Kanata Light Rail Transit Planning and Environmental Assessment Study

TRANSIT PROJECT ASSESSMENT REPORT

Prepared for:

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ACRONYMS

AAQC	Ambient Air Quality Criteria
ACG	Agency Consultation Group
AIP	Agreement in Principle
ANSI	Area of Natural and Scientific Interest
AOO	Algonquins of Ontario
BCG	Business Consultation Group
BMP	Best Management Practices
BRT	Bus Rapid Transit
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CTC	Canadian Tire Centre
DFO	Department of Fisheries and Oceans
DND	Department of National Defense
EA	Environmental Assessment
EB	East Bound
ECA	Environmental Compliance Approval
ENCG	Environmental Noise Control Guideline
END	Endangered
EPR	Environmental Project Report
ESA	Environmental Site Assessment
ESR	Environmental Study Report
FVS	Flood Vulnerable Structure
GIS	Geographic Information Service
GMP	Greenbelt Master Plan
GP	General Purpose
HADD	Harmful Alteration, Disturbance or Destruction of fish habitat
HOV	High Occupancy Vehicle
HWY	Highway
KNBP	Kanata North Business Park
KNT	Kanata North Transitway
LoS	Level of Service
LRT	Light Rail Transit
MGS	Ministry of Government Services
MMAH	Ministry of Municipal Affairs and Housing
MNRF	Ministry of Natural Resources and Forestry
MECP	Ministry of the Environment, Conservation and Parks
MTCS	Ministry of Tourism Culture and Sport
MTO	Ontario Ministry of Transportation
MVCA	Mississippi Valley Conservation Authority
NCC	National Capital Commission
NHIC	Natural Heritage Information Centre
NRCAN	Natural Resources Canada
OESA	Ontario Endangered Species Act
OHA	Ontario Heritage Act
OP	Official Plan
OPP	Ontario Provincial Police
OWRA	Ontario Regulation Ontario Water Resources Act
PCG	Public Consultation Group

pphpd	Person per hour per direction
PTTW	Permit to take Water
RMA	Roadway Modification Approval
ROW	Right-of-Way
SAR	Species at Risk
SARA	Species at Risk Act
SB	South Bound
SC	Special Concern
SWM	Stormwater Management
TDM	Transportation Demand Management
THR	Threatened
TMP	Transportation Master Plan
TOD	Transit-Oriented Development
TPAP	Transit Project Assessment Process
UNA	Urban Natural Area
ZBL	Zoning By-Law

EXECUTIVE SUMMARY

On September 7, 2016, Transportation Committee approved the statement of work for the *Kanata Light Rail Transit (LRT) Planning and Environmental Assessment Study (Bayshore Station to Palladium Drive)*. Subsequent to this approval, on March 8, 2017, Council approved the Stage 2 LRT Implementation – Project Definition and Procurement Plan, which included a recommendation to expand the Confederation Line West LRT from Bayshore Station to Moodie Drive. As such, the Bayshore Station to Moodie Drive segment was de-scoped from the Kanata LRT study limits, with the new reduced limits extending from Moodie Drive to Palladium Drive.

In addition, on September 13, 2017, Council approved the Stage 2 Light Rail Transit Project and Procurement Update, and received the functional design for the Bayshore to Moodie LRT, including the 2.5 kilometres of additional rail, Moodie Station, and a Light Maintenance and Storage Facility (LMSF) to meet operational needs and requirements for the expanded Stage 2 LRT. There were two functional designs provided for this LMSF: one for opening day, and a second "ultimate" footprint that protected for a potential future expansion when Stage 2 LRT to Kanata is implemented. This location of the "ultimate" LMSF close to Moodie Drive was assessed along with various options in the Kanata area as part of the scope of work for the Kanata LRT Transit Project Assessment Process Environmental Assessment (EA).

Consultation with the Kanata North Business Park (KNBP) and the Department of National Defence (DND) was undertaken to address the high growth potential for their sites. Although both preferred LRT corridor options to the north that directly served their respective sites, the Kanata LRT Study considered corridor options that provided the most benefit to all of Kanata. In the near term when LRT is extended to Moodie Station, transit can be provided to these sites with frequent bus service along Moodie Drive, Carling Avenue, and March Road. In the future, the feeder network will consider new technologies of that time, such as fixed guideway systems and connected autonomous vehicles. Any technology option must be capable of aligning with future capacity and service requirements, which could be significant during peak demand.

The Kanata LRT Study identified and examined 13 LRT corridor options, covering a broad area of Kanata. Following an extensive evaluation based on criteria such as ridership, network connectivity, the natural and social environment, and cost, the preferred LRT corridor is identified along the north side of Highway 417 as it best meets all the criteria. The preferred option is depicted in Figure 1 below.

Figure 1: Preferred LRT corridor

The benefits of this corridor are as follows:

- Provides a central transit spine equally supporting all of Kanata;
- Supports the future March Road and Fernbank Bus Rapid Transit (BRT) corridors and other north-south bus routes;
- Includes no significant environmental or social impacts;
- Supports development objectives along route;
- Significant portions of this corridor are being protected through previous EA studies; and,
- Provides a cost-effective solution to build and operate.

In response to public feedback to address the intensification opportunities in the growing Kanata South and Stittsville area, additional analysis was undertaken, resulting in a recommended plan that extends LRT from Palladium Drive/Canadian Tire Centre to Hazeldean Road. Long-term benefits include:

- Maximizes ridership by connecting more directly to the development around Hazeldean Road, whereas the Canadian Tire Centre, on its own, has comparatively low ridership except during events;
- Creates a more efficient transit network with LRT on a an elevated structure in this section as it avoids conflicts with major cross streets;
- Maximizes connectivity with the future east-west transit priority corridor serving Stittsville as well as the future Bus Rapid Transit (BRT) corridor serving Fernbank lands; and,
- Maximizes opportunities for transit-oriented development on vacant lands surrounding the LRT corridor.

Light Maintenance and Storage Facility (LMSF)

Although Council approved the functional design, including protection for an ultimate LMSF at Moodie, as part of the 2017 Stage 2 Light Rail Transit Project and Procurement Update, the location of the LMSF was confirmed as part of the scope of the Kanata EA study. This analysis was included within the Kanata study in order to explore the various alternatives, as well as to identify if a more suitable location to serve Kanata LRT was available, and if LMSF operations would further improve at an alternate site. The Kanata LRT study identified eight additional sites for evaluation that were assessed from a transportation, social, biological environment, operations, and cost perspective.

Many sites either had active development applications or existing development commitments through the Kanata West Development Area. In addition, many sites were too close to residential areas, and as such, ranked poorly from a social perspective. Based on this analysis, the Moodie LMSF continues to be the recommended site. The Confederation Line West LRT extension to Moodie Drive and LMSF received provincial EA approval in February 2018.

Recommended Plan

Building on the City's Stage 1 and Stage 2 LRT plans, the Kanata LRT extension will include another 11 kilometres, terminating at Hazeldean Road, will include eight stations, and four park and rides. This extension will bring 90% of Kanata residents within 5 kilometres of rail and for the City as a whole, 80% of residents within 5 kilometres of rail.

Much of this LRT corridor has been protected as it has been defined through previous planning and EA studies dating back to the mid-1990s. Key elements of the LRT design include:

- Approximately 5.5 kilometres of the LRT will be at grade;
- Approximately 1.5 kilometres will be below grade in an open cut;
- Approximately 4 kilometres will be on an elevated structure or embankment;
- Convenient pedestrian and cycling connectivity from stations to surrounding communities. A parallel multi-use pathway throughout the full length of the LRT corridor will be provided through a combination of existing and new linkages;
- Public washrooms at terminus stations and major transfer stations between rail rapid transit and other major rapid transit corridors; and,
- Four park and ride facilities consisting of the existing park and ride lots at Eagleson (1,220 spaces) and Terry Fox Stations (540 spaces), a relocated park and ride at Palladium Station/Canadian Tire Centre (200 spaces), and a new park and ride lot at Hazeldean Station (650 spaces).

Financial Implications

Even though the Kanata LRT link is beyond the City's 2031 Affordable Rapid Transit Network plan, the study examined how the project can be implemented in sections, if, and when, funding is available. The proposed staging priority identified below is based on ridership and capital cost (2017 dollars, Class C estimate).

Staging Priority	Capital Cost
1. Moodie Station to Terry Fox Station	$710 M
2. Terry Fox Station to Palladium Station	$640 M
3. Palladium Station to Hazeldean Station	$500 M
Total Project Cost	$1.85 B

Public Consultation/Input

Consultation included three (3) rounds of meetings with the Agency Consultation Group (National Capital Commission (NCC); Ministry of Transportation Ontario (MTO); Ontario Ministry of Tourism; Culture and Sport (MTCS); Ottawa Provincial Police (OPP); Rideau Valley Conservation Authority (RVCA); Mississippi Valley Conservation Authority (MVCA); Hydro Ottawa; and, Infrastructure Ontario), the Business Consultation Group (landowners; developers; and, businesses), and the Public Consultation Group (community associations; and, interest groups) and two public open houses. Separate consultation with Indigenous Peoples included a presentation to the Algonquins of Ontario Consultation Office.

Overall, there was significant support for the recommended LRT corridor and station locations with some concerns that were addressed as follows:

- Connectivity to stations – A connectivity study proposes parallel multi-use pathways (new and existing) throughout the length of the LRT corridor with linkages to the stations;
- March Road/Eagleson Road connectivity to park and ride – A pedestrian and cycling overpass will be provided to connect the park and ride on the south side of Highway 417 to the LRT station on the north side;
- Advance the timing of implementation – This project is currently identified as post 2031 as it is not included in the City's affordable network; and,
- LRT does not serve the Kanata North Business Park – This site can be served with feeder service to the main LRT line. March Road is identified as a transit corridor through the 2012 Kanata North Transitway (March Road) BRT EA Study. Opportunity still exists to determine the technology choice for these feeder lines at a later date.

1. INTRODUCTION

The City of Ottawa is the proponent of a Planning and Environmental Assessment Study to fulfill the requirements of Ontario's Transit Project Assessment Process (TPAP) for the Kanata Light Rail Transit Extension (Kanata LRT) project in accordance with Regulation 231/08 under Ontario's Environmental Assessment Act. The proponent will plan, develop, consult, and file this transit project with the Ministry of Environment and Climate Change (MECP), with the aid of various consultants and sub-consultants. The City of Ottawa will have charge of this project as it evolves and moves through the TPAP process, following the responsibilities and obligations identified in Regulation 231/08 during the planning stages, TPAP process, implementation and operation of the preferred undertaking described herein.

This TPAP Report provides the background and an overview of the study including the location and rationale for the proposed project; environmental assessment requirements; the public consultation process; the existing and future social, transportation, infrastructure and utilities, economic, natural and physical conditions; an evaluation of alternative designs; the selection of a preferred alternative; the Recommended Plan; and, an assessment of the effects of the Kanata LRT extension.

1.1. PURPOSE OF THE PROJECT

The City of Ottawa ("the City") is proceeding with the preparation of a Planning and Environmental Assessment (EA) Study following the TPAP for the expansion and improvement of its rapid transit network to accommodate existing and future demand. The intent is to extend the Confederation Line west from Moodie Station and create a LRT trunk line serving Kanata to support the transit mode split objectives of the City's TMP. Existing land uses and future development established in the City's Official Plan (OP) will also guide the project development. The Kanata LRT project is an important component of the City's overall vision for transportation service and infrastructure improvements required to support anticipated future growth.

1.2. PROJECT BACKGROUND

The Kanata LRT project is a component of the City's planned primary rapid transit network. It is identified in the City's Transportation Master Plan (TMP) as part of the Ultimate Rapid Transit Network, with implementation currently anticipated beyond the TMP's 2031 horizon year (Figure 1-1).

The City is currently constructing Stage 1 of its new Light Rail Transit (LRT) network, which stretches from Tunney's Pasture in the west to Blair Station in the east. This facility (the Confederation Line) will replace the main east-west portion of the existing Ottawa Transitway Bus Rapid Transit (BRT) facility to address capacity and reliability issues associated with on-street running of buses through the downtown area. Stage 1 LRT is expected to open in early 2019.

Following on from Stage 1, The City of Ottawa has secured funding and is pursuing implementation of the Stage 2 LRT program, which will see construction of an additional 39 km of LRT and 23 stations as follows:

- Confederation Line East LRT Extension (Blair – Trim)
- Confederation Line West LRT Extension (Tunney's Pasture – Baseline & Moodie)
- Trillium Line Extension (Greenboro – Earl Armstrong/Bowesville & Ottawa International Airport)

Environmental Studies have been completed for each of the Stage 2 LRT project components.

Stage 2 LRT projects are expected to commence revenue operations starting in 2021 (Trillium Line), with the Confederation Line East LRT Extension in 2022 and the Confederation Line West LRT Extension in 2023. While Bayshore Station was originally identified in the TMP Affordable Rapid Transit Network and Confederation Line West LRT Extension EA as the western terminus of the Confederation Line LRT, work undertaken as part of Stage 2 LRT preliminary engineering has identified a further extension of LRT west to Moodie Drive as being achievable within the available budget envelope. Extending LRT to Moodie Station provides for a LRT terminus closer to the Department of National Defense Carling Campus federal employment node and provides for a Light Maintenance and Storage Facility (LMSF) to support LRT operations. This LMSF will be located west of Moodie Drive, between Corkstown Road and Highway 417.West of Moodie Station, the TMP 2031 Network Concept envisions a dedicated BRT facility running parallel with Highway 417 from Moodie Drive to Huntmar Drive. It then proceeds south along the east side of Huntmar Drive and the planned Kanata West North-South Arterial Road, terminating at Hazeldean Road. The TMP ultimate rapid transit plan that includes the Kanata Light Rail Transit (LRT) Line converts this BRT facility between Moodie Drive and Palladium Drive (Canadian Tire Centre) to LRT technology, with BRT continuing south of Palladium to Hazeldean Road, where it transitions to an at-grade median BRT facility within the North-South Arterial Road continuing to a terminus at Fernbank Road.

The future rapid transit network between Moodie Drive and Palladium Drive has been studied multiple times, to varying levels of detail in different segments, and requires a cohesive review of all prior work and the development of a single study to recommend a realistic, affordable and attractive LRT service for the City's rapidly growing west end. Prior work laid out a general corridor in some areas, protected alignment in others and has advanced to detail design and the pre-construction of related infrastructure in other areas. These plans will benefit from a single LRT-based lens to allow for future implementation of rapid transit in a consolidated manner.

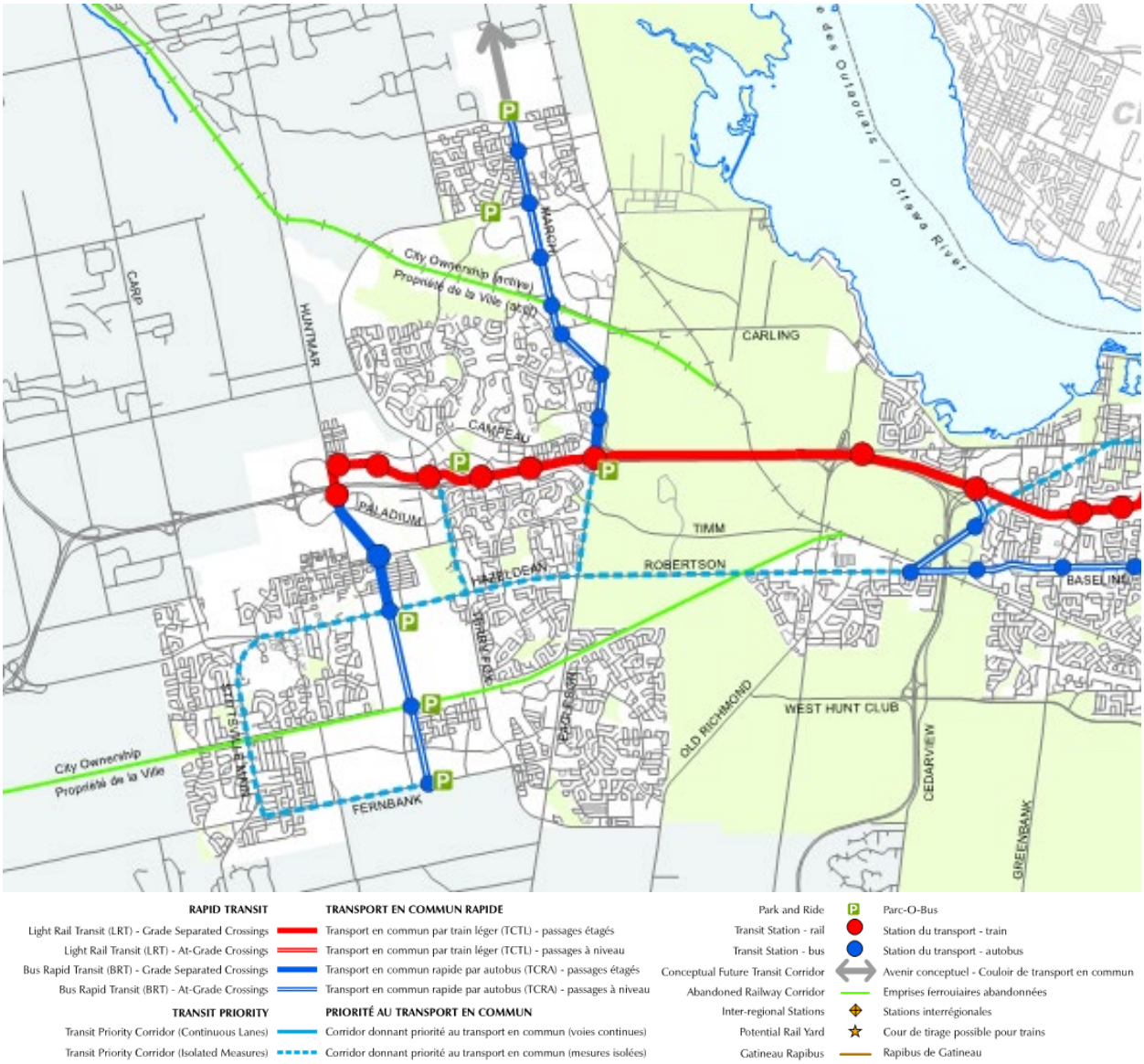


Figure 1-1: Study Area

This TPAP Report identified and examined a range of alternative LRT corridors within a broad study area to determine the ideal route for the future LRT. Detailed alignment and cross-sections, including station locations and layouts have been identified with consideration of the area environmental constraints. Key agency and public stakeholders provided input at key points in the study process. Included in the proposed designs are required modifications to existing road crossings and connections as well as multi-use pathways and active transportation connections.

This TPAP Planning and EA Study defined a corridor for the future expansion of the City's LRT network to Kanata. Extending LRT to Kanata is identified in the Ultimate Network in the City's 2013 TMP. This study updates the work done in the TMP, examining potential corridors along Highway 417, and to the north and south of the highway beyond the study area map shown above. The study outcome is a Recommended Plan that identifies the LRT corridor, station locations, and supporting facilities, and determines a project staging and implementation strategy based on ridership and affordability. While this project is not currently part of the City's Affordable Rapid Transit Network, the City needs to identify the LRT corridor and functional design to establish

future right-of-way requirements, protect the corridor, and inform the ongoing planning and development of adjacent lands.

Key considerations for the Kanata LRT TPAP Planning and EA Study included the following:

- Coordinating with the current Confederation Line West LRT Extension to Moodie Planning and EA study;
- Coordinating with the West Transitway Extension (Bayshore Station to Moodie Drive) detailed design currently underway and in operation by late 2017;
- Identifying station locations integrated with existing communities, planned uses, and promoting transit-oriented development;
- Reviewing the need for and location of an LMSF to support the Kanata LRT;
- Incorporating a separate multi-use pathway within or adjacent to the LRT facility as per the Official Plan;
- Incorporating accesses or linkages to existing and planned pedestrian, cycling, and multi-use pathway facilities;
- Developing the project's capital and operating costs; and,
- Identifying a preliminary construction phasing plan.

1.3. REPORT ORGANIZATION

The remainder of this report is organized as follows:

Section 2: Study Process, described the steps taken in the preparation of this Environmental Project Report and the extensive consultation program undertaken to gather comments from the general public and stakeholders during both the planning and environmental assessment stage of the Kanata LRT project.

Section 3: Project Need and Justification, describes the need and justification for the transit project, which is based mainly on pre-planning work undertaken by the City of Ottawa. The Council-approved rapid transit network, as described in the 2013 TMP update and its supporting documents, addresses major issues such as project need, corridor development, and technology assessment. These issues were thoroughly assessed through that planning exercise and do not have to be revisited in the EA for the Kanata LRT, although corridor alternatives have been re-assessed based on updated ridership results.

Section 4: Existing Environmental Conditions, describes the existing environmental setting within the original, broad study area, including an overview of the prevailing social (transportation, land use, socio-cultural, municipal services, noise, vibration and air quality) and natural (physical, biological) environments.

Section 5: Development and Evaluation of Alternative Corridors and Alignments, highlights the City of Ottawa Vision and Policies, goals of the Kanata LRT project, and planning principles and design criteria. Additionally, a description of the alternative corridors developed, the preliminary screening of corridors, and the evaluation process that led to the selection of the preferred corridor are detailed.

Section 6: Alternative Design Evaluation, highlights the evaluation of specific designs along the preferred corridor.

Section 7: Updated Existing Conditions, provides an up to date and more in depth description of the environmental setting for the study based on the preferred corridor. By refining the study area boundaries and providing more detailed investigations where required, mitigation measures can be applied to the recommended plan where appropriate at the design stage.

Section 8: Recommended Plan, describes the Recommended Plan for the Kanata LRT project. The Recommended Plan documents the horizontal and vertical alignment, station locations and layouts, general arrangements of elements in the station, general arrangements for new and/or revised structures along the route and documents other relevant elements such as transit-oriented development and pedestrian/cycling connectivity opportunities.

Section 9: Assessment and Evaluation of Impacts, describes the assessment approach and methodology followed to address potential environmental effects of the project which have been identified as well as mitigation measures which may be put in place to reduce or eliminate negative environmental effects.

Section 10: Future Commitments, identifies municipal, provincial and federal approvals or permits that may be required for implementation of the Kanata LRT project. Additionally potential mechanisms for modifying the Recommended Plan for the transit project are provided. Follow-up and monitoring requirements are also detailed in this section.

Section 11: Conclusion, provides a concise overview of the scope of the project.

2. STUDY PROCESS

2.1. ONTARIO ENVIRONMENTAL ASSESSMENT ACT

The purpose of the *Ontario Environmental Assessment Act RSO 1990 (*EA Act*)* is to help protect and conserve Ontario's environment by ensuring that projects subject to the Act follow a planning process leading to environmentally sound decision-making. An environmental assessment involves identifying and planning for environmental issues and effects prior to implementing a project. The process allows for opportunities for public involvement in the decision-making process of the project. The planning and assessment is summarized in an Environmental Assessment Report prepared by the proponent of the project and is subject to review by the public and government agencies.

In June of 2008, the Transit Projects Regulation (*Ontario Regulation 231/08*) was created under the EA Act to guide public transit projects through approval. The process requires public sector proponents to assess the impacts of their project, identify mitigation measures, undertake consultation and make available information or documentation completed for the pre-planning work which led to the selection of the Recommended Plan for the transit project.

The Transit Projects Approval Process (TPAP) outlined in Ontario Regulation 231/08 provides a framework for an accelerated consultation and review process regarding the assessment of the potential environmental effects of a transit project, to enable decision-making within six months from the time an EA Study is launched.

The project planning phase for the Kanata LRT commenced with the City's Transportation Committee approval of the Statement of Work for the Planning and Environmental Assessment Study on 14 September 2016. During the project planning phase, the work concentrated on taking the vision and direction outlined in the TMP and developing a Recommended Plan for the functional design of the project. Extensive public consultation (as outlined in Section 3.0) was undertaken as a part of this process.

In 2018, Ottawa City Council unanimously approved the functional design for the Kanata LRT project, including the Recommended Plan, and directed staff to commence the Transit Project Assessment Process (TPAP) and documentation based on the functional design, and file the respective Project Reports in accordance with the Ontario Transit Regulation 231/08.

The Transit Project Assessment Phase of the project was designed to meet the Province of Ontario's TPAP as prescribed in Ontario Regulation 231/08. The six-month EA transit process is primarily for public consultation, documentation, and provincial approval of the TPAP Report. Once the TPAP Report is submitted to the Minister of the Environment, Conservation and Parks (MECP), the approval period is 35 days (this is within the six-month timeline). If the Minister does not render a decision by the end of the 35th day, the project is considered approved. Should there be bump-up requests, the scope of those requests is now limited to matters of provincial interest only, including: natural environment, cultural heritage values or interests, and constitutionally protected aboriginal or treaty rights.

In accordance with Ontario Regulation 231/08 (O.Reg. 231/08) this TPAP Report has been completed and made publicly available. As part of the assessment process, the TPAP Report will be placed on public record for comment and review prior to MECP approval. If there are concerns of provincial interest that cannot be resolved, a written objection may be made and sent to the Minister for consideration. This Report has developed over a rigorous and complex study process over an extended period of time (Figure 2-1).

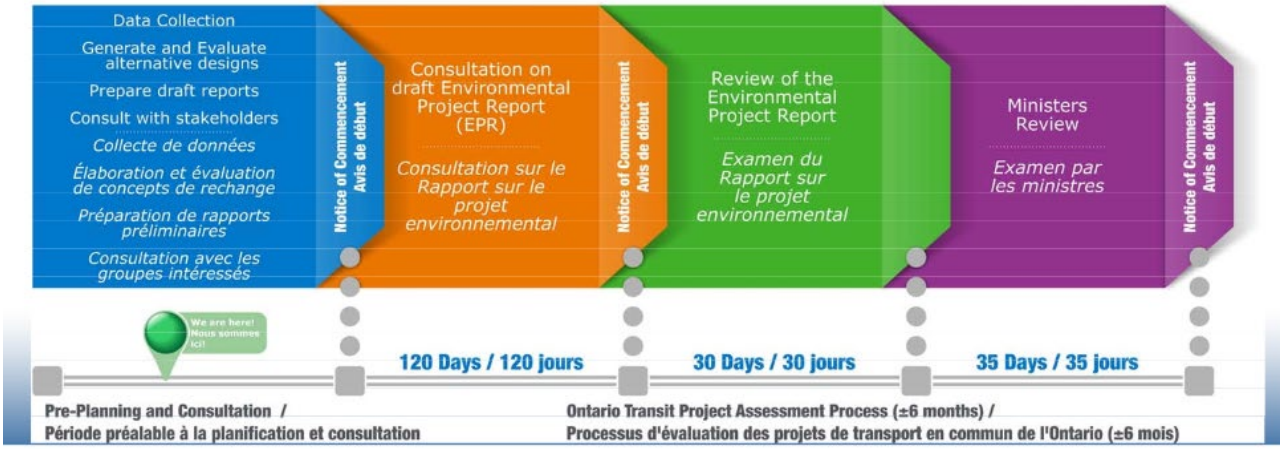


Figure 2-1: Environmental Assessment Process

2.2. CANADIAN ENVIRONMENTAL ASSESSMENT ACT, 2012

The purpose of the *Canadian Environmental Assessment Act, 2012* is to protect the components of the environment that are within the legislative authority of the federal government from significant adverse environmental effects caused by a designated project. Additionally the Act serves to promote cooperation and coordinated action between federal and provincial governments with respect to environmental assessments.

Under Section 67 of the Canadian Environmental Assessment Act (CEAA), 2012:

"An authority must not carry out a project on federal lands, or exercise any power or perform any duty or function conferred on it under any Act of Parliament other than this Act that could permit a project to be carried out, in whole or in part, on federal lands, unless (a) the authority determines that carrying out of the project is not likely to cause significant adverse environmental effects; or (b) the authority determines that the carrying out of the project is likely to cause significant adverse environmental effects and the Governor in Council decides that those effects are justified in the circumstances under subsection 69(3)".

As federal lands may be required for various phases of project completion, an Environmental Effects Analysis of all the physical activities proposed on federal lands is required, under Section 67 of CEAA, 2012. No approvals from the National Capital Commission under the *National Capital Act* can be issued before these obligations are fulfilled. An Environmental Effects Analysis of a proposed project will determine the need to eliminate or mitigate adverse effects, to modify the project or to recommend further assessment requirements based on detailed design.

The proposed project may also require approval through the Federal Land Use, Design and Transaction Approvals (FLUDTA) process under the National Capital Act. Other federal authorities that may have an interest in the project include Public Services and Procurement Canada, Fisheries and Oceans Canada, the Canadian Transportation Agency, and Transport Canada. This Report was prepared in consultation with the NCC and is intended to form the basis for evaluation of environmental effects when the Federal EA requirements are met.

2.3. CONSULTATION

A key component of the EA process is undertaking public consultation. The planning and coordination of the infrastructure and environmental mitigation requirements for the project, in consultation with the community, will help to ensure that the objectives of the City, the community, other approval authorities and stakeholders are fulfilled.

2.3.1. CONSULTATION GROUPS

The study proceeded under the direction of the City of Ottawa and benefitted from the direct involvement and guidance of an Agency Consultation Group (ACG) consisting of City staff, consultants in a variety of disciplines and representatives from government agencies and approval bodies that may have an interest in the project; a Public Consultation Group (PCG) consisting of representatives from directly affected Community Associations and interested community groups; and a Business Consultation Group (BCG) including business associations, institutions and large commercial establishments/developers.

Each member of the consultation group has had the opportunity to review material prepared to date. The input of these groups has informed the Recommended Plan contained herein, and has been paramount in developing the final description of the transit project.

