of the systems and from past project involvement including the City of Winnipeg Flood Activity/Emergency Manual and the Draft 2011 Technical Memorandum, “Lot 16 Drain/Bishop Grandin Pumping Station - Model Results and Recommended Flooding Protection Measures”. Knowledge of past City of Winnipeg design storms and new land drainage sewer design criteria is also important in understanding each system.

The Rational Method was also utilized to provide a rough estimate of the flows that would be generated by each of the adjacent land drainage systems and compared to the runoff generated by the infoWorks models.

Adjacent Land Drainage Systems and Impact of Southwest Transitway Flows

Drainage from the Southwest Transitway is proposed to be routed to existing adjacent land drainage systems using a combination of new land drainage sewers and ditches which run parallel along the Southwest Transitway. These adjacent land drainage systems are discussed in the following subsections (from South to North), where some background related to each system is provided (i.e., existing sewer system, level of service, more complex hydraulic structures).

The drainage boundaries of the Southwest Transitway which flow into each system are also defined. The Southwest Transitway drainage concept applicable to each land drainage system is presented, as well as any design restrictions considered to limit the peak flow rate to existing conditions.
The D’Arcy land drainage system is a separated sewer district defined by the drainage area of the 2200 mm diameter LDS outfall just south of Bishop Grandin Boulevard (approximately 170 ha), shown in Figure 52. The catchment area associated with the D’Arcy LDS system is bounded by the CN Railway tracks to the west and the Red River to the east. The system extends south from Bishop Grandin Boulevard to the northern boundary of the University of Manitoba. There are no SRBs in the D’Arcy LDS system.

The level of service for the majority of the D’Arcy system is equivalent to a 2-year MacLaren rainfall. However, as part of the Bishop Grandin Extension Project, the 1250 mm diameter existing LDS along Pembina Highway was diverted east to a new 1650 mm trunk sewer/2200 mm diameter LDS outfall. The local LDS system located east of University Crescent was also routed toward the new outfall. The new 1650 mm downstream LDS trunk and 2200 mm LDS outfall were designed based on the 5-year MacLaren rainfall therefore increasing the capacity at the downstream end of the D’Arcy LDS system.

The tie-in location for the Southwest Transitway south of Bishop Grandin Boulevard was selected based on the 5-year capacity of the 1650 mm LDS trunk and 2200 mm LDS outfall. The D’Arcy LDS system differs from the Somerset and Riviera LDS systems as it has a greater capacity, which facilitates routing the Southwest Transitway drainage into the existing system.

As a base option, the Southwest Transitway drainage for a 5-year MacLaren rainfall between Markham Road and Bishop Grandin Boulevard was routed north toward the Bishop Grandin Boulevard 1650 mm diameter main sewer trunk as shown in Figure 52. The proposed drainage concept along the Southwest Transitway considers runoff from the CN tracks that will be shifted approximately 5.7 m to the west as part of the project. The cross-section of the Southwest Transitway between Bishop Grandin Boulevard and Markham Road is shown in Figure 10.

The drainage concept also considers the proposed Chancellor Station, Markham Station, and IGF Station (which includes a large bus terminal facility). The Southpark Drive Connection is also considered as part of the drainage concept.

Because of the limited space available for ditches along the Southwest Transitway, a new LDS sewer will be required along the Southwest Transitway to accommodate drainage with diameters ranging from 750 mm at the upper end of the system (1250 m length) near IGF Station to 900 mm (960 m length) along the Transitway North-South segment and 1050 mm (400 m length) at the downstream end. A new 450 mm diameter LDS is also proposed along the Markham Station to accommodate drainage. The new LDS system for the Southwest Transitway also provides adequate storage to limit the flows into the existing D’Arcy system so that peak flows do not become greater as a result of the additional flow contribution. The hydraulic grade line (HGL) along the Bishop Grandin trunk is shown in Illustration 28.

The future development of the Southwood Lands will require a new LDS and outfall to the Red River and, therefore, it may be possible to develop a more optimal drainage plan for the section of the transitway between the CN Letellier right-of-way and IGF Station.

Such a plan would require the construction of a new outfall in advance of development. Until the Southwood Lands are developed, existing ponds or new temporary ponds on those lands could be used to store runoff for subsequent routing to the new outfall. The portion of the transitway alignment between the CN Letellier subdivision (at Southpark Drive) and IGF Station could be drained in this manner. As development occurs, a new LDS could supplement or replace the ponds for permanent drainage of both the transitway and the Southwood Lands. Such an approach could potentially be cost-shared by the University, the City, and developers.

A hydraulic assessment was carried out to evaluate the Southwood outfall option and to obtain an estimate of the potential cost savings compared to the D’Arcy option presented in Section 11.3.1. The comparison showed that the costs would be within the same range of magnitude. Note that the Southwood outfall would require a gate chamber for protection against high river levels and potential riverbank works.

In summary, both options merit further consideration during the detailed design for Stage 2 of the Southwest Transitway.

Lot 16 Drain

Background

In 2011, AECOM developed a model of the Lot 16 Drain in InfoWorks to identify required flood protection measures for the 2011 Spring Flood. The InfoWorks model is comprised of the Plaza Drive system and the Bishop Grandin Underpass drainage areas of the Lot 16 Drain, including four pumps at the underpass. A 2400 mm diameter LDS outfall to the Red River, protected by a positive gate, is located at the downstream end of the Lot 16 Drain.


15 AECOM, 2011, Draft Technical Memorandum – Lot 16 Drain/Bishop Grandin Pumping Station – Model Results and Recommended Flood Protection Measures
The contributing drainage area of the Lot 16 Drain, shown in Figure 53 is approximately 4940 ha based on recent studies completed by AECOM including the 2011 Draft Technical Memorandum Lot 16 Drain/Bishop Grandin Pumping Station – Model Results and Recommended Flood Protection Measures and the 2013 Draft Report Inland Cement Lakes Investigation and Review of May 2010 Storm Performance.

The drainage area consists of both rural and urban components resulting in two distinct flow peaks. The urban area is located at the eastern downstream end of the system while the large rural contribution is at the upper end of the system. The first peak is associated with the urban runoff which reaches the outlet of the Lot 16 Drain more quickly while the second peak is much larger and is associated with the rural runoff contribution. Because the second peak in the Lot 16 Drain is much larger and occurs later, routing Southwest Transitway drainage towards the Lot 16 Drain was considered reasonable as the urban peak occurs much sooner and would therefore not cause an increase in the peak HGL.

Future Development (Sugar Beets Lands)

Within the Lot 16 Drain catchment area, there is the potential for future development of a large area (approximately 49 ha) north of Bishop Grandin Boulevard and west of the proposed Southwest Transitway alignment referred to as the Sugar Beets Lands previously identified in Figure 50. For the Sugar Beets Lands, similar to other developments in the City, it is has been assumed that WWD would restrict runoff from the development to a C value equivalent to existing conditions. This would result in an increase in runoff volume in the Lot 16 Drain but should have no impact on the flood peak. For this reason, the future development of this area has not been considered as part of the Southwest Transitway drainage concept. In addition, the design restrictions that would be imposed by WWD (i.e., C value) are still unknown.

Southwest Transitway Drainage Concept / Letellier Tunnel Pumping Station

The Southwest Transitway drainage between Chevrier Boulevard and Bishop Grandin Boulevard is routed towards the 2400 mm diameter LDS trunk which is part of the Lot 16 Drain system. The proposed LDS system is designed to accommodate a 50-year MacLaren event, which includes approximately 440 m of LDS, ranging from 375 mm to 750 mm. The LDS discharges to the Letellier Tunnel Pumping Station located just north of Plaza Drive, on the east side of the Manitoba Hydro right-of-way, as shown in Figure 53. A 300 mm forcemain is also required to route drainage from the pumping station to the ditch along the east side of the Southwest Transitway. The proposed LDS system is designed to accommodate a 50-year MacLaren event, which includes approximately 440 m of LDS, ranging from 375 mm to 750 mm. The LDS discharges to the Letellier Tunnel Pumping Station located just north of Plaza Drive, on the east side of the Manitoba Hydro right-of-way, as shown in Figure 53. A 300 mm forcemain is also required to route drainage from the pumping station to the ditch along the east side of the Southwest Transitway.
Also included at the south end of this section of the Southwest Transitway is a new Transitway Bridge over Bishop Grandin Boulevard, which will include an AT Path. A new Rail Bridge over Bishop Grandin Boulevard will also be constructed. Based on this concept, however, the proposed new structures will not affect the existing drainage conditions at Bishop Grandin Boulevard.

### Model Results

The model results confirmed that the Southwest Transitway runoff contribution will have a negligible effect on the peak HGL for the Lot 16 Drain, as shown in Illustration 30. The peak flow is attributed to the second flow peak which is much larger due to the Lot 16 Drain rural runoff contribution. The timing of the urban runoff contribution is also sooner and therefore has little impact on the peak HGL.

![Illustration 30: HGL along Lot 16 Drain](image)

### 11.3.4 Riviera Crescent

The Riviera Crescent land drainage system is a separated sewer district defined by the drainage area of the 1800 mm diameter LDS outfall at Riviera Crescent (approximately 357 ha), shown in Figure 54. The area east of the Southwest Transitway alignment is primarily residential similar to the Somerset Avenue land drainage system. The remainder of the system bounded by Waverley Street and the Southwest Transitway consists of a combination of commercial and industrial developments. The Riviera system does not contain any SRBs or other major hydraulic features (i.e., major drains, weirs, etc.).

The hydraulic model of the Riviera system shows an existing level of service roughly equivalent to a 5-year MacLaren rainfall event. Although the LDS system extends from the Red River west to Waverley Street, the primary focus in the assessment of this system was east of the proposed Southwest Transitway as this corresponds to the tie-in point for the Southwest Transitway drainage flows into the Riviera system, as shown in Figure 54. However, the area west of the Southwest Transitway is an important consideration since it represents the runoff contribution in the upper part of the Riviera catchment.

South of the Transitway Overpass of McGillivray Boulevard, drainage is routed south towards the Clarence Avenue 1825 mm diameter main trunk sewer, which is part of the Riviera LDS system. Southwest Transitway drainage north of the Letellier Tunnel is also routed towards the Riviera LDS system. The Southwest Transitway drainage concept associated with the Riviera LDS System is shown in Figure 54 and considers both the Clarence and Chevrier Stations. The proposed ditch configuration from the McGillivray Overpass to the Letellier Tunnel is consistent with that proposed north of the McGillivray Overpass and referenced in Section 11.3.5 (Somerset Avenue).

The 5-year runoff was computed from the existing Manitoba Hydro right-of-way to the Riviera LDS System. It was determined that to match the runoff for existing conditions, a 250 mm diameter restriction at the outlet of the proposed Southwest Transitway outlet is required. With this restriction, the proposed ditch system will act as a detention facility and be required to store the 100-year MacLaren event, as per City of Winnipeg standard.

To store the runoff volume for a 100-year MacLaren event, approximately 400 linear meters of ditch is proposed between the Transitway Overpass of McGillivray and the Letellier Tunnel. The ditching will consist of 150 m north of Clarence Avenue beginning where the AT Path diverges from the Southwest Transitway, and 250 m south of Clarence Avenue. The ditch will be connected by a 450 mm culvert crossing Clarence Avenue.

The ditch consists of 4H:1V side slopes, a bottom width of 1.5 m and a longitudinal slope of 0.1%. The depth ranges from 1.2 m to 1.4 m, requiring a width of approximately 12.7 m designated for ditching. An underdrain will also be included beneath the ditches to ensure they are fully drained of any standing water that may pool after rainfall events. The under drain will consist of a 150 mm diameter perforated pipe wrapped in non-woven geotextile fabric laid at the bottom of a small trench and backfilled with porous media.

Swales will also be located around roadways and MSE walls from the McGillivray Overpass to drain water towards the larger drainage ditches. In addition to the ditches and swales, new LDS ranging from 450 mm to 600 mm are required to accommodate drainage at the Clarence and Chevrier Stations.

Similar to that described for the Lot 16 Drain system (Section 11.3.3), the proposed ditches are located within the Manitoba Hydro right-of-way. Therefore, approval from Manitoba Hydro will be required at the detailed design stage to ensure that the ditches do not adversely affect their maintenance operations. Ditches will be constructed around the existing and proposed hydro towers, while ensuring access is maintained.

Flows from the Letellier Tunnel and the Southwest Transitway to the south (between Marahan Avenue and Bishop Grandin Boulevard) were routed south to the Lot 16 Drain, as described in Section 11.3.3.

Illustration 31 compares the HGL downstream of the tie in point along the Clarence Avenue 1825 mm diameter main trunk sewer for existing conditions and with the Southwest Transitway flow contribution. As noted above, a flow restriction into the Clarence 1825 mm diameter trunk sewer was applied and additional storage in the ditches along the Southwest Transitway was provided to maintain the existing peak HGL in the Riviera LDS system.

16 Criteria for Stormwater Management*, 2001, Urban Development Institute (UDI) Manitoba Division
The Somerset Avenue land drainage system is a separated sewer district defined by the drainage area of the 1800 mm LDS outfall at Somerset Avenue east of Riverside Drive (approximately 780 ha), shown in Figure 55. There are four SRBs in this system located west of Waverley Street (SRB 6-15, SRB 6-18, SRB 6-22 and SRB 6-24) which have been incorporated in the InfoWorks model based on the approach defined in the Minor System section.

A weir also exists east of SRB 6-15 which controls the level of SRBs 6-15, 6-18 and 6-24. Another LDS flow control is a pipe crest under Waverley Street at Lindenwood Place, which is slightly lower than the weir at SRB 6-15. These flow control structures have also been included in the InfoWorks model of the system.

The model simulations of the existing conditions in the system show that the level of service is roughly equivalent to a 2-year event, particularly in the area east of Waverley Street. The level of service is indicative of when the sewers were constructed in this land drainage district (1960’s and 1970’s). Post 1974 LDS systems were designed to accommodate a 5-year MacLaren event based on the Drainage Criteria Manual17 for the City of Winnipeg.

For the Southwest Transitway drainage concept, drainage along the North-South segment south of Parker Avenue will be directed south toward the Somerville 1800 mm diameter trunk sewer. Southwest Transitway drainage north of the proposed McGillivray Overpass will also be routed north towards the Somerville trunk, as shown in Figure 55.

The Somerset LDS District has an existing low level of service and the runoff from the proposed Southwest Transitway needs to be restricted via a 250 mm diameter pipe to match existing conditions. The ditches, similar to those in the Riviera LDS system, will act as detention facilities and will be required to store the runoff volume of a 100-year MacLaren event.

Approximately 540 linear meters of ditch is proposed between Parker Avenue and McGillivray Boulevard (380 m north of Somerville Avenue and 160 m south of Somerville Avenue). The ditch south of Somerville Avenue will terminate before the north end of the Transitway Overpass of McGillivray, such that no water is stored immediately adjacent to the proposed MSE walls. Swales will be located around the roadway and MSE walls to drain water towards the ditch.

The proposed ditch configuration consists of 4H:1V side slopes, a bottom width of 1.5 m and a longitudinal slope of 0.1%. The ditch will run along the east side of the Southwest Transitway with a depth ranging from 1.0 m to 1.35 m, which will require that a width of approximately 12.3 m be allocated to ditching. An underdrain will also be included beneath the ditches to ensure they are fully drained of any standing water that may pool after rainfall events.

Approval from Manitoba Hydro will be required for the proposed transitway ditches at the detailed design stage to ensure that they do not adversely impact Manitoba Hydro’s maintenance operations.

Ditches will be constructed around the existing and proposed hydro towers and access maintained.

The proposed runoff from the Southwest Transitway for a 5-year MacLaren storm was routed into the Somerset LDS system to assess the potential impacts to the HGL. The HGL along the Somerville 1800 mm diameter trunk sewer is shown in Illustration 32. Because the runoff from the Southwest Transitway is restricted into the Somerset LDS system, the HGL associated with the 5-year MacLaren rainfall for existing and proposed conditions are the same.

11.3.6 Parker Retention Pond

The Cockburn and Calrossie Combined Sewer Relief Works project, which is currently being carried out independently by the City of Winnipeg Water and Waste Department (WWD), involves the construction of a new land drainage sewer to provide basement flood relief to the Cockburn West and SoutheastJessie combined sewer areas. The current design concept for the relief works includes a new Parker Retention Pond (shown in Illustration 33) and a downstream sewer trunk which runs along Rockman Street/Byng Avenue and eventually discharges to a new Calrossie outfall.
The Parker Retention Pond is related to the Southwest Transitway for the following reasons:

1. Flows from the proposed Transitway Underpass of CN Wye Tracks could be pumped and routed to the Parker Retention Pond;
2. Drainage along the east-west Southwest Transitway alignment north of Parker Avenue could be routed toward the Parker Retention Pond; and,
3. The City of Winnipeg WWD and Winnipeg Transit are working together to ensure that the proposed footprint for the Parker Retention Pond does not conflict with the Southwest Transitway (shown in red in Illustration 33) and that the desired capacity for the Cockburn and Calrossie Combined Sewer Relief Works is maintained.

Flows from the Pembina Highway Underpass could also be pumped and diverted toward the Parker Retention Pond but with some challenges. The Pembina Highway Underpass and its potential integration with the land drainage design concept for the Transitway Underpass of CN Wye Tracks is described in Section 11.4 (Transitway Underpass at CN Wye Tracks and Pembina Highway Underpass).

While the Parker Retention Pond design has not yet been finalized, the runoff volume contribution from the Southwest Transitway is very small compared to the total storage capacity of the pond. Therefore, if the pond shape or size were to change, this will not affect the Southwest Transitway land drainage concept.

Drainage for the Southwest Transitway east-west alignment along Parker Avenue will be accommodated by constructing a ditch along the south side of the Southwest Transitway up to Georgina Street where a culvert will be installed and the ditch will continue on the north side of the Southwest Transitway. The ditch will continue to the east where it will drain to the Parker Retention Pond, as shown in Figure 56. This drainage concept also considers the Parker Station near the Beaumont Street Connection.

The following is the recommended ditch configuration along Parker Avenue based on a 25-year MacLaren design event:

- 4H:1V side slopes
- Bottom width of 1.5 m
- Depth ranging from 0.4 m to 1.01 m
- Maximum top width of 9.6 m
- Longitudinal slope of 0.1%
- 150 mm (6 inch) diameter under drain

The recommended ditch configuration includes an underdrain consisting of a 150 mm diameter sock wrapped perforated pipe laid at the bottom of a small trench and backfilled with porous media. This underdrain will ensure that the ditches are fully drained of any standing water that may pool after rainfall events.

To provide drainage along the Beaumont Street Connection, swales will be constructed along both sides of the roadway consisting of 4H:1V side slopes at a 0.1% longitudinal slope.

### 11.4 Transitway Underpass at CN Wye Tracks and Pembina Highway Underpass

This section describes the proposed pumping station concepts for the Pembina Highway Underpass and for the Southwest Transitway Underpass at CN Wye Tracks. As part of the functional design for the Southwest Transitway, drainage concepts that consider both components of the SWT2-Pembina Underpass project were reviewed to determine the best overall recommendation.

The Parker Retention Pond, which is part of the Cockburn and Calrossie Combined Sewer Relief Works was discussed in Section 11.3.6. The role of the pond as part of the Southwest Transitway - Stage 2 Project was also introduced in this section and will be described further in Section 11.4.2 (Transitway Underpass of CN Wye Tracks).

The background related to the Pembina Highway Underpass Project is presented below.

### 11.4.1 Pembina Highway Underpass

As part of the Preliminary Engineering Study for Upgrading the Pembina Highway Underpass (May 2013), three options were outlined for discharge locations of the underpass runoff:

1. Outlet to the existing combined sewer (CS) under existing outlet conditions including on site storage;
2. Outlet to the new relief sewer using estimated allocated outlet capacity and required on site storage; and,
3. Outlet to a separate LDS outfall based on potential development land north of Parker Avenue (Parker Lands) using a separated LDS system through the Calrossie LDS District.

At the time the report was prepared, Option 1 was the only viable option as it was unlikely that a relief sewer or separated system would be available to discharge the underpass runoff. Option 2 and Option 3 were the two relief options for the Cockburn and Calrossie Combined Sewer Relief Works.
However, the construction of a new 2700 mm diameter Calrossie outfall has since begun making Option 3 a possibility. The new Calrossie outfall is part of the Cockburn and Calrossie separation concept. Option 2, associated with a new relief sewer for the Cockburn and Calrossie Combined Sewer Relief Works, is therefore no longer feasible as plans have already moved forward with separation (i.e., Option 3).

Options 1 and 3 are described in more detail in the following subsections.

**Dry Pond to Cockburn East**

Option 1 was developed so that the underpass runoff could be discharged into existing and available infrastructure. This was completed by implementing a dry pond in the east cloverleaf at the Jubilee Avenue and Pembina Highway intersection. The dry pond was designed to only drain once levels in the Cockburn CS had subsided, thus negating any increase in basement flooding risk. This option still remains a viable and very cost-effective solution for discharging the underpass runoff as the required infrastructure exists and is in near proximity to the proposed pumping station. There would also be no measurable impact to the basement flooding risk in the area.

**West Towards Parker Retention Pond**

Option 3 would involve discharging the Pembina Underpass runoff into the proposed Cockburn/Calrossie LDS system. Since the Cockburn and Calrossie Combined Sewer Relief Works will be grouped together with the Pembina Underpass and Southwest Transitway-Stage 2 projects, the proposed Parker Retention Pond may be constructed before the Pembina Underpass project begins.

If this is the case, then it is possible to build a forcemain running from the proposed pumping station location crossing Pembina Avenue to Sparling Avenue. The forcemain would then connect to a LDS sewer on Sparling Avenue which would ultimately discharge into the Parker Retention Pond.

This option may be considered attractive since the storm runoff would be discharged into the LDS system, as opposed to the CS system (Option 1). However, there would be a significant cost increase as approximately 220 meters of 525 mm diameter forcemain would be required and would need to be routed through a number of obstacles both existing and proposed. Utilizing a forcemain will also increase the pump costs, as the pumps will have to provide significantly greater total head requirements as compared to a gravity system. Access may also be an issue. Furthermore, if this option is selected, the Pembina Underpass project would be delayed until construction of the Cockburn/Calrossie downstream sewer trunk between the new Calrossie Outfall and the Parker Retention Pond is completed.

**Transitway Underpasses of CN Wye Tracks**

As part of the Southwest Transitway - Stage 2 project, underpasses are proposed under the two CN tracks west of the Pembina Underpass (referred to as the Transitway Underpasses of CN Wye Tracks). The design concept for the Southwest Transitway assumes that flow from this underpass would be pumped and routed toward the new Parker Retention Pond.

The pumping station configuration for the Transitway Underpasses of CN Wye Tracks is similar to the proposed Option 1 concept for the Letellier Tunnel but requires a greater capacity because of the larger contributing area. Based on the 50-year design methodology described previously, the required pump capacity is 860 L/s. Additional details related to the pumping station design are provided in Section 11.5.

The LDS for the Transitway Underpasses of the CN Wye Tracks will consist of 300 mm to 1050 mm diameter pipe leading to the pumping station as shown in Figure 56. Similar to the Letellier Tunnel, a new 1050 mm diameter forcemain will be required from the Transitway Underpasses of CN Wye Tracks Pumping Station to the Parker Retention Pond.

In addition to the LDS, some ditching is also required to drain the area between the rail tracks and the top of slope of the underpass section. Two 400 mm diameter culvert crossings under the CN Rail tracks will also be required to accommodate the ditch drainage. The culverts have been sized based on a 50-year MacLaren event to ensure the hydraulic design criteria for the rail line is met. As an additional measure to protect the rail line, it is recommended that the ditch elevations be set to overflow into the underpass if the 50-year design rainfall event were exceeded.

### 11.4.3 Single Pump Station Servicing Transitway Underpass of CN Wye Tracks and Pembina Highway Underpass Project

The previous sections describe the recommended pumping station concepts for the Pembina Highway Underpass and for the Transitway Underpasses of CN Wye Tracks if the two components were considered separately.

The option of constructing one larger pumping station was also considered to satisfy the needs of both projects. There are some advantages of building one pumping station instead of two especially since the two projects are within such close proximity. While the required pumps and station footprint would be larger, the cost of building one larger pumping station would be less than building two separate pumping stations.

However, based on a review of the existing underground infrastructure in this area, the costs of routing the Pembina Underpass (LDS associated with routing the flow to a larger pumping station near the Parker Retention Pond) would be larger, resulting in overall costs that are expected to be within the same range (if not exceed) the cost of building two separate pumping stations.

There would also be construction issues related to installing the larger LDS in this area compared to building a separate pumping station option because of the depth of installation. To connect the Pembina Underpass drainage, approximately 480 m of 1050 mm diameter pipe would be routed west (north of the CN tracks) on the Taylor Lands from the Pembina Underpass (where an easement would be required to make the design feasible).

Proceeding with and crossing the underpass projects independently would also have to cross the CN Wye tracks to a pumping station located just east of the Parker Retention Pond. Furthermore, due to the overall project schedule and the depth of the LDS, tunnel boring methods (TBMs) would have to be employed for the installation of the LDS sewer, which would require a multitude of deep and expensive jacking and receiving shafts.

Since there are likely no cost savings and because of the negotiations that would be required to obtain an easement in the Taylor Lands, the option of combining the Transitway Underpasses of CN Wye Tracks and the Pembina Highway Underpass drainage to one pumping station is not recommended.
11.4 Recommendation

Based on a review of the pumping station concepts servicing the Pembina Underpass and the Transitway Underpasses of the CN Wye Tracks, it is recommended that two separate pumping stations (with power and MTS connections) be built. Our recommendation for the Pembina Underpass pumping station is to adopt Option 1 (Outlet to the existing CS under existing outlet conditions including on site storage). Option 1 will provide significant cost savings and allow for the Pembina Highway Underpass to be constructed independently of the Cockburn and Calrossie Combined Sewer Relief Works.

The pumping station for the Transitway Underpasses of the CN Wye Tracks will provide a total capacity based on a 50-year MacLaren rainfall design. The station will be configured with two pumps and discharge directly to the Parker Retention Pond as described in Section 11.4.2.

11.5 Pumping Station Design

As described in previous sections, two land drainage pumping stations will be designed for the Southwest Transitway – Stage 2 project to handle stormwater runoff entering the underpass grade separation and tunnel areas at the following locations:

- Letellier Tunnel; and,
- Transitway Underpass of CN Wye Tracks.

An additional land drainage pumping station will also be required as part of the Pembina Highway Underpass as defined in the Preliminary Engineering Study for Upgrading the Pembina Highway Underpass (May 2013) and summarized in Section 11.4.1.

The proposed pumping stations for the Southwest Transitway – Stage 2 Project will be designed to provide capacity to accommodate a 50-year design summer rainfall event (1200 l/s for Letellier Tunnel and 860 l/s for Transitway Underpass of CN Wye Tracks). The conceptual layout for the pumping stations is shown in Figures 57 and 58.

The recommended configuration of the pumping stations is to use a wet well with submersible pumps which is similar to many recently constructed land drainage pumping stations for the City of Winnipeg including the Kenaston Underpass, the Southwest Transitway – Stage 1 Tunnel and the Bishop Grandin Underpass.

The proposed conceptual pumping station is expected to consist of a wet well design utilizing the following:

- Building substructure, which includes a CIP reinforced concrete structure/wet well;
- Submersible pumps servicing the underpass drainage system;
- Building superstructure to house pumping station, mechanical and electrical equipment;
- Primary and standby power supplies (by means of one Manitoba Hydro service and one natural gas powered generator);
- Monitoring and controls, including remote monitoring and site services;
- Below ground structural portion of the pumping station designed to ACI 350-06 requirements; and,
- Above ground structural portion of the pumping station using NBC 2010 building code as amended by the Manitoba Building Code Regulation 31/2011.

11.6 Summary

The land drainage functional design concept for the Southwest Transitway – Stage 2 Project has been prepared based on discussions with the City of Winnipeg and will be finalized at the detailed design stage. The proposed design considers both the Southwest Transitway – Stage 2 and the Pembina Underpass components of the SWT2-Pembina Underpass project.

The drainage concept for the Southwest Transitway – Stage 2 Project was developed in consideration of existing and planned alignments for Manitoba Hydro and CN infrastructure, of the existing locations of the Branch II Aqueduct and Fort Garry Feedermain, and of the transitway’s structures, grade separations, stations, and street connections. The stations and street connections were important to consider as they substantially increase the impervious area and generate more runoff. In some instances, the area required for these features limited drainage options due to insufficient space for ditching.

The drainage concept consists of a combination of new land drainage sewers and ditches along the Southwest Transitway which will drain into existing adjacent land drainage systems (as shown in Figure 51). This is standard design practice provided that an analysis has been carried out to show that there is no increase in the peak flow rate to the existing sewers. The adjacent systems include D'Arcy Drive, the University of Manitoba Southwood Lands, Lot 16 Drain, Riviera Crescent, Somerset Avenue and Parker Retention Pond. The proposed pond is part a separate on-going project, the Cockburn and Calrossie Combined Sewer Relief Works, and has been included in the list of adjacent systems as drainage along Parker Avenue will be routed east toward the pond via ditches. It is also proposed that runoff at the Transitway Underpass of CN Wye tracks be pumped into the pond.
Models of the adjacent systems were created using the software InfoWorks CS to assess the existing hydraulic conditions and to determine the impact of additional flows. Transitway flows into the adjacent systems were restricted via a small pipe inlet (250 mm diameter) to maintain the existing peak discharge. Because of the flow restriction, the new LDS and ditches were upsized along the majority of the Southwest Transitway to provide the necessary storage capacity to handle a 100-year MacLaren rainfall. The results of the hydraulic assessment show that there is no effect on the peak flow rate in the adjacent systems.

With the exception of a few sections in the vicinity of stations where 400 to 600 mm diameter LDS is required, ditching is proposed along the Southwest Transitway between Parker Avenue and Chevrier Boulevard. The ditch configuration consists of 4H:1V side slopes and a bottom width of 1.5 m, with depths ranging from 1.0 to 1.4 m. Drainage near the proposed Letellier Tunnel is restricted because of numerous conflicts and consists of LDS (ranging from 375 to 750 mm diameter). Between Bishop Grandin Boulevard and Markham Road/IGF Station, a new LDS system is proposed with diameters ranging from 750 mm near IGF Station to 900 mm along the transitway and 1050 mm downstream to a tie-in to the existing D’Arcy Drive system. Depending on future development in the Southwood lands, it may be possible to develop a more optimal drainage plan for the section of the transitway between the CN Letellier right-of-way and IGF Station.

The at-grade drainage design is based on a 5-year MacLaren storm rainfall in accordance with City of Winnipeg design standards. The drainage design for the underpass/tunnel areas is based on a target 50-year MacLaren rainfall total capacity. Due to the flow restriction into the adjacent land drainage sewer systems, the majority of the ditches along the transitway are designed to provide the necessary storage capacity to handle a 100-year MacLaren rainfall. Two pumping stations, at the Letellier Tunnel and at the Transitway Underpass of the CN Wye Tracks, are included as part of the land drainage concept.
12.0 Railway Works

12.1 Railway Consultations

On October 4, 2013 Dillon/AECOM/City met with the CN Engineering Group. As the functional design for Stage 2 of the Southwest Transitway project had just recently been assigned, the purpose of this meeting was to provide the CN Technical group background of the project and to document project contacts. Possible alignments and impact on CN infrastructure was discussed.

On January 10, 2014 Dillon/AECOM met with CN Design and Construction. The purpose of this meeting was to present the functional design and transitway alignment to CN and to inform its staff of the areas where the transitway and structures would impact CN in some manner. The proposed alignment for Stage 2 of the Southwest Transitway from Jubilee Avenue to the University of Manitoba, as well as work carried out to date was presented to CN. CN provided input, comments, and direction for continued consultation as the project proceeds. Preliminary alignment drawings for the Stage 2 transitway were provided to CN.

On January 21, 2014 Dillon/AECOM/City met with CN Senior Management. The purpose of this meeting was to update CN Senior Management on the progress of the Stage 2 transitway project, to document expected design and construction processes, to inform CN of the input required during the design/ construction, and to convey overall project schedule. The overall project impacts on existing CN infrastructure at a number of locations were discussed at this meeting.

On March 5, 2014 Dillon/AECOM met with R.S. Harris Transport Ltd. The purpose of this meeting was to discuss the draft functional design as it relates to Harris Transport, and to receive feedback and input from Harris Transport regarding preliminary design solutions to address the impact of the draft functional plan on Harris’s rail and transport operations.

On July 7, 2014 Dillon/AECOM/City met with CN Senior Management. The purpose of this meeting was to inform newly-appointed CN management staff about the project and to update them on the work that had been undertaken to date.

Minutes of the above meetings are included in Appendix K.

12.2 Proposed Railway Works

This section provides details of the proposed works at the specific locations where the project impacts CN rail infrastructure.

12.2.1 Portage Junction

The work required to accommodate the Southwest Transitway was completed in the 2013 study Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65). CN was involved in this study and is aware of the impacts on its infrastructure and is in general agreement with the recommended plan. All project work proposed at this location remains as recommended in the above report.

The existing CN Rail Bridge over Pembina Highway will be replaced with a new rail bridge over Pembina Highway at a location north of the existing rail bridge. This work will include the relocation of existing CN tracks to align with the new rail bridge. The two existing wye tracks (Letellier Sub - east leg of wye; track WC02 - west leg of wye) will be relocated from their current alignments to connect with the realigned Rivers Subdivision.

To accommodate the transitway, with no at-grade crossings of rail tracks, underpasses of the east and west wye tracks are required. The structures will be constructed at-grade (no underpass excavation) at the relocated track locations. These underpass locations would not impact the current Letellier and WC02 trackage; however, there are three CN buildings (MDW garage, tool house, S&C building with antenna tower) that will need to be relocated initially. CN confirmed that the removal/relocation of the above noted buildings is not a concern and can be addressed without impacting the construction of the transitway. Moreover, CN will give consideration to the consolidation of the buildings into a single building.

After completion of the Letellier and WC02 structures and CN building/tower relocations, the proposed wye tracks would be constructed over the new structures to ensure minimal downtime to CN operations. Upon completion of the proposed wye track cut-overs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these structures would take place and the transitway would be constructed. A plan of the proposed works at Portage Junction is shown in Figure 59.

12.2.2 Letellier Tunnel

South of Chevrier Boulevard, a transitway tunnel underneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track is required to bring the transitway to the east side of the rail line to provide pedestrian and transit access to existing commercial properties, Pembina Highway and the University of Manitoba. This tunnel would be very similar in length and construction procedures to the transitway tunnel constructed as part of the Stage 1 project through the Fort Rouge Yards. An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro lines/towers, negative response from the public, and transit operational concerns.

The north end of the tunnel structure will be on the west side of the Letellier Subdivision south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 621 m further south on the east side of the Letellier. The tunnel structure includes a covered tunnel approximately 203 m in length with retaining walls approximately 197 m in length approaching the north tunnel entrance and 221 m in length approaching the south tunnel entrance.

The tunnel will provide grade-separated transition of the transitway between the alignment in the Manitoba Hydro right-of-way on the west side of the Letellier track and the planned transitway alignment on the east side of the Letellier track. During construction, temporary relocation of the CN Letellier line right-of-way would be required to stage the construction of the tunnel.
12.0 Railway Works

12.0.1 Functional Design Report

12.2.3 AT Path between Chevrier Station and Plaza Station

The transitway project includes an AT Path that parallels the transitway alignment. The design constraints for the Letellier Tunnel do not allow a tunnel width sufficient to accommodate an AT Path through the tunnel. Between Chevrier and Plaza Stations, therefore, the AT Path alignment must be at-grade and cross CN track(s). CN indicated that an alignment for this section of the AT Path that is within the CN Letellier right-of-way would not be acceptable for safety reasons. CN’s preference is to route the alignment via Chevrier Boulevard, Hudson Street, and the Manitoba Hydro right-of-way between the two stations.

12.2.4 Plaza Station

Plaza Station is proposed to be located south of the Letellier Tunnel, opposite Plaza Drive, and would serve the area adjacent to Pembina Highway on the east side of CN Letellier right-of-way and a planned transit-oriented development on the west side of the CN Letellier track. Under an existing agreement between CN and the City, there is a private vehicle crossing of the track adjacent to the planned location for Plaza Station. This vehicle crossing is to be removed and replaced with an alternative pedestrian/cycling facility that links Plaza Station with the west side of the track. Further discussion about this issue is required between the City and CN.

12.2.5 CN Rail Bridge over Bishop Grandin Boulevard

Between the south end of the Letellier Tunnel and a point south of Markham Road, the existing track and railroad crossing signal systems will be relocated westerly within the CN Letellier right-of-way to accommodate the transitway alignment. This work will include the construction of a new CN Rail Bridge over Bishop Grandin Boulevard parallel to the existing rail bridge over Bishop Grandin. A new Transitway Bridge over Bishop Grandin Boulevard would be constructed in the current location of the existing rail bridge.

CN indicated that it would only allow approximately an eight-hour shutdown of its Letellier line to accommodate this work as well as the cut over the main-track. CN will review and advise the maximum block length permitted once additional design and construction details are available for review and acceptance.

12.2.6 Letellier Subdivision Works (South of Letellier Tunnel)

The 1994 City/CN agreement as it relates to the Letellier Subdivision is discussed in Section 3.1.1. From its perspective, CN noted that the two major points in the agreement are that the City needs to provide CN 180 days of notice to invoke the agreement and that all track relocation and other CN work needs to be completed within a 2-year time frame from notice.

According to 2006 data from Transport Canada, an average of three trains per day use the Letellier line. The maximum permitted train speed on the Letellier line is 25 mph which classifies it as a “Class II” track.

The transitway alignment in the section between the Letellier Tunnel and a point south of Markham Road requires relocation of the Letellier line in a westerly direction. The initial option was to relocate the track by approximately 7.62 m, with a provision for CN service road along the east side of the re-positioned Letellier track between Bishop Grandin Boulevard and Markham Road. This offset was based on the 1994 agreement which states the existing 99 ft right-of-way will be shared equally with the City and CN and the westerly 49.5 ft would remain CN right-of-way. The 7.62 m (25 ft) relocation was determined by placing the relocated CN Letellier track in the center of CN’s revised right-of-way.

During the public consultation for the project, residents of Waverley Heights expressed concerns about this relocation with respect to safety and noise. Upon subsequent review, CN and the City agreed to a reduced offset of 5.7 m (which is similar to the offset used for the Stage 1 transitway along Donald Street) and the re-positioning of the CN service road on the west side of the Letellier track in the section between Bishop Grandin Boulevard and Markham Road. The proposed track relocation is shown in plan view in Figure 61 and in cross-section in Figure 10.

During meetings with CN, inquiries were made about any internal CN requirements and/or procedures that would be required as part of the Letellier line relocation. CN indicated it was not aware of any and that it would respond to Dillon/AECOM if any were required, upon receipt/review of concept track/transitway design drawings. To address local residential concerns, CN was informed that the project includes installation of a noise attenuation wall on the west property line of the City’s feederman right-of-way (which is west of the CN Letellier line) between Bishop Grandin Boulevard and a point south of Markham Road.

CN indicated that, with the service road located on the west side of the Letellier line and with the offset reduced to 5.7 m from the 7.62 m within the Letellier subdivision, space on the west side of the track would be maximized for right-of-way drainage, snow storage and the service road. The revised relocation of the Letellier track in a westerly direction to 5.7 m (18.7 ft) from the existing centerline of the Letellier track meets CN’s needs. In addition to reducing the noise and vibration impacts on adjacent properties, the 5.7 m offset would also be sufficient if a second track or siding/passing track were built within the CN right-of-way in the future.

12.2.7 Crossings of the CN Letellier Track

New traffic signals to be installed at Chancellor Drive and at Markham Road where these streets intersect the transitway and the Letellier track will provide green time to vehicles on Chancellor Drive and on Markham when there are no BRT buses or CN trains operating through the intersections. Buses operating on the transitway will use a Transit Signal Priority system to communicate with the traffic signal controller at each of these intersections as they approach the intersections. When a bus is detected, the traffic signal will provide the appropriate signal phase to allow the bus to pass through the intersection with no or minimal delay. When a CN train is crossing these intersections, railway warning devices will be activated to stop vehicles on Chancellor and on Markham and transitway buses intending to turn west onto Chancellor or Markham.
The back-to-back flashers and the lowering of the vehicle and pedestrian gates will be activated in accordance with AREMA standards in advance of the train reaching the crossing. The flashers shall be placed at an acceptable angle so that motorists on Chancellor Drive and on Markham Road and operators of buses intending to turn west from the transitway onto Chancellor Drive or onto Markham Road both can see the warning device to inform them that a train is passing and that the vehicle gates are lowered.

If the appropriate sight angle of the flashers cannot be achieved during detailed design so that both motorists and bus operators can see the flashers, an additional flasher will be required to be installed to warn operators of buses on the transitway. A description and illustration of the anticipated signalized intersection control and the traffic signal operating scheme outlining possible scenarios for the crossing operations are included in Appendix M. These signal plans are preliminary in nature and will require refinement during detailed design.

CN is in general agreement with the upgraded and/or relocated signalization requirements at existing grade-level public crossings to accommodate both the Letellier line and Transitway, and is aware that although more difficult than a standard intersection, similar situations exist in other locations. Further discussions with CN on this matter will be required during detailed design.

Under an existing agreement with the City of Winnipeg, there is a private vehicle crossing of the Letellier track in the vicinity of Plaza Station. This vehicle crossing is to be removed and replaced with an alternative pedestrian/cycling facility that links Plaza Station with the west side of the track. Further discussion about this issue is required between the City and CN. Proposed layouts for the crossings of the Letellier track are included in Appendix M.

### Functional Design of Railway Works

The functional design, plan, and profile of the required railway works is documented in Appendix N. The remainder of this section provides additional information.

#### Roadbed

The functional design for the railway works is based on a standard design for Class II trackage. A soils investigation by a geotechnical engineer, including soils lab testing, will need to be completed in the early stage of the detailed design to review the engineering characteristics of existing soil conditions within the proposed railway construction limits. It is critical in new embankment construction to determine if subsurface materials as well as subsurface and surface drainage conditions encountered during sampling require any special construction practices beyond what is typically specified.

The track roadbed is comprised of sub-grade, sub-ballast, and ballast. The top stratum of granular material in the track structure is the ballast. Its main purposes are to:

- Support the track superstructure and, in combination with the sub-ballast, distribute its loads on the sub-grade roadbed;
- Anchor and restrain the track from longitudinal and lateral movements;
- Drain rainwater freely within the substructure; and,
- Facilitate fine adjustment of track alignment, grade and cross level.

### Track Structure Requirements

The track structure requirements are as follows:

**CN Rivers Subdivision and CN Letellier Subdivision:**
- Track Material: 136 lb. continuous welded rail (CWR) on hardwood cross ties;
- Ballast depth: 300 mm (12 in) below base of cross tie and;
- Ballast shoulder: 300 mm (12 in) beyond end of cross tie (for CWR).

**Spur (Non-Main) Line Track:**
- Track Material: 115 lb. jointed rail on hardwood cross ties;
- Ballast depth: 300 mm (12 in) below base of cross tie and;
- Ballast shoulder: 150 mm (6 in) beyond end of cross tie (for CWR).

Existing track structure is made of jointed rail. To minimize train noise where the CN Letellier Subdivision is relocated closer to adjacent residential developments, it is required that continuous welded rail (CWR) with premium ties and fasteners be installed. All tie plates, spikes, anchor pattern, class of ballast, etc. shall conform to CN engineering track standards for Class II trackage.

### Turnout Requirements

Rail turnout requirements are as follows:

- CN Rivers Subdivision turnouts: CN #10, 136lb., RBM type frog, power operated;
- CN Letellier Subdivision turnouts: CN #10, 136lb., RBM type frog, manually operated; and,
- Spur (Non-Main) track turnouts: CN #8sp, 115 lb., SGM type frog.

All track removal shall be salvaged and sorted according to CN marking specifications and stockpiled at a material laydown area designated by CN.

### Utilities

Based on previous experience with rail track construction in the Fort Rouge Yards during the Southwest Transitway – Stage 1 project, it is expected the SWT2-Pembina Underpass project will require public utility infrastructure modifications for the new CN Rail Bridge over Pembina Highway. Based on existing knowledge of the site, at a minimum, Bell and Rogers fibre optic cables and junction boxes are present and will require protection and/or relocation. While a preliminary assessment of utility crossings of the CN Letellier track was undertaken, a detailed site investigation and evaluation will be required during detailed design to determine utility protection and/or relocation requirements at railway crossings. The utility modifications would be undertaken prior to commencement of the construction of new railway embankments.
12.3.5 CN Letellier Crossing Signals

As discussed above, new grade level crossing protection signal work is required at the following crossings:

- Chancellor Drive intersection with the Letellier track and transitway;
- Markham Road intersection with the Letellier track and transitway.

At Chancellor and at Markham Road, these works include flashing lights, bells and gates on either side of the CN Letellier track to warn motorists, and flashing lights and gates on either side of the track to warn pedestrians using the sidewalks that cross the tracks. Note that the design for the new railway crossing signals will need to be integrated with that for the traffic signals that will be implemented by the City for the transitway crossings of Chancellor Drive and Markham Road.

Note that these works will be required to be completed prior to the relocation of the Letellier track.

12.3.6 Crossing Surfaces

As the relocated Letellier track must be in service prior to the removal of the existing track, the crossing surfaces for the new tracks (i.e., crossing planks) and any required re-surfacing of the street approaches to the tracks must be undertaken in conjunction with the new Letellier track.

12.3.7 Railway Works Related to the Letellier Tunnel

Two existing spur lines that provide a westerly rail connection between the Letellier track and the Fort Garry Industrial Park must be permanently relocated to accommodate the Letellier Tunnel. Both spur lines and connecting tracks are required to remain operational during construction of the tunnel. In addition, a temporary shoofly is required during the construction of the tunnel.

CN Track WC07 (North Spur Line):

Track WC07 must be permanently relocated southerly and its profile must be raised (existing saq removed) to accommodate tunnel construction staging and clearance requirements. The existing CN Letellier Subdivision turnout location is to be maintained and the turnout is to be unaltered.

CN Track WC21 (South Spur Line):

Track WC21 must be permanently relocated northerly to accommodate construction staging for the tunnel. The proposed track WC21 and other R.S. Harris Transport Ltd. track relocations are required to maintain Harris’s existing track and yard configuration. The proposed track re-configuration will improve the existing track geometry (i.e., flatter curves, resulting in lower maintenance and reduced probability of derailment).

CN Letellier Shoofly

A temporary track detour of the CN Letellier track on the east side of its existing alignment is required to facilitate construction of the Letellier Tunnel. This location will allow for optimal tunnel construction staging, while minimizing track relocation costs. The exact location is to be determined during detailed design, with clearance requirements from adjacent Manitoba Hydro towers and the proposed tunnel being verified at that time.
Utility Works

13.1 Manitoba Hydro Transmission, Distribution, and Communication Lines

The project requires removal/relocation of hydro infrastructure (including transmission, communication, and distribution lines) along the transitway alignment. Extensive consultation with Manitoba Hydro has been undertaken to develop a plan of hydro-related work that accommodates the project and the safety, maintenance, and long range planning needs of Manitoba Hydro.

Within each of the three sections of the Manitoba Hydro right-of-way (referred to as Parker Hydro Corridor, North Hydro Corridor, and South Hydro Corridor, respectively), Figure 17a shows the existing arrangement of hydro infrastructure in relation to the proposed transitway alignment. To accommodate the start of project construction in 2016, Manitoba Hydro has committed to the removal and/or relocation of the LT1 transmission line (illustrated in blue) by the spring of 2016. Upon completion of this work by Manitoba Hydro, the resulting arrangement of lines within the hydro right-of-way will be as illustrated in Figure 17b. In relation to the transitway, Manitoba Hydro’s long-term plan for the arrangement of lines within its right-of-way is shown in Figure 17c.

The removal/relocation work to be undertaken by Manitoba Hydro by the spring of 2016, including all design, construction, and construction management, will include the following features to accommodate the transitway:

- The use of tubular towers, rather than lattice towers, for the new transmission lines. The smaller footprint of the tubular towers is required to fit the relocated lines within the reconfigured right-of-way;
- An increase in tower heights in certain locations to ensure sufficient clearance of transitway lighting standards, stations, parking lots, and the Transitway Overpass of McGillivray Boulevard; and,
- Other requirements to meet safety regulations and to accommodate construction of the hydro works in the vicinity of the City of Winnipeg aqueduct and water mains located within the hydro right-of-way.

Throughout the transitway alignment, there are locations where the project will cross Manitoba Hydro communication cables (both overhead and underground). Overhead communication lines will be required to be relocated and underground communication cables will be required to be lowered as required. In addition, there are overhead distribution lines and customer service feeds that cross the transitway alignment. These will need to be redistributed, buried, or reassigned to existing infrastructure to maintain service to hydro customers.

13.2 Street Lighting

New street lighting and cabling is required throughout the entire length of the transit corridor, in all adjacent parking lots, and along new transitway connections to the street system. In addition, existing street lighting where the transitway intersects the street system will be reconfigured. The street lighting will be designed in accordance with the City of Winnipeg’s Guide for the Design of Roadway Lighting and Clear Zone Guideline for Urban Regional Streets, and must include consideration of LED lighting.

13.3 Natural Gas Distribution

The transitway alignment crosses three existing natural gas distribution lines: A 200 mm line along Chevrier Boulevard, a 50 mm line along Chancellor Drive, and a 50 mm line along Markham Road. These lines will be required to be lowered where the transitway crosses them.

13.4 Manitoba Telecom Services Communication Lines

Existing lines cross the transitway alignment at Seel Avenue, Chevrier Boulevard, Manahan Avenue, Chancellor Drive, and Markham Road. Lines that are underground will be required to be lowered where they cross the transitway, overhead lines on poles shared with Manitoba Hydro will be relocated in instances where the shared poles will be required to be moved. While some underground lines are at a depth that will not be affected by project construction, adjustments to their underground cabinets and manholes will be required. The transitway includes two new pump stations to service the underpass or the CN Wye tracks and the Labellier Tunnel. These facilities require MTS connections for telephone service and/or network data lines.

13.5 Other Communications Companies’ Lines

For lines owned by Shaw, Telus, and TeraSpan, there are various underground and overhead lines that will require relocation. Some are shallowly buried along streets that cross the transitway and will be required to be lowered. Other lines that are currently located on Manitoba Hydro poles being relocated will be required to be re-routed. The Pembina Trails School Division has an existing underground fibre optic line that crosses the transitway alignment at Seel Avenue and will be required to be lowered.
14.0 Active Transportation

14.1 Active Transportation Requirements

The existing active transportation path adjacent to the Stage 1 transitway is to be extended along the Stage 2 transitway. The extended primary path is to have the following features:

- A sufficient width to accommodate commuter cyclists, recreational cyclists, wheelchair users, in-line skaters, skateboarders, and pedestrians, with a designated lane for pedestrians and wheelchair users that is separate from the lane used by other wheeled users;
- Connections with existing and planned paths in the active transportation network at several locations along the transitway;
- Signal activation by active transportation users where the path crosses streets at intersections controlled by traffic signals;
- Included in transitway underpass, overpass, and bridge structures, adjacent to the northbound transitway lane (separated from the lane by a physical barrier);
- Directly connected to all stations; and,
- Served by bicycle storage facilities (racks and lockers) at each station.

A plan of the proposed active transportation path and connections is shown in Figure 62 and features the following:

- A primary path on the south and east sides of the Stage 2 transitway, extended from the southern end of the Stage 1 path to Markham Road;
- Due to safety reasons, the primary path is not routed through the Letellier Tunnel. Instead, the path is routed at-grade from Chevrier Station on the west side of the CN Letellier tracks to Plaza Station on the east side of the CN Letellier tracks via Chevrier Boulevard and Hudson Street. Immediately south of Hudson Street, portions of three properties will need to be acquired to enable the path to continue further south towards Plaza Station within the Manitoba Hydro corridor on the east side of the Letellier track;
- Signal activation by active transportation users at path intersections with the following streets: Georgina Street, Clarence Avenue, Chevrier Boulevard, Chancellor Drive, Markham Road, Southpark Drive at Pembina Highway, and at University Crescent; and,
- The primary path will have connections to existing/planned paths and destinations in adjacent areas, including:
  a. The existing path adjacent to the Stage 1 transitway (with an improved connection to the path on the south side of Jubilee Avenue);
  b. Existing and planned active transportation paths adjacent to Pembina Highway between Jubilee Avenue and Harrow Street;
  c. Existing sidewalks and streets on Rockman Street, Daniel Street, Beaumont Street, Georgina Street, and Planet Street;
  d. Existing and planned active transportation paths on Hurst Way, Sommerville Avenue, Seel Avenue, McGillivray Boulevard, Waller Avenue, and the Bishop Grandin Greenway;
  e. Through existing parks to Farwell Bay and Marshall Crescent;
  f. The Pembina Highway Cycle Tract between Chevrier and Plaza Drive;
  g. To the former Sugar Beets lands, owned by Hopewell Developments, located west of the CN Letellier subdivision opposite Plaza Station;
  h. The Pembina Highway Cycle Track between Bishop Grandin and Markham;
  i. On the north side of Southpark Drive and through the Southwood lands to the University of Manitoba; and,
  j. To other locations as may be determined during detailed design.

14.2 Design Criteria

The design criteria for the active transportation paths are shown in Table 45.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Requirements</td>
<td>Paths with separate lanes for cyclists and pedestrians are to have a consistent orientation of the lanes throughout the path length (assists visually impaired pedestrians to determine where to expect cyclists);</td>
</tr>
<tr>
<td></td>
<td>Where space permits, cyclist and pedestrian paths are to be separated by a strip of grass or other planting;</td>
</tr>
<tr>
<td></td>
<td>Paths are to be graded to ensure positive drainage and year-round use;</td>
</tr>
<tr>
<td></td>
<td>Paths are to meet all relevant accessibility and universal design standards of the City of Winnipeg;</td>
</tr>
<tr>
<td></td>
<td>Paths are to meet the CPTED Principles of the City of Winnipeg (access/egress design must consider potential for user entrapment; path alignment must provide views into and along the path);</td>
</tr>
<tr>
<td></td>
<td>Path intersections at roadways should be at right angles to the roadway and provide clear sight lines between motorists and pedestrians/cyclists;</td>
</tr>
<tr>
<td></td>
<td>Access control barriers (to prevent vehicular access); speed control measures; and, traffic signage for cyclists are to be provided where paths intersect with roadways;</td>
</tr>
<tr>
<td></td>
<td>Connection paths are to cross the transitway runningway only at stations and at controlled roadway intersections;</td>
</tr>
<tr>
<td></td>
<td>Shaded rest spots and benches should be provided at reasonable intervals along pathways;</td>
</tr>
<tr>
<td></td>
<td>Paths are to be lit by transitway street lights and, where necessary, by additional dedicated path lighting; and,</td>
</tr>
<tr>
<td></td>
<td>Paths are to support operation of City maintenance vehicles.</td>
</tr>
</tbody>
</table>

For the purposes of this report, the term Active Transportation refers to any form of human-powered transportation, including walking, cycling, using a wheelchair, in-line skating, or skateboarding. A path designated for active transportation users is referred to as an AT Path or a Multi-Use Path (MUP) in this report.
### Southpark Drive Complete Street (see Figure 13 for cross-section)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Path Width</td>
<td>4.5 m</td>
</tr>
<tr>
<td>Width of Pedestrian Portion</td>
<td>1.4 m</td>
</tr>
<tr>
<td>Width of Cycling Portion</td>
<td>2.9 m</td>
</tr>
<tr>
<td>Width of Colour Contracting Stamped Tactile Dividing Strip (where space does not permit dividing strip or planted material)</td>
<td>0.2 m</td>
</tr>
<tr>
<td>Width of dividing strip of grass or planted material (where space permits)</td>
<td>1.0 m</td>
</tr>
<tr>
<td>Painted Centre Yellow Line on Cyclist Portion</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum Longitudinal Slope of Path</td>
<td>4.95%</td>
</tr>
<tr>
<td>Maximum Cross Slope of Path</td>
<td>2.00%</td>
</tr>
<tr>
<td>Depth of Asphalt Path</td>
<td>75 mm</td>
</tr>
<tr>
<td>Depth of Base Course</td>
<td>75 mm</td>
</tr>
<tr>
<td>Depth of Crushed Sub-Base</td>
<td>150 mm</td>
</tr>
<tr>
<td>Geotextile Fabric Separation (non-woven)</td>
<td>Yes</td>
</tr>
<tr>
<td>Subgrade Compaction</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Note

- The City of Winnipeg plans to undertake, as a separate initiative, the design of identification and wayfinding signs for Winnipeg’s active transportation network. Signage standards developed by this initiative will be used for the active transportation facilities included in the project.
- During the detailed design of the active transportation infrastructure, consultations with the City’s Active Transportation Coordinating Group (ATCG) will be required.
15.0 Lighting for Stations and Pathways

While regular street lighting will be installed throughout the length of the transitway, additional lighting is required in station areas and along portions of the active transportation pathways where the transitway street lights do not provide sufficient illumination. In general, the guidelines used for pedestrian lighting for Stage 1 of the Southwest Transitway are used for the Stage 2 project.

15.1 Design Guidelines for Station Lighting

The following guidelines are used for the design of station lighting:

- **Light levels on the platform must be a minimum of 75 lux under the station canopies and 40 lux throughout the remainder of the station with smooth lighting transitions;**
- **Lighting must be included in the roof structures of all canopies and shelters;**
- **The light source for canopies and shelters must use a LED system with polycarbonate diffusers;**
- **Pedestrian lights are to match the style and type of fixture used for pedestrian lights in the Southwest Transitway – Stage 1 stations;**
- **The light source for pedestrian lights must be LED;**
- **Pedestrian lights must be located behind the platform (a minimum clear area of 3 m is required on the platform so passenger sight lines of arriving buses are not obscured);**
- **The spacing of pedestrian lights must be arranged to provide the required lighting levels on station platforms;**
- **Light level measurement must include all light sources, including street lights, pedestrian lights, canopy lights, and shelter lights;**
- **All lighting must be equipped with shielding, lenses, or cut-off devices to eliminate light trespass and glare for adjoining properties; and,**
- **All LED lighting must be of current technology at the time of construction.**

15.2 Design Guidelines for Pathway Lighting

The following guidelines are used for the design of pathway lighting:

- **Light levels on pathways must comply with the City of Winnipeg (Parks Division) requirements for multi-use pathways;**
- **The design and installation of the pathway lighting must be coordinated with Manitoba Hydro;**
- **The pathway lighting design must be integrated with rest spot and bench locations, pathway intersections, and station lighting;**
- **Pathway lights are to match the style and type of fixture (e.g., carriage lights) used for pathway lights in the Southwest Transitway – Stage 1 project;**
- **The light source, to be approved by Manitoba Hydro, should be LED;**
- **The pathway lighting must be equipped with shielding, lenses, or cut-off devices to eliminate light trespass and glare for adjoining properties; and,**
- **All LED lighting must be of current technology at the time of construction.**
16.0 Landscaping and Aesthetics

16.1 Landscaping and Aesthetics Requirements

The landscaping and aesthetic design is required to:

- Be consistent with landscaping and aesthetic treatments (including use of rapid transit logo and colours) for Stage 1 of the Southwest Transitway;
- Provide Rapid Transit themed gateway features at strategic locations on the transitway (e.g., bus access points, Letellier Tunnel entrances);
- Retain and protect existing vegetated areas, where possible;
- Use strategic plantings and aesthetic treatments to enhance the appearance of structures, retaining walls, and noise attenuation walls;
- Locate strategic plantings in station areas that enhance station architecture, define and enhance pedestrian paths and waiting areas, screen parking areas, and screen service and maintenance areas;
- Provide shade at rest spots and benches, where possible;
- Use treatments along active transportation facilities that define the paths, screen unpleasant views, and provide pedestrian comfort; and,
- Provide space for public art (e.g., interpretive/historical features integrated into stations, planters, fencing, retaining walls, tunnel walls, etc.).

16.2 Design Guidelines for Landscaping and Aesthetics

The following design guidelines are used for landscaping and aesthetics:

- Adherence to principles of sustainable landscapes, including use of naturalized plantings that are salt tolerant, that are appropriate for the location, and that require low maintenance;
- Adherence to CPTED principles;
- Compliance with the Universal Design Policy, the Universal Design Guiding Principles, and the Accessibility Design Standards of the City of Winnipeg;
- Tree plantings must comply with guidelines in the “City of Winnipeg Tree Planting Details and Specifications - Downtown Area and Regional Streets” document;
- Tree plantings must comply with City of Winnipeg Forestry Guidelines (e.g., variety of deciduous and coniferous trees, with no more than 30% of a single variety);
- Compliance with requirements specified by the City of Winnipeg Naturalist, including for use of native grasses;
- Preparation of a tree protection plan (prepared by a certified arborist) prior to construction;
- Raised planters are to be used for trees and shrubs at stations, where possible;
- Street trees in pavement require a minimum of 8.5 cubic metres of soil per tree;
- All planting areas at stations and in Park and Ride lots require a subgrade drainage system connected to the transitway drainage system;
- Precast concrete paving stones, consistent with those used for Stage 1 of the transitway, are required to define platform areas, pedestrian amenity zones, and bus stop pole locations in stations;
- Yellow detectable warning panels are required to be installed in a continuous band along platform edges in stations;
- Deciduous shade trees are to be provided along the length of the primary multi-use active transportation path;
- Benches and waste receptacles are to be provided at rest spot and bench areas;
- On the transitway connection between the CN Letellier right-of-way and the University of Manitoba, deciduous street trees are to be provided in the sodded boulevards on both sides of the street/runningway;
- At on-street bus stops on the transitway connection between the CN Letellier right-of-way and the University of Manitoba and on the university campus, deciduous trees in pavement (with a minimum of 8.5 cubic metres of soil per tree) are to be planted where possible, and precast concrete paving stones are required to define platform areas, pedestrian amenity zones, and bus stop pole locations; and,
- Designated snow storage sites, established in consultation with the Public Works Department and project stakeholders, are to be located along the transitway at places that do not conflict with landscaping/aesthetic treatments at stations or with transitway gateway features.

16.3 Brenda Leipsic Dog Park

In 2007, the City of Winnipeg entered into a 3-year agreement with Manitoba Hydro to lease land within the Manitoba Hydro right-of-way for the purposes of an off-leash dog park. The original agreement, which expired in July 2010, has been updated and the area has continued to be used as the Brenda Leipsic Dog Park.

The existing dog park is approximately 32 acres in size and is located north of Parker Avenue between Hurst Way and Daniel Street. An unimproved area at the west end of the dog park, accessed from Hurst Way, is used for vehicle parking by dog owners.

As the alignment for Stage 2 of the transitway traverses through the existing dog park, a reconfiguration of it will be necessary if the City and Manitoba Hydro determine that a dog park is to be maintained within the Manitoba Hydro right-of-way. An option for a reconfiguration (with a comparison to the limits of the existing dog park) is shown in Illustration 34.
The reconfigured option, approximately 14.5 acres in size, would be located to the west and to the north of the transitway between Edderton Avenue and Georgina Street (in the area between McGillivray Station and Parker Station) and would feature:

- Fencing to keep dogs within the off-leash area;
- A dedicated vehicular approach from the planned easterly extension of Hurst Way; and,
- A designated parking area for the vehicles of dog owners.

During detailed design for the transitway, further discussions with the Parks and Open Space Division of the City’s Public Works Department and with Manitoba Hydro will be necessary to determine whether a dog park is to be maintained in the area and, should the City and Manitoba Hydro mutually agree to maintain a dog park, to determine design requirements for the reconfigured area.

**ILLUSTRATION 34: RECONFIGURATION OPTION FOR BRENDA LEIPSIC DOG PARK**
17.0 Fencing

The following fencing is required for the project:

- Decorative stainless steel fence (incorporating the rapid transit logo) mounted on the median barrier in the following stations: Parker, McGillivray, Clarence, Chevrier, Plaza, Chancellor (separate ones for the southbound and northbound portions of the split station), and Markham;
- Standard fencing between a reconfigured Brenda Leipsic Dog Park and the transitway (see Section 16.3);
- Standard fencing between the transitway runningway and the rail track within the CN Letellier right-of-way;
- Standard fencing between the transitway runningway and the active transportation path within the CN Letellier right-of-way;
- Decorative fencing between stations and the rail track within the CN Letellier right-of-way;
- Standard fencing adjacent to the retaining walls of the Letellier Tunnel; and,
- Standard fencing on the east, north, and west sides of IGF Station (to prevent pedestrian use of bus access, bus egress, and bus circulation areas of the station).
A noise attenuation wall is required to reduce the noise impacts of freight train operations for residents of Waverley Heights. The noise attenuation wall, of concrete construction and incorporating appropriate aesthetics, is to be located on the west property line of the City’s feedermain easement (as shown in Figure 10) between the north end of the residential area (opposite Lake Village Road) and a point south of Markham Road. The recommended height of the wall, at 5.0 m, is to screen the top elevation of a passing train.
The following systems are required for the Southwest Transitway:

- Electronic BUSwatch displays signs;
- Bus Arrival Warning System;
- Closed Circuit TV system at stations and at strategic points on the transitway; and,
- Bus Operations Message Display Signs at strategic points on the transitway.

19.1 BUSwatch Display Signs

BUSwatch display signs, based on the same technology used for the existing network of BUSwatch signs at major on-street stops and at Stage 1 transitway stations (equipment supplied by Ferrograph Limited, systems integration by Winnipeg Transit), are to be installed on each platform of the stations and stops shown in Table 46. Note that 10 Type B signs and 18 Type C signs are required.

<table>
<thead>
<tr>
<th>Station/Stop</th>
<th>Platform</th>
<th>BUSwatch Sign Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parker Station</td>
<td>Westbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Eastbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>McGillivray Station</td>
<td>Southbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>Clarence Station</td>
<td>Southbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>Chevrier Station</td>
<td>Southbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>Plaza Station</td>
<td>Southbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>Chancellor Station</td>
<td>Southbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>Markham Station</td>
<td>Southbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Ferrograph Type C</td>
<td>1</td>
</tr>
<tr>
<td>BB Southpark, N/S Pembina</td>
<td>Eastbound</td>
<td>Ferrograph Type B</td>
<td>1</td>
</tr>
<tr>
<td>WB Southpark, F/S Pembina</td>
<td>Westbound</td>
<td>Ferrograph Type B</td>
<td>1</td>
</tr>
<tr>
<td>Southwood Lands (assume two stations, locations to be determined)</td>
<td>2 per station</td>
<td>Ferrograph Type B</td>
<td>4</td>
</tr>
<tr>
<td>IG F Bus Stops at University Crescent</td>
<td>Eastbound</td>
<td>Ferrograph Type B</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Westbound</td>
<td>Ferrograph Type B</td>
<td>1</td>
</tr>
<tr>
<td>NB University Crescent, Opposite Chancellor Matheson</td>
<td>Northbound</td>
<td>Ferrograph Type B</td>
<td>1</td>
</tr>
<tr>
<td>WB Dafoe Road at School of Music</td>
<td>Westbound</td>
<td>Ferrograph Type B</td>
<td>1</td>
</tr>
<tr>
<td>University of Manitoba Station</td>
<td>Westbound</td>
<td>Ferrograph Type C</td>
<td>4</td>
</tr>
</tbody>
</table>

19.2 Bus Arrival Warning System

A bus arrival warning system, based on the same technology used for the existing system installed at Osborne, Harkness and J ubilee Stations (design by Nova 3 Engineering, equipment supplied by Integrated Protection Technologies), is to be installed at the stations shown in Table 47. The system provides an audible warning (chime) and a visual warning (flashing light) at crosswalks of the runningway within stations as buses approach the stations on the high-speed section of the transitway.

<table>
<thead>
<tr>
<th>Station</th>
<th>Bus Direction of Approach</th>
<th>Warnings to be Provided for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parker Station</td>
<td>Westbound</td>
<td>Rapid transit buses and feeder buses</td>
</tr>
<tr>
<td></td>
<td>Eastbound</td>
<td>Rapid transit buses and feeder buses</td>
</tr>
<tr>
<td>McGillivray Station</td>
<td>Southbound</td>
<td>Rapid transit buses and feeder buses</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Rapid transit buses and feeder buses</td>
</tr>
<tr>
<td>Clarence Station</td>
<td>Southbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td>Chevrier Station</td>
<td>Southbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td>Plaza Station</td>
<td>Southbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td>Chancellor Station</td>
<td>Southbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td>Markham Station</td>
<td>Southbound</td>
<td>Rapid transit buses</td>
</tr>
<tr>
<td></td>
<td>Northbound</td>
<td>Rapid transit buses</td>
</tr>
</tbody>
</table>

19.3 Closed Circuit TV Surveillance System

For purposes of operations management and safety, it is the intention of Winnipeg Transit to install a closed circuit TV (CCTV) surveillance system along the full length of the Southwest Transitway. Cameras would be located within all stations and parking lots and at strategic points between stations on the transitway. A control room for the system would be located within the administration building at Fort Rouge Garage.
As this system must be integrated with existing CCTV systems operated by Winnipeg Transit and other City departments and with information systems for the Transit Control Centre, it will be supplied and installed as a separate City initiative. As part of the transitway project, however, the necessary conduit for the CCTV system’s cabling is to be installed along the transitway.

### 19.4 Bus Operations Message Display Signs

For emergency response and special operations situations, it is the intention of Winnipeg Transit to install electronic bus operations message display signs at strategic points along the transitway to enable Transit Control Centre staff to provide instructions to bus operators. These display signs would be sited at the following locations:

- At the south end of Harkness Station to direct southbound buses away from emergency events in Osborne Station and in the Stage 1 tunnel;
- At the intersection of Warsaw Avenue with the transitway to direct southbound buses away from emergency events in the Stage 1 tunnel and to direct buses operating on eastbound Warsaw away from emergency events in Osborne Station and in the Stage 1 tunnel;
- Immediately south of the intersection of the Fort Rouge Garage access road with the transitway to direct northbound buses away from emergency events in the Stage 1 tunnel and in Osborne Station;
- At the south end of Chevrier Station to direct southbound buses away from emergency events in the Letellier Tunnel; and,
- At the south-end of Chancellor Station to direct northbound buses away from emergency events in the Letellier Tunnel.