2.3.1.1. Agency Consultation Group

The ACG was formed to address the full range of technical issues and to comment on special studies as well as applicable procedures, legislation and policies. ACG members included agencies and government department representatives from Municipal, Provincial and Federal levels. Representation included:

Internal ACG (City of Ottawa)

- Planning, Infrastructure, and Economic Development
- Stage 2 LRT Office
- Transportation Services
- Public Works – Operations Engineering
- Asset Management
- Public Works – Roads and Traffic Operations
- Natural Systems
- Community Sustainability
- RPAM
- Paramedic Services
- Fire Services
- Police Services
- Environmental Engineering Services Department

External ACG Representation

Federal

- National Capital Commission
- National Defence
- Canadian Environmental Assessment Agency – Ontario Regional Office
- Environment and Climate Change Canada – EPA Division
- Transport Canada
- Infrastructure Canada
- Public Service and Procurement Canada
- Department of National Defense

Provincial

- Ministry of Tourism Culture and Sport
- Ministry of the Environment, Conservation and Parks – Environmental Assessment and Approvals Branch
- Ministry of Natural Resources and Forestry
- Ministry of Transportation

Regional

- Rideau Valley Conservation Authority
- Mississippi Valley Conservation Authority
- Hydro Ottawa Limited
- Hydro One Networks Inc.
- Bell Canada
- Rogers Cable
- Enbridge
- Transport Action Canada

Aboriginal Communities

- Algonquins of Ontario
- Algonquins of Pikwàkanagàn
- Kitigan Zibi Anishinabeg
- Métis Council of Ottawa

Meeting agendas and notes are contained in Appendix A – Consultation Record. Table 2-1 outlines the meeting dates and main agenda topics.

Table 2-1: Agency Consultation Group Meetings

Meeting #	Date	Main Agenda Topics
1	May 11, 2017	Introductions, Study Overview and Context, Evaluation of Corridors, Next Steps, Other Items/Questions
2	September 19, 2017	Study Update, Alternative Corridor Selection, Alternative Designs, Introduction of Light Maintenance and Storage Facility, Next Steps, Other Items/Questions
3	November 21, 2017	Alternative design evaluation and the preliminary recommended plan for the alignment and station location.

2.3.1.2. Business Consultation Group

The BCG was formed to review work-to-date and to provide comments on study activities, issues and concerns that reflect each group's interests and values. BCG members consisted of:

- Local businesses and property owners
- Adjacent Development Land Owners
- Kanata North BIA
- Kanata Central BIA
- Ottawa West Board of Trade
- Ottawa Senators
- Ottawa Carleton District School Board
- Ottawa Catholic School Board
- Ottawa Student Transportation Authority
- French Catholic School Board

Meeting agendas and notes are contained in **Appendix A – Consultation Record**. Table 2-2 outlines the meeting dates and main agenda topics.

Table 2-2: Business Consultation Group Meetings

Meeting #	Date	Main Agenda Topics
1	May 16, 2017	Introductions, Study Overview and Context, Evaluation of Corridors, Next Steps, Other Items/Questions
2	September 21, 2017	Study Update, Alternative Corridor Selection, Alternative Designs, Introduction of Light Maintenance and Storage Facility, Next Steps, Other Items/Questions
3	November 23, 2017	Alternative design evaluation and the preliminary recommended plan for the alignment and station location.

2.3.1.3. Public Consultation Group

The PCG was formed to enable community and interest groups to provide direct input to the study and comments on technical and local issues and concerns. PCG members included representatives from City wards adjacent to the corridor, interest groups and various City of Ottawa advisory committees. Representation included:

- Cityview Community Association
- Crystal Beach/Lakeview Community Association
- Bridlewood Community Association
- Kanata South Community Association
- Arcadia Community Association
- Kanata Beaverbrook Community Association
- Kanata North TACK
- Healthy Transportation Ottawa
- Bayshore Community Association
- Citizens for Safe Cycling
- Greenspace Alliance
- Accessibility Advisory Committee
- Fairwinds Community Association
- Stittsville Village Association
- Jackson Trails Community Association
- Blackstone Fernbank Crossing Community Association

Meeting agendas and notes are contained in **Appendix A – Consultation Record**. Table 2-3 outlines the meeting dates and main agenda topics.

Table 2-3: Public Consultation Group Meetings

Meeting #	Date	Main Agenda Topics
1	May 16, 2017	Introductions, Study Overview and Context, Evaluation of Corridors, Next Steps, Other Items/Questions
2	September 21, 2017	Study Update, Alternative Corridor Selection, Alternative Designs, Introduction of Light Maintenance and Storage Facility, Next Steps, Other Items/Questions
3	November 23, 2017	Alternative design evaluation and the preliminary recommended plan for the alignment and station location.

2.3.2. PUBLIC OPEN HOUSES

Two Public Open Houses were held at key phases in the TPAP process. Notice of each session was published in local newspapers as well as a notification posted on the project website. Individuals who identified their desire to be added to an email notification list were also advised via email of any upcoming open houses. The following table provides an overview of open house dates and main agenda topics.

Table 2-4: Public Open Houses and Information Sessions

Meeting #	Date, Time & Location	Main Agenda Topics
1	June 5, 2017 5:30 – 8:30 pm Kanata Recreation Complex	Study Context and Overview; Study Goals; Study Process; Schedule; Need and Justification; Existing Conditions; Corridor Alignments Evaluated; Preliminary Preferred Corridor; and Next Steps. A formal presentation was given at 6:30 pm
2	December 7, 2017 5:30 - 8:30 p.m. Kanata Recreation Complex	The alternative design evaluation and the preliminary recommended plan for the alignment and station location A formal presentation was given at 6:30 pm

2.3.3. INDIVIDUAL STAKEHOLDER AND LANDOWNER MEETINGS

In addition to the Consultation Group Meetings and the Public Open Houses, the study team has met with many key stakeholders along the corridor to discuss specific elements of the proposed design.

These individual stakeholder meetings have focused on a variety of topics, such as the impact on adjacent properties, how the project related to specific policies or mandates of agencies, connections to local employment and residential land uses, and future development opportunities. Individual stakeholder meetings have been held with:

- The National Capital Commission
- National Defence
- Public Services and Procurement Canada
- Stage 2 LRT Office
- The Ottawa Senators
- Minto
- Broccolini
- Urbandale
- Kanata West Landowners Group
- RioCan
- Ontario Provincial Police

2.3.4. ABORIGINAL CONSULTATION

The consultation with Aboriginal Communities, described below, is consistent with the requirements of the proponent described in Regulation 231/08. The City of Ottawa has followed the process set out by the MECP through an active consultation regiment, as described below and detailed in **Appendix A, Annex V**.

The MECP provided guidance regarding consultation with Aboriginal Communities. On the advice of the MECP, contact with Aboriginal Communities was made initially to inform them of the project and identify opportunities for involvement. A summary of Aboriginal consultation is contained in **Appendix A – Consultation Record, Annex V**.

2.3.5. CITY OF OTTAWA WEBSITE

A project website (www.ottawa.ca/kanatalrt) was established at project initiation. The website contains information on the background, study area, design, as well as open house display boards, presentations, and summaries. Consultation efforts will continue as the study progresses to the next phase of the project.

3. PROJECT NEED AND JUSTIFICATION

This section outlines the need and justification for the Kanata LRT Extension (KLRT) project, which is based on previous work undertaken as part of the City of Ottawa Official Plan (OP), TMP, and supported by current and future transit demand, transit network requirements, policy directions and land use objectives.

3.1. NEED FOR THE PROJECT

The City of Ottawa Official Plan, 2013 (OP) and its supporting Master Plans provide a vision of future growth for the City and sets the policy framework to guide its physical development over the planning horizon to the year 2031.

The pattern of intensification described by the OP is one of nodes and corridors. The Central Area is the focus, as it is the economic and cultural nerve centre of the city. The Central Area contains the highest density development pattern in the entire city. Complementing the road network that reaches out from the Central Area is the dedicated rapid transit network whose major stations anchor nodes of dense development, designated as Mixed-Use Centres and Suburban Town Centres. These areas act as suburban downtowns, and seek to take full advantage of the volume of transit riders that pass through by providing complementary intensive commercial, employment, and residential land uses.

The OP encourages areas around major transit stations to develop as compact, walkable, mixed-use developments with densities that support transit use. LRT technology will encourage plans for Transit Oriented Development (TOD) areas to provide direction for growth in areas around transit stations. Along the Kanata LRT alignment, TOD and intensification will be directed to areas around stations with significant development potential, specifically those designated as Town Centre, Mixed-Use Centres, Employment Areas and Enterprise Areas.

The areas that will be serviced by the Kanata LRT are anticipated to grow substantially over the planning horizon. The City's population is forecasted to grow 23% from 2011 to 2031 with 79% of that growth predicted to occur in urban areas outside the Greenbelt. The number of jobs is projected to grow about 24% from 2011 to 2031, with 72% occurring in the inner area and suburbs. This points to a need to move an increased number of people efficiently, reliably, and safely from outer areas into the Central Area, and vice-versa. As such, the number of transit trips taken into the inner suburbs and areas is expected to rise substantially. The areas targeted for TOD and intensification will see an increased demand for people wanting to live, shop, and work both in their neighbourhood and downtown. Higher rapid transit technology such as LRT supports these forecasted trends by fueling growth and redevelopment.

Coinciding with this growth are the aggressive modal splits the City aims to achieve by 2031. By 2031, the City of Ottawa aims to have nearly 26% of all morning-peak period travel occur via public transit. This is an aggressive target considering that over the same period, the total number of trips taken is projected to grow by 32%. To achieve these splits, the Kanata LRT will provide a more efficient and reliable level of transit service, as well as a vastly improved user experience. With substantial planned improvements to transit service downtown and limited planned increases to road capacity, the modal share of transit within the travel market will increase. High rates of transit ridership to, from and within the inner suburbs are expected to continue.

The OP serves as a basis for, and provides guidance on, a wide range of municipal activities by pursuing strategic directions in four key areas. The Kanata LRT will address these strategic directions in the following manner:

Managing Growth

- The City will manage growth by directing it to the urban area where services already exist or where they can be provided efficiently.
- Rural development will be directed to Villages to enhance their vitality, with provision for Village expansion where it is economically feasible and environmentally sound.
- Growth in the urban area will be directed to areas where it can be accommodated in compact and mixed-use development, and served with quality transit, walking and cycling facilities.
- Downtown Ottawa will be a vibrant mix of thriving economic and cultural activities within a setting that celebrates the unique qualities of both the City and the National Capital.

The Kanata LRT will support growth in areas designated within the urban boundary, by providing fast, reliable, comfortable service which is an attractive alternative to the automobile; and supplying increased transportation network capacity necessary to support increased development densities.

Providing Infrastructure

- A transportation system that emphasizes transit, walking and cycling will be built.
- Public water and sanitary wastewater facilities will be provided to reinforce the City's commitments to a compact urban area and safe and healthy communities.
- Development in the rural area will be primarily on the basis of private individual services where they are safe and environmentally sound.

The Kanata LRT will introduce high quality, high capacity rapid transit to the west end of the City within the urban area. Implementing this and other rapid transit projects at an early stage will attract auto users to transit and stimulate higher density land development, both of which will be necessary to achieve the significant increases in transit contemplated in the OP. The early implementation will also stimulate transit use in new urban communities within the area.

Maintaining Environmental Integrity

- Air quality will be supported by a transportation system that emphasizes transit, walking and cycling, and by policies that protect forests, wetlands and other natural environment areas.
- Provincially and locally significant wetlands and forests will be conserved.
- The City will preserve natural features and the integrity of natural systems by directing land use and development in a way, and to locations that maintain ecosystem functions over time.
- Green spaces will be valued and protected for their environmental, cultural heritage, recreational, educational and aesthetic qualities.

The Kanata LRT will contribute to improved air quality by providing a competitive, attractive alternative to the automobile trips. By serving a broad range of nodes targeted for intensified development, the project will also support a more compact urban form, which will contribute to reduced energy use.

Creating Liveable Communities

- The City will provide opportunities to increase the supply of affordable housing throughout the rural and urban areas.
- Growth will be managed in ways that create complete communities with a good balance of facilities and services to meet people's everyday needs, including schools, community facilities, parks, a variety of housing, and places to work and shop.

The City will provide for a wide range of rural and urban economic activities in suitable locations.

- The design of the city, the maintenance of greenspace and the high quality of life will enhance the attractiveness of the city for business development.
- Familiar landscapes and heritage buildings will be maintained despite on-going change.
- Rural communities will continue to be valued for their distinct economies and lifestyles.
- Attention to design will help create attractive communities where buildings, open space and transportation work well together.
- The process of community building in the urban and rural area will be open and inclusive.
- Agricultural lands will be preserved for future generations and mineral resources will be protected for extraction.

The implementation of rapid transit and/or the protection of potential transit corridors at the earliest possible stage of the land development process will create an environment that fosters transit-supportive land use. There are significant opportunities along the Kanata LRT to achieve transit-oriented development. The availability of these sites combined with the benefits of transit will create long-term transit ridership and support more compact and mixed-use developments at each of these locations.

3.2. OPPORTUNITIES

While supporting residential and employment growth is central to the role of rapid transit, one objective for the line is to connect all of the places that contribute to a vital community including hospitals, schools, recreation opportunities and shopping. The preferred alternative chosen will need to consider the balance of these opportunities and constraints. Opportunities are available in each corridor to support the development of LRT, including areas ready for development or redevelopment as well as environmental benefits of reduced bus usage and the implementation of electric LRT to improve local air quality and reduce impacts from noise and vibration while providing a higher level of service. An improved transit experience for passengers is another opportunity that combines with local land use to increase the community's level of sustainability.

Redevelopment & Intensification

Existing employment centres and those areas designated in the OP for intensification present opportunities for transit connectivity. In the study area these include:

- Kanata Town Centre;
- Kanata North Business Park;
- Kanata West Lands including area around the Canadian Tire Centre; and,
- Fernbank Community Design Plan (CDP) area.

In general, target areas for intensification are focused on central areas, mainstreets, mixed use centres and town centres.

3.2.1. ENVIRONMENTAL BENEFITS

Electric LRT has net positive environmental impacts when compared against comparable levels of BRT service required to move a similar number of people. In addition to electric propulsion, which reduces greenhouse gases, particulate, sulphur and nitrogen oxides and other contaminants, LRT also reduces the number of vehicles required to carry the large volumes of passengers predicted. Modern LRT vehicles are typically quieter than the buses they replace and provide a high quality service for riders while reducing impacts on the areas around BRT facilities.

There are some environmental elements that will be impacted by the LRT project. Along the route there is some noise generated by the system, even if it is lower than the current BRT system. The alignment is not likely to follow the existing BRT corridor exactly, so there is the potential for limited localized impacts on adjacent homeowners experiencing noise, traffic, and light pollution.

3.2.2. TRANSIT EXPERIENCE

A completely segregated LRT system will provide an enhanced passenger experience to the current bus system within the study area, which has dedicated (shoulder) lanes along Highway 417 between Moodie Drive and the March/Eagleson interchange but otherwise shares road space with general traffic in Kanata. Modern LRT vehicles will provide a higher quality trip through increased rider comfort, frequent and predictable travel times and efficient connections with bus feeder routes at stations. Extension of LRT sooner than currently identified in the City's TMP will improve transit experience for customers by improving access to safe, clean and reliable rapid transit service.

New stations provide the opportunity for enhanced amenities and services to passengers including information about next train arrival and journey times as well as increased capacity and weather protection for passenger transfers. Station facilities will be sized to meet expected need, preventing over-crowding and improving the customer experience.

Implementation of LRT in the identified rapid transit corridor will also reduce or eliminate future disruption and costs associated with conversion from a BRT to an LRT facility and allow for optimization of design to meet LRT requirements from the outset.

4. EXISTING ENVIRONMENTAL CONDITIONS

This section of the report presents the findings of the studies, investigations and policy review undertaken to document the existing conditions within the Kanata LRT study area. This section is intended to document the baseline conditions for the study area against which the potential environmental effects of the alternatives can be assessed. Overall, the baseline data was collected and analyzed for key environmental parameters in order to:

- provide an understanding of existing conditions;
- allow for future predictions of how the proposed project may cause these environmental conditions to change;
- allow for future predictions of how adverse effects can be mitigated and beneficial effects enhanced; and,
- Provide a basis for designing monitoring programs.

The area being evaluated has been the subject of extensive study in the form of other environmental assessments. These previous studies have been used to inform the documentation of existing conditions. New content will be added for any gaps that may exist in the work that has been done to date. The studies that will be used are:

- Kanata North Transitway - Highway 417/March-Eagleson Interchange to North Of Maxwell Bridge Road (City of Ottawa, 2013);
- Western Transitway Connection, Terry Fox Drive to Fernbank Road (City of Ottawa, 2012);
- Transportation Environmental Study Report (TESR) for the Expansion of the Ottawa Queensway (Highway 417) from Highway 416 easterly to Anderson Road (MTO, 2008); and,
- West Urban Community Transit Integration Study and Environmental Assessment (City of Ottawa, 1996)

The following sub-sections describe the existing social, ecological, economic, physical, and transportation conditions encompassing the general study area. Once a preferred corridor is selected, a detailed update to existing conditions will occur localized to that corridor.

4.1. STUDY AREA

4.1.1. PHYSICAL BOUNDARIES

The study area for the existing conditions may vary depending on the environmental feature which was investigated. The study area generally extends west from Moodie Drive to Palladium Drive, and reaches as far north as March/Eagleson, and as far south as Hazeldean (Figure 4-1).

Figure 4-1: Study Area

4.1.2. TEMPORAL BOUNDARIES

The temporal boundaries of this Study will encompass all phases of project implementation, including planning and design, construction and operation.

4.2. SOCIAL ENVIRONMENT

Valued components of the social environment that may be affected by the proposed project and therefore would influence the study include the following:

- Planning Policies;
- Land Use; and,
- Land Ownership.

4.2.1. PLANNING POLICIES

4.2.1.1. Federal Policy

The Federal policy context for this project consists of the NCC's Plan for Canada's Capital, the objectives of which are further elaborated in other plans including the Greenbelt Master Plan, Capital Urban Lands Plan, Central Experimental Farm National Historic Site Management Plan, and Sector Plan for Confederation Heights.

Plan for Canada's Capital (2017)

The Plan is a long range planning document that acts as a blueprint for the evolution of federal lands within the Nation's Capital; it guides the federal management of lands to ensure that the capital reflects its national importance. The Plan acknowledges a shared and collective responsibility with municipal and provincial planning authorities in order to achieve the objectives of the plan.

The Plan has three strategic pillars that guide it including:

- Meaningful Capital;
- Picturesque Capital; and
- Natural Capital.

The Plans acknowledges that municipalities continue to make significant investments to develop efficient public transit networks that provide additional mobility options for residents. Investments in providing dedicated pedestrian and cycling infrastructure have helped to achieve a safer and more sustainable transportation network. The Plan describes several emerging trends for the National Capital Region including providing residents with choices in mobility including walking, cycling, transit and driving.

The Plan supports the renewal of federal government complexes near rapid transit stations and changes to federal accommodation will include locating facilities near readily available transit.

Greenbelt Master Plan (2013)

The Greenbelt Master Plan (as part of the larger Plan for Canada's Capital) directs and guides the preservation and evolution of the National Capital Greenbelt into 2067.

The Plan sets out policies for:

- Protected ecologically significant habitats;
- A connected system of natural lands;
- Sustainable farming;
- Capital experiences, achieved through compilation of a recreation pathway system offering visitor features such as trails, protected views and interpretation areas;
- Greenbelt profile and environmental leadership; and
- Federal and non-federal facilities which respect the Greenbelts roles of natural environment, sustainable agriculture and capital experiences and recreation which demonstrate sustainable design and operations.

Each KLRT corridor being considered will cross the Greenbelt from Moodie to March Road, either along Highway 417, or potentially along other existing transportation corridors in the Greenbelt such as Carling Avenue. This crossing, regardless of where it is located, will be adjacent to a combination of five land use designations: 1) Core Natural Area, 2) Natural Links, 3) Federal Facility & Operations, 4) Non-Federal Facility & Operations, and 5) Agriculture. The primary objectives of these three land use designations are outlined in Table 4-1.

Table 4-1: Primary Objectives of Land Used Designations

Land Use Designation	Primary Objectives
Core Natural Area	• Protect biodiversity and ecosystem health for the long term • Restore and enhance terrestrial and aquatic biodiversity • Enhance Canada's Capital through the conservation of natural visual landscapes
Natural Links	• Protect natural linkages between Core Natural Areas • Establish or restore terrestrial and aquatic linkages in fragmented landscapes within the Greenbelt • Provide public activities and interpretation away from sensitive features • Facilitate adaption to environmental change (resiliency) • Enhance Canada's Capital through conservation of natural visual landscapes
Federal Facility & Operations	• Accommodate existing federal facilities of organizations of Capital importance with specialized land needs, i.e. seclusion or large operational areas. • Enhance Canada's Capital by ensuring federal facilities in the Greenbelt contribute positively to the Greenbelt's visual landscapes. • Establish and maintain Built Area footprint limits. • Phase out federal facilities, over the long term and at the end of their life cycle, as opportunities occur. • Provide specific direction for sustainable building management and design for edge facilities that interact with both urban and Greenbelt landscapes, such as the Public Services and Procurement Canada (PSPC) Carling Campus (future National Defence Headquarters).
Non-Federal Facility & Operations,	• Permit existing non-federal facilities, encouraging them to complement the Natural Environment, Agriculture, and Capital Experiences & Recreation roles of the Greenbelt • Enhance Canada's Capital by ensuring that Non-Federal Facilities in the Greenbelt contribute positively to the Greenbelt's visual landscapes. • Provide specific direction for sustainable design for edge facilities that interact with urban and Greenbelt landscapes, such as the Queensway-Carleton Hospital and the Nepean Sportsplex.
Agriculture	• Practice sustainable agriculture • Support productive Greenbelt farms that contribute to local and regional food supply • Diversify Greenbelt farming and provide opportunities for agri-tourism • Reduce the area covered by large mono-culture farming operations and promote diverse agriculture lands • Enhance Canada's Capital through conservation of natural visual landscapes

The Greenbelt Master Plan includes Sector Plans which provides more detailed information on the land use designations, Capital experiences, and the recreation networks in specific parts of the Greenbelt. The Shirley's Bay Sector and the Stony Swamp Sector are located within the study area.

Shirley's Bay Sector

The Shirley's Bay Sector (Figure 4-2) is located north of Highway 417, and extends westward until Moodie Drive. The Sector Plan, denoted by characters on the Sector Plan, identifies a number of Guidelines and Actions which may be interacted with, and which must be considered:

- C – Stillwater Creek
- H – Shirley's Bay Farmsteads
- I – Carling Avenue Lands beside Crystal Beach Community
- J – Expansion Area at 161 Hertzberg Road, near Carling Avenue
- N – Visual Quality – Moodie Drive
- ? – Visual Quality – March Road
- P – Campground
- Q – Equestrian Park
- S – Nineteenth Tee Driving Range
- W – Burke's Settlement
- Y – 185 Corkstown Road Non-Federal Facility

There are also two protected views from Highway 417, one just east of March Road that looks north, and one at the CN Railway underpass, looking east.

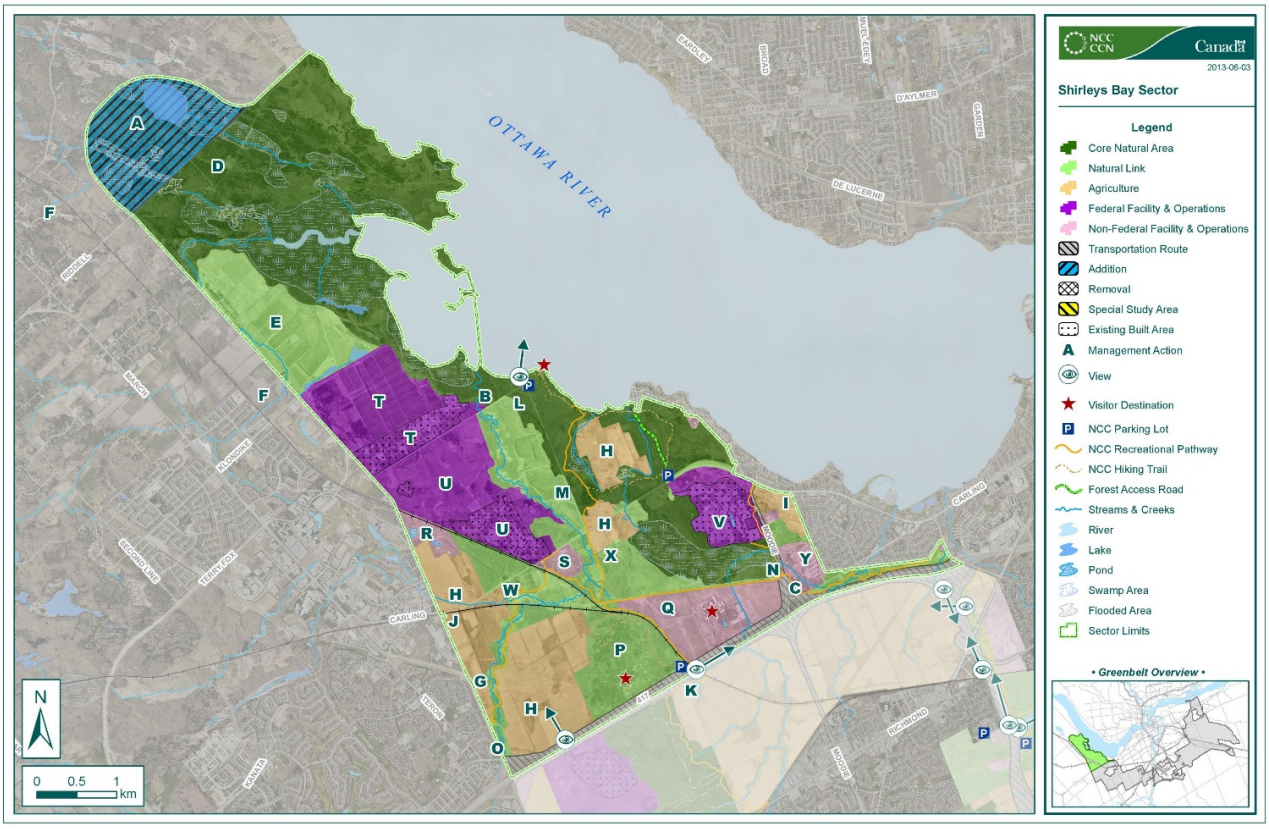


Figure 4-2: NCC Greenbelt Master Plan -Shirley's Bay Sector

Stony Swamp Sector

The Stony Swamp Sector (Figure 4-3) is located south of Highway 417, and extends westward until Eagleson Drive. The Sector Plan, denoted by characters on the Sector Plan, identifies a number of Guidelines and Actions which may be interacted with, and which must be considered:

I – Eagleson Road Farm Fields
J – Stony Swamp Farmsteads
L – Greenbelt Edge at Urban Limit of Bells Corners
P – Scenic Routes along Timm and West Hunt Club Roads
Q – CANMET Federal Facility
R – Eagleson Park and Ride

This sector plan also identifies the same protected views contained in the Shirley's Bay sector plan, described above.

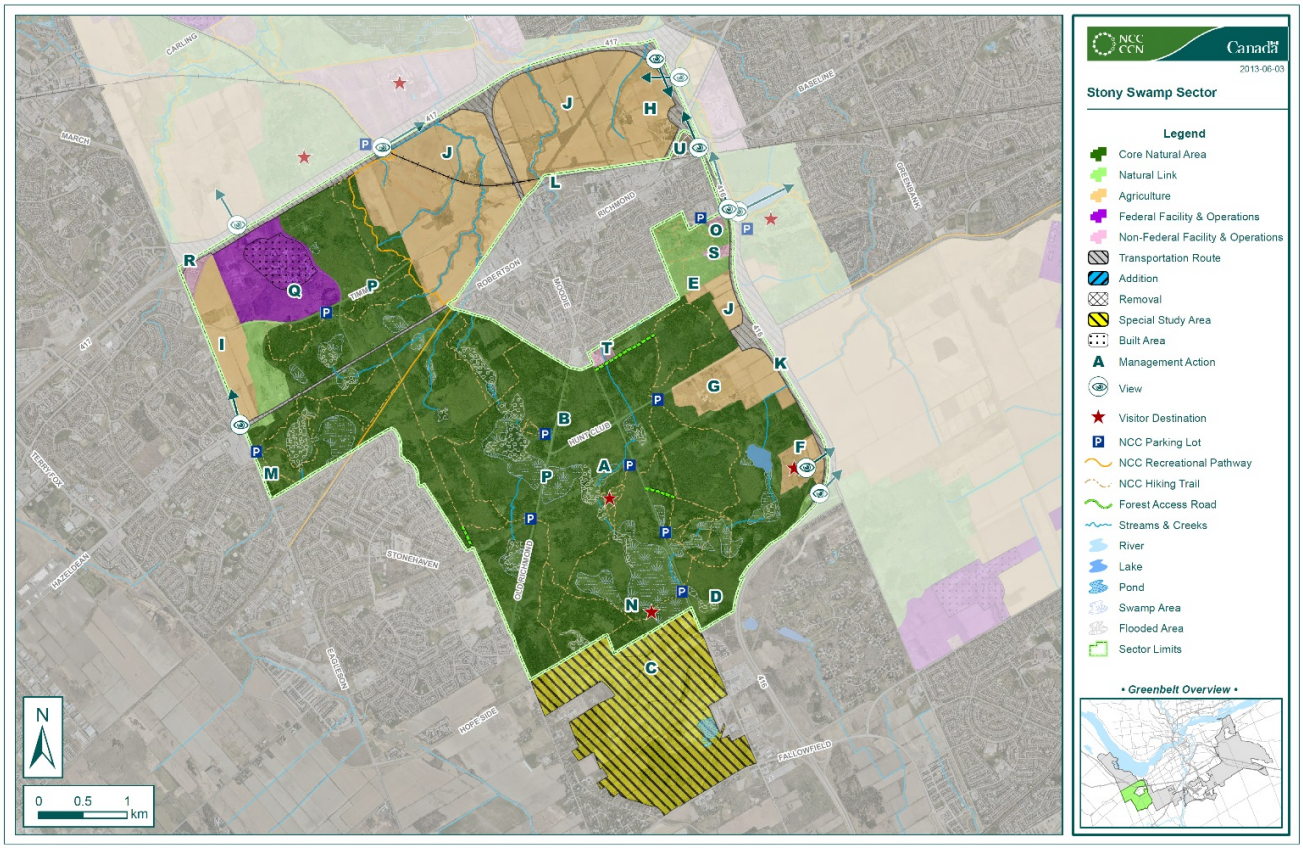


Figure 4-3: NCC Greenbelt Master Plan -Stony Swamp Sector

4.2.1.2. Provincial Policy

The Provincial Policy Statement (PPS), 2014, is authorized under Section 3 of the Planning Act. It contains policies relating to a wide range of areas of Provincial interest. Of relevance in regards to the study are policies that relate to recreation, transportation systems and infrastructure, long-term economic prosperity, and the protection of natural, cultural, and built heritage. In particular, the PPS promotes:

- Healthy and active communities by facilitating active transportation and community connectivity (Section 1.5.1);
- The planning for and protection of corridors and right-of-ways for transportation infrastructure and transit to meet current and projected needs (Section 1.6.8);
- Providing a safe, efficient, cost-effective, and reliable multimodal transportation systems that facilitate the movement of people, are integrated with adjacent systems and are appropriate to address projected needs (Section 1.67 and 1.1.7 f);
- Maintaining or restoring the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems and recognizing linkages between and among natural heritage features and areas, surface water features and ground water features (Section 2.1.2);
- Restricting development and site alteration in or adjacent to significant wetlands, woodlands, valleylands, wildlife habitat, and areas of natural and scientific interest in the Ottawa area (Ecoregion 6E) unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions (Section. 2.1.4 – 2.1.5, 2.8);
- Restricting development and site alteration in habitat of endangered or threatened species except in accordance with provincial and federal requirements (Section 2.1.7);
- Restricting development and site alteration in or near sensitive surface or groundwater features such that their features and related hydrological functions will be protected, improved, or restored (Section 2.2.2); and
- Conserving heritage and significant cultural heritage landscapes (Section 2.6.1).

4.2.1.3. Municipal Planning

The municipal policy and development context affecting the study area consists of: the City of Ottawa Official Plan (OP); Secondary Plans; and the Comprehensive Zoning By-Law (ZBL), existing land use; and projected major development.

City of Ottawa Official Plan

The City of Ottawa's first OP was adopted by City Council in May 2003 and approved by the Minister of Municipal Affairs and Housing in November 2003 and updated every 5 years. On November 26, 2013 Ottawa City Council unanimously approved the OP (OPA#150); the plan was approved by the Minister of Municipal Affairs on April 24, 2014 although appeals are still pending. Policies contained within the approved plan update are still considered council policy pending appeals.

As outlined in Section 2.3, the City of Ottawa OP (as amended by OPA #150) and its supporting Master Plans provide a vision of future growth for the City and sets the policy framework to guide its physical development over the planning horizon to the year 2031. The Plan serves as a basis for and provides guidance on a wide range of municipal activities. The study corridor is affected by a number of City of Ottawa OP land use designations (Figure 4-4).

Notwithstanding these designations and corresponding policy sections, Policy 10 under Section 3.1 of the OP entitled Generally Permitted Uses – Public Utilities and Municipal Services, reads in part that public utilities and municipal services and facilities that are authorized under the requirements of the *Environmental Assessment Act* may be permitted in all land-use designations of the OP. Additionally, other public utilities and municipal services and facilities are permitted in all land-use designations on Schedules A and B (OPA #96).

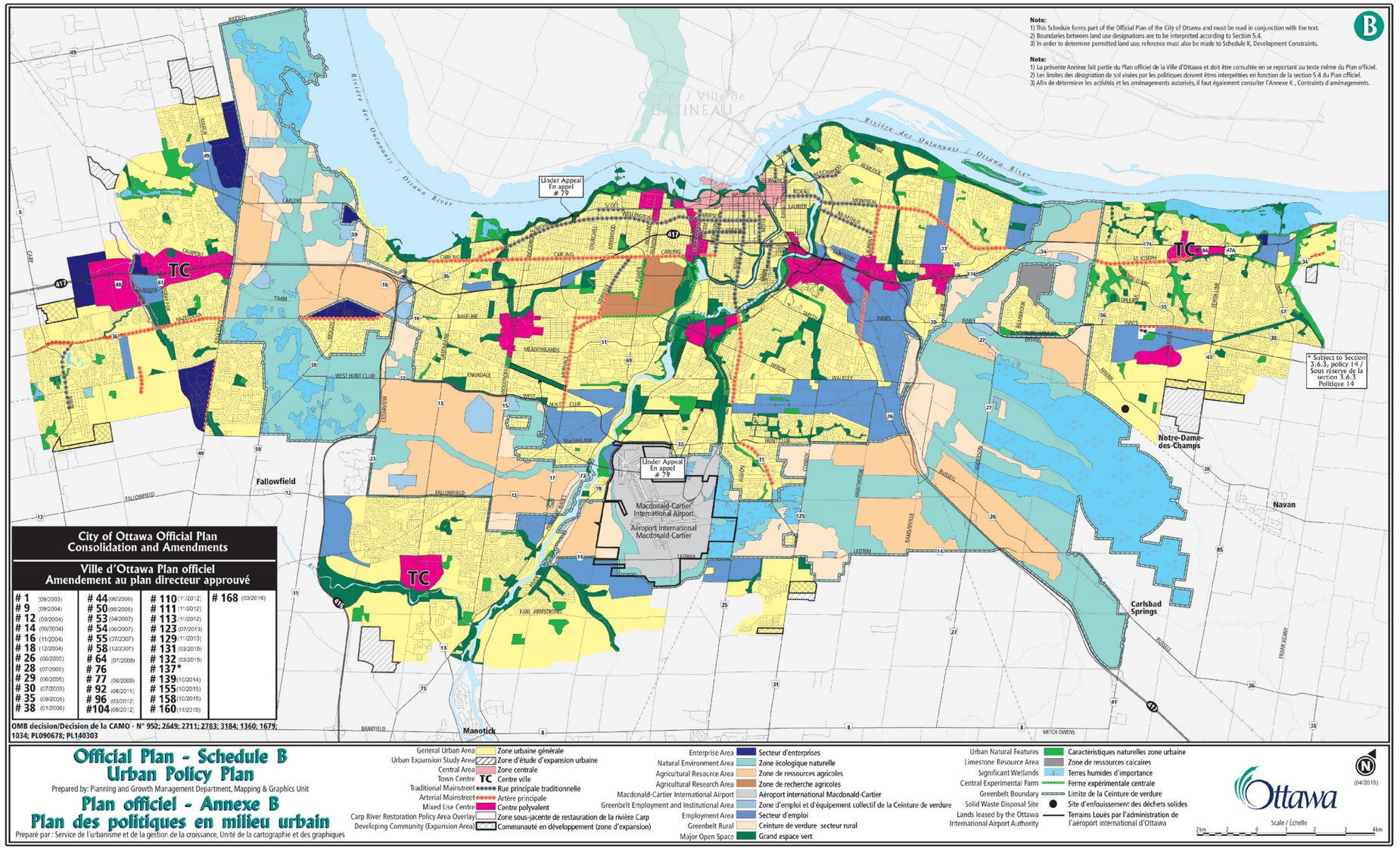


Figure 4-4: Official Urban Policy Plan

Urban Policy Plan – Schedule B

The General Urban Area designation, including land further north and south of Highway 417, permits all types and densities of housing as well as employment, shopping, service, industrial, cultural, leisure, parks, entertainment and institutional uses. To conserve the local nature of neighbourhoods, where uses are proposed that are intended to serve wider parts of the city, such as transit, these should be directed to the edges of neighbourhoods and situated along higher-order roads where the needs of these facilities can be more easily met and impacts controlled.

Mixed Use Centres, including Kanata Town Centre and the Kanata West area, are strategically located on the City's rapid-transit network and adjacent to major roads. These centres act as central nodes of activity within their surrounding communities and the city as a whole. Transit supportive land uses such as offices, high schools, hotels, retail uses and high and medium density residential development are encouraged to locate in these areas. The planning for these areas must consistently ensure that the centres are transit-oriented and that the functional integration of transit and surrounding uses is achieved. Transit-oriented development in the centres is more than density and transit as it entails a designed environment where walking and cycling are attractive options within the centre. The City has adopted *Transit-Oriented Development Guidelines* for use in the Town Centres, Mixed Use Centres and other transit-oriented areas, to assist applicants in submitting well-designed, context-sensitive development applications.

Town Centre: This designation is guided by the Community Design Plan policies of the OP. These require that Mixed use Centres, Town Centres and proposed village boundary adjustments proceed by community design plan to be approved by Council as secondary plans.

Greenbelt Employment, Greenbelt Rural areas, and Agricultural Resource Areas are located on the easterly portion of the study area. The Greenbelt also contains natural environment areas and significant wetlands that link environmental features within the urban area to a larger natural landscape in the rural area, and as such the Greenbelt is a mosaic of land uses and facilities. The policies for the Greenbelt in the OP implement the provisions of the *1996 Master Plan for the National Capital Greenbelt*, as prepared by the NCC. The Greenbelt Employment and Institutional Area designation permits institutional, cultural, recreational and research facilities. Lands designated Greenbelt Rural are used for farming, forestry, recreation, and small-scale commercial uses directly related to rural activities within the Greenbelt. For more information on natural features within the Greenbelt, see Section 4.5 below.

Employment and *Enterprise* lands anticipate a healthy mix of business, retail, housing, institutional and cultural uses. Uses that support this designation consist predominantly of offices, manufacturing, warehousing, distribution, research and development facilities and utilities. The maintenance of an adequate supply of suitable employment land is essential to the future economic prosperity of Ottawa and its residents. Employment land provides for a wide range of economic activities, job opportunities and pay scales. These designations provide for the concentration of at least 2,000 jobs at a range of densities and fulfill the projected need for employment land in the city to the planning horizon. It is understood that the City of Ottawa is conducting a review of Enterprise lands, and that this designation is fluid in the vicinity of Kanata.

City of Ottawa Secondary Plans and Community Design Plans

The City's OP is supported by a collection of Secondary Plans, Community Design Plans, and Site Specific Policies prepared by former municipalities for specific areas. The plans contain complementary and more detailed policy direction for given areas and neighbourhoods in the City. The Secondary Plans which affect the study area include:

- Kanata Town Centre
- Fernbank Community Design Plan
- Kanata West Concept Plan

Kanata Town Centre: The Site Specific Policies for the Kanata Town Centre are both detailed and comprehensive. The policies contain a range of objectives and design principles that encourage the development of an active, vibrant core area containing a mix of uses arranged in a form and scale appropriate to its function and human activity. Close to public transit, high density residential and office development is envisioned both along Castlefrank Road/Kanata Avenue and in the vicinity of the proposed rapid transit station. Transportation policies recognize the importance of rapid transit and the need to maximize transit usage. Approaches offered to encourage ridership include high intensity development around stations and user friendly design features such as lighting, security measures and convenient pedestrian linkages.

The Kanata West Concept Plan was completed in September 2002, and City Council approved the general land use and development principles of the Concept Plan in March 2003. According to the Concept Plan, Kanata West is intended to be a sustainable community in terms of the mix of uses and the form of development, and will provide a full complement of opportunities for people to live, work, play and learn. The mix of uses will include office, housing, retail, institutional, entertainment and leisure activities (Figure 4-5).

The Fernbank Community Design Plan was completed in 2009. The intent of the Fernbank Community Land Use Plan is to create a complete residential community with a full range of housing choices (including affordable housing) that is complemented and supported by appropriate community facilities such as parks and schools, while providing opportunities to work and shop in close proximity to the residential neighbourhoods (Figure 4-6). The plan incorporates a transit corridor.

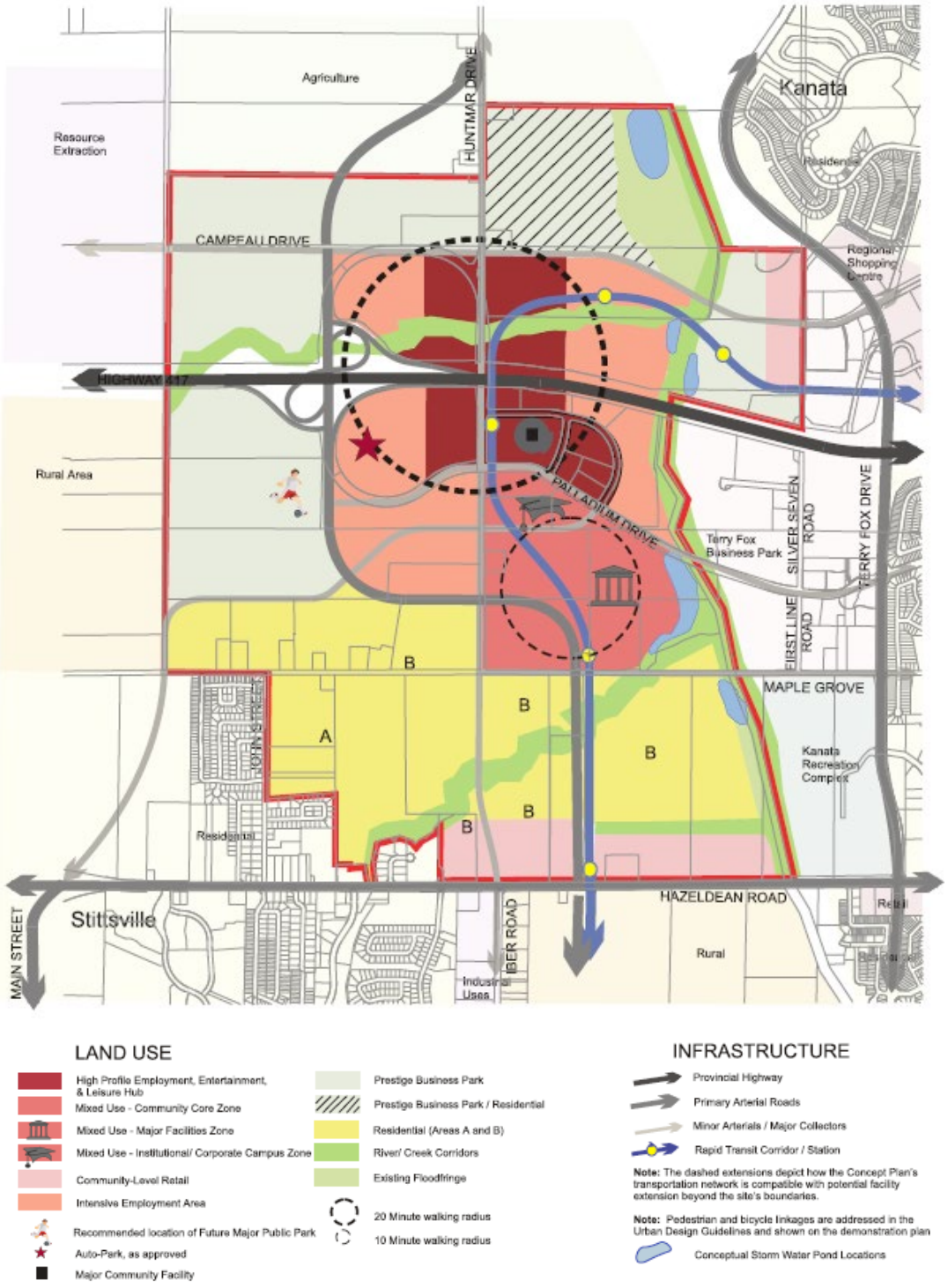


Figure 4-5: Kanata West Concept Plan

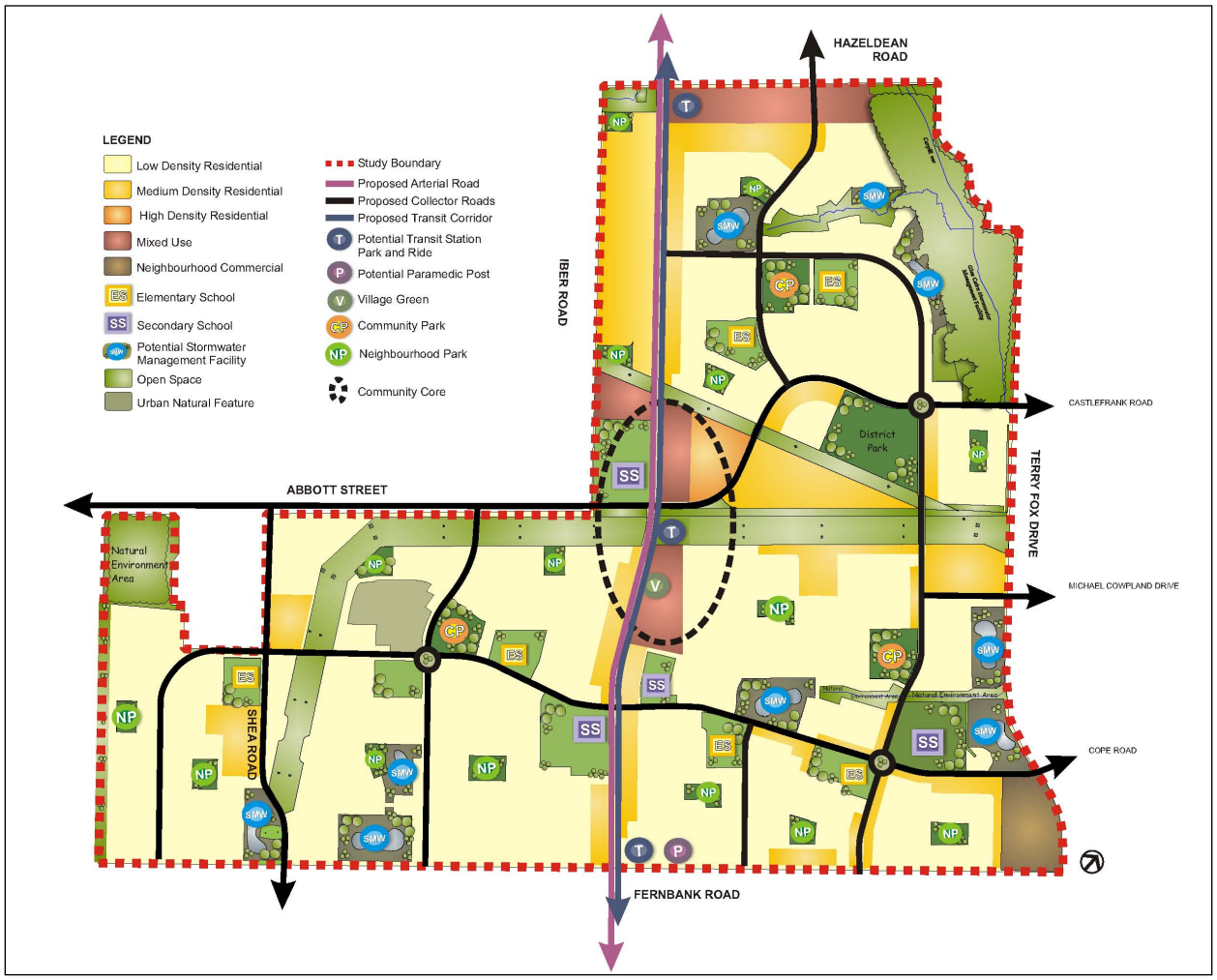


Figure 4-6: Fernbank Community Design Plan – Land Use Plan

Comprehensive Zoning By-Law

The City's Zoning By-Law No. 2008-250 implements many of the policies of the City's OP, which focuses growth within the urban part of the City; promotes increased transit ridership; emphasizes good urban design; preserves environmental integrity; and will achieve compact mixed-use communities. The provisions of the City's Comprehensive ZBL affecting the area are identified in (Figure 4-7). The lands within the study area are contained within a range of zones including agricultural, open space, recreational, residential, institutional and commercial. Given the detailed nature of municipal land use zoning provisions, a characterization of zoning is provided rather than a detailed inventory of applicable zones and related standards.

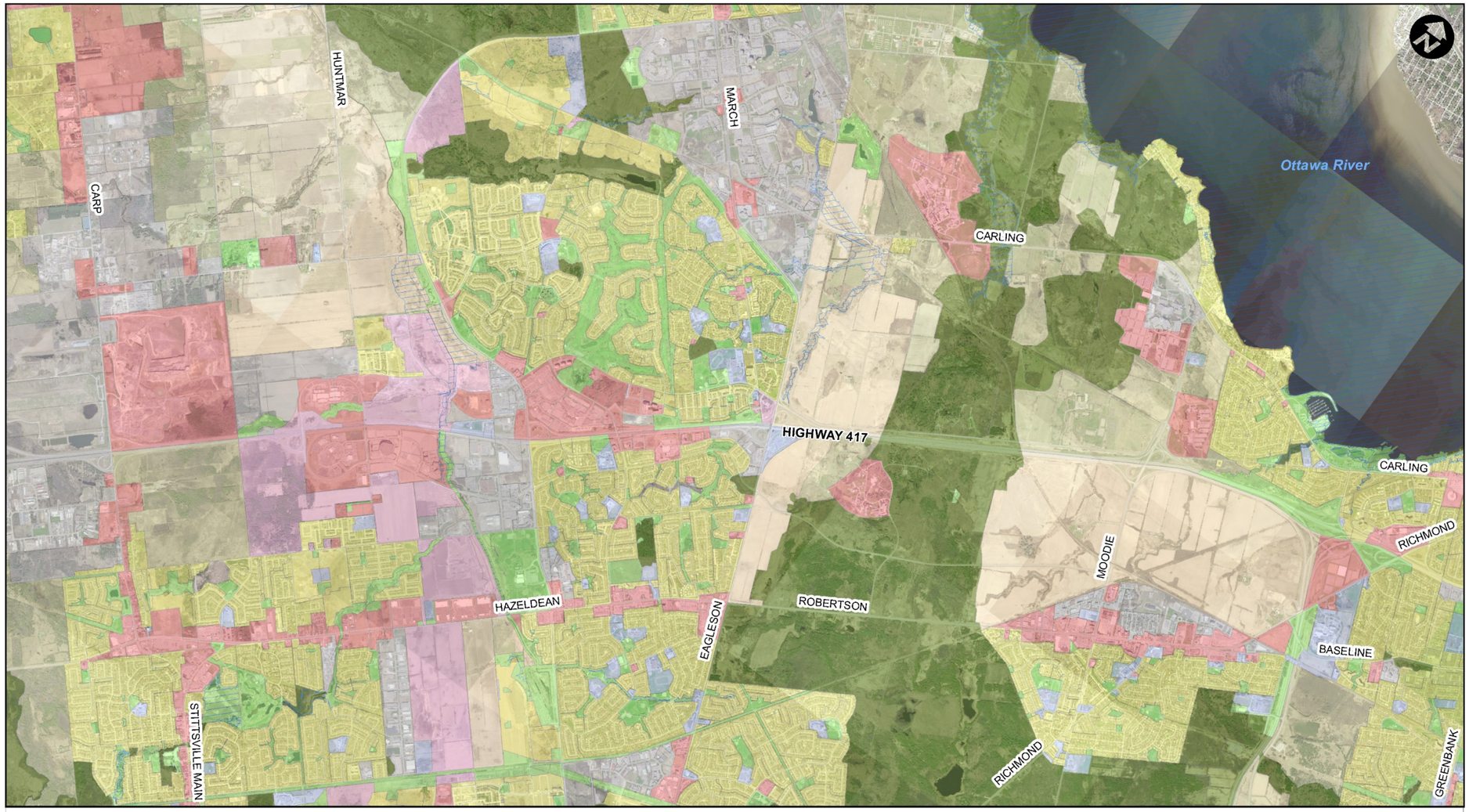


Figure 4-7: Zoning

Transportation Master Plan (2013)

The City's 2013 TMP builds on the work of previous plans carried out in 2003 and 2008. It establishes policies and strategies for providing transportation services for the population and employment targets of the City's OP, expected to be in place by the year 2031. The TMP identifies the transportation facilities and services that the City will implement to serve a projected population of 1.14 million people by 2031. The plan identifies a number of modifications to road and transit infrastructure priorities to account for adjustments in growth patterns, emerging issues and strategic opportunities. More so than in previous plans, the current TMP also places a strong emphasis on the concept of affordability, including prioritizing projects based on financial criteria and fiscal constraints. Ottawa's 2008 TMP included a transportation vision that expressed how a future transportation system would benefit residents. That vision has been maintained in the updated TMP with a few minor modifications.

The expanded Rapid Transit and Transit Priority (RTTP) network will include LRT, BRT, O-Train facilities plus on-road transit priority measures to achieve the City's transit objectives. Expansion of the RTTP network as described in the 2013 TMP is aimed to significantly increase the ease of mobility and attractiveness of transit use for residents. The *2031 RTTP Network Concept* was developed to both accommodate an expected growth in demand for peak period transit trips (by 2031) and to provide a level of service that will attract it. As previously mentioned, although the 2031 RTTP Network Concept may not be fully implemented by 2031, it is important that the City protect lands that would be required for its eventual implementation.

The *Affordable RTTP Network* will provide as many of the 2031 RTTP Network Concept benefits as possible within the City's projected funding envelope. The projects of the Affordable Network were strategically selected within the TMP to maximize gains in transit ridership within available funds. The prioritization of rapid transit projects resulted from a complex exercise that considered each project using factors such as ridership gains, opportunities for land use intensification, congestion reduction, and operating cost savings. Future updates of the TMP will review and confirm project priorities. The following projects have been identified within the Affordable RTTP and are located in the study area:

Light Rail Transit

- Western LRT: Conversion of the West Transitway to LRT between Tunney's Pasture Station and Baseline Station, Construction of new LRT right of way between existing West Transitway and Pinecrest and conversion of West Transitway to LRT from Pinecrest to Bayshore Station.
- In August 2017, the City approved expanding the Western LRT to Moodie Drive as part of the Stage 2 LRT project (within Affordable RTTP as a BRT corridor).

Bus Rapid Transit

- March Road Bus Rapid Transit Corridor: At-grade BRT corridor in the road right of way with at-grade intersections from just north of Highway 417, to the Kanata North Business Park.; and,
- West Transitway: Construction of new Bus Rapid Transit Facilities between Terry Fox and Eagleson.

Transit Priority

- March Road: Transit signal priority and queue jump lanes between Maxwell Bridge Road and Carling Avenue;
- Eagleson Road: Transit signal priority and queue jump lanes between Hazeldean Road and Eagleson Station; and,
- North-South Arterial: Transit signal priority and queue jump lanes at select intersections along this future North-South Arterial.

4.2.2. LAND USE

The diversity of land use was reviewed based on mapping provided by the City's (2005 Land Use Survey) (Figure 4-8).

The study area from Moodie to March consists of the NCC Greenbelt, which is comprised of Agricultural, Recreation, forested, and Idle Land uses.

Land use between March Road and the Canadian Tire Centre is predominately urban, with a mix of residential, commercial and institutional developments, and vacant land. Key features are described below;

- Kanata Town Centre is a large development with a mix of commercial, offices, and Utility lands that act as a major employment hub and destination for Kanata residents. The land use has a large amount of parking, and can support additional intensification.
- Kanata North Business Park is a large office complex with a mix of office, utility, industrial, and vacant land that acts as a major employment hub for various employment types, including high tech.
- Eagleson Road, south of Highway 417 is bordered to the east by large swatch of vacant land.
- Vacant land north of Highway 417, in the vicinity of Campeau Drive and Huntmar is poised for residential, commercial, and potentially office development.
- Canadian Tire Centre and Palladium Area currently houses a major entertainment and sports stadium, as well as several businesses. The land use has a large amount of parking, and can support additional intensification or a change in land use.
- The area south of Canadian Tire Centre is largely composed of vacant land identified for future residential and commercial development as each of these communities develops.
- The Kanata West Concept Plan was completed in September 2002, and City Council approved the general land use and development principles of the Concept Plan in March 2003. According to the Concept Plan, Kanata West is intended to be a sustainable community in terms of the mix of uses and the form of development, and will provide a full complement of opportunities for people to live, work, play and learn. The mix of uses will include office, housing, retail, institutional, entertainment and leisure activities.
- The Fernbank Community Design Plan was completed in 2009. The intent of the Fernbank Community Land Use Plan is to create a complete residential community with a full range of housing choices (including affordable housing) that is complemented and supported by

appropriate community facilities such as parks and schools, while providing opportunities to work and shop in close proximity to the residential neighbourhoods.

4.2.3. LAND OWNERSHIP

The study area includes Federal, Provincial, municipal and privately owned lands. The Kanata LRT Study Area is centered by Highway 417, which is under Provincial ownership and jurisdiction. There is also Federal (NCC) and Municipal land, as well as significant privately owned lands.

The property fabric of the publicly owned lands and private land ownership located within the study area is a combination of public and private (Figure 4-9). The information shown is considered a general snapshot of ownership and it is important to note that ownership of these lands may change over time.