As this system must be integrated with existing information systems for the Transit Control Centre, it will be supplied and installed as separate City initiative. As part of the transitway project, however, the necessary conduit for the message display system’s cabling is to be installed along the transitway.
20.0 Transit and Traffic Operational Requirements

The following operational requirements will be required to be coordinated with the following City of Winnipeg departments:

- Traffic Services Branch of the Public Works Department:
  - Lane painting and permanent roadway signage on the transitway, at transitway connections with streets, at bus access/egress locations on the transitway, and for closures/realignments of existing streets; and
  - Directional and wayfinding signage required for temporary traffic detours during construction.

- Traffic Signals Branch of the Public Works Department:
  - Upgrade of existing traffic signals at the intersection of Markham Road & Pembina Highway;
  - Design and installation of new traffic signals at transitway intersections with the following streets: Georgina Street, Clarence Avenue, Chevrier Boulevard, Chancellor Drive, Markham Road, Southpark Drive at Pembina Highway, and at University Crescent; and
  - Design and installation of signal activation by active transportation users at path intersections with the following streets: Georgina Street, Clarence Avenue, Chevrier Boulevard, Chancellor Drive, Markham Road, Southpark Drive at Pembina Highway, and at University Crescent.

- Traffic Signals Branch of the Public Works Department and the Transit Department:
  - Design, integration, and implementation of transit signal priority for rapid transit service at transitway intersections with the following streets: Georgina Street, Clarence Avenue, Chevrier Boulevard, Chancellor Drive, Markham Road, Southpark Drive at Pembina Highway, and at University Crescent.

- Transit Department:
  - Special operational signage on the transitway (e.g., intersection reference numbers, wayside identification numbers, unauthorized use signs);
  - Integration of the transitway’s electronic BUSwatch signs with the existing system;
  - Design and implementation of any future Bus Operations Message Display system on the transitway; and,
  - Design, integration, and implementation of any future CCTV system on the transitway.
21.0 Property Requirements

A map of property requirements for the SWT2-Pembina Underpass project is contained in Appendix O. For each affected property, the map identifies the nature of the acquisition, the property location, and the approximate area (in square metres). The nature of the property requirements is summarized in Table 48.

The Real Estate Division of the City’s Planning, Property and Development Department has commenced work to acquire these properties prior to the start of the SWT2-Pembina Underpass project in the spring of 2016.

**TABLE 48: SUMMARY OF PROPERTY REQUIREMENTS FOR SWT2-PMBINA UNDERPASS PROJECT**

<table>
<thead>
<tr>
<th>Type of Acquisition</th>
<th>Affected Properties</th>
<th>Total Area (m²)</th>
<th>% of Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN Land to be Acquired for SWT2-Pembina Underpass project</td>
<td>4</td>
<td>65,621</td>
<td>19.6%</td>
</tr>
<tr>
<td>Manitoba Hydro Land to be Acquired for SWT2-Pembina Underpass project</td>
<td>1</td>
<td>61,932</td>
<td>18.4%</td>
</tr>
<tr>
<td>Manitoba Hydro Land to be Leased for SWT2-Pembina Underpass project</td>
<td>21</td>
<td>112,982</td>
<td>33.7%</td>
</tr>
<tr>
<td>Private Land to be Acquired for SWT2-Pembina Underpass project</td>
<td>35</td>
<td>71,628</td>
<td>21.9%</td>
</tr>
<tr>
<td>CN Land to be Acquired for Manitoba Hydro</td>
<td>2</td>
<td>980</td>
<td>0.3%</td>
</tr>
<tr>
<td>City Land to be transferred to Private Owner</td>
<td>2</td>
<td>1,055</td>
<td>0.3%</td>
</tr>
<tr>
<td>Private Land to be Acquired for CN</td>
<td>7</td>
<td>12,177</td>
<td>3.6%</td>
</tr>
<tr>
<td>University of Manitoba Land to be Acquired for Public Right-of-Way in Southwood Lands</td>
<td>2</td>
<td>7,480</td>
<td>2.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>74</strong></td>
<td><strong>335,855</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
22.0 Construction Sequencing Considerations

The SWT2-Pembina Underpass project comprised of the Southwest Transitway - Stage 2 project, the Pembina Underpass project, and associated land drainage works, is planned to be delivered through a PPP.

The RFQ/RFP and Project Agreement phases of the PPP procurement are expected to be completed by the first quarter of 2016 with detailed design and construction planned over the 2016 – 2019 period.

The final schedule for detailed design and construction will be developed by the successful PPP consortium in collaboration with the City and will be required to consider the following:

- The relocation of existing transmission lines within the Manitoba Hydro corridor (referred to as “early works”) is required to be completed by Manitoba Hydro by the spring of 2016;

- Railway works (including temporary track detours, the new CN Rail Bridge over Pembina Highway, the Transitway Underpasses of the CN Wye tracks, the Letellier Tunnel, the new CN Rail Bridge over Bishop Grandin Boulevard, the westerly relocation of the CN Letellier track, and all associated rail realignments) will be required to be completed in advance of transitway construction in the corresponding areas;

- The large structural component of the PPP project (new CN Rail Bridge over Pembina Highway, demolition of existing CN Rail Bridge over Pembina Highway, new Transitway Bridge over Pembina Highway, new AT Underpass of Jubilee Ramp, new Transitway Underpasses of CN Wye Tracks, new Transitway Overpass of McGillivray Boulevard, Letellier Tunnel, new CN Rail Bridge over Bishop Grandin, demolition of existing CN Rail Bridge over Bishop Grandin, and new Transitway Bridge over Bishop Grandin) will require structural construction works throughout the 2016 – 2019 construction period;

- The high modal split for events at Investors Group Field requires that IGF Station and transit access between IGF Station and Pembina Highway be constructed as soon as possible (prior to June 1 of the second year of construction), while respecting the University of Manitoba’s planning process for the Southwood lands;

- Passenger platforms and Park and Ride lots at McGillivray and Clarence Stations are to be built at the earliest opportunity (even in advance of runningway construction) to enable use by special transit service for events at Investors Group Field. If these facilities are constructed in advance of the transitway runningway, buses would, as an interim measure, operate on the regular street system between the stadium and these stations;

- All other stations, active transportation facilities, and landscaping are to be built in the latter parts of the construction period; and,

- The traffic congestion on Pembina Highway that will result during the construction of the new CN Bridge over Pembina Highway, the Transitway Bridge over Pembina, the widening of Pembina Highway, and associated drainage works will require that a rapid transit routing alignment be used to provide reliable service during construction. Such an alignment could include a combination of on-street operation, on-street transit priority measures, and transitway runningway segments between structures built prior to the completion of the structures.
23.0 Public Engagement Program

23.1 Overview

The public engagement program was undertaken to assist with the development of a functional design for Stage 2 of the Southwest Transitway. The program was designed to comply with basic public engagement principles of early, regular, and integrated involvement of key stakeholders and the general public throughout the development of the functional design.

The consultation program was carried out as a two-round process over a period of five months between October 2013 and February 2014. The full “Public Engagement Report” for the Southwest Transitway – Stage 2 project, prepared by Landmark Planning & Design Inc., is attached in Appendix P and describes the consultation methodology and project inputs received for both rounds of the consultation program.

The focus for stakeholder feedback was specifically directed towards the transitway alignment for Stage 2 that had previously been approved by City Council. A substantial amount of useful, project-relevant feedback was received and integrated into decision-making by the functional design team. Many stakeholders provided feedback concerning other alignment options not selected for study by Council, as well as feedback concerning the suitability of rapid transit as an overall City direction. Stakeholders were made aware that this type of feedback would be received, collected, formalized and provided to City of Winnipeg representatives for their further consideration, while feedback directly associated with the functional design project at hand would be directly incorporated into project decision-making.

23.2 Consultation Methodology

The stakeholder and public engagement process is shown in Illustration 35. The process was carried out using a “two-round” methodology, whereby input was gathered at key milestones during the development of the functional design. Round 1 was conducted early in the process with the purpose of communicating the general alignment, scoping issues, and understanding expectations from stakeholders and the general public. Round 2 was carried out following the development of a draft functional design with the purpose of receiving feedback on the functional design and using that feedback to refine the functional design and respond to participant questions.

Various consultation mechanisms were employed including individual and stakeholder group meetings, public open house events, telephone conversations, public notification and the use of a project website to provide materials, project updates, and accommodate public comment.

There was substantial participation by stakeholder groups and members of the general public. Approximately 800 people participated in one form or another.

23.3 Public and Stakeholder Feedback

Round 1 occurred between October 2013 and December 2013. Round 2 occurred between January 2014 and March 2014. This section summarizes the results of both rounds of the consultation process.

The purposes of the Round 1 consultation were:

- To provide basic, early project information (i.e., scope, timing, design, etc.); and,
- To identify issues and ideas that the design team should consider during the preparation of the functional design.

The purposes of the Round 2 consultation were:

- To provide detailed information relating to the draft functional design, including responses to the issues, concerns and ideas presented by participants in the Round 1 consultation; and,
- To identify opportunities to adjust the draft functional design and/or provide further information based on participant feedback.
The consultation approach included the following components during each of the two rounds of consultation:

- Meeting with approximately 25 internal and external stakeholder groups or individuals (e.g., City departments, utilities, nearby institutions, advocacy groups, etc.);
- Meetings with individuals (i.e., residents, landowners, renters, etc.);
- Small Group Meetings with residents, businesses or property managers with property directly adjacent to the proposed transitway corridor;
- Information sessions for the general public;
- Information provided via a project website; and,
- “Full-time” direct access by phone or email to the public consultation team.

Participants represented a range of perspectives including residents living directly adjacent to the planned transitway, those living nearby, and other Winnipeg citizens living further from the proposed project. Businesses, organized interest groups, land leaseholders and transit users also participated. About half of respondents that participated in Round 1 of the consultation process also participated in Round 2 of the consultation process, indicating good continuity as well as appropriate on-going participation opportunities.

The vast majority of participants in each round of the consultation process indicated that the team members working with participants were helpful, and that the information provided was beneficial.

During Round 1 of the consultation process stakeholders provided a mix of opinions concerning the project:

- Adjacent commercial and multi-family property owners, and owners of vacant land noted the benefits of this project with respect to the potential for the transitway to increase value for transit-oriented development (TOD) on these sites, which, in turn, will increase the City’s property tax base and contribute to OurWinnipeg’s infill development goals along rapid transit corridors. Owners would also like to ensure residents have access to AT pathways along the route;
- Existing and future transit users expressed a range of opinions regarding the Stage 2 project; many were supportive of the new service and the overall rapid transit plan for Winnipeg, while others were not supportive for various reasons as outlined below;
- A significant number of individuals that participated in the consultation expressed a concern regarding the loss of “perceived public space”. The “Parker Lands” are privately held lands mistakenly seen to be public lands due to the frequent use by local residents for strolling, dog-walking, etc. The desire is to “preserve” all or part of these lands;
- There is concern regarding the potential impact to the existing Brenda Leipsic Dog Park; it is apparent that many dog park users think the dog park area is much larger than it is (i.e., the entirety of the “Parker Lands” versus an officially designated area much smaller in size); users are concerned about loss of the dog park;
- Individuals living in homes directly adjacent to the proposed corridor expressed concerns regarding the potential for disruptive effects such as noise, vibration, transitway lighting and odour;
- Individuals living directly adjacent and to the west of Letellier rail line expressed concerns about the potential for increased noise, vibration and risk associated with the potential relocation of the rail line closer to their residences;
- A number of individuals expressed concern regarding potential decreases in transit service on Pembina Highway; and,
- Many participants provided commentary considered to be outside the scope of this functional design project; the commentary can be generally summarized as advocating for: elimination of rapid transit as an option altogether; relocation of the selected rapid transit route to another route (e.g., Pembina Highway, Letellier rail corridor); or concern regarding project cost.

During Round 2 of the consultation process, stakeholders provided a variety of comments concerning the draft functional design including:

- Many respondents indicated that initial concerns had been addressed through the draft functional design. Some respondents continued to suggest an alternative routing for the transitway beyond the scope of the draft functional design study;
- There was substantial support for the AT component of the draft functional design. A number of participants provided specific suggestions for improvement of the proposed AT components;
- A number of participants provided suggestions for transit service, particularly concerning the frequency of Pembina Highway routes;
- A number of participants indicated an on-going concern about the potential for noise and dust from buses to negatively impact the enjoyment of their properties;
- A number of participants provided suggestions for the placement and design of the stations (i.e., station amenities), including consideration for vision impaired individuals;
- A number of participants provided suggestions for modifying the road system in and around the proposed transitway;
- Commentary concerning the existing Brenda Leipsic Dog Park generally indicated that the provision of an alternative dog park nearby was a reasonable solution;
- Commentary concerning the University of Manitoba access point was generally favourable towards using the Southpark Drive alignment rather than the Markham Road alignment;
- A small number of participants provided both negative and positive commentary concerning proposed Park and Ride locations. Concerns focused on the potential for transit riders to park on nearby residential streets rather than in designated Park and Ride spaces;
- A small number of participants re-iterated a wish to designate areas in the “Parker Lands” for use as a public park; and,
- A small number of participants expressed concern regarding the potential project cost.

19 93% of respondents to the Round 1 Open House comment sheet indicated the team was helpful, and 89% indicated the information was helpful. 99% of respondents to the Round 2 Open House comment sheet indicated the team was either helpful (89%) or somewhat helpful (10%), and 98% indicated the information was either helpful (87%) or somewhat helpful (11%). In Round 2 only four respondents indicated that either the staff or the information were not helpful.
An Issue-Response table is provided in Section 3.0 of the full report in Appendix P. This table summarizes primary concerns or questions raised during both rounds of the consultation process and the response of the study team to each of these matters.

### Follow-Up Adjacent Residents Meetings

At the request of the Public Works Standing Policy Committee of City of Winnipeg Council, the project team arranged for follow-up meetings with residents living directly adjacent to the transitway corridor south of Bishop Grandin Boulevard, where it is proposed for the CN Letellier rail line to be relocated westerly. The intent was to provide this group with any updated information relevant to the proposed rail relocation. Two meetings were held with approximately 35 people in attendance.

Project representatives provided an overview of the project (primarily for those participants that had not participated to date) and also provided current information with respect to the rail relocation aspect of the proposed project, including:

- Updated information concerning a planned noise retention wall, including likely anticipated location, construction style, and height; and,
- Updated information concerning existing and anticipated noise and vibration, including supporting material to suggest that anticipated rail vibration is likely to decrease rather than increase as a result of the proposed works.

Participants indicated appreciation for the additional information. A number of participants indicated on-going concern about the ability to determine whether, post construction, there would be a way of determining whether the constructed works were having an impact on their residences (i.e., potential damage due to vibration and potential disruption due to increased noise). Meeting notes and display materials are provided in the full report contained in Appendix P.
The conceptual Rapid Transit Route Network Plan that is envisioned to operate on the Southwest Transitway is shown in Figure 63. The operational requirements for this network plan were a major consideration in the development of the functional design for the transitway.
Appendix A

Figures
CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

FIGURE 12
TRANSITWAY ALIGNMENT BETWEEN LETELLIER RIGHT-OF-WAY AND UNIVERSITY OF MANITOBA

G:\CAD\138439\_Reports\Functional Design Report-Final\Figure-12.dwg

TRANSPORT STOPS
INTERSECTION MODIFICATIONS
AT PATH

SOUTHPARK     DR
PEMBINA    HWY
MARKHAM     RD
UNIVERSITY CRESCENT
MARKHAM  RD
SNOW  ST
DARTMOUTH  DR
CHANCELLOR MATHESON
INTERSECTION MODIFICATIONS
AT PATH

INVESTORS GROUP FIELD

INVESTORS GROUP FIELD
FIGURE 18
ALIGNMENT IN UNIVERSITY OF MANITOBA SOUTHWOOD LANDS
LONG TERM

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

G:\CAD\138439\_Reports\Functional Design Report-Final\Figure-18.dwg

INTERSECTION MODIFICATIONS

ACTIVE TRANSPORTATION PATH

FOUR LANE ROAD RIGHT OF WAY

FOUR LANE ROAD RIGHT OF WAY

IGF STATION

INVESTORS GROUP FIELD
FIGURE 20 (REVISED)
UNIVERSITY OF MANITOBA STATION - BUS STAGING AREA
TYPICAL CROSS SECTION AT LETELLIER TUNNEL
TYPICAL SECTION AT IGF STATION
(LOOKING EAST)
INTERSECTION MODIFICATIONS

PEDESTRIAN RAMP

ELEVATED WALKWAY FROM STADIUM ENTRANCE LEVEL TO TERMINAL

STADIUM ENTRANCE APPROX. 4.0 m ABOVE GROUND LEVEL

CONCEPT FOR IGF STATION

FIGURE 33

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN
Appendix B

Southwest Transitway - Stage 2: Construction Record Drawings for Deep Utilities
Appendix C

Southwest Transitway - Stage 2: Original Lock Joint and Hyprescon Design Notes for Deep Utilities
CONSERVATIVE DESIGN STRENGTHS
COMBINED INTERNAL-EXTERNAL ANALYSIS
PRESTRESSED CONCRETE & CYLINDER PIPE
REINFORCED CONCRETE CYLINDER PIPE

CLASS A

APPROVED

ALVORD, BURDICK & HOWSON

BY  E. E. Eshelby

DATE  Mar 9, 1959

\[ \omega_1 = \frac{W}{3} \left( \frac{3}{P} \right) \]

\[ W_0 = 5200 \]

3 EDGE BEARING, LBS./LIN. FOOT

INTERNAL PRESSURE P.S.I.

GREATER WINNIPEG WATER DISTRICT
APPROVED  Mar 11, 1959
Manager and Chief Engineer
CONSERVATIVE DESIGN STRENGTHS
COMBINED INTERNAL-EXTERNAL ANALYSIS
PRESTRESSED CONCRETE & CYLINDER PIPE
REINFORCED CONCRETE CYLINDER PIPE

CLASS D

APPROVED
ALVORD, BURDICK & HOWSON

BY E. E. Emerson
DATE Mar 9, 1959

\[ \omega = \frac{W}{3P} \sqrt{P - f_o} \]

\[ d = 7,630 \]

\[ 0 + w = 8,020 \]

\[ 3 \text{ EDGE BEARING, LBS./LIN. FOOT} \]

\[ \text{INTERNAL PRESSURE PSI} \]

GREATERN WINNIPEG WATER DISTRICT
APPROVED Mar 11, 1959

Central Manager and Chief Engineer
CANRON INC.

AWWA C-301 APPENDIX "A" DESIGN

City of Winnipeg
Tender 88-86

1650mm DIAMETER C-301 (E) PIPE

Datas:

Pw = Working Pressure = 350 kPa
Pwh = Transient Pressure = 350 kPa
Pt = Test Pressure = 550 kPa

Pd = Design Pressure = Larger of Pw + Pwh or Pt
= 550 kPa
= 80 P.S.I.

Bd = Trench width = O.D. + 1m = 3m = 9.8 feet

w = unit weight of backfill material = 1925 kg/m3 = 120 lbs/ft3

Ku' = .11

Lf = Load factor = 1.5

A - Condition 1

H = Depth of fill = 3.1 meter = 10 feet

Live Load = AASHTO HS20 LOADING

- Calculation of external load

Wd = External load for trench installation
= 8865 x 1.2 = 10638 lbs/lin.ft.

"Concrete Pipe Design Manual"
Table 29 (D)

WITH

Ku' = .11
w = 120 lbs/ft.3
Bd = 9.8 feet

Live load

WL = 510 lbs./lin.ft. from "Concrete Pipe Design Manual". table 45

Combined analysis (See graph)

For a class 14 pipe

Po = 149 P.S.I.
Wd = 10890 lbs./lin.ft.

For working conditions

Pw/Po = .54

Wd/Lf = .65

For live load

Pw/Po = .54

Wd/Lf + WL /1.5 = .69

CLASS 14 PIPE IS ADEQUATE
Page 4....

B. Condition "2"

H = Depth of fill = 3.49 m = 11.25 feet
Live Load = E85 Railroad

- Calculation of external Load

\[ W_d = \text{External load for trench installation} \]
\[ = 10,160 \times 1.2 = 12,192 \text{ lbs/lin.ft.} \]

"Concrete Pipe Design Manual" Table 29 (d)

With

\[ K_u = .11 \]
\[ w = 120 \text{ lbs/ft.} \]
\[ B_d = 9.8 \text{ feet} \]

- Live Load

\[ W_L = C_{po} \times B_c \times (1 + \text{IF}) \]

from "Concrete Pipe Handbook"

\[ = 8,814 \text{ lbs/ft.} \]

at 3.49 m cover

Where

\[ B_c = \text{Pipe O.D.} = 6.56 \text{ feet} \]
\[ \text{IF} = \text{Impact factor} = .75 \]
\[ p_o = \frac{25}{25 \times (E + 1)} = 2175 \text{ lbs.ft.2} \]
\[ C = .353 \]

\[ E = \text{Cooper Axle Loading} \]
\[ = 85 \text{ KIPS} \]
Combined analysis (see graph 2)

For a class 20 pipe

\[ \frac{P_w}{P_o} = 0.37 \quad \frac{W_d/LF}{W_o} = 0.59 \]

For working conditions

\[ \frac{P_w}{P_o} = 0.37 \quad \frac{W_d/LF + WL/1.5}{W_o} = 1.01 \]

CLASS 20 PIPE IS ADEQUATE
CANRON INC.

AWWA C-301 APPENDIX "A" DESIGN

City of Winnipeg
Tender 88-86
750mm DIAMETER C-301 (65") PIPE

Datas:

Pw = Working Pressure = 690 kPa
Pwh = Transient Pressure = 344 kPa
Pt = Test Pressure = 1000 kPa

Pd = Design Pressure = Larger of Pw + Pwh or Pt
= 800 kPa
1.4
1.25
= 116 P.S.I.

Bd = Trench width = O.D. + 1000mm = 1.92m = 6.3 feet

w = unit weight of soil material = 1925 kg/m3 = 120 lbs/ft3

Ku' = .110

Lf = Load factor = 1.5

A - Condition 1

H = Depth of fill = 3.1 meter = 10 feet

Live Load = HS20 LOADING

Calculation of external load

Wd = External load for trench installation
= 4551 x 1.2 = 5462 lbs./lin.ft. "Concrete Pipe Design Manual" Table 22 (D)

DRAWING REVIEW

The review of this drawing does not in any way relieve the contractor of responsibility for its accuracy or for compliance with the contract documents.

CITY OF WINNIPEG

1479 Buffalo Place, Winnipeg, Manitoba RJJ 1L7

UMA ENGINEERING LTD.

WITH

Ku' = .11
w = 120 lbs/ft.3
Bd = 6.3 feet

Live Load

Wl = 280 lbs./lin.ft. from "Concrete Pipe Design Manual", table 45

Combined analysis (see graph 3)

For a class 16 pipe

Po = 200 P.S.I.
Wo = 6220 lbs./lin.ft.

SO

For working conditions

Pw/Po = .58

\[ \frac{Wd/Lf}{Wo} = .59 \]

For Live Load

Pw/Po = .58

\[ \frac{Wd/Lf + Wl/1.5}{Wo} = .62 \]

CLASS 16 PIPE IS ADEQUATE
B. Condition "2"

H = Depth of fill = 3.5 m = 11.5 feet

Live Load = E85 Railroad

- Calculation of external load

\[ W_d = \text{External load for trench installation} \]

\[ = 5246.5 \times 1.2 \text{ = 6296 lbs/lin.ft.} \]

"Concrete Pipe Design Manual" Table 22 (D)

With

\[ K_u = .11 \]

\[ w = 120 \text{ lbs/ft.3} \]

\[ B_d = 5 \text{ feet} \]

- Live Load

\[ WL = C_p o \times B_c x (1 + I_f) \] from "Concrete Pipe Handbook"

Equation 4.47

\[ = 3928 \text{ lbs/ft. at 3.5m cover} \]

Where

\[ B_c = \text{Pipe O.D.} = 3 \text{ feet} \]

\[ I_f = \text{Impact factor} = .75 \]

\[ p_o = 25 (E + 1) = 2175 \text{ lbs/ft.2} \]

\[ C = .344 \]

\[ E = \text{Cooper Axle Loading} \]

\[ = 85 \text{ KIPS} \]
June 8th, 1988

CANRON INC.

DRAWING REVIEW

The review of this drawing does not in any way relieve the contractor of responsibility for its accuracy or for compliance with the contract documents.

AWWA C-303 PIPE DESIGN

City of Winnipeg
Tender 88-86

Earth Load Calculation

\[ W_d = 4370 \text{ lbs/ft} \]

With

\[ H = \text{earth cover} = 3.7m \times 12 \text{ feet} \]
\[ w = \text{weight of fill material} = 120 \text{ lbs/ft}^3 \]
\[ \theta = \text{bedding angle} = 90 \text{ degrees} \]

Live Load

E85 Railroad Load

\[ W_L = C_p o \beta (I + I_f) \]
\[ = 1402 \text{ lbs/ft} \quad \text{at 3.7 meter cover} \]

Where

\[ B_c = \text{O.D. of pipe} = 2 \]
\[ \beta = \text{Impact factor} = 0 \]
\[ P_o = 25 \left( E + 1 \right) = 2150 \text{ lbs/ft}^2 \]
\[ C = \text{pressure coefficient} = 0.326 \]

Total load on pipe

\[ W_d + W_L = 5772 \text{ lbs/lin.ft.} \]
\[ \leq 7534 \text{ lbs/lin.ft.} \quad \text{(Allowable Earth Load)} \]

Pipe Data

\begin{align*}
\text{m. Dia.} &= 560.000 \text{ mm} (20.000 \text{ in.}) \\
\text{D. pipe (D)} &= 508.000 \text{ mm} (20.000 \text{ in.}) \\
\text{D. Cyli (D)} &= 552.450 \text{ mm} (21.750 \text{ in.}) \\
\text{tan radius (r)} &= 280.593 \text{ mm} (11.047 \text{ in.}) \\
\text{D/2 Dia} &= 5.560 \text{ mm} (0.219 \text{ in.}) \\
\text{1/4 th} &= 1.519 \text{ mm} (0.060 \text{ in.}) \\
\text{lining} &= 20.766 \text{ mm} (0.815 \text{ in.}) \\
\text{rating} &= 25.400 \text{ mm} (1.000 \text{ in.}) \\
\text{dE Area} &= 10100.000 \text{ mm}^2/m (4.772 \text{ in}^2/ft) \\
\text{d/2 area} &= 1519.000 \text{ mm}^2/m (0.718 \text{ in}^2/ft) \\
\text{design pressure} &= 1.037 \text{ Mpa} (150.470 \text{ psi}) \\
\end{align*}

Bedding Data

\begin{align*}
\text{bedding angle} &= 90.000 \text{ degrees} \\
\text{bedding constant} &= 0.096 \\
\text{Julius of Soil Reaction (E')} &= 400.000 \text{ psi} \\
\text{reflection Lag Factor (DL)} &= 1.000 \\
\end{align*}

Section Properties (metric) A

\begin{align*}
\text{Lining} &= 20706.00 \text{ mm} \\
\text{Cylinder} &= 11392.00 \text{ mm} \\
\text{Rod} &= 6500.00 \text{ mm} \\
\text{Coating} &= 30960.00 \text{ mm} \\
\text{Total} &= 69958.00 \text{ mm} \\
\end{align*}

Section Properties (imperial) A

\begin{align*}
\text{Lining} &= 8173.60 \text{ in} \\
\text{Cylinder} &= 4492.70 \text{ in} \\
\text{Rod} &= 2540.00 \text{ in} \\
\text{Coating} &= 9144.00 \text{ in} \\
\text{Total} &= 14261.30 \text{ in} \\
\end{align*}

Allowable loading (imperial units) A

\[ D_1 = 1.00000 \]
\[ D = 20.00000 \text{ in.} \]
\[ E = 4000000.00 \text{ psi} \]
\[ D_1 K = 0.09600 \text{ in}^2/ft \]
\[ \text{ Allowable Loading: } 109555.4 \text{ N/M (7553.7 lb/lin.ft)} \]
500mm (20") DIA. PRETENSIONED CYLINDER PIPE

<table>
<thead>
<tr>
<th>Nom. Dia.</th>
<th>500 mm</th>
<th>Conc. Lining 'A' Nom.</th>
<th>22.2 mm</th>
<th>Std. Pipe Length 7.32 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual I.D.</td>
<td>508.0 mm</td>
<td>Mortar Coating (min.) 'B'</td>
<td>25.4 mm</td>
<td>Nom. Pipe Wall 'T'</td>
</tr>
<tr>
<td>O.D. Cylinder</td>
<td>553.5 mm</td>
<td>Bell Depth 'C'</td>
<td>82.6 mm</td>
<td>O.D. Pipe at Bell 'E'</td>
</tr>
<tr>
<td>Joint Dia.</td>
<td>585.2 mm</td>
<td>Spigot Depth 'D'</td>
<td>95.3 mm</td>
<td>Joint Ring Dwg. M-A-101, M-A-151</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class</th>
<th>Working Pressure kPa</th>
<th>Select</th>
<th>Total Area, As mm²/m²/m</th>
<th>Steel Area mm²/m²</th>
<th>Steel Gauge t mm</th>
<th>Cylinder Area mm²/m²</th>
<th>Cylinder Dia. mm</th>
<th>Spacing 3m</th>
<th>No. per</th>
<th>Cylinder kg/m</th>
<th>Spiral kg/m</th>
<th>Lining Coating kg/m</th>
<th>Weight kg/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>1035</td>
<td>G</td>
<td>2506</td>
<td>1506</td>
<td>1.51</td>
<td>1000</td>
<td>5.6</td>
<td>24.4</td>
<td>123</td>
<td>21</td>
<td>13.6</td>
<td>83</td>
<td>128</td>
</tr>
</tbody>
</table>

SPECIFICATION: ANNA C303
PREP. BY: S.G.          DATE: MAY 31, 1988
APPROVED BY

CANRON hyprescon®

FORM #01

DWG. NO. 46-3002
Appendix D

Southwest Transitway - Stage 2:
Original Lock Joint and Hyprescon Laying
Schedules for Deep Utilities
## PIPE LAYING SCHEDULE

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Description</th>
<th>Length (ft)</th>
<th>Unit Price ($)</th>
<th>Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>154th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>154.00</td>
<td>0.12</td>
<td>18.48</td>
</tr>
<tr>
<td>2</td>
<td>155th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>155.00</td>
<td>0.12</td>
<td>18.60</td>
</tr>
<tr>
<td>3</td>
<td>156th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>156.00</td>
<td>0.12</td>
<td>18.72</td>
</tr>
<tr>
<td>4</td>
<td>157th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>157.00</td>
<td>0.12</td>
<td>18.84</td>
</tr>
<tr>
<td>5</td>
<td>158th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>158.00</td>
<td>0.12</td>
<td>18.96</td>
</tr>
<tr>
<td>6</td>
<td>159th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>159.00</td>
<td>0.12</td>
<td>19.08</td>
</tr>
<tr>
<td>7</td>
<td>160th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>160.00</td>
<td>0.12</td>
<td>19.20</td>
</tr>
</tbody>
</table>

**NOTES:**
- All lengths are in feet.
- Unit prices are in dollars per unit.
- Total does not include any additional costs or taxes.

---

## PIPE LAYING SCHEDULE

<table>
<thead>
<tr>
<th>Schedule No.</th>
<th>Description</th>
<th>Length (ft)</th>
<th>Unit Price ($)</th>
<th>Total ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>154th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>154.00</td>
<td>0.12</td>
<td>18.48</td>
</tr>
<tr>
<td>2</td>
<td>155th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>155.00</td>
<td>0.12</td>
<td>18.60</td>
</tr>
<tr>
<td>3</td>
<td>156th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>156.00</td>
<td>0.12</td>
<td>18.72</td>
</tr>
<tr>
<td>4</td>
<td>157th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>157.00</td>
<td>0.12</td>
<td>18.84</td>
</tr>
<tr>
<td>5</td>
<td>158th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>158.00</td>
<td>0.12</td>
<td>18.96</td>
</tr>
<tr>
<td>6</td>
<td>159th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>159.00</td>
<td>0.12</td>
<td>19.08</td>
</tr>
<tr>
<td>7</td>
<td>160th Joint 3/4&quot; x 1/2&quot; x 1/2&quot;</td>
<td>160.00</td>
<td>0.12</td>
<td>19.20</td>
</tr>
</tbody>
</table>

**NOTES:**
- All lengths are in feet.
- Unit prices are in dollars per unit.
- Total does not include any additional costs or taxes.
Appendix F

Southwest Transitway - Stage 2:
Fort Garry - St. Vital Feedermain - Design Graphs
Appendix G

Southwest Transitway - Stage 2:
Lot 16 Drain Wall Forces - Design Calculations
### Pipe Dimensions

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Pipe diameter</th>
<th>Pipe inner diameter</th>
<th>Pipe outer diameter</th>
<th>Mean radius</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>478 mm</td>
<td>347.4 mm</td>
<td>508 mm</td>
<td>2.33 m</td>
<td>2000 mm</td>
</tr>
</tbody>
</table>

### Design

<table>
<thead>
<tr>
<th>Design</th>
<th>Import</th>
<th>Ground</th>
<th>Cover</th>
<th>Brick From Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.2 m</td>
<td>12.0 m</td>
<td>0.2 m</td>
<td>9.6 m</td>
</tr>
</tbody>
</table>

### Soil Unit Weight

<table>
<thead>
<tr>
<th>Soil Unit Weight</th>
<th>12.85 kN/m³</th>
</tr>
</thead>
</table>

### Soil Load

<table>
<thead>
<tr>
<th>Soil Load</th>
<th>25.41 kN/m³</th>
</tr>
</thead>
</table>

### Live Load

<table>
<thead>
<tr>
<th>Live Load</th>
<th>16.03 kN/m³</th>
</tr>
</thead>
</table>

### Pipe Load

<table>
<thead>
<tr>
<th>Pipe Load</th>
<th>52.36 kN/m³</th>
</tr>
</thead>
</table>

### Fluid Weight

<table>
<thead>
<tr>
<th>Fluid Weight</th>
<th>28.54 kN/m³</th>
</tr>
</thead>
</table>

### Pipe Wall Forces - ACE 27-00

<table>
<thead>
<tr>
<th>Moment, kN/m²</th>
<th>17.69</th>
<th>17.79</th>
<th>17.77</th>
<th>17.79</th>
<th>17.79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear, kN/m</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Thrust, kN</td>
<td>76.71</td>
<td>76.71</td>
<td>76.71</td>
<td>76.71</td>
<td>76.71</td>
</tr>
</tbody>
</table>

### Material Properties

<table>
<thead>
<tr>
<th>Fc</th>
<th>30.06 MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>k</td>
<td>1</td>
</tr>
<tr>
<td>qv</td>
<td>0.065</td>
</tr>
<tr>
<td>qt</td>
<td>0.005</td>
</tr>
<tr>
<td>d</td>
<td>10.092 m</td>
</tr>
<tr>
<td>f'c</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
<tr>
<td>f'0</td>
<td>27.62 MPa</td>
</tr>
</tbody>
</table>

### Moment Resistance

| C  | 237.84 mm |
|    |           |

### Thrust Resistance

| N  | 6477.70 N/m |
| SF | 6.06        |

### Shear Resistance

| N  | 150.24 N/m |
| SF | 1.98        |

### Checks

- Bending Moment: OK
- Thrust: OK
- Shear: OK
Test Hole Location Plan
(test hole locations are approximate)
GENERAL STATEMENT
NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earthwork, foundations, and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earthwork and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.
LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- $q_u$ - undrained shear strength (kPa) derived from unconfined compression testing.
- $T_v$ - undrained shear strength (kPa) measured using a vane.
- $\phi_p$ - undrained shear strength (kPa) measured using a pocket penetrometer.
- $P_v$ - undrained shear strength (kPa) measured using a lab vane.
- $\gamma$ - bulk unit weight ($kN/m^3$).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Penetrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content ($W_L$, $W_F$).

The undrained shear strength ($S_u$) of a cohesive soil can be related to its consistency as follows:

<table>
<thead>
<tr>
<th>$S_u$ (kPa)</th>
<th>CONSISTENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12</td>
<td>very soft</td>
</tr>
<tr>
<td>12 – 25</td>
<td>soft</td>
</tr>
<tr>
<td>26 – 60</td>
<td>medium or firm</td>
</tr>
<tr>
<td>61 – 100</td>
<td>stiff</td>
</tr>
<tr>
<td>101 – 200</td>
<td>very stiff</td>
</tr>
<tr>
<td>200</td>
<td>hard</td>
</tr>
</tbody>
</table>

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows:

<table>
<thead>
<tr>
<th>N – BLOWS/0.30 m</th>
<th>COMPACTNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>very loose</td>
</tr>
<tr>
<td>4 – 10</td>
<td>loose</td>
</tr>
<tr>
<td>10 – 30</td>
<td>compact</td>
</tr>
<tr>
<td>30 – 50</td>
<td>dense</td>
</tr>
<tr>
<td>50</td>
<td>very dense</td>
</tr>
</tbody>
</table>

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows:

<table>
<thead>
<tr>
<th>N – BLOWS/0.30 m</th>
<th>COMPACTNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>very loose</td>
</tr>
<tr>
<td>4 – 10</td>
<td>loose</td>
</tr>
<tr>
<td>10 – 30</td>
<td>compact</td>
</tr>
<tr>
<td>30 – 50</td>
<td>dense</td>
</tr>
<tr>
<td>50</td>
<td>very dense</td>
</tr>
<tr>
<td>Depth (m)</td>
<td>Soil Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>0</td>
<td>SAND &amp; GRAVEL (Fib) - trace silt</td>
</tr>
<tr>
<td>2</td>
<td>CLAY - silty</td>
</tr>
<tr>
<td>3</td>
<td>CLAY - silty</td>
</tr>
<tr>
<td>4.5</td>
<td>Silt (sl) sandy, trace to some clay, trace to some gravel, loose cobbles</td>
</tr>
<tr>
<td>23.0</td>
<td>END OF TEST HOLE AT 23.01 m IN BEDROCK.</td>
</tr>
</tbody>
</table>

Notes:
1. Auger refusal at 15.1 m below ground surface in silt (sl).
2. HOE boring below 15.1 m.
3. Slope of dam observed at 13.71 m to 16.15 m below ground surface during drilling.
4. Water level measured at 6.1 m immediately after drilling.
5. Installed 25 mm diameter cone penetrometer to 25.0 m with 0.3 m of screen bottom and flush mount metal protection cover. Backfilled with sand to 0.5 m from bottom and backfill to surface.
6. Ground water measurements:
   - Jan 18, 2012: 7.20 m, elev. 228.24
   - May 24, 2012: 7.82 m, elev. 224.61 (shown on log).
**SOIL DESCRIPTION**

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>PENETRATION TESTS</th>
<th>UNDRAINED SHEAR STRENGTH</th>
<th>ELEVATION (m)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>79</td>
<td></td>
<td></td>
<td>223</td>
<td></td>
</tr>
<tr>
<td>97</td>
<td></td>
<td>-2.2, 2 blows/150 mm</td>
<td>222</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td></td>
<td></td>
<td>221</td>
<td></td>
</tr>
<tr>
<td>910</td>
<td></td>
<td>-38, 30 blows/150 mm</td>
<td>218</td>
<td></td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>PENETRATION TESTS</th>
<th>UNDRAINED SHEAR STRENGTH</th>
<th>ELEVATION (m)</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td></td>
<td>-2.2, 2 blows/150 mm</td>
<td>232</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td></td>
<td>-2, 2 blows/150 mm</td>
<td>228</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td></td>
<td>-1, 1 blows/100 mm</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td>-2.2, 2 blows/150 mm</td>
<td>225</td>
<td></td>
</tr>
</tbody>
</table>

**END OF TEST HOLE AT 15.54 m BELOW GROUND SURFACE IN SILT (TLU)**

Notes:
1. Auger refusal at 15.54 m below ground surface.
2. No disturbance observed during drilling.
3. Water level measured at 15.1 m below ground surface immediately after drilling.
4. Installed 25 mm diameter standpipe piezometer to 15.1 m with 3 m of woven bottom and 0.5 m in a cup metal protection cover. Identified with sand to 3.5 m from bottom and turns into soil surface.
5. Ground water measurement:
   - March 9, 2012: 15.50 m, elav. 234.51 m
   - May 24, 2012: 9.1 m, elav. 219.09 m (shown on log).

**AECOM**

LOGGED BY: M. Askar
COMPLETION DEPTH: 15.54 m
COMPLETION DATE: 1/12/20
PROJECT ENGINEER: Fares Khalil

Page 2 of 2
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL SYMBOL</th>
<th>SOIL DESCRIPTION</th>
<th>SAMPLE TYPE</th>
<th>PENETRATION TESTS</th>
<th>UNDRAINED SHEAR STRENGTH</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>PAVEMENT</td>
<td>- Asphalt 155 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Concrete 235 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>SAND AND GRAVEL (FR)</td>
<td>- loose sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- brown to grey, medium grained gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- coarse grained sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CLAY AND SILT</td>
<td>- grey, medium, medium grained sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- high plasticity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF TEST HOLE AT 1.52 m BELOW PAVEMENT SURFACE IN CLAY.

Notes:
1. Sloping observed at 1.1 m during drilling.
2. No seepage observed during drilling.
3. Test hole backfilled with auger cuttings and asphalt patch upon completion.

LOGGED BY: M. Alhar
COMPLETION DEPTH: 1.52 m
REVIEWED BY: Farkh Khalil
COMPLETION DATE: 11/12/19
PROJECT ENGINEER: Farkh Khalil

AECOM
SOIL DESCRIPTION

DEPTH (m)  | SOIL SYMBOL | DESCRIPTION
---|---|---
0  | PAVEMENT  | Asphalt 155 mm
    |          | Concrete 168 mm
    | SAND and GRAVEL (FR) - trac set
    |          | brown, moist
    |          | medium grain gravel
    |          | coarse grained sand
    | CLAY     | silty
    |          | brown to gray, residual firm
    |          | high plasticity

END OF TEST HOLE AT 1.52 m BELOW PAVEMENT SURFACE IN CLAY:

Notes:
1. No sloughing observed during drilling.
2. No seepage observed during drilling.
3. Test hole backfilled with auger cuttings and asphalt patch upon completion.

LOGGED BY: M. Alfiar
COMPLETION DEPTH: 1.52 m
REVIEWED BY: Fares Khall
COMPLETION DATE: 11/12/18
PROJECT ENGINEER: Fares Khall

SOIL DESCRIPTION

DEPTH (m)  | SOIL SYMBOL | DESCRIPTION
---|---|---
0  | PAVEMENT  | Asphalt 155 mm
    |          | Concrete 168 mm
    | SAND (FL) - greyly, silty
    |          | brown, moist
    |          | medium grain gravel
    |          | coarse grained sand
    | CLAY     | silty
    |          | brown to gray, residual firm
    |          | high plasticity

END OF TEST HOLE AT 1.52 m BELOW PAVEMENT SURFACE IN CLAY:

Notes:
1. Sloughing observed at 0.9 m during drilling.
2. No seepage observed during drilling.
3. Test hole backfilled with auger cuttings and asphalt patch upon completion.

LOGGED BY: M. Alfiar
COMPLETION DEPTH: 1.52 m
REVIEWED BY: Fares Khall
COMPLETION DATE: 11/12/18
PROJECT ENGINEER: Fares Khall
Appendix I

Southwest Transitway - Stage 2: Geotechnical Information: Test Hole Location Plan and Test Hole Logs
Figure 00

Prospective Test Hole Location Plan
SWRT Phase II
City of Winnipeg, MB

Geotechnical Investigation
Test Hole Locations

TH14-02
TH14-04
TH14-07
TH14-09
TH14-10

TEST HOLE LOCATIONS
SOUTHWESTERN TRANSIT CORRIDOR

LEGEND

1:16000

Figure: 00

Geotechnical Investigation
Test Hole Locations

TH14-04
TH14-09
TH14-10

TEST HOLE LOCATIONS
SOUTHWESTERN TRANSIT CORRIDOR

LEGEND
GENERAL STATEMENT
NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earthwork, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earthwork and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

<table>
<thead>
<tr>
<th>Description</th>
<th>UML Log Symbols</th>
<th>UBC Classification</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVELS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Gravels</td>
<td>G</td>
<td>0.5</td>
<td>C_4 &lt; 10.0</td>
</tr>
<tr>
<td>Poorly graded gravels, sandy gravels, with little or no fines</td>
<td>GP</td>
<td>0.5</td>
<td>not satisfying GW requirements</td>
</tr>
</tbody>
</table>

COARSE GRAINED SOILS

<table>
<thead>
<tr>
<th>Description</th>
<th>UML Log Symbols</th>
<th>UBC Classification</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Sands</td>
<td>S</td>
<td>0.5</td>
<td>C_4 &lt; 10.0</td>
</tr>
<tr>
<td>Poorly graded sands, sandy gravels, with little or no fines</td>
<td>SP</td>
<td>0.5</td>
<td>not satisfying SW requirements</td>
</tr>
</tbody>
</table>

FINE GRAINED SOILS

<table>
<thead>
<tr>
<th>Description</th>
<th>UML Log Symbols</th>
<th>UBC Classification</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLAYES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean clay</td>
<td>C</td>
<td>0.5</td>
<td>C_4 &lt; 10.0</td>
</tr>
<tr>
<td>Organic silt and clays, of low plasticity, lean clays</td>
<td>OL</td>
<td>0.5</td>
<td>classification is based upon Plasticity Chart</td>
</tr>
</tbody>
</table>

ORGANIC SED & CLAYES

<table>
<thead>
<tr>
<th>Description</th>
<th>UML Log Symbols</th>
<th>UBC Classification</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORGANIC SED &amp; CLAYES</td>
<td>O</td>
<td>0.5</td>
<td>C_4 &lt; 10.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>UML Log Symbols</th>
<th>UBC Classification</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORGANIC SED &amp; CLAYES</td>
<td>O</td>
<td>0.5</td>
<td>C_4 &lt; 10.0</td>
</tr>
</tbody>
</table>

HIGHLY ORGANIC SOILS

<table>
<thead>
<tr>
<th>Description</th>
<th>UML Log Symbols</th>
<th>UBC Classification</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic silt and clays, of low plasticity, lean clays</td>
<td>OL</td>
<td>0.5</td>
<td>classification is based upon Plasticity Chart</td>
</tr>
</tbody>
</table>

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.
### Soil Description

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Soil Type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Wet, firm below 10.7 m</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Some fill inclusions below 11.9 m</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Glacial Till (SLT): grey clay, some sand, trace gravel, light grey, moist to wet, compact, low plasticity</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Reddish brown, some gravel below 15.2 m</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Boulder (400 mm, granite) at 16.8 m</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Limestone: fine-grained, calcite infill at joints, trace lineations, white, grey, R2, R3, weak to medium strong, highly fractured to 18 mm below ground surface, core angle at 90 degrees, discontinuity characteristics, weathering to moderately dense spacing, unweathered, smooth to rough planar joints</td>
<td></td>
</tr>
</tbody>
</table>

### Penetration Tests

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Sample Type</th>
<th>Sample #</th>
<th>SPT N</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Gravel</td>
<td>2</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Gravel</td>
<td>3, 4</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Gravel</td>
<td>5, 6</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Gravel</td>
<td>7, 8, 9</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Gravel</td>
<td>10, 11</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Gravel</td>
<td>12, 13</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Gravel</td>
<td>14, 15</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

### Unconfined Strength

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Unconfined Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>N/A</td>
</tr>
<tr>
<td>11</td>
<td>N/A</td>
</tr>
<tr>
<td>12</td>
<td>N/A</td>
</tr>
<tr>
<td>13</td>
<td>N/A</td>
</tr>
<tr>
<td>14</td>
<td>N/A</td>
</tr>
<tr>
<td>15</td>
<td>N/A</td>
</tr>
<tr>
<td>16</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Elevation

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>N/A</td>
</tr>
<tr>
<td>11</td>
<td>N/A</td>
</tr>
<tr>
<td>12</td>
<td>N/A</td>
</tr>
<tr>
<td>13</td>
<td>N/A</td>
</tr>
<tr>
<td>14</td>
<td>N/A</td>
</tr>
<tr>
<td>15</td>
<td>N/A</td>
</tr>
<tr>
<td>16</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Comments

- Wet, firm below 10.7 m
- Some fill inclusions below 11.9 m
- Glacial Till (SLT): grey clay, some sand, trace gravel, light grey, moist to wet, compact, low plasticity
- Reddish brown, some gravel below 15.2 m
- Boulder (400 mm, granite) at 16.8 m
- Limestone: fine-grained, calcite infill at joints, trace lineations, white, grey, R2, R3, weak to medium strong, highly fractured to 18 mm below ground surface, core angle at 90 degrees, discontinuity characteristics, weathering to moderately dense spacing, unweathered, smooth to rough planar joints

END OF TEST HOLE AT 23.2 m IN BEDROCK

Notes:
1. Power Auger Refusal at 15.5 m in Glacial Till...
2. HQ coring below 15.5 m...
3. Sewage observed at 16.7 m during drilling...
4. Sloughing observed at 12.8 m during drilling...
5. Inserted 56 mm diameter sono sonar per meter (SPN@400) to 28.6 m below ground surface with 0.3m cross raise by 0.9 m stick-ups...
6. Above ground protective casing installed...
7. Test had banded wall up to 16.3 m below ground surface and plugged with concrete to ground water...
8. Groundwater monitoring...
   - Jan 15, 2014 at Ev. 228.50 m
   - Jan 17, 2014 Bore 228.90 m
   - Jan 23, 2014 Bore 228.90 m
   - Jan 25, 2014 Bore 225.00 m
   - March 7, 2014 Bore 225.00 m
   - March 24, 2014 Ev. 224.60 m

LOGGED BY: Aaron Kaluznak
COMPLETION DEPTH: 23.16 m
PROJECT ENGINEER: James McCutcheon
### Soil Description

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Soil Type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>TOPSOIL</td>
<td>- dark brown to black, frozen, dry to moist when thawed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- light gray to brown, frozen, moist when thawed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fine to medium sand, trace gravel</td>
</tr>
<tr>
<td>1.0</td>
<td>CLAY-silty, trace sand</td>
<td>- light gray, moist</td>
</tr>
<tr>
<td>2.4</td>
<td></td>
<td>- fine to medium sand</td>
</tr>
<tr>
<td>3.1</td>
<td></td>
<td>- fine to medium sand</td>
</tr>
<tr>
<td>4.9</td>
<td></td>
<td>- fine to medium sand, trace gravel</td>
</tr>
<tr>
<td>7.6</td>
<td></td>
<td>- dark gray, soft below 7.6 m</td>
</tr>
<tr>
<td>9.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>13.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>21.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>22.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>23.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>24.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>25.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>26.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>27.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>28.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.0</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.1</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.2</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.3</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.4</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.5</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.6</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.7</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.8</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>29.9</td>
<td></td>
<td>- - -</td>
</tr>
<tr>
<td>30.0</td>
<td></td>
<td>- - -</td>
</tr>
</tbody>
</table>

**Penetration Tests**
- **SPT**: Standard Penetration Test
- **UCPB**: Undrained Cyclic Penetration Test

**Undrained Cyclic Penetration Tests**
- **SPT**: Standard Penetration Test
- **UDCT**: Undrained Cyclic Cyclic Penetration Test

- **Comments**: Various observations and measurements are recorded throughout the depth range, including penetration test results, soil description, and comments on the condition of the borehole.

**Notes**
1. Power Auger Refusal at 18.3 m in Glacial Till
2. No seepage observed during drilling
3. No sloughing observed during drilling
4. Installed 25 mm diameter standoff pipe (SPH148) at 18.3 m below ground surface with 0.3 m casing back to end of 0.9 m stick-up
5. Above ground protective casing installed
6. Test hole backfilled with sand up to 16.8 m below

---

**Logbook Entry**
- **Logged By**: Aeon Caluznik
- **Completion Depth**: 18.29 m
- **Reviewed By**: Zayed Shakir
- **Project Engineer**: James MCCUTCHEON

**Diagram**
- Schematic representation showing the depth, soil layers, and penetration test results.

---

**AECOM**
- Page 2 of 3
- Document title and project details are not visible in the provided image.
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL DESCRIPTION</th>
<th>PENETRATION TESTS</th>
<th>UNMINERIALIZED SUGAR STRENGTH</th>
<th>SAMPLE TYPE</th>
<th>PENETRATION TESTS</th>
<th>UNMINERIALIZED SUGAR STRENGTH</th>
<th>ELEVATION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>ground surface and plugged with bentonite to ground surface. 7. Groundwater monitoring:  - Jan 21, 2014 Env. 223.01 m  - Jan 26, 2014 Env. 224.42 m  - Jan 20, 2014 Env. 224.32 m</td>
<td>SPT (N)</td>
<td>50 60 120 200</td>
<td>210 210 210</td>
<td>211 211 211</td>
<td>212 212 212</td>
<td>213 213 213</td>
<td></td>
</tr>
</tbody>
</table>

### Diagram Description
- **SOIL DESCRIPTION**
  - **TOPSOIL AND ORGANICS**
    - Black, moist, fibrous
    - Silt - some clay
      - Light brown to light grey, frozen, moist when thawed
        - High water content
      - High plasticity
        - - 2 m below 2.4 m
  - **CLAY**
    - Clay - silt, silty sand, fine sand, silt, silt clastics, fine sand, silt, silt clastics
      - Light brown to light grey, frozen, moist when thawed
        - High water content
      - High plasticity
        - - 2 m below 2.4 m
  - **SILT**
    - White silt inclusions (potentially sulfide) at 4.0 m
  - **SAND**
    - Sand inclusion (12mm, dry, medium-grained) at 5.7 m
  - **GRAY**
    - Large gravel and silt inclusion (100mm)
      - Black, fibrous, silt clastics (100mm)
      - Grey, homogeneous below 0.5 m

### Comments
- Sample received in split spoon.
- Tube recovery: 100%
April 17, 2014

Ms. Tracey Braun, Director
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

Re: Submission of Environment Act Proposal, Environmental Impact Statement and Class 2 Development Fees for the City of Winnipeg Southwest Rapid Transit Corridor – Stage 2 Project

Dear Ms. Braun,

The City of Winnipeg is seeking approval and licensing under the Manitoba Environment Act for the proposed development of the City of Winnipeg’s Stage 2 of the Southwest Rapid Transit Corridor (the Project). Stage 1 of the Southwest Transitway was opened in April 2012 and is currently in operation from Queen Elizabeth Way in the downtown area of the City of Winnipeg to Pembina Highway and Jubilee Avenue. Stage 2 of the Project extends the Southwest Rapid Transit Corridor from Pembina Highway and Jubilee Avenue south to the University of Manitoba.

Dillon Consulting Limited and their sub-consultant, M. Forster Enterprises, met with Manitoba Conservation and Water Stewardship Environmental Approvals Branch officers on November 18, 2013 to discuss the proposed Project and determine the environmental licensing and regulatory requirements for the proposed Project. During the meeting, it was determined that the proposed Project would be considered as a Class 2 Development under the Manitoba Environment Act and will require an Environment Act License from the Province of Manitoba. A review of current Canadian Environmental Assessment Act and other federal regulations and guidelines (e.g., Transport Canada, Fisheries and Oceans Canada, federal P3 funding under PPP Canada) found that there are no federal review, approval or licensing requirements for the Project.

Further to the November 18, 2013 meeting, we are pleased to provide a completed Environment Act Proposal form, Environmental Impact Statement Report and the required $7,500 fee for a Class 2 Development. Attached find four (4) hard copies and one (1) electronic copy of this report.

We trust that our submission is complete and meets current regulatory requirements. We look forward to working further with your Department on this important Project. Please contact the undersigned if you require any other information or clarification.

Best regards,

Dillon Consulting Limited

Dave Krahm, P. Eng.
Project Manager

Dennis Heinrichs, M.Sc P. Eng
Senior Environmental Lead

DPK/jcr
Environmental Act Proposal Form

Name of the development:
City of Winnipeg Southwest Rapid Transit Corridor – Stage 2

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):
Class 2

Legal name of the applicant:
City of Winnipeg

Mailing address of the applicant:
421 Osborne Street, Winnipeg, Manitoba R3L 2A2

Contact Person: Mr. Bjorn Radstrom, Project Manager, Winnipeg Transit
City: Winnipeg
Province: Manitoba
Postal Code: R3L 2A2
Phone Number: 204-986-5743
Fax: 204-986-6663
email: bradstrom@winnipeg.ca

Location of the development: City of Wpg., Pembina Hwy & Jubilee to Bison Drive/U of M
Contact Person: Mr. Bjorn Radstrom, Project Manager, Winnipeg Transit
Street Address:

Legal Description:

City/Town: Winnipeg
Province: Manitoba
Postal Code: R3L 2A2
Phone Number: 204-986-5743
Fax: 204-986-6663
email: bradstrom@winnipeg.ca

Name of proponent contact person for purposes of the environmental assessment:
Mr. Dave Krahm, P.Eng.

Phone: 204-453-2301, ext 4046
Fax: 204.452.4412
Mailing address: Dillon Consulting Limited
1558 Willson Place
Winnipeg, Manitoba R3T 0Y4

Email address: dkrahm@dillon.ca
Webpage address: www.dillon.ca

Date: April 17, 2014
Signature of proponent, or corporate principal of corporate proponent: [Signature]

Printed name: [Printed Name]
A complete Environment Act Proposal (EAP) consists of the following components:

- Cover letter
- Environment Act Proposal Form
- Reports/plans supporting the EAP (see “Information Bulletin - Environment Act Proposal Report Guidelines” for required information and number of copies)
- Application fee (Cheque, payable to Minister of Finance, for the appropriate fee)

For more information:
Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/conservation/ecn

Per Environment Act Fees Regulation (Manitoba Regulation 168/98):

<table>
<thead>
<tr>
<th>Class</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>$1,000</td>
</tr>
<tr>
<td>Class 2</td>
<td>$7,500</td>
</tr>
<tr>
<td>Class 3</td>
<td>$10,000</td>
</tr>
<tr>
<td>Water</td>
<td>$60,000</td>
</tr>
<tr>
<td>Energy</td>
<td>$120,000</td>
</tr>
</tbody>
</table>

---

City of Winnipeg – Transit Department
Southwest Rapid Transit Corridor – Stage 2
Environmental Review and Assessment

**TABLE OF CONTENTS**

1. INTRODUCTION ............................................................. 1
2. PROJECT LOCATION ....................................................... 1
3. PROJECT FUNDING ........................................................ 3
4. PROJECT BACKGROUND AND NEED .................................... 3
5. PROJECT OBJECTIVES .................................................... 4
6. PROJECT DESCRIPTION ................................................... 5
7. PROJECT COMPONENTS ................................................... 7
   7.1 Transitway Right-of-Way ......................................... 7
   7.2 Pembina Highway Widening at Jubilee Underpass, CN Rail Bridge over Pembina Highway ................. 8
   7.3 Transitway Bridge over Pembina Highway ..................... 9
   7.4 New Transitway Underpass of CN Wye Tracks (CN Letellier and WCO2 Spur) at the CN Portage Junction .................................................... 9
   7.5 Transitway Overpass of McGillivray Boulevard ............... 10
   7.6 Letellier Tunnel .................................................... 10
   7.7 Relocation of CN Letellier Track, CN Letellier Rail Bridge over Bishop Grandin Boulevard, Transitway Bridge over Bishop Grandin Boulevard ................................................. 10
   7.8 Stations ............................................................ 11
   7.9 Park and Ride ...................................................... 12
   7.10 Transitway Runningway, Connections between the Transitway and Street System, At-Grade Intersections .................................................... 12
   7.11 Active Transportation ............................................. 13
   7.12 Railway Works Considerations .................................. 13
   7.13 Drainage Works .................................................... 14
   7.14 Termination of Parker Avenue/Extension of Beaumont Street .................................................... 16
   7.15 Utilities ........................................................... 17
   7.16 Services Required of City of Winnipeg Departments ........ 18
   7.17 Landscaping ....................................................... 19
8. PROJECT SCHEDULE ...................................................... 19
9. PROJECT CONSTRUCTION ACTIVITIES ......................... 20
10. PROJECT OPERATIONS AND MAINTENANCE ACTIVITIES .... 21
    10.1 Structures ....................................................... 21
    10.2 Transitway ....................................................... 21
    10.3 Stations ........................................................ 22
    10.4 Park and Ride ................................................... 22
    10.5 Active Transportation Pathways ............................... 22
    10.6 Railworks ....................................................... 22
    10.7 Land Drainage System ......................................... 22
    10.8 Landscaping .................................................... 22
City of Winnipeg – Transit Department  
Southwest Rapid Transit Corridor – Stage 2  
Environmental Review and Assessment

Table 16-5: Examples Of Human/Structural Responses to Various Vibration Sources and Levels ................................................................. 36
Table 16-6: Province of Manitoba Conservation Ranking System for Species .................................................... 45
Table 16-7: Endangered, Threatened or Species of Special Concern Potentially Found in the PSA .............................................................. 57
Table 16-8: Demographics of Neighbourhoods Located in the PSA Based on the City of Winnipeg 2006 Census Community Profiles .............................................. 60
Table 16-9: First Nations Reserves Located Within or Adjacent to the RSA ................................................................. 63
Table 18.1-1: Attenuation of Construction Equipment Noise with Distance .................................................. 72
Table 19-1-1: Summary of Proposed Mitigation Measures ............................................................... 88
Table 20-1-1: Residual Effects and Assessed Environmental Consequence of Residual Effects ................. 100

**LIST OF FIGURES**

Figure 1-1: Project Location ................................................................. 2
Figure 6-1: Recommended Alignment for Stage 2 of the Southwest Transitway .................................................. 6
Figure 7-1: Land Drainage Design Concepts .................................................. 15
Figure 8-1: Proposed Project Construction Schedule .................................................. 20
Figure 16.1-1: City of Winnipeg Natural Areas and Habitat Quality in the Parker Lands ................................. 44
Figure 16.2-1: Location of Cattail Stands and Milkweed Plants in the Recommended Alignment for the Southwest Transitway Stage 2 Route ............................................. 54

**LIST OF PHOTOS**

Photograph 1: View showing ground surface conditions in a cattail stand located on the west side of the Manitoba Hydro transmission line RoW between Mercury Bay and Willson Place, October 01, 2013 ................................................................. 43
Photograph 2: View facing northwest of a mowed area and patch of aspen, cattails and willows in the Parker Lands area, October 01, 2013 ................................................................. 43
Photograph 3: View facing southeast in the Parker Lands of an aspen woodland patch located adjacent to Parker Avenue, October 01, 2013 ................................................................. 44
Photograph 4: View facing west of the milkweed seed pods found on the west side of the Manitoba Hydro transmission line RoW between Mercury Bay and Willson Place, October 01, 2013 ................................................................. 47
Photograph 5: Close-up view of the milkweed seed pods found on the west side of the Manitoba Hydro transmission line Right-of-Way between Mercury Bay and Willson Place, October 01, 2013 ................................................................. 47
Photograph 6: View of the large bur oak in the aspen/oak woodland of the Parker Lands, October 01, 2013 .................................................................................. 48
Photograph 7: View of the large peachleaf willow in the aspen/oak woodland of the Parker Lands, October 01, 2013 .................................................................................. 48

**LIST OF APPENDICES**

Appendix A: Project Area Figures
Appendix B: List of Plant Species Present in the PSA
Appendix C: Copy of the Request to MCDC and MCDC Response
Appendix D: Copy of the Request to MHRB and MHRB Response
1 INTRODUCTION

The City of Winnipeg (the City) is proposing to develop Stage 2 of the Southwest Transitway (the Project). Stage 1 of the Southwest Transitway was opened in April 2012 and is currently in operation from Queen Elizabeth Way in the downtown area of the City of Winnipeg to Pembina Highway and Jubilee Avenue. Stage 2 of the project looks at extending the Southwest Transitway from Pembina Highway and Jubilee Avenue south to the University of Manitoba. An extension of Stage 2 from Jubilee Avenue to Bison Drive would complete the link between downtown Winnipeg to the University of Manitoba (U of M), Investors Group Field and southwest suburbs, providing a one-seat trip for passengers (Dillon Consulting Limited 2013a).

The City of Winnipeg Transit Department retained Dillon Consulting Limited. (Dillon) and their sub-consultants to conduct the Functional Design Study for Stage 2 of the Southwest Transitway. The Functional Design study is composed of several components, including an Environmental Assessment (EA) of the proposed Project.

Based on discussion with Manitoba Conservation and Water Stewardship (MCWS), the Project will be considered as a Class 2 Development under the requirements of the Manitoba Environment Act, and therefore requires submission of an Environmental Impact Statement (EIS), and approval by MCWS to obtain an Environment Act License (EAL) (B. Webb, pers. comm. 2013). This document provides the EA of the proposed Project and serves as the EIS for submission to MCWS.

2 PROJECT LOCATION

The Project is located within the City of Winnipeg between the Pembina Highway and Jubilee Avenue overpass and Bison Road (Figure 1-1).

3 PROJECT FUNDING

The City of Winnipeg will be seeking project funding under the Government of Canada’s Public-Private Partnerships (P3) program. The Stage 2 Transitway project from Pembina/Jubilee to the University of Manitoba is expected to be delivered as a P3 project in conjunction with the widening of Pembina Highway at the Jubilee overpass and the associated railway works.

The City has outlined a capital funding commitment of 37.5% of the Project Costs, which will be matched by the Province of Manitoba. PPP Canada’s commitment will be 25% of the costs related to the Design Build Finance Maintain contract and will be subject to the approval by the Federal Government. Specific terms, conditions and timing of the contributions from the Province and PPP Canada are expected to be finalized in the spring/early summer of 2014.
4 PROJECT BACKGROUND AND NEED

The population of Winnipeg is expected to grow by approximately 205,000 over the 2006 - 2031 time period, resulting in a population of approximately one million people in the City and surrounding area by 2031. This growth is expected to occur most extensively in the southwest part of Winnipeg, which has a current population of 75,000 and is expected to grow by over 40% over the next 20 years. There are three major industrial areas and several commercial areas in the southwest part of the City that are experiencing even higher growth. In addition, the province’s two largest universities (the University of Manitoba - 30,000 students/staff, and the University of Winnipeg - 10,000 students/staff) are located within the service area of the Southwest Transitway and are expanding their campuses and educational offerings.

The growth in this area of the City is placing tremendous strain on the existing transportation infrastructure. The major arterial street in the area, Pembina Highway, is already highly congested with average traffic volumes of approximately 60,000 vehicles each weekday. This volume is expected to increase as development continues in the City’s southwest quadrant. To accommodate the growth in development and population, there are only limited opportunities to expand the road infrastructure. Although a high level of transit service operates on Pembina Highway, it is subject to significant delays and slow speeds caused by the traffic congestion. The increasing travel times along Pembina Highway, coupled with the resulting decrease in transit schedule reliability, threatens Winnipeg’s ability to provide a high quality transit service to its citizens.

In 2011, Winnipeg’s City Council approved “Our Winnipeg”, the City’s long-term development plan (City of Winnipeg 2011a). “Our Winnipeg” outlines a 25-year vision for the physical, social, environmental and economic development to position the City for sustainable growth and ensure Winnipeg’s future competitiveness. The vision outlined in “Our Winnipeg” is brought into action through supporting Community Strategies, including the Sustainable Transportation Strategy and the City’s Transportation Master Plan (TMP). The TMP approved by City Council includes the development of an initial network of four rapid transit corridors:

- Southwest Corridor (parallel to Pembina Highway using existing Canadian National (CN) Rail and Manitoba Hydro Right-of-Ways [RoWs]);
- Eastern Corridor (parallel to Nairn and Regent Avenues);
- Western Corridor (within or parallel to Portage Avenue); and
- Northern Corridor (within or parallel to Main Street).

The City’s highest priority is the Southwest Corridor (named the Southwest Transitway) that connects downtown with Winnipeg’s rapidly growing southwest sector and the University of Manitoba.

Stage 1 of the Southwest Transitway, the initial phase of Winnipeg’s rapid transit network, was constructed during 2009/10. The Stage 1 transitway (3.6 kilometres [km] in length, located between downtown and Pembina Highway and Jubilee Avenue, with three highly developed stations) opened for service in April 2012 and is used by a bus Rapid Transit (BRT) network of 13 routes, providing fast, frequent, reliable service throughout the day on all days of the week. Rapid transit routes access the transitway at four locations to provide trips without transfer for passengers travelling between the southwest part of the City and downtown.

The City’s next rapid transit project is Stage 2 of the Southwest Transitway. As shown in Figure 1-1, this project will extend the transitway southerly from Pembina Highway and Jubilee Avenue to the University of Manitoba using land within Manitoba Hydro and CN Rail RoWs for most of its alignment. This alignment, recommended by a study completed and subsequently approved by City Council in 2013, provides an opportunity to deliver rapid transit service directly to the University of Manitoba, downtown, and several neighbourhoods in the southwestern and western parts of the City. The project also includes a widening of Pembina Highway as it underpasses the CN mainline at the northern limit of the Stage 2 transitway project.

This project is consistent with the strategic direction identified in the City’s TMP and will provide essential transportation infrastructure required to accommodate the new growth in the southwest part of the City.

5 PROJECT OBJECTIVES

The objectives of Stage 2 of the Southwest Transitway are to create benefits that meet the key strategic goals outlined in the City’s Sustainable Transportation Strategy and TMP. These benefits include:

- **Improved Transit Service and Increased Ridership** - The transitway will allow rapid transit vehicles to operate at high speed in a dedicated runway free of interference from other traffic. This ability will result in faster travel times and high schedule reliability and, in combination with frequent service, attractive and comfortable stations, state-of-the-art buses, and real-time passenger information, significant benefits will be realized by existing transit users and an increase in corridor ridership of 12% to 15% is expected to be generated.

- **Reduction in Traffic Congestion** - Pembina Highway, the major arterial roadway in the corridor, is highly congested due to the significant population growth in the southwest quadrant of the City. The implementation of the transitway to achieve an increase in the transit mode split, in combination with the widening of Pembina Highway by an additional northbound lane at the Jubilee underpass, is expected to improve travel times and reduce congestion for both transit users and motorists.

- **Improved Access to Investors Group Field** - Based on experience during the 2013 CFL season, approximately 13,000 people use transit (40% transit mode split) for events at Investors Group Field located at the southern end of Stage 2 of the transitway. With a fully built-out transitway, significant improvements in travel time, reliability, and comfort will accrue for spectators attending events at the stadium.