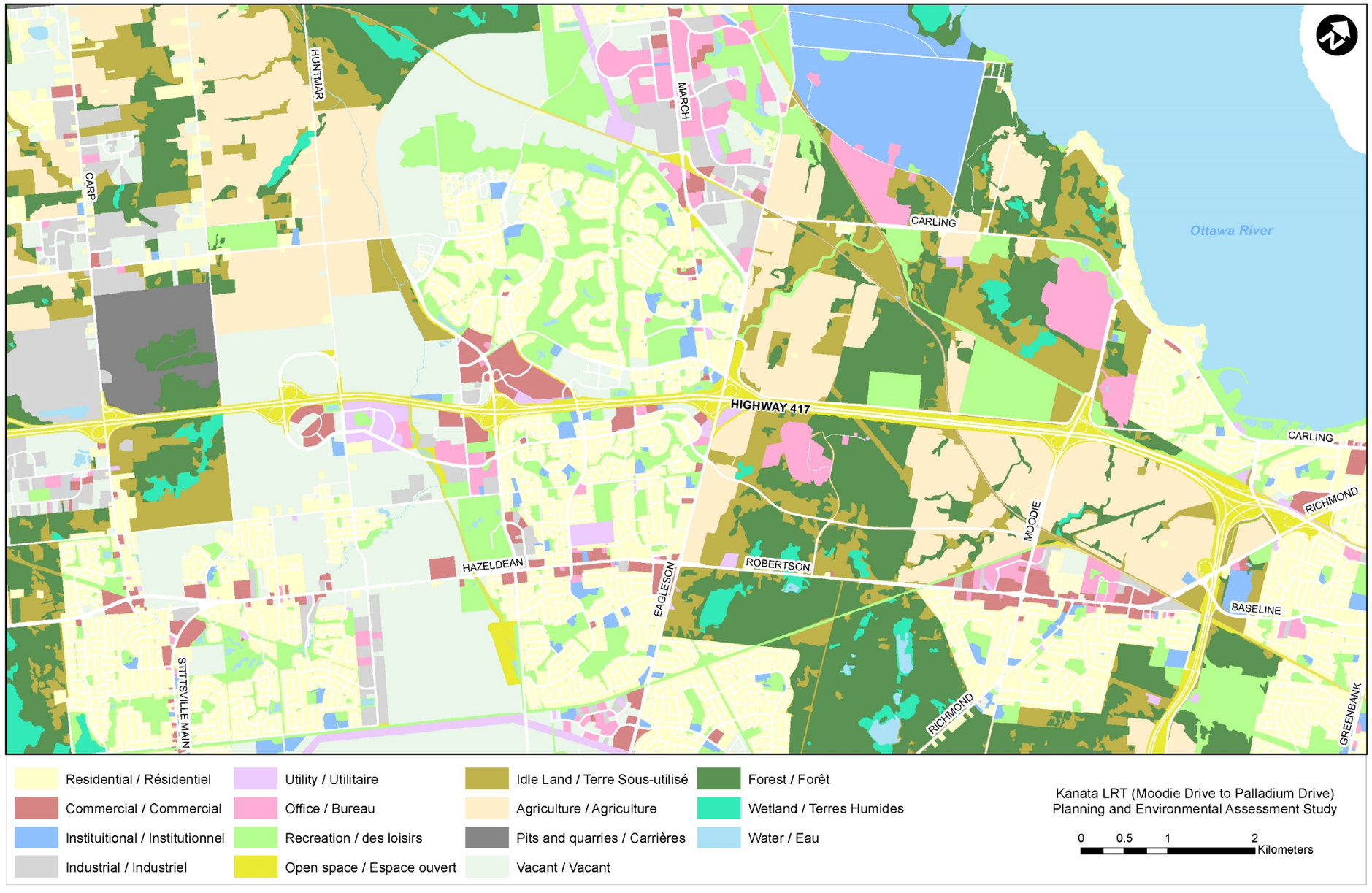


Figure 4-8: Land Use

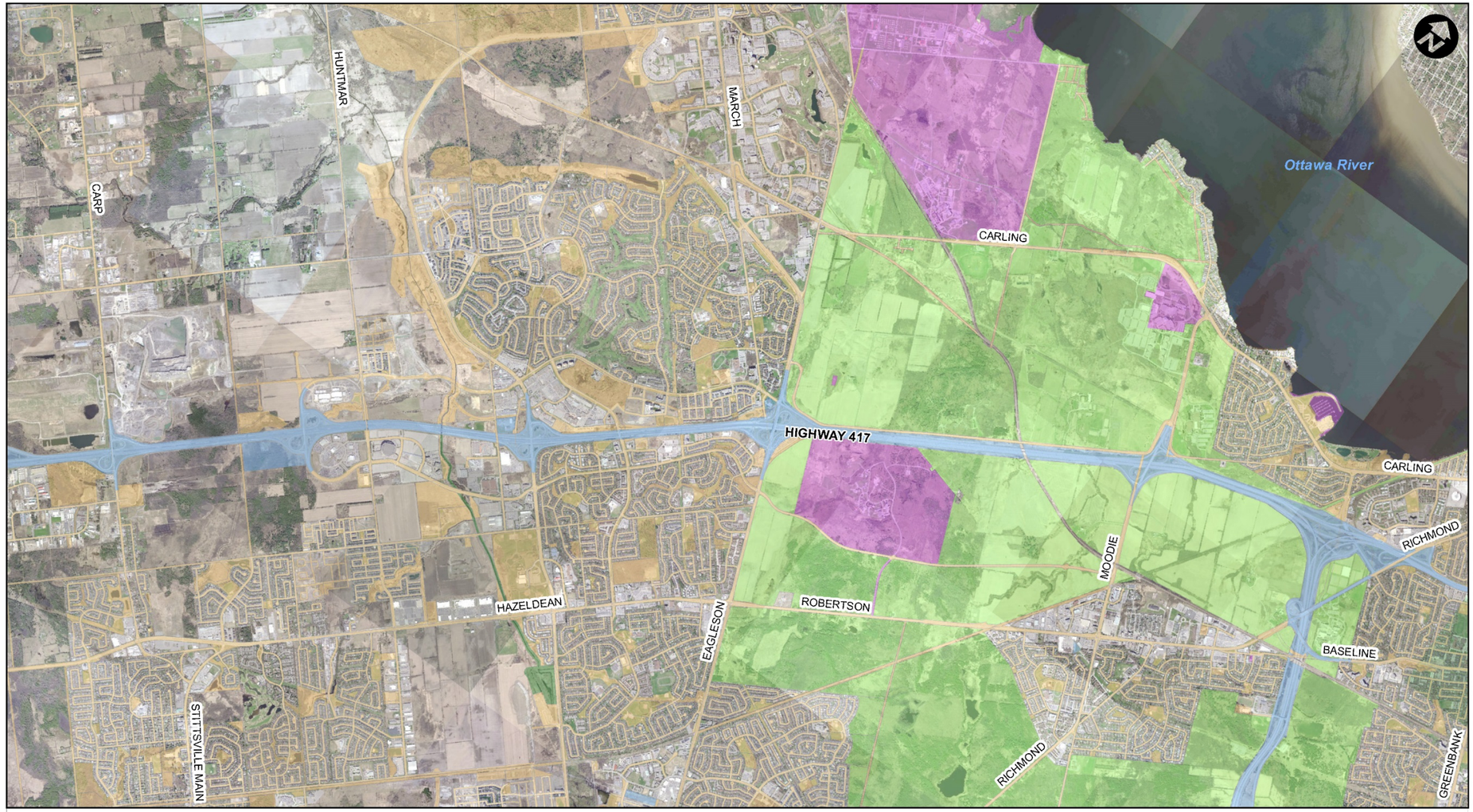


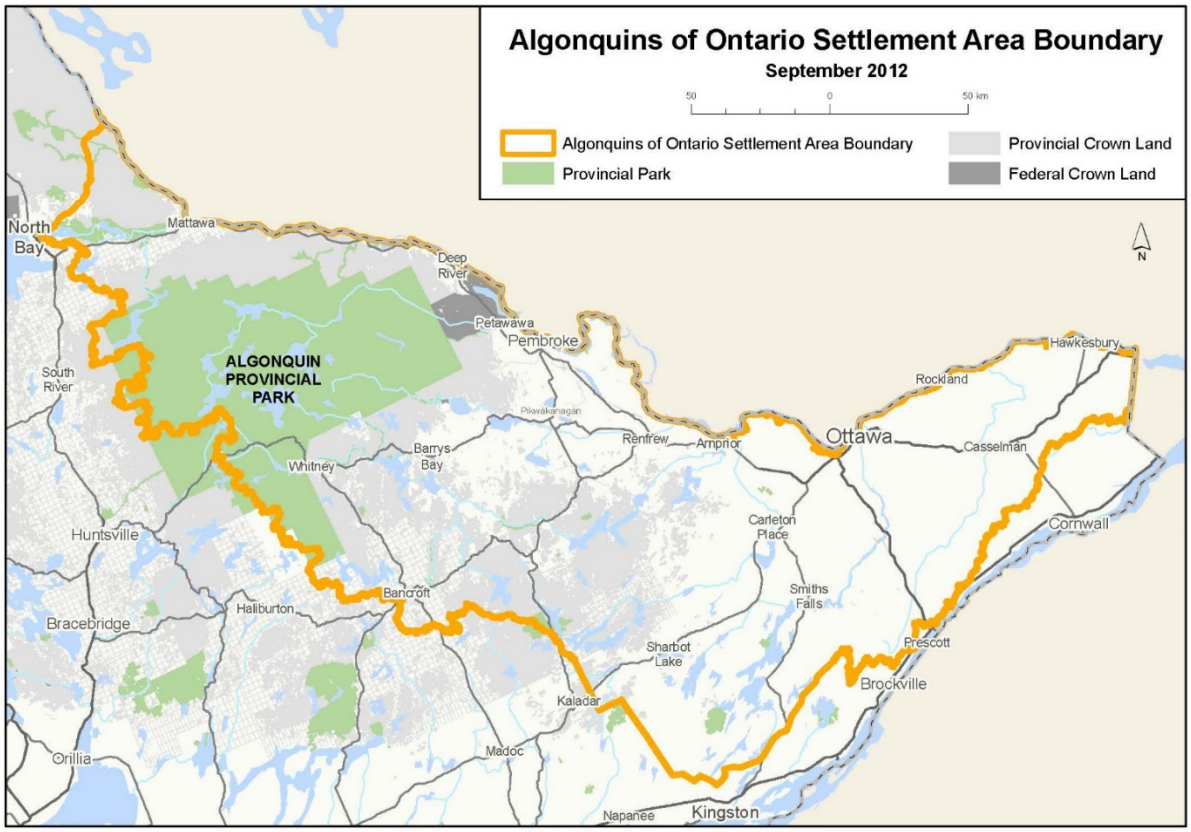
Figure 4-9: Land Ownership (January 2017)

4.2.4. ABORIGINAL LAND CLAIMS

The Algonquins lived in present-day Ontario for thousands of years before Europeans arrived. Algonquin territory originally extended from the St. Lawrence River to the French River in the west, south to the Adirondack Mountains in New York State, and north above Lake Abitibi. Over the past several hundred years, the description of Algonquin Territory has changed to be the lands and waters on both sides of the Ottawa River watershed from modern Hawkesbury to Lake Nipissing and north past the headwaters of the Ottawa River. Today, ten Algonquin communities comprise the Algonquins of Ontario (AOO):

- The Algonquins of Pikwakanagan First Nation
- Antoine
- Kijicho Manito Madaouskarini (Bancroft)
- Bonnechere
- Greater Golden Lake
- Mattawa/North Bay
- Ottawa
- Shabot Obaadjiwan (Sharbot Lake)
- Snimikobi (Ardoch)
- Whitney and Area

Based on a Protocol signed in 2004, these communities are working together to provide a unified approach to negotiate a modern-day Treaty. The AOO land claim includes an area of nine million acres within the watersheds of the Kitchisippi (Ottawa River) and the Mattawa River in Ontario, an unceded territory that covers most of Eastern Ontario, including Ottawa, and most of Algonquin Park (Figure 4-10). More than 1.2 million people live and work within the Settlement Area. There are 85 municipal jurisdictions fully or partially located within the unceded Settlement Area, including 76 lower and single tier municipalities and 9 upper tier municipalities.



Source: INAC, 2015

Figure 4-10: Algonquin of Ontario Unceded Settlement Area Map

On October 18, 2016, the AOO and the Governments of Ontario and Canada reached a major milestone in their journey toward reconciliation and renewed relationships with the signing of the Agreement-in-Principle (AIP). The signing of the AIP is a key step toward a Final Agreement, and a modern-day Treaty, which will clarify the rights of all concerned. By signing the AIP, the AOO and the Crown have expressed, in a formal way, their mutual intention and desire for a lasting partnership. This event signaled the beginning of a new relationship between the AOO and the Crown, one in which the mistakes of the past must be supplanted by a new type of mutual respect and cooperation.

The AIP is not a legally binding document. Rather, it opens the way for continued negotiations toward a Final Agreement that will define the ongoing rights of the Algonquins of Ontario to lands and natural resources within the Settlement Area in Eastern Ontario.

The Negotiation Teams are now hard at work to ensure that the next phase of negotiations towards a Final Agreement will succeed. If a Final Agreement is achieved through this next phase, and if it is ratified by Algonquins and by the federal Parliament and provincial Legislature, it will take the form of a modern-day treaty setting out Algonquin Aboriginal and treaty rights protected under Section 35 of the *Constitution Act, 1982*.

There are two parcels of land identified in the Agreement-in-Principle within the study area:

- PIN 045160053, located at the intersection of Carling Avenue and March Road; and
- PIN 045110461, located at the intersection of Steacie Drive and Teron Road.

4.2.5. ARCHAEOLOGICAL POTENTIAL

Archaeological potential is established by determining the likelihood that archaeological resources may be present within the study area. In accordance with the MTCS' 2011 Standards and Guidelines for Consultant Archaeologists, the following are features or characteristics that indicate both archaeological potential within the study area.

A number of factors are used to determine archaeological site potential. For prehistoric sites criteria are principally focussed on topographical features such as the distance from the nearest source of water, the nature of that water body, distinguishing elements in the landscape (including ridges, knolls, drumlins and eskers), and the types of soils found within the area being assessed. For historic sites, the assessment of site potential is more reliant on historical documents (such as land registry records, census and assessment rolls, etc.), cartographic and aerial photographic evidence, and the inspection of the study area for possible above ground remains or other evidence of a demolished historical structure.

Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and, considered alone, may result in a determination of archaeological potential. These water sources include rivers, lakes, creeks/streams, wetlands, ponds, etc. Within the Study Area the Ottawa River and the Carp River are the two primary water bodies which trigger archaeological potential. However, the various creeks and tributaries of both rivers also have archaeological potential as they are sources of potable water and may have been used for travel and resource procurement. Additional triggers for Pre-Contact Indigenous archaeological potential are elevated and well drained soils. Within the Study Area these include sandy areas within predominantly clay plain topography or elevated ridges such as that noted east of Huntmar Road. Current geological investigations have not identified relic shorelines in the study area vicinity.

Historic Euro-Canadian archaeological potential is primarily based on historic mapping and proximity to early historical transportation routes (trails, passes, roads, railways, and portage routes), location of historic buildings and properties listed on a municipal register or designated under the Ontario Heritage Act or that is a federal, provincial or municipal historic landmark or site. Within the study area there are a large number of historic transportation corridors as well as a large number of mapped structures that appear on the 1863 and 1878 historic mapping. Some notable historic corridors within the study area include, Moodie Drive, Richmond Road, Eagleson Road, Robertson and Hazeldean Roads, Huntmar and Carp Roads, among many others.

There have been a large number of archaeological assessments completed within the study area including work along the Carp River, Highway 417 and Terry Fox Drive. These, and other assessments, have resulted in the identification of at least 15 archaeological sites within the Study Area. Some of the notable sites is a large Pre- Contact Indigenous site located on the banks of the Carp River as well has historic sites located off of Hazeldean Road and Huntmar Road.

4.2.6. CULTURAL HERITAGE RESOURCES

Cultural Heritage Resources in the project area include a number of properties listed on the City of Ottawa *Heritage Register* and designated under Part IV of the *Ontario Heritage Act*. The area includes part of the Greenbelt, an area recognized and valued for its rural agricultural heritage character and views. The Greenbelt also includes several properties owned by the National Capital Commission (NCC) with buildings recognized or designated by the Federal Heritage Building Review Office, including Silver Spring Farm at 3501 Richmond Road. The area is also next to the Ottawa River, a Canadian Heritage River.

The Bishop Quarry and Campbell Quarry in the Greenbelt (between Highway 417, Moodie Drive, Robertson Road, and Eagleson Road) are significant as the origin sites for sandstone used in the Parliament Buildings. Properties in the project area listed and designated in the City of Ottawa *Heritage Register* or under the City's Heritage Zoning Overlay include:

- Kemp's Tavern, at 5816 Hazeldean Road;
- A schoolhouse at 400 Goldridge Drive;
- Fairfields Heritage Property at 3080 Richmond Road;
- Mosgrove Schoolhouse at 2976 Richmond Road;
- Mulligan's Schoolhouse/the Cheshire Cat pub at 2193 Richardson Side Road;
- T. Richardson Farm at 1665 Richardson Side Road;
- The Bradley Homestead at 4 Bradley Farm Court;
- Scissons House at 910 March Road;
- A schoolhouse at 895 March Road;
- March House at 806 March Road;
- Old Town Hall at 821 March Road;
- Orange Lodge at 160 Flamborough Way;
- John Armstrong/Bidgood House at 1150 Old Carp Road;
- The Stone House at 47 Naismith Crescent;
- St. John's Anglican Church, Rectory and Cemetery at 321 Sandhill Way;
- The Our Lady of Peace Anglican Church and Cemetery at 3861 Old Richmond Road; and,
- 185 Bound Stone Way.

Many of the known and potential cultural heritage resources in the area are indicated on the attached map. The area also contains many additional properties from the 19th and 20th centuries with structures over 40 years old that have not been previously investigated for potential cultural heritage value or interest.

4.2.6.1. Landscape Character

Overall the study corridor passes through some of the most non-descript low-density urban areas of Kanata to Moodie. However, the NCC Greenbelt includes some of the finest, rural agrarian landscapes in the whole city. The pattern of fields and hedgerows offers long views, and contiguous patches of natural habitat. These portions will likely be the most challenging in terms of integration of a new transportation facility.

There are also small strip malls and restaurants that are typically associated with newer suburban development. The Highway 417 corridor passes through the Kanata Town Centre, which is

predominantly row and single-family homes backing onto a concrete noise barrier, and some commercial buildings on the south side of the highway and flanking Terry Fox Drive.

The wooded areas and undulating farmland that comprise this portion of the Greenbelt in the study area characterize this section. Large expanses of open space dotted with heritage farmhouses and barns contrast with the enclosure of mature woodlands and contribute to a rural sense of place. Several NCC staging areas can be found off some of the smaller roads that supply parking and trail access into the Greenbelt.

4.2.7. AIR QUALITY, NOISE AND VIBRATION

4.2.7.1. Air quality

The assessment of ambient air quality requires determining the concentration of a pollutant at a particular location, measured either in parts per million (ppm) or micrograms per cubic metre ($\mu g/m^3$). The resulting concentrations are compared to clean air standards that have been set by the Ontario Ministry of the Environment. The standards include a set of air quality criteria for pollutants commonly produced by highway traffic including Carbon Monoxide (CO), Hydrocarbons (HC), Oxides of Nitrogen (NOx), and Particulate Matter (PM) in addition to other secondary components. There are three primary sets of standards and guidelines that include:

- The Ambient Air Quality Criteria (AAQC) are the Ministry's targets for clean air from all sources of pollutants, including transit, transportation, and industrial facilities when considered with other sources.
- Ontario Regulation 419: Air Pollution – Local Air Quality Standards (O.Reg. 419) are the legal limits for single or multiple sources falling within a single property, such as an industrial facility.
- Canadian Ambient Air Quality Standards (CAAQS).
- The AAQC standards for representative pollutants are listed in Table 4-2.

Table 4-2: Ambient Air Quality Standards for Representative Pollutants

Pollutant	AAQC (µg/m³)	2020 CAAQS (µg/m³)	Limiting Effect
CO	36,200 (1 Hour)	N/A	Health
	15,700 (8 Hour)	N/A	
NO_x	400 (1 Hour)*	112 (1 Hour)	Health
	200 (24 Hour)*	N/A	
	N/A	32 (Annual)	
PM_{10} < 10µm	50 (24 Hour)	N/A	Health
$PM_{2.5}$ < 2.5µm	30 (24 Hour)	27 (24 Hour)	Health
	N/A	8.8 (Annual)	
Benzene	2.3 (24 Hour)	N/A	Health
	0.45 (Annual)	N/A	
1,3-Butadiene,	10 (24 Hour)	N/A	Health
	2 (Annual)	N/A	
Formaldehyde	65 (24 Hour)	N/A	Health
Benzo(a)pyrene	0.00005 (24 Hour)	N/A	Health
	0.00001 (Annual)	N/A	
Acetaldehyde,	500 (½ Hour)	N/A	Health
	500 (24 Hour)	N/A	
Acrolein	4.5 (1 Hour)	N/A	Health
	0.4 (24 Hour)	N/A	

Note: Limit for NOx is a mixture of both NO and NO_2. In ambient air, NO converts to NO_2, which has more severe health effects than NO. Therefore, AAQC is based on health effects of NO_2

The City of Ottawa combats air pollution through its Air Quality and Climate Change Action Plan (AQCCMP) which was issued in 2005 and has since undergone a number of amendments. In 2005 Ottawa City Council set an emission target to reduce corporate greenhouse gases (GHG) by 30% and community GHG emissions by 20% from 1990 levels. Increase in transit use and providing transit facilities is in line with the AQCCMP policy and programs. The 12.5 km Confederation Line light rail system is projected to reduce GHG emission by 38 kt/year by 2031 and the Kanata LRT will add to the GHG overall reduction.

4.2.7.2. Noise

For the purpose of this study, the term "noise" refers to the obtrusive sound caused by vehicular traffic and its impact on people (Table 4-3). Typically, remediation is required when the noise resulting from vehicular traffic adversely affects indoor and outdoor living conditions and exceeds specific limits set out by the City of Ottawa. Based on these limits, the following categories were used in classifying the roadways and intersections:

SEVERE	Daytime noise levels at receivers are expected to exceed 65 dBA
HIGH	Daytime noise levels at receivers are expected to fall in the range of 60 to 65 dBA
MODERATE	Daytime noise levels at receivers are expected to fall in the range of 50 to 60 dBA
LOW	Daytime noise levels at receivers are expected to be lower than 50 dBA

Table 4-3: Classification of Existing Ambient Noise Levels

Relevant Roads and/or Intersections	Nearby Occupancy	Noise Levels
HWY 417 – Moodie to Palladium	Commercial; Residential; Open	HIGH
HWY 417 & Eagleson	Residential	HIGH
HWY 417 & Terry Fox	Residential; Commercial	HIGH

A further detailed review of noise and receptors of the Kanata LRT corridor was conducted and evaluated existing and future vehicles noise traffic within the study area. In the assessment nine (9) receptors within the Kanata LRT corridor where assessed with the future noise from the LRT line. According to the City of Ottawa Environmental Noise Control Guidelines (ENCG), all nine (9) receptors within the LRT corridor are below the established ambient noise levels, therefore no noise mitigation is required as part of the LRT Kanata project.

Furthermore, the activity and traffic pattern around the existing bus stations and proposed LRT stations are expected to remain similar to the current function of each station. The nearest station to any dwelling is Kanata Town Station which is 50 m from the nearest dwelling. All other stations would be located within busy commercial areas (and having further significant setback distances) or located in close proximity to Highway 417 or major arterial roadways, such that any increase in bus activity would likely be overcome by roadway traffic. Beyond 100 meters from arterial roadways and 500 m from a freeway, noise levels fall below the ENCG objective level of 55 dBA.

4.2.7.3. Vibration

A number of receptors (five in total) were assessed for vibration impacts along the Kanata LRT corridor. The International standards Organization, The United States Federal Transportation Authority, and the MECP and the Toronto Transit Commission, among others establish vibration criteria for a variety of building functions and were used to assess the ground vibrations with in the Kanata LRT corridor. In general terms, vibration levels throughout the area are expected to fall below the human perception level of 0.1 mm/s (72 dBV).

4.2.8. VIEWS AND VISTAS

The most dramatic and satisfying views are those of the Gatineau Hills, which lie across the Ottawa River in Quebec. Dramatic views of Ottawa are offered from Highway 417 east-bound when descending the 'Kanata Hill'. The views along the Highway 417 corridor through Kanata are confined by the noise barrier walls on each side and the occasional mid-rise commercial buildings

4.3. TRANSPORTATION

4.3.1. TRANSIT NETWORK

Kanata is a large suburb in the City of Ottawa, located west of the downtown core. Kanata is separated from the inner core of Ottawa by the National Capital Commission Greenbelt. The main connection between inner Ottawa and Kanata is provided by the MTO Highway 417, which runs in an east-west direction through the middle of Kanata. As shown in the City's OP, the areas around Highway 417 through Kanata are designated as Mixed Use Centre, with the remaining majority of Kanata designated as General Urban Area. Major employment and enterprise areas exist to the north in the Kanata North Business Park along March Road and to the south in the Kanata South Business Park along Eagleson Road (Figure 4-11).

Figure 4-11: Study Area – Kanata Community

In addition to Highway 417, a number of east-west arterial roadways connect Kanata across the Greenbelt to Ottawa, including Carling Avenue, Robertson Road and West Hunt Club/Old Richmond Road.

4.3.2. ROAD NETWORK

The roadways which make up the study area are described below:

Carling Avenue is an arterial roadway with a posted speed limit of 60 km/h and a cross-section that varies between 2-lanes, 4-lanes and 6-lanes along its corridor. In developed areas, sidewalks are provided along both sides of the roadway and on-street parking is not permitted. Through the Greenbelt, and continuing to its terminus in Kanata at March Road, Carling Avenue has a two-lane rural cross section with paved shoulders. Carling Avenue is generally controlled by traffic signals at major intersecting roadways with bus stops provided along both sides of the roadway.

Robertson Road is an arterial roadway with a posted speed limit of 60 km/h and a cross-section of 4-lanes along its corridor. This roadway connects the Bells Corners community with Kanata, extending from Eagleson Road and Baseline Road. West of Eagleson Road, this roadway continues as Hazeldean Road while east of Baseline Road, it continues east as Richmond Road. West of Fitzgerald Road and through the Greenbelt it has a rural cross section with paved or gravel shoulders. Robertson Road is controlled by traffic signals at major intersecting roadways and transit service is provided along its corridor.

West Hunt Club Road is an arterial roadway with a posted speed limit of 80 km/h and a cross-section that varies between 2-lanes and 4-lanes along its corridor. This roadway provides an indirect connection between Ottawa and Kanata via Old Richmond Road, which links road users to Terry Fox Drive in the south and Robertson Road in the north. In addition, Hunt Club Road provides a major link across the Rideau River and serves the Ottawa International Airport via Uplands Drive and Airport Parkway.

Three major interchanges connect Highway 417 with arterial roadways serving the north and south neighbourhoods of Kanata. These interchanges are located at Eagleson Road, Terry Fox Drive and Palladium Drive. An additional interchange at Kanata Avenue provides a connection to/from central residential areas, but is not considered to be as significant as the adjacent connections. The general characteristics of these roadways are described below.

Eagleson Road is an arterial roadway with a posted speed limit ranging from 60 to 80 km/h and a cross-section that varies between 2-lanes, 4-lanes and 6-lanes along its corridor. This north-south roadway extends beyond the boundaries of Kanata. North of Campeau Drive, it continues as March Road, and in the south continues to the community of Richmond, Ontario. Eagleson Road serves as the major connection to/from the Kanata Business Parks in the north and south ends of the community. There is a large OC Transpo Park and Ride located near the interchange of Highway 417 and Eagleson Road

Terry Fox Drive is an arterial roadway with a posted speed limit ranging from 60 to 80 km/h and a cross-section that varies between 2-lanes and 4-lanes along its corridor. Located on the western edge of Kanata, it is generally a north-south roadway from March Road in the north to Eagleson Road in the south. Terry Fox Drive provides a main connection between residential neighbourhoods and commercial/business areas within Kanata.

Palladium Drive is an arterial roadway with a posted speed limit ranging between 60 and 70 km/h and a cross-section of 4-lanes along its corridor. The road is directly connected to Highway 417 via the Palladium interchange, which provides a major connection to local attractions such as the Canadian Tire Centre and the Tanger Outlet mall. In addition, Palladium Drive serves the Palladium Auto Park which includes several automobile dealerships as well as car rental facilities. This roadway intersects with Huntmar Drive north and south of Highway 417 and also with Terry Fox Drive to the east, where it continues as Katimavik Road.

Kanata Avenue is an arterial roadway within the vicinity of its interchange with Highway 417, but is designated as a major collector north of Campeau Drive and south of Katimavik Road. It has a posted speed limit of 50 km/h and a cross-section of 2-lanes along its corridor. It operates between Terry Fox Drive in the north and Katimavik Road in the south, where it continues as Castlefrank Road. Kanata Avenue serves as a major transit route connection to the Terry Fox Station/Park and Ride within the Kanata Centrum Shopping Centre, which provides transit service to the community of Kanata. From a road user perspective, this roadway serves the residential neighbourhoods to the north and south of Highway 417.

The typical traffic pattern in Kanata consists of heavy commuter volume headed towards the central downtown core (eastbound) in Ottawa during the morning and returning (westbound) in the afternoon via Highway 417. The Canadian Tire Centre is located in Kanata along Palladium Drive, which holds special events such as hockey games, concerts and conferences, generally during off-peak or weekend time periods. During special events, traffic patterns are mostly attracted to/from the Palladium Drive and Terry Fox Drive interchanges, with heightened traffic demand along both these arterial roadways for short periods at the beginning and end of an event. Additionally, the recently opened Tanger Outlet mall north of Highway 417 along Palladium Drive is a major consumer attraction with most of its traffic demand occurring on weekends.

The existing transit system provides a series of routes travelling north-south along Eagleson Road, Teron Road, Kanata Avenue and Castlefrank Road as well as east-west along Campeau Drive, Palladium Drive and Katimavik Road. A majority of the routes connect transit users to Terry Fox Station, Teron Station and the Eagleson Park and Ride. These stations allow users to transfer to express routes that connect with the existing BRT serving the central Ottawa area. During special events at the Canadian Tire Centre, express bus routes are provided to/from the event via Palladium Drive, connecting attendees from across the entire City. Figure 4-12 depicts the transit routes serving the community of Kanata.