- **Transit Oriented Development (TOD)** - The TMP identifies four designated TOD sites along the Southwest Transitway corridor, including the Fort Rouge Yards; the Southwood Golf Course lands; the former Sugar Beet lands near Pembina Highway and Bishop Grandin Boulevard; and the Parker lands west of Pembina Highway and south of the CN main line. Recent development
announcements since the opening of the Stage 1 corridor, and in anticipation of completion of Stage 2, have indicated a strong interest by developers in promoting TOD along the transitway, including ones adjacent to Harkness Station (19-storey high rise building), Osborne Station (5-storey mixed use commercial and office building) and Fort Rouge Station (Fort Rouge Yards development - 1,000 dwellings – project underway).

- **Revitalization of Downtown** - Winnipeg’s downtown has experienced significant revitalization in recent years including such developments as the Graham Transit Mall, MTS Centre, Manitoba Hydro Place, and Centrepoint. In addition, existing surface parking lots are being converted into higher-value uses, such as the “Sports, Hospitality and Entertainment District” (SHED), SoPo Square, SkyCity Centre, Cresswin’s planned development of the empty parking lot at 416 Main Street, and the expansion of the RBC Convention Centre. In revitalizing the downtown landscape, these developments reduce the availability of parking spaces in the area. A reliable rapid transit service operating via the Graham Transit Mall into the heart of Winnipeg’s downtown area will provide a viable and less expensive alternative to commuters while enhancing citizens’ access to the revitalized downtown area.

- **Reduction in Greenhouse Gas Emissions** - The implementation of the transitway will reduce greenhouse gas emissions (GHGs) as a result of a mode shift from high-consumption private automobiles to public transit and active transportation. Operating efficiencies resulting from higher speeds and new vehicles are expected to reduce emissions from the bus fleet that operates on the transitway.

- **Support the Local Economy** – The design, construction, and implementation of the transitway will have numerous positive impacts on the local Winnipeg economy. Direct benefits will accrue to local design and engineering companies and to local construction contractors. Spin-off benefits will be realized from local bus purchases, from the TOD developments, from improvements to downtown revitalization and accessibility, and from an improved urban transportation system in the southwest sector of the city.

6 PROJECT DESCRIPTION

Figure 6-1 provides an illustration of the recommended alignment for the Project. Additional details are provided on Figures 1 to 4 in Appendix A, which depict the recommended alignment from south to north. The transitway will operate on an exclusive RoW from the intersection of Jubilee Avenue and Pembina Highway to Bison Drive at the CN rail RoW. The corridor alignment extends from Stage 1 of the Southwest Transitway from Jubilee Avenue over Pembina Highway on a structure just north of the Jubilee Avenue Overpass. West of Pembina Highway, the transitway alignment passes under two CN rail tracks (Letellier Subdivision and switching track), and continues west paralleling Parker Avenue. At the westerly end of the Parker Land the alignment turns in a south-easterly direction, crosses the existing Parker Avenue and then is located within the Manitoba Hydro RoW until it intersects the CN Letellier rail line, north of Bishop Grandin Boulevard. Just south of Munahan Avenue, this alignment crosses over two railway service tracks and the CN Letellier subdivision on an overpass structure, touching down on the east side of the Letellier Subdivision just north of Plaza Drive.
From this point, the alignment continues south along the east side of the CN rail line, crosses Bishop Grandin Boulevard on an overpass, and terminates at Bison Drive.

Stage 2 of the Southwest Transitway will involve the construction of the following infrastructure:

- Approximately 7.6 km of runningway roadwork to extend the transitway from Pembina Highway and Jubilee Avenue to Markham Road and to the University of Manitoba;
- Widening of Pembina Highway by one lane through the Jubilee Underpass;
- Construction of a new CN Rail Bridge over Pembina Highway and demolition of the existing CN Rail Bridge structure;
- Construction of a new Transitway Bridge over Pembina Highway;
- Construction of new Transitway Underpasses of CN Yxe Tracks at the CN Portage Junction;
- Construction of a Transitway Overpass of McGillivray Boulevard;
- Construction of a Transitway Tunnel beneath the CN Letellier rail line (Letellier Tunnel);
- Construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard;
- Construction of a new Transitway Bridge over Bishop Grandin Boulevard;
- Construction of roadway connections between the transitway and the street system;
- Seven modern transit stations along the Stage 2 transitway;
- Construction of new Park and Ride facilities at two of the transitway stations;
- Two new stations on the transitway connection to the University of Manitoba, a new transit station at Investors Group Field, and upgrades to existing stations on the Fort Garry campus of the University of Manitoba;
- New signalized intersections with transit priority signals; and
- A new Active Transportation Path (AT pathway) along the transitway with direct connections to existing paths and to the stations, and bicycle storage facilities at the stations.

Following the construction of Stage 2, the completed Southwest Transitway will encompass 11.2 kilometres of bus-only transitway, 11 rapid transit stations, a comprehensive network of rapid transit routes that provide one-seat trips for most travel to/from/within the service area, and a continuous AT pathway between the southwest part of the city and the downtown.

### 7 PROJECT COMPONENTS

#### 7.1 Transitway Right-of-Way

The RoW for Stage 2 of the Southwest Transitway will be located in lands currently owned by the City of Winnipeg, CN Rail, Manitoba Hydro, the University of Manitoba, and some private interests. Of the 7.6 km of the Stage 2 transitway:

- 0.5 km are on City of Winnipeg land;
- 2.6 km are within the CN Letellier RoW;
- 3.2 km are within the Manitoba Hydro RoW;

- 0.3 km are on undeveloped privately-owned land; and,
- 1.0 km are on University of Manitoba land.

The status for use of the required lands not currently owned by the City can be summarized as follows:

<table>
<thead>
<tr>
<th>Land Owner</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN Rail</td>
<td>Under a 1994 agreement between the City of Winnipeg and CN, the City already has in place a lease for the CN lands required for Stage 2 of the transitway.</td>
</tr>
<tr>
<td>Manitoba Hydro</td>
<td>Under a 2014 Memorandum of Agreement between the City and Manitoba Hydro, the City will acquire those lands in the Manitoba Hydro RoW required for the transitway project on mutually agreed terms.</td>
</tr>
<tr>
<td>University of Manitoba</td>
<td>During 2014-15, the City and the University will negotiate an agreement for the use of a portion of the former golf course lands required for the transitway project on mutually agreed terms.</td>
</tr>
<tr>
<td>Private Lands</td>
<td>Minor portions of a few private properties are required for the project. The City will undertake negotiations with the owners for the acquisition of these lands.</td>
</tr>
</tbody>
</table>

The City’s land acquisition strategy will be completed by the time the project is forecasted to begin construction in early 2016 and will not impact the commencement of “on ground construction”.

#### 7.2 Pembina Highway Widening at Jubilee Underpass, CN Rail Bridge over Pembina Highway

At the north limit of the Project, Pembina Highway passes under a roadway that connects Jubilee Avenue with Pembina Highway. This underpass has two northbound lanes and three southbound lanes. Due to the very high traffic volumes through the underpass (60,000 vehicles per day; 6,000 vehicles during the peak hour), the underpass currently functions at an unacceptable level of service in the northbound direction. To improve traffic operations at this location, the Project includes a widening of the northbound roadway through the underpass from two lanes to three lanes.

Two existing structures and one planned structure are located in the vicinity of the underpass. The existing structures include the Jubilee overpass roadway and, to the north of the overpass, a CN Rail Bridge over Pembina Highway that accommodates three tracks of CN’s main line and a service road. The planned structure is a new Transitway Bridge over Pembina Highway to be constructed as part of the southerly extension of the Southwest Transitway. The new transitway bridge is required to be constructed between the Jubilee overpass and the CN Rail Bridge.

To accommodate the additional northbound lane on Pembina Highway and the new transitway bridge, the existing CN Bridge over Pembina Highway will need to be replaced by a new and longer rail bridge at a location north of the existing rail bridge. These works were investigated in detail in a study conducted for the Public Works Department of the City of Winnipeg (Dillon Consulting Limited 2013b). During the study, extensive consultation was undertaken with the City’s Public Works, Water and Waste, and Transit departments, with CN, and with all affected utility companies to ensure the recommended design met all requirements. All parties have approved the recommended design. The works to widen Pembina Highway and to replace the CN Bridge over Pembina Highway will include the following:
Railway Works
- The construction of the new CN Rail Bridge over Pembina Highway that accommodates four tracks and an improved service road;
- The relocation of existing tracks within the CN Rivers subdivision to align with the new rail bridge;
- The relocation of two existing wye tracks at Portage Junction to align with the relocated CN Rivers tracks; and
- The demolition of the existing CN Bridge over Pembina Highway.

Roadway Works
- The reconstruction of Pembina Highway to provide for three lanes in each direction through the Jubilee Underpass; and
- The construction of AT pathways, 4.5 metres in width, on each side of Pembina Highway, including connections to the planned active transportation path along the Southwest Transitway.

Utility Works
- The relocation of an existing combined sewer outfall to accommodate the lowering of the Pembina roadway through the underpass; and
- The construction of a land drainage sewer system, including a retention pond, to accommodate run-off during major rainfall events.

7.3 Transitway Bridge over Pembina Highway
This transitway bridge will be constructed between the Jubilee overpass and the new CN Rail Bridge over Pembina Highway. This bridge will accommodate one transitway lane in each direction and a two-way AT pathway adjacent to the northbound transitway lane (separated from the lane by a physical barrier).

7.4 New Transitway Underpass of CN Wye Tracks (CN Letellier and WC02 Spur) at the CN Portage Junction
In the Portage Junction rail lands (defined by the triangular area bounded by the CN Rivers subdivision on the north, the Jubilee roadway overpass on the east, Parker Avenue on the south, and the eastern edge of undeveloped land on the west) are located two wye tracks (the CN Letellier rail line and the WC02 spur line) and some maintenance buildings. As described above, the two existing wye tracks at Portage Junction will be required to be re-aligned with the relocated CN Rivers tracks. A new transitway underpass of each of the CN wye tracks will be constructed to provide a grade-separation between the transitway and the wye tracks. Because the wye tracks will be relocated to new alignments, the underpass structures can be initially constructed at grade without disrupting existing rail operations. Following construction, the wye tracks will be relocated on the new structures and the old tracks abandoned, the excavations beneath the structures will be undertaken, and the transitway through the underpasses will be constructed.

7.5 Transitway Overpass of McGillivray Boulevard
A new transitway structure will be constructed over McGillivray Boulevard, a high-speed urban arterial thoroughfare with two through lanes in each direction and a wide boulevard between the eastbound and westbound roadways. On either side of McGillivray Boulevard, the transitway is oriented north-south within the Manitoba Hydro RoW. Within this RoW are located four existing and two planned hydro transmission lines, a City of Winnipeg aqueduct, and a major water feeder main. In consultation with Manitoba Hydro and the City, the transitway alignment and the new overpass have been designed to minimize impacts on these utilities. The overpass design includes the use of vertical walls (Mechanically Stabilized Earth – MSE) to minimize impacts on hydro and underground infrastructure. The new overpass will accommodate one transitway lane in each direction and a two-way AT pathway adjacent to the northbound transitway lane (separated from the lane by a physical barrier).

7.6 Letellier Tunnel
At approximately Chevrier Boulevard, a new transitway tunnel (Letellier Tunnel) will be constructed to transition the transitway from the Manitoba Hydro RoW on the west side of the CN Letellier tracks to the east side of the tracks. The transitway needs to be aligned on the east side of the CN Letellier subdivision to provide rapid transit access to existing high-density development between Chevrier and Markham Road, and to provide efficient transit access to Investors Group Field and the University of Manitoba. The Letellier Tunnel will be constructed beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track. The north end of the tunnel structure will be on the west side of the Letellier subdivision immediately south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 621 metres further south on the east side of the Letellier subdivision. The tunnel structure includes a covered tunnel approximately 200 metres in length with retaining walls approximately 200 metres in length approaching the north tunnel entrance and 225 metres in length approaching the south tunnel entrance. During construction, a temporary shroud of the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required.

7.7 Relocation of CN Letellier Track, CN Letellier Rail Bridge over Bishop Grandin Boulevard, Transitway Bridge over Bishop Grandin Boulevard
Between the south end of the Letellier Tunnel and a point south of Markham Road, segments of the existing track, signals and switches will be relocated westerly within the CN Letellier RoW to accommodate the transitway alignment. This work will include the construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel to and immediately west of the existing rail bridge over Bishop Grandin Boulevard. After construction of the new rail bridge is completed and the CN Letellier track is relocated, the old rail infrastructure will be removed, CN operations will be shifted to the relocated line, and a new Transitway Bridge over Bishop Grandin Boulevard will be constructed in the current location of the existing rail bridge. The Transitway Bridge will accommodate one transitway lane in each direction and a two-way AT pathway adjacent to the northbound transitway lane (separated from the lane by a physical barrier).
7.8 Stations

Stage 2 of the Southwest Transitway will include the construction of seven new stations along the transitway, two new stations on the transitway connection to the University of Manitoba, a new station at Investors Group Field and upgrades of existing stops on the University of Manitoba campus. The new transitway stations will include:

- Parker Station (between Georgeina Street and Beaumont Street, north of Parker Avenue);
- McGillivray Station (north of McGillivray Boulevard, near Seel Avenue);
- Clarence Station (between Clarence Avenue and Waller Avenue);
- Chevrier Station (north of Chevrier Boulevard);
- Plaza Station (east side of CN Letellier track at west limit of the Public Road referred to as Plaza Drive);
- Chancellors Station (a "split" station on east side of CN Letellier track; northbound platform north of Chancellors Drive; southbound platform south of Chancellors Drive); and
- Markham Station (east side of the CN Letellier track, north of Markham Road).

Major features of these stations include large heated shelters, canopies over the platforms, station identification and wayfinding signage, information kiosks, electronic signs that display real-time bus departures, benches, waste receptacles, and bicycle storage facilities.

Two new stations will be built on the transitway connection to the University of Manitoba at:

- Southpark Drive near Pembina Highway; and
- On the University's Southwood lands near the Transitway and Markham Road intersection.

These two stations will include such amenities as heated shelters, a sign structure, electronic signs, information kiosks, benches, and waste receptacles.

Existing stops to be upgraded on the University of Manitoba campus include:

- University of Manitoba Station on Dafoe Road;
- School of Music Stop;
- Northbound University Crescent at Matheson Road; and
- Northbound University Crescent at Dafoe Road.

These stops will include such amenities as heated shelters, a sign structure, electronic signs, information kiosks, benches, and waste receptacles.

A special purpose station will be construction at Investors Group Field (IGF) to accommodate buses serving major events at the stadium. Up to 200 buses are used to transport spectators to and from events. IGF Station will be located adjacent to the stadium. An overhead pedestrian walkway will be built between a stadium entrance and the station's large central loading platform to segregate pedestrian movements from bus operations.

7.9 Park and Ride

Large park and ride facilities will be constructed at McGillivray Station and at Clarence Station. At McGillivray Station, an existing parking lot on the west side of the Manitoba Hydro RoW (currently leased by the Church of the Rock) will be extended further north to the station. Street connections will be provided between the parking lot and Buffalo Place and Seel Avenue. At Clarence Station, a new parking lot will be built on the west side of the Manitoba Hydro RoW adjacent to the station. Street connections will be provided between the parking lot and Clarence and Waller Avenues.

7.10 Transitway Runningway, Connections between the Transitway and Street System, At-Grade Intersections

Between stations, the transitway runningway will include a 3.5 metre lane and a shoulder allowance in each direction. Within each station, two lanes will be constructed in each direction to allow express buses to overtake other buses that may be boarding passengers and to provide for bus turning movements between the runningway and the street system. Roadway connections between the transitway and the street system will be constructed at the following locations to permit transit routes operating on the transitway to be "through-routed" to their various destinations in southwest Winnipeg:

- From Parker Station to Hurst Way/Wilkes Avenue/Sterling Lyon Parkway;
- From Parker Station to Beaumont Street;
- From McGillivray Station to Seel Avenue;
- From Clarence Station to Clarence Avenue;
- From Chevrier Station to Chevrier Boulevard;
- From Chancellors Station to Chancellors Drive;
- From Markham Station to Markham Drive;
- From the transitway to Southpark Drive; and
- From IGF Station to University Crescent.

The transitway will have at-grade crossings with the street system at the following five locations:

- Georgeina Street (near Parker Station);
- Clarence Avenue (near Clarence Station);
- Chevrier Boulevard (near Chevrier Station);
- Southpark Drive and Pembina Highway; and
- University Crescent (near IGF Station).

These intersections will be controlled by new traffic signals. Where possible, transit signal priority technology will be used to enable buses to communicate with the traffic signal controllers to provide priority to rapid transit service. In addition, the transitway will have at-grade crossings with the street system in close proximity to the CN Letellier track at the following two locations:

- Chancellors Boulevard (near Chancellors Station); and
- Markham Boulevard (near Markham Station).
Flashing warning signals currently operate at these rail crossings to stop on-street eastbound and westbound traffic and pedestrians while a train passes. These flashing warning signals will be repositioned to stop on-street eastbound/westbound traffic, pedestrians, and southbound transitway bises intending to turn right from the transitway onto either Chancellor or Markham when a train is passing. In addition, traffic signals will be installed to permit transitway bises to cross the streets and make turns from or to the transitway at these locations. The CN flashing warning signals and the traffic signals will be integrated to ensure safe operations. Transit signal priority technology will be used to enable rapid transit bises to communicate with the traffic signal controllers to provide priority to buses over other on-street traffic.

7.11 Active Transportation

The project includes an extension of the existing AT pathway adjacent to the Stage 1 transitway along the Stage 2 transitway to the University of Manitoba. The path will be sufficiently wide to accommodate cyclists and pedestrians and will be connected to existing paths in the active transportation network at several locations along the transitway. The path will be included in transitway underpass, overpass, and bridge structures, adjacent to the northbound transitway lane (separated from the lane by a physical barrier). Due to safety reasons, the path will not be included in the Letellier Tunnel. Instead, the path will be routed at grade from Chevrier Station on the west side of the tracks to Plaza Station on the east side of the CN Letellier tracks via Chevrier Boulevard and Hudson Street. The AT pathway will be directly connected to all stations. Bicycle storage facilities will be provided at each station.

7.12 Railway Works Considerations

For the following railway works described above, i.e., CN Rail Bridge over Pembina Highway, Transitway Underpass of CN Wye Tracks at Portage Junction, Letellier Tunnel, Relocation of CN Letellier Track and CN Letellier Rail Bridge over Bishop Grandin Boulevard, the following guidelines were used in the development of the functional plans:

- Existing operating train speeds of 30 to 40 kph in the CN Letellier subdivision will be maintained following completion of the project;
- Proposed temporary and permanent track alignments and turnout configurations are based on approved CN engineering standards;
- To minimize train noise, continuous welded rail (CWR) with premium ties and fasteners will be used for the relocated CN Letellier track (based on CN engineering track standards);
- A noise attenuation wall is proposed on the west side of the relocated CN Letellier track between Bishop Grandin Boulevard and Markham Road; and
- During project construction, CN service on the CN Rivers tracks and on the CN Letellier track and spur tracks will be maintained.

7.13 Drainage Works

The land drainage functional design concept for the Project has been prepared based on discussions with the Water and Waste Department of the City of Winnipeg and will be finalized at the Detailed Design stage as carried out by the contractor, Project Co (Dillon Consulting Limited 2013a). Figure 7-1 illustrates the proposed design and includes considerations of the drainage requirements for the Cockburn and Calrossie Combined Sewer Relief Works, the Pembina Highway Underpass, as well as Stage 2 of the Southwest Transitway Project. Drainage concepts that consider all three components were reviewed to determine the overall recommendation. For example, based on a review of the pumping station concepts serving the Pembina Highway Underpass and the proposed Transitway Underpass of the CN Wye Tracks, it was recommended that two separate pumping stations be built.

The drainage concept for the transitway considers restrictions from Manitoba Hydro transmission lines, the CN Railway, the Branch Island aqueduct and Fort Garry feedermain, and was developed based on various features of the proposed transitway structures (i.e. Transitway Underpass of CN Wye Tracks, Transitway Overpass of McGillin, Letellier Tunnel) as well as several stations and street connections. The stations and connections are important to consider as the impervious area increases considerably and therefore generate more overland runoff. In some cases, it also limited the drainage options as there was no longer enough space for ditching.

The concept consists of a combination of new land drainage sewers (LDS) and ditches along the transitway that would drain into existing adjacent land drainage systems. This approach is standard design practice provided that an analysis has been carried out to show that there is no increase in the peak flow rate. The adjacent systems include the Parker Retention Pond, Somerset Avenue, Riviera Crescent, Lot 16 Drain, D'Arcy Drive and the University of Manitoba Southwood lands. As part of the Cockburn and Calrossie Combined Sewer Relief Works, the current design concept for separation involves the construction of the Parker Retention Pond. The design and construction of the Parker Retention Pond is being carried out by the City of Winnipeg Water and Waste Department and is not part of Stage 2 of the Southwest Transitway project. The recommended alignment and drainage design for the Project interacts with the pond into consideration, but the Parker Retention Pond is not part of the Project.
The Parker Retention Pond has been included in the list of adjacent systems as drainage along Parker Avenue will be routed east toward the pond via ditches. It is also proposed that runoff at the Transitway Underpass of CN Wye tracks be pumped into the Parker Retention Pond.

The conceptual design for the Parker Retention Pond includes incorporation of natural features and native plants, such as those used by Native Plant Solutions (a division of Ducks Unlimited Canada), a group currently developing methods and plans for the construction of stormwater ponds that incorporate upland, wet meadow, and wetland plants and features for constructed ponds (Ross 2013). The pond will provide water retention to address current inadequacies in the existing sewer systems, prevention of overland flooding in the area, and replace the function of the wet meadow and cattails stands as wet areas and habitat for the existing vegetation and wildlife in the PSA that require these seasonally wet conditions.

Models of the adjacent systems were created using the software InfoWorks CS to assess the existing hydraulic conditions and determine the impact of additional flows. Transitway flows into the adjacent systems were restricted via a small pipe inlet (250 mm diameter) to maintain the existing peak discharge. Because of the flow restriction, the new LDS and ditches for the transitway were upsized to provide the necessary storage capacity to handle a 100-year MacLaren rainfall. The results of the hydraulic assessment show that there is no effect on the peak flow rate in the adjacent systems.

With the exception of a few sections near stations (400 to 600 mm diameter LDS), ditching is proposed along the transitway between Parker Avenue and Chevrier Boulevard. The ditch configuration consists of 6:1:1V side slopes and a bottom width of 1.5 metres, with depths ranging from 0.80 to 1.05 metres. Drainage near the proposed Letellier Tunnel is restricted because of numerous conflicts and consists of LDS (ranging from 375 to 1050 mm diameter), South of Bishop Grandin Boulevard to Markham Road, a new LDS system is also proposed with diameters ranging from 750 mm near the KGF Station to 900 mm along the Transitway North-South segment and 1050 mm downstream.

The ditch drainage design is based on a 5-year MacLaren storm based on City of Winnipeg design standards. The design standard for underpasses is more stringent as water accumulation could render the underpass impassable. For this reason, the drainage design for the underpasses was based on a target 50-year MacLaren rainfall total capacity, which is a higher level of service than for the design used for the pumping station for the Stage 1 transitway tunnel. Two pumping stations are included as part of the land drainage concept at the Transitway Underpass of CN Wye and the Letellier Tunnel.

7.14 Termination of Parker Avenue/Extension of Beaumont Street

As this transitway alignment requires the termination of Parker Avenue at Hurst Way and the transitway, an extension of Georgina Street from Parker Avenue to Hurst Way is planned as a replacement road to accommodate travel between the residential areas west of Pembina Highway and the Sterling Lyon/Linden Woods area.
7.15 Utilities

The following utility work will need to be undertaken to accommodate the Project:

- **Manitoba Hydro Transmission, Distribution, and Communication Lines** – The Project requires removal/relocation of hydro infrastructure (including transmission, communication, and distribution lines) along the transitway alignment. Extensive consultation with Manitoba Hydro was undertaken to develop a plan of hydro-related work that accommodates the Project and the safety, maintenance, and long range planning needs of Manitoba Hydro. To accommodate the start of project construction in 2016, Manitoba Hydro has committed to the removal and/or relocation of the lines prior to December 31, 2015. As a result, the City will arrange for this work to be carried out by Manitoba Hydro prior to executing its contract with Project Co.

- **Street Lighting** – New street lighting and cabling is required throughout the entire length of the transit corridor, in all adjacent parking lots, and along new transitway connections to the street system. In addition, existing street lighting where the transitway intersects the street system will be reconfigured.

- **Natural Gas Distribution** – The transitway alignment crosses three existing natural gas distribution lines: a 200 mm line along Chevrier Boulevard, a 50 mm line along Chancellor Drive, and a 50 mm line along Markham Road. These lines will be required to be lowered where the transitway crosses them.

- **Manitoba Telecom Services Communication Lines** – Existing lines cross the transitway alignment at Seel Avenue, Chevrier Boulevard, Manahan Avenue, Chancellor Drive, and Markham Road. Some lines that are underground will be required to be lowered where they cross the transitway. In some instances, it may be possible to relocate some of these lines on overhead poles shared with Manitoba Hydro. While some underground lines are at a depth that will not be affected by project construction, adjustments to their underground cabinets and manholes will be required. The project includes two new pump stations to service the underpasses. These facilities require MTs connections for telephone service.

- **Other Communications Companies’ Lines** – For lines owned by Shaw, Telus, and TeraSpan, there are some underground and overhead lines that will require relocation. Some are shallowly buried along streets that cross the transitway and will be required to be lowered. Other lines that are currently located on Manitoba Hydro poles that will be relocated will need to be re-routed. The Pembina Trails School Division has an existing underground fibre optic line that crosses the transitway alignment at Seel Avenue. This line will be required to be lowered.

7.16 Services Required of City of Winnipeg Departments

The Project will require the following services from the City of Winnipeg:

- **The Traffic Services Branch of the Public Works Department** will be required to provide permanent roadway signage on the transitway, at transitway connections with streets, at bus access/egress locations on the transitway, and for closures/realignments of existing streets. During construction, directional and wayfinding signage will be required for temporary traffic detours.

- **The Traffic Signals Branch of the Public Works Department** will be required to upgrade existing traffic signals at the intersection of Markham Road and Pembina Highway, and to design and install new traffic signals at transitway intersections with the following streets: Georgina Street, Clarence Avenue, Chevrier Boulevard, Chancellor Drive, Markham Road, Southpark Drive at Pembina Highway, Markham Road on the University of Manitoba lands, and University Crescent.

- **The Forestry Branch and Naturalist Services Branch of the Public Works Department** will be required to assess trees and other vegetation removed from the Project limits and to inspect newly installed trees, landscaping, and plantings, in keeping with the City’s Natural Area Appraisal and Tree Removal Guidelines.
The Transit Department will be required to arrange for any special operational signage on the
transitway and for the integration of the transitway's electronic variable message signs and Closed
Circuit Televisions (CCTV) infrastructure with existing systems.

The Geomatics Branch of the Planning, Property and Development Department will be required to
install monuments and property pins at various locations within the Project limits.

7.17 Landscaping

Landscape treatment will be a unifying element of the Southwest Transitway and will be used to enhance
the aesthetic quality of the transitway, while improving micro-climate conditions such as environmental
relief from the effect of sun and wind. The use of low maintenance, hardy, xeriscape plant material will
ensure the highest level of survivability with the lowest level of supplementary watering, pruning and
weeding. The selection of plant material will complement station design, have seasonal variation and
provide functional characteristics for shade, security, winter protection and colour. Plant species native to
the area will be used where possible. The City of Winnipeg Naturalist Services Branch will consult with
Native Plant Solutions to determine appropriate plant species for the Project landscaping requirements,
including the Parker Retention Pond.

8 PROJECT SCHEDULE

Based on the required Project components described above, a construction schedule for the Project was
developed to take place over the 2016 to 2019 time period. This schedule considers the requirements of
the City, Winnipeg Transit, Manitoba Hydro, CN, and the University of Manitoba. The construction
schedule for the Project components is shown in Figure 8-1.

9 PROJECT CONSTRUCTION ACTIVITIES

The Project construction activities will include construction of the following components:

- Structures, which will include the CN Pembina Overpass and Portage Junction, McGillivray
  Overpass, Letellier Tunnel, Bishop Grandin CN Overpass, Bishop Grandin Transitway Overpass
  and Investors Group Field Station Ramp;

- Roadworks, which will include the Pembina Highway Improvements, the Transitway along the
  Parker Lands, Manitoba Hydro RoW, Letellier Rail Line and to the University of Manitoba, and the
  termination of Parker Avenue and extension of Georgia Drive to Hurst Way;

- Stations within the Parker Lands, Hydro RoW, Letellier Rail Line and at the University of
  Manitoba;

- Landscaping;

- Active Transportation Pathways;

- Drainage and Underground Relocations;

- Third Party Utilities; and

- Railworks.
The construction activities will be carried out in accordance with current Best Management Practices (BMPs), regulations, specifications and standards for the transportation and rail industries. Equipment and methods to be employed will be typical of other urban transportation and rail projects previously undertaken in the City, e.g. use of heavy construction equipment such as asphalt pavers, backhoes, bulldozers, cement trucks, concrete mixers, cranes, drills, dump trucks, excavators, graders, heavy and light trucks, pavers, pile drivers, scrapers, packers, and assorted hand tools. The construction of the transitway and associated structures and works will require large amounts of gravel, sand and fill, as well as asphalt, cement, geotextiles and other building materials. Landscaping and the construction of the AT pathways and ditches will also require the use of native soils and plants to establish stable vegetated areas that are functional, low maintenance and aesthetically pleasing. A number of staging areas, shooflies, construction access points and traffic management plans will also be required for the Project construction activities. Additional information on the construction activities, equipment, methods and approach will be developed for the Detailed Design phase of the Project.

10 PROJECT OPERATIONS AND MAINTENANCE ACTIVITIES

The Project will enter the operations and maintenance (O&M) phase on completion of the construction activities. As this project is expected to be undertaken as a P3 Project, the project will require that the Project Co. (referred to as Contractor through the remainder of the document) carry out all maintenance of the facility for a 30 year time frame. After this time frame the City will take on the facility and the maintenance. The following information provides a brief description of activities during the Project O&M phase.

10.1 Structures

O&M of the structures associated with the Southwest Transitway will be carried out by the Contractor selected by the City of Winnipeg. O&M activities will be consistent with the activities undertaken for similar City of Winnipeg structures, e.g., free of debris, snow or ice and safe for travel expansion joint repair, curb replacement etc.

10.2 Transitway

Once in operation, scheduled transit service will operate on the transitway 24 hours a day. During peak periods (between 7:00 a.m. and 9:00 a.m. and 3:30 p.m. and 5:30 p.m.), 30 buses per hour will operate on the transitway in each direction (for a total of approximately 60 buses per hour). During off-peak periods, an average of 15 buses per hour per direction (a total of 30 buses per hour) will operate on the transitway. One to two buses per hour will use the transitway between 1:00 am and 5:00 am.

Buses utilizing the transitway will consist of a mix of current City of Winnipeg buses and new Rapid Transit articulated vehicles – modern, state-of-the-art rubber-tired vehicles that provide high-level comfort and passenger amenities. Emergency vehicles will also have access to the transitway, when required. Buses will travel along the transitway at speeds of up to 80 kilometres per hour. Entering and exiting stations, bus speeds will be restricted to between 35 and 50 kilometres per hour.

Runningway maintenance activities throughout the transitway corridor will be consistent with those undertaken for all City of Winnipeg streets. Maintenance work will consist of joint and curb repairs, joint sealing, diamond grinding etc. During the winter months, snow clearing will take place on a regular basis and snow will be hauled to registered snow dump areas.

10.3 Stations

Stations along the transitway will operate during the same hours as the transitway. The buses traveling the transitway will stop at each of the proposed stations. Ongoing maintenance at the stations will be consistent with the maintenance activities currently in place for Winnipeg Transit stations.

10.4 Park and Ride

The new Park and Ride stations along the transitway will operate during the same hours as the City’s existing Park and Ride stations and bus operations. The buses traveling the transitway will stop at all stations that have Park and Ride facilities. Ongoing maintenance at the Park and Ride stations will be consistent with the maintenance activities currently in place for Winnipeg Transit Park and Ride stations.

10.5 Active Transportation Pathways

The new AT pathways will be operated and maintained in the same manner as the existing City of Winnipeg AT pathways, i.e., open for multiple uses (cycling, rollerblading, walking) with the trails kept free of debris and safe for the intended uses.

10.6 Railworks

The railworks located within CN property will be operated and maintained by CN. Any areas, facilities or structures associated with the railworks that are located within City of Winnipeg property will be operated and maintained by the Contractor selected by City. Ongoing maintenance will be consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries.

10.7 Land Drainage System

The City of Winnipeg Water and Waste Department will be responsible for maintaining Parker Retention Pond, while the Contractor will be responsible for maintaining the ditches, LID, pumping stations for the first 30 years. Consistent with current department practices, regular inspections of the facilities will be conducted to ensure that they are functioning as designed. The City of Winnipeg Water and Waste Department currently has a person assigned for the O&M of retention basins to conduct annual to semi-annual maintenance including the removal of rubbish, rodents, etc.

10.8 Landscaping

The Contractor selected by the City will be responsible for maintaining the landscaped areas alongside the Transit Corridor, while the will be responsible for maintaining the landscape areas at the Parker Retention Pond. Maintenance activities will include planting, mowing, mulching, pruning, watering and weeding, as well as regular inspections to ensure that the vegetation is healthy, functioning as designed and aesthetically pleasing.
11 PROJECT DECOMMISSIONING

The transitway and associated infrastructure have been designed as permanent features in the City of Winnipeg and decommissioning is not anticipated. However, should the City of Winnipeg decide at some point in the future to decommission the transitway, decommissioning will be done in a manner consistent with up-to-date construction/demolition and environmental standards.

12 PROJECT ALTERNATIVES

12.1 Alternative Modes

The Rapid Transit Task Force’s “Made in Winnipeg” report evaluates the options of Bus Rapid Transit (BRT) and Light Rail Transit (LRT). The study involved a review of twenty LRT systems in the United States and three in Canada, as well as over thirty-five BRT systems in Canada, the United States, South America, Australia and England. The studies focused on the structures, capital and operating costs, passenger capacities, and key features of the systems various implemented in the focus jurisdictions, and relates these factors to the implementation of a BRT system or to various alternative LRT systems (traditional LRT, electric LRT, and diesel). In addition, the study compared BRT and LRT systems with respect to functional requirements, design features, schedule adherence, and the ability for existing infrastructure to be used to support rapid transit development. The study also involved consultation with technical experts and the general public.

The report’s evaluation reveals the following:\(^2\)

- Both BRT and LRT can fulfill the functional requirements of a rapid transit system providing high capacity, high performance, urban transit routes and services.
- BRT and LRT share the same key features including runningways, transit priority measures, real-time passenger information systems, centralized stations with passenger amenities, brand identity, presence and sense of permanence.
- The key features of a rapid transit system have a greater effect on system performance (speed, frequency, reliability) than the choice of vehicle (bus or train).
- Rapid transit systems with more exclusive runningways (separated from other vehicles) have the most reliability and schedule adherence.
- BRT systems with exclusive runningways operate at travel times comparable to LRT.
- The differences between LRT and BRT are primarily public perception and cost.
- BRT has lower capital costs, lower operating costs for passenger demands predicted for Winnipeg and lower equivalent annualized costs (annualized capital costs combined with annual operations and maintenance costs) than LRT.


For the Southwest Transit Corridor in particular, the complexity created by the proximity of major utilities (CN mainline and branch lines, Manitoba Hydro transmission lines and sub-stations, aqueduct, major water and sewer mains, intersecting arterial roadways) and the pattern of available capital funding require that the corridor be constructed in stages. The BRT approach (where transit vehicles can operate both on the transitway and on regular streets) enables each stage to be put into service immediately after construction. In comparison, LRT requires the complete line to be constructed before any service can be operated and any benefits realized. The BRT approach permits an earlier return on rapid transit investment than would otherwise be possible for the Southwest Corridor.

12.2 Alternative Routing

The following four options for the routing of Stage 2 of the Southwest Transitway were identified and assessed in the Southwest Rapid Transit Corridor Stage 2 Alignment Study (Dillon 2013a):

- Concept 1A – Parker/Manitoba Hydro Lands Paralleling CN West Rail Line;
- Concept 1B – Parker/Manitoba Hydro Lands Paralleling Parker Avenue;
- Concept 2 – CN Letellier Subdivision; and,
- Concept 3 – Pembina Highway Center Median.

Concept 1A extends from Stage 1 of the Southwest Rapid Transit Corridor from Jubilee Avenue over Pembina Highway on a structure just north of the Jubilee Avenue Overpass. West of Pembina Highway, the transitway alignment passes under two CN rail tracks (Letellier Subdivision and switching track), at which point Concept 1A continues west alongside CN’s main line. At the westerly end of the Parker Lands, the alignment turns in a southeasterly direction, crosses Parker Avenue, and then is located within the Manitoba Hydro RoW until it intersects the CN Letellier rail line just north of Bishop Grandin Boulevard. This alignment provides an opportunity to use a pedestrian connection under or over the existing CN rail line to link with the developable Shidlico lands on the north side of the tracks, one of the 11 Major Redevelopment Sites designated in “Our Winnipeg” (City of Winnipeg 2011a) and “Complete Communities” (City of Winnipeg 2011b). However, this alignment would significantly impact the current developable Gem Equities Inc. lands north of Parker Avenue, also a Major Redevelopment Site.

Concept 1B extends from Stage 1 of the Southwest Rapid Transit Corridor from Jubilee Avenue over Pembina Highway on a structure just north of the Jubilee Avenue Overpass. West of Pembina Highway, the transitway alignment passes under two CN rail tracks (Letellier Subdivision and switching track), at which point Concept 1B continues west paralleling Parker Avenue. At the westerly end of the Parker Lands the alignment turns in a southeasterly direction, crosses the existing Parker Avenue and then is located within the Manitoba Hydro RoW until it intersects the CN Letellier rail line, north of Bishop Grandin Boulevard. The Concept 1A and 1B alignments are identical south of Parker Avenue within the Manitoba Hydro RoW and the CN Letellier Row.

Concept 2 extends Stage 1 of the Southwest Transitway from Jubilee Avenue over Pembina Highway on a structure just north of the Jubilee Avenue Overpass. West of Pembina Highway, the alignment follows the east side of CN’s Letellier sub-division continuing south and crossing Byng Place, Windermere
City of Winnipeg – Transit Department
Southwest Transitway – Stage 2
Environmental Review and Assessment

Avenue, Somerset Avenue, Waterford Avenue, Southwood Avenue, McGillivray Boulevard, Waller Avenue, Clarence Avenue, Chevrier Boulevard, Bishop Grandin Boulevard, Chancellor Drive, Markham Road, terminating at Bison Drive. All street crossings within this section would be at grade and controlled by signalized gates to accommodate both transit and CN train traffic, with the exception of Bishop Grandin Boulevard, which will be a new overpass structure.

Concept 3 extends Stage 1 of the Southwest Transitway from Jubilee Avenue along the center median of Pembina Highway to Bison Drive. This option would require extensive property, dislocate many commercial properties, require extensive reconstruction of Pembina Highway for the entire length south of Jubilee Avenue, create significant safety concerns at all 48 median openings along Pembina Highway, and would be unable to cross Bishop Grandin Boulevard. For these reasons, the Pembina Highway median alignment option was considered to be not viable.

An extensive review and evaluation of Concepts 1A, 1B, 2 and 3 was conducted that considered the engineering, socio-economic and environmental issues; property impacts; Transit Orientated Development (TOD); tax incentives; ridership; active transportation; future build-out opportunities; public feedback; and expected construction costs. Based on the review and evaluation, Concept 1B was selected as the preferred alignment for Stage 2 of the Southwest Transitway. This alignment completes the link between downtown Winnipeg and southwest Winnipeg, and provides for access to/from the U of M, Investors Group Field, and new neighbourhoods. Additional information on the alternative routing options, evaluation process and public consultation program are provided in the “Southwest Rapid Transit Corridor Stage 2 Alignment Study – Final Report” (Dillon 2013a).

13 REGULATORY FRAMEWORK

As noted in Section 1, the Project will be considered as a Class 2 Development under the requirements of the Manitoba Environment Act, and therefore requires submission of an Environmental Impact Statement (EIS) and approval by MCWS to obtain an Environment Act License (EAL) (B. Webb, pers. comm. 2013). Under the Canadian Environmental Assessment Act (CEAA) 2012, the Project does not require review or approval by the Canadian Environmental Assessment Agency. The federal and provincial environmental legislation applicable to the proposed Project at the time of writing included the following:

- Canada
  - Canadian Environmental Protection Act
  - Fisheries Act and Regulations
  - Migratory Birds Convention Act
  - Species at Risk Act
  - Transport Canada
  - Wildlife Act

- Manitoba
  - Climate Change and Emissions Reductions Act
  - Dangerous Goods Handling and Transportation Act
  - Endangered Species Act

- Environment Act
- Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat;
- Noxious Weeds Act and Regulation
- Sustainable Development Act
- Waste Reduction and Prevention Act and Regulations
- Wildlife Act

14 ENVIRONMENTAL ASSESSMENT METHODS

The Project is considered to be a Class 2 Development under the Manitoba Environment Act and therefore requires an Environmental Assessment (EA) of the proposed Project activities to obtain an Environment Act License from the Province of Manitoba.

The methods and analysis used to identify and determine potential environmental effects within the Project area consisted of the following:

- Review of engineering, consultation and environmental information from previous studies;
- Information on land use, topography and location of commercial areas, industrial areas, recreational areas, residential areas, parks, protected areas, watercourses, waterbodies, forests, wetlands, roadways, trails and other infrastructure was determined by a desk-top review and examination of topographic maps, drainage maps, aerial imagery and published information for the area.
- The above-noted features were further examined and ground-truthed by a field survey of the Project study area. The field survey provided on-site observations and documentation of the presence and location of the proposed BRT route; Manitoba Hydro transmission lines and transmission line ROW, CN yards and CN ROW; vegetated areas; mowed or cultivated areas; residences, parking lots, businesses and other infrastructure; potential fish and wildlife habitat; protected areas; roads and other human made structures or land use practices. The field survey was conducted on October 01, 2013, by a two person crew consisting of a qualified botanist and a qualified fisheries and wildlife biologist.
- Provincial (Manitoba Conservation Data Centre [MCDC]) and federal (Committee on the Status of Endangered Wildlife in Canada [COSEWIC]) Species at Risk Act (SARA) databases and registries were reviewed and cross-referenced to species distribution maps, habitat preferences, breeding periods and migration times to determine the potential for the presence of any species listed as endangered, threatened or of special concern within the Project area.
- Review of information provided in the Manitoba Breeding Bird Atlas, Manitoba Herps Atlas, annual publications released by MCDC on MCDC Rare Plant Surveys and Stewardship Activities and recent Environmental Impact Statements (EIS) completed for projects located within the region.
- Review of the City of Winnipeg Naturalist reports for the Project area, including the Parker Lands.
- Contact with the Invasive Species Council of Manitoba (ISCM) to obtain a current list of invasive species for the Project area.
- Review of the City of Winnipeg’s “Ecologically Significant Natural Lands Strategy and Policy” (December 2007) and current City of Winnipeg Tree Removal Guidelines.
• A request was submitted to the MCDC for information on the presence of any rare or endangered species in the Project area.
• A request was submitted to the Manitoba Historic Resources Branch (MHRB) for information on the presence of any heritage resources in the Project area.
• A review of current First Nations Treaty Lands, Reserves, and/or Community Interest Zones in the Project Area.
• A meeting on November 18, 2013, with Manitoba Conservation and Water Stewardship (MCWS) regulatory staff to review the project and determine the requirements for the EIS.
• Review and incorporation of the stakeholder information provided in the Public Consultation program.
• Review of applicable municipal, provincial, and federal environmental regulations, guidelines, and/or policies.
• Potential effects were identified based on knowledge of the Project area, previous experience with similar projects, professional experience in conducting environmental assessments, and knowledge of applicable municipal, provincial, and federal environmental regulations, guidelines, and/or policies.
• Canadian Environmental Assessment Act (CEAA) criteria were used to determine the potential environmental effects, the presence of residual effects once mitigation measures have been considered, if the remaining residual effects will have an environmental consequence, and the need for any follow-up or monitoring activities. Information on the criteria used to assess the residual effects and environmental consequence of the residual effects is provided in Section 20.

15 STUDY AREA

15.1 Project Study Area
The Project Study Area (PSA) is defined as the area that will be physically altered and/or directly affected by the Project construction activities and/or Project O&M (O&M) activities. The Project activities will take place within the existing CN Rail, Manitoba Hydro RoW corridor, and City of Winnipeg-owned land; therefore, the PSA was designated as the area located within the existing CN Rail and Manitoba Hydro RoW where Project activities will occur.

15.2 Local Study Area
A Local Study Area (LSA) is selected to include the spatial area in which direct effects from the Project are anticipated to occur. To examine the potential environmental effects of the Project in the local area, the LSA was designated as the lands, watercourses/waterbodies, residences, businesses, facilities and infrastructure located within 0.5 kilometres (km) of either side of the existing CN Rail and Manitoba Hydro RoW.

15.3 Regional Study Area
A Regional Study Area (RSA) is selected to include the spatial area in which direct and indirect effects from the Project are anticipated to occur. To examine the potential environmental effects of the Project in the region, the RSA was designated as the City of Winnipeg. This area was selected to:
• Encompass wildlife movements and activities in the area, including Species At Risk;
• Include any affected watercourses, waterbodies or wetlands that extend outside of the PSA and LSA;
• Examine potential effects on land use, recreation, development and/or other stakeholder interests in the region.

16 EXISTING ENVIRONMENT

16.1 Overview of Project Area
The Project is located within the City of Winnipeg between the Pembina Highway and Jubilee Avenue overpass and Bison Road (Figure 1-1; Figure 6-1; Appendix A). The majority of the PSA is contained within the CN RoW and/or Manitoba Hydro RoW. These RoW areas are routinely mowed and maintained as per CN and Manitoba Hydro operational and safety standards.

The PSA consists of vacant land south of the CN tracks near the Pembina Highway and Jubilee Avenue junction bounded to the south by Parker Avenue (known as the Parker Lands) and the Manitoba Hydro transmission line RoW leading south from the western edge of this property to Bison Drive. The proposed route follows the Manitoba Hydro transmission line RoW to a point south of Clarence Avenue, where it then joins the CN RoW and travels south to Bison Drive.

The Parker Lands include a City of Winnipeg off-leash dog park, paths used for walking and cycling, and plots for gardening. During the field survey, dumping of refuse was evident as well as dumping of garden waste. Some non-native “garden escapes” such as ground-ivy (Glechoma hederacea), Tartarian honeysuckle (Lonicera tatarica) and wild asparagus (Asparagus officinalis) have colonized some of the patches of woodlands. The corridor for the CN rail and RoW has trails used for walking and cycling, garden plots, and provides east/west access across the railroad tracks. More dumping of household items was evident in this section of the PSA.

16.2 Field Survey
The entire PSA was surveyed on foot. Information on the habitat conditions, disturbed areas and species present was recorded on field data sheets and photographed using the camera option on an Oregon 550 hand-held GPS and/or a Garmin Map 60C/Sx hand-held GPS. The start and end point of each surveyed area and any other areas of interest (e.g., plant species location) were marked as a waypoint on the GPS.

Additional time was spent surveying the Parker Lands area, which is vacant land south of the CN railroad tracks near the Pembina Junction, bounded to the south by Parker Avenue. This land is a focal point for a local community group that is concerned the Project will affect a wetland area that provides habitat for
Northern leopard frog (*Lithobates pipiens*), a species of Special Concern under the federal SARA, and also affect areas of deciduous forest, wet meadow and grassland that occurs in the Parker Lands. Special attention was paid to surveying the Parker Lands and the search for species of conservation concern.

The field survey was conducted on October 01, 2013; therefore, the majority of migratory wildlife species would have already left the area; the wet meadow and/or wetland areas were dry; and plants that grow and flower in spring or early summer were not present or were in senescence. However, the timing of the survey provided a good indication of the size and permanence of the wet areas, the plant species within and adjacent to the wet areas, and aided in the classification of these areas as potential Northern leopard frog habitat. A late spring survey would be required to provide a better understanding of the amount and duration of water present in the stand and its wetland classification, as well as additional information on the presence/absence of spring blooming plants and wildlife in the area, e.g., Northern leopard frog, migratory birds.

### 16.3 Biophysical Environment

#### 16.3.1 Climate

Climate can be defined as the generally prevailing weather conditions of a region throughout the year, and is typically described by variables such as air pressure, cloud cover, humidity, precipitation, hours of sunshine, temperature, wind speed and wind direction. The PSA is located in the prairie region of Canada. Climate within the prairies ranges from semiarid to humid continental and is typified by long, cold winters and short, warm summers with little precipitation. The region experiences variable winds, an abundance of sunshine, and occurrences of severe weather incidences in all seasons.

Environment Canada has collected climate data for several areas within Canada, from which 30-year climate normals and averages can be calculated for particular locations. The most recent 30-year climate normals provided by Environment Canada are for the period of 1971 to 2000. The Environment Canada weather reporting station considered to be closest to the PSA is located at Winnipeg Richardson International Airport. This station is located at 49°55' N and 97°14' W at an elevation of 238.7 m above sea level. Table 16-1 summarizes the Canadian climate normals data from 1971 to 2000 for Winnipeg Richardson International Airport (Environment Canada 2013a).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Average (°C)</td>
<td>-17.8</td>
<td>-13.6</td>
<td>-6.1</td>
<td>4</td>
<td>12</td>
<td>17</td>
<td>19.5</td>
<td>18.5</td>
<td>12.3</td>
<td>5.3</td>
<td>-5.3</td>
<td>-14.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Daily Maximum (°C)</td>
<td>-12.7</td>
<td>-8.5</td>
<td>-1.1</td>
<td>10.3</td>
<td>19.2</td>
<td>23.3</td>
<td>25.8</td>
<td>25</td>
<td>18.6</td>
<td>10.8</td>
<td>-0.9</td>
<td>-9.7</td>
<td>8.3</td>
</tr>
<tr>
<td>Daily Minimum (°C)</td>
<td>-22.8</td>
<td>-18.7</td>
<td>-11</td>
<td>-2.4</td>
<td>4.8</td>
<td>10.7</td>
<td>13.3</td>
<td>11.9</td>
<td>6</td>
<td>-0.3</td>
<td>-9.6</td>
<td>-19.1</td>
<td>-3.1</td>
</tr>
<tr>
<td>Precipitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfall (mm)</td>
<td>0.2</td>
<td>2.5</td>
<td>7.5</td>
<td>21.5</td>
<td>58</td>
<td>89.5</td>
<td>70.6</td>
<td>75.1</td>
<td>51.9</td>
<td>31</td>
<td>6.1</td>
<td>1.6</td>
<td>415.6</td>
</tr>
<tr>
<td>Snowfall (cm)</td>
<td>23.1</td>
<td>14.2</td>
<td>15.8</td>
<td>10.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.4</td>
<td>5</td>
<td>21.4</td>
<td>19.8</td>
<td>110.6</td>
</tr>
<tr>
<td>Total (mm)</td>
<td>19.7</td>
<td>14.9</td>
<td>21.5</td>
<td>31.9</td>
<td>58.8</td>
<td>89.5</td>
<td>70.6</td>
<td>75.1</td>
<td>52.3</td>
<td>36</td>
<td>25</td>
<td>18.5</td>
<td>513.7</td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windspeed (km/h)</td>
<td>17.1</td>
<td>16.7</td>
<td>17.7</td>
<td>18.4</td>
<td>17.9</td>
<td>16.4</td>
<td>14.6</td>
<td>14.9</td>
<td>17.1</td>
<td>18</td>
<td>17.4</td>
<td>17.1</td>
<td>16.9</td>
</tr>
<tr>
<td>Most Frequent Direction</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Source: Environment Canada’s National Climate Archive (Environment Canada 2013a).

The annual mean daily temperature in Winnipeg for the period of 1971-2000 was 2.6°C. The mean daily temperatures in January and July were -17.8°C and 19.5°C, respectively. The mean annual total precipitation during this period was 513.7 mm, the majority of which fell as rain. The average annual wind speed was 16.9 km/h and most frequently blew from the south (Environment Canada 2013a).

#### 16.3.2 Air Quality and Greenhouse Gas Emissions

Air quality and greenhouse gas (GHG) emissions within the PSA are affected by the commercial, industrial, recreational, transportation and urban activities that occur in the region. The Province of Manitoba and Environment Canada operate air quality monitoring stations in the cities of Brandon, Flin Flon, Thompson, and Winnipeg, Manitoba. The air quality monitoring stations closest to the Project area are located in the City of Winnipeg at 65 Ellen Street and at 299 Scotia Street. Air quality parameters that are monitored include: carbon monoxide (CO), particulate matter ≤ 10 microns (PM10), particulate matter ≤ 2.5 microns (PM2.5), nitric oxide (NO), nitrogen dioxide (NO2), nitrogen oxides (NOx), ground level ozone (O3), sulphur dioxide (SO2), wind direction, and wind speed (Government of Manitoba 2013a). Recent and historical data for the measured parameters can be obtained online at the Government of Manitoba air quality website.

Guidelines for ambient air quality have been compiled for many parameters in the Manitoba Air Quality Criteria (July 2005) (Government of Manitoba 2013b). These guidelines come primarily from the Canadian Council of Ministers of the Environment’s (CCME) (1999) national ambient air quality objectives. For this assessment, these guidelines were supplemented with criteria from CCME’s (2000) standards for particulate matter and ozone and Ontario Ministry of Environment’s (2012) objectives for PM10.

Data from the downtown station at Ellen Street, which is the monitoring station closest to the Project Area, are provided in Table 15-2. The only parameter that regularly exceeded guideline levels was ground level ozone (O3), a product primarily of vehicle emissions.
<table>
<thead>
<tr>
<th>Pollutant (unit)</th>
<th>Year</th>
<th>Annual Mean</th>
<th>Maximum Data Value</th>
<th># Samples Above MDL</th>
<th># Samples Above MAL</th>
<th># Samples Above MTL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-hr 24-hr</td>
<td>1-hr 24-hr 1-hr</td>
<td>24-hr 1-hr 24-hr</td>
<td>1-hr 24-hr 1-hr</td>
<td>24-hr 1-hr 24-hr</td>
</tr>
<tr>
<td>Carbon Monoxide (CO) (ppm)</td>
<td>2007</td>
<td>0.4 3.7 1</td>
<td>-- -- 35 ppm -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>0.4 2.3 1</td>
<td>-- -- 0 -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>0.4 5.8 1.1</td>
<td>-- -- 0 -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0.2 2.3 0.6</td>
<td>-- -- 0 -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0.1 1.5 0.4</td>
<td>-- -- 0 -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.2 1.6 0.5</td>
<td>-- -- 0 -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO₂) (ppb)</td>
<td>2007</td>
<td>-- -- --</td>
<td>-- -- -- -- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>11.6 91 31</td>
<td>-- -- 0 0 0 -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>11.6 88 37.8</td>
<td>-- -- 0 0 0 -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>9.2 77 30.7</td>
<td>-- -- 0 0 0 -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>11.5 70 36.8</td>
<td>-- -- 0 0 0 -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>9.9 49.7 28.9</td>
<td>-- -- 0 0 0 -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitric Oxide (NO) (ppb)</td>
<td>2007</td>
<td>7.4 446 50.2</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>7.1 151 38.6</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>7.9 281 69.6</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>4.6 191 39.6</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>5.3 175.7 40.4</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>5.3 226.8 59.9</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Oxides (NOx) (ppb)</td>
<td>2007</td>
<td>-- -- --</td>
<td>-- -- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>18.6 209 68.8</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>17.8 353 89.5</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>17.2 217 66.5</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>17.2 239.4 77.3</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>15.2 262.1 85.3</td>
<td>-- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphur Dioxide (SO₂) (ppb)</td>
<td>2007</td>
<td>-- -- --</td>
<td>-- -- -- -- -- -- -- --</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>0 35 3</td>
<td>0 0 0 0 0 -- 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>0 14 2</td>
<td>0 0 0 0 0 -- 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0 13 3</td>
<td>0 0 0 0 0 -- 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>0 11 2</td>
<td>0 0 0 0 0 -- 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0 17 1</td>
<td>0 0 0 0 0 -- 0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Data from Government of Manitoba 2013a

1. Indicates that there are no data and/or no guidelines or objectives for this parameter
2. MDL is Maximum Detectable Level. This level 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.
3. MAL is the Maximum Acceptable Level. This level is deemed essential to provide adequate protection for soils, water, vegetation, materials, animals, visibility, personal comfort, and well-being.
4. MTL is Maximum Tolerable Level. This level denotes a time-based concentration of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.
5. CO, NOx, and O₃ guidelines, along with PM₁₀ and PM₂.₅, reference levels, are from CCME 1999 and 2008.
7. MAL (Reference Level). Reference level is defined by CCME (1999) as the level above which there are demonstrated effects on human health or the environment.
8. PM₂.₅, MAL from CCME 2000.
Environment Canada has also developed the “Air Quality Health Index” (AQHI), an index that is based on the relative risk to human health that can be caused by a combination of common air pollutants (Environment Canada 2013b). These pollutants include ground-level ozone (O₃), particulate matter (PM₂.₅) and nitrogen dioxide (NO₂). The AQHI is measured on a colour-coded scale from 1 to 10+ and the values are also grouped into risk categories (low, moderate, high, very high) to identify the level of risk. The higher the number, the greater the health risk associated with local air quality (Environment Canada 2013b). The Province of Manitoba states that “recent monitoring has shown that the health risks associated with air quality for the cities of Brandon and Winnipeg are generally low, with an average AQHI rating of around three or lower in both locations” (Government of Manitoba 2013c).

Environment Canada currently tracks six GHG substances as part of Canada’s efforts to identify, quantify and reduce sources of GHGs. The six substances are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphur hexafluoride (SF₆), perfluoro-carbons (PFCs), and hydrofluoro-carbons (HFCs) (Environment Canada 2013c). Environment Canada produces an annual “National Inventory Report on Greenhouse Gas Sources and Sinks in Canada” for submission to the United Nations Framework Convention on Climate Change (UNFCCC) (United Nations 2013). The report includes a summary of GHG emissions for each province. Table 16-3 provides a summary of Manitoba’s GHG emissions from 1990 to 2011, which is from the most recent National Inventory Report.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Equivalent</td>
<td>18,300</td>
<td>21,000</td>
<td>20,500</td>
<td>21,300</td>
<td>21,200</td>
<td>19,800</td>
<td>19,700</td>
<td>19,500</td>
</tr>
</tbody>
</table>


Of the provinces and territories, Manitoba had the 7th highest GHG emissions in Canada in 1990, 2009, 2010, and 2011. Additional information on the relative amounts of each tracked substance for different GHG categories (i.e., energy, industrial processes, solvent and other product use, agriculture and waste) can be found in the annual National Inventory Reports.

It is expected that the existing air quality and GHG emissions within the PSA are affected by the following local activities:
- Vehicle exhaust and road dust from traffic on the paved and dirt roads and trails within and adjacent to the PSA;
- Emissions from CN rail traffic within and adjacent to the PSA;
- Emissions from residential, commercial and industrial activities and equipment use within and adjacent to the PSA, including vehicle and air traffic;
- Emissions from commercial and industrial wastes, wastewater plants and lagoons within and adjacent to the PSA; and
- Generation and transportation of airborne pollutants from the surrounding commercial, industrial, recreational and urban activities in the LSA and RSA, i.e., the City of Winnipeg.

16.3.3 Noise and Vibration

Existing noise and vibration levels in the PSA are expected to be typical of an urban area located within an active freight rail mainline, residential areas and the presence of commercial, industrial, recreational and transportation activities. The east side of the PSA consists of residential areas and areas located behind the parking lots, businesses and shopping areas located along Pembina Highway and other roadways. The west side of the PSA between Hurst Way and Bishop Grandin Boulevard consists of commercial and industrial businesses and facilities, as well as the Wilkes Reservoir and Hurst Pumping Station.

It is expected that the majority of existing noise and vibration in the PSA and LSA are due to CN rail traffic, vehicle traffic, air traffic and industrial activities. Sources of noise and vibration identified for the PSA, LSA and RSA include:
- Rail traffic on the CN line;
- Light, medium and heavy vehicle traffic on Hurst Way, the Pembina Highway and Jubilee Avenue overpass, McGillivray Avenue, Clarence Avenue, Chevrier Boulevard, Bishop Grandin Boulevard Chancellor Drive, Markham Road, and other roads within and surrounding the PSA;
- Commercial and industrial activities;
- CN rail, Manitoba Hydro transmission line and RoW operation and maintenance activities;
- City of Winnipeg road O&M activities, including collection of garbage and recycling, snow clearing, construction, and road repairs;
- Air traffic; and
- Human activities in urban and recreational areas.

Common noise levels and typical human reactions are summarized in Table 16.4. As shown in Table 16.4, average background noise levels from road and rail traffic in the PSA likely range from about 60 to 70 dBA, although actual noise levels would be dependent on the volume of traffic, speed of the traffic and distance from the road or railway. The areas surrounding the PSA consist of both residential and light industrial uses and typical noise levels in the PSA from these sources likely range from about 50 to 55 dBA. Road construction equipment noise ranges between about 76 dB and 89 dB at 15 m from the equipment.
Table 16-4: Common Noise Levels and Typical Human Reactions

<table>
<thead>
<tr>
<th>Source</th>
<th>Decibels (dB)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car horn/propeller aircraft/air raid siren</td>
<td>120</td>
<td>Threshold of pain</td>
</tr>
<tr>
<td>Amplified rock band</td>
<td>110</td>
<td>Maximum vocal effort</td>
</tr>
<tr>
<td>Running train</td>
<td>100</td>
<td>Discomfort</td>
</tr>
<tr>
<td>Heavy truck at 15 m/Busy city street</td>
<td>90</td>
<td>Very annoying - Hearing damage (8 hr)</td>
</tr>
<tr>
<td>Paver at 15 m</td>
<td>89</td>
<td>-</td>
</tr>
<tr>
<td>Jackhammer at 15 m</td>
<td>88</td>
<td>-</td>
</tr>
<tr>
<td>Concrete mixer at 15 m</td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>Bulldozer, Grader or Louder at 15 m</td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>Pneumatic tool at 15 m</td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>Generator at 15 m</td>
<td>81</td>
<td>-</td>
</tr>
<tr>
<td>Backhoe at 15 m</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>Factory floor</td>
<td>80</td>
<td>Annoying</td>
</tr>
<tr>
<td>Freight train at 15 meters</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>Concrete vibrator at 15 m</td>
<td>76</td>
<td>-</td>
</tr>
<tr>
<td>Pump at 15 m</td>
<td>76</td>
<td>-</td>
</tr>
<tr>
<td>Passenger car at 65 mph at 8 m</td>
<td>70</td>
<td>Telephone use difficult</td>
</tr>
<tr>
<td>Radio or TV-audio, vacuum cleaner</td>
<td>70</td>
<td>-</td>
</tr>
<tr>
<td>Normal piano practice</td>
<td>60-70</td>
<td>-</td>
</tr>
<tr>
<td>Normal conversation</td>
<td>60</td>
<td>Intensive</td>
</tr>
<tr>
<td>Noisy office</td>
<td>50</td>
<td>Speech interference</td>
</tr>
<tr>
<td>Light automobile traffic at 30 m</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Public library</td>
<td>40</td>
<td>Quiet</td>
</tr>
<tr>
<td>Soft whisper at 5 m</td>
<td>30</td>
<td>Very quiet</td>
</tr>
<tr>
<td>Rustle of leaves</td>
<td>10</td>
<td>Just audible</td>
</tr>
<tr>
<td>Threshold of hearing</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Sources: Beranek 1956: Cambridge Mortgage and Housing Corporation (CMHC) 1961; City of Los Angeles 1970; Harris, Miller, Miller and Hanson (HMMH) 2014.

D. J. Martin (1977) conducted a study on ground vibrations due to construction noise generated by different types of equipment on different types of soils and surfaces. Martin (1977) classified the construction equipment as follows:

- Tracked plant, such as dozers and tractor shovels;
- Rubber-tired plant, such as motorised scrapers and dump trucks; and
- Continuous or intermittent impacting plant, such as pile drivers and vibratory rollers.

The following information is excerpted from Martin’s 1977 study. The study found that vibration levels at 10 m from equipment such as an earth moving plant and sheet-piling rig were above the threshold of human perception and could cause disturbance to people. However, the levels were much lower than the levels that could likely cause architectural damage to buildings. The results showed that the major sources of vibration in road construction were the tracked earthmoving plant, compaction plant and intermittent impacting plant. Rubber-tired equipment did not generate ground surface vibration levels high enough to be detected by human subjects. At distances greater than 10 m, ground attenuation effects may reduce the vibration levels to values below human sensitivity. The measurements obtained in this investigation showed that ground vibration levels are unlikely to be high enough to cause any disturbance to people situated at distances greater than 20 m from the source of vibration due to attenuation in the soil.

Table 16-5 provides an example of human/structural responses to a variety of vibration sources and levels, including trains, rapid transit and buses.

Table 16-5: Examples Of Human/Structural Responses To Various Vibration Sources and Levels

<table>
<thead>
<tr>
<th>Human/Structural Response</th>
<th>Vibration Levels (Vdb)</th>
<th>Typical Sources (15 m from source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold, minor cosmetic damage to sensitive buildings</td>
<td>100</td>
<td>Blasting from construction projects</td>
</tr>
<tr>
<td>Difficulty with tasks such as reading a Video Display Terminal (VDT) screen</td>
<td>90 to 95</td>
<td>Bulldozers and other heavy tracked construction equipment</td>
</tr>
<tr>
<td>Residential annoyance, infrequent events (e.g., commuter rail)</td>
<td>80 to 90</td>
<td>Locomotive at 80 km/hr</td>
</tr>
<tr>
<td>Residential annoyance, frequent events (e.g., rapid transit)</td>
<td>70 to 75</td>
<td>Light rail vehicle at 80 km/hr</td>
</tr>
<tr>
<td>Limit for vibration sensitive equipment; approximate threshold for human perception of vibration</td>
<td>60 to 65</td>
<td>Bus or truck, typical</td>
</tr>
<tr>
<td>Light automobile traffic at 30 m</td>
<td>50 to 55</td>
<td>Typical background vibration</td>
</tr>
</tbody>
</table>

Source: Harris, Miller, Miller and Hanson (HMMH) 2006; Vdb = vibration velocity in decibels relative to a level of 1x10^-6 inches per second.

The rapid transit buses for the Project will be rubber-tired vehicles that will travel at a speed of about 80 km/hr in the transitway corridor. The information in Table 16-5 provides the expected Vdb from rapid transit using a light rail vehicle and the expected Vdb from a typical bus or truck. Based on the information in Table 16-5, it is expected that vibration levels in the existing CN rail corridor in the PSA may range from 80 to 90 Vdb at 15 m from the rail line, the vibration levels from rapid transit buses may range from 60 to 75 Vdb at 15 m from the BRT line, and vibration levels from construction equipment may range from 90 to 95 Vdb at 15 m from the operating equipment (i.e., immediately within the project area).

16.3.4 Terrain and Soils

The City of Winnipeg is located at the convergence of the Red and Assiniboine rivers in the broad plain of the Red River Valley, in the Winnipeg Ecodistrict of the Lake Manitoba Plain Ecoregion. The area covers the Lake Agassiz clay plain that represents the offshore lake bottom deposits of glacial Lake Agassiz (Mattole et al. 1998). Surface topography is relatively flat with elevations rising gently eastward and westward from the Red River. The regional stratigraphy of the Winnipeg area consists of clay and silt overlaying glacial till and resting on carbonate bedrock.
Soils in the Winnipeg Ecodistrict are predominantly imperfectly drained Gleyed Humic Vertisols and Gleyed Vertic black Chernozemics, and poorly drained Gleysolic Humic Vertisols and humic Vertisols, which have developed on calcareous, clayey glaciolacustrine sediments (Smith et al. 1998). These sediments range in thickness from more than 60 m near the United States border to less than 1 m locally in the northern part of the basin. Gleyed Rego Black Chernozemic and Gleysolic soils also occur on shallow, extremely to very strongly calcareous, loamy to silty sediments, some of which occur in the form of intersecting bars and spits and were formed during the latter stages of Lake Agassiz (Smith et al. 1998).

Soil conditions at the proposed site are expected to be a thin organic layer overlying clay soils. In January 2014, AECOM completed the geotechnical investigation program for the Project, which consisted of four deep test holes and two intermediate test holes. Drilling of test holes at McGillivray Boulevard and at Bishop Grandin Boulevard was advanced 6 m into bedrock. Drilling of test holes at the area of the proposed tunnel near Manitoba Avenue was terminated at auger refusal at 5.8 m and 2.3 m into till, respectively. Test holes south of McGillivray Boulevard and north of Bishop Grandin Boulevard were drilled to 6 m below existing grade and terminated in the clay unit. Although the project extends over 7 km, the encountered soil stratigraphy in the test holes were practically uniform and are typical to areas within the limits of City of Winnipeg (AECOM 2014). In descending order the soil profile consisted of:

- Glacio-lacustrine clay;
- Glacial till; and
- Limestone bedrock.

Glacio-lacustrine silty clay up to 12 m thick was encountered in all test holes. Thin topsoil about 150 mm thick overlays the clay in most test holes. Silt layers about 1.0 m thick were observed in the top two metres of the clay unit. Typically, the clay is brown changing to grey with depth, firm to stiff becoming soft with increasing depth, moist and of high plasticity. The clay is underlain by glacial till that typically contains variable amounts of clay, sand, and gravel. Boulders and cobbles are known to be present within the till unit and were encountered during the drilling. Where the drilling advanced into bedrock below the till unit at McGillivray Boulevard and Bishop Grandin Boulevard, the thickness of the till layer varies from 4 m to 6 m. In vicinity of Manotamin Avenue, auger refusal was encountered about 6 m into till, therefore till thickness may be greater than 6 m. The till is brown to light grey, soft/loose in the upper zone and become dense to very dense with increasing depth. Coring was necessary to advance the drilling through very dense and boulders/cobbles dominated lower zone of the till. The till is underlain by limestone bedrock, which forms an artesian aquifer. The bedrock surface was elevated at elevations between 214.0 m and 215.0 m in both the McGillivray Boulevard and at Bishop Grandin Boulevard test hole locations.