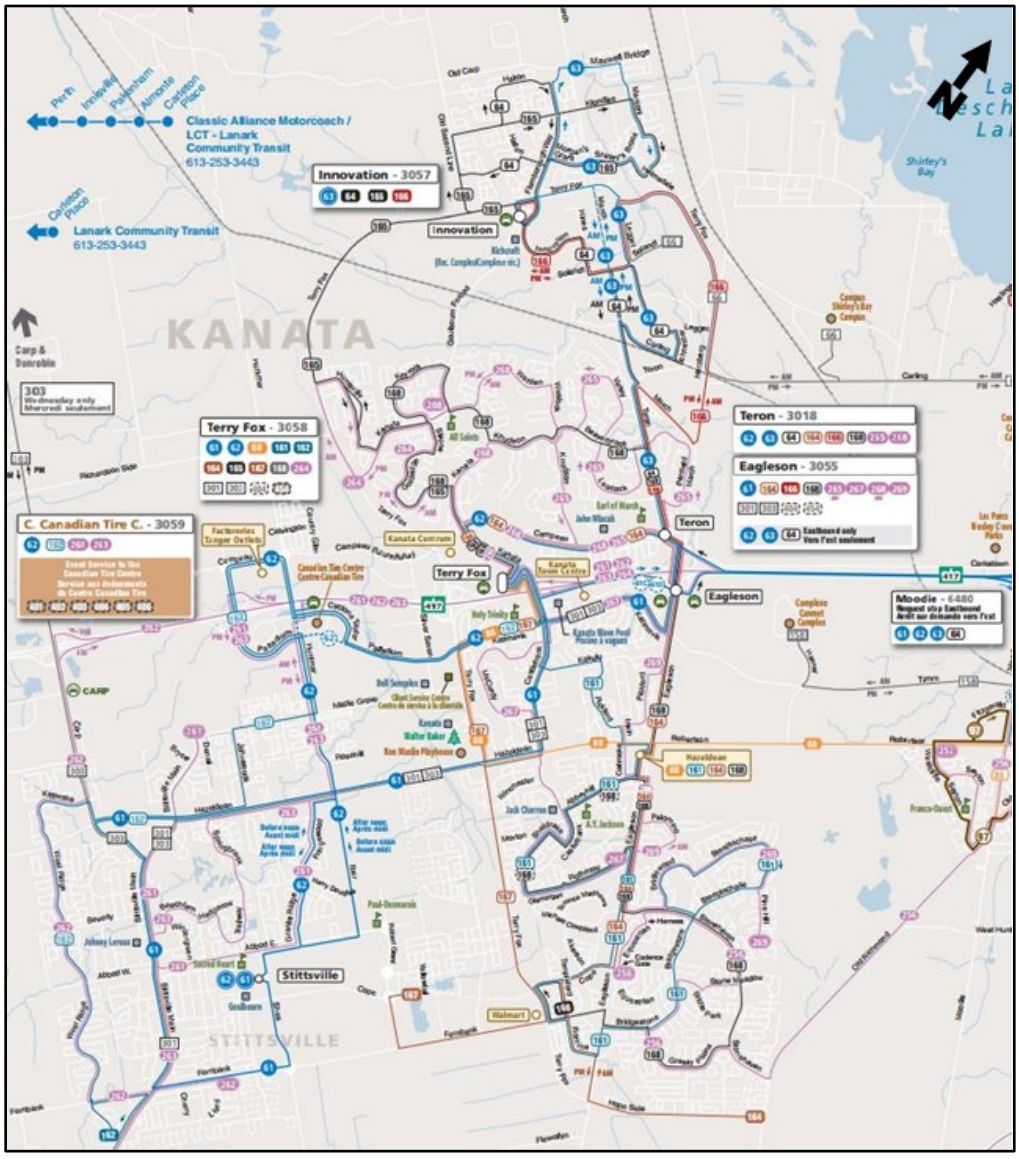


Figure 4-12: Study Area Transit Map

4.3.3. PEDESTRIAN NETWORKS

The TMP sets the objective of increasing the walking modal share across the city from 9.3% in 2005 to 10% in 2031. This increase reflects the City's strategic direction to build compact, mixed-use developments. In 2009, the City released the final *Ottawa Pedestrian Plan.* The purpose of the plan is to develop a long-term strategy to "develop, strengthen and support a pedestrian culture throughout the City of Ottawa". The plan identifies and recommends changes to infrastructure, policies and programs in an attempt to encourage people to walk more often.

In general most of the major roads in the vicinity of the study area are provided with sidewalks on at least one side. The City and the NCC's off-road cycling network and multi-use pathways also provide opportunities for walking within the capital and the study area

4.3.4. CYCLING NETWORKS

Cycling facilities in and around the Kanata LRT study area include streets with designated bike lanes and some streets with a wide paved shoulder, and multi-use pathways (Figure 4-13). These paths intersect at various points throughout the study area. With regard to the overall cycling network, the TMP states that the City will "adopt an integrated cycling network including the spine route system and National Capital Commission Pathways and complementary community route system identified in the Ottawa Cycling Plan". With regard to multi-use pathways, the City will "provide, or require others to provide, multi-use pathways within and between neighbourhoods, where physical constraints allow". In reference to the rapid transit corridor, the City will "provide multi-use pathways in or adjacent to rapid transit corridors, where physical constraints allow, to be constructed simultaneously" and "provide walking and cycling crossings or rapid transit corridors, where physical constraints allow, considering the level of demand and alternative crossing opportunities.

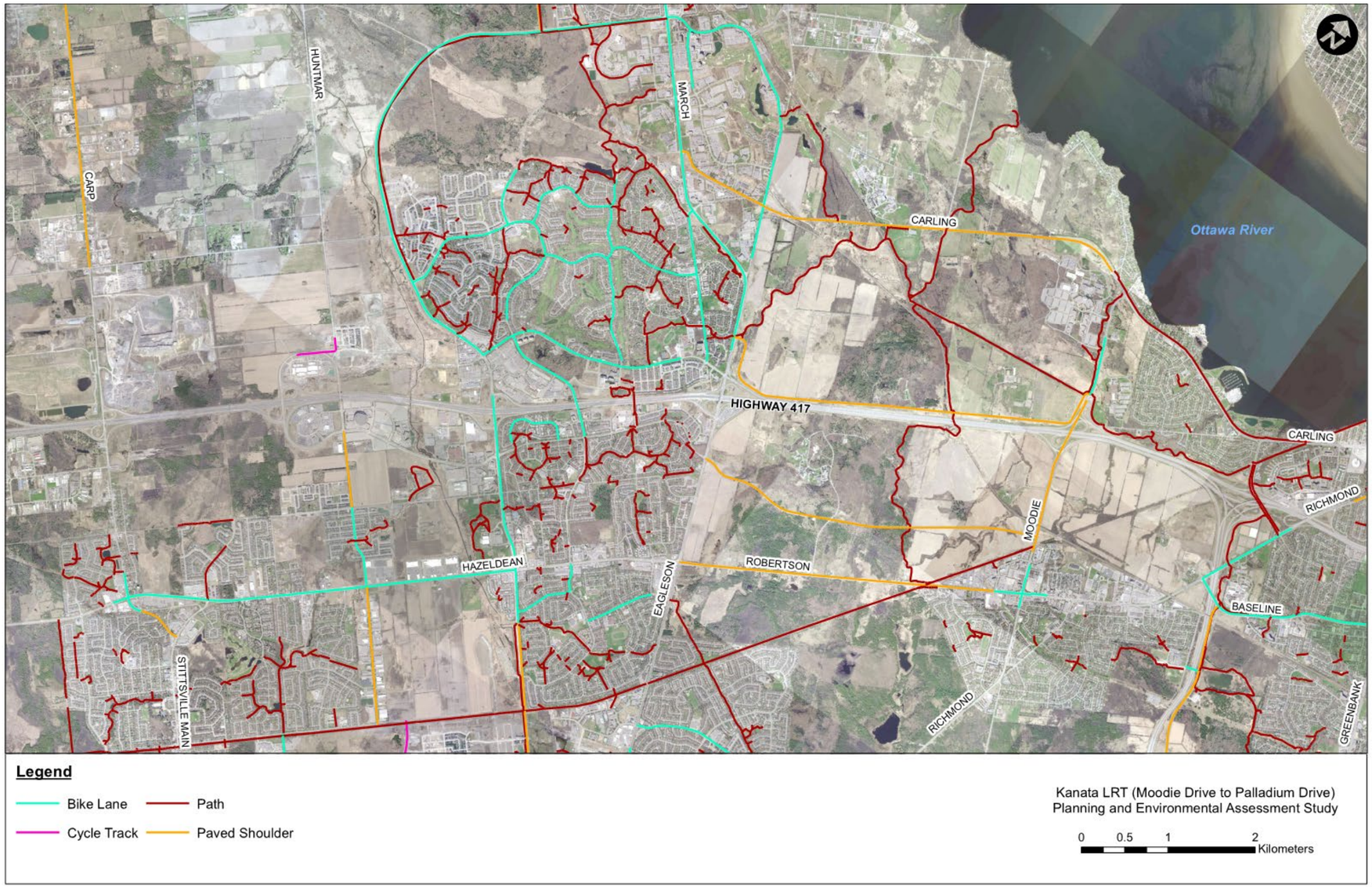


Figure 4-13: Existing Cycling Network

4.3.5. RAILWAYS

The Beachburg Subdivision is a freight rail line located in both Ontario and Quebec. The rail line extends west from Ottawa through Kanata North, crossing under Highway 417 west of Moodie Drive, and continues westward towards Carleton-March Wards before crossing the Ottawa River near the village of Galetta into Quebec.

The Arnprior Subdivision is a freight rail line which runs from Nepean Junction (connection to the CNR Beachburg Subdivision) to Arnprior, Ontario. It is a City-owned rail corridor which currently sees limited service (approximately 1 train per direction per week).

4.3.6. GOODS MOVEMENT

Efficient goods movement by truck, rail and air supports Ottawa's economic livelihood and competitiveness, with trucks fulfilling the primary mode of local freight transportation. The City maintains a comprehensive network of designated truck routes, relying primarily on freeways, highways and arterial roads to provide access to industrial and commercial areas while minimizing impacts on residential areas. These roads have been designed to withstand use by heavy trucks, the sizes of which are legislated by the Province of Ontario.

In general, by providing several alternative routes and thereby spreading the impacts so that they are not concentrated in one area, trucking impacts on residential areas are minimized. Increased road congestion impacts the ability of these routes to provide an efficient system

4.4. INFRASTRUCTURE AND UTILITIES

This section summarizes the existing infrastructure and utilities in the Kanata LRT Transitway Corridor.

4.4.1. WATER DISTRIBUTION SYSTEM

The water distribution system within the study corridor includes watermains, feedermains, valves, and hydrants. Watermains of 256 to 610 mm and larger within the study area are shown in Figure 4-14.

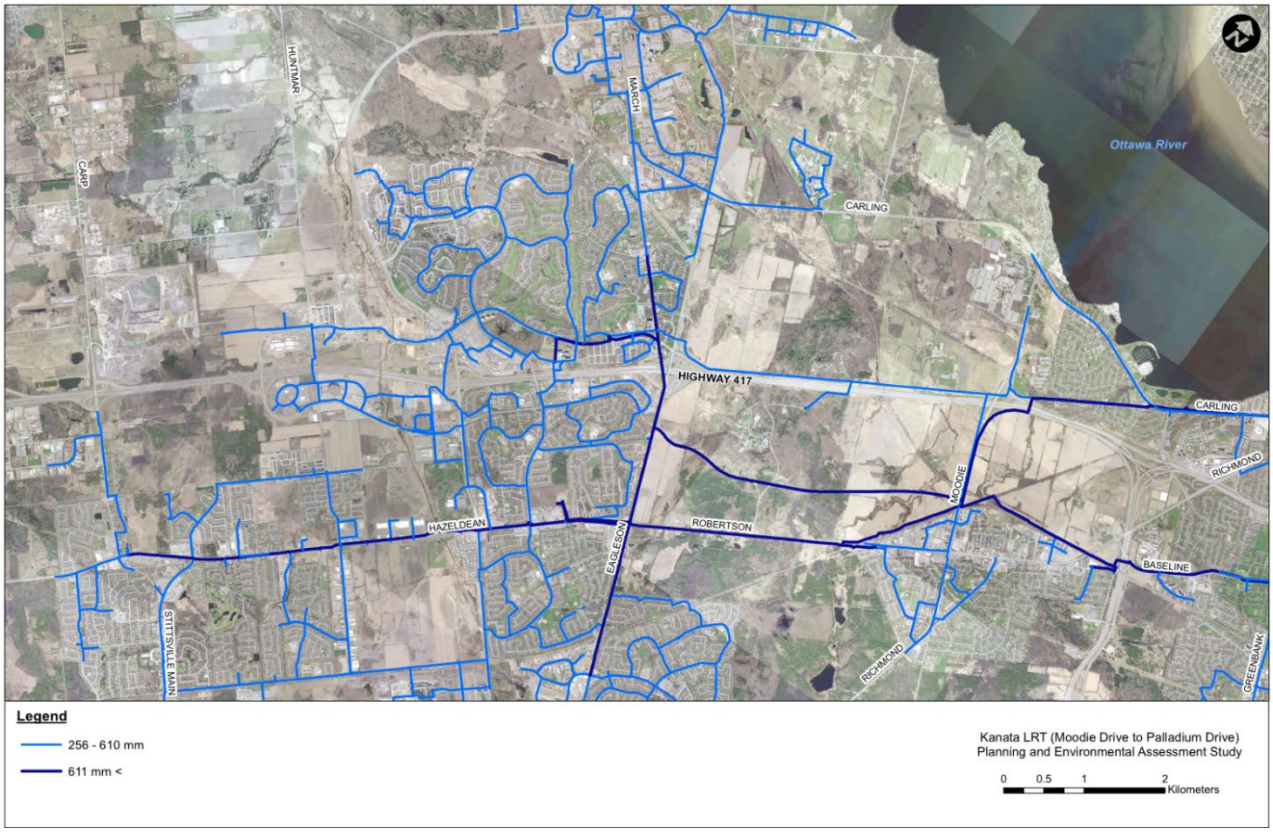


Figure 4-14: Watermain Distribution System in the study area corridor

4.4.2. SANITARY SEWERS

The sanitary sewer system within the Kanata LRT study area includes sewers of varying diameters (Figure 4-15). Sewers with a diameter of greater than 1350 mm are located to the east and north of Moodie Drive and typically follow or parallel road corridors such as Highway 417 and Rifle Road. Sanitary sewers with a diameter less than 1350 are located and service the residential areas such as Kanata North and the communities along Katimavik.

Figure 4-15: Location of sewers within the study corridor

4.4.3. STORM DRAINAGE

The storm sewer system within the study corridor includes sewers, trunk sewers, maintenance holes/chambers, and stormwater management (SWM) facilities. Only storm sewers of 600 mm in diameter and greater are identified as shown in Figure 4-16. There is more of a concentration of storm pipes of greater than 1200mm in the Kanata North/South and south Moodie Drive areas. Numerous culverts are located along Highway 417.

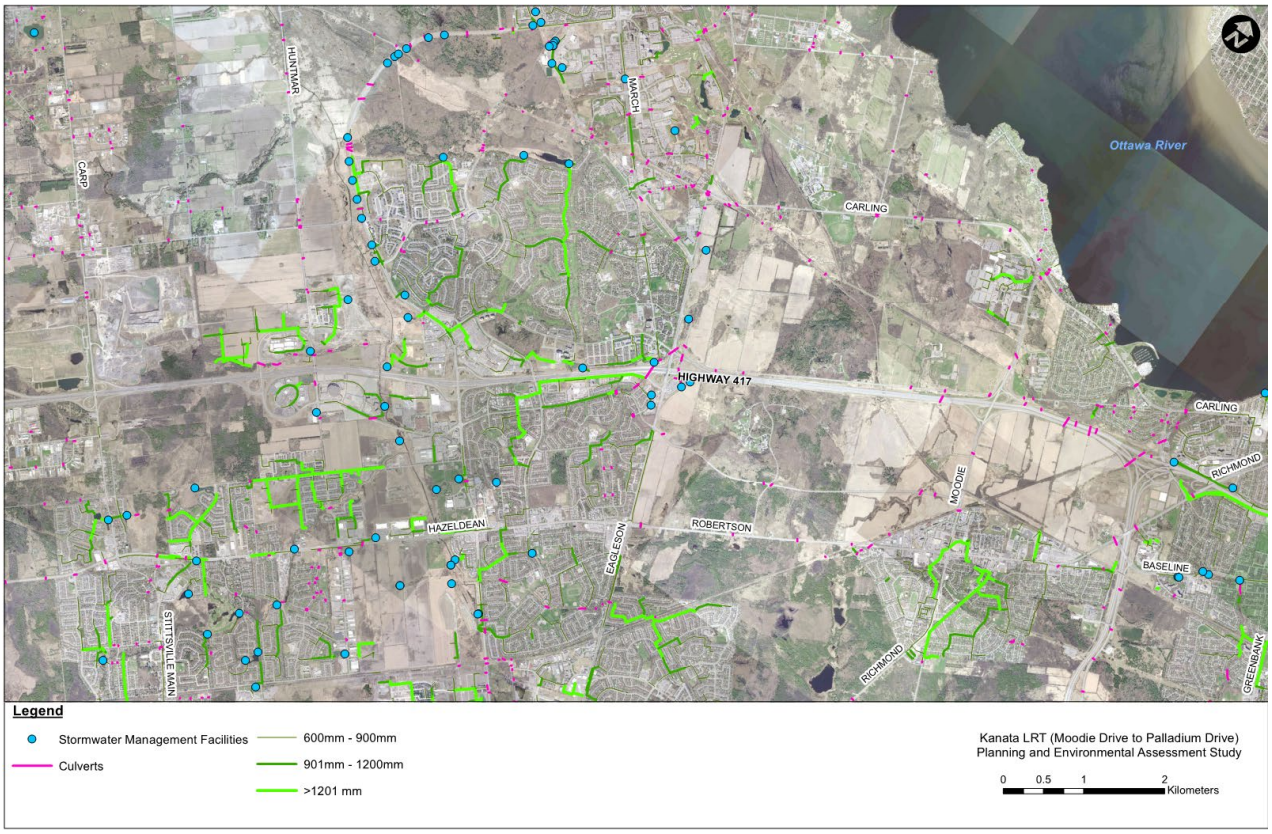


Figure 4-16: Stormwater network including management facilities within the study corridor

4.4.4. UTILITIES

All major utilities including hydro, telephone, gas, cable, pipelines and fibre optics are anticipated to be found within the study corridor. Most of the utilities (Hydro Ottawa, Bell Canada, Enbridge Gas, Rogers Cable and some fibre optics) are concentrated at roadway crossings.

4.5. BIOLOGICAL ENVIRONMENT

A review of available resources was conducted on various biological municipal, provincial and federal mapping databases within and surrounding the project site. The following is a summary of available data of diverse land uses (e.g. residential, commercial and agricultural) and natural heritage features (e.g. watercourse, urban natural features, provincially significant wetlands, species at risk, and areas of natural or scientific interest).

4.5.1. WATERSHEDS

The study area occurs in the jurisdictions of the Mississippi Valley Conservation (MVC) and the Rideau Valley Conservation Authority (RVCA). The MNRF identified zero sensitive and 42 non-sensitive municipal drains within the study area. The MNRF indicates non-sensitive lake and pond features occur in the study area.

Mississippi Valley Conservation Watershed

The Carp River generally flows south to north and generally bisect the study area between Terry Fox Drive and Huntmar Drive. The Carp River is a tributary of the Ottawa River with the confluence located in the Fitzroy Harbour area. The Carp River has undergone significant restoration activities within the study area to improve the condition of the river and to enhance terrestrial and aquatic habitats. The Carp River is a warm water system.

Poole Creek is a tributary of the Carp River and occurs south of Highway 417 and generally flows south west to north east. The upper reaches of Poole Creek is a cold or cool-water system that is fed by an extensive marsh area south west of Palladium Drive. . The lower reaches of Poole Creek are warm water habitat (MVC 2009).

Feedmill Creek is a tributary of the Carp River that primarily occurs north of Highway 417 and west of the Carp River. Feedmill Creek generally flows west to east.

Watts Creek flows south then north through the federal lands east of Hertzberg/Eagleson Road, outletting into the Ottawa River at Shirley's Bay. Watts Creek is a coolwater system containing 20 fish species.

Shirley's Brook originates in the South March Highlands west of Terry Fox Drive. Shirley's Brook flows east and north through a variety of land uses before it empties into Shirley's Bay on the Ottawa River. Shirley's Brook is a cool-warm system that is home to more than 20 fish species.

Rideau Valley Conservation Area

Stillwater Creek is located on the east side of the study area and contains cool-water and cool-warm features. Stillwater Creek has historically supported 41 fish species.

The Carp River Subwatershed

The Carp River flows north through the study area and eventually enters the Ottawa River in Fitzroy Harbour, Ontario. The City of Ottawa undertook the Carp River, Poole Creek and Feedmill Creek Restoration which involves "change to the channel as well as the following design elements: increased sinuosity; reduction in channel cross-section; creation of ponds and deltas; "nested" channels; varied substrate; riparian vegetation planting" (City of Ottawa 2018). Carp River restoration south of Highway 417 commenced in March 2013 and restoration work north of Highway 417 is expected to be completed in 2018. The alignment crosses an unnamed tributary of the Carp River at Hazaeldean road and another unnamed tributary of the Carp River at the southern edge of the Canadian Tire Centre on Huntmar Drive.

The two significant valleylands which have been identified within the study area and are located within the Feedmill Creek and Poole Creek Natural Heritage System. Further consultation with

MVCA is recommended to discuss potential permitting that may be required should encroachment be required at both sites.

4.5.2. AQUATIC FEATURES

Five watercourse features and associated drains were identified within the Kanata LRT study area. The study area falls within the jurisdiction of the MVCA and RVCA including features in the Carp River subwatershed (i.e., Poole Creek, Feedmill Creek, unnamed tributaries), Watts Creek subwatershed, and the Stillwater Creek subwatershed. Please see **Appendix B: Supporting Reports** for the detailed Natural Environment Existing Conditions Report.

Carp River System

The Carp River watershed occurs entirely within the City of Ottawa, its 42 km length drains 306 km^2 (Niblett 2016). The Carp River flows north through the study area and eventually enters the Ottawa River in Fitzroy Harbour, Ontario. As early as 15 years ago the Carp River was considered "degraded" and classified as a warm-water system (Robinson Consultants Inc. 2004). The City of Ottawa undertook the Carp River, Poole Creek and Feedmill Creek Restoration which involves "change to the channel as well as the following design elements: increased sinuosity; reduction in channel cross-section; creation of ponds and deltas; "nested" channels; varied substrate; riparian vegetation planting" (City of Ottawa 2018). Carp River restoration south of Highway 417 commenced in March 2013 and restoration work north of Highway 417 is expected to be completed in 2018.

The alignment crosses the Carp River and four of its tributaries (i.e., Feedmill Creek, Poole Creek, two unnamed tributaries) at the west end of the study area and in the area of the on-going restoration works.

Feedmill Creek

This tributary to the Carp River is classified as a cool-water system, however water temperatures in Feedmill Creek may support cold water fish species (City of Ottawa 2016). Twelve fish species are known to occur in this cool-water watercourse. Cool-water systems are a relative rarity in the City of Ottawa and typically more sensitive to disturbance (City of Ottawa 2012). The City of Ottawa has identified 12 fish species in Feedmill Creek.

Poole Creek

The upper reaches of Poole Creek (e.g., upstream of Hazeldean Road) are classified as a cool-water system, while the lower reaches near the confluence with the Carp River are warm-water. The City of Ottawa has identified 20 fish species in Poole Creek. The upper reaches of Poole Creek are cold-water habitats known to support cold-water species such as Brown Trout and Mottled Sculpin. Brown Trout has been stocked upstream of Sweetham Drive approximately 1.5km upstream of the study area. They were not stocked elsewhere due to thermal restrictions for that species (MVCA 2009). For this reason, this species is unlikely to occur within the study area.

This creek has been identified as significant due to its cool-water designation which is rare in the City of Ottawa and such systems are most sensitive to disturbance (City of Ottawa 2011, City of Ottawa 2012). Personal communication with Amy MacPherson (2018) identified a recent capture of American Eel in Poole Creek.

Unnamed Tributaries to the Carp River

The alignment crosses an unnamed tributary of the Carp River at Hazeldean Road and another unnamed tributary of the Carp River at the southern edge of the Canadian Tire Centre on Huntmar Drive.

Watts Creek System

The Watts Creek watershed contains two main watercourses – Watts Creek and the Kizell Drain. The upper reaches of Watts Creek flow through highly urbanized areas south of Highway 417 before crossing the highway and entering NCC and Department of National Defense (DND) lands, eventually outletting to the Ottawa River at Shirley's Bay. Watts Creek is classified as a cool-water system known to contain 20 fish species including historical records of Bridle Shiner (Notropis bifrenatus), a special concern species (Dillon Consulting Limited, 1999). Bridle Shiner are not known to occur north of the Rideau River at Highway 416 (personal communication with Amy MacPherson, Planner, City of Ottawa), suggesting this observation may be an error or the range of Bridle Shiner was historically larger. Northern pike (Esox lucius) juveniles have also been observed within Watts Creek, suggesting that areas suitable for spawning may be nearby (MVCA 2014).

Stillwater Creek System

Stillwater Creek originates in Stoney Swap (a PSW) and is classified as a cool-water system containing cool-warm water features downstream of the study area. The creek passes through NCC agricultural lands, conservation lands, and a residential area north of Highway 417 before outflowing into the Ottawa River at Britannia Bay. The area between Corkstown Road and Moodie Drive is within the study area and contains some of the lowest temperatures and may be indicative of ground water inputs. This creek has historically supported 41 fish species (RVCA 2015).

The three permanent tributaries of Stillwater Creek join the mainstem north of Highway 417 (Canadian Environmental Assessment Agency 2018).

Wetlands (Provincially Significant)

No provincially significant wetlands (PSWs) occurred within or adjacent to the study area, however unevaluated wetlands do occur adjacent to the study area

4.5.3. FISHERIES

The study area contains Carp River, Poole Creek, Feedmill Creek, Stillwater Creek, and Watts Creeks which collectively contain a diverse mix of warm and cool water generalist species that are moderately to highly tolerant of degraded habitats.

Within the study area, the MNRF identified non-sensitive spawning habitat for the following species:

- Brown Bullhead (Ictalurus nebulosus)
- Common Carp (Cyprinus carpio)
- Northern Pike (Esox lucius)
- Pumpkinseed (Lepomis gibbosus)
- Silver Redhorse (Moxostoma anisurum)
- Smallmouth Bass (Micropterus dolomieu)
- Walleye (Sander vitreus)

The MNRF has identified non-sensitive fish nursery habitat for the following species:

- Banded Killifish (Fundulus diaphanus)
- Blacknose Shiner (Notropis heterolepis)
- Bluntnose Minnow (Pimephales notatus)
- Brook Stickleback (Culaea inconstans)
- Carps and Minnows (Cyprinidae)
- Central Mudminnow (Umbra limi)
- Creek Chub (Semotilus atromaculatus)
- Eastern Blacknose Dace (Rhinichthys atratulus)
- Emerald Shiner (Notropis atherinoides)
- Northern Hog Sucker (Hypentelium nigricans)
- Pumpkinseed (Lepomis gibbosus)
- Rock Bass (Ambloplites rupestris)
- Sunfishes (Centrarchidae)
- White Sucker (Catostomus commersonni)
- Yellow Perch (Perca flavescens)

Waterways within the study area are known to contain common and diverse fish communities which may be impacted by construction activities. If the proposed work will impact fish or fish habitat, a DFO Self-Assessment should be completed, with appropriate mitigation measures, to determine whether further consultation with DFO will be required.

4.5.4. TERRESTRIAL ENVIRONMENT

4.5.4.1. Natural Heritage Features

Areas of Natural or Scientific Interest (ANSI) – Earth Sciences

Queensway Road Cut

Nepean (Potsdam) sandstone found in the Queensway Roadcut about 2 km east of Eagleson Road proposed as a reference section for the Nepean (Potsdam) Formation. These sections occur north and south of the Queensway and are about 760 metres long and range from 0.6 - 7 metres thick at the north exposure.

Campbell's Quarry

Campbell's Quarry is located on the CANMET Complex immediately south of Highway 417 between Eagleson Road and Moodie Drive. Beds of Nepean (Potsdam) sandstone, very similar to those seen at the Queensway roadcut are exposed in the Campbell's Quarry. A large quantity of sandstone from this site was used in the construction of the Parliament Buildings.

Queensway Extension Sandstone

Located immediately east of the Terry Fox Drive interchange on Highway 417. This feature displays a series of very good exposures showing characteristics typical of the Nepean Formation.

Eagleson's Corners is located just west of Eagleson Road on Hazeldean Road, south of Highway 417 between Eagleson Road and Terry Fox Drive.

Katimavik (March Limestone) is located on Chimo Drive between the Beaufort Drive and Nanook Crescent intersections, south of Highway 417 between Eagleson Road and Terry Fox Drive.

Areas of Natural or Scientific Interest (ANSI) – Life Science

Crystal Bay Forest (Candidate)

The Crystal Bay Forest is located within the NCC Greenbelt north of Highway 417 and west of Moodie Drive and the Carling Campus. An unusual dry, young to submature late successional deciduous upland forest consisting of Sugar Maple (*Acer saccharum*) and Ironwood (*Ostrya virginiana*) with Basswood (*Tilia americana*), Bitternut Hickory (*Carya cordiformis*) and Red Maple (*Acer rubrum*) being locally important. This area also provides potential ecological significance as part of a natural corridor linking Shirley's Bay with the Stony Swamp Conservation Area.

Stony Swamp (Candidate)

Stony Swamp Wetland Complex occurs south of Highway 417 between Moodie Drive and Eagleson Roads. The Stony Swamp ANSI area covers 1377.2 ha and contains a portion of the headwaters of four locally significant drainage systems: Watts Creek, the Carp River, Stillwater Creek and Graham Creek. The core of the Stony Swamp Conservation Area constitutes the area of this proposed ANSI in the National Capital Commission Greenbelt. The Stony Swamp Conservation Area is an extremely floristically diverse site with 745 species of vascular plants recorded, nearly 560 are native species[17].

South March Highlands (Candidate)

South March Highlands Wetland Complex covers approximately 895 ha and is bounded by March Road in the north, Second Line Road to the east, Kanata Avenue in the south, and Huntmar Drive to the west[14].

Urban Natural Areas (UNA)

The City of Ottawa undertook the Urban Natural Areas Environmental Evaluation Study (UNAEES, Muncaster and Brunton 2005, Muncaster and Brunton 2006) in conjunction with the Greenspace Master Plan (City of Ottawa 2006a). The purpose of the UNAEES was to identify woodlands, wetlands and ravines throughout the City of Ottawa urban area and evaluate their environmental significance. The UNAEES has been approved by the City Council and adopted into the City's OP (2013) as these lands are deemed ecologically valuable within the City. Those Urban Natural Areas (UNA) worthy of protection and/or acquisition were assessed using strategic guidelines set forth within the Urban Natural Features Strategy (City of Ottawa 2006b). Those UNAs identified as priority areas that are worthy of protection include; high and moderate-rate sites, natural features currently in City ownership (which includes sites with low environmental rating), recognized planning status, and promote environmental stewardship on privately-owned lands with a low environmental rating (City of Ottawa 2006b). A total of 40 UNAs were re-designated to Urban Natural Features (UNF) based on this strategy. UNFs are shown on Schedule B of the OP (2013) as land use designations.

Two UNAs evaluated with High or Moderate significance were identified within or adjacent to the study area and one unevaluated UNA (Palladium Interchange) was identified. Poole Creek North of Hazeldean is the only UNF in the study area targeted for preservation in the Urban Natural Features Strategy (City of Ottawa 2006) (**Appendix A**). Therefore, this feature has been designated as a UNF on Schedule B of the OP, which involves an absolute prohibition on development and zoned environmental protection (City of Ottawa 2006).

- Kanata Town Centre Core Park (UNA) – This area has been ranked as highly significant and contains upland woodland with meadow and bedrock outcrops. Small marsh and wetlands also occur throughout.
- North of Maple Grove (UNA) – This area has been ranked as moderately significant and contains regenerating agricultural fields regenerating into young woodlands and wetlands over limestone bedrock.
- Palladium Interchange (UNA) – This area has not yet been evaluated.
- Poole Creek North of Hazeldean (UNF) – This area has been ranked as moderately significant and contains a valleyland containing extensive marsh and wooded slopes.

Official Plan Designations

The Natural Heritage System for the City of Ottawa is composed of City's OP environmental designations of Significant Wetlands, Natural Environment Areas, Rural Natural Features, Urban Natural Features, as well as well as natural links of stream and wooded corridors (City of Ottawa 2013). The Natural Heritage System shown on Schedule L3 of the OP has been identified to occur and traverses the study area in three distinct sections (Figure 2-1, City of Ottawa 2013). Other natural environment land use designations also apply to the study area and contains the additional OP environmental designations as shown on Schedule B (City of Ottawa 2013):

- Greenbelt Rural: part of the Greenbelt policy and includes permitted activities of farming, forestry, recreation, etc.
- Natural Environment Area: lands that hold a high environmental value with components of wetlands, significant woodlands, and wildlife habitat. Designated lands are protected and preserved to ensure inherent function of natural features.
- Agricultural Resource Area: lands with nutrient-rich soils ideal for cash crops and livestock farms. The City's intent is to protect this resource for future generations and limit development in such areas.
- Carp River Restoration Policy Area Overlay: the purpose of the restoration policy is to recognize that proposed channel modifications and restoration works may occur, and development is allowed but numerous conditions must be met beforehand.
- Major Open Space: large parks, parkway corridors, and corridors reserved for rapid-transit and major roads. This is a key component to the Greenspace Network within the City.

4.5.5. WILDLIFE

The MNRF identified non-sensitive waterfowl staging areas and wintering areas for white-tailed deer within the general study area. The Stittsville Wetland Complex provides areas for waterfowl moulting and suitable waterfowl breeding habitat.

The following sections discusses the results for wildlife and wildlife habitat that may have potential to interact with the study area which includes the assessment of candidate significant wildlife habitat. Please see the Natural Environment Existing Conditions report in **Appendix B: Supporting Reports** for additional detail.

Seasonal Concentration Areas

Seasonal wildlife concentration areas contain relatively high densities of a species at specific periods in their life cycle and/or during a particular season. Seasonal concentration areas tend to be relatively small in relation to the area of habitat used at other times of the year and include: waterfowl/shorebird stopover and staging areas, raptor winter roosts, bat and reptile hibernacula/wintering areas, bat maternity colonies and stopover areas, bird nesting colonies, passerine/butterfly migration concentrations, and deer yards.

The following potential candidate Seasonal Concentration Areas were identified within the study area during field investigations:

- Waterfowl Stopover and Staging Areas (Terrestrial and Aquatic): Field investigations documented agricultural fields within the study area that may experience spring flooding/sheet water from mid-March to May. Marshes and watercourses also traverse throughout the study area. Both habitats provide foraging habitat for migrating waterfowl.
- Raptor Wintering Area: Field investigations documented a combination of forest communities adjacent to meadow communities that are >20 ha in size. This candidate feature is present within the Natural Heritage System between Moodie Drive and March Road.
- Bat Maternity Colonies: Field investigations documented forested communities throughout the study area with potential to contain suitable cavity trees for roosting and maternal bats.
- Turtle Wintering: Open aquatic features with permanent water are present within the study area. There is potential for all watercourses to provide habitat for wintering individuals.
- Reptile Hibernacula: Field investigations documented numerous rock crevices and exposed bedrock with cracks throughout the study area. The Queensway Roadcut Earth ANSI also holds potential to house hibernating snakes as the area is composed of broken and fissured rock. Personal communication with Amy MacPherson (2018) identified a known snake hibernaculum near a City pathway connecting Canadian Shield Avenue to Gray Crescent. This area is beyond 120 m of the preferred alignment.

- Colonially-nesting Bird Breeding Habitat (Bank and Cliff) and (Ground for Brewer's Blackbird): Field investigations documented rock cut cliffs along Highway 417, eroding banks within Poole Creek as well as exposed soil banks within cultural meadow communities. Brewers Blackbird is not known to occur in eastern Ontario and will no longer be considered in this report per direction from the City of Ottawa (personal communication with Amy MacPherson, City of Ottawa on October 23, 2018)

Deer Yarding Areas: The MNRF information request response identified a non-sensitive Stratum 1 deer yarding area. However, the agency did not provide a location and this has potential to occur within the study area,

Rare or Specialized Habitat

Rare habitats provide for vegetation communities that are considered rare in the province. Communities that are assigned an S-rank of S1 to S3 (extremely rare to rare-uncommon) as defined by the NHIC could qualify and include areas with slopes, sand, alvar, old growth, savannah, and prairie.

Specialized habitats are areas supporting wildlife species with very specific habitat requirements, areas with exceptionally high species or community diversity, or areas that provide habitat that greatly increases a species' likelihood of survival. Such areas include: nesting habitat for waterfowl, raptors, area-sensitive birds, and turtles. Amphibian breeding habitat and the presence of seeps/spring has also been addressed.

The following potential candidate Seasonal Concentration Areas were identified within the study area during field investigations:

- Waterfowl Nesting Area: Field investigations documented upland habitats adjacent to wetland habitats throughout the study area which may provide for suitable nesting.
- Woodland Raptor Nesting Area: Field investigations documented forested communities that are >30 ha in size with an interior habitat of >10 ha. This candidate feature is present within the Natural Heritage System between Moodie Drive and March Road.
- Turtle Nesting Area: Field investigations documented areas of exposed soil adjacent to watercourses and wetland habitat. Suitable turtle nesting areas were also present in the form of road shoulders where loose sand and/or exposed gravel occur.
- Amphibian Breeding Habitat: Stormwater management ponds, wetlands and temporary pools of water within forested communities are present within the study area and may provide habitat for breeding amphibians.
- Woodland Area-sensitive Breeding Bird Habitat: An interior mature forest that is >30 ha is present within the study area and may provide habitat for woodland breeding birds.

Habitat for Species of Conservation Concern

This category includes species that are considered provincially rare (S1-S3, SH) or are listed as Special Concern due to substantial population declines in Ontario. It does not include habitats of Endangered or Threatened species identified under the ESA (2007). It does however include nesting habitat for marsh, open country, and shrub birds.

Special concern and rare wildlife species that have been reported from this area by either MNRF, NHIC, or OBBA and for which suitable habitat is present within the vicinity of the study area includes: Snapping Turtle, Northern Map Turtle, Common Nighthawk, Red-headed Woodpecker, Eastern Wood-pewee, Wood Thrush, Golden-winged Warbler, and Grasshopper Sparrow.

Animal Movement Corridors

Animal movement corridors are defined as habitats that essentially link two or more wildlife habitats and enable wildlife to safely move from one habitat to another as a response to seasonal habitat requirements, which differ from species to species (MNR 2000). This category includes amphibian and deer movement corridors.

Although MNRF response did not indicate animal movement corridors, there is opportunity for wildlife movement of white-tailed deer throughout the study area as a non-sensitive Stratum 1 deer yarding area was identified. Also, other transient species such as Blanding's Turtle have potential to move between areas of natural and agricultural lands north and south of Highway 417 where the CNR rail line crosses Corkstown Road under Highway 417. A potential corridor may occur connecting Shirley's Bay to the north and Stony Swamp to the south.

All candidate features require a significance evaluation to determine if confirmed SWH is present within the study area. Once functional design and preferred alignment has been finalized for Kanata LRT, candidate SWH can be further refined at that time.

4.5.6. SPECIES AT RISK

The following species have been identified by the Natural Heritage Information Centre and the MNRF as potentially occurring in the study area:

- American Eel (Anguilla rostrata, END)
- Bank Swallow (Riparia riparia, THR)
- Barn Swallow (Hirundo rustica, THR)
- Blanding's Turtle (Emydoidea blandingii, THR)
- Bobolink (Dolichonyx oryzivorus, THR)
- Butternut (Juglans cinerea, END)
- Chimney Swift (Chaetura pelagica, THR)
- Eastern Meadowlark (Sturnella magna, THR)
- Eastern Small-footed Myotis (Myotis leibii, END)
- Eastern Whip-poor-will (Caprimulgus vociferus, THR)
- Lake Sturgeon (Acipenser fulvescens, THR)
- Least Bittern (Ixobrychus exilis, THR)
- Little Brown Myotis (Myotis lucifugus, END)
- Loggerhead Shrike (Lanius ludovicianus, END)
- Northern Long-eared Bat (Myotis septentrionalis, END)
- Pale-bellied Frost Lichen (Physconia subpallida, END)
- Rusty-patched Bumble Bee (Bombus affinis, END)
- Tri-Colored Bat (Perimyotis subflavus, END)

A "Restricted Species" was noted in the NHIC search results. Restricted species names and status' are not identified because doing so may put them further at risk (e.g., commercially exploitable species, species with sensitive life cycles or occurrences). An Endangered "Sensitive Species" was identified by the MNRF.

The MNRF provided the following list of Special Concern species that may occur in the study area.

- Black Tern (Chlidonias niger, SC)
- Eastern Wood-pewee (Contopus virens, SC)
- Golden-winged Warbler (Vermivora chrysoptera, SC)
- Common Nighthawk (Chordeiles minor, SC)
- Eastern Milksnake (Lampropeltis triangulum, SC)
- Monarch (Danaus plexippus, SC)
- Northern Map Turtle (Graptemys geographica, SC)
- Peregrine Falcon (Falco peregrinus, SC)
- Red-headed Woodpecker (Melanerpes erythrocephalus, SC)
- River Redhorse (Moxostoma carinatum, SC)
- Snapping Turtle (Chelydra serpentina, SC)
- West Virginia White (Pieris virginiensis, SC)
- Wood Thrush (Hylocichla mustelina, SC)
- grasshopper sparrow (Ammodramus savannarum, SC)
- Bridle Shiner (Notropis bifrenatus, SC) has historically occurred in Watts Creek.

4.6. PHYSICAL ENVIRONMENT

This section provides a summary on the existing geotechnical environment within the broader Kanata LRT study area. Information is summarized based on mapping from the Geological Survey of Canada and the Ontario Geological Survey.

4.6.1. BEDROCK AND SURFICIAL GEOLOGY

The study area is extensive and the subsurface conditions vary significantly across the roughly 9 kilometer by 9 kilometer study area. Published geological maps for the study area, including surficial geology (Figure 4-17), depth to bedrock (Figure 4-18) and bedrock geology mapping (Figure 4-19) are shown below. It is noted that published geological mapping characterizes the native subsurface conditions and pre-development depths to bedrock.

The general stratigraphic sequence in the study area typically consists of peat, alluvial sands and silts and/or near- shore and deltaic sands and gravels, overlying sensitive marine clays, glacial till, and bedrock. Not all of these deposits are present at all locations, but all units are mapped within the study area. Peat deposits, which are present in low-lying areas, such as along the Carp River valley, as well as in pockets in areas of shallow bedrock, such as south of Robertson Road, are generally soft and highly compressible. Alluvial deposits, such as those present along the railway corridor northeast of March Road and Carling Avenue, are often loose and saturated. Large portions of the study area are characterized by thick deposits of marine clay. The upper few metres of the clay deposit is typically weathered to form a stiff to very stiff crust. The underlying unweathered grey clay is typically of firm consistency, but is occasionally soft, and is very sensitive to disturbance. A relatively thin silt/sand transitional layer is frequently encountered between the clay and underlying glacial till. The glacial till typically consists of a heterogeneous mixture of gravel, cobbles, and

boulders in a matrix of silty sand or sandy silt. Lenses and layers of more permeable sand and gravel outwash deposits can be found within the glacial till. Cobbles and boulders are also frequently encountered within the glacial till deposit.

The bedrock throughout most of the project area consists of a sedimentary sequence of sandstone, dolostone, and limestone Nepean, March, Oxford, Bobcaygeon and Verulam Formations. However, the area of Kanata North is primarily underlain by Precambrian basement rocks consisting of undifferentiated metamorphic and igneous rocks including granite, quartzite and gneiss. The depth to bedrock varies significantly throughout the study area. In some areas, bedrock outcrops are visible at surface, such as along Highway 417 between Corkstown Road and Eagleson Road and near Terry Fox Drive, and along March Road between Corkstown Road and Teron Road and north of Carling Avenue. In other areas, such as along Huntmar Drive, at the March/Eagleson and Moodie Drive interchanges, and along Carling Avenue between Herzberg Road and March Road, mapping indicates the depth to bedrock to extend to 15 to 25, and occasionally 50, metres below ground surface.

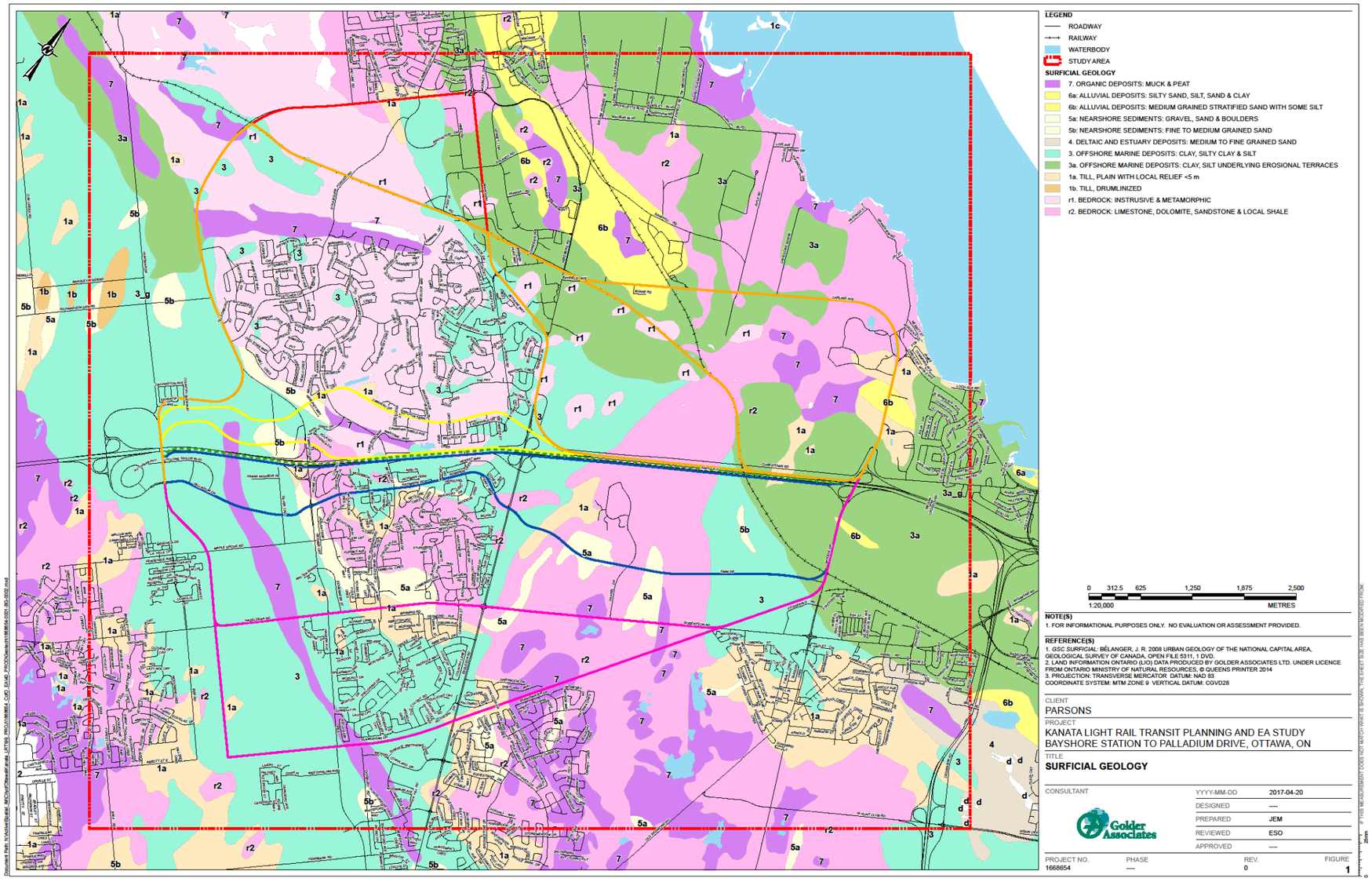


Figure 4-17: Kanata LRT Surficial Geology

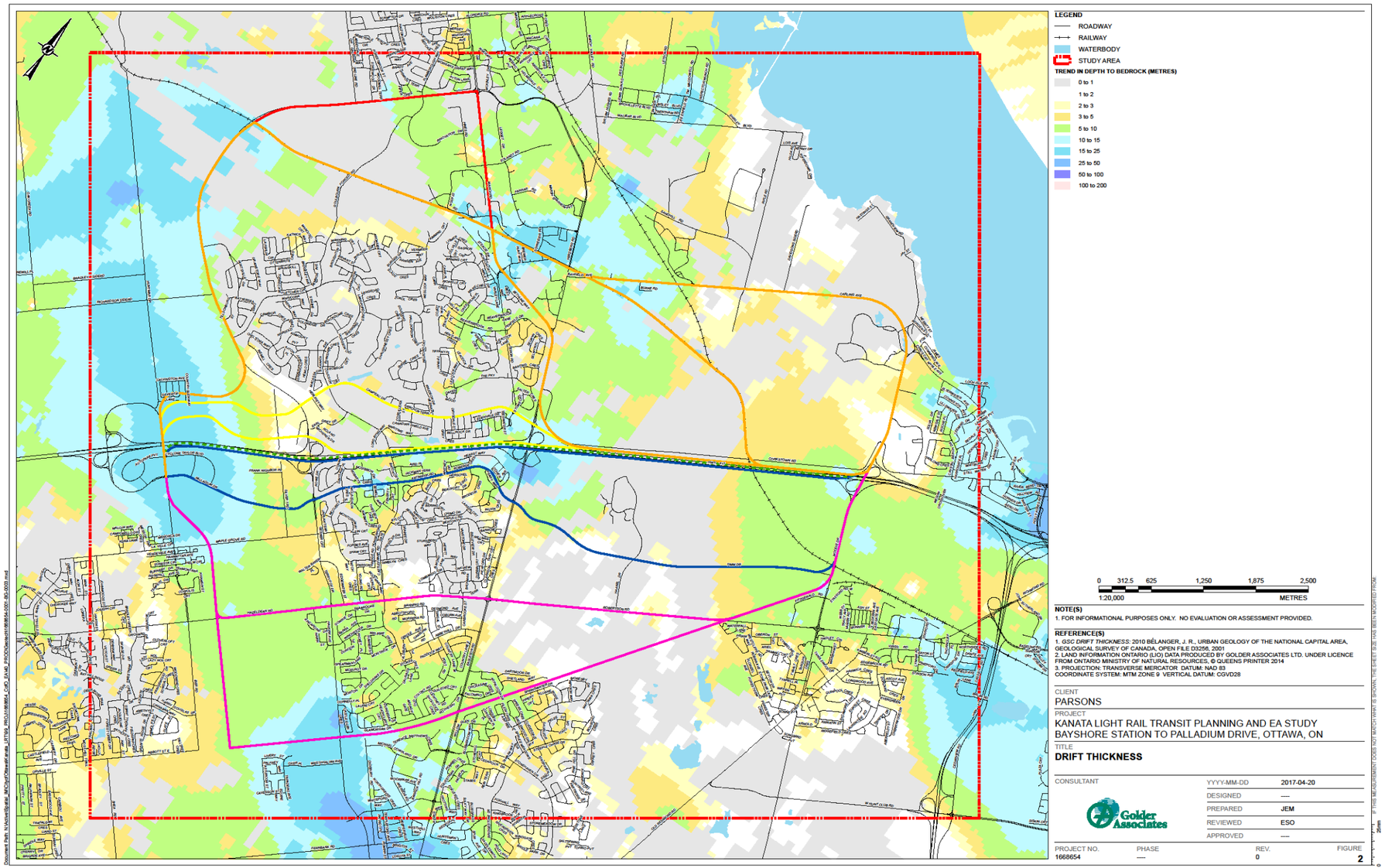


Figure 4-18: Kanata LRT Drift Thickness

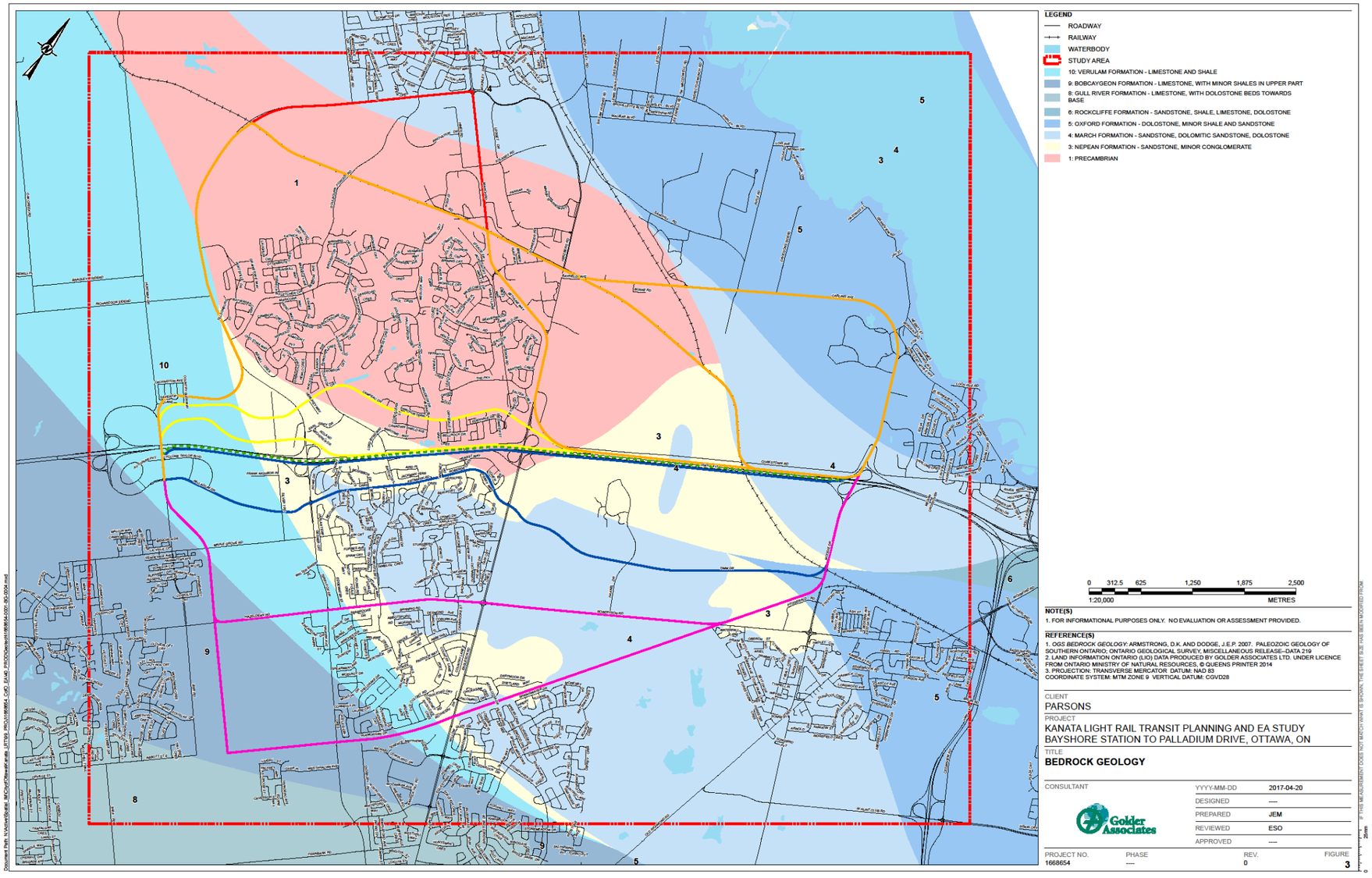


Figure 4-19: Kanata LRT Bedrock Geology

4.6.2. SLOPES AND RAVINES

In general the study area is flat with some slight elevation changes and slopes northeast towards the Ottawa River. To the east of Moodie Drive and towards Corkstown Road the elevation is predominantly flat with an elevation of approximately 68 to 72 meters. Heading westward along Highway 417 the elevation climbs to 112 meter and drops slightly downhill in and around Kanata to 96 meters.

In the study area there are a few ravines that are mostly associated with watercourses including Stillwater Creek located to the southwest of Moodie Drive and Highway 417. Portions of the Stillwater Creek system have been identified as significant valleylands in the City's Natural Heritage System. There is also another shallow ravine associated with Watts Creek which flows north through March Road and Corkstown Road. It should also be noted that there is a sharp elevation change as highway 417 approaches and passes over the Beachburg rail corridor.

4.6.3. GROUNDWATER

Groundwater falls under the City's environmental mandate in terms of it being a natural resource that has issues surrounding the overall protection and its use. The City shares its responsibility of managing the resource with the Province being the overriding authority. The City adopted a framework for a Groundwater Management Strategy (GMS) in April 2003 to help plan for groundwater uses in terms of growth and infrastructure development. As part of this strategy and to better understand, the City undertakes studies to define groundwater and develops public information to assist residents who rely upon this resource.

There are many major aquifers that have been identified within the city limits which are an important source of drinking water. The sedimentary limestones, dolostones and shales of the area are the primary water supply for many private homes. Wells are the main water supply for rural communities. The Kanata area is serviced with municipal water. Generally rural wells are located within the study area.

A description of subsurface water and hydrogeological conditions was developed by Golder Associates through desktop review and local knowledge gained from past studies. The findings of Golder are outlined below, and contained in detail in **Appendix B: Supporting Reports**:

- Groundwater level is approximately 1-2 m below the level of Corkstown Road in the vicinity of the at-grade CN rail crossing;
- Groundwater conditions near the Watts Creek crossing at March Road suggest the near surface groundwater is at or near grade, while artesian groundwater is indicated within glacial till deposits below 30 m depth;
- Groundwater conditions at Kanata Town Station are approximately 3-4 m below the existing ground surface and become shallower west of the Kanata Town Station (approximately 1-2 m);
- Groundwater level at Kanata Avenue, north of Highway 417, is at the under laying bedrock surface (1-2 m below grade);
- Groundwater north of Highway 417 from Kanata Avenue to Terry Fox Drive (and Terry Fox Station) is approximately 2-4 metres below existing ground surface; and,

- Groundwater north of the Feedmill Creek crossing in the vicinity of Huntmar Drive is assumed to be close to grade.

The study area is supplied with municipal water and there are a very limited number of parcels remaining within 250 m of the proposed alignment that may be privately serviced (e.g., 210 Huntmar Drive which is likely to be redeveloped in the near future, 180 Huntmar Drive which has a water supply well but which is expected to connected to municipal supply once installed on Huntmar Drive, and 821 Corkstown Road whose well is likely more than 500 m from the proposed alignment). Based on their distance to areas of possible disturbance and the other factors mentioned, these wells are not expected to be impacted.

4.6.4. CONTAMINATION AND HAZARDOUS MATERIALS

The potential for environmental contamination was based on a preliminary review of the geo-environmental conditions of the study area:

- Aerial Photos (1958, 1965, 1976, 1991, 2014), GeoOttawa, 2016.
- Historical Land Use Inventory (HLUI), provided by the City of Ottawa
- Federal Contaminated Sites Inventory (FSCI), Treasury Board of Canada Secretariat

Aerial photos

Aerial photographs of the Study Area for the years 1965, 1976, 1999, and 2014, were reviewed. A summary of the observations made is presented below:

- For the 1965 aerial photo, the Study Area is only visible as far west as Eagleson Road. The Study Area is predominantly occupied by farmland. A few sporadic rural residential properties are present.
- The 1976 aerial photo shows evidence of the beginnings of the area's development, as a number of residential subdivisions have been built throughout the study area, along with a few industrial and/or commercial structures.
- Railway lines have transected the study area, running northwest to southeast and northeast to southwest since at least the 1950s.
- By 1999, the study area has been further developed and is comprised of a diverse mix of land uses, including agricultural, commercial, industrial, recreational greenfield, forested land and residential. Some of the study area is located within the National Capital Commission Greenbelt, and is transected by numerous roads, multi-use pathways, roadways, and Highway 417 (Hwy 417).
- The 2014 aerial photography shows minor changes in the study area since 1999.

Historical Land Use Inventory (HLUI)

A map of recorded Historical Land Use Inventory Parcels was provided by the City of Ottawa (Figure 4-20). The HLUI provides information of the type and location of all land uses within the boundaries of the study area, which had or have the potential to cause contamination in soil, groundwater or surface water. The HLUI identifies approximately 600 potentially contaminated properties within the broad study area boundaries, including over 180 different facility types. HLUI parcels appear to be concentrated along Carling Avenue to March Road, Carp Road, Hwy 417, and Robertson Road. A fair amount of relatively smaller HLUI parcels are spread across the remainder of the study area. Major environmental concerns include but are not limited to potential current and/or former: gas stations, snow dumps, landfills, and industrial and commercial land uses.