16.3.4.1 Potentially Impacted or Contaminated Sites

The Manitoba Contaminated Sites List (MCWS 2014a) was reviewed to identify potentially impacted or contaminated sites within or adjacent to the PSA. The online list is maintained by Manitoba Conservation and was last updated September 16, 2013 (checked as of March 24, 2014). The list includes impacted or contaminated sites in Manitoba, but may not include all sites for which the Department currently maintains files. An updated file search will be completed prior to Detailed Design of the Project to confirm all the information Manitoba Conservation maintains on a site.

All neighboring street names listed on the provided drawings and maps were searched in the list. All street names with listed properties were mapped using their addresses. Property locations that were not adjacent or near the proposed BRT corridor are not included in this screening list. A total of nine potentially impacted or contaminated sites (CS) were found to be near or adjacent to the proposed BRT corridor:

- 960 Pembina Highway, Goodyear Canada Inc., CS, File No. 20295
- 1761 Pembina Highway, Minute Mugler, CS, File No. 4069
- 1855 Pembina Highway, Mr. Grease (Former), CS, File No. 20628
- 2355 Pembina Highway, Shell Canada Self-Serve (Former), CS, File No. 20623
- 555 Hervo Street, Rogers Sugar (Former), CS, File No. 20623
- 77 Irene Street, Indul Wall Systems, CS, File No. 20729
- 10 Irene Street, Simmons Equipment Rentals, CS, File No. 20726
- 1397 Buffalo Place, Superior Cable Corp, CS, File Nos. 19561, 19565
- 1455 Buffalo Place, Powell Equipment Ltd (Former), CS, File No. 19566

All of the known impacted sites are outside of the actual transitway alignment properties and Manitoba Conservation indicated that all impacts are contained within the impacted properties, as identified on the Manitoba Conservation Contaminated Sites List (MCWS 2014a).

16.3.5 Groundwater

The following information on groundwater in the City of Winnipeg was obtained from Render 1970. There are three regional aquifers beneath the City of Winnipeg: the Upper Carbonate aquifer, Lower Carbonate aquifer and the Sandstone aquifer. The Upper Carbonate aquifer is the major aquifer underlying the Winnipeg area and occurs in the top 15 to 30 m of the Paleozoic bedrock limestones and dolomites. The Upper Carbonate aquifer is partially confined above by the glacial drift and below by the slightly pervious underlying carbonate rock. A relatively minor aquifer, called the Lower Carbonate aquifer, occurs in the bottom 7.5 m to 15 m of the Red River formation, along the contact with the upper shale unit of the Winnipeg Formation. The Winnipeg Formation contains an Upper Sandstone aquifer that is 6 m to 12 m thick, and a Lower Sandstone aquifer that is 3 m thick. Both of these Sandstone aquifers contain saline water. Recharge of the Upper Carbonate aquifer occurs through the glacial till and glaciofluvial deposits located in the uplands along the borders of the Red River Basin and in Birds Hill.

The original settlers of the City of Winnipeg initially used river water to supply commercial, industrial and residental water needs. In 1900, the City converted from river water to using groundwater from the Upper Carbonate aquifer (Render 1970). From 1890 to 1914, the City examined the Red, Assiniboine and Winnipeg Rivers, the Upper Carbonate aquifer, and the Lake of the Woods as alternate water sources,
ultimately choosing Shoal Lake in Lake of the Woods as the supply for the Aqueduct system. The City continued to use groundwater sources for commercial and industrial applications (e.g., air conditioning, cold storage), but all residential potable water needs were met by the City of Winnipeg’s piped water distribution system from the Aqueduct. Today a number of commercial, industrial and provincial monitoring wells remain in operation in the City and all residential potable water needs are provided via the Aqueduct. As such, there are no residential potable water wells in the PSA, LSA or RSA.

Excessive discharge from the Upper Carbonate aquifer has frequently interfered with deep excavations in the Winnipeg area (Render 1970). This interference occurred during the construction of the Greater Winnipeg Aqueduct Branch 2 Tunnel in 1959 when groundwater flows of about 500 gallons/minute (2,275 litres/minute) were intercepted in the carbonate rock (Render 1970). Groundwater flows have also interfered in the construction of bridge and building foundations in the City (Render 1970). In recognition of these potential groundwater incursions, the Project construction plans will include methods to depressurize the aquifer and remove any groundwater from the excavation sites, if required.

Groundwater in this area of the Upper Carbonate aquifer can be saline due to the presence of chlorides and other dissolved solids such as calcium, magnesium, potassium, sodium and sulfate (Betcher 1986; Render 1970). Groundwater chloride concentrations can range from 500 to 1000 mg/l in this area of Winnipeg (Render 1970). The current Canadian Council of Ministers of the Environment (CCME) guideline for chloride concentrations for the protection of aquatic life is 640 mg/l in the short-term, and 120 mg/l in the long term (CCME 2014). As such, groundwater may be removed from the excavation sites by installing temporary wells. This groundwater will be analyzed to confirm/approve suitability for discharge to the land drainage network or for discharge to the existing City of Winnipeg sewer system for treatment at the South End Water Pollution Control Centre (SEWPC). Pumped groundwater will not be directly released to the Red River or any other watercourse in the RSA.

The LSA contains part of Winnipeg’s Aqueduct system, including the enclosed Wilkes Reservoir and accompanying Hurst Pumping Station on the west side of Hurst Way near Parker Avenue. This reservoir can supply up to 500 million litres of water per day to southwest Winnipeg (City of Winnipeg 2002). The Project construction plans will include measures to isolate and remove any groundwater encountered during the excavation activities; therefore, there will be no interactions between groundwater and the Aqueduct system due to the Project activities.

16.3.6 Surface Water

Areas of surface water in the PSA are limited to the ditches that parallel the CN RoW and Manitoba Hydro RoW on the west side of the PSA and low-lying areas and wet meadows in the Parker Lands, CN RoW and Manitoba Hydro RoW. During the field survey, these areas were dry and the only indication of the presence of water was small isolated stands of cattails (Typha spp.) found in the ditches and at three locations in the PSA (see Section 16.3.9). The presence of cattails and other water tolerant plant species such as willows (Salix spp.) indicated that these areas may contain water during periods of spring melt, peak runoff or high levels of precipitation. There were no creeks, streams, ponds or other watercourses or waterbodies found to be present in the PSA.

The LSA includes or is adjacent to the Red River in two places: at the northern extent of the PSA and approximately mid-way in the PSA where the corridor turns south to parallel the CN rail line (Figure 6-1). The Red River is approximately 150 m wide near these locations. The river channel has uniformly sloping banks (where erosion and undercutting has not occurred) and a wide central thalweg. River levels vary seasonally, typically between 3.5 m and 6 m in depth (Dillon Consulting Limited 2009).

The RSA includes the Red River, Assiniboine River, Seine River and number of creeks (e.g. Sturgeon Creek, Onandaga Creek). With the exception of the Red River, these watercourses are located outside of the Project construction areas and proposed Project land drainage system (Section 10.7), and there are no anticipated effects from the Project on these watercourses.

The functional design concept for the Project land drainage system was prepared based on discussions with the Water and Waste Department of the City of Winnipeg and will be finalized at the Detailed Design stage (Section 10.7). Figure 7-1 illustrates the proposed drainage design for the Transitway Project and takes into consideration the Cockburn and Calrossie Retention Pond, the Pembina Highway Underpass, and the Southwest Transitway components of the project. The concept consists of a combination of new land drainage sewers and ditches along the transitway that would drain into existing adjacent land drainage systems and the retention pond. This approach is design practice provided that an analysis has been carried out to show that there is no increase in the peak flow rate. The adjacent systems include the Parker Retention Pond, Somerset Avenue, Riviera Crescent, Lot 16 Drin, D’Arcy Drive and the University of Manitoba Southwood Lands. As part of the Cockburn and Calrossie Combined Sewer Relief Works, the current design concept for separation involves the construction of the Parker Retention Pond. The pond has been included in the list of adjacent systems as drainage along Parker Avenue will be routed east toward the pond via ditches. It is also proposed that runoff at the Transitway Underpass of CN Wye tracks be pumped into the pond. The design and construction of the Parker Retention Pond is being carried out by the City of Winnipeg Water and Waste Department and is not part of Stage 2 of the Southwest Transitway project.

With the exception of a few sections near stations (400 to 600 mm diameter LDS), ditching is proposed along the transitway between Parker Avenue and Chevrier Boulevard. Drainage near the proposed Letellier Tunnel is restricted because of numerous conflicts and consists of LDS (ranging from 375 to 1050 mm diameter). South of Bishop Grandin Boulevard to Markham Road, a new LDS system is also proposed with diameters ranging from 750 mm near the IGF Station to 900 mm along the Transitway North-South segment and 1050 mm downstream.

The ditch drainage design is based on a 5-year MacLaren storm based on City of Winnipeg design standards. The design standard for underpasses is more stringent as water accumulation could render the underpass impassable. For this reason, the drainage design for the underpasses was based on a target
50-year MacLaren rainfall total capacity, which is a higher level of service than for the design used for the pumping station for the Stage 1 transitway tunnel. Two pumping stations are included as part of the land drainage concept at the Transitway Underpass of CN Wy e and the Letellier Tunnel.

The land drainage system for the Project has been designed to utilize existing drainage pathways and the Parker Retention Pond to move water off of the land surface and retain the flows prior to discharge to existing combined sewer and stormwater drainage systems. The results of the hydraulic assessment conducted for the Project land drainage system showed that there is no effect on the peak flow rate in the adjacent systems, including the City’s planned Parker Retention Pond.

### 16.3.7 Fish and Fish Habitat

There is no fish or fish habitat in the PSA. The LSA includes or is adjacent to the Red River in two places: at the northern extent of the PSA and approximately mid-way in the PSA where the corridor turns south to parallel the CN rail line (Figure 6-1). The RSA includes the Red River, Assiniboine River, Seine River and number of creeks (e.g. Sturgeon Creek, Omands Creek). With the exception of the Red River, these watercourses are located outside of the Project construction areas and proposed Project land drainage system (Section 10.7), and there are no anticipated effects from the Project on these watercourses.

The Red River supports one of the most diverse aquatic communities in Canada, and many species are part of or support commercial, recreational or Aboriginal fisheries. As such, the fish and fish habitat in the Red River are subject to the prohibition against serious harm to fish under the Fisheries Protection Provisions of the Fisheries Act (Fisheries and Oceans Canada [DFO] 2014a). The Red River within the City limits supports a variety of species, including channel catfish (Ictalurus punctatus), northern pike (Esox lucius), walleye (Sander vitreus) and yellow perch (Perca flavescens). Spring and early summer months are sensitive periods for many Red River fish species due to migration, spawning, egg development and rearing activities. Several Species at Risk reside in the Red River, including Bigmouth buffalo (Ictiobus cyprinellus) and lake sturgeon (Acipenser fluvius) (DFO 2013). These species are protected under federal and/or provincial Species at Risk Acts and legislation (MCWS 2013; Government of Canada 2013).

The existing system of combined sewers and/or stormwater drains in the PSA and LSA eventually drain to outfalls located along the Red River. The land drainage system developed for the Project will use this existing system of combined sewers and/or stormwater drains. The City is currently developing a Combined Sewer Overflow Master Plan to replace or improve the combined sewer systems in Winnipeg and reduce wet weather overflows of combined sewage and stormwater into the Red and Assiniboine rivers.
Photograph 1: View showing ground surface conditions in a cattail stand located on the west side of the Manitoba Hydro transmission line RoW between Mercury Bay and Willson Place, October 01, 2013.

Photograph 2: View facing northwest of a mowed area and patch of aspen, cattails and willows in the Parker Lands area, October 01, 2013.

Photograph 3: View facing southeast in the Parker Lands of an aspen woodland patch located adjacent to Parker Avenue, October 01, 2013.

Figure 16-1: City of Winnipeg Natural Areas and Habitat Quality in the Parker Lands
16.3.8.2 Species at Risk and Rare Plants

The MCDC ranks the conservation status of plants according to their scarcity using existing records of their occurrence (Table 16-6). Species are evaluated and ranked by the MCDC on the basis of their range-wide (global - G) status, and their province-wide (subnational - S) status according to a standardized procedure used by all Conservation Data Centres and Natural Heritage Programs. These ranks are used to determine protection and data collection priorities, and are revised as new information becomes available (MCDC 2013).

<table>
<thead>
<tr>
<th>Rank</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very rare throughout its range or in the province (5 or fewer occurrences, or very few remaining individuals). May be especially vulnerable to extirpation.</td>
</tr>
<tr>
<td>2</td>
<td>Rare throughout its range or in the province (6 to 20 occurrences). May be vulnerable to extirpation.</td>
</tr>
<tr>
<td>3</td>
<td>Uncommon throughout its range or in the province (21 to 100 occurrences).</td>
</tr>
<tr>
<td>4</td>
<td>Widespread, abundant, and apparently secure throughout its range or in the province, with many occurrences, but the element is of long-term concern (&gt; 100 occurrences).</td>
</tr>
<tr>
<td>5</td>
<td>Demonstrably widespread, abundant, and secure throughout its range or in the province, and essentially impossible to eradicate under present conditions.</td>
</tr>
<tr>
<td>U</td>
<td>Possibly in peril, but status uncertain; more information needed.</td>
</tr>
<tr>
<td>H</td>
<td>Historically known; may be rediscovered.</td>
</tr>
<tr>
<td>X</td>
<td>Believed to be extinct; historical records only, continue search.</td>
</tr>
<tr>
<td>SNR</td>
<td>A species not ranked. A rank has not yet assigned or the species has not been evaluated.</td>
</tr>
<tr>
<td>SNA</td>
<td>A conservation status rank is not applicable to the element.</td>
</tr>
</tbody>
</table>

Table 16-6: Province of Manitoba Conservation Ranking System for Species

Source: Manitoba Conservation Data Centre 2013

A request was submitted to the MCDC to confirm the presence or absence of any provincially or federally listed species. The reply confirmed that a search of the Manitoba Conservation Data Centre’s rare species database had been completed and there were no occurrences found within the Project area (C. Friesen, Biodiversity Information Manager, Manitoba Conservation, pers.comm.). A copy of the response is provided as Appendix C.

There were no plant species of special concern, i.e., ranked as S1 - very rare, S2 - rare, or S3 – uncommon, found during the field survey or listed on the City of Winnipeg Natural Area site reports for the Parker Lands (City of Winnipeg 2013a, 2013b). There were no plant species listed under the Manitoba Endangered Species Act (MESA), SARA, or that have a special designation by COSEWIC observed to be present in the PSA (Government of Canada 2013; MCWS 2013). Additional information on Species at Risk is found below in Section 16.3.11.

16.3.8.3 Plants of Interest

Although there were no species of conservation concern found within the PSA, there were some plants that are of special interest due to their history in the area or role as habitat for wildlife species. Plant species of interest that were observed in the PSA during the field survey include:

- Several showy milkweed plants (Asclepias speciosa) were found in two locations (14U 632162m E, 5531797m N; 14U 632155m E, 5532934m N) along the west side of the Manitoba Hydro RoW (Photograph 4 and Photograph 5). Milkweed is important to the survival of Monarch butterflies (Danaus plexippus), which is currently listed as a Species of Special Concern under SARA (Government of Canada 2013).
- In the oak-aspen woods, some fairly large specimens of bur-oak trees (Quercus macrocarpa) were observed (14U 632191m E, 5532589m N) (Photograph 6).
- Some large specimens of peachleaf willow (Salix amygdaloides) were found in one of the wetter areas in the Parker Lands (Photograph 7). These willows are the only species of willows in southern Manitoba that reach tree-size and are most often relegated to stream and riverbanks.
- There appears to be a former homestead site in the wooded area adjacent to Heatherdale Avenue in the Parker Lands as indicated by a row of large cottonwood (Populus deltoides) trees and the remnants of what appeared to be a driveway. A large cottonwood tree was also present in the Manitoba Hydro RoW at the same location as the third stand of cattails (Photograph 12 in Section 16.3.9).

There may be some remnant tall grass prairie plant species surviving in the area, but due to the late season sampling and the late summer mowing it was not possible to identify all of the grass species. Prairie cordgrass (Spartina pectinata), a native grass found in wet areas and moist prairie, was common in the unmowed areas. The plant species list for the Parker 3 Site #550 includes big bluestem (Andropogon gerardii), a grass found in native tall-grass prairies, which was reported to be present in a 1995 survey (City of Winnipeg 2013b). As noted above, the timing of the survey was not optimal for the identification of plant species that emerge and flower earlier in the growing season.
Photograph 4: View facing west of the milkweed seed pods found on the west side of the Manitoba Hydro transmission line Right-of-Way between Mercury Bay and Willson Place, October 01, 2013.

Photograph 5: Close-up view of the milkweed seed pods found on the west side of the Manitoba Hydro transmission line Right-of-Way between Mercury Bay and Willson Place, October 01, 2013.

Photograph 6: View of the large bur oak in the aspen/oak woodland of the Parker Lands, October 01, 2013.

Photograph 7: View of the large peachleaf willow in the aspen/oak woodland of the Parker Lands, October 01, 2013.
16.3.8.4 Invasive Plants
Disturbance of natural habitats often introduces plants that are not native to the area. Some non-native plants are able to out-compete native species and degrade natural areas. These aggressive non-native plants can become invasive. According to the Invasive Species Council of Manitoba (ISCM) several of the plant species found in the survey are of concern as they are listed as Category 2 (Localized Presence) Invasive Species (C. Heming, pers.comm., ISCM 2013). The ISCM identifies the following listing and management criteria for Category 2 species:
- Criteria for listing:
  - These invasive plants are present in Manitoba and are capable of further spread;
  - pathways for spread are present; and,
  - are easily identifiable with available resources.
- Minimum Management Criteria (MMC):
  - eradication is first option, when feasible;
  - containment and control programs are second option;
  - education and awareness programs to foster prevention; and,
  - a response plan is available or under development.
Plants found during the survey or previously recorded in the area that are listed at Category 2 species are:
- common tansy (Tanacetum vulgare);
- common reed (invasive phragmites) (Phragmites australis) (found in previous City of Winnipeg [2013b] survey);
- European (common) buckthorn (Rhamnus cathartica);
- ox-eye daisy (Leucanthemum vulgare); and
- purple loosestrife (Lythrum salicaria).
Additional plants found during the survey that are listed as invasive by ISCM are:
- Canada thistle (Cirsium arvense);
- creeping bluebell (creeping bellflower) (Campanula rapunculoides);
- daisy’s violet (daisy’s rocket) (Hesperis matronalis);
- field sow thistle (perennial sow thistle) (Sonchus arvensis);
- lesser burdock (Arctium minus);
- narrow-leaved cattail (Typha angustifolia);
- reed canary grass (Phalaris arundinacea);
- tufted vetch (bird vetch) (Vicia cracca); and
- wormwood (absinthe) (Artemisia absinthium).

Photograph 8: Wild asparagus plant in the wooded area behind Heatherdale Avenue in the Parker Lands, October 01, 2013.

16.3.9 Wetlands
There was a total of three areas observed that consisted of mainly cattails and grasses and that likely hold water during periods of high runoff and/or precipitation. All three of these areas were dry with no standing water at the time of the survey. Cattails were also present in some of the ditches along the west side of the RoW throughout the proposed Project route.

The first of the three areas was located in the Parker Lands on the north side of Heatherdale Avenue (Photograph 9 and Photograph 10). This area contained a stand of cattails and grasses about 5 m wide and 12 m in length. The area surrounding the cattail stand had been recently mowed.
Based on the Stewart and Kanrud (1971) system of wetland classification, the presence of cattails would indicate that the area would be considered a Class III – Seasonal wetland or a Class IV- Semi-permanent wetland. This area is classified as a Class B wetland by the City Naturalist Department (City of Winnipeg 2013a; Figure 16-5).

The second area was located on the west side of the Manitoba Hydro transmission line RoW between Mercury Bay and Willson Place (Photograph 11). In this area was a stand of cattails and grasses about 8 m wide and 15 m in length. The area around the cattail stand had been mowed on or near August 08, 2013 (Bob Lapka, pers. comm.).

Based on the Stewart and Kanrud (1971) system of wetland classification, the presence of cattails would indicate that the area would be considered a Class III – Seasonal wetland or a Class IV- Semi-permanent wetland.

The third area was located in the center of the Manitoba Hydro transmission line and CN RoW about 120 m south of Manahan Avenue at the Hervo Street CN sidetrack (Photograph 12). This area contained a stand of cattails and grasses about 30 m wide and 30 m in length. The area around the cattail stand had been mowed on or near August 08, 2013 (Bob Lapka, pers. comm.).
Photograph 12: View facing southeast of the stand of cattails and grasses located in the center of the Manitoba Hydro transmission line and CN RoW about 120 m south of Manahan Avenue at the Hervo Street CN sidetrack, October 01, 2013. A portion of the large cottonwood tree also located at this site appears at the top left of the photograph.

Based on the Stewart and Kantrud (1971) system of wetland classification, the presence of cattails would indicate that the area would be considered a Class III – Seasonal wetland or a Class IV- Semi-permanent wetland.

In addition to these three areas, wet areas with cattails, willow and grass species were also present in the wooded area of the Parker Lands on the north side of Heatherdale Avenue and in a patch of vegetation north of Parker Avenue to the east of Hurst Way (Photograph 2). It is expected that the ground surface and near-surface soils would be saturated and potentially hold water in these areas during periods of high runoff and/or precipitation.

Figure 16-2 shows the location of the three cattail stands and milkweed plants in the PSA.

16.3.10 Wildlife and Wildlife Habitat

As noted in Section 16.3.8 above, the Parker Lands area is a mix of open grassland with small patches of oak-aspen woods and moister depressions of cattails, dogwood and willows. The north/south corridor is maintained as a mowed RoW with some drainage ditches and scrubby woodland patches along the edges.

The following wildlife species were observed during the field survey: American crow (Corvus brachyrhynchos), Canada goose (Branta canadensis) (Photograph 13), common grackle (Quiscalus quiscula), downy woodpecker (Picoides pubescens), house sparrow (Passer domesticus), Northern flicker (Colaptes auratus), and red squirrel (Tamiasciurus hudsonicus). There was also an incidental observation of muskrat (Ondatra zibethicus) by Project staff adjacent to the PSA.
Although not observed at the time of the field survey in October, other wildlife likely reside in or use habitat within the PSA. It is expected that other urban wildlife such as chipmunks (Tamias spp.), eastern cottontail rabbit (Sylvilagus floridanus), eastern gray squirrel (Sciurus carolinensis), ground squirrels (Spermophilus spp.), meadow voles (Microtus pennsylvanicus), raccoon (Procyon lotor), striped skunk (Mephitis mephitis), and white-tailed deer (Odocoileus virginianus) are present in the PSA and use the available habitat for some or all of their lifecycle requirements (i.e., breeding, nesting, rearing of young, feeding, migration). The PSA may also provide habitat for bat species such as the big brown bat (Eptesicus fuscus), as well as a number of resident and migratory bird species. The survey was conducted in the fall after the migratory period for many bat and bird species; therefore, it could not be determined if any of these species are present in the PSA. The wooded area adjacent to Heatherdale Avenue included a number of tangles of shrubs (dogwood, willow), tree snags, tall trees (aspen, cottonwood, oak, peachleaf willow) and grassy areas that could provide habitat for a number of species (Photograph 14). Photograph 15 shows the only nest activity observed in the PSA. The two patches of milkweed that were not mowed could provide essential habitat for Monarch butterflies (Photograph 4 and Photograph 5).

Although the wetland areas observed were dry at the time of the field survey, it is expected that these areas and the other wet areas within the PSA could provide summer habitat for the Northern leopard frog, and potentially year-round habitat for the wood frog (Lithobates sylvaticus). Additional discussion of the available Northern leopard frog habitat is provided in Section 16.3.11 below.
16.3.11 Species at Risk

The MCDC, MESA, SARA and COSEWIC databases were reviewed prior to the field surveys and cross referenced to species distribution maps to identify potential species listed as endangered, threatened or of special concern that may be present in the RSA (i.e., the City of Winnipeg). Table 16-7 provides a summary of the species listed as endangered, threatened or of special concern potentially found within the RSA.

Table 16-7: Endangered, Threatened or Species of Special Concern Potentially Found in the PSA

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>MESA Status</th>
<th>COSEWIC Status</th>
<th>SARA Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibians and Reptiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Leopard Frog</td>
<td>Lithobates pipiens</td>
<td>Not Listed</td>
<td>Special Concern</td>
<td>Special Concern</td>
</tr>
<tr>
<td>Reptiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monarch Butterfly</td>
<td>Danaus plexippus</td>
<td>Not Listed</td>
<td>Special Concern</td>
<td>Special Concern</td>
</tr>
<tr>
<td>Birds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank Swallow</td>
<td>Riparia riparia</td>
<td>Not Listed</td>
<td>Threatened</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Barn Swallow</td>
<td>Hirundo rustica</td>
<td>Not Listed</td>
<td>Threatened</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Bobolink</td>
<td>Dolichonyx oryzivorus</td>
<td>Not Listed</td>
<td>Threatened</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Eastern Wood-Pewee</td>
<td>Contopus virens</td>
<td>Not Listed</td>
<td>Special Concern</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Peregine Falcon</td>
<td>Falco peregrinus</td>
<td>Not Listed</td>
<td>Special Concern</td>
<td>Special Concern</td>
</tr>
<tr>
<td>Short-Eared Owl</td>
<td>Asio flammeus</td>
<td>Not Listed</td>
<td>Special Concern</td>
<td>Special Concern</td>
</tr>
<tr>
<td>Yellow Rail</td>
<td>Crotacops noveboracensis</td>
<td>Not Listed</td>
<td>Special Concern</td>
<td>Special Concern</td>
</tr>
<tr>
<td>Mammals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little Brown Myotis</td>
<td>Myotis hueflauger</td>
<td>Not Listed</td>
<td>Endangered</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Northern Myotis</td>
<td>Myotis septentrionalis</td>
<td>Not Listed</td>
<td>Endangered</td>
<td>Not Listed</td>
</tr>
</tbody>
</table>

None of the species in Table 16-7 were observed to be present in the PSA during the October 01, 2013 survey; all of the species listed in Table 16-7 migrate to overwintering areas outside of the PSA and it is expected that any individuals that could potentially have been present in the PSA were likely to have already migrated by the time of the survey. However, other migratory bird species (Canada geese, common grackle, Northern flicker) were observed in the PSA during the October 01, 2013 field survey. Based on the existing habitat, level of habitat disturbance and ongoing human, commercial, industrial and transportation activities in the PSA, it is expected that the PSA would only provide temporary feeding or resting areas for the bird and mammal species in Table 16-7 during their migratory movements to more optimal breeding and nesting habitats outside of the PSA. The presence of milkweed in the PSA indicates that these areas of the PSA could be used by the Monarch butterfly if this species is present in the area. The wet areas located in the PSA could provide spring and summer habitat for Northern leopard frog. As such, it is expected that the Monarch butterfly and Northern leopard frog could be present in the PSA.

Additional information on these species and their habitat requirements is provided below. There were no other species listed under MESA, SARA or COSEWIC observed to be present in the PSA (Government of Canada 2013; Manitoba Conservation and Water Stewardship 2013).

16.3.11.1 Monarch Butterfly

The Monarch requires milkweed plants to lay their eggs, grow their larvae (caterpillars), form a chrysalis, complete metamorphosis, and emerge as an adult (Government of Canada 2013). Milkweed is the only plant species used by Monarch butterflies to complete their life-cycle requirements for reproduction; as such, the survival of this species is dependent upon the availability of milkweed plants. Adult Monarchs also use nectar-producing wildflowers such as asters (Asteraceae), goldenrod (Solidago spp.) and purple loosestrife for feeding requirements (Government of Canada 2013).

The field survey was conducted after the migratory period for the Monarch butterfly; therefore, it could not be determined if this species is present in the PSA and/or using the milkweed plants that are available in the PSA (Photos 4 and 5).

16.3.11.2 Northern Leopard Frog

Northern leopard frogs are semi-aquatic and require three seasonal habitat types for breeding, foraging, and overwintering (Environment Canada 2013d). Due to the limited dispersion of this species, these three habitat types must be connected and present in close proximity.

- Spring breeding habitat is characterized by warm, shallow waters with some degree of permanence and containing no predatory fish, and may include, for example, marshes, shallow, beaver ponds, dredges, margins of lakes, and other slow-moving water (Environment Canada 2013d).
- Summer foraging habitat may be up to 8 km from breeding areas, and consists of moist riparian or upland areas that are neither heavily wooded nor sparsely vegetated (Environment Canada 2013d).
- Winter habitat is typically within about 1.6 km of breeding habitat (Environment Canada 2013d). This species spends its winters hibernating in water bodies that are cold but do not freeze solid and are well oxygenated. This habitat is found in water bodies deeper than water bodies used for breeding habitat.

The available habitat in the PSA could provide foraging habitat for Northern leopard frog, but there were no areas observed that could provide the depth of water that is required for their breeding needs or the permanent depth they require for overwintering. It is expected that this species migrates to and from the Red River or other permanent waterbodies within the area for its breeding and overwintering habitat requirements.
16.4 Socio-Economic Environment

As a linear infrastructure project, Stage Two of the Southwest Transitway passes through (or adjacent to) several communities. Many of them are residential neighbourhoods, including Beaumont, Maybank, and Waverley Heights; others are industrial parks, including Buffalo and Chevron; and finally, some are mixed-use neighbourhoods, including the Pembina Strip and Montclair. The following sections outline the socio-economic, demographic, and land use characteristics of these adjacent communities.

16.4.1 Community Demographics

Table 16-8 provides a summary of the demographics for the neighbourhoods located in the PSA. The 2011 Census Community Profiles were not yet available for individual Winnipeg neighbourhoods, nor were 2011 statistics yet available for several demographic categories. Therefore, the information provided herein is based on the 2006 Census Community Profiles (City of Winnipeg 2013c). The population of the neighbourhoods adjacent to the transit corridor is nearly 20,000 people, with tens of thousands more living within the southwest quadrant that the transitway will serve. The neighbourhood populations are relatively stable (due to their built-out nature), while their densities tend to be moderately higher than the city average. Average household and family sizes tend to mirror the city averages (of 2.4 and 2.9 respectively), except in the Pembina Strip and Montclair neighbourhoods, where both are significantly lower. Ethnic diversity appears to be more prominent along the southern portion of the route, where between approximately one quarter and one third of the population are visible minorities; the numbers are closer to one tenth in the Beaumont and Maybank neighbourhoods.

Education levels are generally consistent with those of the city at-large, although Waverley Heights and Montclair have higher proportions of those with university education. Unemployment rates vary across neighbourhoods, from a low of 3.7% in Beaumont to a high of 10.7% in Montclair. Median household incomes vary significantly amongst neighbourhoods, ranging from $31,565 in Montclair to $66,384 in Waverley Heights, which in part can be attributed to household size and makeup.

In terms of commuter transportation modes, most neighbourhoods were near the city average (14.2%) for transit use. However, the Pembina Strip neighbourhood (proximate to several major routes) had a much higher percentage of transit ridership, at 24.3%. That neighbourhood also had lowest percentage of those who drove single-occupant vehicles (55.8%, approximately 12% lower than the city average), while Montclair had the highest percentage of those walking or biking (14.0%).

Finally, the residential neighbourhoods along the transitway are home to a variety of housing types and tenures. Over 90% of Beaumont’s housing stock is made up of single family homes, while Maybank and Waverley Heights (61% and 65% respectively) are much closer to the city average of 59%. Homeownership is high within Beaumont, Maybank and Waverley Heights (ranging between 77.2% and 87.1%), while Pembina Strip and Montclair have the highest percentage of renters (76.5% and 92.6% respectively). The housing stock is generally older the further north one travels – 87.8% of the dwellings in Beaumont were built before 1971, while that number in Waverley Heights was only 5.4.
16.4.2 Land Use and Zoning Bylaw Designations

16.4.2.1 Our Winnipeg

The City of Winnipeg’s Development Plan, “Our Winnipeg” (City of Winnipeg 2011a), is a high level policy framework to guide development and growth within the City. The plan includes land use designation maps that provide a general outline of where certain types of growth are most appropriate. The transit corridor passes through three major land use designations:

- **Mature Communities**, which include the Beaumont Street and Maybank Drive neighbourhoods, are generally communities developed before the 1950s. They feature grid-like street patterns, accommodate varied housing densities, and contain several commercial and community nodes.

- **Recent Communities**, which includes Waverley Heights, are areas planned after the 1950s. They are primarily residential neighbourhoods featuring a mix of low and medium density housing. These areas are intended to accommodate some infill development, better transit connections, and increased housing options.

- **Major Redevelopment Sites**, which include the Parker Lands, Sugar Beet Lands, and Southwood Golf Course, present major opportunities for infill development and intensification. Generally, brownfield sites, these underutilized or obsolete parcels are designated to transition into mixed-use, transit-oriented development communities.

“Complete Communities” (City of Winnipeg 2011b), which is one of four “Our Winnipeg” direction strategies, further breaks down the high level land use designations. Employment Lands, which include the Buffalo and Chevrier industrial parks to the west of the transit corridor, are the economic engines of the City. These industrial parks consist in general of manufacturing, warehousing and office developments.

16.4.2.2 Zoning By-law

The Winnipeg Zoning By-law 200/2006 regulates land use in the City of Winnipeg (outside of the downtown) by applying zoning districts to parcels of land within City boundaries. Due to the long, linear nature of the transitway, it inevitably passes through a wide variety of zoning districts.

The residential neighbourhoods to the east of the corridor (Beaumont and Maybank) are primarily zoned R1 – Residential Single Family, which accommodates single family development in lower density neighbourhoods. The Maybank neighbourhood also has pockets of RMF – Residential Multi-Family, which accommodates townhouse and low-rise apartment development.

To the west of the corridor (north of Bishop Grandin Boulevard) lie the Chevrier and Buffalo industrial parks. They are almost exclusively zoned for M1 – Manufacturing Light and M2 – Manufacturing General, which both accommodate varying intensities of manufacturing, processing, distribution, storage and warehousing operations.

The Pembina Strip community, centred around Plaza Drive, is one of the truly mixed-use neighbourhoods along the line. It features a wide range of residential and commercial zoning districts. On the commercial side, C1 – Commercial Neighbourhood, C2 – Commercial Community, and C3 – Commercial Corridor are all present; fronting primarily along Pembina Highway, they feature varying intensities of retail, restaurant, hotel, and service uses. Much of the residential is zoned RMF – Residential Multi-Family, which accommodates the diverse developments of low and mid-rise apartments and condominiums.

In Waverley Heights, much of the land is zoned as R1. However, particularly near the transitway, there are pockets of R2 – Residential Two-Family that accommodate duplexes. There are also a few areas zoned RMF, which accommodate primarily townhouses in this case. In the Montcalm Neighbourhood there exists a mix of C2, C3 and RMF. While the U of M’s Southwood Lands are zoned as PR2 – Parks and Recreation (Community), they are designated as a Major Redevelopment Site. Once the U of M finalizes their plans for the area, it is anticipated that the area will be rezoned for residential and commercial uses in the future. Finally, the transitway’s terminus (University of Manitoba campus) is zoned as EI – Educational and Institutional.

16.4.3 Stakeholders

Over the course of the project, the public consultation team met with a wide variety of stakeholders, including government departments, utilities, schools, adjacent landowners, property managers, community groups, leaseholders, residents and the general public. Approximately 60 meetings were hosted over the two rounds of engagement. The following list outlines a representative sample of these various stakeholder groups:

- **Government, Schools and Utilities**
  - Canadian National Railways
  - City of Winnipeg - Planning, Property and Development
  - City of Winnipeg - City Naturalist
  - City of Winnipeg - City Forester
  - City of Winnipeg – (regarding Parks)
  - City of Winnipeg – (regarding Dog Parks)
  - University of Manitoba
  - City of Winnipeg - Public Works
  - City of Winnipeg - Active Transportation
  - City of Winnipeg - Water and Waste
  - City of Winnipeg - Real Estate Division
  - City of Winnipeg - (regarding Lot 16 Drain)
  - City of Winnipeg – Councillors
  - Manitoba Hydro
  - General Byng School
  - Ralph Maybank School
16.4.4 Aboriginal Interests

Winnipeg is located in Treaty No.1, which was signed in 1871 between the Government of Canada and the Chipewa and Swampy Cree Indian Tribes (Aboriginal Affairs and Northern Development Canada [AANDC] 2013). The First Nations lands found located within or adjacent to the RSA are summarized in Table 16-9. The Long Plain Madison Indian Reserve #1 has three parcels of land located within the City of Winnipeg on Madison Street between St. Matthew Avenue and Silver Avenue near Route 90. The other FN lands are located outside of the City of Winnipeg perimeter. There were no FN lands or interests found to be located in the PSA or LSA.

| Table 16-9: First Nations Reserves Located Within or Adjacent to the RSA |
|-----------------------------|-----------------------------|
| First Nation Reserve Lands   | Location                    |
| Brokenhead Ojibway Nation, Na-Sha-Kee-Penis Reserve Lot 1 | Adjacent to PTH59 near Pritchard Farm Road about 1 km north of the perimeter (PTH101) |
| Long Plain Madison Indian Reserve #1, Parcels A, E and F | Madison Street between St. Matthew Avenue and Silver Avenue near Route 90 |
| Roseau River Anishinabe First Nation, Parcel 95309 | About 0.8 km northwest of PTH101 at PR236 and PTH6 |
| Swan River S.A. convenience store, VLTs and gas station | About 3.5 km west of PTH101 on PTH1 |

Source: AANDC 2013

In 2008, L. J. Barkwell published a document titled “Rooster Town: A Métis Road Allowance Community”, which described the last known road allowance community in Winnipeg. The following information was obtained from Barkwell (2008): This road allowance community was situated at Grant Avenue and Waverley Street and was known as Rooster Town. During the Great Depression of the 1930’s, a number of homeless families, many of whom were destitute Métis, built small shacks illegally on the CN railway property adjacent to City owned land just off Grant Boulevard. The area, now roughly between Weatherdon Avenue and the tracks from Cambridge to Rockwood Streets, became known as Rooster Town. Over the next quarter century the number of squatters varied with economic conditions. By the 1950’s, at least 30 to 50 people clustered there in more than a dozen shacks. Alternate housing was found for six or seven families in 1952, but many preferred to stay where they were. In the summer of 1959, the city offered the last families cash payments of $50 to $75 to move or face eviction proceedings.

The Parker Wetlands Conservation Committee (2013) indicated that the Parker Lands were a part of Rooster Town and therefore part of Métis history. However, the land area described in Barkwell (2008) does not include the Parker Lands area. There were no other publications or information found describing Métis activities or interests in the PSA.

The Manitoba Métis Federation (MMF) has a regional office in Winnipeg, the Winnipeg Métis Association Inc., located on McGregor Avenue. There are no Métis organizations located within the PSA or LSA.

16.4.5 Land Use

Land use within the PSA and LSA consists of the CN rail line and RoW; the Manitoba Hydro transmission lines, structures and RoW; commercial (e.g., shopping and other services along Pembina Highway and other streets), industrial (e.g., Chevrier and Buffalo industrial parks), recreational (Brenda Leipsic dog park, community gardens, walking and cycling trails) and residential areas (e.g., neighbourhoods of Beaumont, Maybank, Montcafn Pembina Strip and Waverley Heights). The RoW areas are routinely mowed and maintained as per CN and Manitoba Hydro operational and safety standards.

The Parker Lands include a City of Winnipeg off-lease dog park, paths used for walking and cycling, and plots for gardening. During the field survey, dumping of refuse was evident as well as dumping of garden waste. The corridor for the CN rail and RoW has trails used for walking and cycling, garden plots, and provides east/west access across the railroad tracks (Photograph 16). More dumping of household items was evident in this section of the PSA. Photograph 17 shows a view of a garden plot located in the Manitoba Hydro RoW on the south side of Clarence Avenue and Photograph 18 shows the view of the parking lot located on the north side of Clarence Avenue in the Manitoba Hydro RoW.
Photograph 16: View facing northwest of the CN rail line and RoW south of Bison Drive, October 01, 2013.

Photograph 17: View facing north of a garden plot in the Manitoba Hydro RoW on the south side of Clarence Avenue, October 01, 2013.

Photograph 18: View facing south of the parking lot located on the north side of Clarence Avenue in the Manitoba Hydro RoW, October 01, 2013.

The City of Winnipeg Brenda Leipsic dog park is located at intersection of Hurst Way and Parker Avenue in the PSA. There are two community gardens located in the PSA, the Parker Block located on City owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McGillivray Boulevard (City of Winnipeg 2014a).

16.4.6 Resource Use

Resource use in the PSA includes use of the lands for: the CN rail line and RoW; Manitoba Hydro transmission lines, distribution lines, towers and RoW; commercial, industrial, recreational and residential land use; cycling, dog walking, gardening and walking areas; roadways and transportation uses; feeding and resting areas for urban wildlife; and runoff and stormwater drainage.

16.4.7 Protected Areas

There are no protected areas located in the PSA or LSA. There are several City of Winnipeg parks and fields, dog parks and community gardens located in the RSA. There are no parks and fields located in the PSA. There are two community gardens and a dog park located in the PSA (Section 16.4.5). These parks, fields and the dog park are operated and maintained by the City.
16.4.8 Heritage Resources

A request was submitted to MHHRB on October 24, 2013 to determine the presence of Heritage Resources in the PSA, particularly in the Parker Lands area. The response received on February 65, 2014 indicated that there were no archaeological sites recorded for the area (P. Blomquist, pers. comm.). A copy of the request and response are provided in Appendix D.

The Manitoba Heritage Resources Branch (MHHRB), Manitoba Historical Society (MHS) and City of Winnipeg Heritage Conservation websites were reviewed to determine the presence of any Heritage Resources or historical sites within the PSA (MHHRB 2014; MHS 2014; City of Winnipeg 2014b). The Joseph P. Borowski Memorial, located at 1639 Pembina Highway near Manahan Avenue in the Maybank neighbourhood, was the only historic site found in the LSA. The search of the MHS site found that Parker Avenue was named in 1882 for journalist Elizabeth Fulton Parker, who assisted in founding of the YWCA in Winnipeg, the Women’s Canadian Club, and the Alpine Club of Canada (MHS 2014). There were no Heritage Resources or historic sites found to be located in the PSA.

17 PUBLIC AND STAKEHOLDER CONSULTATION

Public and stakeholder consultation was undertaken during the Alignment Study component of the Project in 2011 and 2012, and during the Functional Design component of the Study in 2013 and 2014.

For the Alignment Study, Dillon created and implemented an open public consultation program as part of the Project. The purpose of the consultation program was to engage the public and stakeholders in the study so they had the opportunity to understand the facts about the alignment options for the Project and the opportunity to provide input, opinion and feedback about the alignment options for the Project.

Dillon used a variety of consultation tools to communicate information about the Project and solicit feedback from the public:

- **Letters/Information Brochure**: Canada Post distributed one letter/information brochure to 8,097 mailboxes in the neighbourhoods of Parker, Beaumont, Buffalo, Maybank, Chevrier, Pembina Strip, Waverley Heights and Montclair, during the week of September 5, 2012. The brochure provided information on the Project, contact information, and served as the primary invitation to the Open Houses.

- **Advertisements**: Dillon prepared an advertisement for the City of Winnipeg to place in the Winnipeg Free Press on September 8 and 15, 2012. The City of Winnipeg also issued a public media release prior to the public Open House, which generated interest from local print and radio media, including CBC and Winnipeg Free Press.

- **Internet**: Dillon prepared an informative “fact sheet”, which the City of Winnipeg used as a basis for the information posted to the Transit webpage outlining the Project (winnipegtransit.com). The website included information on how the public could get involved and participate by means of the two open houses or online through the survey link. Dillon made the survey available at each Open House, as well as an online Open House. Transit posted the online Open House on winnipegtransit.com to give the opportunity to those who could not attend the open house a chance to participate and provide their feedback.

- **Opinion and Feedback Survey**: Dillon developed one public survey for the purpose of collecting feedback about the three alignment options reviewed in the 2012 alignment study. The survey allowed the public to identify their preferred alternative (Concept 1A, 1B, and 2), as well as provide feedback on specific criteria relating to community linkages, property, neighbourhood, business, environmental, operations, and construction, in addition to general comments/opinions. Dillon distributed the survey at each Open House. The survey was also posted online as part of the online Open House at winnipegtransit.com.

- **Open House**: Transit and Dillon hosted two public open houses for the 2013 alignment study, the first on Wednesday evening of September 19 and the second on a Saturday during the day September 22, 2012. Both Open Houses were held at the Holiday Inn Winnipeg South at 1330 Pembina Highway, near the communities and possible South West Transitway alignment. Information was shared about the two alignment options as well as the overall Project. Over 375 people attended the Open House (331 completed the survey, either in person or online). An online Open House was subsequently posted online through the survey link for study by other interested individuals. The discussions were informed and contributed to the final recommended option.

Additional information on the Public Consultation program carried out by Dillon for the Alignment Study is provided in Dillon’s “Southwest Rapid Transit Corridor Stage 2 Alignment Study – Final Report” (Dillon 2013a).

For the Functional Design component, Dillon and their sub-consultant, Landmark Planning and Design Inc., carried out the public consultation program associated with the Project in two “rounds”. Round 1 occurred between October 2013 and December 2013. Round 2 occurred between January 2014 and March 2014.

The purpose of Round 1 consultation was two-fold:

- Provide basic, early project information (i.e. scope, timing, design, etc.); and
- Identify issues and ideas that the design team should consider during the preparation of the functional design.

The purpose of Round 2 consultation was two-fold:

- Provide detailed information relating to the draft functional design, including responses to the issues, concerns and ideas presented by participants in Round 1 consultation; and
- Identify opportunities to adjust the draft Functional Design and/or provide further information based on participant feedback.

The consultation approach included the following components during each of the two rounds of consultation:

- Meeting with approximately 25 internal and external stakeholder groups or individuals (e.g. City departments, utilities, nearby institutions, advocacy groups, etc.);
- Meetings with individuals (i.e. residents, landowners, renters, etc.);
- Small Group Meetings with residents or businesses with property directly adjacent to the proposed transitway corridor;
- Information sessions for the general public;
• Information provided via a project website; and
• “Full-time” direct access by phone or email to the public consultation team.

Participants represented a range of perspectives including residents living directly adjacent to the planned corridor, those living nearby, and other Winnipeg citizens living more distant from the proposed corridor. Businesses, organized interest groups, land leaseholders and transit users also participated. About half of the respondents that participated in Round 1 of the consultation process also participated in Round 2 of the consultation process, indicating good continuity as well as good on-going participation opportunities. The vast majority of participants in each round of the consultation process indicated that the team members working with participants were helpful, and that the information provided was helpful. During Round 1 of the consultation process, stakeholders provided a mix of opinions concerning the Project:

• Adjacent commercial and multi-family property owners (owners of vacant land) see the benefits of this project with respect to the potential for the transitway to increase value for transit-oriented development (TOD) on these sites, which, in turn, will increase the City’s property tax base and contribute to “Our Winnipeg’s” infill development goals along rapid transit corridors. Owners would also like to ensure residents have access to active transportation (AT) pathways along the route;

• Existing and future transit users expressed a range of opinions regarding the Stage 2 Project; many were supportive of the new service and the overall rapid transit plan for Winnipeg; others were not supportive for various reasons as outlined below;

• A significant number of individuals that participated in the consultation expressed a concern regarding the loss of “perceived public space”. The “Parker Lands” are privately held lands mistakenly seen to be public lands due to the frequent use by local residents for strolling, dog walking, etc. The desire is to “preserve” all or part of these lands.

• There is concern regarding the potential impact to the existing City of Winnipeg dog park; it is apparent that many dog park users think the dog park area is much larger than it is (i.e. the entirety of the “Parker Lands” versus an area about 1/6th the size); users are concerned about loss of the dog park;

• Individuals living in homes directly adjacent to the proposed corridor expressed concerns regarding the potential for disruptive effects such as noise, vibration, transitway lighting and odour;

• Individuals living directly adjacent and to the west of Letellier rail line expressed concerns about the potential for increased noise, vibration and risk associated with the potential relocation of the rail line closer to their residences;

• A number of individuals expressed concern regarding potential decreases in transit service on Pembina Highway;

• Many participants provided commentary considered to be outside the scope of this Functional Design project; the commentary can be generally summarized as advocating for: elimination of rapid transit as an option altogether; relocation of the selected rapid transit route to another route (e.g. Pembina Highway, Letellier rail corridor); or concern regarding project cost.

During Round 2 of the consultation process, stakeholders had a variety of comments concerning the draft functional design:

• Many respondents indicated that initial concerns had been addressed through the draft Functional Design. Some respondents continued to suggest an alternative routing for the transitway beyond the scope of the draft Functional Design study.

• There was substantial support for the Active Transportation (AT) component of the draft Functional Design. A number of participants provided specific suggestion for improvement of the proposed AT components.

• A number of participants provided suggestions for bus routing, particularly concerning the frequency of Pembina Highway routes.

• A number of participants indicated an on-going concern about the potential for noise and dust from buses would negatively impact the enjoyment of their properties.

• A number of participants provided suggestions for the placement and design of the stations (i.e. station amenities), including consideration for vision impaired individuals.

• A number of participants provided suggestions for modifying the road system in and around the proposed transitway.

• Commentary concerning the existing dog park generally indicated that the provision of an alternative dog park nearby was a reasonable solution.

• Commentary concerning the University of Manitoba access point was generally favourable towards using the Southpark Drive alignment rather than the Markham Avenue alignment.

• A small number of participants provided both negative and positive commentary concerning proposed Park and Ride locations. Concerns focused on the potential for transit riders to park on nearby residential streets rather than in designated park and ride spaces.

• A small number of participants re-iterated a wish to designate areas in the “Parker Lands” for use as a public park.

• A small number of participants expressed concern regarding the potential project cost.

Additional information on the Public Consultation program carried out by Landmark Planning and Design Inc. for the Functional Design study is provided in “Southwest Transitway (Stage 2) Public Engagement Report” (Landmark Planning and Design Inc. 2014). An Issue-Response table is provided in Appendix A of the full report. The table summarizes primary concerns or questions raised during both rounds of the consultation process and the response of the study team to each of these matters.

18 POTENTIAL ENVIRONMENTAL EFFECTS

18.1 Bio-physical Environment

18.1.1 Climate

The Project construction activities are not expected to have an effect on the local climate (i.e., no effect on air pressure, cloud cover, humidity, precipitation, hours of sunshine, temperature, wind speed and wind direction).

As noted in Section 5, one of the objectives of the Project is a reduction in GHG emissions. The implementation of the transitway will reduce GHG emissions as a result of a mode shift from
high-consumption private automobiles to public transit and active transportation. Operating efficiencies resulting from higher speeds and new vehicles are expected to reduce emissions from the bus fleet that operates on the transitway. A reduction in GHG emissions during the O&M phase of the Project is considered to be a positive effect of the Project.

18.1.2 Air Quality and Greenhouse Gas Emissions

During the Project construction activities, there will be air and GHG emissions due to exhaust and/or dust from the use of stationary and mobile project equipment (e.g., asphalt pavers, backhoes, bulldozers, dump trucks, excavators, scrapers, packers, etc.). These emissions may have a temporary, localized effect on air quality and GHG emissions in the PSA during the Project construction phase. As noted in Section 18.1.1 above, these emissions are not expected to have a significant effect on climate in the PSA, LSA or RSA.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the Contractor and City will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. The PSA is located in a mixed urban area with existing commercial, industrial, residential and transportation activities. As such, the O&M activities are not expected to have a significant effect on air quality and GHG emissions in the PSA. As noted in Section 18.1.1 above, one of the objectives of the Project is a reduction in GHG emissions, and a reduction in GHG emissions during the O&M phase of the Project is considered to be a positive effect of the Project.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.3 Noise and Vibration

During the Project construction activities, there will be noise and vibration due to the use of stationary and mobile project equipment (e.g., asphalt pavers, backhoes, bulldozers, dump trucks, excavators, scrapers, packers, etc.). This noise and vibration may have a temporary, localized effect on noise and vibration in the PSA during the Project construction phase. As shown in Table 16.4 in Section 16.3.3, average background noise levels from road and rail traffic in the PSA likely range from about 60 to 70 dBA, although actual noise levels would be dependent on the volume of traffic, speed of the traffic and distance from the road or railway. The areas surrounding the PSA consist of both residential and light industrial uses, and typical noise levels in the PSA from these sources likely range from about 50 to 55 dBA. Road construction equipment noise ranges between about 76 dB and 89 dB at 15 m from the equipment.

Sound levels drop by 6 dB for every doubling of the distance from the source of the noise of emission (Engineering Page 2014; Sengpiel Audio 2014). Table 18.1 provides a summary of the expected decibel levels with distance from the construction equipment.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>dB at 15 m</th>
<th>dB at 30 m</th>
<th>dB at 60 m</th>
<th>dB at 120 m</th>
<th>dB at 240 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paver</td>
<td>89</td>
<td>83</td>
<td>77</td>
<td>71</td>
<td>66</td>
</tr>
<tr>
<td>Bulldozer, Grader, Loader</td>
<td>85</td>
<td>79</td>
<td>73</td>
<td>67</td>
<td>61</td>
</tr>
<tr>
<td>Pump</td>
<td>76</td>
<td>70</td>
<td>64</td>
<td>58</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Engineering Page 2014; Sengpiel Audio 2014

The noise levels from the construction activities will decrease over distance. It is expected that the construction noise levels will be in the "very annoying" to "annoying" range for receptors located within 15 m to 30 m of the works, decrease to the "annoying" to "intrusive" range for receptors located within 60 m to 120 m of the works, and be within existing ambient noise levels for receptors located within 240 m of the works (Table 16-4).

Martin (1977) found that ground vibration levels are unlikely to be high enough to cause any disturbance to people situated at distances greater than 20 m from the source of vibration. As such, the vibration produced during the construction activities is not expected to have a significant effect on people or residences located greater than 20 m from the construction sites within the PSA.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. The Project design includes features to reduce noise and vibration in the PSA and mitigate any additional noise and vibration that may occur in the PSA as a result of the Project O&M. These features include:

- Existing operating train speeds of 30 to 40 km/hr in the CN Letellier subdivision will be maintained following completion of the Project;
- To minimize train noise, continuous welded rail (CWR) with premium ties and fasteners will be used for the relocated CN Letellier track (based on CN engineering track standards);
- A noise attenuation wall is proposed on the west side of the relocated CN Letellier track between Bishop Grandin Boulevard and Marlham Road; and
- During Project construction, CN service on the CN Rivers tracks and on the CN Letellier track and spur tracks will be maintained.
City of Winnipeg – Transit Department
Southwest Transitway– Stage 2
Environmental Review and Assessment

In addition to the above, the City has committed to baseline noise monitoring and noise attenuation barrier design within the Project Detailed Design process. The City manages the issue of noise-related traffic through the City of Winnipeg Motor Vehicle Noise Policies and Guidelines, dated October 11, 1984. While dated, the policy provides overall guidance and direction for roadway planning and related noise attenuation, i.e., if the intruding noise level exceeds the existing sound levels by 5 dBA, noise attenuation measures are to be considered. In order to arrive at the sound levels produced by the transitway, the City will require the collection of baseline field measurements along areas of concern, followed by the use noise prediction models of the operational transitway to determine the nature and extent of any attenuation. When outdoor sound levels are 55 dBA or less for daytime and 50 dBA or less for nighttime, no noise control measures are contemplated. Proposed follow-up involves monitoring and periodic inspection of the site for noise/vibration levels, monitoring complaints and ensuring adherence to design specifications.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.4 Terrain and Soils

The construction of the Project will require the permanent alteration of portions of terrain and soils in the PSA, and temporary disturbance to terrain and soils in other areas of the PSA. A section of the terrain and soils located in the Manitoba Hydro RoW between the Parker Lands and Clarence Avenue (Figure 6-1; Appendix A, figures 2, 3 and 4) will be converted from grassy, treed or wet meadow areas to be used as the dedicated transitway, stations and AT pathways, and the section of the Parker Lands located in the Manitoba Hydro RoW between the CN gyle tracks and Heatherdale Avenue will be converted to the Parker Retention Pond (Figure 7-1; Appendix A, blue area outlined on Figure 4). Other smaller areas in this section of the PSA will be converted to ditches as part of the Project drainage system requirements (Figure 7-1; Section 7.13). South of Clarence Avenue to Markham Avenue, the existing parking lot, roadways and grass or dirt areas will also be converted for use as the dedicated transitway, stations, AT pathways and drainage system requirements (Figure 1-1; Appendix A, Figures 1 and 2). The alteration or disturbance of terrain and soils due to the Project construction activities will be limited to areas located within the existing Manitoba Hydro or CN RoWs.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its Contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. These O&M activities do not involve any soil removal and as such are not expected to have a significant effect on terrain and soils in the PSA.

The Manitoba Contaminated Sites List (MCWS 2014a) was reviewed to identify potentially impacted or contaminated sites within or adjacent to the PSA (Section 16.3.4.1). All of the known impacted sites are outside of the actual BRT alignment properties and Manitoba Conservation indicated that all impacts are contained within the impacted properties, as identified on the Manitoba Conservation Contaminated Sites List (MCWS 2014a). As such, there are no expected effects on terrain and soils in the PSA as a result of contaminated sites or the need for site remediation.

There is the potential for the release of hazardous materials as a result of accidents and malfunctions that may occur during the Project construction and/or O&M activities. These potential effects can be mitigated by the implementation of appropriate equipment usage, equipment fuelling and equipment maintenance techniques.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.5 Groundwater

Potential effects to groundwater due to the Project construction and O&M activities include the accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances during the Project construction activities to groundwater sources in the PSA.

The geotechnical investigations for the PSA (AECOM 2014) showed that the soil profile in the PSA generally consists of a thin layer of topsoil, followed by a layer of glacio-lacustrine clay up to 12 m thick, a layer of glacial till from 4 to 6 m thick and a layer of limestone bedrock. This limestone bedrock contains the Upper Carbonate aquifer, which is the major aquifer underlying the Winnipeg area and occurs in the top 15 to 30 m of the Paleozoic bedrock limestones and dolomites (Section 16.3.5). The Upper Carbonate aquifer is partially confined above by the glacial drift and below by the slightly pervious underlying carbonate rock. The water quality in the Upper Carbonate aquifer can be saline in this area of Winnipeg, with groundwater chloride concentrations from 500 to 1000 mg/L (Render 1970). As such, all residential potable water in the PSA is provided by the Aqueduct; there are no residential potable water wells in the PSA, LSA or RSA.

Given that the depth to the aquifer is about 16 to 18 m below ground and lies beneath a layer of clay, it is expected that, along with appropriate mitigation measures (e.g., appropriate equipment usage, fuelling and maintenance techniques), the potential effect of an accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances during the Project construction activities to groundwater sources in the PSA is not significant.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its Contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. These O&M activities do not involve any soil removal or excavations. With appropriate mitigation
measures (e.g., appropriate equipment usage, fuelling and maintenance techniques), it is expected that the potential effect of an accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances during the Project O&M activities to groundwater sources in the PSA is not significant.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.6 Surface Water

The potential effects to surface water in the PSA and LSA include:

- Alteration of the existing drainage regime, flows and/or amount of surface water;
- Changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization; and
- Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to PSA or LSA watercourses, ditches or drains.

The Project construction and O&M activities include the development, operation and maintenance of a land drainage system that would drain into existing adjacent land drainage systems, including the City’s planned Parker Retention Pond. The land drainage system for the Project has been designed to utilize existing drainage pathways and the City’s planned Parker Retention Pond to move water off of the land surface and retain the flows, prior to discharge to existing combined sewer and stormwater drainage systems. The results of the hydraulic assessment conducted for the Project land drainage system showed that there is no effect on the peak flow rate in the adjacent systems. As such, the Project construction and O&M activities are not expected to have a significant effect on the existing drainage regime or flows in the PSA.

The development of the Parker Retention Pond as carried out by the City Water and Waste Department will create a catchment area in areas that currently consist of treed areas, grassy areas, wet meadow and cattail stands. It is expected that these areas are periodically inundated during spring melt and peak runoff periods, and may be inaccessible by pedestrians and/or cyclists during these periods. The development of the Parker Retention Pond will partially capture the runoff and drainage that typically spreads over the area to create a delineated area of about 6.7 ha (Figure 7-2; Appendix A, blue area outlined in Figure 4) that will serve as a pond and wetland area in the PSA. It is the City of Winnipeg Water and Waste Department’s intention to carry out the conceptual and final design for the Parker Retention Pond to incorporate natural features and native plants, as such as those used by Native Plant Solutions (a division of Ducks Unlimited Canada), a group currently developing methods and plans for the construction of stormwater ponds that incorporate upland, wet meadow, and wetland plants and features for constructed ponds (Ross 2013). As such, the amount of surface water in the PSA will not be altered, but the manner in which it is collected, stored and drained in the PSA will be changed from the existing conditions. Although not part of the Project scope, the City’s planned Parker Retention Pond is linked to the Project as the pond will provide water retention as part of the prevention of overland flooding in the area, and replace the function of the wet meadow and cattail stands as wet areas and habitat for the existing vegetation and wildlife in the PSA that require these seasonally wet conditions.

During the Project construction activities there will be areas within the PSA where deep excavations are required, i.e., the road tunnel crossing under the CN rail tracks. Excessive discharge from the Upper Carbonate aquifer and groundwater flows have interfered in the construction of bridge and building foundations in the City in previous projects (Rendler 1970). In recognition of these potential groundwater incursions, the Project construction plans will include methods to depressurize the aquifer and remove any groundwater from the excavation sites. Groundwater will possibly need to be removed from the tunnel excavation and the rail bridge construction sites by installing temporary wells and pumping the groundwater to the existing City of Winnipeg sewer system for treatment at the South End Water Pollution Control Centre (SEWPC). Groundwater will be analyzed to determine its suitability/approval for sanitary sewer or land drainage system discharge. As such, the potential effect of changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization is expected to be not significant.

With appropriate mitigation measures (e.g., appropriate equipment usage, fuelling and maintenance techniques), it is expected that the potential effect of an accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances during the Project construction and/or O&M activities to surface water in the PSA is not significant.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.7 Fish and Fish Habitat

There is no fish or fish habitat located in the PSA. However, the LSA includes portions of the Red River and therefore the potential effects of the Project construction and O&M activities include:

- Changes to the water chemistry of surface waters due to changes to the existing land drainage system in the PSA;
- Changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization; and
- Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to PSA or LSA watercourses, ditches or drains.

The existing system of combined sewers and stormwater drains in the PSA and LSA eventually drain to outfalls located along the Red River. The land drainage system developed for the Project will use this existing system of combined sewers and stormwater drains. There will be no additional drainage inputs or amounts in the PSA. As such, the potential effects on fish or fish habitat in the LSA due to changes to the water chemistry of surface waters as a result of changes to the existing land drainage system in the PSA is expected to be not significant.

As noted in Section 18.1.6, groundwater may need to be removed from the tunnel and rail bridge excavation sites by installing temporary wells and pumping the groundwater to the existing City of Winnipeg sewer system for treatment at the South End Water Pollution Control Centre (SEWPC). Groundwater will be analyzed to determine its suitability/approval for sanitary sewer or land drainage
system discharge. As such, the potential effect of changes to the water chemistry of fish or fish habitat in the LSA by brackish/saline groundwater released during aquifer depressurization is expected to be not significant.

With appropriate mitigation measures (e.g., appropriate equipment usage, fuelling and maintenance techniques), it is expected that the potential effect of an accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances during the Project construction and/or O&M activities to fish or fish habitat in the LSA is not significant.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.8 Vegetation

The potential effects on vegetation due to the Project construction activities include:

- Permanent alteration of treed, grassy, wet meadow and cattail stand areas in portions of the PSA;
- Temporary disturbance to grassy areas in portions of the PSA; and
- Introduction of new or additional non-native or invasive plant species.

The construction of the Project will require the permanent alteration of portions of vegetation in the PSA, and temporary disturbance to vegetation in other areas of the PSA. A section of the vegetation located in the Manitoba Hydro RoW between the Parker Lands and Clarence Avenue (Figure 6-1; Appendix A, Figures 2, 3 and 4) will be converted from grassy, treed or wet meadow areas to be used as the dedicated transitway, stations and AT pathways, and the section of the Parker Lands located in the Manitoba Hydro RoW between the CN wye tracks and Heatherdale Avenue will be converted to the Parker Retention Pond (Figure 7-1; Appendix A, blue area outlined on Figure 4). Other smaller areas in this section of the PSA will be converted to ditches as part of the Project drainage system requirements (Figure 7-1, section 7.13). South of Clarence Avenue to Bison Drive, the existing parking lot, roadways and grass or dirt areas will also be converted for use as the dedicated transitway, stations, AT pathways and drainage system requirements (Figure 6-1; Appendix A, Figures 1 and 2). The alteration or disturbance of vegetation due to the Project construction activities will be limited to areas located within the existing Manitoba Hydro or CN RoWs.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its Contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. These O&M activities do not involve any vegetation removal and as such are not expected to have a significant effect on vegetation in the PSA.

Manitoba Hydro also conducts regular mowing of the grassy areas in the transmission line RoW areas located in the PSA. This existing O&M activity will be continued as part of the Project O&M activities and will not result in any additional environmental effects.

Both the construction and the O&M activities can lead to the introduction of non-native or invasive plants as seeds of these plants may be brought in to an area by equipment or footwear used in other areas. Mitigation measures to help prevent the introduction or expansion of non-native and invasive plants in the PSA include cleaning of equipment and footwear prior to entering the Project area. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.9 Wetlands

The Project construction activities will result in the permanent change of the majority of the wet meadow and cattail stand areas in the PSA due to the construction of the transitway, AT pathways and stations; development of the drainage system for the Project; and development of the Parker Retention Pond by the City of Winnipeg Water & Waste Department. The City of Winnipeg conceptual and final design for the Parker Retention Pond is anticipating to incorporate natural features and native plants, such as those used by Native Plant Solutions (a division of Ducks Unlimited Canada), a group currently developing methods and plans for the construction of stormwater ponds that incorporate upland, wet meadow, and wetland plants and features for constructed ponds (Ross 2013). The primary function of the Parker Retention Pond is to provide stormwater retention as part of the Cockburn and Calrossie Combined Sewer Relief Works; the current design concept for separation involves the construction of the Parker Retention Pond. The Pond, while a project of City of Winnipeg Water & Waste, has been identified in the list of adjacent systems as drainage along Parker Avenue will be routed east toward the pond via ditches. The City's development of the Parker Retention Pond is anticipated to include the incorporation of natural vegetation and shoreline features that could also provide habitat for the existing vegetation and wildlife in the PSA that require these seasonally wet conditions. The development of the Parker Retention Pond as wetland habitat would provide compensation for the Project effects on the wet meadow and cattails stands in the PSA, provide potential amphibian and other wildlife habitat, meet regulatory requirements, and address stakeholder concerns.

Native Plant Solutions have conducted studies that show how the stormwater ponds that contain wetland plants and features outperform the stormwater ponds designed only with upland plants in terms of:

- Improved water quality and clarity;
- Reduced growth of nuisance algae;
- Decrease in grazing geese;
- Reduced growth of invasive plant species as native plants outcompete the invasive species;
- Reduced sediments and higher absorption of nutrients;
- Reduction of pathogens and degradation of pesticides;
Lower construction and long-term management costs; and,

Creation of natural areas in the urban environment.

Additional advantages of designing and constructing a stormwater pond that incorporates natural features and native plants include:

- Demonstration of environmental awareness and stewardship, due diligence and corporate responsibility by striving to meet Province of Manitoba water quality and wetland protection objectives.
- If the correct plants and features are used and implemented, the stormwater pond could help replace the summer habitat for Northern leopard frog that may be present in the PSA, and potentially increase the quantity and quality of habitat for Northern leopard frog in the area by providing the depth and cover needed for spring breeding activities.
- The stormwater pond and areas around it could be used to provide habitat and propagation of upland, wet meadow and wetland plant Species at Risk and other native prairie plant species.
- The existing milkweed plants in the PSA, additional milkweed plants and other native plants such as goldenrod, black-eyed Susan (Rudbeckia hirta) and wild bergamot (Monarda fistulosa) could be planted as part of the Parker Retention Pond and other Project landscaping activities to provide habitat in the PSA for Monarch butterflies, as well as for birds, bees, dragonflies and other beneficial insects.
- It is expected that the areas of shallow standing water created in the existing wet meadow, grassy areas and stands of cattails in the PSA during the spring and summer provide habitat for mosquitoes. The development of the Parker Retention Pond and land drainage system for the Project will remove some of these standing water areas and potentially reduce mosquito habitat areas. Development of a stormwater pond in the PSA will also create areas of standing water for the growth of mosquitoes; however, the use of native plants to create habitat for birds, bees, dragonflies and other beneficial insects would also encourage the presence of these and other wildlife (e.g., bats) that feed on mosquitoes and mosquito larvae.

During the O&M phase of the Project (Section 10), in addition to the operation of the transway, the City (or its Contractor) will need to perform O&M activities such as transway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. These O&M activities are not expected to have a significant effect on any remaining areas of wet meadow or cattails stands in the PSA, or to any wetland areas created by the development of the City's Parker Retention Pond in the PSA.

Manitoba Hydro also conducts regular mowing of the grassy areas in the transmission line ROW areas located in the PSA. This existing O&M activity will be continued as part of the Project O&M activities and will not result in any additional environmental effects. It is expected that mowing could be ceased or altered in the areas in and around the City's Parker Retention Pond if mowing affects any efforts to propagate specific plant species.

Both the construction and the O&M activities can lead to the introduction of non-native or invasive plants as seeds of these plants may be brought in to an area by equipment or footwear used in other areas. Mitigation measures to help prevent the introduction or expansion of non-native and invasive plants in the PSA include cleaning of equipment and footwear prior to entering the Project area. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.10 Wildlife and Wildlife Habitat

The potential effects on wildlife and wildlife habitat due to the Project construction and O&M activities include:

- Temporary disturbance in the PSA during construction and O&M activities; and
- Permanent alteration of treed, grassy, wet meadow and cattail stand areas in the PSA that may provide habitat.

The treed, grassy, wet meadow and cattail stand areas in the PSA provide small areas of habitat that may provide feeding, foraging, nesting, breeding and/or overwintering habitat for some wildlife species that are adapted to urban living and are able to use these small pockets of habitat areas, and also provide feeding and resting areas for other wildlife species passing through the area on their way to breeding, nesting and/or overwintering areas outside of the PSA. It is expected that the majority of wildlife species present in the PSA are habituated to the noise and activity in the PSA. As such, the potential effect of temporary disturbance during construction and O&M activities is not expected to have a significant effect on wildlife and wildlife habitat in the PSA.

Some of the treed, grassy, wet meadow and cattail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the adjacent Parker Retention Pond. It is expected that the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA will displace some of the wildlife species that may be present in the existing PSA, while other species will remain or return after the completion of the Project construction activities. As such, the potential effect of the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA that may provide wildlife habitat is expected to have a minimal effect on wildlife and wildlife habitat in the PSA.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.1.11 Species at Risk

The potential effects on Species at Risk due to the Project construction and O&M activities include:

- Temporary disturbance in the PSA during construction and O&M activities;
- Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&M areas;
City of Winnipeg – Transit Department  
Southwest Transitway – Stage 2  
Environmental Review and Assessment

- Permanent alteration of grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs; and
- Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.

Table 16-7 in Section 16.3.11 outlines the Species At Risk that may be present in the PSA. All of these species are migratory and/or have specific breeding and/or overwintering habitat requirements that are not present in the PSA. As such, disturbance of these species would only occur during the spring or summer periods when these species would be able to use the habitat available in the PSA. It is expected that the bird and bat species in Table 16-7 would only be present in the PSA for feeding or temporary resting needs, and would avoid the noise and disturbance in the PSA during Project construction and O&M activities.

Although not observed during the field survey, Northern leopard frog and Monarch butterfly may be present in the PSA based on the availability of winter habitat (wet meadow, ditches, cattail stands for Northern leopard frog; milkweed for the Monarch butterfly). Northern leopard frogs present in the PSA during Project construction and O&M activities would be at risk of being injured or killed by various types of equipment, including mowers used by Manitoba Hydro for existing O&M activities. Monarch butterfly larvae would also be at risk of injury or mortality if adult Monarch are able to access the milkweeds plants prior to construction activities, and the milkweed plants are subsequently destroyed.

Mitigation measures that may be used to prevent injury or mortality of Northern leopard frog and/or Monarch butterfly include: conducting a pre-construction survey in the spring to determine the presence and location of any Species At Risk in the PSA; relocating the milkweed plants present in the PSA prior to the construction and O&M activities; capturing and relocating any Northern leopard frogs found within the PSA prior to the construction and O&M activities; and/or scheduling construction and O&M activities to take place in the late summer, fall or winter when these species would not be present in the PSA.

During periods of inundation, the grassy, wet meadow and cattail stand areas in the PSA may provide summer foraging habitat for Northern leopard frog. Some of the treed, grassy, wet meadow and cattail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the Parker Retention Pond. It is expected that the permanent alteration of the grassy, wet meadow and cattail stand areas in the PSA will displace some of the Northern leopard frogs that may have returned to these areas of the PSA in the spring, while other individuals may adapt to new conditions and return after the completion of the Project construction activities. As such, the potential effect of the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA that may provide areas of seasonal habitat for Northern leopard frog is expected to have a minimal effect on Northern leopard frog in the PSA.

The potential loss of milkweed plants in the PSA that may provide Monarch butterfly habitat can be mitigated by: relocating the existing plants in the PSA prior to the Project construction activities; and/or replacing the existing plants with new plantings of milkweed in the landscaped areas for the Project and/or Parker Retention Pond. As such, the overall effect of the potential loss of milkweed plants in the PSA was considered to be not significant.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.2 Socio-Economic Environment

18.2.1 Stakeholders

Potential effects of the Project construction activities on stakeholders include:
- Temporary disturbance due to noise, dust, equipment and crews working in the PSA;
- Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA;
- Permanent alteration of the treed, grassy, wet meadow and cattail stand areas in sections of the PSA;
- Permanent alteration of sections of the dog park and community gardens located on City owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McGillivray Boulevard;
- Creation of AT pathways in the PSA; and
- The Project benefits outlined in Section 5, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions.

The Project construction activities will cause a temporary disturbance to stakeholders due to noise, dust, equipment and crews working in the PSA. The measures that will be employed during construction activities to mitigate these effects are summarized in Table 19.1.

The Project construction activities will cause a temporary disturbance to stakeholders due to disruptions in traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA. The measures that will be employed during construction activities to mitigate these effects are summarized in Table 19.1.

The construction of the Project will require the permanent alteration of land areas in the PSA, and temporary disturbance to lands in other areas of the PSA. A section of the lands located in the Manitoba Hydro RoW between the Parker Lands and Clarence Avenue (Figure 6-1; Appendix A, Figures 2, 3 and 4) will be converted from grassy, treed or wet meadow areas to be used as the dedicated transitway, stations and AT pathways, and the section of the Parker Lands located in the Manitoba Hydro RoW between the CN wye tracks and Heatherdale Avenue will be converted to the Parker Retention Pond (Figure 7-1; Appendix A, blue area outlined on Figure 4). Other smaller areas in this section of the PSA will be converted to ditches as part of the Project drainage system requirements (Figure 7-1; Section 7.13). South of Clarence Avenue to Bison Drive, the existing parking lot, roadways and grass or dirt areas will be converted for use as the dedicated transitway, stations, AT pathways and drainage system requirements (Figure 6-1; Appendix A, Figures 1 and 2). This alteration was perceived as a positive effect by some stakeholders, and as a negative effect by others (Section 17).
During the Public Consultation activities, stakeholders indicated that the provision of an alternative dog park nearby was a reasonable solution to the alteration of the existing dog park (Section 17). Stakeholders also indicated support and a positive reaction to the creation of AT pathways in the PSA (Section 17).

The Project benefits outlined in Section 5, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions, are considered to be positive effects of the Project.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its Contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries.

These O&M activities are temporary in duration, localized in area and similar to the O&M activities that currently occur in the PSA. As such, these O&M activities are not expected to have a significant effect on stakeholders in the PSA.

Table 19.1 in Section 19 provides a summary of the mitigation measures that will be implemented to minimize the potential effects of the Project construction and O&M activities.

18.2.2 Aboriginal Interests

There are no First Nations reserve lands, Treaty Land Entitlements or Community Interest Zones located within the PSA (Section 16.4.4). As such, the Project construction and O&M activities are not expected to affect First Nations lands or First Nations traditional land use activities in the RSA. There are no Métis organizations or known Métis interests located within the PSA or LSA (Section 16.4.4). As such, the Project construction and O&M activities are not expected to affect Métis interests or activities in the PSA or LSA.

18.2.3 Land Use

Potential effects of the Project construction activities on land use include:

- Temporary disturbance due to equipment and crews working in the PSA;
- Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA;
- Permanent alteration of the treed, grassy, wet meadow and cattail stand areas in sections of the PSA;
- Permanent alteration of sections of the dog park and community gardens located on City owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McGillivray Boulevard; and
- Creation of AT pathways in the PSA.

The Project construction activities will cause a temporary disturbance to existing land use in the PSA due to equipment and crews working in the PSA. The measures that will be employed during construction activities to mitigate these effects are summarized in Table 19.1.

The Project construction activities will cause a temporary disturbance to existing land use due to disruptions in traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA. The measures that will be employed during construction activities to mitigate these effects are summarized in Table 19.1.

The construction of the Project will require the permanent alteration of land areas in the PSA, and temporary disturbance to lands in other areas of the PSA. A section of the lands located in the Manitoba Hydro RoW between the Parker Lands and Clarence Avenue (Figure 6-1; Appendix A, Figures 2, 3 and 4) will be converted from grassy, treed or wet meadow areas to be used as the dedicated transitway, stations and AT pathways, and the section of the Parker Lands located in the Manitoba Hydro RoW between the CN wye tracks and Heatherdale Avenue will be converted to the Parker Retention Pond (Figure 7-1; Appendix A, blue area outlined on Figure 4). Other smaller areas in this section of the PSA will be converted to ditches as part of the Project drainage system requirements (Figure 7-1; Section 7.13). South of Clarence Avenue to Bison Drive, the existing parking lot, roadways and grass or dirt areas will also be converted for use as the dedicated transitway, stations, AT pathways and drainage system requirements (Figure 6-1; Appendix A, Figures 1 and 2). These changes to the land base will alter the use of some areas of the PSA, particularly the areas of the Manitoba Hydro RoW used for walking, cycling, dog walking and gardening. With the exception of gardening, the development of the Project’s AT pathways will provide alternate areas for these land use activities in the PSA. It is expected that the City will reutilize or replace the community garden area located adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McGillivray Boulevard.

During the Public Consultation activities, stakeholders indicated that the provision of an alternative dog park nearby was a reasonable solution to the alteration of the existing dog park (Section 17). Stakeholders also indicated support and a positive reaction to the creation of AT pathways in the PSA (Section 17).

As such, the potential effects on land use in the PSA due to the Project construction activities are expected to be not significant.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its Contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting); and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. These O&M activities are temporary in duration, localized in area and similar to the O&M activities that currently occur in the PSA. As such, the O&M activities are not expected to have a significant effect on land use in the PSA.
18.2.4 Resource Use

The existing resource use in the PSA includes use of the lands for: the CN rail line and RoW; Manitoba Hydro transmission lines, distribution lines, towers and RoW; commercial, industrial, recreational and residential land use; cycling, dog walking, gardening and walking areas; roadways and transportation uses; feeding and resting areas for urban wildlife; and runoff and stormwater drainage. There are no hunting, trapping, fishing or gathering of medicinal or sacred plants activities in the PSA.

The Project construction activities are not expected to result in any losses to the existing resource use in the PSA. Some of the land areas will be altered and there will be the additional use of a BRT system, but overall, the resource use will remain the same and the Project construction activities are not expected to have a significant effect on resource use in the PSA.

During the O&M phase of the Project (Section 10), in addition to the operation of the transitway, the City (or its Contractor) will need to perform O&M activities such as transitway and road maintenance (concrete repairs as required, snow clearing in winter, line painting; and maintenance of stations, Park and Ride areas, AT pathways, landscaping and drainage systems. CN will need to conduct O&M activities consistent with the maintenance activities currently in place for existing rail lines and in keeping with current BMPs, regulations, specifications and standards for the transportation and rail industries. These O&M activities are temporary in duration, localized in area and similar to the O&M activities that currently occur in the PSA. As such, the O&M activities are not expected to have a significant effect on resource use in the PSA.

18.2.5 Protected Areas

There are no protected areas located in the PSA or LSA. As such, there were no potential effects to protected areas identified due to the Project construction or O&M activities.

18.2.6 Heritage Resources

The MHRB indicated that there were no records of archaeological findings in the PSA (Section 16.4.8; Appendix D). There were no other Heritage Resources or historic sites found to be present within the PSA (Section 16.4.8). As such, there were no potential effects to Heritage Resources identified due to the Project construction or O&M activities.

In the event that archaeological and/or historical artifacts are discovered during construction, work at the location will cease immediately, and the discovery will be reported to the Project Construction Field Supervisor. The Project Construction Field Supervisor will contact the MHRB for further information and instruction on an acceptable heritage resource management strategy.

19 PROPOSED MITIGATION

The City of Winnipeg is committed to conducting all of their construction projects in a manner that will reduce potential effects on the environment wherever possible. As part of this commitment, the City of Winnipeg through its Contractor will develop a project specific Environmental Management Plan (EMP) for the Project. The EMP will outline the environmental protection procedures and mitigation measures to be implemented before, during and after construction to prevent or minimize any adverse effects on the environment. The construction and O&M activities will be carried out in accordance with all applicable City of Winnipeg by-laws and guidelines (e.g., tree removal guidelines, tree protection guidelines) as well as all applicable provincial and federal laws, acts and regulations.

The potential environmental effects identified in Section 18 will be mitigated using the measures outlined in the EMP and in accordance with the following federal and provincial Acts, policies and regulatory guidance documents:

- Canada
  - Environmental Protection Act
  - Wildlife Act
  - Fisheries Act and Regulations
  - Migratory Birds Convention Act
  - Species at Risk Act
- Manitoba
  - Climate Change and Emissions Reductions Act
  - Dangerous Goods Handling and Transportation Act
  - Endangered Species Act
  - Environment Act
  - Noxious Weeds Act and Regulation
  - Stream Crossing Guidelines for the Protection of Fish and Fish Habitat
  - Sustainable Development Act
  - Transportation of Dangerous Goods Act
  - Waste Reduction and Prevention Act and Regulations
  - Wildlife Act

The current Project construction schedule (Figure 8-1) shows the works required in the PSA (new structures, roadworks for the new transitway, new stations, drainage works, landscaping) occurring at various times of the year from the first quarter of 2016 to the fourth quarter of 2019. The majority of the PSA is located within previously disturbed lands and/or vacant lands that are virtually devoid of wildlife habitat; as such, scheduling construction activities outside of wildlife breeding, nesting or migratory periods is not considered to be required in these areas. However, there are cattails stands and wet meadow areas in the Parker Lands and Manitoba Hydro RoW that may provide habitat for Northern leopard frog (Species at Risk), as well as milkweed patches that may provide habitat for Monarch butterflies (Species at Risk). There are a number of measures that can be taken to mitigate potential effects on these species:

- Conduct a pre-construction survey in the late spring before the start of Project construction activities to confirm the presence/absence of these species in the Parker Lands area.
- Relocate any Northern leopard frogs, if found in the area, to another location of appropriate habitat (e.g., near the Red River).
Table 19-1: Summary of Proposed Mitigation Measures

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Project Mitigation</td>
<td>• Site management, overall environmental management.</td>
<td>• Implementation of BMPs and measures outlined in the Contractor’s EMP as directed by the City of Winnipeg for the Project including water/drainage management and erosion and sediment control measures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Isolation of the work areas as needed to prevent the release or transport of deleterious substances (e.g., fuel, grease, mud) or debris within the Project area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Safety signage and safe work practices will be used at all work areas for the Project as part of site management practices.</td>
</tr>
<tr>
<td>Climate</td>
<td>• No effects identified; the potential effects of GHG emissions are provided in the Air Quality and GHG section below.</td>
<td>• None required; mitigation measures for the potential effects of GHG emissions are provided in the Air Quality and GHG section below.</td>
</tr>
<tr>
<td>Air Quality and GHG Emissions</td>
<td>• During the Project construction and O&amp;M activities, there will be temporary air emissions due to exhaust and dust from the use of stationary and mobile equipment.</td>
<td>• Implementation of BMPs and measures outlined in the EMP for the Project.</td>
</tr>
<tr>
<td></td>
<td>• The expansion and use of Stage 2 of the Southwest Transitway is expected to have an overall effect of reducing GHG emissions in the City of Winnipeg.</td>
<td>• Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mobile and stationary construction equipment will be required to meet appropriate federal emission standards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Equipment and vehicles will not be left idling whenever possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dust control measures such as spraying access roads/areas with water will be implemented as needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The overall effect of reduction of GHG emissions has a positive effect and direction.</td>
</tr>
<tr>
<td>Noise and Vibration</td>
<td>• During the Project construction activities, there will be noise and vibration due to the use of stationary and mobile project equipment (e.g., asphalt pavers, backhoes, bulldozers, dump trucks, excavators, scrapers, packers, etc.).</td>
<td>• Implementation of BMPs and measures outlined in the EMP for the Project.</td>
</tr>
<tr>
<td></td>
<td>• During the Project O&amp;M activities, there will be noise and vibration due to the operation of the BRT line and O&amp;M activities.</td>
<td>• Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Project construction and O&amp;M activities will occur during daytime hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Existing operating train speeds of 30 to 40 km/hr in the CN Letellier subdivision will be maintained following completion of the Project.</td>
</tr>
</tbody>
</table>
City of Winnipeg – Transit Department  
Southwest Transitway – Stage 2 
Environmental Review and Assessment

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain and Soils</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The construction of the Project will require the permanent alteration of portions of soil and terrain in the PSA, and temporary disturbance to soils and terrain in other areas of the PSA.</td>
<td>Implementation of BMPs and measures outlined in the EMP for the Project, including erosion and sediment control measures.</td>
</tr>
<tr>
<td></td>
<td>The Project O&amp;M activities do not involve any soil removal and therefore not expected to have a significant effect on terrain and soils in the PSA.</td>
<td>Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td>Potential for the release of hazardous materials as a result of accidents and malfunctions that may occur during the Project construction or O&amp;M activities.</td>
<td>The area of terrain and soils that will be permanently altered is required for the transitway expansion.</td>
</tr>
<tr>
<td></td>
<td>There were no contaminated sites found within the PSA and therefore no expected effects on terrain and soils in the PSA as a result of contaminated sites or the need for site remediation.</td>
<td>The amount of area affected will be minimized as much as possible by having the areas required to be cleared, surveyed and accurately marked prior to construction.</td>
</tr>
</tbody>
</table>

Dillon Consulting Limited – April 2014 - Project Number: 13-8439

City of Winnipeg – Transit Department  
Southwest Transitway – Stage 2 
Environmental Review and Assessment

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to the PSA during the Project construction or O&amp;M activities.</td>
<td>Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oil changes, refuelling and lubricating of mobile construction equipment will be conducted a minimum of 100 m from any watercourse, wetland or drainage areas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage and disposal of dangerous goods will occur according to Dangerous Goods Handling and Transportation Act and the Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All spills will be reported to the appropriate authority and remediation will be in accordance with applicable regulations.</td>
</tr>
</tbody>
</table>

Dillon Consulting Limited – April 2014 - Project Number: 13-8439

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alteration of the existing drainage regime, flows and/or amount of surface water.</td>
<td>Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures.</td>
</tr>
<tr>
<td></td>
<td>Changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization.</td>
<td>Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td>Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to PSA or LSA watercourses, ditches or drains during the Project construction or O&amp;M activities.</td>
<td>The results of the hydraulic assessment conducted for the Project land drainage system showed that there is no effect on the peak flow rate in the adjacent systems. As such, the Project construction and O&amp;M activities are not expected to have a significant effect on the existing drainage regime or flows in the PSA.</td>
</tr>
<tr>
<td></td>
<td>Groundwater may be removed from the excavation sites by installing temporary wells and pumping the groundwater to the existing City of Winnipeg sewer system for treatment at the South End Water Pollution Control Centre (SEWPCCC). Groundwater will be analyzed to determine its suitability/approval for sanitary sewer or land drainage system discharge. As such, the potential effect of changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization is expected to be not significant.</td>
<td>Oil changes, refuelling and lubricating of mobile construction equipment will be conducted a minimum of 100 m from any watercourse, ditches or drainage areas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage and disposal of dangerous goods will occur according to Dangerous Goods Handling and Transportation Act and the Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001.</td>
</tr>
</tbody>
</table>
### Project Component | Environmental Issue | Mitigation Plans
---|---|---
Fish and Fish Habitat | Changes to the water chemistry of surface waters due to changes to the existing land drainage system in the PSA; Changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization; Accidental release and/or transport of fuel, grease, mud, soil or other deleterious substances to PSA or LSA watercourses, ditches or drains. | Implementation of BMPs and measures outlined in the EMP for the Project, including water/drainage management and erosion and sediment control measures. Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. The existing system of combined sewers and/or stormwater drains in the PSA and LSA eventually drain to outfalls located along the Red River. The land drainage system developed for the Project will use this existing system of combined sewers and/or stormwater drains. There will be no additional drainage inputs or amounts in the PSA. As such, the potential effects on fish or fish habitat in the LSA due to changes to the water chemistry of fish or fish habitat as a result of changes to the existing land drainage system in the PSA is expected to be not significant. Groundwater will be removed from the excavation sites by installing temporary wells and pumping the groundwater to the existing City of Winnipeg sewer system for treatment at the South End Water Pollution Control Centre (SEWPCC). Groundwater will be analyzed to determine its suitability/approval for sanitary sewer or land drainage system discharge. As such, the potential effect of changes to the water chemistry of surface waters by brackish/saline groundwater released during aquifer depressurization is expected to be not significant. Oil changes, refuelling and lubricating of mobile construction equipment will be conducted a minimum of 100 m from any watercourse, ditches or drainage areas. Storage and disposal of dangerous goods will occur according to Dangerous Goods Handling and Transportation Act and the Storage and Handling of Petroleum Products and Allied Products Regulation 188/2001. Storage and disposal of all waste generated at the site will adhere to municipal by-laws and applicable provincial regulations. All spills will be reported to the appropriate authority and remediation will be in accordance with applicable regulations. |

| Project Component | Environmental Issue | Mitigation Plans |
---|---|---|
Vegetation | Permanent alteration of treed, grassy, wet meadow and cattail stand areas in portions of the PSA. Temporary disturbance to grassy areas in portions of the PSA. Manitoba Hydro’s existing O&M activity of mowing in the RoW will be continued as part of the Project O&M activities and will not result in any additional environmental effects. The other Project O&M activities are not expected to have a significant effect on vegetation in the PSA. | Implementation of BMPs and measures outlined in the EMP for the Project. Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. The area of vegetation that will be permanently altered during construction is required for the transitway expansion. The amount of vegetation affected by construction activities will be minimized as much as possible by having the areas required to be cleared, surveyed and accurately marked prior to construction. Any areas of exposed soils will be stabilized and revegetated with an approved seed or plant mix. Replacement of the lost or altered vegetation with new areas of upland vegetation, semi-aquatic vegetation, aquatic vegetation and a pond habitat through Project landscaping, development of the AT pathways and the City’s adjacent development at Parker Retention Pond. All construction equipment and footwear mobilized from outside the construction area shall arrive on the RoW or construction site in clean condition to minimize the risk of weed or pest introduction. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species. The City of Winnipeg guidelines for tree protection, tree removal and tree replacement will be followed. To maintain compliance with the Manitoba Noxious Weed Act, the locations of the existing invasive plants will be marked and the plants removed prior to construction to prevent the proliferation and expansion of these invasive species in the PSA. Vehicle and equipment access will be limited to the RoW and existing roads and paths wherever possible. Work will be halted under very wet or muddy conditions. All Project material used at the site will be removed and the area will be restored to the pre-existing appearance. |
Wetlands | The Project construction activities will result in the permanent change of the majority of the wet meadow and cattail stand areas in the PSA due to the construction of the transitway, AT pathways and stations. | Implementation of BMPs and measures outlined in the EMP for the Project. Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines. The areas of wet meadow and cattail stands that will be permanently altered during construction are required for the transitway expansion. |
<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>development of the drainage system for the Project; and development of the adjacent Parker Retention Pond by the City.</td>
<td>• The amount of wet meadow and cattail stands affected by construction activities will be minimized as much as possible by having the areas required to be cleared, surveyed and accurately marked prior to construction.</td>
</tr>
<tr>
<td></td>
<td>• Manitoba Hydro’s existing O&amp;M activity of mowing in the ROW will be continued as part of Project O&amp;M activities and will not result in any additional environmental effects.</td>
<td>• Replacement of the lost or altered wet meadow and cattail stands with new areas of semi-aquatic vegetation, aquatic vegetation and a pond habitat through project landscaping, development of the AT pathways and the City’s adjacent development of the Parker Retention Pond.</td>
</tr>
<tr>
<td></td>
<td>• The other Project O&amp;M activities are not expected to have a significant effect on any remaining areas of wet meadow or cattails stands in the PSA, or to any wetland areas created by the development of the City’s Parker Retention Pond in the PSA.</td>
<td>• All construction equipment and footwear mobilized from outside the construction area shall arrive on the ROW or construction site in clean condition to minimize the risk of weed or pest introduction. The planting of native species can also help prevent colonization of newly exposed areas by non-native or invasive species.</td>
</tr>
<tr>
<td></td>
<td>• Introduction of new or additional non-native or invasive plant species from equipment and vehicles during construction or O&amp;M activities.</td>
<td>• Vehicle and equipment access will be limited to the ROW and existing roads and paths wherever possible.</td>
</tr>
</tbody>
</table>

Wildlife Habitat

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temporary disturbance in the PSA during construction and O&amp;M activities.</td>
<td>• Implementation of BMPs and measures outlined in the EMP for the Project.</td>
</tr>
<tr>
<td></td>
<td>Permanent alteration of treed, grassy, wet meadow and cattail stand areas in the PSA that may provide habitat.</td>
<td>• Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines, including restricted activity periods.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• It is expected that the majority of wildlife species present in the PSA are habituated to the noise and activity in the PSA. As such, the potential effect of temporary disturbance during construction and O&amp;M activities is not expected to have a significant effect on wildlife and habitat in the PSA.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Project construction and O&amp;M activities will occur during daytime hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The noise levels generated during the Project O&amp;M activities are not expected to exceed noise levels generated by typical activities (including traffic) that occur in the area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The area of potential wildlife habitat that will be permanently altered is required for the transitway expansion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some of the treed, grassy, wet meadow and cattail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the City’s Parker Retention Pond. It is expected that the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA will displace some of the wildlife species that may be present in the existing PSA, while other species will remain or return after the completion of the Project construction activities. As such, the potential effect of the permanent alteration of the treed, grassy, wet meadow and cattail stand areas in the PSA that may provide wildlife habitat is expected to have a minimal effect on wildlife and habitat in the PSA.</td>
</tr>
</tbody>
</table>

City of Winnipeg – Transit Department
Southwest Transitway – Stage 2
Environmental Review and Assessment

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species At Risk</td>
<td>Temporary disturbance in the PSA during construction and O&amp;M activities.</td>
<td>• Implementation of BMPs and measures outlined in the EMP for the Project.</td>
</tr>
<tr>
<td></td>
<td>Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&amp;M areas.</td>
<td>• Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
<tr>
<td></td>
<td>Permanent alteration of grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs.</td>
<td>• Project construction and O&amp;M activities will occur during daytime hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.</td>
</tr>
<tr>
<td></td>
<td>Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.</td>
<td>• All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The noise levels generated during the Project O&amp;M activities are not expected to exceed noise levels generated by typical activities (including traffic) that occur in the area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The areas of potential Species At Risk habitat (wet meadows, cattail stands, milkweed plants) that will be permanently altered are required for the transitway expansion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It is expected that the bird and bat species in Table 16-7 would only be present in the PSA for feeding or temporary resting needs, and would avoid the noise and disturbance in the PSA during Project construction and O&amp;M activities. However, if nests, roosts, burrows or breeding areas for the bird or bat Species At Risk identified in Table 16-7 are discovered during construction or O&amp;M activities, the activities will be halted and appropriate set back distances will be implemented.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mitigation measures that may be used to prevent injury or mortality of Northern leopard frog and/or Monarch butterfly include: conducting a pre-construction survey in the spring to determine the presence and location of any Species At Risk in the PSA; relocating the milkweed plants present in the PSA prior to the construction and O&amp;M activities; capturing and relocating any Northern leopard frogs found within the PSA prior to the construction and O&amp;M activities; and/or scheduling construction and O&amp;M activities to take place in the late summer, fall or winter when these species would not be present in the PSA.</td>
</tr>
<tr>
<td>Project Component</td>
<td>Environmental Issue</td>
<td>Mitigation Plans</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Some of the treed, grassy, wet meadow and catail stand areas in the PSA will be replaced by the landscaping and plantings associated with the development of the AT pathways and the Parker Retention Pond. It is expected that the permanent alteration of the grassy, wet meadow and catail stand areas in the "SA will displace some of the Northern leopard frogs that may have returned to these areas of the PSA in the spring, while other individuals may adapt to the new conditions and return after the completion of the Project construction activities. As such, the potential effect of the permanent alteration of the treed, grassy, wet meadow and catail stand areas in the PSA that may provide areas of seasonal habitat for Northern leopard frog is expected to have a minimal effect on Northern leopard frog in the PSA.
- The potential loss of milkweed plants in the PSA that may provide Monarch butterfly habitat may be mitigated by relocating the existing plants in the PSA prior to the Project construction activities; and/or replacing the existing plants with new plantings of milkweed in the landscaped areas for the Project and/or Parker Retention Pond.
- Implementation of BMPs and measures outlined in the EMP for the Project.
- Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.
- Stakeholders will be notified in advance of the commencement of Project start-up activities.
- Safety signage and safe work practices will be used at all work areas for the Project as part of site management practices.
- Project construction and O&M activities will occur during daylight hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.
- All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.
- Mobile and stationary construction equipment will be required to meet appropriate federal emission standards.
- Equipment and vehicles will not be left idling whenever possible.
- Dust control measures such as spraying access roads/areas with water will be implemented as needed.
- All Project material used at the site will be removed and the area will be restored.
- The alteration of land areas in the PSA due to the Project was perceived as a positive effect by some stakeholders, and as a negative effect by others.

Dillon Consulting Limited – April 2014 - Project Number: 13-8439

City of Winnipeg – Transit Department
Southwest Transitway – Stage 2
Environmental Review and Assessment

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Temporary disturbance due to noise, dust, equipment and crews working in the PSA.
- Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA.
- Permanent alteration of the treed, grassy, wet meadow and catail stand areas in sections of the PSA.
- Permanent alteration of sections of the dog park and community gardens located on City owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McNeillway Boulevard.
- Creation of AT pathways in the PSA.
- The Project benefits outlined in Section 5, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions, are considered to be positive effects of the Project.
- During the Public Consultation activities, stakeholders indicated that the provision of an alternative dog park nearby was a reasonable solution to the alteration of the existing dog park.
- Stakeholders indicated support and a positive reaction to the creation of AT pathways in the PSA.
- The Project benefits outlined in Section 5, e.g., improved transit service and increased ridership, reduction in traffic congestion, improved access to Investors Group Field and reduction in GHG emissions, are considered to be positive effects of the Project.
- The Project construction and O&M activities are not expected to affect First Nations lands or traditional land use activities.
- The Parker Wetlands Conservation Committee suggested that the Parker Lands are part of Rooster Town and Métis history; however, published information for Rooster Town indicates that the Parker Lands were not part of Rooster Town. As such, the Project construction and O&M activities are not expected to affect Métis interests or activities in the PSA or LSA.
- Temporary disturbance due to equipment and crews working in the PSA.
- Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA.
- Permanent alteration of the treed, grassy, wet meadow and catail stand areas in sections of the PSA.
- Permanent alteration of sections of the dog park and community gardens located on City owned lands adjacent to Parker Avenue and Heatherdale Avenue, and the Clarence Avenue garden located on Manitoba Hydro owned lands adjacent to Vincent Street south of McNeillway Boulevard.
- Creation of AT pathways in the PSA.
- Implementation of BMPs and measures outlined in the EMP for the Project.
- Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.
- Stakeholders will be notified in advance of the commencement of Project start-up activities.
- Safety signage and safe work practices will be used at all work areas for the Project as part of site management practices.
- Project construction and O&M activities will occur during daylight hours to minimize the effects of noise on stakeholders and local wildlife. The Project contractors will follow all applicable noise bylaws.
- All equipment used on site will be fitted with appropriate mufflers and be well maintained to minimize noise levels off the site.
- Mobile and stationary construction equipment will be required to meet appropriate federal emission standards.
- Equipment and vehicles will not be left idling whenever possible.
- Dust control measures such as spraying access roads/areas with water will be implemented as needed.
- All Project material used at the site will be removed and the area will be restored.
- The alteration of land areas in the PSA due to the Project was perceived as a positive effect by some stakeholders, and as a negative effect by others.

Dillon Consulting Limited – April 2014 - Project Number: 13-8439
<table>
<thead>
<tr>
<th>Project Component</th>
<th>Environmental Issue</th>
<th>Mitigation Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Use</td>
<td>• The Project construction activities are not expected to result in any losses to the existing resource use in the PSA. Some of the land areas will be altered and there will be the additional use of a BRRT system, but overall, the resource use will remain the same and the Project construction or O&amp;M activities are not expected to have a significant effect on resource use in the PSA.</td>
<td>• None required</td>
</tr>
<tr>
<td>Protected Areas</td>
<td>• No effects identified</td>
<td>• None required</td>
</tr>
<tr>
<td>Heritage Resources</td>
<td>• The MHRB indicated that there were no records of archaeological findings in the PSA (Section 16.4.8; Appendix D).</td>
<td>• Implementation of BMPs and measures outlined in the EMP for the Project. Compliance with all applicable federal, provincial and municipal legislation, codes and guidelines.</td>
</tr>
</tbody>
</table>

**20. RESIDUAL EFFECTS**

Residual Effects are the anticipated effects that are remaining after consideration of the application of all mitigation measures. Residual effects of the proposed Project were defined by following the Order of Effect criteria below:

- **Magnitude** - a measure of the degree or intensity of change that can occur during the Project process, which can be low due to beneficial or adverse effects on the existing environment.
- **Direction** - a function of the effects on the existing environment.
- **Geographic extent** - to the area potentially affected by the effect, either is it the site (i.e., work areas within the Project area). Frequency (effect) - refers to the frequency at which the effect occurs over the specified duration and is described as: negligible (occurs once over the duration of the disturbance), frequent (occurs periodically over the duration of the disturbance or occurs commonly over the duration of the disturbance), rare (occurs occasionally), or extremely rare (occurs rarely).

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Likelihood</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negligible</td>
<td>High</td>
<td>Long-term</td>
</tr>
<tr>
<td>Frequent</td>
<td>High</td>
<td>Short-term</td>
</tr>
<tr>
<td>Rare</td>
<td>Medium</td>
<td>Long-term</td>
</tr>
<tr>
<td>Extremely rare</td>
<td>Low</td>
<td>Short-term</td>
</tr>
</tbody>
</table>

The activities associated with the Study Project were first assessed according to the above criteria, and then evaluated together to predict the overall environmental consequences. Environmental consequences may result in slight changes to the existing environment, and the extent of the changes is described as: very unlikely, unlikely, likely and very likely.
### Table 26-1: Residual Effects and Assessed Environmental Consequence of Residual Effects

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Predicted Residual Effect</th>
<th>Direction</th>
<th>Magnitude</th>
<th>Geographic Extent</th>
<th>Duration</th>
<th>Frequency</th>
<th>Likelihood</th>
<th>Environmental Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality and Greenhouse Gas Emissions</strong></td>
<td>• During the Project construction and O&amp;M activities, there will be temporary air emissions due to exhaust and/or dust from the use of stationary and mobile equipment.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Frequent</td>
<td>Likely</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>• The expansion and use of Stage 2 of the Southwest Transitway is expected to have an overall effect of reducing GHG emissions in the City of Winnipeg.</td>
<td>Positive</td>
<td>Low</td>
<td>Region</td>
<td>Long-term</td>
<td>Continuous</td>
<td>Likely</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Noise and Vibration</strong></td>
<td>• During the Project construction activities, there will be noise and vibration due to the use of stationary and mobile project equipment (e.g., asphalt pavers, backhoes, bulldozers, dump trucks, excavators, scrapers, packers, etc.).</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Frequent</td>
<td>Likely</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>• During the Project O&amp;M activities, there will be noise and vibration due to the operation of the transitway.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Long-term</td>
<td>Frequent</td>
<td>Likely</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>• During the Project O&amp;M activities, there will be noise and vibration due to the O&amp;M activities.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Infrequent to Frequent</td>
<td>Likely to Unlikely</td>
<td>Minimal</td>
</tr>
<tr>
<td><strong>Terrain and Soils</strong></td>
<td>• The construction of the Project will require the permanent alteration of portions of terrain and soils in the PSA.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Long-term</td>
<td>Continuous</td>
<td>Likely</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>• The construction of the Project will require the temporary disturbance of terrain and soils in other areas of the PSA.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Infrequent to Frequent</td>
<td>Likely to Unlikely</td>
<td>Minimal</td>
</tr>
</tbody>
</table>
## Vegetation

- **Permanent alteration of treed, grassy, wet meadow and cattail stand areas in portions of the PSA.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Long-term
  - Frequency: Continuous
  - Likelihood: Likely
  - Environmental Consequence: Low

- **Introduction of new or additional non-native or invasive plant species from equipment and vehicles during construction and site reclamation activities.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Medium-term
  - Frequency: Frequent
  - Likelihood: Likely to Unlikely
  - Environmental Consequence: Minimal

- **Introduction of new or additional non-native or invasive plant species from equipment and vehicles during O&M activities.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Short-term
  - Frequency: Infrequent to Frequent
  - Likelihood: Likely to Unlikely
  - Environmental Consequence: Minimal

## Wetlands

- **The Project construction activities will result in the permanent change of the majority of the wet meadow and cattail stand areas in the PSA due to the construction of the transitway, outlet pathways and stations, development of the drainage system for the Project, and development of the Parker Retention Pond by the City.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Long-term
  - Frequency: Continuous
  - Likelihood: Likely
  - Environmental Consequence: Low

- **Introduction of new or additional non-native or invasive plant species from equipment and vehicles during construction and site reclamation activities.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Medium-term
  - Frequency: Frequent
  - Likelihood: Likely to Unlikely
  - Environmental Consequence: Minimal

- **Introduction of new or additional non-native or invasive plant species from equipment and vehicles during O&M activities.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Short-term
  - Frequency: Infrequent to Frequent
  - Likelihood: Likely to Unlikely
  - Environmental Consequence: Minimal

## Wildlife and Habitat

- **Temporary disturbance in the PSA during construction and O&M activities.**
  - Direction: Negative
  - Magnitude: Low
  - Geographic Extent: Project area
  - Duration: Short-term
  - Frequency: Frequent
  - Likelihood: Likely to Unlikely
  - Environmental Consequence: Minimal

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Predicted Residual Effect</th>
<th>Direction</th>
<th>Magnitude</th>
<th>Geographic Extent</th>
<th>Duration</th>
<th>Frequency</th>
<th>Likelihood</th>
<th>Environmental Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habitat</strong></td>
<td>Permanent alteration of treed, grassy, wet meadow and cattail stand areas in the PSA that may provide habitat.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Long-term</td>
<td>Continuous</td>
<td>Likely</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Temporary disturbance in the PSA during construction and O&amp;M activities.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Infrequent to Frequent</td>
<td>Likely to Unlikely</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>Injury or mortalities to Northern leopard frogs or Monarch butterfly larvae present in the construction and/or O&amp;M areas.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Infrequent to Frequent</td>
<td>Likely to Unlikely</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>Permanent alteration of grassy, wet meadow and cattail stand areas in the PSA that may provide habitat for Northern leopard frogs.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Long-term</td>
<td>Infrequent to Frequent</td>
<td>Likely to Unlikely</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Loss of milkweed plants in the PSA that may provide Monarch butterfly habitat.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Long-term</td>
<td>Infrequent to Frequent</td>
<td>Likely to Unlikely</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Species at Risk</strong></td>
<td>Temporary disturbance due to noise, dust, equipment and crews working in the PSA.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Frequent</td>
<td>Likely</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>Temporary disturbance to traffic patterns, road use and recreational use (walking, cycling, dog walking and gardening) in the PSA.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Short-term</td>
<td>Frequent</td>
<td>Likely</td>
<td>Minimal</td>
</tr>
<tr>
<td><strong>Stakeholders and Land Use</strong></td>
<td>Permanent alteration of the treed, grassy, wet meadow and cattail stand areas in sections of the PSA.</td>
<td>Negative</td>
<td>Low</td>
<td>Project area</td>
<td>Long-term</td>
<td>Continuous</td>
<td>Likely</td>
<td>Low</td>
</tr>
</tbody>
</table>
### Environmental Review and Assessment

#### 21 Follow-up and Monitoring Activities

**21.1 Pre-Construction Monitoring**

The City has committed to include both baseline noise monitoring and noise attenuation barrier design within the Project Detailed Design process. The City manages the issue of noise-related traffic through the City of Winnipeg Motor Vehicle Noise Policies and Guidelines, dated October 11, 1984. While dated, the policy provides overall guidance and direction for roadway planning and related noise attenuation, i.e., if the intruding noise level exceeds the existing sound levels by 5 dBA, noise attenuation measures are to be considered. In order to arrive at the sound levels produced by the transitway, the City will require the collection of baseline field measurements along areas of concern, followed by the use of noise prediction models of the operational transitway to determine the nature and extent of any attenuation. When outdoor sound levels are 55 dBA or less for daytime and 50 dBA or less for nighttime, no noise control measures are contemplated. Proposed follow-up involves monitoring and periodic inspection of the site for noise/vibration levels, monitoring complaints and ensuring adherence to design specifications.

A pre-construction survey for species at risk is one of the measures recommended in Section 19 to mitigate potential effects of the project on species at risk that may be present in the PSA. The survey could be conducted prior to the construction activities to avoid project delays, protect any species at risk that may be present in the PSA, and maintain compliance with regulatory requirements. The appropriate measures to be used to mitigate potential effects to Northern leopard frogs, Monarch butterflies and/or other species at risk will be determined in consultation with MCWS.

**21.2 Construction Monitoring**

The City of Winnipeg will ensure through it procurement process that the contractors’ EMP for this Project will include field inspections during construction, adherence to all applicable federal, provincial and municipal acts and regulations, and adherence to the environmental protection provisions outlined in the Project EMP. The City of Winnipeg will assign an Environmental Inspector for the Project. The Environmental Inspector will be responsible for performing inspections of the work site and documenting any deficiencies noted in the environmental protection measures in the inspection reports. The Environmental Inspector will inspect the Project site routinely to ensure that the site is managed in accordance with the construction documentation and the Project EMP.

**21.3 Post Construction Monitoring**

An Environmental Inspector will examine the work areas for the Project after completion of the Project activities to ensure that the measures outlined in the Project EMP were followed and any areas disturbed by the Project were appropriately restored. Post-construction monitoring may also include monitoring and periodic inspection of the PSA for noise/vibration levels, monitoring complaints and ensuring adherence to design specifications.
22 ACCIDENTS AND MALFUNCTIONS

Potential accidents and malfunctions that may occur during the construction and O&M stages of the project include fires and explosions, transportation accidents, pedestrian accidents, fuel or other petroleum product spills, hazardous material releases, and blowing and falling debris. The potential effects of these accidents and malfunctions, and the proposed mitigation measures and follow-up, are discussed below.

22.1 Fires and Explosions

Fires and explosions during construction and O&M activities may result from propane heaters, welding/cutting, equipment malfunctions and improper storage of hazardous materials. Fires and explosions can cause serious harm to employees, construction workers, the public and the environment. Project delays and increased costs are also possible. Mitigation measures proposed for fires and explosions include: compliance with applicable provincial legislation, codes and guidelines; provision of fire suppression equipment on-site; preparation and implementation of an emergency response plan that includes fire and explosion prevention, notification and response; and immediate notification of the nearest Fire Department if a fire or explosion occurs. Follow-up may include regular inspections by the Fire Commissioner, routine examination of on-site fire suppression equipment, and periodic testing and evaluation of the emergency response plan.

22.2 Transportation Accidents

There is a risk of transportation accidents during Project construction and O&M activities involving equipment, materials, vehicles and pedestrians accessing the PSA. Mitigation proposed includes safe transportation routes; speed restrictions and signage; alternate pedestrian walkways; compliance with applicable provincial legislation and municipal bylaws; an emergency spill response plan that includes transportation accident prevention on-site and response; and immediate notification to MCWS if a reportable accident occurs. Proposed follow-up includes periodic testing and evaluation of the emergency response plan, ensuring that dangerous goods carriers are licensed and ensuring all shipments are in compliance with regulatory requirements.

22.3 Hazardous Substances Releases

There is potential for a hazardous substances release during construction and O&M activities as a result of improper storage, negligent use or collision by a vehicle. Mitigation measures include: compliance with applicable provincial and municipal legislation and guidelines; preparation and implementation of an emergency spill response plan that includes petroleum spill prevention, notification and response; maintenance of an appropriate number and type of spill kits on-site; and immediate notification to Manitoba Conservation if a reportable accident occurs. Contractors and employees on-site will be required to have appropriate spill response equipment during construction and O&M activities. Proposed follow-up includes: requiring contractors to submit an environmental protection plan that addresses spills; establishing protocols for periodic testing and evaluation of the emergency response plan; inspecting fuel storage tanks for compliance with regulatory requirements; and maintaining records of fuel volumes delivered and used. In the event of a spill, remedial action such as the removal of contaminated soils may be undertaken within a reasonable timeframe.

22.4 Wind-Blown Debris

There is potential for wind-blown debris during construction. Wind-blown debris can be unsightly and present a nuisance, inconvenience or possible danger to vehicles and residents. Mitigation measures include securing construction and demolition materials; ensuring a high standard of cleanliness during construction; covering waste receptacles and trucks; and fencing the Project site during construction. Follow-up measures include regular inspection of the Project site for wind-blown debris and taking appropriate action when construction or demolition-related debris is encountered.

23 EFFECT OF THE ENVIRONMENT ON THE PROJECT

The effects of the environment on the Project were identified as:

- The potential presence of wildlife and wildlife habitat, wet meadow and cuttail stands, and wildlife species at risk required consideration during mitigation;
- Existing hydrological and hydraulic conditions on the land base, i.e., seasonal changes in water flow levels and area of inundation, groundwater incursions, drainage requirements;
- Existing condition and use of the landbase in the PSA, which consists of the CN rail line and RoW; the Manitoba Hydro transmission lines, structures and RoW; commercial (e.g., shopping and other services along Pembina Highway and other streets), industrial (e.g., Chevrier and Buffalo industrial parks), recreational (Brenda Leipsic dog park, community gardens, walking and cycling trails) and residential areas (e.g., neighborhoods of Beaumont, Maybank, Montcalm Pembina Strip and Waverley Heights). The RoW areas are routinely mowed and maintained as per CN and Manitoba Hydro operational and safety standards; and
- Seasonal changes in climate that may affect access to and development of the landbase.

These effects have been addressed by:

- Identifying potential species in the PSA, their habitat requirements and measures to mitigate effects on these species;
- Planning and design of the Project to incorporate existing hydrologic and hydraulic conditions;
- Consideration of the condition and use of the landbase in the Project planning and design; and
- Incorporation of the necessary environmental protection measures into Project planning and design, including erosion and sediment control planning, salvage of soils and vegetation and water management.

24 SIGNIFICANCE OF EFFECTS AND CONCLUSION

The Project was determined to not likely result in significant adverse environmental effects based on the:

- Available information on the proposed Project and the existing local environment;
- Assessment of effects outlined in this Environmental Review and Assessment report; and
- Application of proposed mitigation measures and follow-up.
25 CLOSURE

We trust that the above information meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

Sincerely,

DILLON CONSULTING LIMITED

Report prepared by:

Maureen Forster, M.Sc., EP
Senior Aquatic Biologist
M. Forster Enterprises
Winnipeg, Manitoba

Report reviewed by:

Dennis Heinrichs, M.Sc., P.Eng
Senior Environmental Lead
Dillon Consulting
Winnipeg, Manitoba

Dave Krah, P.Eng.
Project Manager
Dillon Consulting
Winnipeg, Manitoba

26 REFERENCES


City of Los Angeles. 1970. Outdoor Noise and the Metropolitan Environment, M.C. Branch et al., Department of City Planning, City of Los Angeles, USA.


City of Winnipeg – Transit Department  
Southwest Transitway – Stage 2  
Environmental Review and Assessment


City of Winnipeg – Transit Department  
Southwest Transitway – Stage 2  
Environmental Review and Assessment


Appendix A:
Project Area Figures
Flora observed in the Stage 2 Southwest Transitway Project Study Area, October 01, 2013  
(Scientific Name Alphabetical by Family)

<table>
<thead>
<tr>
<th>FAMILY/Species (Alphabetical)</th>
<th>Common Name</th>
<th>Provincial S Rank</th>
<th>Introduced</th>
<th>Location</th>
<th>Previously Reported by City of Winnipeg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VASCULAR SPECIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACERACEAE Maple Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acer negundo</td>
<td>Manitoba Maple</td>
<td>S5</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Acer ginnala</td>
<td>Amur Maple</td>
<td>SNA</td>
<td></td>
<td>NON_NATIVE</td>
<td>x</td>
</tr>
<tr>
<td><strong>ANACARDIACEAE</strong></td>
<td>SUMAC FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxicodendron rydbergii</td>
<td>Poison Ivy</td>
<td>S3</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>APICACEAE</strong> Carrot Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samucula marilandica</td>
<td>Seneca Snakeroot</td>
<td>S5</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Zizia ageta</td>
<td>Heart-leaved Alexander</td>
<td>S5</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Zizia aurea</td>
<td>Golden Alexanders</td>
<td>S5</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td><strong>APOCYNACEAE</strong> Dogbane Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apocynum androsaemifolium</td>
<td>Spreading Dogbane</td>
<td>S3</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>ARALIACEAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aralia mideaulis</td>
<td>Wild Sarsaparilla</td>
<td>S5</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>ASCLEPIADACEAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asclepia speciosa</td>
<td>Showy Milkweed</td>
<td>S4</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td><strong>ASTERACEAE</strong> Aster Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achillea millefolium</td>
<td>Yarrow</td>
<td>S5</td>
<td></td>
<td>x</td>
<td>x x x</td>
</tr>
<tr>
<td>Ambrosia psilotachya</td>
<td>Perennial Ragweed</td>
<td>S5</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Artemisia parvifolia</td>
<td>Small-leaved Pursley</td>
<td>S4</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Artemisia spp.</td>
<td>Pursley</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arctium minus</td>
<td>Lesser Burdock</td>
<td>SNA</td>
<td></td>
<td>INVASIVE</td>
<td></td>
</tr>
<tr>
<td>Arctium sp.</td>
<td>Burdock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artemisia absinthum</td>
<td>Wormwood</td>
<td>SNA</td>
<td></td>
<td>INVASIVE</td>
<td>x x x</td>
</tr>
<tr>
<td>Artemisia ludoviciana</td>
<td>Prairie Sage</td>
<td>S5</td>
<td></td>
<td></td>
<td>x x x</td>
</tr>
<tr>
<td>Artemisia sp.</td>
<td>Sage</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Cirsium arvense</td>
<td>Canada Thistle</td>
<td>SNA</td>
<td></td>
<td>INVASIVE</td>
<td>x x x</td>
</tr>
<tr>
<td>Cirsium flodmani</td>
<td>Flodman's Thistle</td>
<td></td>
<td></td>
<td></td>
<td>x x x</td>
</tr>
<tr>
<td>Conyza canadensis</td>
<td>Canada fleabane</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erigeron philadelphicus</td>
<td>Philadelphia Fleabane</td>
<td>S5</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

1. Area north of Parker Avenue and south of CN tracks
2. Corridor of existing MB Hyos Right-of-way

Appendix B:  
List of Plant Species Present in the PSA
<table>
<thead>
<tr>
<th>FAMILY/Species (Alphabetical)</th>
<th>Common Name</th>
<th>Provincial S Rank</th>
<th>Introduced</th>
<th>Location</th>
<th>Previously Reported by City of Winnipeg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAMILY/Species (Alphabetical)</td>
<td>Common Name</td>
<td>Provincial S Rank</td>
<td>Introduced</td>
<td>Location</td>
<td>Previously Reported by City of Winnipeg</td>
</tr>
<tr>
<td>Grindelia squarrosa</td>
<td>Gumweed</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lactuca serriola</td>
<td>Prickly Lettuce</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lappula squarrosa</td>
<td>Bluebrier</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Leucanthemum vulgare</td>
<td>Oxye Daisy</td>
<td>SNA</td>
<td>Cat 2</td>
<td>INVASIVE</td>
<td></td>
</tr>
<tr>
<td>Packera pauciflora</td>
<td>Balsam Groundsel</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solidago canadensis</td>
<td>Canada Goldenrod</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solidago sp.</td>
<td>Goldenrod</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sosnowsky arvensis</td>
<td>Field Snow-thistle</td>
<td>SNA</td>
<td>INVASIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symphyotrichum ericoides</td>
<td>Many-Flowered Aster</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symphyotrichum laeve</td>
<td>Smooth Aster</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symphyotrichum lateriflorum</td>
<td>Calico Aster</td>
<td>S4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanacetum vulgare</td>
<td>Common Tansy</td>
<td>SNA</td>
<td>Cat 2</td>
<td>INVASIVE</td>
<td></td>
</tr>
<tr>
<td>Taraxacum officinale</td>
<td>Common Dandelion</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tragopogon dubius</td>
<td>Goat’s-beard</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BETULACEAE</strong></td>
<td><strong>BIRCH FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corylus americana</td>
<td>American Hazelnut</td>
<td>S4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BORAGINACEAE</strong></td>
<td><strong>BORAGE FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lappula echinata</td>
<td>Bluebrier</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BRASSICACEAE</strong></td>
<td><strong>MUSTARD FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armoracia rusticana</td>
<td>Horseradish</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Hesperis matronalis</td>
<td>Dame’s-violet</td>
<td>SNA</td>
<td>INVASIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lepidium densiflorum</td>
<td>Peppercott</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thlaspi arvense</td>
<td>Field Penny-cress</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CAMPANULACEAE</strong></td>
<td><strong>BLUEBELL FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campanula rapunculoides</td>
<td>Creeping Bluebell</td>
<td>SNA</td>
<td>INVASIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>CAPRIFOLIACEAE</strong></td>
<td><strong>HONEYSUCKLE FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diervilla lonicosa</td>
<td>Bush-Honeysuckle</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lonicera dioica</td>
<td>Twinning Honeysuckle</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lonicera tatarica</td>
<td>Tartarian Honeysuckle</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Symphoricarpus albus</td>
<td>Snowberry</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Symphoricarpus occidentalis</td>
<td>Western Snowberry</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FAMILY/Species (Alphabetical)</th>
<th>Common Name</th>
<th>Provincial S Rank</th>
<th>Introduced</th>
<th>Location</th>
<th>Previously Reported by City of Winnipeg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viburnum lentago</td>
<td>Nannyberry</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viburnum opulus</td>
<td>High-bush Cranberry</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viburnum rafinesquianum</td>
<td>Downy Arrowwood</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CARYOPHYLLACEAE</strong></td>
<td><strong>FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moorhingia lateriflora</td>
<td>Grove Sandwort</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CHENOPODIACEAE</strong></td>
<td><strong>GOOSEFOOT FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salsola tragus</td>
<td>Russian Thistle</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td><strong>CORNACEAE</strong></td>
<td><strong>DOGWOOD FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cora sericea</td>
<td>Red-nose Dogwood</td>
<td>S5</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td><strong>CUCURBITACEAE</strong></td>
<td><strong>GOURD FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echinocystis lobata</td>
<td>Wild Cucumber</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CYPERACEAE</strong></td>
<td><strong>SEDGE FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carex sp.</td>
<td>Sedge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carex teretia</td>
<td>Slender Sedge</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EQUISETACEAE</strong></td>
<td><strong>HORSETAIL FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equisetum arvense</td>
<td>Common Horsetail</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ELAEAGNACEAE</strong></td>
<td><strong>OLEASTER FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaeagnus commutata</td>
<td>Wolf-willow</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaeagnus angustifolia</td>
<td>Russian Olive</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>FABACEAE</strong></td>
<td><strong>PEA FAMILY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astragalus agrestis</td>
<td>Purple Milk-vetch</td>
<td>S5</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Caragana arborescens</td>
<td>Common Caragana</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Glycyrrhiza lepidota</td>
<td>Wild Licorice</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Lathyrus ochroleucus</td>
<td>Cream-coloured Vetching</td>
<td>S4S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lathyrus palustris</td>
<td>Marsh Vetching</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lotus corniculatus</td>
<td>Bird’s-foots Trefoil</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Medicago lupulina</td>
<td>Black Medic</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Medicago sativa</td>
<td>Alfalfa</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Melilotus albus</td>
<td>White Sweetclover</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>FAMILY/Species (Alphabetical)</td>
<td>Common Name</td>
<td>Provincial S Rank</td>
<td>Introduced</td>
<td>Location</td>
<td>Previously Reported by City of Winnipeg</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>------------</td>
<td>----------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Melilotus officinalis</td>
<td>Yellow Sweetclover</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Trifolium hybridum</td>
<td>Alsike Clover</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Trifolium pratense</td>
<td>Red Clover</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Trifolium repens</td>
<td>White Clover</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Trifolium sp.</td>
<td>Clover</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Vicia americana</td>
<td>American Vetch</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Vicia cracca</td>
<td>Tufted Vetch</td>
<td>SNA</td>
<td>INVASIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>FAGACEAE</td>
<td>BEECH FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus macrocarpa</td>
<td>Burr Oak</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>GROSSULARIACEAE</td>
<td>CURRANT FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ribes americanum</td>
<td>Wild Black Currant</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ribes oxycanthoides</td>
<td>Northern Gooseberry</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ribes triste</td>
<td>Swamp Red Currant</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ribes sp.</td>
<td>Currant</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>IRIDACEAE</td>
<td>IRIS FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sisyrinchium montanum</td>
<td>Blue-eyed Grass</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>JUNCACEAE</td>
<td>RUSH FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juncus arcticus</td>
<td>Arctic Rush</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Juncus sp.</td>
<td>Rush</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Juncus tenellus</td>
<td>Path Rush</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LAMIACEAE</td>
<td>MINT FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glechoma hederacea</td>
<td>Ground Ivy</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Lycopodium amarum</td>
<td>Water Horehound</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Lycopodium alpinum</td>
<td>Western Water-horehound</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Mentha arvensis</td>
<td>Mint</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Stachys palustris</td>
<td>Marsh Hedge-nettle</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LILIACEAE</td>
<td>LILY FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asparagus officinalis</td>
<td>Garden asparagus</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Maianthemum canadense</td>
<td>Canada May Flower</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Maianthemum stellatum</td>
<td>Solomon’s Seal</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Smilax lasioneura</td>
<td>Carrion Vine</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LYTHRACEAE</td>
<td>LOOSESTRIFE FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lysimachia spicata</td>
<td>Purple Loosestrife</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FAMILY/Species (Alphabetical)</th>
<th>Common Name</th>
<th>Provincial S Rank</th>
<th>Introduced</th>
<th>Location</th>
<th>Previously Reported by City of Winnipeg</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLEACEAE</td>
<td>OLIVE FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraxinus pensylvanica</td>
<td>Green Ash</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ONAGRACEAE</td>
<td>EVENING PRIMROSE FAMILY</td>
<td></td>
<td>S5</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Epilobium palustre</td>
<td>Marsh Willowherb</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Oenothera biennis</td>
<td>Evening Primrose</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>ORCHIDACEAE</td>
<td>ORCHID FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyripedium parviflorum</td>
<td>Small Yellow Lady’s-slipper</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>PINACEAE</td>
<td>PINE FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larix leucodora</td>
<td>Tamurack</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Picea glauca</td>
<td>White Spruce</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>PLANTAGINACEAE</td>
<td>PLANTAIN FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plantago major</td>
<td>Common Plantain</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>POACEAE</td>
<td>GRASS FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agrostis scabra</td>
<td>Tiddlygrass</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Agrostis stolonifera</td>
<td>Creeping Bent</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Andropogon gerardii</td>
<td>Big Bluestem</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Avena fatua</td>
<td>Wild Oats</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Bromus inermis</td>
<td>Smooth Brome</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Calamagrostis canadensis</td>
<td>Canada Reed Grass</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Elymus repens</td>
<td>Quickgrass</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Hordeum jubatum</td>
<td>Fox Tail Barley</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Muhlenbergia cespitosa</td>
<td>Prairie Muhly</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Phalaris arundinacea</td>
<td>Reed Canarygrass</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Phleum pratense</td>
<td>Timothy</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Phragmites australis</td>
<td>Common Reed</td>
<td>S5</td>
<td>Cat 2: INVASIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Poa pratensis</td>
<td>Kentucky Bluegrass</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Setaria viridis</td>
<td>Green Bristletgrass</td>
<td>SNA</td>
<td>NON_NATIVE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Spartina gracilis</td>
<td>Alkali Cordgrass</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Spartina pectinata</td>
<td>Prairie Cordgrass</td>
<td>S4</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>FAMILY/Species (Alphabetical)</td>
<td>Common Name</td>
<td>Provincial S Rank</td>
<td>Introduced</td>
<td>Location</td>
<td>Previously Reported by City of Winnipeg</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>------------</td>
<td>----------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>POLYGONACEAE</td>
<td>SMARTWEED FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polygonum sp.</td>
<td>Smartweed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rumex crispus</td>
<td>Curly Dock</td>
<td>SNA</td>
<td>NON_NAT VE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Rumex occidentalis</td>
<td>Western Dock</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRIMULACEAE</td>
<td>PRIMROSE FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaux maritima</td>
<td>Sea-milkwort</td>
<td>S4S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RANUNCULACEAE</td>
<td>CROWFOOT FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anemone canadensis</td>
<td>Canada Anemone</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ranunculus sp.</td>
<td>Buttercup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thalictrum dasycarpum</td>
<td>Hairy Meadow rue</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thalictrum velosumosum</td>
<td>Veiny Meadow rue</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RHAMNACEAE</td>
<td>BUCKTHORN FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhamnus alnifolia</td>
<td>Alder-leaved Buckthorn</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Rhamnus cathartica</td>
<td>Buckthorn</td>
<td>SNA</td>
<td>Cat 2 INVASIVE</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>ROSACEAE</td>
<td>ROSE FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amelanchier alnifolia</td>
<td>Saskatoon</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Argentia areruina</td>
<td>Silver Wood</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Crataegus cruscorpa</td>
<td>Round-leaved Hawthorn</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fragaria virginiana</td>
<td>Smooth Wild Strawberry</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geum alepicum</td>
<td>Yellow Avens</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Malus pumila</td>
<td>Apple</td>
<td>SNA</td>
<td>NON_NAT VE</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Prunus pensylvanica</td>
<td>Pin Cherry</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Prunus virginiana</td>
<td>Chokecherry</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Rosa arctocarpa</td>
<td>Prickly Rose</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Rosa sp.</td>
<td>Rose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosa woodsii</td>
<td>Wood's Rose</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubus acutus</td>
<td>Stemless Raspberry</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubus idaeus</td>
<td>Raspberry</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubus pubescens</td>
<td>Trailing Dewberry</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubus sp.</td>
<td>Dewberry</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Spiraea alba</td>
<td>Meadowsweet</td>
<td>S5</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>RUBIACEAE</td>
<td>MADDER FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium boreale</td>
<td>Northern Bedstraw</td>
<td>S5</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FAMILY/Species (Alphabetical)</th>
<th>Common Name</th>
<th>Provincial S Rank</th>
<th>Introduced</th>
<th>Location</th>
<th>Previously Reported by City of Winnipeg</th>
</tr>
</thead>
<tbody>
<tr>
<td>SALICACEAE</td>
<td>WILLOW FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Populus balsamifera</td>
<td>Balsam Poplar</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Populus deltoids</td>
<td>Cottonwood</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Populus tremuloides</td>
<td>Trembling Aspen</td>
<td>S5</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salix amygdaloides</td>
<td>Peach-leaved Willow</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salix exigua</td>
<td>Sandbar Willow</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salix petiolaris</td>
<td>Basket Willow</td>
<td>S4</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salix sp.</td>
<td>Willow</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>SANTALACEAE</td>
<td>SANDALWOOD FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comandra umbellata</td>
<td>Bastard Toadflax</td>
<td>S5</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>TYPHACEAE</td>
<td>CAT-TAIL FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typha angustifolia</td>
<td>Narrow-leaved Cat-tail</td>
<td>S4</td>
<td>INVASIVE</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>ULMACEAE</td>
<td>ELM FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulmus americana</td>
<td>American Elm</td>
<td>S4</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ulmus pumila</td>
<td>Dwarf or Siberian Elm</td>
<td>SNA</td>
<td>NON_NAT VE</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>VIOLACEAE</td>
<td>VIOLET FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viola canadensis</td>
<td>Canada Violet</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VITACEAE</td>
<td>GRAPE FAMILY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parthenocissus quinquefolia</td>
<td>Virginia Creeper</td>
<td>S4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Subject: RE: Rare species in the proposed Southwest Rapid Transit project area
Date: Tuesday, April 1, 2014 at 9:56:18 AM Central Daylight Time
From: Friesen, Chris (CWS)
To: "Maureen Forster"

Maureen

Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's rare species database and found no occurrences at this time for your area of interest.

The information provided in this letter is based on existing data known to the Manitoba Conservation Data Centre at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. An absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present; in many areas, comprehensive surveys have never been completed. Therefore, this information should be regarded neither as a final statement on the occurrence of any species of concern, nor as a substitute for on-site surveys for species as part of environmental assessments.

Because the Manitoba CDC's Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request. Please contact the Manitoba CDC for an update on this natural heritage information if more than six months pass before it is utilized.

Third party requests for products wholly or partially derived from Biotics must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using Biotics data, as follows: Data developed by the Manitoba Conservation Data Centre; Wildlife and Ecosystem Protection Branch, Manitoba Conservation.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information please contact me directly at (204) 945-7747.

Chris Friesen
Biodiversity Information Manager
Manitoba Conservation Data Centre 204-945-7747
chris.friesen@gov.mb.ca
hlp://www.gov.mb.ca/conservaQon/cdc/

From: Maureen Forster [mailto:mforster3@outlook.com]
Sent: March-24-14 8:31 PM
To: Friesen, Chris (CWS)
Subject: Rare species in the proposed Southwest Rapid Transit project area

Hi Chris

My computer died just before Christmas, and I think I have lost some of my emails because of the switch to a new one.

I had sent you a request to see if there are any species of concern in the Stage 2 Rapid Transit project area in Winnipeg, but I can't find it anywhere.
Can you please let me know if there are any species of concern in the area shown on the attached figures.

It is the proposed alignment for the Stage 2 of the Southwest Rapid Transit system, it starts at the Pembina and Jubilee overpass, goes down the CN rail line and RoW, through the Parker Lands area, then turns south down the Manitoba Hydro RoW to Clarence Avenue, joins with the CN line and RoW again, and stays in the CN line and RoW to Bison Drive.

My apologies if I have already asked you for this info, and if I did, please resend it.

Thank you once again for your time and help.

Regards

Maureen

Maureen Forster, M.Sc., EP
Email: mforster3@outlook.com
Office Phone: 204-886-0127
Mobile Phone: 204-471-1477
Address: P.O. Box 913, Teulon, MB R0C 3B0

This communication is confidential and may contain proprietary information for the exclusive use of the intended recipient. Any use, distribution or copying of this transmission, other than by the intended recipient, is strictly prohibited. If you are not the intended recipient, please notify the sender and delete all copies.

Please consider the environment before printing this email.
HR information for Parker Lands area in the City of Winnipeg

From: Maureen Forster (mforster3@outlook.com)
Sent: October-24-13 1:46:57 PM
To: hrb@gov.mb.ca; Perry.Blomquist@gov.mb.ca

1 attachment
Parker Lands NA_City Owned.pdf (789.4 KB)

Hello

Could you please tell me if there are any Heritage Resources or any type of Heritage designations(s) for the area in the City if Winnipeg known as the Parker Lands?

Please see the attached map. The site numbers (201, 550) refer to the City of Winnipeg designation as Natural Areas.

There is information on the internet that implies that this area was once occupied by a Métis community and is a historic site.

I am part of the team conducting an environmental assessment for the area, and I would like to know what the actual designation of this area is in terms of municipal, provincial and national laws/policies, and any other information that HRB may have for this area.

Thank you for your time and help.

Regards
Maureen

Appendix D:
Copy of the Request to MHRB
and MHRB Response
Parker Lands

From: Blomquist, Perry (CHT) (Perry.Bloomquist@gov.mb.ca)   You moved this message to its current location.
Sent: February-05-14 11:08:46 AM
To: 'mforster3@outlook.com' (mforster3@outlook.com)

Hello Maureen,

I have conducted a site search of our database regarding the Parker Lands and nothing of the archaeological sort has been previously recorded. I am sure that there are a number of historic documents and other resources that can be found regarding this land, but for the archaeology side of things, there is nothing of note. Hope this helps.

Cheers,

Perry Blomquist  B.A., M.A.
Archaeological Services Officer
Historic Resources Branch
213 Notre Dame Ave, Winnipeg, MB R3B 1N3
Phone: (204) 945-1071; Fax (204) 948-2384
E-mail: perry.bloomquist@gov.mb.ca

Manitoba
Tourism, Culture, Sport and Consumer Protection
Appendix K

Southwest Transitway - Stage 2: Railway Consultation Meeting Minutes
Responsibilities and contact information for Project staff from the City of Winnipeg, AECOM, McGowan Russell Group, Landmark planning and Dillon Consulting Limited are as follows:

**The City of Winnipeg (COW):**
Bjorn Radstrom, City of Winnipeg’s Project Manager  
Office: 986-5743

**Dillon Consulting Limited (Dillon):**
Overall Project Lead, Transit Operations, Roadway, Structures, Environmental  
Dave Krahn, Project Manager  
Office: 453-2301, Cell: 771-5162  
Bill Menzies, Transit Lead  
Taran Peters, Roadway Alignment & Geometric Design Lead  
Valdine Walker, Project Administrator

**AECOM:**
Rail, drainage, deep utilities, geotechnical works  
James McCutcheon, Roadway Specialist/AECOM Sub-Consulting Lead  
Office: 477-5381  
Keith Fitchett, Land Drainage Lead  
Zeyad Shukri, Geotechnical Lead

**McGowan Russell Group (MRG):**
Stations, aesthetics, landscaping works  
Susan Russell, Landscape Architect  
Office: 956-0396

**Landmark Planning**
Public Consultation works  
Donovan Toews, MCIP  
Office: 204-453-8008

CN stated that Daniel Chan, Manager of Business Development – Real Estate will be the property contact for CN. He is located in Toronto and his number is 905 760-5322.
3  Dave discussed the three areas where rail is affected within this project:
   • Portage Junction has two main line tracks running east west and a spur line coming from the east and the west. Both tie into the Letellier line, which goes south to the US. The construction in this area would include the BRT crossing over Pembina Highway and then under the two spur lines. The assumption is that the two rail structures would be constructed for the spur lines without disrupting the rail movements, upon completion relocate the rail onto the new structures, and then complete the BRT runningway in the area.
   • Just south of Chevrier Boulevard a crossing of the two spur lines which provide access to Hydro (at Waverley) and the old Sugar Beet Factory will be required. In addition, at this location the Letellier line will also need to be crossed to bring the BRT from the west side of the track to the east side.
   • The Letellier line from Bishop Grandin to Bison Drive is currently in the middle of the Right of Way (ROW) and will need to be shifted on one side in order to share the ROW with the BRT runningway. The rail line will need to be moved 25 feet to the west. AECOM stated that at 80 mph, approximately 1000 feet is required to move the rail over 15 feet. The intent is to have the rail shifted before the Chancellor Road crossing.