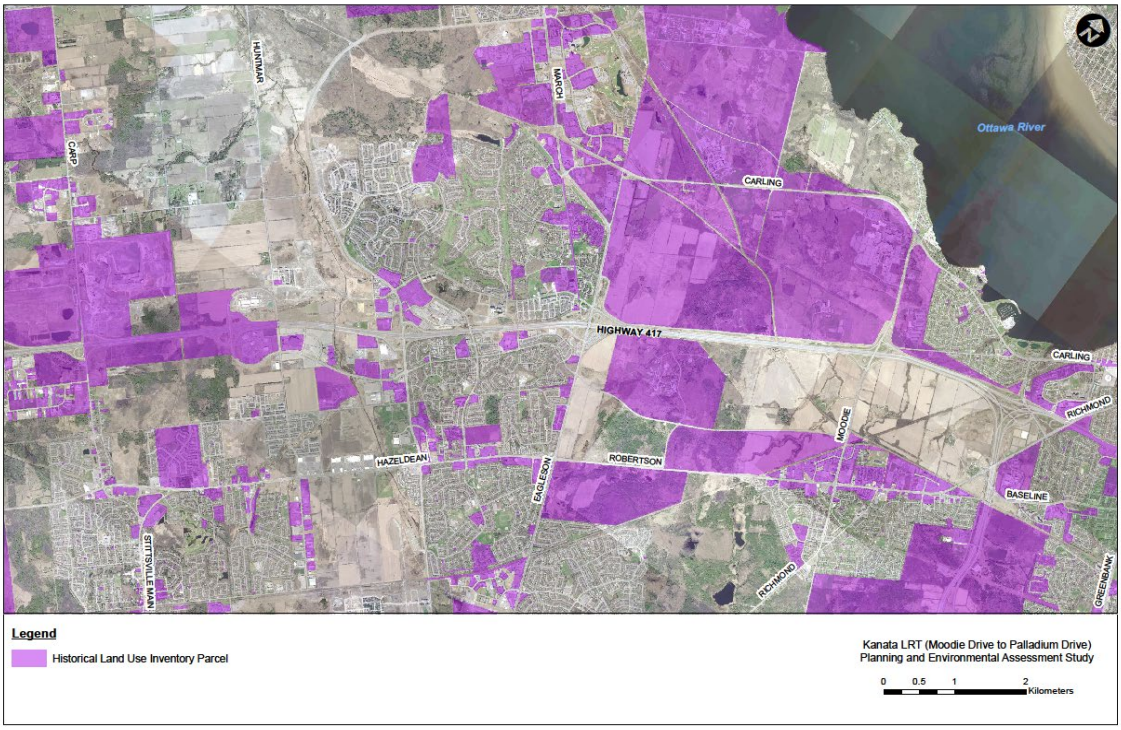


Figure 4-20: Historical Land use Inventory Parcel of Study Area.

Federal Contaminated Sites

The Treasury Board of Canada Secretariat maintains a Federal Contaminated Sites Inventory (FCSI), which includes information on all known federal contaminated sites, as well as non-federal contaminated sites for which they accept some financial responsibility (as well as those that are under investigation for potential contamination). These sites could pose a risk to human health or the environment.

A number of FCSI sites are listed for the broad study area, and are predominantly located to the east of Herzberg and Eagleson Road, to the north and south of Hwy 417. The soil and/or groundwater contaminant types identified for each site includes one of the following: other organics, metals, metalloids and organometallics, petroleum hydrocarbons (PHCs), benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAHs). A summary of the FCSI sites is presented in Table 4-4**:** *Federal Potentially Contaminated Sites within the Kanata LRT Study* Area.

Table 4-4: Federal Potentially Contaminated Sites within the Kanata LRT Study Area

FSCI Identifier	Site	Address	Contaminant Type
00008700	Connaught Skeet Range	4th Line Road	Other inorganics
00008425	Connaught Ranges Range Butt Stop Stockpile	4th Line Road	Metal, metalloid, and organometallic
08591002	Communications Research Centre	3701 Carling Ave., Hwy. 17; Areas 1 to 4 and 8	PHCs
08598006	Connaught Range Primary Training Centre Former Landfill Site	4th Line Road	PHCs, PAHs, metal, metalloid and organometallic
08598005	Connaught Range Primary Training Centre Former Transport Comp.	4th Line Road	PHCs
00000912	Former Disposal Area, South of Water Tower, Shirley's Bay	3701 Carling Ave., Hwy. 17; Areas 1 to 4 and 8	Metal, metalloid, and organometallic
00023313	Rifle Road East	Rifle Road (Shirley's Bay Natural Lands)	PHCs
00026421	Shirley's Bay Campus, P9 Parking	3701 Carling Ave., Hwy. 17; Areas 1 to 4 and 8	Other organics, metal, metalloid, and organometallic
00023343	Herzberg Road and Bayfield Road	No Address Lat. Long: 45.335826, -75.891134	Metal, metalloid, and organometallic
00023341 and 00023311	Watts Creek Sewage Treatment Plant	Carling Ave at Rifle Road	Other organics, metal, metalloid, and organometallic
00022872	3659 Carling Avenue	3659 Carling Avenue	PHCs
0008316	Bells Corners Complex	1 Haanel Drive	PAHs
00023296	597 Robertson Road	597 Robertson Road	PHCs, BTEX
00023358	Robertson Road near Eagleson	No Address Lat. Long: 45.306315, -75.86989	Not Listed

4.6.5. SOURCEWATER PROTECTION AREA

The study area for the corridor falls within the Mississippi Valley and Rideau Valley Source Protection Areas, as described in the Mississippi-Rideau Source Protection Plan, effective January 1, 2015. The Mississippi-Rideau Source Protection Region is 8,500 square km, and is made up of the jurisdictions of the Mississippi Valley and Rideau Valley Conservation Authorities. These plans exists to protect drinking water across municipal boundaries. The Source Protection plan identifies four vulnerable areas: Wellhead Protection Areas, Intake Protection Zones, Highly Vulnerable Aquifers, and Significant Groundwater Recharge Areas. The study area was examined for existence of these areas.

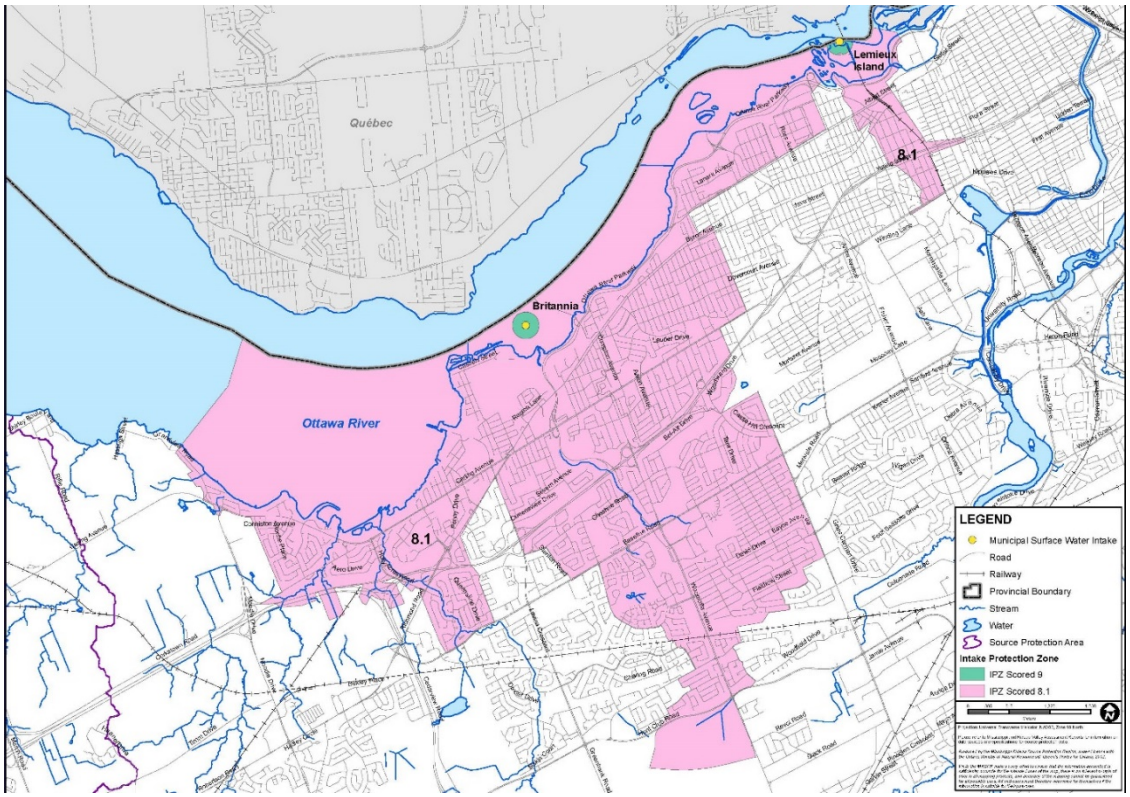


Figure 4-21: Source Water Protection Area

4.6.5.1. Intake Protection Zone

A small portion of the study area is within an Intake Protection Zone, with a vulnerability score of 8.1. The portion of the study area that is within this Intake Protection Zone is at Moodie Drive and Carling Avenue. In this zone, contaminants could reach a drinking water intake pipe at the water treatment plant within two hours. However, the area which scored 8.1 also includes additional drainage area contributing to the intake and a buffer area on land where contaminated run-off can readily reach the river. This area prohibits the land spreading of untreated septage, and any large sewage works such as industrial or sewage treatment plant effluent discharges.

Intake Protection Zones with a score of 8.1 do not preclude the installation of the project, and are permitted to have supporting infrastructure such as stormwater management facilities. For any land use aside from residential within this intake protection zone, a notice from the Risk Management Official in accordance with Section 59)2) of the *Clean Water Act* will be required prior to approval of any Planning Act application. A site-specific land use that is the subject of an application for approval is not designated for the purposes of Section 59 if the applicant can demonstrate that a significant drinking water threat will not be engaged in.

4.6.5.2. Wellhead Protection Area

The study area is not located in a Wellhead Protection Zone.

4.6.5.3. Groundwater Recharge and Vulnerable Aquifers

The study area contains Significant Groundwater Recharge Areas in the vicinity of Highway 417, largely to the south of the highway and in the vicinity of Eagleson Road, Moodie Drive. And Old Richmond Road. The area also contains Highly Vulnerable Aquifers, which are more vulnerable to surface contaminants. Eighty-nine percent (89%) of the Mississippi-Rideau region contains aquifers of similar vulnerability. These areas are for reference only. No policies apply within Significant Groundwater Recharge Areas or Highly Vulnerable Aquifers.

5. DEVELOPMENT AND EVALUATION OF ALTERNATIVE CORRIDORS AND ALIGNMENTS

5.1. GUIDING PRINCIPLES

The following principles informed the selection of alternative corridors for the Kanata LRT.

5.1.1. RAPID TRANSIT NETWORK OVERVIEW

The City's current TMP, updated in 2013, identifies the following rapid transit and transit priority network serving Kanata:

1. A grade-separated BRT corridor running in the Highway 417 corridor from Bayshore Station (Holly Acres Drive) to Palladium Drive (Canadian Tire Centre) and then following the alignment of the future North-South arterial to Hazeldean Road.
    a. Between Hazeldean Road and Fernbank Road this corridor is identified as a median at-grade BRT facility. New Park and Ride lots are identified at Hazeldean, Abbott and Fernbank.
    b. As part of the affordable rapid transit network, the segment between Eagleson/March and Terry Fox Station is identified for implementation, with transit priority measures provided along the north-south arterial between Palladium Drive and Fernbank Road.
    c. The West Transitway Extension from Bayshore to Moodie Drive opened in November, 2107. In the City's ultimate rapid transit network (beyond 2031), this corridor is identified for conversion to LRT technology between Bayshore Station and the Canadian Tire Centre (subject of this Planning and EA Study).
    d. The Stage 2 LRT project has identified the Bayshore – Moodie segment for LRT conversion by 2023, subject to completion of an EA addendum and project funding.
2. A median at-grade BRT corridor is identified for March Road between Highway 417 and Maxwell Bridge Road. As part of the Affordable rapid transit network, a segment between Corkstown Road and Solandt Road has been identified for implementation, with transit priority measures between Solandt and Maxwell Bridge. A new Park and Ride lot is identified as part of the Kanata North CDP at the northern end of this community.
3. Transit priority corridors (isolated measures) are identified for:
    a. Robertson/Hazeldean/Stitsville Main Street corridor between Baseline Road and Fernbank Road.
    b. Terry Fox Drive between Hazeldean Road and Terry Fox Station
    c. Eagleson Road between Hazeldean/Robertson and Eagleson Station
    d. Fernbank Road between Robert Grant Avenue (future at-grade BRT corridor) and Stittsville Main Street

In the affordable rapid transit network, these transit priority measures are identified for implementation on Eagleson Road between Hazeldean and Highway 417, and along Robertson/Hazeldean Roads from Baseline Road to Stittsville Main Street.

As part of the development of corridor alternatives for the Kanata LRT, it is assumed that all elements of the City's Affordable Rapid Transit Network will be in place prior to construction of the Kanata LRT.

Previous planning and EA work has been completed for the BRT Transitway between Bayshore Station and Corkstown Station (West Transitway Extension - Bayshore Station to Moodie Drive, 2012), Moodie Drive and Terry Fox Station (West Urban Community Transit Integration Study and Environmental Assessment Study, 1997), between Terry Fox Station and Fernbank Road (West Transitway Connection - Terry Fox to Fernbank Road, 2012) and the March Road corridor between Highway 417/March/Eagleson Interchange and Maxwell Bridge Road (Kanata North Transitway - Highway 417/March-Eagleson Interchange to North of Maxwell Bridge Road - 2013), the limit of the urban area at the time of the study.

5.1.2. LRT OPERATING REQUIREMENTS

The Kanata LRT will operate as an extension of the Confederation Line West and therefore must be designed to accommodate a similar level of service and train operation. The LRT extension will be designed with no at-grade crossings of the line by other modes. This will require grade separation at all roadway, pathway and rail crossings along the alignment.

The alignment and station locations should support higher speed operations to minimize travel time along the corridor. To provide for higher speed rail operations consistent with a primary rapid transit corridor, horizontal and vertical curves should be generous, allowing for faster train operations and reduced operating and maintenance costs. In constrained areas, reduced curve radii may be accommodated at the expense of travel time and increased operating/maintenance costs and noise impacts.

For corridor planning purposes it is assumed that an at-grade LRT corridor with open drainage ditches will require a minimum 20 m right-of-way (ROW). Additional ROW will be needed at station locations, special trackwork areas, and where a multi-use pathway is located immediately adjacent to the LRT alignment. ROW requirements for tunnels, elevated structures and median operation along roadways can be reduced, and a minimum 12 m right-of-way can be assumed in those locations (not inclusive of space needed for construction of the LRT). Where the LRT will be elevated on embankment the land requirement would be defined by the toe of slope of the embankment and could vary substantially from the typical 20 m at-grade ROW.

The trains will run off a 1500V DC power supply, provided by overhead line electrification (catenary). Traction Power Supply Stations (TPSS) will be required to convert high voltage power supply from the City's electricity grid to provide power to the LRT. TPSS locations will be approximately every 2 km along the line, ideally located to support redundant power supply (i.e. adjacent TPSS locations are fed from a different hydro sub-station) and connect efficiently with the Ottawa Hydro grid.

5.1.3. DESIGN CONSIDERATIONS

Station spacing is largely dependent on the need to serve major destinations (e.g. higher density development, existing/future park and ride facilities, and transit connections). Station spacing generally will be 800 to 2000 m to provide a balance between desired operating speeds and local access to rapid transit. Stations themselves will be designed to be consistent with Confederation

Line Stations currently under construction. Ultimate length 120 m long platforms will be protected for, consistent with the current Confederation Line stations. Initial platform lengths may be shorter (90 or 100 m) depending on train consist size at opening day.

Combining corridor segments could be considered to serve multiple destinations, however this results in branching of service, which has significant implications to LRT operations and cost. Introducing additional branches into the LRT system represents a particular challenge given that train service west of Lincoln Fields Station is already one branch, which limits the ultimate capacity. In general, branching of the line results in a 50% reduction in capacity on each branch (i.e. if 4 minute headways are run on the main line, each branch can only support 8 minute headways). The signaling system of the Confederation Line will ultimately be capable of supporting a 105 second headway on the main part of the line through downtown. Therefore, west and south of Lincoln Fields, the ultimate headway will be 210 seconds (3.5 minutes), assuming half the trains run on each branch. Therefore, a second branch will be only be able to support a train every 7 minutes at most, lower during off-peak hours unless shuttle or overlapping services are implemented to provide minimum headways (15 minutes is considered the minimum rapid transit headway). The challenge will be increased in off-peak hours, particularly late at night when lower headways will be needed given relative reduction in demand for travel.

Supportive local transit would be developed to support the selected alignment. Existing routes would be modified to connect to the nearest station, and provide support to attract riders who live beyond a comfortable walking distance of the future stations. As with other segments of the Confederation Line, the exact details of the bus routings will be developed closer to opening day, however conceptual routes will be developed to demonstrate how demand within Kanata could be served.

The western terminus, as defined in the Scope of Work, for corridor alternatives was considered to be in the vicinity of the Canadian Tire Centre, in keeping with the City's Transportation Master Plan and approved scope of work for this study. Corridor alternatives serving primarily the northern or southern areas of Kanata may require an alternate terminus location or locations given the distances and challenges involved in serving Canadian Tire Centre.

5.2. ALTERNATIVE CORRIDORS

The following provides an overview of the "long-list" of corridor options initially identified for this project. Corridors are generally grouped into alternatives which serve north, central and southern areas of Kanata. Thirteen (13) potential corridors were identified.

For the northern corridor alternatives, there are generally three segments to consider. The first is how the corridor would connect between Moodie Station and a station in the vicinity of the March Road/Carling Avenue intersection. The second segment is how the corridor would serve the Kanata North area. The third segment is how, if desired, a northern corridor alternative could be extended to reach the Canadian Tire Centre, which is the terminus point identified in the City's TMP.

For central corridor alternatives, the decision is primarily one of alignment in relationship to Highway 417, or parallel roadways which may permit closer integration of LRT with surrounding communities and major trip generators.

For southern corridor alternatives, the major considerations are in how the corridor best serves Kanata South and how/whether the terminus is located in Kanata South/Stittsville or turns north to reach the Canadian Tire Centre. Figures Figure 5-1 and Figure 5-2 illustrate the long-list of corridor alternatives.

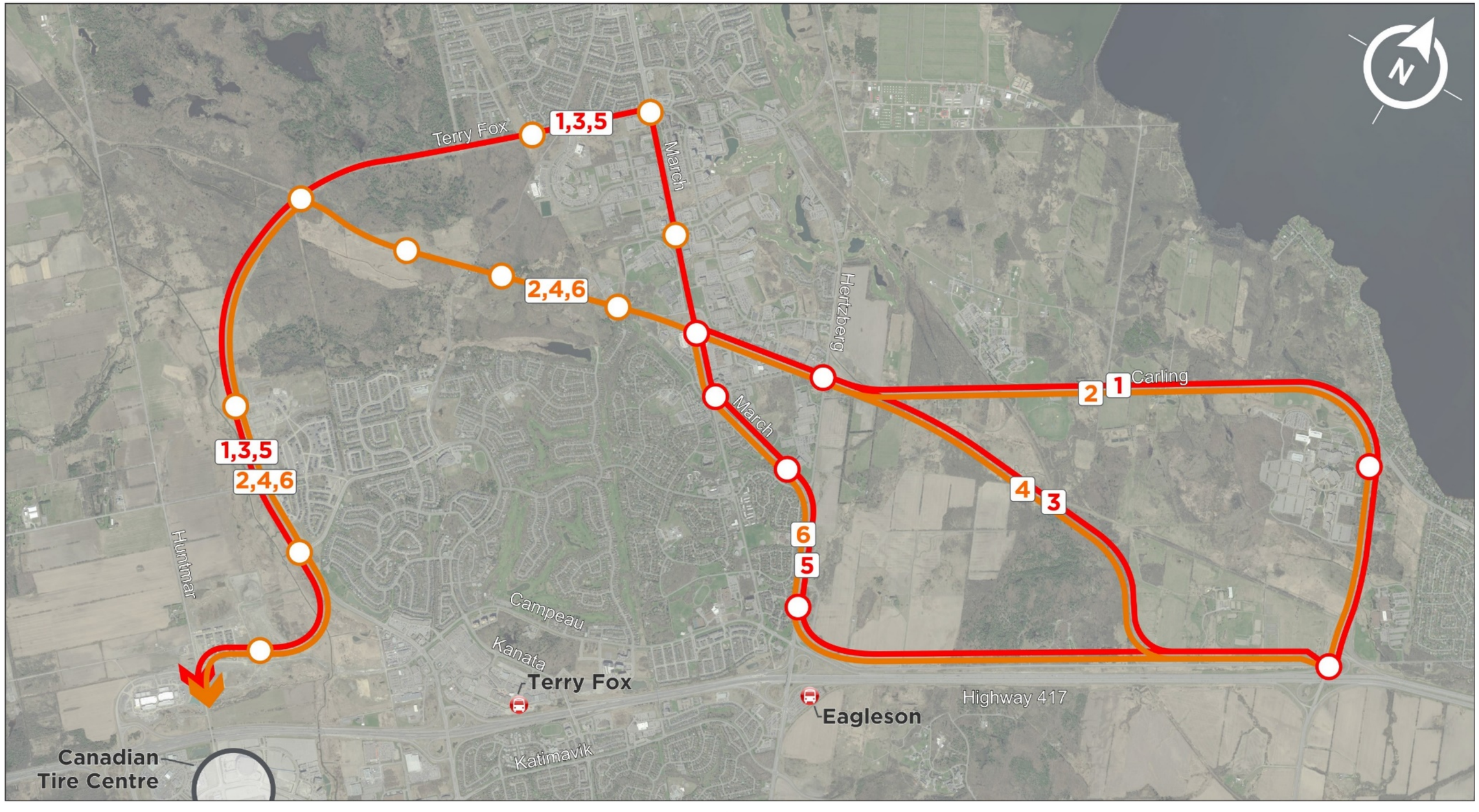


Figure 5-1: Long List of Corridor Alternatives (North)

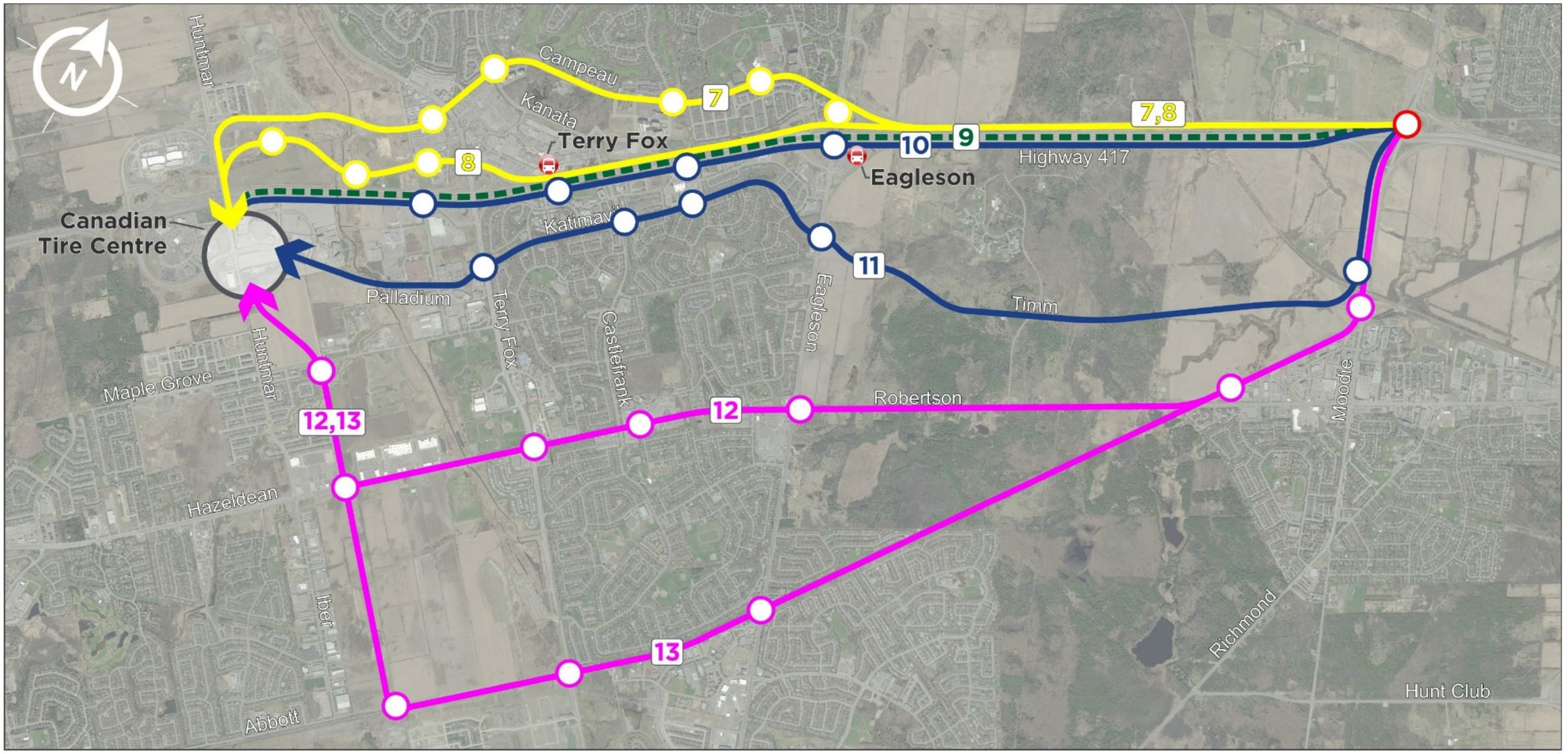


Figure 5-2: Long-list of Corridor Alternatives (Central and South)

5.2.1. MOODIE/CARLING (ROUTES 1 & 2)

This alignment starts from Corkstown Station and turns north up Moodie Drive to serve the Department of National Defence Carling Campus, then west along Carling Avenue to reach the Kanata North area. In the vicinity of Herzberg Road, the corridor transitions to follow within an existing city-owned rail corridor (Renfrew Spur) to March Road.

At March Road, the LRT corridor could either:

- Remain in the Renfrew Spur corridor west of March Road, with a terminus in the vicinity of Terry Fox Drive, or
- Turn north up March Road, with a terminus at the Innovation Park and Ride lot.

Under either of the above options, the corridor could continue on to reach the Canadian Tire Centre via Terry Fox Drive.

Potential Station Locations

- Carling Campus (DND)
- Herzberg Road
- March Road

If the corridor continues to follow the Renfrew Spur west of March Road, additional station locations are:

- Station Road
- Goulburn Forced Road
- West of Goulburn Forced Road
- Terry Fox Drive

If the corridor turns north up March Road, additional station locations are:

- Solandt Road
- Terry Fox Drive
- Innovation Park and Ride

With further extension to Canadian Tire Centre, additional station locations are:

- Huntsville Drive
- Kanata Avenue
- Campeau Drive/Huntmar Drive
- Canadian Tire Centre

Issues and Opportunities

- Provides direct service to Carling Campus (DND/PSPC) employment node.
- Relatively sharp curves needed at Moodie/417 and Moodie/Carling will impact ability to provide higher speed LRT operations.
- Provides direct service to Kanata North area; does not directly serve existing Eagleson or Terry Fox Stations.
- Makes use of an existing underutilized rail corridor; impact to existing rail service will need to be assessed to determine whether LRT can share tracks or a separate track is required to maintain freight rail access.
- Does not directly serve Kanata Centre, or Kanata South/Stittsville. The corridor would either need to be extended south via Terry Fox or an additional LRT corridor provided to serve these destinations. Either option attracts additional costs to construct and maintain compared against likely demand.
- Would require an additional primary rapid transit corridor (LRT or BRT) to serve central and southern Kanata (either a branch configuration for LRT or a BRT corridor with transfer station at Moodie Drive).

5.2.2. HIGHWAY 417/RAILWAY (ROUTES 3 & 4)

This corridor follows along the north side of Highway 417 to the Canadian National Railway Beachburg Subdivision (Beachburg Sub), then swings north to follow the rail line towards Kanata North.

As with corridor option 1, the LRT could either

- Remain within the railway right-of-way, or
- Transition at March Road to run within the March Road right-of-way through Kanata North.

Under either of the above options, the corridor could continue on to reach the Canadian Tire Centre via Terry Fox Drive.

Potential Station Locations

- Herzberg Road
- March Road

If the corridor continues to follow the Renfrew Spur west of March Road, additional station locations are:

- Station Road
- Goulburn Forced Road
- West of Goulburn Forced Road
- Terry Fox Drive

If the corridor turns north up March Road, additional station locations are:

- Solandt Road
- Terry Fox Drive
- Innovation Park and Ride

With further extension to Canadian Tire Centre, additional station locations are:

- Huntsville Drive
- Kanata Avenue
- Campeau Drive/Huntmar Drive
- Canadian Tire Centre

Issues and Opportunities

- Makes use of an existing underutilized rail corridor; impact to existing rail service will need to be assessed to determine whether LRT can share tracks or a separate track is required to maintain freight rail access.
- Provides direct service to Kanata North; does not directly serve existing Eagleson or Terry Fox Stations.
- Does not directly serve Kanata Centre, or Kanata South/Stittsville. The corridor would either need to be extended south via Terry Fox or an additional LRT corridor provided to serve these destinations. Either option attracts additional costs to construct and maintain compared against likely demand.
- Would require an additional primary rapid transit corridor (LRT or BRT) to serve southern Kanata (either a branch configuration for LRT or a BRT corridor with transfer station located at Moodie Drive).

5.2.3. HIGHWAY 417/MARCH ROAD (ROUTES 5 & 6)

This corridor runs along Highway 417 from Moodie Drive to the Eagleson/March Road interchange before turning north and running along March Road to Kanata North. Where the corridor intersects with the City-owned rail line, the corridor could turn west and follow the Renfrew Spur or continue further up March Road to Terry Fox Drive/Innovation Park and Ride. Under either of the above options, the corridor could continue on to reach the Canadian Tire Centre via Terry Fox Drive.

The segment along March Road is already identified as an at-grade bus rapid transit corridor in the City's TMP, with implementation of median bus lanes from Campeau Drive (just north of a grade separated access to March/Eagleson Station) and Terry Fox Drive anticipated as part of the Affordable Rapid Transit network.

Potential Station Locations

- March Road/Campeau Drive
- Herzberg Road
- Teron Road
- March Road/Rail Corridor

If the corridor continues to follow the Renfrew Spur west of March Road, additional station locations are:

- Station Road
- Goulburn Forced Road
- West of Goulburn Forced Road
- Terry Fox Drive

If the corridor turns north up March Road, additional station locations are:

- Solandt Road
- Terry Fox Drive
- Innovation Park and Ride

With further extension to Canadian Tire Centre, additional station locations are:

- Huntsville Drive
- Kanata Avenue
- Campeau Drive/Huntmar Drive

Issues and Opportunities

- Assumed implementation of the City's Affordable Rapid Transit network means median bus lanes along March Road will need to be replaced or deferred to accommodate LRT in this corridor option.
- Provides direct service to Kanata North.
- Requirement for grade separation at intersections along March Road will likely increase costs compared to other corridor options.
- Requires branching of the LRT service or a separate rapid transit corridor to provide service to Eagleson, Terry Fox Stations and communities to the south of Highway 417.