4  Shane asked if there was an agreement for sharing the ROW on the Letellier line from Bishop Grandin south to Bison Drive. Dave Krahm said that there is an agreement in place between the City of Winnipeg and CN from a number of years ago, for the entire Letellier line from the Portage Junction to Bison Drive. Dave will forward a copy of the agreement to those within the meeting.

5  Transit stated that they will be looking at extending the BRT (Bus Rapid Transit) 1 or 2 blocks further south along the Letellier line. These options will be looked at to address various routing and access and egress options.

6  It was noted that road crossings of the cross street with the BRT at Chancellor Drive, Markham Road and Bison Drive will require crossing safety measures similar to that of the rail line to allow free flow for the BRT. AECOM will be looking at these options. It should be noted that the BRT bus frequency will be approximately 50 buses per hour in each direction, during the peak hours. Stop frequencies at the road crossing will have a much higher frequency for the BRT than what currently exists for the rail line.

7  Shane said they would need to determine who owns the spur lines into the old sugar beet factory that goes all the way to Hydro at Waverley Street and Chevrier Boulevard. This will help in starting the discussions on whether these spur lines are still needed, could be consolidated, abandoned, or even if they will be needed to service new industry development in this area.

8  Shane stated that CN has a concern with pedestrians and bicyclers cutting across the railroad tracks. Transit stated that part of the mandate is to provide Active Transportation Pathways (ATP) throughout the project.

9  Regarding the frequency of buses, Randy stated that AECOM would obtain the train frequency data. It was discussed that BNSF also utilizes this Letellier line as well. When asked if this line is needed long term, CN stated that it is. It is not anticipated to be removed in the foreseeable future.

10 Correspondence for CN to go through Travis, for Dillon – Dave Krahm, City of Winnipeg Transit – Bjorn, and the Consulting Team – AECOM

11  The construction is anticipated to start at the south end and move north, so the road can be used for Investors Group Field while the complicated staging and numerous structures of the Portage Diversion are being worked on.

12  Transit stated that the City of Winnipeg funding is in place. Federal funding through P3 Canada is being planned via the application process which is due February 2014 and Provincial funding is currently being worked on.

13  CN stated that the P3 contractor will not be permitted to do rail work, except through traditional bid/build. CN stated that they will not allow their rail line to be built where they are at the mercy of a contractor (P3) who is building to a schedule rather than CN safety and construction standards. Having the CN rail lines removed from the P3 would result in the City of Winnipeg losing out on the cost sharing for that portion of the work. This will take some thought to determine how the rail works can be completed with the anticipation of a P3 contractor engaged in this work.

14  CN was asked if they require a continuous CN Service road along the Letellier line south of Bishop Grandin. AECOM and CN to discuss.

15  There is a feeder main on the west side of the ROW of the Letellier line which will need to be discussed with Water and Waste at the City of Winnipeg to determine the loading assessment and constructability. AECOM is the lead on the municipal utilities and will have these discussions with the City of Winnipeg.
The three structures at the Portage Diversion are rail carrying structures. CN usually maintains these structures but a P3 agreement usually involves 30 years of maintenance. They will need to be discussed at the project progresses. CN agreement is usually with the road authority not a P3. Dillon/AECOM team will look for an example of where a P3 consortium built a rail carrying structure to determine how the agreements were done.

These minutes were recorded by Taran J. Peters. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD

Distribution: Those Present

<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>The three structures at the Portage Diversion are rail carrying structures. CN usually maintains these structures but a P3 agreement usually involves 30 years of maintenance. They will need to be discussed at the project progresses. CN agreement is usually with the road authority not a P3. Dillon/AECOM team will look for an example of where a P3 consortium built a rail carrying structure to determine how the agreements were done.</td>
<td></td>
</tr>
</tbody>
</table>

List of Individuals Involved in Project

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone #</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bjorn Radstrom</td>
<td>204-986-5743</td>
<td><a href="mailto:bradstrom@winnipeg.ca">bradstrom@winnipeg.ca</a></td>
</tr>
<tr>
<td>David Patman</td>
<td>204-986-5737</td>
<td><a href="mailto:dpatman@winnipeg.ca">dpatman@winnipeg.ca</a></td>
</tr>
<tr>
<td>Marceline Hamza</td>
<td>204-986-6493</td>
<td><a href="mailto:mhamza@winnipeg.ca">mhamza@winnipeg.ca</a></td>
</tr>
<tr>
<td>Alex Regiec</td>
<td>204-986-6635</td>
<td><a href="mailto:aregiec@winnipeg.ca">aregiec@winnipeg.ca</a></td>
</tr>
<tr>
<td>Brett Shenback</td>
<td>204-986-5549</td>
<td><a href="mailto:bshenback@winnipeg.ca">bshenback@winnipeg.ca</a></td>
</tr>
<tr>
<td>Suzanne DeweyPovoloedo</td>
<td>204-986-4723</td>
<td><a href="mailto:sdeweypovoloedo@winnipeg.ca">sdeweypovoloedo@winnipeg.ca</a></td>
</tr>
<tr>
<td>Stewart Anderson</td>
<td>204-986-5630</td>
<td><a href="mailto:stewartanderson@winnipeg.ca">stewartanderson@winnipeg.ca</a></td>
</tr>
<tr>
<td>Brad Erickson</td>
<td>204-986-2236</td>
<td><a href="mailto:berickson@winnipeg.ca">berickson@winnipeg.ca</a></td>
</tr>
<tr>
<td>Kas Zurek</td>
<td>204-986-2625</td>
<td><a href="mailto:kzurek@winnipeg.ca">kzurek@winnipeg.ca</a></td>
</tr>
<tr>
<td>Neil Mykof</td>
<td>204-986-7774</td>
<td><a href="mailto:nmykof@winnipeg.ca">nmykof@winnipeg.ca</a></td>
</tr>
<tr>
<td>Stephen Chapman</td>
<td>204-986-5628</td>
<td><a href="mailto:schapman@winnipeg.ca">schapman@winnipeg.ca</a></td>
</tr>
<tr>
<td>Brad Neetle</td>
<td>204-988-7950</td>
<td><a href="mailto:bneetle@winnipeg.ca">bneetle@winnipeg.ca</a></td>
</tr>
<tr>
<td>Glenn Gray</td>
<td>204-360-3596</td>
<td><a href="mailto:ggray@hydro.mb.ca">ggray@hydro.mb.ca</a></td>
</tr>
<tr>
<td>Terry McCarthy</td>
<td>204-360-4127</td>
<td><a href="mailto:tmccarthy@hydro.mb.ca">tmccarthy@hydro.mb.ca</a></td>
</tr>
<tr>
<td>James McCutcheon</td>
<td>204-477-5381</td>
<td><a href="mailto:jmc2@mcmaster.com">jmc2@mcmaster.com</a></td>
</tr>
<tr>
<td>Keith Finchett</td>
<td>204-477-5381</td>
<td><a href="mailto:kfinchett@aecom.com">kfinchett@aecom.com</a></td>
</tr>
<tr>
<td>Zeyad Shukri</td>
<td>204-477-5381</td>
<td><a href="mailto:zeyad.shukri@aecom.com">zeyad.shukri@aecom.com</a></td>
</tr>
<tr>
<td>Randy Domshead</td>
<td>204-477-5381</td>
<td><a href="mailto:rdomshead@aecom.com">rdomshead@aecom.com</a></td>
</tr>
<tr>
<td>John Falcheta</td>
<td>204-477-5381</td>
<td><a href="mailto:john.falcheta@aecom.com">john.falcheta@aecom.com</a></td>
</tr>
<tr>
<td>Bod Paetsch</td>
<td>204-477-5381</td>
<td><a href="mailto:bpaetsch@aecom.com">bpaetsch@aecom.com</a></td>
</tr>
<tr>
<td>Susan Russell, McGowan</td>
<td>204-956-0396</td>
<td><a href="mailto:sruessel@mcgowan.com">sruessel@mcgowan.com</a></td>
</tr>
<tr>
<td>Donovan Toews</td>
<td>204-453-8008</td>
<td><a href="mailto:dtoews@mts.net">dtoews@mts.net</a></td>
</tr>
<tr>
<td>Dave Krath</td>
<td>204-453-2301</td>
<td><a href="mailto:dkrath@dillon.ca">dkrath@dillon.ca</a></td>
</tr>
<tr>
<td>Bill Menkes</td>
<td>204-453-2301</td>
<td><a href="mailto:bmenkes@dillon.ca">bmenkes@dillon.ca</a></td>
</tr>
<tr>
<td>Sinal Rihal</td>
<td>204-453-2301</td>
<td><a href="mailto:srihal@dillon.ca">srihal@dillon.ca</a></td>
</tr>
<tr>
<td>Taran J. Peters</td>
<td>204-453-2301</td>
<td><a href="mailto:tpeters@dillon.ca">tpeters@dillon.ca</a></td>
</tr>
<tr>
<td>Rick Pischadny</td>
<td>204-453-2301</td>
<td><a href="mailto:rplisadny@dillon.ca">rplisadny@dillon.ca</a></td>
</tr>
<tr>
<td>David Marsh</td>
<td>204-453-2301</td>
<td><a href="mailto:dmarrhe@dillon.ca">dmarrhe@dillon.ca</a></td>
</tr>
<tr>
<td>Travis Frechlich</td>
<td>204-231-7763</td>
<td><a href="mailto:travis.frechlich@cn.ca">travis.frechlich@cn.ca</a></td>
</tr>
<tr>
<td>Shane McCartney</td>
<td>204-231-7763</td>
<td><a href="mailto:shane.mccartney@cn.ca">shane.mccartney@cn.ca</a></td>
</tr>
</tbody>
</table>

Transit Department

Southwest Rapid Transit Corridor - Stage 1: Roadway Tie-Ins, Landscaping & Station
Bid Opportunity 085-2013
The specific locations where the proposed transitway alignment and structures were in close proximity to existing CN infrastructure were discussed in detail. These discussions are summarized as follows:

**Portage Function**

- The work required to accommodate the Southwest Transitway was completed in 2013 in a study entitled “Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65)”.
- As this work has recently been completed and CN was involved in this study and is aware of the impacts on their infrastructure and in general agreement with the recommended plan, minimal time was spent on this location.
- To accommodate the relocation of the CN Bridge over Pembina Highway, the CN Rivers Subdivision north and south mainlines would need to be relocated to the north.
- To accommodate the transitway, with no at grade crossings of the rail line, an underpass of the Letellier subdivision (east leg of wy) as well as track WC02 (west leg of wy) would be required. These underpass locations would not impact the current Letellier and WC02 trackage and therefore these underpass structures would be constructed on grade (no underpass excavation), however, there are 3 CN buildings (MOW garage, tool house, S&C building with antenna tower) that will need to be relocated first.
- After the completion of the Letellier and WC02 structures, and CN building relocations, the proposed wye tracks would be constructed over the new structures to ensure minimal downtime to CN operations. Upon completion of the proposed wye track cut-overs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these structures would take place and the transitway would be constructed.
- **CN to investigate and confirm the relocation/removal of these existing buildings.**
- CN confirmed that addressing the removal/relocation of the above noted buildings is not a concern, and could be addressed without impacting the construction of the transitway.
Item | Business | Action By
--- | --- | ---
**Manaham Underpass**  
- At the south end of the Hydro right-of-way, just north of Bishop Grandin, a tunnel underneath the Letellier track is required to bring the transitway to the east side of the rail line with easier pedestrian and bus access to the existing commercial properties, Pembina Highway and the University of Manitoba. This tunnel would be very similar in length and construction procedures to the transitway tunnel constructed as part of the Stage 1 project through Fort Rouge Yards.  
- An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro Lines/Towers, negative response from the public, preferred Transit operational issues and unsafe conditions for buses on an Overpass.  
- Temporary relocation of the CN Letellier line would be required to stage the construction of the Underpass.  
- Accommodation/relocation of the 2 CN Fort Garry Industrial Leads (tracks WCD7 and WCD21) would also be required to stage construction of the underpass tunnel.  
- CN to verify the ownership and review operational requirements of the above-mentioned spur lines and their involvement in any relocation of these spurs for the tunnel.  
- CN to verify if BNSF is a part owner of the Letellier sub-division; only as it pertains to obtaining approvals from BNSF if required.  
- AECOM to determine industrial lead realignment options to accommodate the underpass, as well as reduce tunnel construction staging and forward concept track plans to CN for initial review/acceptance.  
- Signal improvements to accommodate pedestrians and cyclists at the Letellier line at Chevrier may be required if large increases in traffic are noted.  
- CN indicated their initial response to include any Active Transportation Pathways (ATP) within CN right-of-way would not be acceptable for safety reasons.  
- CN indicated that converting the existing private City crossing of Plaza Drive to accommodate pedestrians and cyclists would not be acceptable.  
- CN’s preference is to maintain the ATP along Chevrier to Hudson and then along Hudson until it was able to connect to the transitway using Hydro right-of-way. | Travis F  
Travis F  
Keith G

Item | Business | Action By
--- | --- | ---
**Crossing of Bishop Grandin**  
- As the CN Letellier line south of Bishop needs to be relocated in a westerly direction, the current recommendation is to relocate the CN Letellier line from north of Bishop Grandin to just south of Markham Avenue.  
- This would require a new CN Overpass at Bishop Grandin. The current thought is to construct the new sub-structure for the CN overpass, approximately 10.5 m west of the current location, and then “slide” the current CN superstructure on the newly constructed sub-structure. The old CN sub-structure would then be modified to accommodate the proposed transitway.  
- CN indicated that using the existing CN superstructure on the new foundation is not looked on favorably due to the risk of not being able to bring the line back into operation in an efficient and short time frame.  
- CN would only allow approximately an 8 hour shutdown of their Letellier line to accommodate the sliding as well as their switch over of tracks.  
- CN to confirm the maximum block length permitted for this option.  
- Dillon to review other options at this location and AECOM to pass drawings onto CN for review/acceptance. | Travis F  
Dillon/AECOM  
Dillon/AECOM

**Transitway North of Bishop Grandin to Markham Avenue**  
- The transitway in this section would require the relocation of the Letellier line in a westerly direction by approximately 7.62 m.  
- The City/CN 1994 agreement was discussed as it relates to the above relocation of the rail line. The question was asked on how this Letellier relocation offset was established. The above agreement states the existing 99 foot right-of-way will be shared equally with the City and CN and the westerly 49.5 feet would remain CN right-of-way. The 7.62 m (25 feet) relocation was determined by placing the relocated CN line in the center of the remaining 50 foot right-of-way. CN indicated that if the relocation could be minimized (less than 7.62 m) within their remaining right-of-way this would increase the remaining property on the west side of the tracks for ditch drainage and snow storage. Dillon/AECOM to investigate.  
- CN was in general agreement with the upgraded signalization requirements at existing at-grade public crossings to accommodate both the Letellier line and transitway and was aware that, although more difficult than a standard intersection, similar situations exist in other locations. | Dillon/AECOM
The City/CN 1994 agreement as it related to the Letellier subdivision was discussed and the following is a brief summary:

- CN indicated this agreement was in the hands of their legal department and their Design & Construction group had very little comment at this time.
- It was noted that the two major points in the agreement are that the City needs to provide CN 180 days of notice to invoke the agreement and that all track relocation and other CN work needs to be completed within a 2 year time frame from notice.

The funding and construction process for this project was discussed and the following is a brief summary:

- City and Provincial funding for this project has been approved in principal.
- The City is currently making an application with the PPP Canada for Federal funding of this project.
- If the funding is successful this project will proceed as a P3 Project - Design, Build, Finance and Maintain.
- The Project would generally be responsible for costs of the relocation and structure costs associated with CN infrastructure.

The schedule for this project was reviewed and the following is a brief summary:

- Request for Qualification Release – Quarter 4 2014
- Request for Proposal Release – Quarter 1 2015
- Financial Close – Quarter 4 2015
- Construction Start – Quarter 2 2016
- Construction Completion – End of 2019

CN requested a set of drawings for this project that were used during this presentation so they can discuss in more detail internally. Dillon to submit to CN. (These were submitted to CN January 13, 2014)
These minutes were recorded by Dave Krahm. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD

Distribution: Those Present
Dave Wardrop
Bjorn Radstrom
David Patman
Rick Pudasday
Taran Peters
Bill Menzies
of Manitoba via the Parker Lands, the Manitoba Hydro right-of-way, the CN Letellier subdivision and the former Southwood Golf Course lands. The project also includes a widening of Pembina Highway through the Jubilee underpass and associated land drainage works. The overall project impacts existing CN infrastructure at a number of locations (discussed below). A drawing of the Stage 2 alignment is attached.

3 The specific locations where the City’s project impacts CN infrastructure were discussed in detail. Plans of the transitway geometry, including anticipated alterations to CN infrastructure, were presented for each of the affected locations. These discussions are summarized as follows:

**Portage Junction**
- At the north end of the project, and within the CN Rivers Subdivision, the existing CN Bridge over Pembina Highway will be replaced with a new rail bridge over Pembina Highway at a location north of the existing rail bridge. This work will include the relocation of existing tracks within the CN Rivers subdivision to align with the new rail bridge.
- The two existing wye tracks at Portage Junction (Letellier track - east leg of wye, and track WC02 - west leg of wye) will be relocated to align with the relocated CN Rivers tracks. The structures for the wye tracks will be constructed at grade, with the transitway passing beneath the two underpasses structures of the wye tracks.
- The work required to accommodate the Southwest Transitway was completed in 2013 in a study entitled “Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65)”. All project work proposed at this location follows the recommendations in the above report.
- As this design work has been recently completed and as CN was involved in this study and is aware of the impacts on its infrastructure and is in agreement with the recommended plan, minimal time was spent on the CN works at this location.
- There are 3 CN buildings (MOW garage, tool house, S&C building with antenna tower) that will need to be relocated prior to any work being undertaken at this location.
- After the completion of the underpasses of the Letellier and WC02 tracks, the wye tracks would be relocated on the new structures to ensure minimal downtime to CN operations. Upon completion of the
proposed wye track cut-outs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these structures would take place and the transitway would be constructed through the underpasses.

**Letelier Tunnel**
- The project includes a transitway tunnel beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letelier track. The north end of the tunnel structure will be on the west side of the Letelier subdivision south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 625 metres further south on the east side of the Letelier subdivision. The tunnel structure includes a covered tunnel approximately 200 metres in length with retaining walls approximately 200 metres in length approaching the north tunnel entrance and 225 metres in length approaching the south tunnel entrance. The tunnel will provide a grade-separated transition of the transitway between the alignment in the Manitoba Hydro right-of-way on the west side of the CN Letelier tracks and the planned transitway alignment on the east side of the CN Letelier tracks. During construction, a temporary short cut of the CN Letelier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required.
- An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro Lines/Towers, negative response from the public, preferred Transit operational issues and unsafe operational conditions for buses descending an overpass.
- A Rapid Transit Station (Plaza Station) would be constructed south of the tunnel to serve the area adjacent to Pembina Highway (east side of tracks) and the future Hopewell Development (west side of the tracks).
- It was noted that in previous discussions with CN that maintaining the existing private crossing at Plaza Drive is not preferred to minimize the number of CN track crossings. The City would prefer a pedestrian only crossing with adequate signals at this location to promote Transit oriented development in the City and to provide a critical length to the transit station and the pedestrian/cycle path on the east side of the tracks.
- It was noted that although minimizing at-grade crossings of the rail line is preferred, CN would be willing to re-consider a pedestrian crossing at Plaza Drive due to the minimal train traffic at this location and to accommodate the City’s development plans. Discussion on this item to take place at an appropriate time.

**Letelier Subdivision Works**
- Between the south end of the Letelier Tunnel and a point south of Markham Road, the existing track, signals and switches will be relocated westerly within the CN Letelier right-of-way to accommodate the transitway alignment. This work will include the construction of a new CN Letelier Rail Bridge over Bishop Grandin Boulevard parallel to and approximately 10.5 metres west of the existing rail bridge over Bishop Grandin Boulevard. A new Transitway Bridge over Bishop Grandin Boulevard will be constructed in the current location of the existing rail bridge. The sub-structure of the existing CN Letelier Rail Bridge will be widened and modified to accommodate the transitway.

**Letelier Subdivision Works**
- It was noted that the City plans to install a noise attenuation wall west of the tracks to address local residential concerns.
- A discussion took place on the preferred alignment of the relocated CN track in this area south of Bishop Grandin. The 1994 agreement provides that the 99 foot right-of-way be shared by the City and CN. After some discussion, there was general agreement that having the same minimum offsets as in Stage 1 (5.5m or 18 feet from edge of transitway to centerline of track) should be maintained for Stage 2 with the CN service road positioned on the west side of the tracks.
- Dillon/AECOM are to prepare a cross section for the area south of Bishop Grandin showing the transitway, CN track, and CN service road, including critical dimensions and offsets. AECOM is to forward this cross-section to CN for further discussion and approval.
- It was noted that, within the Letelier subdivision, there are two street crossings (Chancellor Drive and Markham Road) where east-west traffic would intersect with the transitway and the CN Letelier track. AECOM has investigated the crossing protection at these locations that would provide first priority to trains and secondary priority to rapid transit buses crossing the intersections. CN was in general agreement with the upgraded signalization requirements at existing at-grade crossings to accommodate both the Letelier line and transitway and was aware that, although more difficult than a standard intersection, similar situations exist in other locations.
The City/CN 1994 agreement as it related to the Letellier subdivision was briefly discussed and CN indicated the agreement was currently being reviewed by its legal department. It was noted the agreement includes notification and completion time frames with respect to the rail works within the CN Letellier subdivision. Specification of dates will need to be mutually agreed between the City and CN.

The funding, procurement, and construction status for this project was outlined. The following is a brief summary:

- City and Provincial funding for this project has been approved in principal.
- The City is currently making an application with the PPP Canada for Federal funding of this project.
- Upon federal funding being confirmed, the project will be procured as a Design-Build-Finance-Maintain (DBFM) Public Private Partnership.
- The Project would in general be responsible for costs related to the CN rail works, including, relocations and seismic issues.
- The City is responsible for the project. CN was assured that all work pertaining to its infrastructure will be undertaken in conformance with its standards and timing/operational requirements.

- If there are design standards, pre-qualified rail contractors, and construction procedures that need to be followed, these items need to be clearly documented in the Request for Qualifications (RFQ)/Request for Proposal (RFP) process of the PPP procurement and the construction consortium will need to follow all of these requirements.
- CN will be asked to participate in the RFQ and RFP documentation/process to make sure that there procedures and requirements have been addressed.
- During the RFP process, Commercial Confidential Meetings (CCM’s) will be taking place with the short-listed qualified bidders to answer any questions that may arise and to review design/construction proposals. The intention of these meetings is to ensure that none of the bids would be disqualified due to unacceptable design assumptions. CN would be requested to take an active part in these meetings.

The expected schedule for this project is as follows:

- Request for Qualification Release – Quarter 4, 2014
- Request for Proposal Release – Quarter 1, 2015
- Financial Close – Quarter 4, 2015
- Construction Period – 2016 to 2019

Formal documentation of the Project Background, Public-Private-Partnership structure, City’s commitment to CN, and CN’s requested commitment to the project will be sent to CN for CN’s review and acceptance. As the PPP Canada submission needs to document CN concurrence with this process timely attention to this documentation and response is required. CN was in general agreement with this documentation.

During the meeting, Bill Menzies provided some background information on the City’s development plan (Our Winnipeg) and Transportation Master Plan, including the City’s objectives to create transit-oriented development near the proposed transitway stations. It was agreed that the implications of the City’s plans for the project’s rail works will require further discussion between CN and the City.

These minutes were recorded by Dave Krahn. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD
Distribution: Those Present
David Patman
Rick Pidsadny
Taran Peters
James McCutcheon
Keith Gerrits
### Purpose of Meeting:

- To introduce the Stage 2 Transitway Team to Jamie Boychuk the new CN General Manager and to provide CN with an update of the progress of the Stage 2 Transitway Project and expectations and requirements moving forward. This project may also be referred to in City documents as the CIP or Capital Integration Project (Stage 2 of the Southwest Transitway and Widening of the Pembina Highway Underpass) to reflect the cross-departmental nature of the project.

### Business

1. Dave Wardrop the Director of Winnipeg Transit thanked everyone for attending this meeting and introductions were carried out. Dave indicated that the Stage 2 Transitway Project was approved by City Council at the end of June and that the project was now proceeding with the Request for Qualifications (RFQ) and Request for Proposal (RFP) from potential consortiums before moving on to construction.

2. Dillon’s Project Manager, Dave Krahn, provided a brief overview of the team and the Stage 2 project. It was noted that the Transitway project also includes a widening of Pembina Highway through the Jubilee underpass and associated land drainage works. The overall project impacts existing CN infrastructure at a number of locations which are discussed below. A drawing of the Stage 2 alignment and the areas where it has an impact on CN is attached.

3. The specific locations where the City’s project impacts CN infrastructure were discussed. Plans of the transitway geometry, including anticipated alterations to CN infrastructure, were presented for each of the affected locations. These discussions are summarized as follows:

#### Portage Junction

- At the north end of the project, and within the CN Rivers Subdivision, the existing CN Bridge over Pembina Highway will be replaced with a new rail bridge over Pembina Highway at a location north of the existing rail bridge. This work will include the relocation of existing tracks within the CN Rivers subdivision to align with the new rail bridge, which will improve the curve geometry for CN trains.

- The work required to accommodate the Southwest Transitway was completed in 2013 in a study entitled “Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65)”. All project work proposed at this location follows the recommendations in the above report.

- As this design work has been recently completed and as CN was involved in this study and is aware of the impacts on its infrastructure and is in agreement with the recommended plan, minimal time was spent on the CN works at this location.

- The two existing wye tracks at Portage Junction (Letellier track - east leg of wye, and track WC02 - west leg of wye) will be relocated to align with the relocated CN Rivers tracks. The structures for the wye tracks will be constructed at grade, with the transitway passing beneath the two underpass structures of the wye tracks.

- After the completion of the underpasses of the Letellier and WC02 tracks, the wye tracks would be relocated on the new structures to ensure minimal downtime to CN operations. Upon completion of the proposed wye track cut-overs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these new structures would take place and the transitway would be constructed beneath these new underpasses.
Letellier Tunnel

- The project includes a transitway tunnel beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track. The north end of the tunnel structure will be on the west side of the Letellier subdivision south of Chervier Boulevard. The other end of the tunnel structure will be approximately 625 metres further south on the east side of the Letellier subdivision. The tunnel structure includes a covered tunnel approximately 200 metres in length with retaining walls approximately 200 metres in length approaching the north tunnel entrance and 225 metres in length approaching the south tunnel entrance. The tunnel will provide a grade-separated transition of the transitway between the alignment in the Manitoba Hydro right-of-way on the west side of the CN Letellier tracks and the planned transitway alignment on the east side of the CN Letellier tracks. During construction, a temporary shoofly of the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required.
- An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro Lines/Towers, negative response from the public, preferred Transit operational issues and unsafe operational conditions for buses descending an overpass toward an intersection.
- A Rapid Transit Station (Plaza Station) would be constructed south of the tunnel to serve the area adjacent to Pembina Highway (east side of tracks) and the future Hopewell Development (west side of the tracks).

Letellier Subdivision Works

- Between the south end of the Letellier Tunnel and a point south of Markham Road, the existing track, signals and switches will be relocated westerly by 5.7 m within the CN Letellier right-of-way to accommodate the transitway alignment. This work will include the construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel to the existing rail bridge over Bishop Grandin Boulevard. A new Transitway Bridge over Bishop Grandin Boulevard will be constructed in the current location of the existing rail bridge.
- It was noted that the City plans to install a noise attenuation wall west of the tracks to address local residential concerns.

It was noted that, within the Letellier subdivision, there are two street crossings (Chancellor Drive and Markham Road) where east-west traffic would intersect with the transitway and the CN Letellier track. AECOM has investigated the crossing protection at these locations that would provide first priority to trains and secondary priority to rapid transit buses crossing the intersections.

CN thanked the team for the presentation and indicated this was an important project to the City and that CN would help out as required to make this project a success.

There were no additional technical questions of John Falcetta regarding the CN rail work that is to be undertaken. John Falcetta excused himself from the rest of the meeting due to AECOM’s interest in the upcoming RFQ and RFP.

The funding, procurement, and construction status for this project was outlined. The following is a brief summary:

- City and Provincial Funding for this project has been approved in principal.
- The City has made application with the PPP Canada for Federal funding of this project.
- With confirmation of Federal Funding, the project will be procured as a Design-Build-Finance-Maintain (DBFM) Public Private Partnership. Some documents may refer to the project as a Design-Build-Finance-Operate-Maintain (DBFM), however bus operations and bus maintenance will remain with Winnipeg Transit.
- The City would be responsible for most of the costs relating to the CN rail works, including relocations and structures. The exceptions to this would be where current agreements indicate otherwise or where enhancements to CN infrastructure have been requested by CN.
- The City of Winnipeg is responsible for the overall project. CN was assured that all work pertaining to its infrastructure will be undertaken in conformance with its standards and timing/operational requirements.
- If there are design standards, pre-qualified rail contractors, and construction procedures that need to be followed, these items need to be clearly documented in the Request for Qualifications (RFQ)/Request for Proposal (RFP) process of the PPP procurement and the construction consortium will need to follow all of these requirements.
CN will be asked to participate in the RFQ and RFP documentation/process to make sure their procedures and requirements have been addressed.

During the RFP process, Commercially Confidential Meetings (CCM’s) will be taking place with the short listed qualified bidders to answer any questions that may arise and to review design/construction proposals. The intention of these meetings is to ensure that none of the bids would be disqualified due to unacceptable design assumptions. CN would be requested to take an active part in these meetings.

The expected schedule for this project is as follows:

- Request for Qualification Release – Quarter 3 or 4, 2014
- Request for Proposal Release – Quarter 1, 2015
- Financial Close – Quarter 4, 2015
- Construction Period – 2016 to 2019

A Memorandum of Understanding with CN on the Project Background, Public-Private-Partnership structure, City’s commitment to CN, and CN’s requested commitment to the project was sent to CN in draft form at the end of January. With the approval of Council for this project there are some minor updates required to this agreement and this revised document will be sent directly to Jamie Boychuk at CN for review and acceptance. The Transitway Project as well as PPP Canada requires this documentation and CN’s concurrence with this process and timely attention and response is requested.

Bjorn Rådström, the City Project Manager for this project presented an overview of the Plaza Station and the previous request of CN to allow a pedestrian crossing at this location. With the City’s objectives to create Transit-Oriented Development (TOD) near any proposed Transitway Stations and the approved development for the Sugar Beet Lands west of the tracks, this would be an ideal pedestrian connection to the Plaza Station. Jamie Boychuk indicated that a pedestrian crossing is not preferred at this location for reasons of safety. Mr. Boychuk suggested that either a pedestrian overpass or underpass should be considered at this location. The City responded that these options had been investigated and that an overpass is not acceptable to Hydro due to their high voltage lines and an underpass is not acceptable to the City Water and Waste department due to their main aqueduct and feederman at this location. CN also made the suggestion that if some existing street crossings could be closed this might be an option in exchange for the pedestrian crossing at Plaza Drive. The City indicated they would again review pedestrian crossing options at this location and requested that CN reconsider their stance on a pedestrian crossing of the CN Rail at Plaza Drive.

These minutes were recorded by Dave Krahm. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD
Distribution: Those Present
David Patman
Taran Peters
MEETING MINUTES

Project: Southwest Transitway (SWT) – Phase Two Functional Design
Meeting: Harris Transport, Dillon Consulting Limited, Aecom, Landmark Planning and Design
Date: March 5, 2014 (1:30 PM – 2:30 PM)
Location: Harris Transport (555 Hervo)

Purpose
- To discuss the draft functional design as it relates to Harris Transport, and provide a project update
- To receive feedback and input from Harris Transport regarding preliminary design solutions to address the impact on Harris’ rail and transport operations resulting from the draft functional design

Attendance
Kyle Harris - Harris Transport
Cory Woods - Harris Transport
Rick Pidsadny - Dillon Consulting Limited – Planner
Keith Gerrits - AECOM
Donovan Toews - Landmark Planning and Design – Planner

Notes
DT gave introductions and noted the second round of consultation near completion. DT provided an overview of the reasons for the meeting.

KG explained the proposed design solutions for maintaining uninterrupted rail access to the site, indicating that constructing the solution may result in a 1-3 day outage in order to make the final transition from the existing track to the new track.

The amount of storage for cars beyond the east limit of the property should be status quo. KH inquired as to the ownership of this section of the track. It was unknown.

A closer look is required at the area near the southeast corner of the main building where a service door is currently located. Grading may be an issue here. KG to examine further.

The proposed rail changes generally look acceptable to Harris Transport.

RP outlined the changes required to the entrance area at the end of Hervo. KH was concerned about the loss of any land in this area since truck staging is already cramped. KH felt that the gate reconfiguration seemed to make sense from a functional point of view. There may be opportunity to reconstruct the gating as a double-swing gate.

RP offered that there may be some trade off with respect to any loss of land, by making better use of land now unused along the east property line. KH acknowledged this as a potential idea. Both parties will consider this further at later stages.

DT advised of next steps including that any land acquisition needs or physical changes would only take place on full funding was in place and City of Winnipeg council approved the project. If these take place, construction would likely begin in 2016.

Actions:
- RK to send a copy of the plan to Harris
- KG to examine grading issue at southeast corner of the main building and revisit with Harris as required.

Recorded by Brendan Salakoh on February 21, 2014 for Landmark Planning & Design Inc.
Bjorn gave the introductions and their respective roles within the project. Dave Krahm gave a brief summary and overview of the project, discussing the various project phases and tasks. Dave mentioned that the current team for Stage 2 Transitway project is the same team that was involved in Stage 1. He also cited previous work and studies that have been carried out. Copies of these reports, if needed by team members, should be requested from Valdine Walker.

CN stated that Daniel Chan, Manager of Business Development – Real Estate will be the property contact for CN. He is located in Toronto and his number is 905 760-5322.
<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Dave discussed the three areas where rail is affected within this project:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Portage Junction has two main line tracks running east west and a spur line coming from the east and the west. Both tie into the Letellier line, which goes south to the US. The construction in this area would include the BRT crossing over Pembina Highway and then under the two spur lines. The anticipation is that the two rail structures would be constructed for the spur lines without disrupting the rail movements, upon completion relocate the rail onto the new structures, and then complete the BRT running way in the area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Just south of Chevrier Boulevard a crossing of the two spur lines which provide access to Hydro (at Waverley) and the old Sugar Beet Factory will be required. In addition, at this location the Letellier line will also need to be crossed to bring the BRT from the west side of the track to the east side.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The Letellier line from Bishop Grandin to Bison Drive is currently in the middle of the Right of Way (ROW) and will need to be shifted to one side in order to share the ROW with the BRT running way. The rail line will need to be moved 25 feet to the west. AECOM stated that at 80 mph, approximately 1000 feet is required to move the rail over 13 feet. The intent is to have the rail shifted before the Chancellor Road crossing.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Shane asked if there was an agreement for sharing the ROW on the Letellier line from Bishop Grandin south to Bison Drive. Dave Krahn said that there is an agreement in place between the City of Winnipeg and CN from a number of years ago, for the entire Letellier line from the Portage Junction to Bison Drive. Dave will forward a copy of the agreement to those within the meeting.</td>
<td>Dave K</td>
</tr>
<tr>
<td>5</td>
<td>Transit stated that they will be looking at extending the BRT (Bus Rapid Transit) 1 or 2 blocks further south along the Letellier line. These options will be looked at to address various routing and access and egress options.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>It was noted that road crossings of the cross street with the BRT at Chancellor Drive, Markham Road and Bison Drive will require crossing safety measures similar to that of the rail line to allow free flow for the BRT. AECOM will be looking at these options. It should be noted that the BRT bus frequency will be approximately 50 buses per hour in each direction, during the peak hours. Stop frequencies at the road crossing will have a much higher frequency for the BRT than what currently exists for the rail line.</td>
<td>AECOM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Shane said they would need to determine who owns the spur lines into the old sugar beet factory that goes all the way to Hydro at Waverley Street and Chevrier Boulevard. This will help in starting the discussions on whether these spur lines are still needed, could be consolidated, abandoned, or even if they will be needed to service new industry development in this area.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Shane stated that CN has a concern with pedestrians and bicyclers cutting across the railroad tracks. Transit stated that part of the mandate is to provide Active Transportation Pathways (ATP) throughout the project.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Regarding the frequency of buses, Randy stated that AECOM would obtain the train frequency data. It was discussed that BNSF also utilizes this Letellier line as well. When asked if this line is needed long term, CN stated that it is. It is not anticipated to be removed in the foreseeable future.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Correspondence for CN to go through Travis, for Dillon – Dave Krahn, City of Winnipeg Transit – Bjorn, and the Consulting Team – AECOM</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The construction is anticipated to start at the south end and move north, so the road can be used for Investors Group Field while the complicated staging and numerous structures of the Portage Diversion are being worked on.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Transit stated that the City of Winnipeg funding is in place. Federal funding through P3 Canada is being planned via the application process which is due February 2014 and Provincial funding is currently being worked on.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>CN stated that the P3 contractor will not be permitted to do rail work, except through traditional bid/build. CN stated that they will not allow their rail line to be built where they are at the mercy of a contractor (P3) who is building a schedule rather than CN safety and construction standards. Having the CN rail works removed from the P3 would result in the City of Winnipeg losing out on the cost sharing for that portion of the work. This will take some time to determine how the rail works can be completed with the anticipation of a P3 contractor engaged in this work.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>CN was asked if they require a continuous CN Service road along the Letellier line south of Bishop Grandin. AECOM and CN to discuss.</td>
<td>AECOM/CN</td>
</tr>
<tr>
<td>15</td>
<td>There is a roadway on the west side of the ROW of the Letellier line which will need to be discussed with Water and Waste at the City of Winnipeg to determine the loading assessment and constructability. AECOM is the lead on the municipal utilities and will have these discussions with the City of Winnipeg.</td>
<td></td>
</tr>
</tbody>
</table>
The three structures at the Portage Diversion are rail carrying structures. CN usually maintains these structures but a P3 agreement usually involves 30 years of maintenance. They will need to be discussed at the project progresses. CN agreement is usually with the road authority not a P3. Dillon/AECOM team will look for an example of where a P3 consortium built a rail carrying structure to determine how the agreements were done.

These minutes were recorded by Taran J. Peters. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD

Distribution: Those Present

List of Individuals Involved in Project

<table>
<thead>
<tr>
<th>TRANSIT</th>
<th>Phone #</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bjorn Radstrom</td>
<td>204-986-5743</td>
<td><a href="mailto:bradstrom@winipeg.ca">bradstrom@winipeg.ca</a></td>
</tr>
<tr>
<td>David Putman</td>
<td>204-986-5737</td>
<td><a href="mailto:dputman@winipeg.ca">dputman@winipeg.ca</a></td>
</tr>
<tr>
<td>Marcelina Hama</td>
<td>204-986-6493</td>
<td><a href="mailto:mhama@winipeg.ca">mhama@winipeg.ca</a></td>
</tr>
<tr>
<td>Alex Regiec</td>
<td>204-986-6935</td>
<td><a href="mailto:aregiec@winipeg.ca">aregiec@winipeg.ca</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLANNING PROPERTIES &amp; DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brett Sheenback</td>
</tr>
<tr>
<td>Suzanne DeweyPovelofo</td>
</tr>
<tr>
<td>Stewart Anderson</td>
</tr>
<tr>
<td>Brad Erickson</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WASTE &amp; WATER DEPARTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kas Zurek</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PUBLIC WORKS DEPARTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neil Myska</td>
</tr>
<tr>
<td>Stephen Chapman</td>
</tr>
<tr>
<td>Brad Neimek</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MANITOBA HYDRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenn Gray</td>
</tr>
<tr>
<td>Terry McCarthy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AECOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>James McCutcheon</td>
</tr>
<tr>
<td>Keith Fitchett</td>
</tr>
<tr>
<td>Zeyad Shukri</td>
</tr>
<tr>
<td>Randy Donstead</td>
</tr>
<tr>
<td>John Falcetta</td>
</tr>
<tr>
<td>Bod Paetke</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>McGowan Russell Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susan Russell</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landmark Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donovan Toews</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dillon Consulting Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dave Kraln</td>
</tr>
<tr>
<td>Bill Menzies</td>
</tr>
<tr>
<td>Sial Rihal</td>
</tr>
<tr>
<td>Taran J. Peters</td>
</tr>
<tr>
<td>Rick Pusadny</td>
</tr>
<tr>
<td>David Marah</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travis Frechlich</td>
</tr>
<tr>
<td>Shane McCartney</td>
</tr>
</tbody>
</table>
The specific locations where the proposed transitway alignment and structures were in close proximity to existing CN infrastructure were discussed in detail. These discussions are summarized as follows:

**Portage Function**

- The work required to accommodate the Southwest Transitway was completed in 2013 in a study entitled “Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65)”.  
- As this work has been recently completed and CN was involved in this study and is aware of the impacts on their infrastructure and in general agreement with the recommended plan, minimal time was spent on this location.
- To accommodate the relocation of the CN Bridge over Pembina Highway, the CN Rivers Subdivision north and south mainlines would need to be relocated to the north.
- To accommodate the transitway, with no at grade crossings of the rail line, an underpass of the Letellier subdivision (east leg of wye) as well as track WC02 (west leg of wye) would be required. These underpass locations would not impact the current Letellier and WC02 trackage and therefore these underpass structures would be constructed on grade (no underpass excavation), however, there are 3 CN buildings (MOW garage, tool house, S&C building with antenna tower) that will need to be relocated first.
- After the completion of the Letellier and WC02 structures, and CN building relocations, the proposed wye tracks would be constructed over the new structures to ensure minimal downtime to CN operations. Upon completion of the proposed wye track cut-overs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these structures would take place and the transitway would be constructed.
- **CN to investigate and confirm the relocation/removal of these existing buildings.**
- CN confirmed that addressing the removal/relocation of the above noted buildings is not a concern, and could be addressed without impacting the construction of the transitway.
<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
</table>
| Manahan Underpass | - At the south end of the Hydro right-of-way, just north of Bishop Grandin, a tunnel underneath the Letellier track is required to bring the transitway to the east side of the rail line with easier pedestrian and bus access to the existing commercial properties, Pembina Highway and the University of Manitoba. This tunnel would be very similar in length and construction procedures to the transitway tunnel constructed as part of the Stage 1 project through Fort Rouge Yards.  
- An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro Lines/Towers, negative response from the public, preferred Transit operational issues and unsafe conditions for buses on an Overpass.  
- Temporary relocation of the CN Letellier line would be required to stage the construction of the Underpass.  
- Accommodation/relocation of the 2 CN Fort Garry Industrial Leads (tracks WC07 and WC21) would also be required to stage construction of the underpass tunnel.  
- CN to verify the ownership and review operational requirements of the above-mentioned spur lines and their involvement in any relocation of these spurs for the tunnel.  
- CN to verify if BNSF is a part owner of the Letellier sub-division; only as it pertains to obtaining approvals from BNSF if required.  
- AECOM to determine industrial lead realignment options to accommodate the underpass, as well as reduce tunnel construction staging and forward concept track plans to CN for initial review/acceptance.  
- Signal improvements to accommodate pedestrians and cyclists at the Letellier line at Chevrier may be required if large increases in traffic are noted.  
- CN indicated their initial response to include any Active Transportation Pathways (ATP) within CN rights-of-way would not be acceptable for safety reasons.  
- CN indicated that converting the existing private City crossing of Plaza Drive to accommodate pedestrians and cyclists would not be acceptable.  
- CN’s preference is to maintain the ATP along Chevrier to Hudson and then along Hudson until it was able to connect to the transitway using Hydro right-of-way. | Travis F

<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
</table>
| Crossing of Bishop Grandin | - As the CN Letellier line south of Bishop needs to be relocated in a westerly direction, the current recommendation is to relocate the CN Letellier line from north of Bishop Grandin to just south of Markham Avenue.  
- This would require a new CN Overpass at Bishop Grandin. The current thought is to construct the new sub-structure for the CN overpass, approximately 10.5 m west of the current location, and then “slide” the current CN superstructure on the newly constructed sub-structure. The old CN sub-structure would then be modified to accommodate the proposed transitway.  
- CN indicated that using the existing CN superstructure on the new foundation is not looked on favorably due to the risk of not being able to bring the line back into operation in an efficient and short time frame.  
- CN would only allow approximately an 8 hour shutdown of their Letellier line to accommodate the sliding as well as their switch over of tracks.  
- CN to confirm the maximum block length permitted for this option.  
- Dillon to review other options at this location and AECOM to pass drawings onto CN for review/acceptance. | Travis F

<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
</table>
| Transitway North of Bishop Grandin to Markham Avenue | - The transitway in this section would require the relocation of the Letellier line in a westerly direction by approximately 7.62 m.  
- The City/CN 1994 agreement was discussed as it relates to the above relocation of the rail line. The question was asked on how this Letellier relocation offset was established. The above agreement states the existing 99 foot right-of-way will be shared equally with the City and CN and the westerly 49.5 feet would remain CN right-of-way. The 7.62 m (25 feet) relocation was determined by placing the relocated CN line in the center of the remaining 50 foot right-of-way. CN indicated that if the relocation could be minimized (less than 7.62 m) within their remaining right-of-way this would increase the remaining property on the west side of the tracks for ditch drainage and snow storage. Dillon/AECOM to investigate.  
- CN was in general agreement with the upgraded signalization requirements at existing at-grade public crossings to accommodate both the Letellier line and transitway and was aware that, although more difficult than a standard intersection, similar situations exist in other locations. | Dillon/AECOM

Dillon/AECOM

Dillon/AECOM

Dillon/AECOM
It was noted the City will be requesting a noise wall along the west side of the Letellier line from Bishop Grandin to Markham.

CN indicated they had a concern with the location of this noise wall, as it will impact/jeopardize the snow storage in this area and other options/alignments should be considered. Dillon/AECOM to review options and forward plans to CN for review/acceptance.

The question was raised whether there was any CN internal requirements/procedures that would be required as part of the Letellier line relocation. CN indicated they were not aware of any and that they would respond to Dillon/AECOM if any were required, upon receipt/review of concept track/Transitway design drawings.

A discussion on service roads along this narrowed section of Letellier line was discussed. AECOM suggested that hi-rail equipment should be used to carry out any maintenance in this 1550 m length of rail line relocation. CN responded they want the option for a service road.

CN requested AECOM check if there is any CN undergrounds/fiber optics in this section of rail line that would need to be relocated.

The City/CN 1994 agreement as it related to the Letellier subdivision was discussed and the following is a brief summary:

- CN indicated this agreement was in the hands of their legal department and their Design & Construction group had very little comment at this time.
- It was noted that the two major points in the agreement are that the City needs to provide CN 180 days of notice to invoke the agreement and that all track relocation and other CN work needs to be completed within a 2 year time frame from notice.

The funding and construction process for this project was discussed and the following is a brief summary:

- City and Provincial funding for this project has been approved in principal.
- The City is currently making an application with the PPP Canada for Federal funding of this project.
- If the funding is successful this project will proceed as a P3 Project - Design, Build, Finance and Maintain.
- The Project would generally be responsible for costs of the relocation and structure costs associated with CN infrastructure.

The Client for this project will still be the City of Winnipeg and CN needs to be assured that all work pertaining to their infrastructure will be done to their standards and timing/operational requirements.

If there are design standards, pre-qualified rail contractors, and construction procedures that need to be followed, these items need to be clearly documented in the Request for Proposal (RFP) and the construction consortium will need to follow all of these requirements.

For the Transitway portion of the project the Project Company will be responsible for the maintenance of the infrastructure for the duration of the P3 project which is expected to be 25 - 30 years.

CN was asked if the maintenance of the CN Pembina Overpass Bridge and the Bishop Grandin Bridge should form part of this overall maintenance or whether CN would prefer to carry out the maintenance on their facilities independently. If this maintenance work would be carried out as part of the Project Company then any preferred contractors that carry out this work would be documented in the RFP.

CN to review internally and respond back to Dillon/AECOM. Dillon to follow up with the City for existing board orders.

This maintenance question also applies to the track maintenance in the areas where the track was relocated. Initial thoughts were that this would be carried out by CN. CN to confirm.

During the RFP process Commercial Confidential Meetings (CCM’s) will be taking place with the short listed Project Companies to answer any questions that they may have. If the consortium has an innovative idea on how to construct one of the CN structures they will request a meeting with the City and CN to make sure this idea has some merit and that they can proceed. The intention of these meetings would be to make sure that none of the bids would be disqualified due to unacceptable design assumptions. CN would need to take an active part in these meetings as it relates to their infrastructure.

The schedule for this project was reviewed and the following is a brief summary:

- Request for Qualification Release – Quarter 4 2014
- Request for Proposal Release – Quarter 1 2015
- Financial Close – Quarter 4 2015
- Construction Start – Quarter 2 2016
- Construction Completion – End of 2019

CN requested a set of drawings for this project that were used during this presentation so they can discuss in more detail internally. Dillon to submit to CN. (These were submitted to CN January 13, 2014)
These minutes were recorded by Dave Krahm. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD

Distribution:
Those Present
Dave Wardrop
Bjorn Radstrom
David Patman
Rick Pudasny
Taran Peters
Bill Menzies
SOUTHWEST RAPID TRANSIT CORRIDOR - STAGE 2
FUNCTIONAL DESIGN STUDY
BID OPPORTUNITY 685-2013
MINUTES OF CN MEETING #3
Engineering Update

DILLON FILE NO.: 13-8439-1000
DATE: January 21, 2014
TIME: 1:30 p.m.
LOCATION: CN Office
     “M” Building CN Symington Yard – 821 Lagimodiere Boulevard
PRESENT:
Jim Newton        CN - General Manager of Prairie Sub-Region
Tom Wincheruk    CN – Assistant Regional Chief Engineer
Travis Froehlich  CN - Engineering
David Wardrop     City Transit - Director
Björn Rådstrokn  City Transit – Stage 2 City Project Manager
Dave Krahn        Dillon - Stage 2 Consultant Project Manager
Bill Menzies      Dillon – Stage 2 Transitway Designer
John Falcetta     AECOM – Rail Specialist
Randy Domstad     AECOM – Rail Designer

<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose of Meeting: - To update CN Executive on the progress of the Stage 2 Transitway Project, to document expected design and construction process, to inform CN of the input required during the design/construction, and to convey overall project schedule.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Dave Wardrop the Director of City Transit thanked everyone for attending this important meeting and introductions were carried out.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Dillon’s Project Manager, Dave Krahn, provided a brief overview of the team’s experience and of the Stage 2 project. The team involved in this project is composed of the same individuals that successfully undertook the Stage 1 project from Queen Elizabeth Way to Jubilee Avenue. The Stage 2 project includes a southerly extension of the transitway from Jubilee to the University of Manitoba via the Parker Lands, the Manitou Hydro right-of-way, the CN Letellier subdivision and the former Southwood Golf Course lands. The project also includes a widening of Pembina Highway through the Jubilee underpass and associated land drainage works. The overall project impacts existing CN infrastructure at a number of locations (discussed below). A drawing of the Stage 2 alignment is attached. The specific locations where the City’s project impacts CN infrastructure were discussed in detail. Plans of the transitway geometry, including anticipated alterations to CN infrastructure, were presented for each of the affected locations. These discussions are summarized as follows: Portage Junction</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>At the north end of the project, and within the CN Rivers Subdivision, the existing CN Bridge over Pembina Highway will be replaced with a new rail bridge over Pembina Highway at a location north of the existing rail bridge. This work will include the relocation of existing tracks within the CN Rivers subdivision to align with the new rail bridge.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The two existing wye tracks at Portage Junction (Letellier track - east leg of wye, and track WC02 - west leg of wye) will be relocated to align with the relocated CN Rivers tracks. The structures for the wye tracks will be constructed at grade, with the transitway passing beneath the two underpass structures of the wye tracks.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The work required to accommodate the Southwest Transitway was completed in 2013 in a study entitled “Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65)”. All project work proposed at this location follows the recommendations in the above report.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>As this design work has been recently completed and as CN was involved in this study and is aware of the impacts on its infrastructure and is in agreement with the recommended plan, minimal time was spent on the CN works at this location.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>There are 3 CN buildings (MOW garage, tool house, S&amp;C building with antenna tower) that will need to be relocated prior to any work being undertaken at this location.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>After the completion of the underpasses of the Letellier and WC02 tracks, the wye tracks would be relocated on the new structures to ensure minimal downtime to CN operations. Upon completion of the</td>
<td></td>
</tr>
</tbody>
</table>
proposed wye track cut-overs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these structures would take place and the transitway would be constructed through the underpasses.

**Letellier Tunnel**
- The project includes a transitway tunnel beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track. The north end of the tunnel structure will be on the west side of the Letellier subdivision south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 625 metres further south on the east side of the Letellier subdivision. The tunnel structure includes a covered tunnel approximately 200 metres in length with retaining walls approximately 200 metres in length approaching the north tunnel entrance and 225 metres in length approaching the south tunnel entrance. The tunnel will provide a grade-separated transition of the transitway between the alignment in the Manitoba Hydro right-of-way on the west side of the CN Letellier tracks and the planned transitway alignment on the east side of the CN Letellier tracks. During construction, a temporary south of the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required.
- An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro Lines/Towers, negative response from the public, preferred Transit operational issues and unsafe operational conditions for buses descending an overpass.
- A Rapid Transit Station (Plaza Station) would be constructed south of the tunnel to serve the area adjacent to Pembina Highway (east side of tracks) and the future Hopewell Development (west side of the tracks).
- It was noted that in previous discussions with CN that maintaining the existing private crossing at Plaza Drive is not preferred to minimize the number of CN track crossings. The City would prefer a pedestrian only crossing with adequate signals at this location to promote Transit oriented development in the City and to provide a critical length to the transit station and the pedestrian/cycle paths on the east side of the tracks.
- It was noted that although minimizing at-grade crossings of the rail line is preferred, CN would be willing to re-consider a pedestrian crossing at Plaza Drive due to the minimal train traffic at this location and to accommodate the City’s development plans. Discussion on this item to take place at an appropriate time.

**Letellier Subdivision Works**
- Between the south end of the Letellier Tunnel and a point south of Markham Road, the existing track, signals and switches will be relocated west of the CN Letellier right-of-way to accommodate the transitway alignment. This work will include the construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel to and approximately 10.5 metres west of the existing rail bridge over Bishop Grandin Boulevard. A new Transitway Bridge over Bishop Grandin Boulevard will be constructed in the current location of the existing rail bridge. The sub-structure of the existing CN Letellier Rail Bridge will be widened and modified to accommodate the transitway.

**Letellier Subdivision Works**
- It was noted that the City plans to install a noise attenuation wall west of the tracks to address local residential concerns.
- A discussion took place on the preferred alignment of the relocated CN track in this area south of Bishop Grandin. The 1994 agreement provides that the 99 foot right-of-way be shared by the City and CN. After some discussion, there was general agreement that having the same minimum offsets as in Stage 1 (5.5m or 18 feet from edge of transitway to centerline of track) should be maintained for Stage 2 with the CN service road positioned on the west side of the tracks.
- Dillon/AECOM are to prepare a cross section for the area south of Bishop Grandin showing the transitway, CN track, and CN service road, including critical dimensions and offsets. AECOM is to forward this cross-section to CN for further discussion and approval.
- It was noted that, within the Letellier subdivision, there are two street crossings (Chancellor Drive and Markham Road) where east-west traffic would intersect with the transitway and the CN Letellier track. AECOM has investigated the crossing protection at these locations that would provide first priority to trains and secondary priority to rapid transit buses crossing the intersections. CN was in general agreement with the upgraded signalization requirements at existing at-grade crossings to accommodate both the Letellier line and transitway and was aware that, although more difficult than a standard intersection, similar situations exist in other locations.
4. The City/CN 1994 agreement as it related to the Letellier subdivision was briefly discussed and CN indicated the agreement was currently being reviewed by its legal department. It was noted the agreement includes notification and completion time frames with respect to the rail works within the CN Letellier subdivision. Specification of dates will need to be mutually agreed between the City and CN.

5. The funding, procurement, and construction status for this project was outlined. The following is a brief summary:
   - City and Provincial funding for this project has been approved in principal.
   - The City is currently making an application with the PPP Canada for Federal funding of this project.
   - Upon federal funding being confirmed, the project will be procured as a Design-Build-Finance-Maintain (DBFM) Public Private Partnership.
   - The Project would in general be responsible for costs related to the CN rail works, including exactions and taxes.
   - The City is responsible for the project. CN was assured that all work pertaining to its infrastructure will be undertaken in conformance with its standards and timing/operational requirements.
   - If there are design standards, pre-qualified rail contractors, and construction procedures that need to be followed, these items need to be clearly documented in the Request for Qualifications (RFQ)/Request for Proposal (RFP) process of the PPP procurement and the construction consortium will need to follow all of these requirements.
   - CN will be asked to participate in the RFQ and RFP documentation/process to make sure that these procedures and requirements have been addressed.
   - During the RFP process, Commercial Confidential Meetings (CCM’s) will be taking place with the short listed qualified bidders to answer any questions that may arise and to review design/construction proposals. The intention of these meetings is to ensure that none of the bids would be disqualified due to unacceptable design assumptions. CN would be requested to take an active part in these meetings.

6. The expected schedule for this project is as follows:
   - Request for Qualification Release – Quarter 4, 2014
   - Request for Proposal Release – Quarter 1, 2015
   - Financial Close – Quarter 4, 2015
   - Construction Period – 2016 to 2019

7. Formal documentation of the Project Background, Public-Private-Partnership structure, City’s commitment to CN, and CN’s requested commitment to the project will be sent to CN for CN’s review and acceptance. As the PPP Canada submission needs to document CN concurrence with this process timely attention to this documentation and response is required. CN was in general agreement with this documentation.

8. During the meeting, Bill Menzies provided some background information on the City’s development plan (Our Winnipeg) and Transportation Master Plan, including the City’s objectives to create transit-oriented development near the proposed transitway stations. It was agreed that the implications of the City’s plans for the project’s rail works will require further discussion between CN and the City.

These minutes were recorded by Dave Krahn. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD

Distribution: Those Present
   - David Patman
   - Rick Pidsadny
   - Tarun Peters
   - James McCutcheon
   - Keith Gerrits
2 Dillon’s Project Manager, Dave Krahn, provided a brief overview of the team and the Stage 2 project. It was noted that the Transitway project also includes a widening of Pembina Highway through the Jubilee underpass and associated land drainage works. The overall project impacts existing CN infrastructure at a number of locations which are discussed below. A drawing of the Stage 2 alignment and the areas where it has an impact on CN is attached.

3 The specific locations where the City’s project impacts CN infrastructure were discussed. Plans of the transitway geometry, including anticipated alterations to CN infrastructure, were presented for each of the affected locations. These discussions are summarized as follows:

**Portage Junction**

- At the north end of the project, and within the CN Rivers Subdivision, the existing CN Bridge over Pembina Highway will be replaced with a new rail bridge over Pembina Highway at a location north of the existing rail bridge. This work will include the relocation of existing tracks within the CN Rivers subdivision to align with the new rail bridge, which will improve the curve geometry for CN trains.

- The work required to accommodate the Southwest Transitway was completed in 2013 in a study entitled “Preliminary Engineering Study for the Upgrading of Pembina Highway Underpass (CN Mile 2.65)”. All project work proposed at this location follows the recommendations in the above report.

- As this design work has been recently completed and as CN was involved in this study and is aware of the impacts on its infrastructure and is in agreement with the recommended plan, minimal time was spent on the CN works at this location.

- The two existing wye tracks at Portage Junction (Letellier track - east leg of wye, and track WC02 - west leg of wye) will be relocated to align with the relocated CN Rivers tracks. The structures for the wye tracks will be constructed at grade, with the transitway passing beneath the two underpass structures of the wye tracks.

- After the completion of the underpasses of the Letellier and WC02 tracks, the wye tracks would be relocated on the new structures to ensure minimal downtime to CN operations. Upon completion of the proposed wye track cut-overs to these new structures, the existing wye tracks would be removed/salvaged, excavation under these new structures would take place and the transitway would be constructed beneath these new underpasses.
Letellier Tunnel

- The project includes a transitway tunnel beneath the CN Fort Garry Industrial Leads (tracks WC07 and WC21) and the CN Letellier track. The north end of the tunnel structure will be on the west side of the Letellier subdivision south of Chevrier Boulevard. The other end of the tunnel structure will be approximately 625 metres further south on the east side of the Letellier subdivision. The tunnel structure includes a covered tunnel approximately 200 metres in length with retaining walls approximately 200 metres in length approaching the north tunnel entrance and 225 metres in length approaching the south tunnel entrance. The tunnel will provide a grade-separated transition of the transitway between the alignment in the Manitoba Hydro right-of-way on the west side of the CN Letellier tracks and the planned transitway alignment on the east side of the CN Letellier tracks. During construction, a temporary shield for the CN Letellier track and a temporary relocation of the CN Fort Garry Industrial Leads will be required.

- An overpass at this location was investigated and was not recommended due to conflicts with the numerous high voltage overhead Hydro Lines/Towers, negative response from the public, preferred Transit operational issues and unsafe operational conditions for buses descending an overpass toward an intersection.

- A Rapid Transit Station (Plaza Station) would be constructed south of the tunnel to serve the area adjacent to Pembina Highway (east side of tracks) and the future Hopewell Development (west side of the tracks).

Letellier Subdivision Works

- Between the south end of the Letellier Tunnel and a point south of Markham Road, the existing track, signals and switches will be relocated westerly by 5.7 m within the CN Letellier right-of-way to accommodate the transitway alignment. This work will include the construction of a new CN Letellier Rail Bridge over Bishop Grandin Boulevard parallel to the existing rail bridge over Bishop Grandin Boulevard. A new Transitway Bridge over Bishop Grandin Boulevard will be constructed in the current location of the existing rail bridge.

- It was noted that the City plans to install a noise attenuation wall west of the tracks to address local residential concerns.

It was noted that, within the Letellier subdivision, there are two street crossings (Chancellor Drive and Markham Road) where east-west traffic would intersect with the transitway and the CN Letellier track. AECOM has investigated the crossing protection at these locations that would provide first priority to trains and secondary priority to rapid transit buses crossing the intersections.

CN thanked the team for the presentation and indicated this was an important project to the City and that CN would help out as required to make this project a success.

There were no additional technical questions of John Falcon regarding the CN rail work that is to be undertaken. John Falcon excused himself from the rest of the meeting due to AECOM’s interest in the upcoming RFQ and RFP.

The funding, procurement, and construction status for this project was outlined. The following is a brief summary:

- City and Provincial Funding for this project has been approved in principle.

- The City has made application with the PPP Canada for Federal funding of this project.

- With confirmation of Federal funding, the project will be procured as a Design-Build-Finance-Maintain (DBFM) Public Private Partnership. Some documents may refer to the project as a Design-Build-Finance-Operate-Maintain (DBFOM), however bus operations and bus maintenance will remain with Winnipeg Transit.

- The City would be responsible for most of the costs relating to the CN rail works, including relocations and structures. The exceptions to this would be where current agreements indicate otherwise or where enhancements to CN infrastructure have been requested by CN.

- The City of Winnipeg is responsible for the overall project. CN was assured that all work pertaining to its infrastructure will be undertaken in conformance with its standards and timing/operational requirements.

- If there are design standards, pre-qualified rail contractors, and construction procedures that need to be followed, these items need to be clearly documented in the Request for Qualifications (RFQ)/Request for Proposal (RFP) process of the PPP procurement and the construction consortium will need to follow all of these requirements.
BO #685-2013 Stage 2 of the Southwest Transitway – Functional Design
CN Meeting #4
July 7, 2014

<table>
<thead>
<tr>
<th>Item</th>
<th>Business</th>
<th>Action By</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>CN will be asked to participate in the RFQ and RFP documentation/process to make sure their procedures and requirements have been addressed.</td>
<td></td>
</tr>
<tr>
<td>•</td>
<td>During the RFP process, Commercially Confidential Meetings (CCM’s) will be taking place with the short-listed qualified bidders to answer any questions that may arise and to review design/construction proposals. The intention of these meetings is to ensure that none of the bids would be disqualified due to unacceptable design assumptions. CN would be requested to take an active part in these meetings.</td>
<td></td>
</tr>
</tbody>
</table>

6 The expected schedule for this project is as follows:
- Request for Qualification Release – Quarter 3 or 4, 2014
- Request for Proposal Release – Quarter 1, 2015
- Financial Close – Quarter 4, 2015
- Construction Period – 2016 to 2019

A Memorandum of Understanding with CN on the Project Background, Public-Private-Partnership structure, City’s commitment to CN, and CN’s requested commitment to the project was sent to CN in draft form at the end of January. With the approval of Council for this project there are some minor updates required to this agreement and this revised document will be sent directly to Jamie Boychuk at CN for review and acceptance. The Transitway Project as well as PPP Canada requires this documentation and CN’s concurrence with this process and timely attention and response is requested.

City/CN

7 Bjorn Rådström, the City Project Manager for this project presented an overview of the Plaza Station and the previous request of CN to allow a pedestrian crossing at this location. With the City’s objectives to create Transit-Oriented Development (TOD) near any proposed Transitway Stations and the approved development for the Sugar Beet Lands west of the tracks, this would be an ideal pedestrian connection to the Plaza Station. Jamie Boychuk indicated that a pedestrian crossing is not preferred at this location for reasons of safety. Mr. Boychuk suggested that either a pedestrian overpass or underpass should be considered at this location. The City responded that these options had been investigated and that an overpass is not acceptable to Hydro due to their high voltage lines and an underpass is not acceptable to the City Water and Waste department due to their main aqueduct and feedermain at this location. CN also made the suggestion that if some existing street crossings could be closed this might be an option in exchange for the pedestrian crossing at Plaza Drive. The City indicated they would again review pedestrian crossing options at this location and requested that CN reconsider their stance on a pedestrian crossing of the CN Rail at Plaza Drive.

City/CN/Dillon

These minutes were recorded by Dave Krahn. Any errors or omissions should be reported to Dillon Consulting Limited immediately.

Next Meeting: TBD
Distribution: Those Present
David Patman
Taran Peters
MEETING MINUTES

Project: Southwest Transitway (SWT) – Phase Two Functional Design
Meeting: Harris Transport, Dillon Consulting Limited, Aecom, Landmark Planning and Design
Date: March 5, 2014 (1:30 PM – 2:30 PM)
Location: Harris Transport (555 Hervou)

Purpose

- To discuss the draft functional design as it relates to Harris Transport, and provide a project update
- To receive feedback and input from Harris Transport regarding preliminary design solutions to address the impact on Harris’ rail and transport operations resulting from the draft functional design

Attendance

Kyle Harris Harris Transport
Cory Woods Harris Transport
Rick Pisdany Dillon Consulting Limited – Planner
Keith Gerrits AECOM
Donovan Toews Landmark Planning and Design – Planner

Notes

DT gave introductions and noted the second round of consultation near completion. DT provided an overview of the reasons for the meeting.

KG explained the proposed design solutions for maintaining uninterrupted rail access to the site, indicating that constructing the solution may result in a 1-3 day outage in order to make the final transition from the existing track to the new track.

The amount of storage for cars beyond the east limit of the property should be status quo. KH inquired as to the ownership of this section of the track. It was unknown.

A closer look is required at the area near the southeast corner of the main building where a service door is currently located. Grading may be an issue here. KG to examine further.

The proposed rail changes generally look acceptable to Harris Transport.

RP outlined the changes required to the entrance area at the end of Hervou. KH was concerned about the loss of any land in this area since truck staging is already cramped. KH felt that the gate reconfiguration seemed to make sense from a functional point of view. There may be opportunity to reconstruct the gating as a double-swing gate.

RP offered that there may be some trade off with respect to any loss of land, by making better use of land now unused along the east property line. KH acknowledged this as a potential idea. Both parties will consider this further at later stages.

DT advised of next steps including that any land acquisition needs or physical changes would only take place on full funding was in place and City of Winnipeg council approved the project. If these take place, construction would likely begin in 2016.

Actions:

- RK to send a copy of the plan to Harris
- KG to examine grading issue at southeast corner of the main building and revisit with Harris as required.

Recorded by Brendan Salakoh on February 21, 2014 for Landmark Planning & Design Inc.
Appendix L

Southwest Transtiway - Stage 2: Proposed Traffic Signal Operations at Transitway/Railway/Street Intersections
To: File
CC: Keith Gerrits, AECOM
Subject: Southwest Transit-Way Traffic Signal Operation for At-Grade Crossings
From: John G. Van Hoff, P.E.
Date: May 9, 2014

The purpose of this memorandum is to present the basic operation of the signalized at-grade crossings along the Southwest Transit-Way. The proposed Bus Rapid Transit (BRT) would run parallel to the existing Leetellei railroad trackway.

A traffic signal system will be placed at each at-grade crossing. The traffic signals system will incorporate and treating the railroad, and the transit corridor as the main line cross street of the at-grade crossing. As in the Chancellor Drive crossing, the BRT and railroad would be the north-south legs of the signalized crossing and Chancellor Drive would be the east-west legs of the two phased intersections. The traffic signal would rest in green for Chancellor Drive until there is a demand to serve the BRT or the railroad.

Signaling each of the crossings will help manage and control all movements through the signalized crossing/intersection. There are four possible pre-emption scenarios that could be implemented by the traffic signal for the combined rail and BRT signalized street crossings: 1) A bus only approaches the crossing, 2) A train only approaches the crossing, 3) A bus approaches the crossing and before the bus exits the crossing a train approaches the crossing, and 4) A train approaches the crossing and before the train exits the crossing a bus approaches the crossing. Each of these possible scenarios assumes the traffic signal will rest in green for the crossing street until there is a BRT or train pre-empt service call. Chancellor Drive is identified as the cross street for discussing the four basic operating schemes below, however it would be the same for any other cross street operations.

**Bus Only**
Bus detection will activate a low priority pre-empt service call that will transition the traffic signal from the cross street green to the bus phase. Chancellor Drive minimums will be served before the traffic signal transitions to the bus phase. The railroad gates will not be activated by the bus detection, however the vehicles will be stopped the proper distance upstream from the railroad crossing equipment.

**Train Only**
Train detection will activate a high priority pre-empt service call that will transition the traffic signal from Chancellor Drive green to the bus corridor phase, which is compatible with the railroad movement. Because the at-grade crossing will rest in Chancellor Drive green (the track clearance interval) there is no need to introduce a track clearance interval in the pre-empt sequence unless there is a potential for vehicles to queue back onto the trackway for a nearby intersection. The traffic signal can simply transition, after serving the Chancellor Drive minimum signal times, to the bus corridor phase in preparation for the railroad warning system activation. The railroad gates will be activated with the train detection.

**Bus First Then the Train**
If a train activates a high priority pre-empt while the traffic signal is serving a low priority bus pre-empt routine, the higher priority pre-empt will over-ride the lower priority bus pre-empt. The traffic signal will recognize it in the lower priority pre-empt routine and transition to the requirements for the higher priority railroad pre-empt as discussed above, which includes the activation of the railroad warning system. Because the bus pre-empt has already stopped the cross street traffic, the railroad pre-empt does not need to activate a track clearance interval and will maintain/hold Chancellor Drive in red. The traffic signal will not transition to normal operation until both the bus and train have released the pre-empt service calls. Upon release of the higher railroad pre-empt the traffic signal will look for other pre-empt service calls before transitioning to normal operation, which in this case would be Chancellor Drive green.

**Train First Then the Bus**
Train detection will activate a high priority pre-empt service call, which will continue to operate until the train pre-empt is released. During the pre-empt hold, the traffic signal will display a green for the BRT through movement because it is compatible and does not conflict with the train movement. Upon release of the higher priority railroad pre-empt the traffic signal will look for other pre-empt service calls before transitioning to normal operation. If a bus pre-empt service call is still active when the train pre-empt is released, the bus pre-empt service call will maintain control of the traffic signal and hold Chancellor Drive in red. Upon release of the Bus pre-empt service call the traffic signal will transition to normal operation, which in this case would be Chancellor Drive green.

If the bus is allowed to leave the corridor at any given cross street, and that maneuver requires the bus to cross the trackway, it is recommended that a separate turn lane be installed to manage/control the turn movement with a red arrow if a railroad pre-empt service call should be made. The transit from the low priority bus pre-empt to the high priority train pre-empt will need to serve the minimums for the turn movement. Because the through movement of the bus is compatible and does not conflict with the train movement, it could still be served during the railroad pre-empt. Also, the bus pre-empt has already stopped the cross street traffic, therefore the railroad pre-empt does not need to activate a track clearance interval and will maintain/hold Chancellor Drive in red.

A schematic diagram below is showing the possible "Bus then Train" and "Train then Bus" sequence of events in coordination with the traffic signal phase operation. The diagram shows the Chancellor Drive pedestrian minimum green (dark green) and the pedestrian flashing "Don’t Walk" (yellow) assuming pedestrian access would be allowed across the train and BRT corridor. The BRT dark green is the time necessary for the bus to clear the crossing, while the light green is the time the BRT through movement will have a green indication simply because the train is controlling the crossing and the BRT through movement is compatible and does not conflict with the train movement.
EXISTING CROSSING AND SIGNALS TO REMAIN UNTIL NEW CROSSING AND SIGNALS IN SERVICE

PUBLIC CROSSING - CHANCELLOR DRIVE
M 2.73 CN LETELLIER SUB

SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

EXISTING TRACKS PROPOSED TRACK OTHER PROPOSED TRACKS SOUTHWEST TRANSITWAY
P - U/G POWER - WATERLINES
OH - OH POWER BUILDINGS
U/G GAS PIPE FIBRE OPTIC CABLE
U/G SEWER TELEPHONE / CABLE
Appendix N

SWT2 - Pembina Underpass Project:
Railway Works - Functional Design Drawings
MATCHLINE AT STA 4+800 REFER TO DWG 10-CR-1007
MATCHLINE AT STA 5+250 REFER TO DWG 10-CR-1009

EXISTING CN LETELLIER SUB
TOP OF RAIL AT CENTRELINE
ORIGINAL GROUND AT CENTRELINE

MB HYDRO OH WIRE ENCROACHMENT
M 3.01 - M 3.26
MARKHAM STATION
PROPOSED AT PATH SEE CR-0004

NOT SHOWN ON PLAN
ALLSTREAM Inc. U/G WIRE
5+184.226  M 3.22
DEPTH TO BE CONFIRMED.

CENTRA GAS U/G GAS PIPE
5+164.826  M 3.21
DEPTH TO BE CONFIRMED.

CoW U/G WATER
5+180.806  M 3.22
DEPTH TO BE CONFIRMED.

CoW U/G SEWER
5+174.070  M 3.22
DEPTH TO BE CONFIRMED.

MB HYDRO U/G WIRE
M 3.19
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
M 3.19
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
M 3.10
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
M 3.03
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
M 3.01
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
5+183.290  M 3.22
DEPTH TO BE CONFIRMED.
MATCHLINE AT STA 5+250 REFER TO DWG 10-CR-1008

EXISTING CN LETELLIER SUB
TOP OF RAIL AT CENTRELINE

ORIGINAL GROUND AT CENTRELINE

MB HYDRO OH WIRE
M 3.46
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
M 3.41
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

MB HYDRO U/G WIRE
M 3.28
LOCATION & DEPTH TO BE CONFIRMED.
NOT SHOWN ON PLAN.

EXISTING TRACKS
PROPOSED TRACK
O/P
UG POWER
UG GAS PIPE
FIBRE OPTIC CABLE
UG SEWER
TV
TELEPHONE / CABLE

SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

PLAN & PROFILE - CN LETELLIER SUB
Sta. 5+250 to Sta. 5+700

1. ALL Dimension AND HIDDEN LINES Hybrid Orthogonal.
2. Property for Information Only.
Appendix O

SWT2 - Pembina Underpass Project:
Property Requirements
# TABLE OF CONTENTS

1.0 Introduction .........................................................................................................................1  
  1.1 Consultation Methodology  
  1.2 Notification Approach  
  1.3 Overall Participation  

2.0 Stakeholder Meetings and Public Feedback .................................................................4  
  2.1 Stakeholder Meetings  
  2.2 Adjacent Residents and Businesses Meetings  
  2.3 Leaseholder Meetings  
  2.4 Public Open House 1  
  2.5 Public Open House 2  
  2.6 Follow up Adjacent Residents Meetings  

3.0 Issue – Response Summary ........................................................................................................34  

4.0 Next Steps .................................................................................................................................39
APPENDICES

Appendix A – Project Notification Materials (Samples)
Appendix B – Stakeholder Meeting Notes
Appendix C – Adjacent Residents and Businesses Group Meetings - Flipchart Notes
Appendix D – Leaseholder Meeting Notes
Appendix E – Round 1 Open House Display Materials
Appendix F – Round 1 Open House Comment Sheet
Appendix G – Round 1 Open House Respondent Comments - Raw Data
Appendix H – Round 2 Open House Display Materials
Appendix I – Round 2 Open House Comment Sheet
Appendix J – Round 2 Open House Respondent Comments - Raw Data
Appendix K – Adjacent Residents Follow-up Meeting Notes
Appendix L – Adjacent Residents Follow-up Meeting Display Materials

EXECUTIVE SUMMARY

The public consultation program associated with the Southwest Transitway (Stage 2) project was carried out in two ‘rounds’. Round 1 occurred between October 2013 and December 2013. Round 2 occurred between January 2014 and March 2014. This report summarizes the results of both rounds of the consultation process.

The purpose of Round 1 consultation was two-fold:
- To provide basic, early project information (i.e. scope, timing, design, etc.)
- To identify issues and ideas that the design team should consider during the preparation of the functional design.

The purpose of Round 2 consultation was two-fold:
- To provide detailed information relating to the draft functional design, including responses to the issues, concerns and ideas presented by participants in Round 1 consultation; and
- To identify opportunities to adjust the draft functional design and/or provide further information based on participant feedback.

The consultation approach included the following components during each of the two rounds of consultation:
- Meeting with approximately 25 internal and external stakeholder groups or individuals (e.g. City departments, utilities, nearby institutions, advocacy groups, etc.);
- Meetings with individuals (i.e. residents, landowners, renters, etc.)
- Small Group Meetings with residents, businesses or property managers with property directly adjacent to the proposed transitway corridor
- Information sessions for the general public
- ‘Full-time’ direct access by phone or email to the public consultation team

Participants represented a range of perspectives including residents living directly adjacent to the planned transitway, those living nearby, and other Winnipeg citizens living further from the proposed project. Businesses, organized interest groups, land leaseholders and transit users also participated. About half of respondents that participated in Round 1 of the consultation process also participated in Round 2 of the consultation process, indicating good continuity as well as good on-going participation opportunities.
The vast majority of participants in each round of the consultation process indicated that the team members working with participants were helpful, and that the information provided was helpful.  

During Round 1 of the consultation process stakeholders provided a mix of opinions concerning the project:

- Adjacent commercial and multi-family property owners, and owners of vacant land noted the benefits of this project with respect to the potential for the transitway to increase value for transit-oriented development (TOD) on these sites, which, in turn, will increase the City’s property tax base and contribute to OurWinnipeg’s infill development goals along rapid transit corridors. Owners would also like to ensure residents have access to active transportation (AT) pathways along the route;
- Existing and future transit users expressed a range of opinions regarding the Stage 2 project; many were supportive of the new service and the overall rapid transit plan for Winnipeg; others were not supportive for various reasons as outlined below;
- A significant number of individuals that participated in the consultation expressed a concern regarding the loss of ‘perceived public space’. The ‘Parker Lands’ are privately held lands mistakenly seen to be public lands due to the frequent use by local residents for strolling, dog-walking, etc. The desire is to preserve all or part of these lands.
- There is concern regarding the potential impact to the existing City of Winnipeg dog park; it is apparent that many dog park users think the dog park area is much larger than it is (i.e. the entirety of the ‘Parker Lands’ versus an officially designated area about 1/6th the size); users are concerned about loss of the dog park;
- Individuals living in homes directly adjacent to the proposed corridor expressed concerns regarding the potential for disruptive effects such as noise, vibration, transitway lighting and odour;
- Individuals living directly adjacent and to the west of Letellier rail line expressed concerns about the potential for increased noise, vibration and risk associated with the potential relocation of the rail line closer to their residences;
- A number of individuals expressed concern regarding potential decreases in transit service on Pembina Highway;
- Numerous participants provided commentary considered to be outside the scope of this functional design project; the commentary can be generally summarized as advocating for: elimination of rapid transit as an option altogether; relocation of the selected rapid transit route to another route (e.g. Pembina Highway, Letellier rail corridor); or concern regarding project cost.

During Round 2 of the consultation process stakeholders provided a variety of comments concerning the draft functional design:

- Many respondents indicated that initial concerns had been addressed through the draft functional design. Some respondents continued to suggest an alternative routing for the transitway beyond the scope of the draft functional design study.
- There was substantial support for the Active Transportation (AT) component of the draft functional design. A number of participants provided specific suggestions for improvement of the proposed AT components.
- A number of participants provided suggestions for transit service, particularly concerning the frequency of Pembina Highway routes.
- A number of participants indicated an on-going concern about the potential for noise and dust from buses to negatively impact the enjoyment of their properties.
- A number of participants provided suggestions for the placement and design of the stations (i.e. station amenities), including consideration for vision impaired individuals.
- A number of participants provided suggestions for modifying the road system in and around the proposed transitway.
- Commentary concerning the existing dog park generally indicated that the provision of an alternative dog park nearby was a reasonable solution.
- Commentary concerning the University of Manitoba access point was generally favourable towards using the Southpark Drive alignment rather than the Markham Road alignment.

---

1 95% of respondents to the Round 1 Open House comment sheet indicated the team was helpful, and 89% indicated the information was helpful. 99% of respondents to the Round 2 Open House comment sheet indicated the team was either helpful (89%) or somewhat helpful (10%); and 98% indicated the information was either helpful (87%) or somewhat helpful (11%). In Round 2 only four respondents indicated that either the staff or the information were not helpful.
- A small number of participants provided both negative and positive commentary concerning proposed park and ride locations. Concerns focused on the potential for transit riders to park on nearby residential streets rather than in designated park and ride spaces.
- A small number of participants re-iterated a wish to designate areas in the ‘Parker Lands’ for use as a public park.
- A small number of participants expressed concern regarding the potential project cost.

An Issue-Response table is provided in Section 3.0 of this report. This table summarizes primary concerns or questions raised during both rounds of the consultation process and the response of the study team to each of these matters.

1.0 Introduction

The public engagement program was undertaken to assist with the development of a functional design for Stage 2 of the Southwest Transitway in Winnipeg, Manitoba. The program was geared towards maximizing basic public engagement principles of early, regular, and integrated involvement of key stakeholders and the general public throughout the development of the functional design.

The consultation program was carried out as a two-round process over a period of nine months between October 2013 and June 2014. This report describes the consultation methodology and project inputs received for both rounds of the consultation program.

The scope of the work involved the preparation of a functional design for a general alignment as selected by Council. The selection of this alignment was the result of a previous study that examined a number of alignment options for the transitway. Therefore the focus for stakeholder feedback was specifically directed towards commentary relevant to this selected alignment option, and a substantial amount of useful, project-relevant feedback was received and integrated into decision-making by the design team.

Many stakeholders provided feedback concerning other alignment options not selected for study by Council, as well as feedback concerning the suitability of rapid transit as an overall City direction. Stakeholders were made aware that this type of feedback would be received, collected, formalized and provided to City of Winnipeg representatives for their further consideration, while feedback directly associated with the functional design project at hand would be directly incorporated into project decision-making.

1.1 Consultation Methodology

Figure 1.0 illustrates the stakeholder and public engagement process. The process was carried out using a ‘two-round’ methodology, whereby input was gathered at key milestones during the development of the functional design. Round 1 was conducted early in the process with the purpose of communicating the general alignment, scoping issues, and understanding expectations from stakeholders and the general public. Round 2 was carried out following the development of a draft functional design with the purpose of receiving feedback on the functional design and using that feedback to refine the functional design and respond to participant questions.

This report summarizes input from both rounds. Various consultation mechanisms were employed including individual and stakeholder group meetings, public open house events, telephone conversations, public notification and the use of a project website to provide materials, project updates, and accommodate public comment.
1.2 Notification

A variety of means of notification were undertaken in order to ensure maximum opportunity for input into the plan development. Notification methods included local and city-wide newspaper advertisement, website posting, community posters in prominent neighbourhood locations, direct notification by postcard to nearby residents and businesses, letter notification to directly adjacent residents, building managers, and commercial operations.

Figure 1.0 Public and Stakeholder Consultation Approach

1.3 Overall Participation

There was substantial participation by stakeholder groups and members of the general public. Approximately 800 people participated in one form or another. Figure 2.0 illustrates the location of individuals or organizations that participated in the process.

Figure 2.0 Stakeholder Location Map

A sample of notification materials can be found in Appendix A.
2.0 Stakeholder Meetings and Public Feedback

2.1 Stakeholder Meetings
The study team had discussions with the following stakeholder groups:

Government, Schools and Utilities
- Canadian National Railways
- City of Winnipeg - Planning, Property and Development
- City of Winnipeg - City Naturalist
- City of Winnipeg - City Forester
- City of Winnipeg - (regarding Parks)
- City of Winnipeg - (regarding Dog Parks)
- University of Manitoba
- City of Winnipeg - Public Works
- City of Winnipeg - Active Transportation
- City of Winnipeg - Water and Waste
- City of Winnipeg - Real Estate Division
- City of Winnipeg - (regarding Lot 16 Drain)
- Manitoba Hydro
- General Byng School
- Ralph Maybank School

Adjacent Landowners
- Hopewell
- Gem Equities
- 1500 Parker Avenue
- Winnipeg Blue Bombers
- Victoria Hospital
- Winnipeg Humane Society
- Thompson in the Park (Funeral Home)
- A&S Homes
- Shindico
- Harris Transport

Community Groups
- Parker Wetlands Conservation Committee
- Bike Winnipeg

- Winnipeg Rapid Transit Coalition
- Bishop Grandin Greenway
- Vision Impaired Resource Network

The general format for each of these stakeholder meetings included the following elements:

Round 1
- Overview of project scope, process and timing
- Overview of existing Stage 1 rapid transit facilities
- Overview of stakeholder interest map
- Overview of general corridor alignment and design constraints
- Discussion concerning specific stakeholder interests
- Discussion concerning particular concerns and questions
- Identification of next steps

Round 2
- Recap of project scope, process and timing
- Overview of draft functional design
- Discussion concerning specific stakeholder interests
- Discussion concerning particular concerns and questions
- Identification of next steps

Participants indicated that these meetings were appreciated and helpful. Participants were advised that they could contact a project representative at any time during the project process, and that ongoing communication was expected up to and through the construction period should the project proceed.

A table outlining specific issues and responses is provided in Section 3.0. Meeting notes are provided in Appendix B.

2.2 Adjacent Residences and Businesses Meetings
Residents and businesses living or operating directly adjacent to the proposed transitway corridor were invited to attend one of a series of small group meetings that were held prior to larger public open house events in each of Round 1 and Round 2. One purpose of these meetings was to communicate project information such as project timing, project process, general alignment, station information, etc. In Round 1 meetings staff were also able to answer
questions and to hear from participants the factors they felt should be considered when the design team would be preparing the draft functional design for the transitway. In Round 2 meetings staff presented the draft functional design and asked participants for feedback in order to make any improvements to the design as feasible.

Meetings were held at Dillon Consulting offices (1558 Willson Place) and generally consisted of about 10-25 individuals. Meetings lasted approximately 90 minutes and facilitators committed to staying as long as participants had questions. During Round 1 meetings, facilitators also committed to recording the questions raised and returning with as many answers as possible during Round 2 of the engagement process. During Round 2 meetings, facilitators committed to keeping participants informed as the project proceeded.

The following notes provide a summary of comments and questions raised during Round 1 meetings:

<table>
<thead>
<tr>
<th>Category</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Service</td>
<td>Would there be new transit routes? Would service continue on Pembina Highway?</td>
</tr>
<tr>
<td></td>
<td>How many buses would on the rapid transit (RT) corridor? How often?</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Will there be a pedestrian crossing to the Taylor Street development?</td>
</tr>
<tr>
<td></td>
<td>How will pedestrians and bikes be accommodated? What about connecting existing pathways with new active transportation (AT) pathways?</td>
</tr>
<tr>
<td></td>
<td>How will the corridor be designed to avoid vehicles on AT/pedestrian paths?</td>
</tr>
<tr>
<td>Land Uses</td>
<td>Would commercial development occur along the RT line in existing residential areas?</td>
</tr>
<tr>
<td></td>
<td>What will happen with the dog park? How will this be addressed?</td>
</tr>
<tr>
<td>Functional Design</td>
<td>What will the intersections at Chancellor and Chevrier (and others) and the corridor look like? How will they be designed?</td>
</tr>
<tr>
<td></td>
<td>How will the corridor cross Pembina?</td>
</tr>
<tr>
<td></td>
<td>How will the RT corridor be designed on Markham (i.e. on-street low speed, high speed busway)?</td>
</tr>
<tr>
<td></td>
<td>Will there still be vehicular access via Markham for condos/residents?</td>
</tr>
<tr>
<td></td>
<td>Can there be separate roads for vehicles and transit at Markham?</td>
</tr>
</tbody>
</table>

4 See Appendix C for a complete list of flipchart questions and notes from each meeting. During Round 2, participants were provided answers to the questions listed in the charts above.
### 2.3 Leaseholder Meetings

- Anchor Marine
- Church of the Rock
- Buhler Industries
- Fort Garry MB Church

At the time of writing, a number of project stakeholders held rights to existing leases with Manitoba Hydro to use lands located within the same Hydro corridor that the transitway is proposed within. During Round 1, project representatives met with each of the stakeholders noted above to introduce the project and understand what, if any, impacts the project may have on these lease arrangements.

In each case the project team committed to outlining what impacts there may be as part of the functional design process and subsequently looking for means of mitigating any impacts as they became apparent.

Follow up meetings with these stakeholders were held during Round 2. In each case, project staff helped identify impacts and proposed or potential mitigation measures for each of the lease holdings.

Meeting notes can be found in Appendix D. A table outlining specific issues and responses from all stakeholders is provided in Section 3.0.

<table>
<thead>
<tr>
<th><strong>How will privacy be addressed for those homes adjacent to the corridor?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Will there be mitigation for impacted landowners? Particularly by grade separated crossing at McGillivray?</strong></td>
</tr>
<tr>
<td><strong>What will be the impacts of the RT corridor on lanes and parking to the east of the rail line?</strong></td>
</tr>
<tr>
<td><strong>How close will the corridor be to Parker Avenue residents?</strong></td>
</tr>
<tr>
<td><strong>Can the corridor be moved as far west as possible by industrial park in hydro corridor?</strong></td>
</tr>
<tr>
<td><strong>What will be the impacts of the RT corridor on lanes and parking to the east of the rail line?</strong></td>
</tr>
<tr>
<td><strong>How close will the corridor be to Parker Avenue residents?</strong></td>
</tr>
<tr>
<td><strong>Can the corridor be moved as far west as possible by industrial park in hydro corridor?</strong></td>
</tr>
<tr>
<td><strong>What about property values and the rail and RT corridor? How will this impact us?</strong></td>
</tr>
<tr>
<td><strong>Parker Lands</strong></td>
</tr>
<tr>
<td><strong>What about the forest and wetlands in the Parker Lands area?</strong></td>
</tr>
<tr>
<td><strong>What about wildlife and natural area? How will this be addressed?</strong></td>
</tr>
<tr>
<td><strong>University of Manitoba</strong></td>
</tr>
<tr>
<td><strong>How far into the campus is the RT planned to go?</strong></td>
</tr>
<tr>
<td><strong>How will RT corridor planning be integrated with planning of UofM Southwood lands?</strong></td>
</tr>
<tr>
<td><strong>Stations</strong></td>
</tr>
<tr>
<td><strong>Is there more info on station locations, design, etc?</strong></td>
</tr>
<tr>
<td><strong>Will there be a rapid transit station at Bison Drive?</strong></td>
</tr>
<tr>
<td><strong>Will there be a BRT stop at Markham and Pembina? Would like to avoid stops due to noise, disturbance, etc</strong></td>
</tr>
<tr>
<td><strong>How will people on Pembina Highway get to the stations?</strong></td>
</tr>
<tr>
<td><strong>How will pedestrians move to and from the stations without going through backyards?</strong></td>
</tr>
<tr>
<td><strong>Operations</strong></td>
</tr>
<tr>
<td><strong>What vehicles will be allowed on the RT corridor? Just transit vehicles?</strong></td>
</tr>
<tr>
<td><strong>How will snow be dealt with? Clearing?</strong></td>
</tr>
<tr>
<td><strong>Until what time will the buses run on the corridor?</strong></td>
</tr>
<tr>
<td><strong>Timing</strong></td>
</tr>
<tr>
<td><strong>When would construction start? When would the line be operational?</strong></td>
</tr>
<tr>
<td><strong>What would the construction schedule be? When would the RT corridor be operational?</strong></td>
</tr>
<tr>
<td><strong>Costs</strong></td>
</tr>
<tr>
<td><strong>Who pays for the cost of relocating the rail line and cost of RT corridor construction?</strong></td>
</tr>
<tr>
<td><strong>What happens if we don’t get the funding?</strong></td>
</tr>
<tr>
<td><strong>Process</strong></td>
</tr>
<tr>
<td><strong>Will copies of the materials from the meetings be made available?</strong></td>
</tr>
<tr>
<td><strong>Can drawings/cross sections be provided showing hydro towers, gas, rapid transit?</strong></td>
</tr>
</tbody>
</table>
2.4 First Public Open House

2.4.1 Description

Four public open house sessions were held during Round 1 of the engagement process. Two were held on November 18th, 2013 and two on November 19th, 2013 at the CanadInns Fort Garry (1792 Pembina Highway). Approximately 300 people attended. Participants were invited to review a range of concept display boards (see Appendix E), and to speak with project representatives.

Participants were provided with a comment sheet (see Appendix F). The following figures provide a summary of the data received from 140 open house participants. Figure 2.0 illustrates that respondents living both near and far from the proposed transitway alignment attended the meeting and provided feedback.

This data was used to in a manner that could help address concerns and take advantage of any noted opportunities in preparing the functional design for the transitway, pathways and stations.

2.4.2 Effectiveness

Participants were asked whether they found the information provided helpful, and whether they found the staff on duty helpful. Figure 3.0 shows that of the 140 respondents that provided input to this question, the vast majority of respondents (92%) found the information provided at the meeting to be useful and 89% found the staff at the event to be helpful. This is significant given that many participants also expressed concerns about the project, which suggests that the meeting format and information content were effective and appropriate for this stage of the project. Of those respondents that did not find the meeting useful (11% or 10 respondents) only three offered explanation, which focused on the amount of information being provided (too extensive/detailed).

Comments about notification:

- Would have liked to have been notified earlier
- Do not prohibit people from giving out flyers
- Use newspapers & flyers to residents in immediate areas
- Put a detailed notice on the board in the dog park
- More notice on open houses
- Have TV stations announce meetings in advance. I get all my news from TV. I found out about this meeting from the Cycle Winnipeg list serve.
Comments about staff:

- Have all parties present to answer questions. i.e. a CN representative.
- Staff was very knowledgeable, yet also polite. Excellent job!
- More staff/get more of the consultants to come out and answer questions.
- Felt ignored, wondering if anyone is listening, or is this just a placate the common folk.
- Very helpful.
- Friendly.
- Have more people available to talk to.
- Stakeholders to answer questions.
- Interesting that you have a transit guy here, but not an A.T. person... that would help.
- Be more open to alternative points of view. You can’t engineer out the human factor affected by and advancing this proposal.
- It would have been nice to have someone from Gem Equities here to elaborate on the housing plans going in nearby (i.e. when/what) as it seems to impact many of the questions I asked tonight.
- Yes they were helpful.

Comments about content:

- More info about routes IE: Express on Transitway redundant routes. Service on Pembina.
- You need to have better answers based on factual projections and not what and how you might develop.
- Information somewhat helpful; have all answers to questions; appears lots unknown.
- Hoping for more substantial detail/design suggestion. Much of this presentation was recycled info.
- Perhaps display a timeline of city, province involvement in the project - planning decision, finance.
- Scale bars should be all over your maps. There were some with scale bars but some without. It just helps to give an idea of how far things are from each other.
- Concrete answers about liability concerns (i.e. who will be held accountable for shifting/vibrations that cause damage to homes/foundations). For how long will they hold responsibility?
- More detail is needed regarding crossing at intersections.
- More detail on grade separation areas.

Comments about reporting and due diligence:

- Provide copies of meeting minutes/ notes to anyone requesting. ([staff] have committed to this.)
- [Whether this process was helpful] remains to be decided when we see if you have taken into consideration any of our concerns & suggestions. Perhaps in January.
- Use the internet, put info and plans online.
- You showed the stakeholders meeting dates but not what any of the stakeholders thought. Can’t you summarize the results of those meetings?
- [Improve the process] by providing maps that we could take home and show our families.
- Correct the spelling and grammar in the final report on the city web site.
- Make the reports concerning this project available online electronically. Have a clear statement of who the target future bus/transit riders are (What are we trying to achieve? What problems are solved?).
- Where is the assessment study? How can you go ahead with this idea without finding out if it will lose money in the long run.
- Do an unbiased environmental impact assessment.
- Do transit research to justify the project.
- We think that they are on the right track.
- Actively engage cyclists in discussion.

Comments about process:

- Stop rushing the project to source funding and do a proper study before carrying on.
- Wait to hear from the community; do ridership surveys before going through with this.
- Town Hall where we can voice our options to the crowd. Conscientious thinking is good.
- Appreciate the "open house" process.
- More evening open houses for those who work regular hours.
- This is a good consultation process. The public has had every opportunity to hear and provide input. Continue as planned.
- So frustrating – It seems your plan is decided, you know who makes money here, you don’t care what users feel, you can build an overpass for this?? What about Waverley/Wilkes??
- Ask sincerely for consultation before significant decisions are made.
- The city needs to listen to what the tax payer has to say. I believe the City of Winnipeg had their minds made up before any of these meetings began.
- Doing this just to go faster doesn’t make any sense, so go where the people are.
- This was good!
- Implement the suggestions given by community members!
- Keep us informed.
- Ongoing communication during the planning process.
- It’s beside the point. What engagement do they need? There are engineering challenges that don’t need public input.
- Actually listen to people and do some studies on feasibility of different options before coming up with all kinds of designs.
- Thanks for including the public on this process.
- Continue to offer information sessions open to the public as you have been doing.
- No representation by those that voted this travesty.
- Do more route selection consultations

Other Comments:

- No matter what “avenue” you take it will affect some people and ensure the decision makers are a mix of professionals, directly concerned folk and Winnipeggers who are very “pro” Winnipeg.
- I am also a part of the neighborhood network team for the University. I feel the University is trying to listen to the neighborhood and I hope the Rapid Transit Team does the same to alleviate impact on the neighborhood.
- Take into account public opinion and listen to the majority that is against this alignment
- Presentation explaining what the project is would have been good. Not sure what stage the project is in.
- A better understanding of project.
- I am glad to see this happening.
- My interests are more specific to deal with at this stage.
- Streamline the downtown portion somehow?
- A walk through of Fairway Woods would be good; meet with residents once complete.
- Letellier straight south to old rail line on south side of U of M property.
- Instead of park&ride the city should encourage mixed use development at transit stops.
- Parker lands, U of M, golf course - needs to be spelled out more.
- Toronto transit has info on their website as to why they favour subways - stops further apart yields increased speed. Our bus transit has advantages - stops are closer less walking and few stairs.
- I think the project is not efficient or economically feasible and should be reassessed.
- Be patient - despite all the nay-saying this route is best.
- The stations should include surface parking for commuters

2.4.3 Respondent Interest Areas

Figure 4.0 summarizes participants’ response to the question “What are three reasons you are interested in this project?”

The following information provides summary of each topic as listed in Figure 4.0., cited in order of frequency. 5,6

General Support: Respondents indicated general support for the Stage 2 rapid transit project.

Negative Impacts: Respondents listed specific concerns about the project to specific properties, including those associated with noise, vibration, light and dust pollution, and property values.

Active Transportation: Respondents were typically existing AT users hopeful that active transportation would be included within the project scope; respondents provided specific suggestions7.

Parks and Parker Lands: Respondents were concerned about the impact to the Parker Lands areas8. Many respondents felt that these lands were of value to the community and of ecologically importance for the City of Winnipeg.

General Project Interest: Respondents indicated a variety of reasons for their general interest in this project.

Bus Routes, Bus Service: Respondents were both interested and concerned about existing and future feeder bus routes and frequency of service on selected routes. Pembina Highway bus services were of particular concern to a number of respondents.

Specific Project Benefits: Respondents cited a series of specific project benefits they were interested in, including reduction in vehicle use, reduction in greenhouse gases, and reduction in travel time.

Other Project Options: Respondents indicated a preference for a series of other rapid transit project options including, light rail transit and alternative routes such as the Letellier Corridor and Pembina Highway.

5 Verbatim transcriptions of comments provided are included in Appendix G.
4 These project comments will be reviewed to capitalize on opportunities presented and to address concerns as part of the Round 2 consultation process.
7 See Section 2.4.4 of this report under heading “Active Transportation”
8 Respondents did not distinguish between publicly owned Dog Park lands and the privately owned ‘Parker Lands’.
Traffic Concern: Respondents had specific concerns related to the potential for bus rapid transit to negatively impact other vehicular traffic in specific locations.

Transit User: A number of respondents indicated they were interested in the project as existing transit users.

Lives Close: A number of respondents indicated they were interested in the project because they live near the proposed route.

Project Cost: A number of respondents were concerned about the cost of the project.

Project Process: A number of respondents had concerns or were skeptical about past and future decision-making process associated with this project.

General Opposition: A number of respondents indicated general opposition to the project without indicating a specific concern.

Stations: A few respondents had concerns or suggestions with respect to the location and number of rapid transit stations.

Project Due Diligence: A few respondents had concerns or suggestions with respect to the research and investigation that had been or would be carried out to justify this project and ensure good project planning and design.

Existing Dog Park: A few respondents expressed a desire to either preserve or replace the existing dog park if this project would disrupt it.

Other General Comments: A variety of other reasons were cited for respondents’ interest in the project. A complete list of comments provided is in Appendix C.

2.4.4 Project Improvement Suggestions

Respondents were asked how they felt that the rapid transit project could be improved during the functional design process. These responses will be used to help improve the functional design presented in Round 2 of the engagement process.

Specific Comments included:

Alternate Routes
- This transitway should run down Pembina Highway (x11)
  - It’s not too late to reconsider the route.

Where this term occurs; "(x11)" it indicates that the number of respondents that provided the same or similar comment, in this case, 11.
I think "Gem" is waiting for their money.
- Our Councillor John Orlikow supports Pembina Hwy development.
- Pembina to McGillivray or all along railway puts the route closer to more people.
- Keep it close to Pembina Hwy. businesses.
- Greater effort needs to be made at studying Rapid Transit on Pembina or Letellier-Line makes much more sense from a business perspective.
- I fail to see how you will get people to take Transit on any other route.
- Build all crossings above ground or all below ground along Pembina Hwy.
- A route that benefits the bulk of riders/existing commercial business on Pembina
- We need LRT straight down Pembina.
- Anyone travelling to an address on Pembina will not find the Phase 2 route helpful or useful.

Improve Transit Routes and Scheduling (x6)
- Make sure fast/frequent service on Pembina is created or maintained (x4).
- Improve scheduling so buses have more capacity.
-Extend route 99 out to University.
- Make sure 36 route stop @ Pembina and Windermere is maintained
- Keeping the 160 and possibly adding another route or more buses for the 160 route once it is open

The transitway should run on the Letellier Row (x5)
- Nearer Pembina will increase ridership.
- Could mean shared grade separations with the railway.
- Divert Letellier line for Rapid Transit. This would eliminate cost of two tunnels.
- More direct route along the railway right of way.
- Make transit readily available to those who use it.
- Slower speeds are not a factor to reject the rail line.

Present alternatives - Pembina, Waverly, and Kenaston that respond to actual developmental traffic volumes.

Run the transit in a different route. Other options were proposed.
- It can’t be improved; it’s in the wrong place to begin with.
- Routes do not seem to be well thought out.
- Enter to U of M via Markham has problems.
- Be sure to have Markham route.

Active Transportation
- Jubilee underpass; make sure pathways are bike friendly/accessible from Harrow. (x2)
- Make crossing at Jubilee and Pembina available to cyclist and pedestrians.

Convenient bicycle path that doesn’t wind through neighborhoods.
- More direct/efficient cycle routes (Pembina). Better indication of cycle/bus routes (e.g. painted lanes) signs don’t always work.
- AT level of services should be as high as Transit in terms of intersection design, travel priority, quality of infrastructure, amenity.
- Current bump outs on Pembina are dangerous for cyclists and pedestrians alike- please don’t make this mistake consider buffers seriously. – signage very NB!!
- Relocate the railway and use the rail for cyclist.
- The bike pathway comes too far off Pembina Hwy. for cyclists looking for a quick safe way to get downtown.
- Prefer to have active transportation routes alongside the Letellier line.
- Bike route along Pembina.
- Straight AT paths that follow the whole route. Including the overpasses and tunnels.
- Add in AT from Whyte Ridge.
- As long as cyclists are separated from cars and buses - I’m in favour. Like the way it is now from Jubilee to transitway at Osborne - do more of that phase.
- Don’t make me stop and get off my bike - if you do I’ll stick to the road and won’t get to benefit from these improvements.

Crossings
- The grade crossings need to be like railroad crossings with arms and complete transit priority. (x2)
- No grade separation crossing on Beaumont/Parker Lands, which is in a quiet neighbourhood area. (x2)
- Please ensure that if light-controlled intersections are installed that pedestrians do not have to wait 3 min to cross.

Parker Lands, Southwood Lands and Dog Park
- Rapid Transit should not go through the Parker Wetlands (x5);
  - Examine alignment at East end of Parker Land.
  - Leaving the Parker Wetlands as natural reserve or park.
  - Stay out of the Parker wetlands
  - An environmental impact assessment is critical. The forest and Parker Wetland are functional ecosystems that must be protected.
- I cannot see how a rapid transit corridor through a quiet back part of Fort Garry with forest and wetlands can truly be protected. How would we access it with buses coming and going?
  - Please make sure there is a green space saved for the dog park and make it accessible from the neighborhood with a few more overpasses for pedestrians. (x4)
  - Allocation of where the dog park will be relocated in the functional design phase must be shown.
  - Having the bus route go through the Brenda Leipsic dog park is insane.
  - Find a way to go around the dog park and the forest
  - Keep the green space and trees in Southwood lands.
  - Respect viable cultural and ecological corridors.

**Park and Ride**

- Coordination with being able to Park and Ride should continue.
- Have Park and Ride lots on stations by McGillivray, Clarence, and Chevrier.
- Easy access to Park and Ride, try to improve the image of Winnipeg.
- Park and ride opportunities should not be limited to routes adjacent to rapid transit.
- Park & ride along feeder routes, express routes to connect to rapid transit.
- The stations should include surface parking for commuters.
- Instead of Park and Ride the city should encourage mixed use development at rapid transit stops.
- Important to have door to door service to the U of M park & ride facilities would help to increase ridership.

**Stations**

- Need off street drop off loops at transit stations for cars and bus. (x2).
- Not too many bus stops along route need to have connection to west end of the City.
- Clarence station would be much better if it was situated near Waller - serves McGillivray Park (relatively dense for Fort Garry) and is closer to AT pathway, which is quite busy.
- The U of M and Stadium should be very functional and accessible.
- A station located closer to Hurst Way near Wilkes Avenue.
- Remove the Chevrier station as it is redundant.
- Cycling lockup places at the stations.

**Mitigation Suggestions**

- Implement project with the least amount of impact on the nearby community and surrounding green space.
- Make this an enhancement to our community. Put up trees like Manitoba cedar, that will provide a "green" barrier between houses & corridor. Use low head lighting so it's less intrusive. Make it a "park" space.
- Earth berms to separate from homes along corridor (including trees).
- Limit destruction of trees with sewers instead of ditches.
- Just leave as much marsh forest as possible for the neighborhood.
- If it must proceed, leave forest intact and preserve the dog park.
- I would like to see a plan that would preserve as much of the wooded area as possible.
- Put fences beside the lanes thru the dog park.
- The entrance to the university property at Markham should be located further from our property with trees and a raised berm to alleviate the continuous noise at houses.
- Consider traffic calming in Beaumont area and side streets.
- Sound barrier where close to homes.
- Move the tracks towards Pembina and put the transit closer to our property with wall.
- Do not move train tracks! Or move them towards Pembina.
- Slow down the trains to reduce risk of vibration and safety concerns.
- Can you please build the barrier wall before construction starts to minimize the noise and invasive nature of construction mess/dust.
- Continue to leave Parker/Hurst Way, so those living in 'Planet Bays' do not need to back track to get out of area (i.e. having to drive back to Beaumont to get to Waverley). Connect bike and sidewalks to existing streets and sidewalks. Lots of signs on bike paths. It's hard to understand how to follow existing paths.
- Build it closer to the rail line behind Parker Ave.
- Re-route via different location; cover any damage caused by train/vibration; have trains lower speed; buffer wall for noise.
- If the transitway misses my compound and a turnaround area for my customers and suppliers to access my business is constructed, my needs will be met.
- I understand that no changes will be made to address our concerns but an elimination of business taxes would help.
Timing

- I hope it is built soon.
- Hope the project is finished soon, increase in land prices over time.
- Get the funding in place and proceed with finished design and construction ASAP.
- Build the stadium component next year. It is difficult to do progressive work in the City. Don't despair.
- Build it ASAP.

Other

- I ride daily from For Rouge to Downtown and it is incredibly efficient.
- Don't do it, save your money. For students: build some student residential high rises at the U of M. Problem solved.
- Make density targets as part of the surrounding corridor.
- In favour, want to support a higher-density mixed use development.
- Not that I ride, but concerned about the increased bus traffic on Markham Rd from the U of M.
- Why can't they share the railway track? There must be a new track wheel out there.
- The downtown part is anything but "Rapid".
- Plan for the future as much as possible - lane width along the full transit way, access by residents/users to transitway.
- For Stage 2, include rails in the concrete transitway so when the time come to upgrade from bus to light rail some of the infrastructures is already in place. It's cheaper in the long run.
- Move track as little as possible - provide CN Inspection track for hydro access between property & track.
- A train system that would avoid congesting the downtown and would build for the future would make more sense.

2.4.5 Interactive Drawings

Large-scale drawings were provided at each open house and participants were encouraged to add small 'sticky-notes' to the drawings and to provide comments concerning specific locations along the transitway. One of the drawings was dedicated to Active Transportation concerns and ideas, while the other was dedicated to any other concerns or ideas.

The following comments were provided on the Active Transportation drawing:\n
- Cycling path needed for Waverly between Bishop Grandin and McGillivray.
- Multi-use path between Markham Station and University through new development needs to be considered.
- What happens to local pedestrians and cyclists when trying to cross BRT intersections (i.e. Kids)?
- If alternatives are needed for AT, priority must match rapid transit line.
- Need AT grade separated at McGillivray and at Bishop Grandin.
- Provide AT connection from Plaza/Pembina to transitway and improve directional signage.
- Existing signal at Pembina eastbound to Plaza is too fast.
- Improve Copenhagen 'left box'.
- Waller connection for AT would be convenient.
- Tie AT pathway to park at Marshall Crescent.
- Create a 'habitat corridor' alongside pathway.
- Benches for old (and not so old) folks to rest please.
- Winter snow clearing a priority please.
- Pembina 'bike bays' impossible [to navigate] today.
- Bump outs are dangerous - pedestrians must be separated from cyclists.
- Cycle path along Pembina should be positioned along highway rather than double stop along Letellier.
- If there is going to be a cycling path along Letellier have a fence along Hudson back lane.
- Need cycling along Pembina - way too difficult to take the dogleg.
- A 'living fence' please.

These comments are paraphrased.
Pathway on Hurst Way would be safer and more accessible for pedestrians and cyclists.

How would the crossing of transitway at Parker work?

Fence along the walking and bike path.

AT way-finding signage with distances and walk times please.

Would like more bike garages.

Consider native vegetation in planting plan please - tall grass prairie species.

Left turn going south on Point and Windermere.

Buffered cycling along Pembina for cyclists who live in Beaumont area.

Yes! Bike racks needed at each station.

More on street signage for bicycle paths.

Painted cycle paths in critical areas area great!

Important to connect AT from Pembina and Harrow - how do we cross?

Would be great to connect walking path at Bishop Grandin to Superstore by this transitway.

Extend AT on Markham to connect to schools.

Need to provide quality bicycle facilities to Chancellor Square and mall.

Make sure to connect cyclists across University Crescent.

Improve Plaza for bicycle traffic.

Cyclists heading downtown won’t follow the detour - they will go straight down Pembina.

Connect AT to Buffalo Place.

Bicycle paths that are direct, not winding through residential areas.

Make sure there are bike and pedestrian connections over Pembina.

Pedestrian Crossing at Jubilee.

Please keep AT at end of Sommerville.

Ensure good, safe cycling from Waverley Heights, Whyte Ridge and Linden Ridge.

Connect to Investors Group Field by flyover trail - let’s do it right!

Other comments provided by ‘sticky-note’ follow a similar pattern as the written comments provided. They include:

- Keep Parker green area/wetlands. (x7)
- Avoid/minimize damage to forest. (x6)
- The bogs, foxes, deer, dogs, swamps and forests need protection. Look at the City’s own planning mandate.
- I visit the wetlands regularly - please do not destroy this place. (x2)
- Leave the forest alone; Parker needs the sound/sight buffer.
- Build an overpass over the forest or go around.

Forestry and parks are an asset to the City.

Use land for water retention – do not want/need increase drainage in river.

Did you know there are tonnes of Saskatoons in this forest?

There is too little greenspace inside the Perimeter as it is; don’t take this away.

When will a thorough environmental study be done? (x2)

Why was the environmental study an after-thought?

No more Kentucky Bluegrass – use native plants!

Save the dog park. (x3)

What will happen to the dog park?

Community gardens, where do these go?

Don’t cause drainage issues that impact residents.

Maintain vibrant regular transit down Pembina.

[Private companies] are laughing all the way to the bank. (x2)

Transitway is too far off of Pembina to make any sense to collocate with industrial area.

Wrong place (no passenger base).

Too expensive (buying back land given away).

Rapid Transit? Two miles out, two miles in?

Why even build it? Why spend $300m on something that really won’t make much difference?

How exactly are the people who will eventually live in this “major development” supposed to get out of here with the train line on one side and the rapid transit on the other - they will be boxed in.

Yes! [to the Parker alignment]

Yes! [to Jubilee overpass]

No grade separated crossing on Beaumont.

Don’t move Hurst Way.

Will you build overpasses at every major crossing?

Will there be lights at Parker/Hurst? I’d rather not be T-boned by a bus on my drive home.

Why not integrate north from Beaumont and Hurst Way.

Need a bus station at Clarence.

Lots [of industrial community employees] use the bus.

[The industrial community] does not use the bus.

[Industrial employees] do not use the bus now, but might with better service.
2.5 Second Public Open House

2.5.1 Description

Four public open house sessions were held during Round 2 of the engagement process. Two were held on February 24th, 2014 and two on February 25th, 2014 at the CanadInns Fort Garry (1792 Pembina Highway). Approximately 300 people attended. Participants were invited to review a range of concept display boards (see Appendix H), and to speak with project representatives.

Participants were provided with a comment sheet (see Appendix I). The following figures provide a summary of the data received from 158 open house participants. Figure 5.0 illustrates that similar to Round 1 participation, respondents living both near and far from the proposed transitway alignment attended the meeting and provided feedback. Round 2 included a greater proportion of individuals that live nearby the proposed transitway and a smaller proportion of individuals that live directly adjacent. This is likely explained by the fact that directly adjacent residents were invited to a second set of special meetings for adjacent residents prior to the public open house.

This data was used to test the draft functional design for the transitway, pathways and stations and see what modifications could be made or should be made.

2.5.2 Effectiveness

Participants were asked whether they found the information provided helpful, and whether they found the staff on duty helpful. Figure 6.0 shows that of the 158 respondents that provided input to this question, all but one participant (99%) found the staff at the event to be either helpful or somewhat helpful. Respondents also indicated that the information provided was useful (85%) or somewhat useful (11%). Only three participants did not find the information useful at all.

Comments about staff:

- Very helpful. (x8)
- Very helpful and informative (x3).
- Staff were very knowledgeable and patient (x3)
- Thank you! (x2)
- Well done.
- Respectful, Knowledgeable, thoughtful.
- Extremely [helpful]. Not just helpful but personable and easily approachable
- Knowledgeable and they seem to listen.
Very easy to access and open to discussion.
- [A team member was] excellent.
- [A team member] answered my concerns. Thank you Trevor!
- The gentleman explained it very well. David was super!
- [A team member] has been patient and helpful however when voicing our concerns noted above we found [another team member was] dismissive and condescending.
- All of my questions/concerns were addressed. I am on-side with this plan.
- Seemed more interested in steering away from issues rather than address and talk about them.
- Yes definitely answered all questions.
- Polite and well spoken.
- They would not discuss alternative alignment.
- Give answers which are only pro development along this line. None other considered.
- City officials should be here also.
- No one here can actually change decisions that were made. Where are the councillors who voted? Why did they do this without listening to their communities?
- Very helpful. Was reassured that the transit Corridor will not be along Markham.
- Would be nice to have someone from CN Rail and possibly Hydro to answer questions.
- Answered questions thoroughly.

Comments about information provided:
- Presentation boards well done, informative, straightforward. Planning process explained. Thank you.
- Explained construction and design process and sequence of construction and why Markham is no longer preferred route.
- Really well done.
- More information was provided at this meeting when compared to the first one.
- Nice to see Active Transportation accommodation.
- It would be nice if the high resolution version of the boards was available online. The maps don’t get much detail with what’s there.
- Yes. Helps to know what is planned.
- Everything was explained well and good presentations on display boards.
- Updated and more detail provided.
- It is imperative the truth come out not given by a group who has not done their homework.
- Interesting.
- Excellent.
- Very good information.

Map should have been redrawn. Many x’s, arrows convey unprofessionalism.
- Found out our private property was thought to be a public park.
- Helpful to find all on web (x2).
- Where is the report on the November/13 “consultation”? Will there be some sort of noise analysis? Noise barrier’s for residential areas?
- Nice to see AT connections at Pembina and Jubilee.
- It gave me a good idea where the bus way will be placed and will go.
- Explains were the transit system will be located and distinction for residents for Gaylene Place and Pembina.
- Very much so. Great maps.
- Were unable to answer the concern raised for railway relocation near residence.
- I understand how and when this project will unfold.
- This gave me more info to not want the destruction in this area that this plan will bring.
- Excellent exhibits.
- Liked to see that the Parker St. Dog park will continue to exist.
- BUT...the noise is concerning if a wall is not built.
- Yes, the maps were great.
- Very [helpful]!
- Way too many BS slides. “rubber-tired vehicles”? They’re called buses...say it straight.
- I was pleased to see the active living paths.

2.5.3 Respondent Interest Areas

Figure 7.0 illustrates the interest areas from each Round of the consultation program. While the Round 1 data refers to the reasons for being interested in the project, the Round 2 data is derived indirectly from the topics that respondents provided commentary on. Some key observations when comparing the data between Round 1 and Round 2 include:

- The number of people offering general support commentary dropped. This is not an indication of an actual drop in support; there are likely two reasons for the change in focus. First, in two-round consultation processes like this one, individuals that are satisfied with a project in Round 1, tend not to participate during Round 2 because their interests are often seen to have been met. Second, with more detailed project information available during Round 2, commentary provided is generally more specific in nature, so general project support data would have to be implied (and therefore not recorded as ‘general support’). A closer look at the commentary provided confirms the substantial positive feedback of many participants;
- The number of respondents offering commentary about neighbourhood impacts, while still high, was reduced between Round 1 and Round 2. This reduction is likely due to the information provided on this topic, which outlined how many of these concerns could be mitigated.
- The level of interest in Active Transportation was relatively even. Written commentary generally affirms the Active Transportation component of the project as positive.
- There was an increase in the number of respondents providing commentary concerning the use of the privately held Parker Lands for public park purposes. The increase is likely due to the additional broad efforts of a local community group that is lobbying for the preservation of these lands. This group held a community event on the first day of the SWT Open House events.
- There was an increase in the number of respondents providing commentary concerning a series of topics including stations, dog park, U of M access, and park and ride areas. This is likely due to the fact that Round 1 did not include detailed information on these topics, and Round 2 introduced greater detail on these topics.
- There was an increase in the number of respondents providing commentary concerning the project process and alternative routes. Project process comments included a mix of positive and negative commentary, while those commenting on alternative routes were generally also opposed to the use of the Parker Lands for this project.
- There was a decrease in the number of people providing commentary that was of a ‘general opposition’ nature. This is likely due to respondents providing more specific reasons for their opposition, since more detailed project information was being provided during Round 2.

2.5.4 Summary of Commentary

Respondents offered specific commentary on the key project topics. Raw data for this commentary is provided in Appendix J.

Active Transportation

Participants were generally supportive of the improvements proposed for Active Transportation infrastructure in conjunction with the transitway construction, and provided specific suggestions for increasing accessibility, improving maintenance, and providing infrastructure such as the use of switchbacks, bicycle parking at stations, bike racks on buses. Participants also urged the City to ensure the needs of both recreational and commuting cyclists were met. A number of participants felt that a more direct route between Jubilee and the University of Manitoba was needed for cyclists.
Bus Routing
Numerous respondents made specific routing requests or suggestions, particularly advocating for an increase in the frequency of routes travelling along Pembina Highway. Respondents made suggestions concerning better connections and feeder routes, simplification of routes, provision of a transit hub at U of M, and adding bus stops on Southpark.

Cost
A small number of respondents expressed concern about the potential cost of the transitway.

Dog Park
Respondents emphasized the need to maintain a dog park in this area and some participants acknowledged that the draft plans identified a solution for providing a dog park.

Due Diligence
A few respondents questioned whether enough due diligence had been carried out concerning overall costs, ridership, speed of service and frequency of service.

General Approval
Many respondents expressed satisfaction concerning the draft plans and encouraged the project forward.

General Opposition
A few respondents indicated general opposition without pointing at any specific issue.

General Neighbourhood Impacts
Many respondents expressed concern about the potential for their property to be negatively impacted due to safety concerns, construction impact, air pollution, parking on adjacent streets and disrupted or new traffic patterns. A number of respondents acknowledged that their initial concerns about neighbourhood impacts had been resolved.

Park and Ride
A few respondents suggested that more park and ride areas were required in order to increase ridership, potentially at sites not directly adjacent to the corridor.

Parker Lands and Greenspace
Numerous respondents expressed the on-going opinion that the privately held Parker Lands should be converted to public park. A few respondents asked about maintaining community gardens within the identified corridor.

Process
A number of respondents were eager to see the project begin and asked to be kept up to date with the project status. Some respondents felt that the information provided was insufficient and already decided upon.

Rail Relocation
A number of respondents expressed concern about the potential for their property to be negatively impacted due the relocation of the existing rail line closer to their homes citing safety concerns, and potential for noise and vibration to increase. A number of respondents acknowledged that their initial concerns about noise and vibration would be resolved by the proposed mitigation measures.

Route
Numerous respondents continued to express the opinion that the selected route would be better located along Pembina Highway or the Letellier Rail corridor. A number of participants expressed support for the new location for U of M access (at Southpark).

Safety
A few respondents expressed concern about safety with respect to construction vehicles, station locations and interaction with the existing rail line.

Stations
Numerous respondents provided suggestions for station designs and locations, including heating, the proximity of the Chevrier and Clarence Stations, and adequate parking at stations.

Traffic
Some respondents expressed concerns that the transitway buses would cause an increase in car traffic problems.

Other
Numerous other suggestions and concerns were provided by respondents including walking distance to stations, opposition to transit oriented development, signage displays, adjacent land uses, other rapid transit routes within the City and project timing.

2.6 Follow-up Adjacent Residents Meetings

At the request of the Public Works Standing Policy Committee of City of Winnipeg Council, the project team arranged for follow-up meetings with residents living directly adjacent to the transitway corridor south of Bishop Grandin Boulevard,
where it is proposed for the CN Letellier rail line to be relocated westerly. The intent was to provide this group with any updated information relevant to the proposed rail relocation. Two meetings were held, one at 5PM on June 23, 2914 and a second at 7PM on June 23, 2014. Approximately 35 people attended the meetings.

Project representatives provided an overview of the project (primarily for those participants that had not participated to date) and also provided current information with respect to the rail relocation aspect of the proposed project, including:

- Updated information concerning a planned noise retention wall, including likely anticipated location, construction style, and height
- Updated information concerning existing and anticipated noise and vibration, including supporting material to suggest that anticipated rail vibration is likely to decrease rather than increase as a result of the proposed works

Participants indicated appreciation for the additional information. A number of participants indicated on-going concern about the ability to determine whether, post construction, there would be a way of determining whether the constructed works were having an impact on their residences (i.e. potential damage due to vibration and potential disruption due to increased noise)

Meeting notes and display materials are provided in Appendix K and Appendix L respectively.

3.0 Issues and Responses

This section provides a summary of issues, concerns and ideas raised by stakeholders and the responses to each of these by the project team.

<table>
<thead>
<tr>
<th>#</th>
<th>ISSUE</th>
<th>RESPONSE</th>
</tr>
</thead>
</table>
| 1 | Rail Relocation and Mitigation | The study team investigated a number of measures to mitigate this concern, including:  
- Reducing the distance the rail line would be moved closer, from 25’ to approximately 18’;  
- The construction of a noise retention wall along the west limit of the rail right-of-way. Style and location is to be determined;  
- The construction of new rail bed (ballast) – CN confirms that new ballast should reduce the actual experienced vibration;  
- New construction will use ‘seamless rail’ techniques to reduce noise and vibration due to train wheels passing over rail joints.  
It is likely that all of these measures can be implemented. |
| 2 | Parker Lands | The selected route for the transitway project cannot avoid the Parker Lands. There are certain treed areas that the transitway can avoid, however at the east end of these lands, there is very little flexibility as to where the transitway can be routed. The constraints of the existing rail lines coupled with the configuration of the existing Jubilee underpass combine to reduce the available options. This is complicated by long term plans from the Water and Waste Department of the City of Winnipeg to locate a large water retention facility north of the proposed transitway and at the east end of the Parker Lands. The balance of the Parker Lands towards the west end are privately held. These lands would have to be purchased or expropriated in order to establish them for public purposes. This would be an undertaking not related to the transitway project. |
### # ISSUE

<table>
<thead>
<tr>
<th>#</th>
<th>ISSUE</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Parker/Hurst Connection and the Beaumont Underpass</td>
<td>The study team provided cross section drawings that illustrated the actual separation distance between the proposed transitway and the homes in question. The separation distance is substantial. The team helped homeowners understand that property values are actually more likely to increase than decrease, or in the worst case remain stable. The team indicated that landscape planting will be provided along the proposed active transportation pathway which would meander adjacent to or near the rear lot lines of these homes.</td>
</tr>
<tr>
<td>4</td>
<td>Impact to Leased Areas within the existing Hydro Corridor Lands</td>
<td>The study team worked carefully to identify the existing leased areas and to look for opportunities to reconfigure built works in a manner that resulted an equivalent option in each case.</td>
</tr>
<tr>
<td>5</td>
<td>French Street Reconfiguration</td>
<td>The study team prepared a design option that will reconfigure the lane access such that industrial/commercial vehicles can still easily turn around within the subdivision area. Private lands are required to make the changes.</td>
</tr>
<tr>
<td>6</td>
<td>University of Manitoba Access</td>
<td>The study team examined a previously unidentified alternative for accessing the University of Manitoba lands on Southpark Avenue. The team discussed this option with directly affected stakeholders (Markham interests, Southpark property owners, University of Manitoba, etc.). The option was generally favourably looked upon and the plans modified accordingly.</td>
</tr>
<tr>
<td>7</td>
<td>Multi-family Parking and Access</td>
<td>The study team redesigned the affected parking areas in an effort to create a ‘no net loss’ of parking for each owner.</td>
</tr>
</tbody>
</table>

### # ISSUE

<table>
<thead>
<tr>
<th>#</th>
<th>ISSUE</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Proximity of Homes to Transitway</td>
<td>Some homeowners with homes directly adjacent to the existing hydro corridor (north of Bishop Grandin) expressed concern about noise, pollution and loss of property value that they felt would result from the transitway construction.</td>
</tr>
</tbody>
</table>
| 10 | Active Transportation Pathways | Many participants wished to see AT paths along the length of the transitway route, as well as good connections to other existing or proposed pathways. Participants were also looking for grade separations at key locations. The study team undertook a major planning effort together with participating stakeholders to develop and modify initial plans to create a functional, connected, and grade separated (in certain locations) pathway system. Specific noteworthy changes included:  
- Sidewalks and multi-use pathways connecting to existing multi-use pathways and sidewalks in adjacent neighbourhoods were added.  
- Seating areas were added to reduce spacing to approximately 200m (including seating at stations)  
- Grade separated crossings with the transitway were indicated for Pembina, McGillivray & Bishop Grandin  
- Connection to multi-use pathway in the Stage 1 Southwest Transitway to be provided  
- Potential connection to Buffalo Place was confirmed.  
<p>|</p>
<table>
<thead>
<tr>
<th>#</th>
<th>ISSUE</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Stations</td>
<td>Participants were interested in knowing where stations would be located and in the design of the stations. Particular design concerns included the desire for heated shelters, accessibility for vision and mobility impaired individuals, schedule information, and bicycle parking and storage. The study team examined the number and locations of the stations and made changes accordingly, including elimination of one station in the Parker Lands area. Other suggestions for station modifications for increased accessibility will be addressed at the detailed design stage.</td>
</tr>
</tbody>
</table>
| 12 | University of Manitoba and Investors Group Field Station Planning    | At the time of writing the U of M was undertaking a planning process for the development of the Southwood Lands, which the transitway is proposed to pass through. The specific location of the transitway and the U of M stations need to be coordinated through to the Detailed Design stage. The IGF, located on the U of M lands, will also require a fairly large station to accommodate the events that occur throughout the year. Both the transitway plans and the U of M development plans need to be carefully considered to create a plan that works for all interests. The study team worked carefully with both the U of M and the IGF towards design solutions that will work for all parties. Due to the lag time between the two projects collaborative, planning efforts were still underway at the time of writing. A number of significant items were agreed upon including:  
- The location of the transitway from Pembina Highway (at Southpark)  
- A substantial portion of the transitway through the Southwood Lands would be dedicated to transit only  
- A substantial station area for bus staging would be accommodated in part along the north side of the IGF stadium.  
- During ‘non-event’ days buses would make use of the transitway passing along the north side of the stadium  
- In conjunction with the University’s ongoing campus planning, transit routings and stops may be adjusted as necessary to ensure that excellent transit access to the Fort Garry campus is maintained. |
| 13 | Park and Ride                                                        | Participants indicated that park and ride facilities would be an important asset for the success of the transitway. Some participants were concerned that the park and ride stations would attract unwanted on-street parking on adjacent residential streets. The study team identified two large park and ride locations and initiated a preliminary design of these areas to determine appropriate site access and circulation and to understand the volume of cars that could be accommodated in each area. The draft plans include these park and ride areas in the Functional Design and cost estimates. Detailed design of the park and ride locations will take place at the Detailed Design stage. The park and ride locations will be of sufficient size to accommodate a large number of commuting riders. |

<table>
<thead>
<tr>
<th>#</th>
<th>ISSUE</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Bus Routing</td>
<td>Many participants wanted information concerning proposed bus route changes, and also provided suggestions for bus routes changes. Of particular interest was the desire to increase regular service along Pembina Highway. Winnipeg Transit will consider all the routing suggestions carefully, particularly the request to provide increased service on Pembina Highway. Routes will be adjusted at the project implementation stage.</td>
</tr>
<tr>
<td>15</td>
<td>Dog Park</td>
<td>Participants did not want to lose the existing dog park as result of the transitway. The study team identified a new location for the dog park that is in the immediate vicinity of the existing dog park and of a similar size. The new location will provide an opportunity to improve vehicular access, signage and fencing. These details will be addressed during the Detailed Design stage of the project.</td>
</tr>
<tr>
<td>16</td>
<td>Land Acquisition</td>
<td>There are a number of private land parcels that are required for the transitway project. The study team discussed potential land acquisitions with each affected landowner. Owners understood the project requirements and the reasons for the acquisition. Acquisition will not occur until City Council approves the project for construction. Landowners will be appropriately compensated either by negotiation or through expropriation procedures.</td>
</tr>
<tr>
<td>17</td>
<td>Due Diligence</td>
<td>Some participants expected further due diligence to be carried out concerning overall costs, ridership, speed of service, environmental impacts and frequency of service. The City of Winnipeg and Winnipeg Transit are comfortable that sufficient due diligence with respect to cost, ridership and frequency of service has taken place to support Stage 2 of the rapid transit system in southwest Winnipeg. An environmental impact assessment was being undertaken at the time of writing and would follow appropriate channels of authority.</td>
</tr>
<tr>
<td>18</td>
<td>Process</td>
<td>Some participants felt that the information provided was insufficient and already decided upon. The study team provided information at a level of detail that is appropriate for a Functional Design study. Further project details will be determined at the next project stage of</td>
</tr>
</tbody>
</table>
Detailed Design. The major decision to pursue a Functional Design for the transitway along this route was made by Winnipeg City Council, however the Functional Design itself was flexible with respect to many factors such as those that are highlighted elsewhere in this table.

<table>
<thead>
<tr>
<th>#</th>
<th>ISSUE</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Safety</td>
<td>The Functional Design includes safety as an important factor when considering issues such as pedestrian movement, width of pavement, barriers and warning systems. All of these issues will need to satisfy safety regulations and guidelines through the Detailed Design and Construction stages of the project.</td>
</tr>
<tr>
<td>19</td>
<td>Traffic</td>
<td>The study team has designed the transitway to minimize interaction between the transitway and the existing road system. Major intersections will be grade-separated. Minor at-grade intersections will be transit-priority signalized. Even at peak times, only one bus will pass through these intersections once every three minutes, which will not be a cause for significant traffic interruption.</td>
</tr>
</tbody>
</table>

### 4.0 Next Steps
The project team has incorporating feedback from respondents wherever feasible into the functional design planning for the Stage 2 transitway. The project team will continue to communicate with stakeholders while the funding is being pursued and prior to (and during) the construction period.

### Appendix A
Notification materials (Sample)
Appendix A – Sample Notification Materials

YOU ARE INVITED:

SOUTHWEST TRANSITWAY PROJECT
PUBLIC INFORMATION SESSION

Drop in anytime:  
Venue: 
3:30 to 5:30PM Monday, November 18
7:00 to 9:00PM Monday, November 18
1824 Pembina Hwy.
3:30 to 5:30PM Tuesday, November 19
7:00 to 9:00PM Tuesday, November 19

Winnipeg’s City Council recently approved the alignment for the extension of the Southwest Transitway from Jubilee Avenue to the University of Manitoba. This alignment will bring the transitway west and south, creating new opportunities for transit-oriented development (TOD) and extending rapid transit service to existing and new neighbourhoods in the southwest part of the city.

As part of the design of the project, areas for TODs are being identified. The project team is currently identifying potential TOD opportunities and constraints. Please attend the open house for more information about the project and to provide us with input on such topics as station sites, active transportation pathways, transit routes, and other considerations for TODs.

For more information please contact:
Donovan Towes
Landmark Planning & Design Inc.
Winnipeg, MB R3B 0G5
204-453-8008

Project website:
Appendix B

Stakeholder Meeting Notes
Appendix C

Adjacent Residents and Businesses Flipchart Meeting Notes

October 28, 2013 - Evening Session

Issues/Comments:

- Larger city/corporate interests on the back of individuals.
- Will people use it?
- Cost?
- Vibration/dust/lights.
- Can it be moved westerly?
- Berm/sound attenuation.
- Station to ‘fit community’.
- Timing?
- Concern regarding bridge at McGillivray mitigation.
- Wildlife (EA).

Questions:

1. How will the corridor handle snow drifts, particularly on Hydro and Parker Lands?
2. Why did the “dog leg” corridor route get chosen? Why not the rail line alignment?
3. Are noise abatement features (walls, fences, etc) going to be included, particularly along the rail line?
4. Will there be a rapid transit station at Bison Drive?
5. Can corridor be moved as far west as possible by industrial park in hydro corridor?
6. Where will the park and ride lots be?
7. Will there be mitigation for impacted landowners? Particularly by grade separated crossing at McGillivray?
8. What will the noise wall look like? Height? Design?
9. How will dust/particulates be handled?
10. How close will the corridor be to Parker Ave?
11. Is the corridor designed with LRT in mind (upgrade at a future date)?
12. Can drawings/cross sections be provided showing hydro towers, gas, rapid transit?
13. What happens if we don’t get the funding?

October 29, 2013 - Afternoon Session

Issues/Comments:

- Rationale for bump out.
- Existing routes.
- Noise/vibration (fencing buffer, asphalt? rubber?).
Appendix C - Adjacent Residents and Businesses Flipchart Notes

Questions:

1. How do we get to the stations?
2. What about noise & vibration? How will this be mitigated?
3. What about property values? Will they go down?
4. What about the forest and wetlands in the Parker Lands area?
5. Why can’t the corridor go down the rail line?
6. How will the corridor cross Pembina?
7. Why is the corridor proposed to cross Pembina at Markham?
8. How close will the corridor be to Parker Avenue residents?
9. Will the corridor include rubber in pavement to reduce noise?
10. Until what time will the buses run on the corridor?
11. Would fencing/noise abatement walls be built where rail line is being moved?
12. How will privacy be addressed for those homes adjacent to the corridor?
13. Will park and ride lots be provided along the route?
14. Will a park and ride lot be provided at Markham at the corridor?

October 29, 2013 - Evening Session

Issues/Comments:

- P&R.
- Intersection configurations.
- Acquisition.
- Rail relocation/speeds vs. vibration.
- Pedestrians crossing main line.
- Community gardens.
- Timing.
- Compensation/buyout.
- Hurst Eay/Parker connection.
- Wall height.
- Rail construction techniques.
- Vibration mitigation.
- Capital costs of buses, diesel, etc.

November 4, 2013 - Afternoon Session

Issues/Comments:

- Letellier option rational.
- Routes (McGillivray/rail, additional?)
- Limiting distances (houses).
- Mitigation (walls), privacy.
- Park and ride ‘spillover’.
- People accessing industrial buildings for work.
- Parking problems.
- Using pathways for cars.
- Environmental reviews (wildlife, emissions, contamination?).
Appendix C – Adjacent Residents and Businesses Flipchart Notes

Questions:

1. How close will the rail tracks be to the property lines? Any regulations dealing with this?
2. How will people on Pembina Highway get to the stations?
3. How will you keep people from parking in the neighborhood to take RT?
4. How will the corridor be designed to avoid vehicles on AT/ped paths?
5. Are there any plans for noise mitigation measures, such as walls, berms, fences, etc.?
6. What about wildlife and natural area? How will this be addressed?
7. What will happen to the old Public Works yard site on Markham? Park and ride lot?
8. What is the noise comparison between buses and trains?
9. How will this affect property lines?
10. What would the construction schedule be? When would the RT corridor be operational?
11. Would commercial development occur along the RT line in existing residential areas?
12. What will happen with the dog park? How will this be addressed?

November 5, 2013 - Morning Session

Issues/Comments:

- New routes? (160?)
- Could BRT become LRT?
- Safety barriers? Fencing? Noise?
- Timing.

Questions:

1. Would there be new transit routes? Would service continue on Pembina Highway?
2. What about LRT? Is the RT corridor designed with this in mind?
3. How many buses would on the RT corridor? How often?
4. How will the RT be enclosed to keep children and people out and safe?
5. Is the RT corridor alignment “set”? Will other corridors be examined?
6. Will copies of the materials from the meetings be made available?
7. Is there more info on station locations, design, etc?
8. How long is the route?
9. When would construction start? When would the line be operational?
10. What will be the impacts of the RT corridor on lanes and parking to the east of the rail line?

November 5, 2013 - University of Manitoba Neighbourhood Network

This meeting was hosted by the University of Manitoba. It is an existing organized group that meets regularly with the University to discuss development on or near the University Campus.

34 neighbours attended together with three University representatives and three members of the design team responsible for planning/designing the University southwood lands site.

Questions:

1. Why access U of M at Markham?
2. How will the RT corridor be designed on Markham (ie. on street low speed, high speed busway)
3. Why will it take until 2019 to open? Why not faster?
4. Will there still be vehicular access via Markham for condos/residents?
5. How will buffering/screening of Markham condos be addressed?
6. Can there be separate roads for vehicles and transit at Markham?
7. Will there be a BRT stop at Markham and Pembina? Would like to avoid stops due to noise, disturbance, etc.
8. How will noise be mitigated?
9. How will snow be dealt with? Clearing?
10. How will pedestrians and bikes be accommodated? What about AT and existing pathways be connected?
11. How far into the campus is the RT planned to go?
12. What vehicles will be allowed on the RT corridor? Just transit vehicles?
13. How will RT corridor planning be integrated with planning of UofM Southwood lands?

November 6, 2013 - Evening Session

Issues/Comments:

- Why Markham?
- Noise/vibration.

Questions:

1. Would there be new transit routes? Would service continue on Pembina Highway?
2. What about LRT? Is the RT corridor designed with this in mind?
3. How many buses would on the RT corridor? How often?
4. How will the RT be enclosed to keep children and people out and safe?
- Why is the rail being relocated to the west?
- Train speeds/safety/light.
- Drainage/smell.
- What about property value?
- Cost? Is it worthwhile?
- Type of wall?
- Lost bus routes?
- Isn’t it too ambitious?
- Is it safe?
- How frequent are buses?
- Who will be responsible for damage?
- Why not the other side?
- Soil investigation?

Questions:

1. Are the train tracks moving closer to homes from the RT corridor? Why and how can this be avoided?
2. What about mitigation measures for noise and vibrations; both from rail and RT corridor? Walls, fences, berms?
3. What about train speeds? Will they slow down?
4. What about property values and the rail and RT corridor? How will this impact us?
5. What about drainage in the rail corridor? This needs to be improved.
6. What about the smell of the buses - what will be done about the fumes?
7. What will the noise mitigation walls look like? What will the design look like?
8. What about light trespass from the stations and the RT corridor to houses?
9. How will pedestrians move to and from the stations without going through backyards?
10. What about potential train derailments and moving the rail closer to homes to make room for RT corridor?
11. What about vibration and property damage due to construction, rail operations and RT operations? Who is responsible?
12. Who pays for the cost of relocating the rail line and cost of RT corridor construction?
[Meeting notes available on request]

Appendix E

Round 2 Open House Display Materials
Appendix E - Round 2 Open House Display Materials

**SOUTHWEST TRANSITWAY (STAGE 2) PUBLIC OPEN HOUSE**
Monday, November 18, 2013 3:30 to 5:30PM and 7:00 to 9:00PM
Tuesday, November 19, 2013 3:30 to 5:30PM and 7:00 to 9:00PM

- Welcome to the Southwest Transitway (Stage 2) Open House Meeting
- While the general routing for the Transitway has been determined, the precise alignment and other project details are being worked out.
- This Open House is being held to provide project information about this project and to ask for your input concerning items such as station sites, bus routing, active transportation, property or other impacts and mitigation.
- Project Representatives are available to answer questions or discuss issues or concerns with you.
- Follow up public Open Houses are planned for January 2014.

**WHAT IS BUS RAPID TRANSIT?**

- Bus Rapid Transit (BRT) is a very popular form of rapid transit implemented throughout the world. BRT uses specific transit-only roadways, called "Transitways" that transit vehicles use to operate at high speeds, away from traffic congestion.
- BRT vehicles are standard-sized rubber-tired vehicles that can operate on and off the Transitway, using the regular street system to pick up passengers, then travel at high speeds on the Transitway to major destinations. When operating on-street, BRT vehicles take advantage of transit priority measures already built, such as diamond lanes, transit signal priority lights, and the Graham Transit Hall.
- A number of transit routes use the Transitway, with buses exiting heading at either end of the Transitway at intermediate points. This permits operation of a very flexible route network, which minimizes the need to transfer, providing a one-seat trip for a majority of passengers.
- The BRT systems have the following features:
  - Transitways - exclusive to transit vehicles for high-speed service
  - High-frequency service throughout the day
  - Rapid Transit Stations along the Transitway
  - Modern state-of-the-art buses with air-conditioning and other passenger amenities
  - Electronic real-time passenger information systems (such as GPS tracking, on-board "next stop" displays, and electronic "next bus" displays at stops)
  - Traffic signal priority at intersections

**WHAT IS THE PURPOSE OF THE PROJECT?**

- Stage 1 of the Southwest Transitway was opened in April 2012 and is currently in operation from Downtown to Pembina and Jubilee. Stage 2 will run from Pembina and Jubilee south to Booth Drive.
- Winnipeg City Council has selected this alignment for the Transitway.
- The main objective of the study team is to prepare a "Functional Design" for the Transitway in order to prepare a cost estimate that can be included in a submission for project funding to the federal government.
- The Functional Design must consider many variables including existing constraints within the corridor, impacts and benefits to stakeholders and cost.

**WHAT PUBLIC AND STAKEHOLDER CONSULTATION IS TAKING PLACE?**

- We have been speaking with numerous stakeholder groups early in our process to identify specific Transitway issues.
- This Open House meeting is similar in that we are asking for your opinions on the Transitway. The list of stakeholder meetings is displayed to the right.
- Over the next few months we will review our engineering and stakeholder information and prepare a draft of the Functional Design, we will then hold further public meetings to ask for your input on the transitway functional design.
Appendix E – Round 2 Open House Display Materials

**CONSTRANTS**

- In order to prepare the functional design, it is important that we understand all of the constraints we face.
- Constraints include things like existing infrastructure, roads, rail lines, transmission towers, underground pipes, and property lines. Constraints can also include property ownership, land leases, and neighborhood property impacts.
- All of these factors need to be considered in preparing a functional design.

**STATIONS**

- Stations will be located at strategic points along the transitway.
- The number and design of these stations is necessary to maximize ridership and efficiency. The final number and location of stations will be evaluated during Round 3 of the engagement process.
- The stations will vary in terms of their size.

**CROSS SECTIONS**

- These three cross sections illustrate the potential location of the bus transitway in relation to other features within the corridor such as transmission towers, underground utilities, property lines and adjacent structures.

**RAPID TRANSIT ROUTES**

- The transitway will be used by the existing rapid transit routes in the southwest quadrant of the city as well as potential new rapid transit routes.
- A high level of transit service will be maintained on Wekamp Highway along the bus rapid transit service and the 401 rapid transit service.
- The map below illustrates a conceptual rapid transit route network for the southwest corridor.
**ACTIVE TRANSPORTATION (AT)**

- The project design will include walking and cycling paths and connections to the existing pedestrian/bicycle network along the route.
- The drawing below illustrates existing and potential pedestrian and bicycle facilities.

---

**NEXT STEPS**

- Over the next two months we will collate all of the information we have collected to date and prepare a draft Functional Design for the transitway.
- We will hold another public meeting in January to share the draft Functional Design with stakeholders and listen to feedback.
- We will then revise the draft Functional Design and prepare a cost estimate for submission to the federal government.

Thank you for attending this event – your feedback is valuable to us.

For more information please contact:
Donovan Toews, MOP
Landmark Planning & Design Inc.
dtoews@landmark.info
204-433-8008

These display boards are available on the Winnipeg Transit website: [www.winnipegt.com](http://www.winnipegt.com).
Appendix G

Round 1 Open House Respondent Comments

Raw Data
Appendix G – Round 1 Open House Respondent Comments – Raw Data

<table>
<thead>
<tr>
<th>Coding Interests</th>
<th>Coding Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active Transportation</strong></td>
<td><strong>Costs</strong></td>
</tr>
<tr>
<td>I'm a cyclist and transit rider</td>
<td>The amount of infrastructure required may prove more costly than the Lettellier or Pembina option</td>
</tr>
<tr>
<td>I am an active cyclist and transit rider</td>
<td>This plan too convoluted and too expensive and too much away from population on Pembina Hwy.</td>
</tr>
<tr>
<td>I use AT daily</td>
<td>Money - every major city project lately has exceeded its budget significantly. How can we prevent this with this project?</td>
</tr>
<tr>
<td>Location of AT for cycling</td>
<td>Cost to the public</td>
</tr>
<tr>
<td>Cycle year around, need a alternative to Pembina. Bike path from Bison Dr to Chevier must be separate from transit and plowed regularly</td>
<td>The cost to taxpayers</td>
</tr>
<tr>
<td>I use AT as a primary method of travel</td>
<td><strong>Dog Park</strong></td>
</tr>
<tr>
<td>Pembina underpass is one of the scariest places to bike in town. Looking forward to improvement.</td>
<td>Preserving the dog park</td>
</tr>
<tr>
<td>Active transportation, bike paths</td>
<td>Dog park</td>
</tr>
<tr>
<td>Cycling/walking should be viable transportation options</td>
<td>Find a nearby alternative to the Parker Dog Park</td>
</tr>
<tr>
<td>AT improvements relating to the project</td>
<td>I live right beside Pembina/Windermere; you're going to kill our dog park.</td>
</tr>
<tr>
<td>I work nearby</td>
<td>Dog Park</td>
</tr>
<tr>
<td>Use bike &amp; walking trails in the area</td>
<td>I go to the dog park EVERYDAY.</td>
</tr>
<tr>
<td>Absence of cycling route along Pembina connecting to Jubilee path</td>
<td><strong>Due Diligence</strong></td>
</tr>
<tr>
<td>People who use AT frequently are short changed</td>
<td>I'm interested because there are flaws in projected costs of Phase 1</td>
</tr>
<tr>
<td>A lot of Winnipeg AT infrastructure poorly deals with places where it interfaces with roads, sidewalks, etc... I hope it will be done well this time.</td>
<td>There is a lack of transit ridership statistics and research to support the forecasted ridership anticipated from southwest suburbs.</td>
</tr>
<tr>
<td>Cyclists should not have to travel miles out of their way to reach their destinations. Following the route phase 2 takes does not address problems on Pembina HWY.</td>
<td>Concern about lack of environmental study RE: Parker lands. Who does this benefit? Let's see the study to show this going to truly increase transit ridership.</td>
</tr>
<tr>
<td>I often cycle in the area being changed</td>
<td>Lack of studies too many unanswered questions regarding development.</td>
</tr>
<tr>
<td>AT is important to us</td>
<td>Review route alignment with respect to Hydro fibre cables</td>
</tr>
<tr>
<td>Bike form &quot;Planets&quot; to Ray Fennel Park</td>
<td><strong>General Impacts</strong></td>
</tr>
<tr>
<td>Cycling paths are very important, especially connection to GF and U of M from SW neighbourhood.</td>
<td>Because it is going to disrupt my neighborhood</td>
</tr>
<tr>
<td>Interested in AT improvements</td>
<td>TOD is too risky to depend upon its success</td>
</tr>
<tr>
<td>The existing RT was poorly planned in relation to AT.</td>
<td>It will impact our children's safety (biking across the bus path at intersections)</td>
</tr>
<tr>
<td>Need to improve bike/pedestrian interception at lane stops along Pembina.</td>
<td>This will affect my life. If we chose the location because there was no transit route on the street and a quiet back yard. Gone, quiet gone!</td>
</tr>
<tr>
<td>People who do the planning don't use AT and should listen to those who do.</td>
<td><strong>General Interests</strong></td>
</tr>
<tr>
<td>Pedestrians passing through our site on N &amp; S side</td>
<td>As a citizen to inform myself</td>
</tr>
<tr>
<td>I support active transpiration</td>
<td>Interested to see that resources are used in the best way</td>
</tr>
<tr>
<td>Concerned about a tax dollar</td>
<td>Just to stay informed and understand what will be built</td>
</tr>
<tr>
<td>As overburdened City of WPG taxpayer, wasting money on over budgeted projects including existing transitways</td>
<td>May be a future user of BRT</td>
</tr>
<tr>
<td>Wondering why there is high cost for transit and super transit routes are not adequate?</td>
<td>To understand the City's choice of location</td>
</tr>
<tr>
<td></td>
<td>General interest as a transit user.</td>
</tr>
<tr>
<td></td>
<td>Sustainable transportation field of study in school.</td>
</tr>
</tbody>
</table>
### Appendix G – Round 1 Open House Respondent Comments – Raw Data

#### Coding Interests

<table>
<thead>
<tr>
<th>General Interest</th>
<th>Technical interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Interest</td>
<td>This project affects my community.</td>
</tr>
<tr>
<td>General Interest</td>
<td>Understand active transport plans</td>
</tr>
<tr>
<td>General Interest</td>
<td>It took forever for my children to ride bus from Chareswood to U of M (over 1hr).</td>
</tr>
<tr>
<td>General Interest</td>
<td>Wanted to see new plan.</td>
</tr>
<tr>
<td>General Interest</td>
<td>Interested in City of Winnipeg plans</td>
</tr>
<tr>
<td>General Interest</td>
<td>Generally interested in this topic</td>
</tr>
<tr>
<td>General Interest</td>
<td>Concerned about Winnipeg's development</td>
</tr>
<tr>
<td>General Interest</td>
<td>I'm a student at U of M with a particular interest in planning</td>
</tr>
<tr>
<td>General Interest</td>
<td>Sensible development of southland (U of M property)</td>
</tr>
<tr>
<td>General Opposition</td>
<td>Profit for the few has taken priority over the representation of nature of the many</td>
</tr>
<tr>
<td>General Opposition</td>
<td>Believer in the importance of open network urban spaces</td>
</tr>
<tr>
<td>General Opposition</td>
<td>My children use the bus, why would you take them 2 miles off track?</td>
</tr>
<tr>
<td>General Opposition</td>
<td>There is no reason to have this new project; the service is fine.</td>
</tr>
<tr>
<td>General Opposition</td>
<td>Because it's going to lead to more unwanted development in the neighborhood</td>
</tr>
<tr>
<td>General Opposition</td>
<td>Even though the plan view the absurdity of this proposal is grossly evident</td>
</tr>
<tr>
<td>General Opposition</td>
<td>Because it impacts on the future of Winnipeg</td>
</tr>
<tr>
<td>General Support</td>
<td>Was supportive of the project since it began 10 years ago</td>
</tr>
<tr>
<td>General Support</td>
<td>Progressive move to hopefully reduce the amount of vehicular congestion in the South.</td>
</tr>
<tr>
<td>General Support</td>
<td>Interested in sustainable transportation. – Like near &quot;for Rouge Yards&quot; which the success of in some way is hinged to this expansion.</td>
</tr>
<tr>
<td>General Support</td>
<td>Rapid transit is needed</td>
</tr>
<tr>
<td>General Support</td>
<td>Want to see a comprehensive RT</td>
</tr>
<tr>
<td>General Support</td>
<td>Love the 1st stage of Rapid Transit.</td>
</tr>
<tr>
<td>General Support</td>
<td>Want to see bus transit improved.</td>
</tr>
<tr>
<td>General Support</td>
<td>About time we have proper public transportation</td>
</tr>
<tr>
<td>General Support</td>
<td>Looking forward to a better system since '76</td>
</tr>
<tr>
<td>General Support</td>
<td>I own my Condo suite at Logan on the Red and I take the bus a lot. I like the first phase of RT</td>
</tr>
<tr>
<td>General Support</td>
<td>There is a need to provide a rapid transit option for this City</td>
</tr>
<tr>
<td>General Support</td>
<td>I want to be able to use transit more</td>
</tr>
<tr>
<td>General Support</td>
<td>Rapid Transit is good for the City</td>
</tr>
<tr>
<td>General Support</td>
<td>Faster connection to the U of M and downtown</td>
</tr>
<tr>
<td>General Support</td>
<td>Anything that lightens the traffic on game days</td>
</tr>
<tr>
<td>General Support</td>
<td>Rapid transit is a necessary step forward for the City</td>
</tr>
<tr>
<td>General Support</td>
<td>Need a viable rapid alternative to private vehicles/a rapid alternative for non-car owners</td>
</tr>
</tbody>
</table>

#### Coding Interests

<table>
<thead>
<tr>
<th>General Support</th>
<th>Transportation system must be developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Support</td>
<td>A good transit system is important to the well-being of the entire city and its inhabitants.</td>
</tr>
<tr>
<td>General Support</td>
<td>Transit is critical to the City's future vibrancy</td>
</tr>
<tr>
<td>General Support</td>
<td>RT to U of M is essential</td>
</tr>
<tr>
<td>General Support</td>
<td>We use the current bus a few times a week and find the new rapid transit terrific. I see the need for this expansion; we've used the bus trail by the current rapid transit and love it.</td>
</tr>
<tr>
<td>General Support</td>
<td>Interested in an expanded transit system in Winnipeg</td>
</tr>
<tr>
<td>General Support</td>
<td>Want to see my area grow in a positive way</td>
</tr>
<tr>
<td>General Support</td>
<td>Strategy that works for a larger part of the City from St. Norbert to Tuxedo, St. James to U of M, Transcona to Downtown</td>
</tr>
<tr>
<td>General Support</td>
<td>I want rapid transit to succeed</td>
</tr>
<tr>
<td>General Support</td>
<td>Improve transit in Winnipeg</td>
</tr>
<tr>
<td>General Support</td>
<td>RT is 20 years behind schedule here</td>
</tr>
<tr>
<td>General Support</td>
<td>Wanting the best outcome</td>
</tr>
<tr>
<td>General Support</td>
<td>Rapid transit is key</td>
</tr>
<tr>
<td>General Support</td>
<td>I support a Rapid Transit system</td>
</tr>
<tr>
<td>General Support</td>
<td>Winnipeg needs to be seen as a progressive city, currently is not.</td>
</tr>
<tr>
<td>General Support</td>
<td>Let's do it right - best-in-class design</td>
</tr>
<tr>
<td>General Support</td>
<td>Make the route attractive and get the right type of development</td>
</tr>
<tr>
<td>Lives Close</td>
<td>I live in the area</td>
</tr>
<tr>
<td>Lives Close</td>
<td>Live very close to the new route</td>
</tr>
<tr>
<td>Lives Close</td>
<td>We live directly adjacent to this corridor</td>
</tr>
<tr>
<td>Lives Close</td>
<td>I live by the Corridor</td>
</tr>
<tr>
<td>Lives Close</td>
<td>Residents close to IG stadium</td>
</tr>
<tr>
<td>Lives Close</td>
<td>I work at U of M &amp; live by Osborne</td>
</tr>
<tr>
<td>Lives Close</td>
<td>I live nearby - will use transit &amp; bike connections</td>
</tr>
<tr>
<td>Lives Close</td>
<td>I live close by</td>
</tr>
<tr>
<td>Lives Close</td>
<td>Proximity to where I live and work</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>There will be a decrease in ridership on Pembina which will hurt our business since we supply less expensive (i.e. refurbished) equipment and many of our clients ride.</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Speeding up route by not going by many potential riders along Pembina. This doesn’t make any sense. Planner said McGillivray route was not considered, don’t see why not.</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Would like to see a transitway similar to Calgary &amp; Edmonton (light rail transit)</td>
</tr>
<tr>
<td>Coding</td>
<td>Interests</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>I always thought light rail was the most effective. BUT can see value in the accessibility of the bus routes. I also thought that the Lettelier line would be most efficient. That too has been tampered with.</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>I hoped Transway would be on the alternate Pembina Route</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Rerouting the transit corridor</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Don’t like the dog leg at the beginning. I think you should follow the rail Line from the start.</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Conscious about the decision- making process RE: Routing.</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Develop Pembina more extensively</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Hate where the 2nd stage will be located</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Service along Pembina vs Transway</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Poor route selection</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>Use the existing rail line that parallels with Pembina</td>
</tr>
<tr>
<td>Other RT Options</td>
<td>I had hoped phase 2 would be closer to my home because I would have used it if it was going to shorten my commute. It will pass out community too far West to be much use for us in old Fort Garry.</td>
</tr>
<tr>
<td>Parks/Greenspace</td>
<td>I use the greenspace, I enjoy going there</td>
</tr>
<tr>
<td>Parks/Greenspace</td>
<td>The development of the remaining parks. Save the parks</td>
</tr>
<tr>
<td>Parks/Greenspace</td>
<td>I do not appreciate getting rid of all the green space</td>
</tr>
<tr>
<td>Parks/Greenspace</td>
<td>We need to keep existing greenspace within Winnipeg</td>
</tr>
<tr>
<td>Parks/Greenspace</td>
<td>Protection of green space allowances</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Parker green space is precious</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Protection of the Parker wetlands &amp; forest area</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>I live by Parker Woods</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Destruction of Wetlands</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>I live near the Parker forest &amp; dog park and would like to see them maintained. This route should be along Pembina or the railway tracks not through the forest and green space.</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>The Parker wetlands are an ecologically sensitive area</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>I don’t want the Parker Wetlands destroyed</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>I don’t believe the transit needs to go through the Parker Wetlands.</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>My concern is regarding the rush this project has been handled without proper study of the impacts on the Parker Wetlands and mostly important the interest behind the project (such as Gem equity, etc.). It seems to be more important to spend a little less and destroy our green areas than spend a bit more and consolidate both sides. City/Transit development and citizens interest/ well being</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>To see the Parker Area preserved</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Concerned about Parker Wetlands/ forested areas be preserved as much as possible. We need to save our green spaces. I am concerned about potentials light/noise impact for the area. The increased traffic in the area is also concerning.</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Concerned about forest areas North of Parker</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Would love to see wetlands untouched</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>People can relax there. Preserve nature in mid-city.</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Because it is ruining a green space used by lots of people and animals</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Parker wetlands should be left undisturbed</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Loss of Parker Wetlands and Dog Park is a big negative</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Infrastructure of area cannot support development of Parker lands.</td>
</tr>
<tr>
<td>Parker Lands</td>
<td>Use Parker wetlands for recreation</td>
</tr>
<tr>
<td>Process</td>
<td>Poorly coordinated</td>
</tr>
<tr>
<td>Process</td>
<td>To take pre-emptive action rather than after the fact</td>
</tr>
<tr>
<td>Process</td>
<td>This project is driven by special interest and shady politics</td>
</tr>
<tr>
<td>Process</td>
<td>Hoping the political responses does not delay the project</td>
</tr>
<tr>
<td>Process</td>
<td>When will we find out if there will be anything done to address concerns?</td>
</tr>
<tr>
<td>Process</td>
<td>Don’t have faith in the City Hall bringing this to a positive outcome</td>
</tr>
<tr>
<td>Process</td>
<td>Tired of planning serving (?) instead of vice versa.</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>The timing and congestion to get to the stadium</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>To drive less and use my bike more</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Climate change</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Interested in the City becoming more transit-oriented</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>More efficient transit systems</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Big GHG reduction opportunity (transit, bus, walk)</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Will help develop under-used land</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Access for me as i get older</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Need ways to reduce greenhouse gases</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Transit oriented development increasing urban density</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Need reliable and safe active transport corridors</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>I want to reduce Winnipeg’s dependence on cars</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Faster route to downtown area</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Only RT will improve auto congestion</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Rapid Transit helps increase density and new developments</td>
</tr>
<tr>
<td>Project Benefits</td>
<td>Only RT will really create vibrant downtown</td>
</tr>
<tr>
<td>Route/Service</td>
<td>I want to know how the plans will affect my commute?</td>
</tr>
<tr>
<td>Route/Service</td>
<td>Bridgewater forest routes</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Pembina Hwy(McGill &amp; Windermere) transit service</td>
</tr>
<tr>
<td>Coding</td>
<td>Interests</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Routing of bus routes</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Loss of service at Pembina and McGillivray</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>I am afraid of losing service, glad to see the 160 will continue on Pembina.</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Location of proposed routes and effect to bus service for morning commutes</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Keep the bus frequency on Pembina since the proposed bus stations are far and Pembina is near.</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>The bus service will be all but destroyed for people who live in that corridor between Osborne and U of M.</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Concerned about access to RT</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Replacing routes</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>As it is the bus routes &amp; schedule to and from HSC do me no good unless I want to be murdered @ MN waiting for a bus. So any changes to bus routes &amp; accessibility do me no favors.</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Wanted to know how service on Pembina would be affected.</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Impacted by the removal of most bus services off of Pembina HWY onto the first phase of Rapid Transit (North of Jubilee)</td>
</tr>
<tr>
<td>Routing/Service</td>
<td>Wondering what the planned frequency of service will be?</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>How will the Transit planned affect my family in regards to traffic volume, noise, expropriation and cost?</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>The railway tracks CN line that is directly behind my house</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>This may lower the cost of real estate due to noise &amp; pollution from the buses</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Impact on my property value</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>I don't want buses rumbling behind my home</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Worried about losing compound space that is required to operate my business</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Vibration damages to my home</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Added vibration causing damage to my property</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Drainage damages to my home</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Water and drainage issues cause by moving tracks</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Increase in noise and vibration from busses, general disruption of a chosen quiet neighborhood</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>I am concerned about flooding in my home</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Impact of noise levels near my house</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Noise from bus route</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Risk of moving train tracks closer to my property</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Noise and safety issues caused by moving train closer to property line</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Concerned about noise, dust &amp; lights. Would like this addressed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coding</th>
<th>Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Impacts</td>
<td>The relocation of the train 25' closer to my yard concerns me for: Noise, vibration, drainage between my yard and the track.</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Interested in turnaround for land adjacent to Chevrier Blvd. and Manahan Rd. (or connection of the two).</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Proximity of train to house</td>
</tr>
<tr>
<td>Specific Impacts</td>
<td>Vibration from train - foundation and other damage</td>
</tr>
<tr>
<td>Stations</td>
<td>Concerned the new stations are not close to shopping</td>
</tr>
<tr>
<td>Stations</td>
<td>Location of stations - close to current address in Ft. Richmond</td>
</tr>
<tr>
<td>Stations</td>
<td>Proximity of stations to industrial area (Clarence)</td>
</tr>
<tr>
<td>Stations</td>
<td>More storage for bikes at stations</td>
</tr>
<tr>
<td>Stations</td>
<td>Concerned the new stations are isolated, would not transfer at night</td>
</tr>
<tr>
<td>Traffic</td>
<td>Concerned the Beaumont overpass &amp; related road upgrades will increase traffic through Beaumont and nearby Streets</td>
</tr>
<tr>
<td>Traffic</td>
<td>Very busy by Windemere and Point Rd going south on Pembina</td>
</tr>
<tr>
<td>Traffic</td>
<td>I am concerned about increased traffic on Beaumont especially with a K-8 school on the street.</td>
</tr>
<tr>
<td>Traffic</td>
<td>Concerned with possible increased traffic and noise in area via Beaumont</td>
</tr>
<tr>
<td>Traffic</td>
<td>Traffic</td>
</tr>
<tr>
<td>Traffic</td>
<td>Traffic has major affect on us</td>
</tr>
<tr>
<td>Traffic</td>
<td>It will impact our daily commute</td>
</tr>
<tr>
<td>Traffic</td>
<td>Feedback on traffic impact near Waverley Heights</td>
</tr>
<tr>
<td>Traffic</td>
<td>The will help alleviate heavy traffic on Pembina</td>
</tr>
<tr>
<td>Traffic</td>
<td>I drive on Parker Ave all the time</td>
</tr>
<tr>
<td>Traffic</td>
<td>Definitely have grade separation over/under Parker Ave</td>
</tr>
<tr>
<td>Traffic</td>
<td>Are you going to build overpasses on all major roadways?</td>
</tr>
<tr>
<td>User</td>
<td>I use BRT</td>
</tr>
<tr>
<td>User</td>
<td>This is my route to/from work</td>
</tr>
<tr>
<td>User</td>
<td>Plan to use 2nd phase to go to events at IGF and U of M</td>
</tr>
<tr>
<td>User</td>
<td>Transit is my ride</td>
</tr>
<tr>
<td>User</td>
<td>Transit rider</td>
</tr>
<tr>
<td>User</td>
<td>Visit the U of M frequently</td>
</tr>
<tr>
<td>User</td>
<td>I use the bus in the winter</td>
</tr>
<tr>
<td>User</td>
<td>I have to use buses regularly</td>
</tr>
<tr>
<td>User</td>
<td>Avid user of transitway already in place</td>
</tr>
<tr>
<td>Other</td>
<td>Want to be engaged in the planning and development phases</td>
</tr>
<tr>
<td>Other</td>
<td>I am co-chair of [WRTC]</td>
</tr>
<tr>
<td>Other</td>
<td>Will our land be required for the construction of the project?</td>
</tr>
<tr>
<td>Other</td>
<td>I spoke at the 1st meeting</td>
</tr>
<tr>
<td>Coding</td>
<td>Interests</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Other</td>
<td>We are considerably behind in getting this done</td>
</tr>
<tr>
<td>Other</td>
<td>Attend U of M</td>
</tr>
<tr>
<td>Other</td>
<td>I'm a tax payer</td>
</tr>
<tr>
<td>Other</td>
<td>Wheelchair access to all stations &amp; pathways, true access not just one</td>
</tr>
<tr>
<td>Other</td>
<td>&quot;cut down&quot; as an afterthought.</td>
</tr>
<tr>
<td>Other</td>
<td>The original project 2011 affected my residence (918 Jubilee)</td>
</tr>
<tr>
<td>Other</td>
<td>Transport Engineering Masters Student</td>
</tr>
<tr>
<td>Other</td>
<td>U of M Student</td>
</tr>
<tr>
<td>Other</td>
<td>I hear once the transit goes up 3000 condos will be built</td>
</tr>
<tr>
<td>Other</td>
<td>There will be no development under the Hydro line to drain the Parker</td>
</tr>
<tr>
<td>Other</td>
<td>lands</td>
</tr>
<tr>
<td>Other</td>
<td>I hear that Katz sold our land and that was once City property!!!</td>
</tr>
</tbody>
</table>

Appendix H

Round 2 Open House Display Boards
Appendix H – Round2 Open House Display Boards

WELCOME!

SOUTHWEST TRANSITWAY (STAGE 2)
PUBLIC OPEN HOUSE

Monday, February 24, 2014: 3:30 to 5:30PM and 7:00 to 9:00PM
Tuesday, February 25, 2014: 3:30 to 5:30PM and 7:00 to 9:00PM

Welcome to the Southwest Transitway (Stage 2) Open House Meeting.
This Open House is being held to provide project information about the draft Functional Design of the Transitway and to ask for your feedback.
Project representatives are available to answer questions or discuss issues or concerns with you.

WHAT IS BUS RAPID TRANSIT?

- Bus Rapid Transit (BRT) is a very popular form of rapid transit implemented throughout the world. BRT uses specific transit-only roadways, called "transitways", that transit vehicles use to operate at high speeds, away from traffic congestion.
- BRT vehicles use state-of-the-art curb-side vehicles that can operate on and off the Transitway, using the regular street system to pick up passengers, then travel at high speeds on the Transitway to major destinations. When operating on-street, BRT vehicles take advantage of transit priority measures already built, such as dedicated lanes, transit signal priority lights, and the Graham Transit Mall.
- A number of transit routes use the Transitway, with buses entering/exiting at either end of the Transitway or at intermediate points. This permits operation of a very flexible route network, which minimizes the need to transfer, providing a one-seat trip for many passengers.
- BRT systems have the following features:
  - Translines - exclusive to transit vehicles for high-speed service
  - High-frequency service throughout the day
  - Rapid Transit Stations along the Transitway
  - Modern state-of-the-art buses with air-conditioning and other passenger amenities
  - Electronic real-time passenger information systems (such as GPS tracking, on-board "next stop" display, and electronic "next bus" display at stations)
  - Transit signal priority at intersections

WHAT IS THE PURPOSE OF THE PROJECT?

- Stage 1 of the Southwest Transitway was opened in April 2012 and is currently in operation from Downtown to Pembina & Jubille.
- Stage 2 of the Transitway is proposed to extend the corridor south to Mohawk Road and to the University of Manitoba.
- Winnipeg City Council has selected the Park-+ Hydro alignment for the Transitway.
- The main objective of the study team is to prepare a Functional Design for the Transitway.
- The Functional Design considers many variables including existing constraints within the corridor, impacts and benefits to stakeholders, and cost.

PROJECT NEED

- Development of a rapid transit system is a key component of the City’s Transportation Master Plan to provide options with a viable alternative to the automobile to reduce road congestion, and to improve accessibility and mobility.
- The Transitway alignment improves several areas of traffic congestion on Pembina Highway (the major arterial in the corridor).
- It also provides additional capacity in the city’s south-central area, which is expected to grow by 20% by 2030.
- The Transitway is essential to realize a more direct route option for road users, reducing traffic demand on the roadway network and to improve the overall performance of the transportation system.
- The Transitway is an important component of the ongoing revitalization of downtown. Rapid transit service operates into the heart of the downtown in very close proximity to major employment, shopping, medical, cultural, and entertainment centers. It creates more pedestrian safety corridors across downtown, offering reduced travel times, and improving lands currently used for surface parking.
- The Transitway has already stimulated new development approvals, including a transit-oriented Live-Ology of more than 2,000 new homes in the Fort Rouge Public Development in the completed Phase 1 Transitway, and two new transit-oriented Phase 2 Transitway, and two new transit-oriented Phase 3 Transitway, all near Downtown Winnipeg and River Heights Stations. Further development is planned in the River Heights, St. James, and Southport Golf Course Lands.
**PROJECT BENEFITS**

- Rapid transit in Winnipeg will shift a higher proportion of urban travel to the transit system by offering higher order service characterized by high speed, high reliability, high frequency, real-time passenger information, modern ITS (Intelligent Transportation Systems) equipment vehicle, a flexible route network, beautiful stations, a high-quality roadway, and a distinct image.
- Net positive socioeconomic impacts include increased mobility, reduced traffic congestion, reduced production of greenhouse gases and other air pollutants, improved access to downtown, and increased opportunities for tourism.
- Transit-Oriented Development (TOD) refers to higher density mixed-use development focused around transit stations that places the priority on pedestrians, cyclists, and transit users.
- Improving the travel time savings of transit relative to automobile travel.
- Efficient public transit enables people without driver’s licenses and those with disabilities to retain their independence by helping them get to shopping, work, and school.
- By helping to make driving a car an option rather than a necessity; rapid transit reduces the need for vehicle parking lots and extensive road widening, helping to keep our City green.
- New active transportation (TR) facilities including new bicycle and pedestrian paths, connects lots to existing paths, covered bike racks and lockers at the stations, and bike and e-bike transit luses.

**ENVIRONMENTAL IMPACT**

As the initial phase of Winnipeg’s rapid transit network, the Sandford’s Transitway provides citizens with a viable alternative to the automobile, thereby reducing road congestion and emissions from automobile use. This provides a significant benefit; the construction and operation of the transitway includes many environmental and sustainability features:

- All station shelters and buildings would use transparent materials to maximize daylight for the stations, hours of daylight in Winnipeg’s climate during winter months, they would be supplemented by heaters powered by renewable hydro power.
- New bicycle and pedestrian paths would be built as part of the project. New paths along the Transitway, bike lanes and modes at all stations, and permanent (right) tracks under the Transitway as part of the city’s overall active transportation network.
- Multi-screen electronic passenger information display would be installed at all stations. This reduces the need to supply and keep current fixed copy service schedule information at the stations.
- Universal design features (designed in collaboration with the City’s Accessibility Committee) could provide ease of use for all passengers for all components of the Transitway, including parks, waiting, stations facilities, signs, and disposal.
- Landscaping at the stations and along the Transitway would make extensive use of native plants and native grasses. These species have a high rate of carbon capture, do not require chemical replacement, and require less maintenance and watering than the native ones.
CROSS SECTIONS

- These cross sections illustrate the proposed location of the bus runningway in relation to other features within the corridor such as existing transmission towers, underground utilities, property lines and adjacent structures.

PARK AND RIDE

- Two Park and Ride sites are proposed on the right, one near Clunies Ross Street and one near Seafarers Avenue.
- These sites will provide convenient Park and Ride access to rapid transit service for both daily commuting and for events at Islington Group Field.
- Protection measures for adjacent residential areas, such as parking areas, have been incorporated into the design measures for the buildings.

STATIONS

- Stations would be located at strategic points along the Transitway.
- The stations would vary in terms of their size.
- These images are examples of what the stations could generally look like.

RAPID TRANSIT ROUTES

- The Transitway would be used by the existing rapid transit routes in the southwest quadrant of the City as well as potential new rapid transit routes.
- A high level of transit service would be maintained on the existing rapid transit routes, including the 606 Pompeian local service and the 163 Rapid Transit service.
- The map below illustrates a conceptual route network for the Southwest Transitway.
Appendix I

Round 2 Open House Comment Sheet

Southwest Transitway
COMMENT SHEET

This comment sheet is being provided following a meeting you have attended. Your feedback will help us improve the project and our public engagement process. Thank you for participating.

1. Please check the answer that most closely describes your interest:
   - [ ] I am a resident that lives directly adjacent to the planned corridor (shared property line)
   - [ ] I am a resident that lives nearby (within 5 blocks)
   - [ ] I am a resident of Winnipeg
   - [ ] I am a business owner/manager of a nearby business (name: ____________________________)
   - [ ] I am part of an organized interest group (name: ____________________________)
   - [ ] Other: ____________________________

2. Did you attend a previous consultation session (open house, stakeholder meeting, adjacent resident's meeting, etc.)?  [ ] Yes  [ ] No

3. Please tell us a way in which you think the functional design can be improved along this alignment, or a way in which your ideas or concerns could be further addressed:

   ________________________________________________________________

   ________________________________________________________________

4. Did you find the staff at this meeting helpful? (check one)

   [ ] Yes  [ ] Somewhat  [ ] No

   Comments: ___________________________________________________

5. Did you find the information provided at this meeting helpful? (check one)

   [ ] Yes  [ ] Somewhat  [ ] No

   Comments: ___________________________________________________

See reverse to provide further comments.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Transportation</td>
<td>Please note that raised area of bike lane is dumb at the Osborne Bus. This area is too high for a person who has a knee replacement, and people on walkers cannot get on the bus. Buses should be able to be lowered. Also, where you have made new wide cement pieces at Plaza Drive [the sidewalk] curves, please make the whole curve to accommodate handicapped people walking with canes and a crosswalk.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Please ensure enforcement and that you have policemen on Pembina Highway so that when people drive on sidewalk they get tickets. The bicycle path should be removed from Pembina before May so that we do not have problems.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Active transportation routes must keep commuting cyclists in mind.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Make sure switchbacks are included to allow Pembina cyclists to access the Full Yards Trail.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Put more bike racks at more bus stops so that all buses using the transitway have bike racks.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Very pleased regarding the proposed active transportation system. We hope the city will remain committed to clearing said paths on a very regular basis (more than has been done this year!!!).</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>There should be a pedestrian crossing between Bison and Dartmouth.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Ensure that active transportation routes are designed to provide a natural, continuous route.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>At Pembina and University Crescent, it should be possible to build a two way cycle trail linking the Bishop Grandin Boulevard across Pembina. Basically, allow a two-way cycle track on the inside of the bike loop and continue to clog the east side of Pembina by cutting into the separate islands and crossing through the last separator island back to the Bishop Grandin Boulevard.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Very pleased that a bike path has been incorporated throughout the corridor.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Would like to see cycling and walking as part of corridor.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Active transportation needs greater separation from buses/trains, especially on bridged areas. Cyclists do not need another unpleasant bike route.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Ensure maximum connectivity to Waverley, Markham, Pembina, and Bishop Grandin, with separate pedestrian and bike crossings.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Are best practices [going] to be applied for active transportation path snow storage? Would be awesome if this was a showcase for winter active transportation infrastructure!</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Add a pedestrian crossing over rail line between Parker and Sobey’s.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>How is active transportation developed to best-in-class for the FULL ROUTE? Great to have nice sections but what routes are most commonly traveled, and are they fully planned (i.e. connections, intersections w/traffic, overpasses)?</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>The improvement to bike paths needs to be done as soon as possible. The Pembina Hwy path stops right near Bishop Grandin overpass.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>I live in the Beaumont area and bicycle to the west towards Waverley. I would like to see a cycling crossing adjacent to the pedestrian crossing at the McCallumway Station as close to Seel as possible and an active transportation route adjacent to the realigned transit way from Beaumont to Waverley.</td>
</tr>
<tr>
<td>Active Transportation</td>
<td>Active Transportation: the Chevrier connection - continue proposed pathway along the proposed transitway. The jog at Chevrier and Hudson is an inconvenience for active transportation commuters and Chevrier is a heavy use, large vehicle route.</td>
</tr>
<tr>
<td>Topic Comment</td>
<td>Topic Comment</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Active Transportation - I like the tunnel under on/off ramps at Jubilee connection.</td>
<td>Active Transportation: Concern for cyclists, is there a way to connect the bike paths along Bishop Grandin to go right onto the proposed path? How do cyclists get from Chancellor onto proposed path?</td>
</tr>
<tr>
<td>Concern for cyclists, is there a way to connect the bike paths along Bishop Grandin to go right onto the proposed path? How do cyclists get from Chancellor onto proposed path?</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>Restore the bicycle trail along Kenaston (on the) south side from White Ridge as soon as possible.</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I love the bike path!!!</td>
<td>I suggest safe bicycle storage.</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I suggest safe bicycle storage.</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I suggest safe bicycle storage.</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I suggest safe bicycle storage.</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
<tr>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
<td>I work downtown and live off Pembina (Nesbitt Bay). I currently have the option of 5 routes - 161, 162, 163, 183, 185. I love the bike path!!!</td>
</tr>
</tbody>
</table>
We need the dog park.

Dog Park

Dog Park issue addressed.

I hope the city, province and Dillon strongly consider maintaining a dog park near where one is currently sited in the Parker Lands. It is a great space to have and is well used. Thank you for the information.

I think keeping green spaces in our city would be the wiser way to go, the Brenda Leipsic Dog Park, green space north of Parker and Dog Park (sadly slated for development), and the Parks along the hydro line. The whole remaining Parker wetlands and remaining Dog Park should be designed as a Public Park/Dog Park.

My concern: the dog park stays.

Make sure city owns property it's being build on. For example, the firehall.

Show a cost of what you have planned out is good the way I see it.

The comment on proposed alignment is an idiotic choice by city officials.

Showing people what is planned is not consultation. What are the stats on ridership for the bus service from Polo Park? If the bus runs fine as is, instead, focus on buses and making more lanes available to the rail tracks.

The functional design appears to have answered our questions we asked in our meeting. It seems to mitigate our concern of moving the rail tracks west. The houses south of Markham, and south of Bison do not have as much space between the rail tracks and my property, after the 9 meter movement of the rail tracks west. This is not a lot of space and creates safety concerns as well as noise concerns. Also unknown is how much impact it may have on my home (foundation, cracks) from being so much closer to the rail tracks.

I have taken the bus from Polo Park almost every day to get to the U of M. The ride was always good. The bus runs fine as is. Instead, focus on buses and making the two lanes already a congested problem during busy times. Just imagine what one lane is like. I remember how it was in 2011 when the traffic backed up to Bishop Grandin for six months. In that period my business dropped 25 percent. We must run this project seven days a week, and 24 hours a day. If we do not provide service as it needs to.

The new design or development along Bishop Grandin/Pembina intersection: ensure city plans are completed in consultation.

Maintain two lanes of traffic northbound on Pembina at all times. This can be accomplished by splitting the southbound lanes to the north. No parking can be allowed on Pembina at any time during construction. A full scope of work with timelines should be provided to the public a minimum of a year prior to the commencement of construction. Constructor penalties should be applied if the contractor fails behind.

I am pleased with all the work and thought put into the plan to minimize the negative effects on our area.

The functional design appears to have answered our questions we asked in our meeting. It seems very well planned. Any questions we asked were answered to our satisfaction.

I greatly prefer the termination of the route at Markham. It seems to make a lot of sense for entering into the University of Manitoba (stadium) and [this plan] incorporates the future development within the old Southwood golf course. This also seems to mitigate my concern of moving the rail tracks west. The houses south of Markham, and south of Bison do not have as much space between the rail tracks and their property line as many of the properties north of Markham. Terminating the route at Bison would impact the houses south of Markham and south of Bison as the tracks need a distance to gradually re-sync. My home is just south of Bison with only roughly 50 feet between my property and the rail tracks would have ended up with roughly only 16 feet of space between the tracks and my property, after the 9 meter movement of the rail tracks west. This is not a lot of space and creates safety concerns as well as noise concerns. Also unknown is how much impact it may have on my home (foundation, cracks) from being so much closer to the rail tracks.

The design is well thought out.

I am pleased with all the work and thought put into the plan to minimize the negative effects on our area.

I feel our tenants will benefit from the transit system to travel downtown.

I greatly prefer the termination of the route at Markham. It seems to make a lot of sense for entering into the University of Manitoba (stadium) and [this plan] incorporates the future development within the old Southwood golf course. This also seems to mitigate my concern of moving the rail tracks west. The houses south of Markham, and south of Bison do not have as much space between the rail tracks and their property line as many of the properties north of Markham. Terminating the route at Bison would impact the houses south of Markham and south of Bison as the tracks need a distance to gradually re-sync. My home is just south of Bison with only roughly 50 feet between my property and the rail tracks would have ended up with roughly only 16 feet of space between the tracks and my property, after the 9 meter movement of the rail tracks west. This is not a lot of space and creates safety concerns as well as noise concerns. Also unknown is how much impact it may have on my home (foundation, cracks) from being so much closer to the rail tracks.

The new design or development along Bishop Grandin/Pembina intersection: ensure city plans are completed in consultation.

I greatly prefer the termination of the route at Markham. It seems to make a lot of sense for entering into the University of Manitoba (stadium) and [this plan] incorporates the future development within the old Southwood golf course. This also seems to mitigate my concern of moving the rail tracks west. The houses south of Markham, and south of Bison do not have as much space between the rail tracks and their property line as many of the properties north of Markham. Terminating the route at Bison would impact the houses south of Markham and south of Bison as the tracks need a distance to gradually re-sync. My home is just south of Bison with only roughly 50 feet between my property and the rail tracks would have ended up with roughly only 16 feet of space between the tracks and my property, after the 9 meter movement of the rail tracks west. This is not a lot of space and creates safety concerns as well as noise concerns. Also unknown is how much impact it may have on my home (foundation, cracks) from being so much closer to the rail tracks.

I greatly prefer the termination of the route at Markham. It seems to make a lot of sense for entering into the University of Manitoba (stadium) and [this plan] incorporates the future development within the old Southwood golf course. This also seems to mitigate my concern of moving the rail tracks west. The houses south of Markham, and south of Bison do not have as much space between the rail tracks and their property line as many of the properties north of Markham. Terminating the route at Bison would impact the houses south of Markham and south of Bison as the tracks need a distance to gradually re-sync. My home is just south of Bison with only roughly 50 feet between my property and the rail tracks would have ended up with roughly only 16 feet of space between the tracks and my property, after the 9 meter movement of the rail tracks west. This is not a lot of space and creates safety concerns as well as noise concerns. Also unknown is how much impact it may have on my home (foundation, cracks) from being so much closer to the rail tracks.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighbourhood Impacts</td>
<td>I would like more thought and consideration brought forward regarding sound barrier north and south Clarence area.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>Anything that can reduce the noise of the buses would be great.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>We have expressed our concerns before but still no plans for a wall or landscaping to address concerns about noise and dirt, if our requests are being dismissed why doesn’t the city pay for privacy fencing on our property? I’m sure it would be much cheaper.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>My major concern is noise. Is there anything that will help noise reduction?</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>I am concerned about noise generated by the buses.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>I have inner ear problems and I’m concerned about vibrations and noise. I just moved to this condo 3 months ago from 1960 St. Mary’s Road due to noise and vibrations issues.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>Will there be some sort of noise analysis or a Noise barrier for residential areas?</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>I would appreciate if planners would be aware that people live along the pathway and value being able to use their decks and backyards without being on public display.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>Please consider parking on residential streets at the Markham end of the Transitway.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>There may be a residential parking concern since that is the end of the actual south end of the transit corridor for those not going to the U of M.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>Being a resident of Gull Lake Road I am really concerned about the vibration of the speeding overloaded train (track) that is being moved 18 to 20 feet towards my house. I am really not impressed with this project.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>At there are reports recently in news railway has breached safety so many times. I am really concerned, after the Quebec incident. Track behind the residence carry loaded tanker cars, speeding many times day in and day out. The vibrations are already affecting the property. And again due to public moment every day I am concerned about security also. I have heard about planning to build a sound distracting wall from the consultant person. Again stopping sunlight and light from east to my property. I am skeptical about no effects to property as railway tracks moves 20 ft closer to property. Regards, a concerned resident. Note: Should have a impact session from railway department also.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>I am concerned about the noise and pollution to my residence. I know I am supposed to comment on this alignment but I don’t think it makes sense. A straight line down Pembina makes sense. And KEEP GREEN SPACE with this alignment. Keep green space.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>The possible development of the Gem Equities Lands north of Parker Avenue will be &quot;land locked&quot; with the current proposed alignment of Bus Rapid Transit, and existing Canadian National Railway at Waverly Street. A more effective connection from these residential lands to the Beaumont community should be facilitated as part of this project with a Grade Separation of a Bus Rapid Transit crossing (over/under) including an Active Transportation facility. The creation of a &quot;T&quot; intersection at Georgia St. will not likely result in a decrease in traffic volumes through the neighborhood and will not likely create effective traffic calming. The traffic circle/roundabout will do much more to improve efficiencies in traffic movement, traffic calming and improve traffic safety.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>Safety of the property when the rail track is relocated near the properties. Vibrations on property feel like earthquake right now. (The vibrations) will increase when moved.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>I like the rail tracks not being moved closer to property south of Markham.</td>
</tr>
<tr>
<td>Neighbourhood Impacts</td>
<td>NOISE: It is significant.</td>
</tr>
<tr>
<td>Other</td>
<td>I feel the extra walking distance to catch the rapid transit bus will be too far for many of the elderly populations of our complex. We have enjoyed having the option of getting the rapid transit bus on Pembina Highway.</td>
</tr>
<tr>
<td>Other</td>
<td>What is the incentive to travel with rapid transit versus the current bus system? To get more votes at the next election from citizens needing a Waverly to transit development. Whose interests is it really serving? We have the answer...Do you? (To) get more votes at the next election from citizens needing a Waverly underpass or you might be voted out.</td>
</tr>
<tr>
<td>Other</td>
<td>Please consider parking on residential streets at the Markham end of the Transitway.</td>
</tr>
<tr>
<td>Other</td>
<td>Make sure that rights of way are left for the extension of Rapid Transit to other areas of southwest Winnipeg.</td>
</tr>
<tr>
<td>Other</td>
<td>Other Highway town houses.</td>
</tr>
<tr>
<td>Other</td>
<td>I think the transit corridor to the Transcona area should be prioritized as the congestion in these areas is becoming unreasonable.</td>
</tr>
<tr>
<td>Other</td>
<td>Suggestion: Before Waverley/Rail grade separation, complete one lower Taylor west of the Markham end of the Transitway.</td>
</tr>
<tr>
<td>Other</td>
<td>One way to improve service is to have the bus run more on Sunday and faster.</td>
</tr>
<tr>
<td>Other</td>
<td>I really like the improved electronic displays that Winnipeg Transit [has implemented]. I also use the mobile site to check times/routes all the time. It works well. Keep it up! As ridership increases I hope that the number of buses increases also, as there is often standing room only on many Pembina buses currently.</td>
</tr>
<tr>
<td>Other</td>
<td>There should be no traffic lights at this is just defeating the whole concept of rapid transit!</td>
</tr>
<tr>
<td>Other</td>
<td>Better synchronized lights by the city along Pembina could make up for the time lost stopping for the rapid transit. It’s not just on Pembina that we will notice an increase in...</td>
</tr>
<tr>
<td>Topic</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Parks</td>
<td>Keep wetlands as natural area.</td>
</tr>
<tr>
<td>Process</td>
<td>Are residents going to be kept up to date in construction?</td>
</tr>
<tr>
<td>Process</td>
<td>Please get the CORRECT FACTS to the people NOT GIVEN the truth by the wetlands group!</td>
</tr>
<tr>
<td>Process</td>
<td>Where are the post it notes for the maps? Don’t you want to visually see where the concerns are?</td>
</tr>
<tr>
<td>Process</td>
<td>I have serious concerns. First, a high percentage of English as a Second Language families will not be able to read and understand the information. As well, they will not voice concerns because they lack the English to articulate their ideas.</td>
</tr>
<tr>
<td>Process</td>
<td>[The plan is] dangerous for kids. [The planned] Bonnycastle school expansion plus increased traffic in our area causes concerns about extra pressured on Waverley Heights.</td>
</tr>
<tr>
<td>Process</td>
<td>The information was clear and concise but lacking in student consideration [for parking lots].</td>
</tr>
<tr>
<td>Process</td>
<td>I just want this project to be completed. It is too much time, just do it.</td>
</tr>
<tr>
<td>Process</td>
<td>This all seems like everything has been planned out. I don’t think any comment or feedback will do much to change any plans. Too bad!</td>
</tr>
<tr>
<td>Process</td>
<td>We should have had rapid transit years ago, before the number of cars increased. Now keep going and make it happen.</td>
</tr>
<tr>
<td>Process</td>
<td>Please put this construction in some priority. Get it done soon. We have been promised this rapid transit for 40+ years.</td>
</tr>
<tr>
<td>Process</td>
<td>There should be two functional design options.</td>
</tr>
<tr>
<td>Process</td>
<td>Please put this construction in some priority. Get it done soon. We have been promised this rapid transit for 40+ years.</td>
</tr>
<tr>
<td>Process</td>
<td>Looks like decision was already made. No community member in attendance is happy here.</td>
</tr>
<tr>
<td>Process</td>
<td>An impact session should be organized by the Canadian National railway also before this plan is implemented.</td>
</tr>
<tr>
<td>Route</td>
<td>[I am] not convinced the dog leg is the best route.</td>
</tr>
<tr>
<td>Route</td>
<td>The southpark road extension further divides natural area of Southwood and under who’s authority? This route accommodates the development of this park land area. It’s just wrong!</td>
</tr>
<tr>
<td>Route</td>
<td><img src="image" alt="process" /> What about private property?</td>
</tr>
<tr>
<td>Route</td>
<td>I am not a fan of this alignment. The functional design is good for this alignment. Thorough work.</td>
</tr>
<tr>
<td>Route</td>
<td>The southpark road extension further divides natural area of Southwood and under who’s authority? This route accommodates the development of this park land area. It’s just wrong!</td>
</tr>
<tr>
<td>Route</td>
<td>The University of Manitoba access addressed.</td>
</tr>
<tr>
<td>Route</td>
<td>Very happy to see the Markham was not chosen as the entrance into the University grounds.</td>
</tr>
<tr>
<td>Route</td>
<td>I am not a fan of this alignment. The functional design is good for this alignment. Thorough work.</td>
</tr>
<tr>
<td>Topic</td>
<td>Comment</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Route</td>
<td>I insist that you report my strong opposition to the Park route, and equally strong support for the original Letellier subdivision route.</td>
</tr>
<tr>
<td>Route</td>
<td>I think the Southpark Drive idea might be better than the Markham.</td>
</tr>
<tr>
<td>Route</td>
<td>My concerns seem to have been addressed as long as it’s kept off Markham.</td>
</tr>
<tr>
<td>Route</td>
<td>The proposed alignment is to serve not the transit riders, but the developers who will stand to benefit. This project should be called a development project, that is really what the maps, boards and talking heads from Dillon, Landmark and the Winnipeg Transit are saying. The rapid transit corridor should be down Letellier line or Pembina Hwy where people are now. By running the rapid transit corridor away from Pembina this will draw business away from Pembina and lower the value of the Pembina Highway strip. This scheme is nothing but a way for Sam Katz to help his development friends, that’s it. This is apparently going to cost $6 million. There is always some unknown costs that will drive the cost up and up and for 7 km it will cost close to $100 million/km. This money could go to other things like road maintenance and looking after the homeless.</td>
</tr>
<tr>
<td>Route</td>
<td>The proposed route is not convenient for accessing commercial but good for getting there.</td>
</tr>
<tr>
<td>Route</td>
<td>It is hard to justify the southwest alignment given it will be bordered by industrial lands, dog park, and park ‘n’ rides. The benefits don’t seem to outweigh the damage to business along Pembina unless there is a lot of ridership from the industrial community.</td>
</tr>
<tr>
<td>Route</td>
<td>I think this is too costly for a bus route, when it is only a 5 day week transportation. Pembina Highway will have poor service as it is now for regular stops.</td>
</tr>
<tr>
<td>Route</td>
<td>My opinion is the railway track along Pembina need to be moved out of the city, the city needs to run along Pembina. You need to eliminate the Parklands dog leg.</td>
</tr>
<tr>
<td>Route</td>
<td>Need to accommodate the future extension of Sterling Lyon to Pembina Highway.</td>
</tr>
<tr>
<td>Route</td>
<td>Change the Parker Route to the route down or beside the railroad track.</td>
</tr>
<tr>
<td>Route</td>
<td>Just make sure the people along University Crescent and Pembina between Phase 1 rapid transit and University Crescent are not screwed.</td>
</tr>
<tr>
<td>Route</td>
<td>This route is only a shorter financial solution for a project that really in the long-term should have been built down a railway right of way. Along Pembina Highway, sometime in the future, the more direct route will prove to be a better solution. More density on the existing route would support the existing population and economy.</td>
</tr>
<tr>
<td>Route</td>
<td>I think the rapid transit line should run along the railway track or have a designated bus lane on Pembina during rush hour traffic.</td>
</tr>
<tr>
<td>Route</td>
<td>If the answer is to respond to “along this alignment” then there is nothing constructive I can provide. If the question included alternative routes than I could provide a more useful opinion.</td>
</tr>
<tr>
<td>Route</td>
<td>Do not put an intersection at South Park Drive, put an overpass “over” Pembina Highway.</td>
</tr>
<tr>
<td>Route</td>
<td>The southpark route between the transitway and Pembina needs improvements and stops.</td>
</tr>
<tr>
<td>Route</td>
<td>I wish to stress the need to get traffic from Waverley and Sterling Lyon to Pembina and the University of Manitoba terminus must serve the vast majority of users, students, and staff, not the stadium. The ecological integrity of Southwood must be preserved. Please provide heated shelters. Transit Oriented Development is great - must follow economic considerations.</td>
</tr>
<tr>
<td>Route</td>
<td>Provide an automatic connection at Sterling Lyon and Waverley to Pembina near Jubilee (reduced residential traffic). The proposed grade separation at Waverley and the</td>
</tr>
<tr>
<td>Topic</td>
<td>Comment</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>Traffic</td>
<td>Still concerned with pedestrian traffic at intersections like at Chancellor (near Bonnycastle school). I still think traffic being stopped by even more lights will back up Pembina even more, when Pembina is already bumper to bumper the majority time in rush hours.</td>
</tr>
<tr>
<td>Traffic</td>
<td>I’m concerned about the extra bus traffic causing delays especially down Pembina due to transit priority signals during peak traffic hours.</td>
</tr>
<tr>
<td>Traffic</td>
<td>I had hoped this project would have included a more ambitious plan to connect John Hurst Way to the Jubilee/Pembina interchange for vehicular traffic. This would have created a “natural” route for traffic. The existing traffic on Beaumont is way too high for a residential neighbourhood. The plans for the second phase of Rapid Transit are to be commended for the various grade separated crossings and active transportation paths - well done.</td>
</tr>
<tr>
<td>Traffic</td>
<td>I think curbing the flow-through traffic through Beaumont is good.</td>
</tr>
<tr>
<td>Traffic</td>
<td>Jubilee underpass must have two lanes of traffic at all times or business will be very negatively impacted. One of the lanes on the southbound side must be used for northbound traffic.</td>
</tr>
</tbody>
</table>

---

**Appendix K**

**Adjacent Residents Follow-up Meeting Notes**
## RECORD OF MEETING

**Title:** Adjacent Residents Follow-up Meeting  
**Date of Meeting:** June 23, 2014  
**Time:** 5:00PM - 6:00PM  
**Location:** Dillon Consulting Offices  

**In Attendance:**  
- Adjacent Home Owners, W. Side Letellier Corridor and South of Bishop Grandin  
- Brendan Salakoh, Dillon Consulting  
- Donovan Toews, Landmark Planning  
- Julia Toews, Landmark Planning  

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Action By</th>
</tr>
</thead>
</table>

### 1. Introductions and Project Overview

Introductions were made and DT explained the reason for meeting:

Some homeowners were still concerned about the rail relocation, so the project team was asked to provide further information.

DT explained that the project team is working to minimize the impact of the project by considering feedback and adjusting the rail relocation accordingly.

DT explained the current and proposed transit pathway, and a cross-section diagram which now included dimensions for clarity. The tracks will now be located 18.7 feet closer to the property line, instead of 25 feet closer as presented earlier. The distance from a house to its rear property line ranges from 54.1 feet to 97.4 feet, such that most homes along the length will be approximately 100 feet from the centre of the newly located rail line.
### 2. General Questions - Impact, Construction

**Q:** The project is being discussed in the news again. Wasn’t council’s decision final?

**A:** While Council has already made the decision to go ahead with this alignment, there are on-going items to discuss as the project moves forward, and council advised the project team to continue ongoing dialogue.

**Q:** How long will construction last?

**A:** Four construction seasons from 2016 to 2019, with a few months of soft training pushing the inservice date to 2020.

**Q:** How many houses are affected?

**A:** Approximately 100 houses are directly adjacent to the Letellier corridor.

**Q:** Was moving the rail line easterly, and building the transit way westerly ever considered?

**A:** Under that scenario, the busses would need to cross the rail line within a tight corridor. An at-grade crossing of the rail line was not suitable/feasible.

**Q:** Are there any rules regarding the distance between rail lines and houses?

**A:** Not for existing houses, although guidelines exist for new subdivisions.

**Q:** Will homes need to be expropriated? Will the City buy my property?

**A:** No land is required from these adjacent properties. City policy only allows for expropriation where land is physically required to make the project viable.

**Q:** Are there plans for Park-and-Ride at the corner of Markham Road and the planned transit way?

**A:** No.

### 3. Specific Questions - Construction Variables

**Q:** Would the hydro distribution lines be moved underground?

**A:** Yes, the hydro distribution lines south of Bishop Grandin (along the letellier corridor) would be relocated underground. Once relocated, the transitway could be constructed.

**Q:** Would a new bridge be built over Bishop Grandin for the rail line?

**A:** Yes, and the existing rail would be modified to accommodate the transitway.

**Q:** Would any South Park Drive apartments be torn down?

**A:** No.

**Q:** South Park Drive acts as a one-way when cars are parked. Often, the snow is not plowed and so the street narrows – is it wide enough to accommodate transit?

**A:** The right-of-way is wide enough, however the pavement must be widened.

**Q:** Would the multi-use path be 4.5 metres wide?

**A:** Yes, shared between cyclists and pedestrians.

### 4. Noise and Vibrations

**Q:** The trains shake the ground currently, at 50 feet away. I am concerned this will amplify if the rail moves closer to my house.

**A:** Relocating the train would create an opportunity to build a new, continuously-welded rail, that would eliminate the seams that cause harsh ‘clicking’ and increased vibration. A new base (ballast) will also be installed. The project team is fairly confident that vibration and noise would be reduced this way.

A video was presented that helped illustrate the difference in noise and vibration levels of a continuously-welded rail and an old rail with seams/joints.
<table>
<thead>
<tr>
<th>5</th>
<th><strong>Noise Wall</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DT explained that the project team is committed to designing, pricing and including a concrete noise attenuation wall in the functional design.</td>
<td></td>
</tr>
<tr>
<td><strong>Q:</strong> How tall would the wall be?</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> The ultimate height has not yet been established, however it would be a minimum of 10 feet.</td>
<td></td>
</tr>
<tr>
<td><strong>Q:</strong> Where would the wall be located?</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> Most likely just past the rear property line of adjacent homes</td>
<td>Someone noted the possible danger of a dead zone between the wall and the existing fences.</td>
</tr>
<tr>
<td><strong>Q:</strong> Would the wall continue south of Markham Road?</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> Yes, it would be extended as far south as the proposed rail relocation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th><strong>Other - Drainage, Risk</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q:</strong> Will inadequate drainage be addressed?</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> Yes. Drainage will be improved as a result of this project.</td>
<td></td>
</tr>
<tr>
<td><strong>Q:</strong> I am concerned that with a closer rail, the risk of damage due to derailment will increase.</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> CN can legally relocate their rail line anywhere within their right-of-way. With a new, improved railbed there would be less swaying of the train itself, which would decrease the likelihood of a derailment.</td>
<td></td>
</tr>
<tr>
<td>Participant comment: Train speeds have been noticeably slower.</td>
<td></td>
</tr>
<tr>
<td><strong>Q:</strong> I am concerned about how my property value would be affected.</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> For existing homeowners, a closer relocation may appear as a devaluation. For a new buyer, a direct bus route and new pedestrian path is likely to be very attractive. DT cited relevant research that illustrates property values generally do not change even with the introduction of adjacent infrastructure such as transmission towers.</td>
<td></td>
</tr>
<tr>
<td><strong>Q:</strong> Will the city be responsible for any loss in market value?</td>
<td></td>
</tr>
<tr>
<td><strong>A:</strong> No, the city does not compensate for loss or perceived loss of property value.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th><strong>Next Steps</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DT advised that attendees could contact Dillon, Landmark or Winnipeg Transit representatives at any time as the project moves forward.</td>
<td></td>
</tr>
</tbody>
</table>

**Recorded by:** Julia Toews  
**June 23, 2014**
### RECORD OF MEETING

**Title:** Adjacent Residents Follow-up Meeting  
**Date of Meeting:** June 23, 2014  
**Time:** 7:00-8:30PM  
**Location:** Dillon Consulting Offices  
**In Attendance:** Adjacent Home Owners, West Side of Letellier Corridor and South of Bishop Grandin  
Brendan Salakoh, Dillon Consulting  
Donovan Toews, Landmark Planning  
Julia Toews, Landmark Planning

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Action By</th>
</tr>
</thead>
</table>
| 1.   | Introductions and Project Overview  
Introductions were made and DT explained the reason for meeting: Some home owners were still concerned about the rail relocation, so the project team was asked to provide further information.  
DT explained that the project team is working to minimize the impact of the rail relocation by considering feedback and adjusting the project accordingly.  
DT explained the current and proposed transit pathway, and a cross-section diagram which now included dimensions for clarity. The tracks will now be located 18.7 feet further west from the existing tracks, instead of 25 feet as presented earlier. The distance from a house to its rear property line ranges from 54.1 feet to 97.4 feet, such that most homes along the length will be approximately 100 feet from the centre of the newly located rail line. | DT to email a copy of meeting notes and a link to cross-section diagram |

### General Questions

Q: How would the relocated rail line cross Bishop Grandin?  
A: A new bridge would be built for the rail line, so that the existing rail bridge could be upgraded to accommodate the transitway.

Q: Where would the transitway cross the rail line?  
A: At a tunnel located just south of Chevrier Boulevard, and at the Wye tracks via two transitway underpasses.

Q: When would construction begin?  
A: Four construction seasons from 2016 to 2019, with a few months of soft training pushing the in service date to 2020.

Q: Would route numbers continue to be on transit busses?  
A: Yes.

Q: How can we stay informed?  
A: You can contact Winnipeg Transit by telephone or continue to visit the Winnipeg Transit website for updates.

### Noise and Vibration

DT addressed the concern about noise and vibrations from train movement including:  
- The railway would be relocated 18.7 feet closer, instead of 25 feet.  
- The new rail would include a new base and would be continuously welded, eliminating seams that currently cause substantial noise and vibration.  
- A concrete noise wall would be constructed to help further mitigate noise impacts.

Q: How can you be sure the vibrations will decrease? Has any data been collected?  
A: Winnipeg Transit has made an educated estimate based on both research and knowledge of current practices. Conducting a pre-inspection of the disturbance levels in each house is being examined as a possible addition to the construction contract requirements.

Q: Describe a noise wall - how close to my property line would it be?  
A: The noise wall would be concrete, and a minimum of 10 feet tall. Distance from the property line is undetermined.
### 4. Noise Wall

A number of residents indicated in the meeting a preference that the noise wall be "wrapped around" at the ends to prevent strangers from accessing the area between the noise wall and their fences. This construction concept would require the wall to be located along the rear property lines of residences so that the side-yard fences could properly tie in to the new wall and that access could be maintained to the existing feedermain that lies just east of the rear property line of the residences.

**Q:** The wall would be 10 feet high?
**A:** That is the minimum requirement, however the height is undetermined at this time. A participant suggested that the noise wall be constructed as deep as possible to help block vibrations.

**Q:** Has a noise wall been constructed before? How can you know it will be effective?
**A:** Noise walls have been constructed in the city of Winnipeg for prior projects and are demonstrated to be effective.

DT played a short video clip demonstrating the difference in sound and vibration between a jointed rail and a continuously welded rail.

Other comments included:
- Vibration and noise disturbances decrease as train speed decreases.
- Concern for possible danger of a dead zone between the wall and the fences of existing residences.
- A noise wall must be constructed if the project proceeds.
- DT clarified there would only be one wall on the west side of the rail corridor.
- Four participants suggested constructing a noise wall right along the property line, so homeowners may use it as a fence.

### 5. Other

**Q:** Will I lose property?
**A:** No.

**Q:** I am concerned about how my property value would be affected.
**A:** For existing homeowners, a closer relocation may appear as devaluation. For a new buyer, a direct bus route and new pedestrian path is likely to be very attractive. Research has demonstrated that homes along similar linear projects showed no change in property value after 10 years.

There was concern about the loss of trees to accommodate the noise wall. DT indicated that the landscape architect on the team will need to take this into consideration.

**Q:** How will access to homes be affected during construction?
**A:** Access must be available to each house throughout construction.

DT clarified that only four bus routes use the transit way, passing every three minutes during peak times.

**Q:** Will electric busses be used?
**A:** Most or all busses will be diesel although Winnipeg Transit is exploring the use of electric buses on the system. There was some concern regarding the smell of diesel fumes.

**Q:** Will there be bright lights along the transitway?
**A:** There will be lighting at stations and lights along the transitway. Station lighting will be "full-cut off" lighting, as to minimize light pollution.

### 6. Next Steps

DT re-iterated project timelines and reminded participants that they can continue to contact Winnipeg Transit or the project team representatives for any updates or questions that arise.

Recorded by: Julia Toews
June 23, 2014
Appendix L

Adjacent Residents Follow-up Meeting Display Materials
Appendix L – Adjacent Residents Follow-up Display Materials