5.2.4. HIGHWAY 417/CAMPEAU DRIVE (ROUTE 7)

This corridor runs along Highway 417 from Moodie Drive to the Eagleson/March Road interchange before transitioning to run in the Campeau Road corridor. In the vicinity of Terry Fox Drive the corridor would either transition to the previously approved West Transitway Connection, or continue to follow Campeau Road to the vicinity of Huntmar Road before crossing Highway 417 to terminate at the Canadian Tire Centre.

Potential Station Locations

- March Road/Campeau Drive
- Mlacak Community Centre/Earl of March Secondary School
- Knudson Drive/Maritime Way
- Kanata Avenue
- Terry Fox Drive
- Campeau Drive/Huntmar Drive
- Canadian Tire Centre

Issues and Opportunities

- Locates LRT alignment in closer proximity to development, including significant trip generators and community destinations (high school, community centre)
- Offers potential for increased integration with community it serves.
- Requirement of grade separation along Campeau Drive will likely increase costs compared to other corridor options.
- Corridor is located further from Eagleson Park and Ride
- Difficult to access Terry Fox Station, resulting in throw away of the existing station and park and ride facility and the need to construct a new bus terminal and park and ride lot along the corridor.

5.2.5. HIGHWAY 417 – NORTH SIDE (ROUTE 8)

This corridor is the previously identified and approved rapid transit corridor (for BRT technology). The corridor runs along the north side of Highway 417 between Moodie Drive and Terry Fox Station. West of Terry Fox Station the alignment passes around the north side of the highway interchange one level below the road network. West of Didsbury the alignment shifts slightly north to parallel Campeau Drive. It then swings south on embankment and/or viaduct to cross over Highway 417 east of Huntmar to a terminal station between Huntmar and the stadium.

Previous studies have reviewed portions of this alignment, with the Moodie to March/Eagleson segment the least studied, and generally positioned immediately north of the highway in the 1996 West Urban Community study.

Potential Station Locations

- March Road (Eagleson Park and Ride)
- Kanata Town Centre (via Highway 417 Pedestrian Overpass)
- Terry Fox
- Didsbury Drive
- Carp River
- Campeau Drive
- Canadian Tire Centre

Issues and Opportunities

- Approved corridor has two at-grade crossings which will need to be grade-separated or otherwise resolved (Didsbury Road and at a future collector road connecting with Campeau Drive).
- Does not serve Kanata North directly, would require transfer at March Road or branching of LRT.
- Makes use of existing pre-planned/built infrastructure (e.g. underpass at Kanata Avenue, Terry Fox Station).
- Corridor adjacent to highway limits walk-in access from south except via highway overpasses or existing/new pedestrian bridges.

- Less integrated into community but faster/straight alignment with limited grade separations required.
- Substantial walk distance for passengers at Eagleson park and ride.
- Good opportunities for station-oriented development at Kanata Town Centre, Terry Fox (Kanata Centrum), Kanata West lands and in the vicinity of Canadian Tire Centre.
- Terminus at Canadian Tire Centre or further extension on West Transitway Corridor identified in TMP would serve Kanata South/Stittsville.

5.2.6. HIGHWAY 417 – MEDIAN (ROUTE 9)

Similar to the Confederation Line East Extension from Blair to Place d'Orléans, the LRT alignment would transition from Corkstown Station into the median of Highway 417.

The terminus station at CTC could either remain within the highway median, or be located on the south side of the highway adjacent to the stadium.

Potential Station Locations

- March Road (Eagleson Park and Ride)
- Kanata Town Centre (via Highway 417 Pedestrian Overpass)
- Terry Fox
- Didsbury Drive
- Canadian Tire Centre

Issues and Opportunities

- Straight alignment.
- Transition to and from highway median present challenges.
- Limited/no space available in median without impacting traffic lanes, high mast-lighting, requiring shifting of recently constructed highway lanes.
- MTO issues related to safety, constructability and access.
- Station locations more challenging for access via walking, cycling, local transit.
- Abandons approved BRT corridor west of Terry Fox Drive, affecting current land use plans, property city has already acquired through Kanata West development.
- Does not serve Kanata North directly, would require transfer at March Road or branching of LRT.
- Terminus at Canadian Tire Centre or further extension on West Transitway Corridor identified in TMP would serve Kanata South/Stittsville.

5.2.7. HIGHWAY 417 – SOUTH SIDE (ROUTE 10)

This corridor would transition from Moodie Station to the south side of the highway, and run along the south side of Highway 417 from Moodie to CTC.

Potential Station Locations

- Eagleson Road (Eagleson Park and Ride)
- Kanata Town Centre
- Terry Fox (Centrum)
- Didsbury Drive
- Canadian Tire Centre

Issues and Opportunities

- Requires crossing east and westbound lanes of Highway 417.
- Station can be integrated with Eagleson Park and Ride.
- Difficult to integrate with March Road BRT as extension over Highway 417 will require a widened or new overpass structure to accommodate BRT south of Campeau/March intersection.
- Less space available along the south side of the highway to accommodate the LRT
- Potential station-oriented development at Hearst Way/Katimavik.
- Property acquisition will be required.
- Highway ramps at interchange locations present a challenge.
- Pedestrian crossing to access Terry Fox bus station, park and ride lot and Centrum
- Does not require crossing of Highway 417 at west end.
- Abandons approved BRT corridor west of Terry Fox Drive, affecting current land use plans, property city has already acquired through Kanata West development.
- Does not serve Kanata North directly, would require transfer at March Road or branching of LRT.
- Terminus at Canadian Tire Centre or further extension on West Transitway Corridor identified in TMP would serve Kanata South/Stittsville.

5.2.8. MOODIE/TIMM/KATIMAVIK (ROUTE 11)

This alignment starts from Corkstown Station and turns south along Moodie Drive, to just north of Bells Corners, then turns west to run along Timm Drive/Katimavik Road/Palladium Drive to reach Canadian Tire Centre.

Potential Station Locations

- Moodie/Timm
- Eagleson
- Kanata Town Centre
- Castlefrank
- Terry Fox Drive
- Canadian Tire Centre

Issues and Opportunities

- Station sites will require significant property
- Does not directly serve existing park and ride or transit stations
- Does not serve Kanata North. A separate rapid transit corridor with transfer station or branching of LRT at Moodie or Eagleson Road would be required.
- Difficult to connect to important trip generators, local transit routes.
- Roadway geometry challenging, will be difficult to integrate a primary LRT corridor.
- Grade separations challenging.
- Limited right-of-way in some segments will require additional property, particularly at station locations.

5.2.9. MOODIE/ROBERTSON/HAZELDEAN (ROUTE 12)

This alignment starts from Corkstown Station and turns south along Moodie Drive, into Bells Corners, then turns west to run within the Robertson/Hazeldean Road. The corridor could branch off at the future North-South arterial, turning north to reach CTC via the approved West Transitway corridor, and/or continue west along Hazeldean Road to serve Stittsville with a terminus station likely in the area of Stittsville Main Street/Carp Road.

Potential Station Locations

- Moodie/Timm
- Robertson Road
- Eagleson Road
- Castlefrank Road
- Terry Fox Drive
- Hazeldean/North-South Arterial
- Maple Grove Road
- Canadian Tire Centre

Issues and Opportunities

- Extensive grade separation required at intersections along Hazeldean or restriction to right-in/right-out access only.
- Additional right-of-way required.
- Significant property requirements at station locations to accommodate local transit connections.
- Does not serve Kanata North.
- Does not serve existing Eagleson Park and Ride or Terry Fox Station.
- Straight and direct roadway corridor.
- Good potential for future intensification, mixed-use development along the corridor, although station spacing would concentrate development at specific nodes rather than evenly along the corridor.

5.2.10. MOODIE/TRANS CANADA TRAIL (ROUTE 13)

This alignment starts from Corkstown Station and turns south along Moodie Drive, to just north of Bells Corners, then uses the existing City-owned multi-use pathway corridor (TransCanada Trail) to Robert Grant Avenue (North-South Arterial). This corridor could turn north and follow the approved BRT corridor to reach the Canadian Tire Centre, or continue west of Robert Grant to provide direct service into Stittsville.

Potential Station Locations

- Moodie/Timm
- Robertson Road
- Eagleson Road
- Terry Fox Drive
- Abbott/Robert Grant Avenue
- Hazeldean Road
- Maple Grove Road
- Canadian Tire Centre

Issues and Opportunities

- Sharp curve and crossing of Highway 417 in the vicinity of Moodie Drive.
- Serves Bells Corners community.
- Straight and direct corridor, requires limited grade-separations.
- Corridor is generally wide enough (30 m) to accommodate both LRT and existing multi-use pathway, although there will be less space available for landscaping/greenspace within the corridor
- Proximity to residential properties.
- Difficult to provide for station sites with bus transfer facilities, passenger pick-up and drop-off, park and ride lots.
- Corridor is under City ownership.
- Provides direct service to Stittsville area but does not serve Kanata North.
- Can provide a connection to the planned BRT corridor at the North-South arterial (Robert Grant Avenue).
- Does not serve existing Eagleson Park and Ride or Terry Fox station

5.3. PRELIMINARY SCREENING

The following evaluation criteria were used to screen the long-list of corridor alternatives to a short-list which was then carried forward for more detailed evaluation. Table 5-1 outlines the draft evaluation criteria.

Table 5-1: Alternative Corridor Screening Criteria

Analysis Criteria	Indicator	Data Type
Transportation/Transit System: The purpose of this category is to compare the effectiveness of the alternatives to contribute to the success of the planned transportation systems.		
• Rapid Transit Network Connectivity • Road Network Impacts • Catchment potential	• Compatibility with existing and future transit facilities/routes and ease of connectivity • Impacts on road traffic including road capacity, vehicle movements and interaction with LRT • Population, employment and major facilities along the corridor (such as hospitals, universities/colleges, schools, regional facilities, recreation centres, shopping malls)	• Comparative assessment • Comparative assessment • Quantitative assessment
Effect on Social Environment: This category encompasses criteria that assess the compatibility of the LRT with the existing and planned local community, and impacts on archaeological and cultural resources in the corridor.		
• Land use compatibility, including effects of noise, vibration and air quality • Development incentives • TOD incentives • Archaeological/cultural resources	• Compatibility with existing or planned uses of land, including proximity to sensitive uses • Protection and encouragement of property and business investment • Support for transit-oriented development planning • Impact on identified archaeological/heritage resources	• Comparative assessment • Qualitative assessment • Qualitative assessment • Quantitative assessment
Effect on Natural Environment: The focus of this category is to assess the potential effect of the alternative corridors on elements of the natural environment such as fisheries, wildlife, natural vegetation and key natural features within the ecosystem.		
• Surface water • Flora & Fauna • Subsurface conditions	• Disruption of surface water courses • Disruption of natural areas which provide habitat/systems/linkages • Length within areas of potential construction difficulties due to soils limitations	• Qualitative assessment • Qualitative assessment • Quantitative assessment
Cost: The criteria in this group involve the identification of the economic factors associated with an alternative corridors to determine whether it is an acceptable solution to those who will ultimately pay for implementation and to identify public sector capital funding needs.		
• Existing Infrastructure • Contamination Considerations • Capital costs • Land acquisition • Operational costs	• Conflict with existing infrastructure (e.g., water, sewer, utilities and built form) • Disturbance of large areas of contamination • Estimated construction costs • Private property requirements • Operating costs	• Qualitative assessment • Comparative assessment • Comparative assessment • Comparative assessment • Comparative assessment

The evaluation methodology used a combination of quantitative, qualitative and comparative assessment to evaluate each criteria area. For the purposes of consistency, the following definitions were utilized by the Study Team Table 5-2.

Table 5-2: Evaluation Terminology

Definition of Impacts	Terms describing:	
	Negative Impacts	Positive Impacts (i.e., Benefits)
The impact exists, but is of a magnitude small enough that it has little effect, or is of limited benefit; or has the least impact compared to all the alternatives. Best compliance, contribution or benefit.	Negligible	Greatest
The impact exists and is of relatively small physical magnitude or duration. Provides a moderate effect or contribution or benefit.	Minor	Good
The impact exists and has an effect that is relatively large, permanent or has the most impact when compared to other alternatives. Little to no contribution or benefit	Major	Limited

Each Analysis Criteria was summarized and assigned a preference depicted graphically:

- Least Preferred: Limited positive effect; Major impact; or Highest cost.
- Good positive effect; Minor impact; or Moderate cost.
- Most Preferred: Greatest positive effect; Negligible impact; or Lowest cost

The results of the evaluation are shown in Table 5-3.

Table 5-3: Evaluation Results

Analysis Criteria	Indicator and Detail	Route												
		1	2	3	4	5	6	7	8	9	10	11	12	13
1. Ridership Potential & Network Connectivity		▲	▲	▲	▲	●	▲	■	●	▲	▲	■	▲	▲
	Travel time Palladium to Moodie	Longest	Longest	Longest	Moderate	Longest	Longest	Shortest	Shortest	Shortest	Shortest	Moderate	Moderate	Moderate
	Potential to support good connections	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Moderate. Connection at Eagleson would connect south Kanata services to the LRT west of the Greenbelt.	Moderate. Connection at Eagleson would connect south Kanata services to the LRT west of the Greenbelt.	Limited. Connection opportunities constrained by narrow right-of-way and development along Campeau	Greatest. North-south routes would connect to the LRT and provide good internal travel options.	Greatest. North-south routes would connect to the LRT and provide good internal travel options.	Moderate. Connection opportunities constrained by lack of space for stations along south side of Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417.
	Combined Pop and Employment projections, 2031 (within 800 metres)	47,000	35,000	40,000	28,000	43,000	32,000	24,000	25,000	23,000	23,000	24,000	32,000	40,000

Analysis Criteria	Indicator and Detail	Route												
		1	2	3	4	5	6	7	8	9	10	11	12	13
		●	▲	●	■	●	■	▲	●	●	●	▲	▲	▲
2. TOD & City Building opportunities	Connects to potential intensification opportunities as identified in the Official Plan and CDPs	Connects to DND Campus and employment areas in Kanata North. Services the employment area evenly along March Road. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to DND Campus and employment areas in Kanata North. Services the employment area partially along the railway corridor. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to employment areas in Kanata North. Services the employment area evenly along March Road. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to employment areas in Kanata North. Services the employment area partially along the railway corridor. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to edge of Mixed Use Centre west of March, and employment areas in Kanata North. Services the employment area evenly along March Road. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to edge of Mixed Use Centre west of March, and employment area in Kanata North. Services the employment area partially along the railway corridor. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connect to Mixed Use Centre at March, running along the edge via Campeau. Transitions into the Employment / Mixed Use lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to Mixed Use Centre at March and runs centrally through the Mixed Use Centre until transitioning into the Employment / Mixed Use lands at the terminus. Provides spine along 417 for access to intensification opportunities both north and south of Highway 417.	Connects to Mixed Use Centre at March and runs centrally through the Mixed Use Centre until transitioning into the Employment / Mixed Use lands at the terminus. Provides spine along 417 for access to intensification opportunities both north and south of Highway 417.	Connects to Mixed Use Centre at March and runs centrally through the Mixed Use Centre until transitioning into the Employment / Mixed Use lands at the terminus. Provides spine along 417 for access to intensification opportunities both north and south of Highway 417.	Travels nearby of employment lands at Bell's Corners, and then along southerly edge of Mixed Use Centre until transitioning into the employment lands west of Terry Fox. Services the south, but does not provide service to intensification opportunities north of Highway 417	Travels along edge of Employment Lands and Arterial Mainstreet at Bell's Corners, and then along Arterial mainstreet of Hazeldean Road, west of Eagleson. Serves some commercial and employment lands. Services the south, but does not provide service to intensification opportunities north of Highway 417	Travels along edge of Employment Lands and Arterial Mainstreet at Bell's Corners. West of Eagleson, the corridor serves some employment lands and Mixed Use, transitioning to the employment lands. Services the south, but does not provide service to intensification opportunities north of Highway 417
3. Natural Environment Impacts		■	■	■	■	■	■	●	●	●	●	▲	▲	▲

Analysis Criteria	Indicator and Detail	Route												
		1	2	3	4	5	6	7	8	9	10	11	12	13
	Total number of watercourse crossings	16	16	15	15	15	15	8	6	4	4	5	7	8
	Natural habitat (Natural heritage) within 120m (Ha)	73	70	80	77	67	64	12	12	12	14	41	46	56
	Degree of impact that the corridor would have on continuity, connectivity and wildlife linkages	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Some new rail corridor interaction utilizes existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.	Semi-urbanized context. Some new rail corridor interaction utilizes existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.	Urbanized context. No new rail corridor interaction, existing urbanized roadways elsewhere.	Urbanized context. No new rail corridor interaction, existing urbanized roadways elsewhere.	Urbanized context. No new rail corridor interaction, existing urbanized roadways elsewhere.	Urbanized context. No new rail corridor interaction, existing urbanized roadways elsewhere.	Semi-urbanized context. Some new rail corridor interaction utilizes existing urbanized roadways elsewhere.	Semi-urbanized context. Some new rail corridor interaction utilizes existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.
		▲	▲	■	■	▲	▲	▲	●	▲	▲	▲	▲	■
4. Social environment impacts	Total length (km) of each alignment through areas of known archaeological potential	8	7	8	7	9	7	3	3	2	2	5	6	7

Analysis Criteria	Indicator and Detail	Route												
		1	2	3	4	5	6	7	8	9	10	11	12	13
	Impacts on Greenbelt identified resources, as per Greenbelt Master Plan (Nature of crossing, new barrier, scenic arrivals and views, NCC pathway interference)	- Crossing Greenbelt within existing road corridor - New, impermeable barrier in Greenbelt, along Core natural area and natural Link - Transition at Moodie may interfere with protected view along scenic arrival route - Some pathway interference.	- Crossing Greenbelt within existing road corridor - New, impermeable barrier in Greenbelt, along Core natural area and Natural Link - Transition at Moodie may interfere with protected view along scenic arrival route - Some pathway interference.	- Crossing Greenbelt along Highway 417, and then within existing railway corridor (seldom used) - New, impermeable barrier in Greenbelt, dividing Natural Link areas - Transition to Railway corridor interferes with identified view along scenic arrival route - Significant pathway interference.	- Crossing Greenbelt along Highway 417, and then within existing railway corridor (seldom used) - New, impermeable barrier in Greenbelt, dividing Natural Link areas - Transition to Railway corridor interferes with identified view along scenic arrival route - Significant pathway interference.	- Crossing Greenbelt along Highway 417, transitions to March Road along westerly border of Greenbelt - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor, but provides new impermeable barrier along edge of Greenbelt - Transition to March Road interferes with identified view - Some interference with access to NCC pathways	- Crossing Greenbelt along Highway 417, transitions to March Road along westerly border of Greenbelt - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor, but provides new impermeable barrier along edge of Greenbelt - Transition to March Road interferes with identified view - Some interference with access to NCC pathways	- Crossing Greenbelt along Highway 417 - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor - Travels along scenic arrival route, may pose minor interference - Negligible pathway interference.	- Crossing Greenbelt along Highway 417 - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor - Travels along scenic arrival route, may pose minor interference - Negligible pathway interference.	- Crossing Greenbelt along Highway 417 - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor - Crossing of Highway 417 to median obstructs protected view along scenic arrival route. Travels along scenic arrival route, may pose minor interference - Negligible pathway interference.	- Crossing Greenbelt along Highway 417 - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor - Crossing of Highway 417 to south side obstructs protected view along scenic arrival route. Travels along scenic arrival route, may pose minor interference - Negligible pathway interference.	- Crossing Greenbelt within existing road corridor - New, impermeable barrier in Greenbelt, through Core Natural Area and scenic route along Timm Road - Crossing of 417 at Moodie obstructs protected view along scenic arrival route - Some pathway interference.	- Crossing Greenbelt within existing road and railway corridors - New, impermeable barrier in Greenbelt through core natural area - Crossing of 417 at Moodie obstructs protected view along scenic arrival route - Some pathway interference.	- Crossing Greenbelt within existing road, railway, and trail corridors - New, impermeable barrier in Greenbelt through Core Natural Area - Crossing of 417 at Moodie obstructs protected view along scenic arrival route - Significant pathway interference, displaces Transcanada Trail.
	Sensitive uses in close proximity to the corridor (Amenity areas, retirement homes, day cares, care facilities)	Several care facilities and sensitive land uses along corridor, as well as residential amenity area.	Limited impact on sensitive land uses, or good separation from nearby areas	Several care facilities and sensitive land uses along corridor, as well as residential amenity area.	Limited impact on sensitive land uses, or good separation from nearby areas	Several care facilities and sensitive land uses along corridor, as well as residential amenity area.	Several care facilities and sensitive land uses along corridor, as well as residential amenity area.	Residential amenity areas all along Campeau Drive to the north, as well as several care facilities. Major new addition to corridor	No sensitive uses in close proximity; bundled with major transportation corridor.	No sensitive uses in close proximity; bundled with major transportation corridor.	No sensitive uses in close proximity; bundled with major transportation corridor.	Large amount of residential properties along corridor with amenity areas	Large amount of residential properties along corridor with amenity areas	Large amount of residential properties along corridor with amenity areas, day care facilities flank corridor

Analysis Criteria	Indicator and Detail	Route												
		1	2	3	4	5	6	7	8	9	10	11	12	13
5. Construction Complexity		■	▲	▲	▲	■	■	▲	●	■	▲	▲	■	▲
	Number of properties with potential to cause contamination within 75m (HLUI).	213	146	170	103	168	99	48	23	44	69	61	168	139
	Impact on transportation network capacity and functionality	Low	Low	Low	Low	Low	Low	High	None	High	None	Moderate	Moderate	Low
	Degree to which existing infrastructure could be impacted	Minor	Minor	Minor	Negligible	Minor	Minor	Minor	Minor	Major	Minor	Minor	Minor	Negligible
	Length of corridor (km) within problematic soil areas.	10	9	9	9	10	10	5	5	5	6	6	7	10
6. Capital and Operational costs		■	■	■	▲	■	■	▲	●	●	●	▲	▲	▲
	Runningway Lengths (km)	16.6	15.4	15.6	14.4	16.5	15.3	9.3	9.0	8.4	8.4	9.8	10.8	12.2
	Grade Separations	44	29	34	16	42	27	36	16	8	7	31	8	8
	Number of Potential Stations	11	11	11	11	13	13	6	5	5	5	6	8	8
Summary		■	■	■	■	■	■	▲	●	▲	▲	■	■	■

Corridor 8 received more preferred assessments than any other option, and was identified as the preliminary preferred corridor.

However, based on feedback received at the Consultation Group meetings on the need/desire to extend LRT to Kanata North and the need to serve the Stittsville Community to the south, additional corridor evaluation was undertaken for Corridors 5, 8 and 13.

5.4. "SHORT LIST" OF ALTERNATIVE CORRIDORS

Each of the three corridors was reviewed to determine an appropriate terminus location. Resulting was six scenarios for further evaluation:

- Corridor 5 – Ends at Palladium
- Corridor 5A – Ends at Innovation Park and Ride
- Corridor 8 – Ends at Palladium
- Corridor 8A – Ends at Hazeldean
- Corridor 13 – Ends at Palladium
- Corridor 13A – Ends at Robert Grant/Abbott

Each of these corridors is shown in the Figures below.

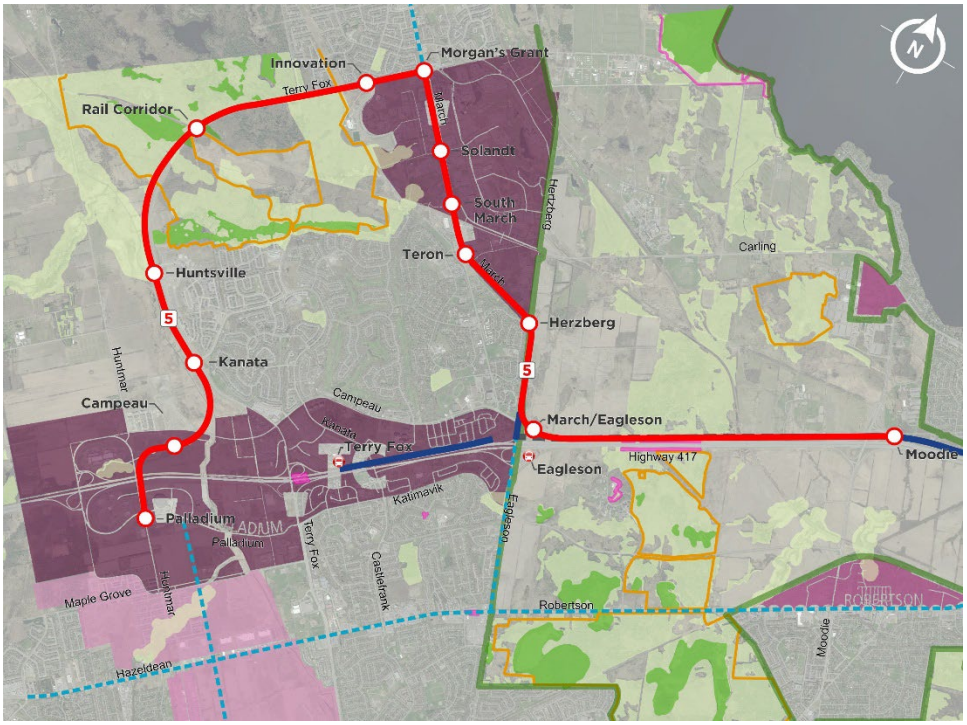


Figure 5-3: Corridor 5

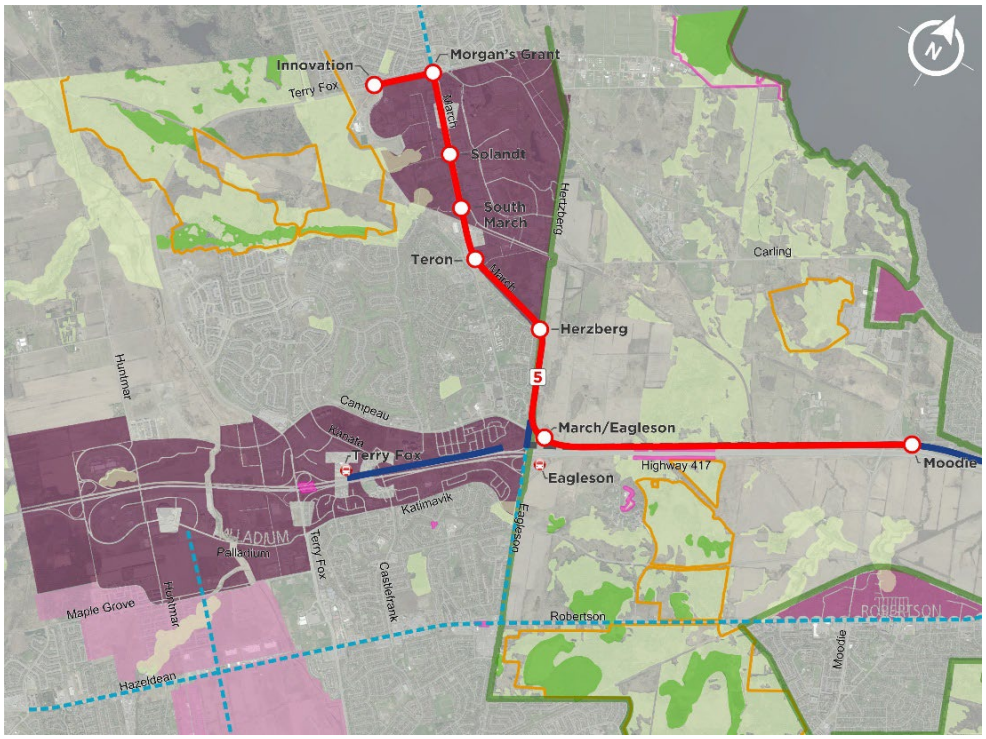


Figure 5-4: Corridor 5A

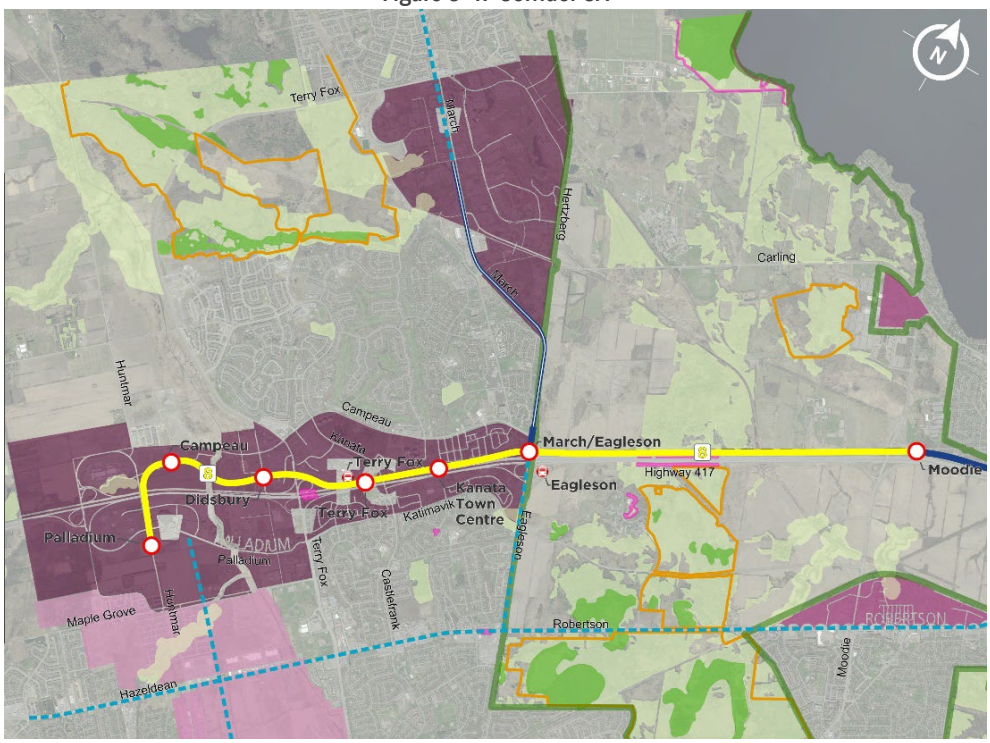


Figure 5-5: Corridor 8

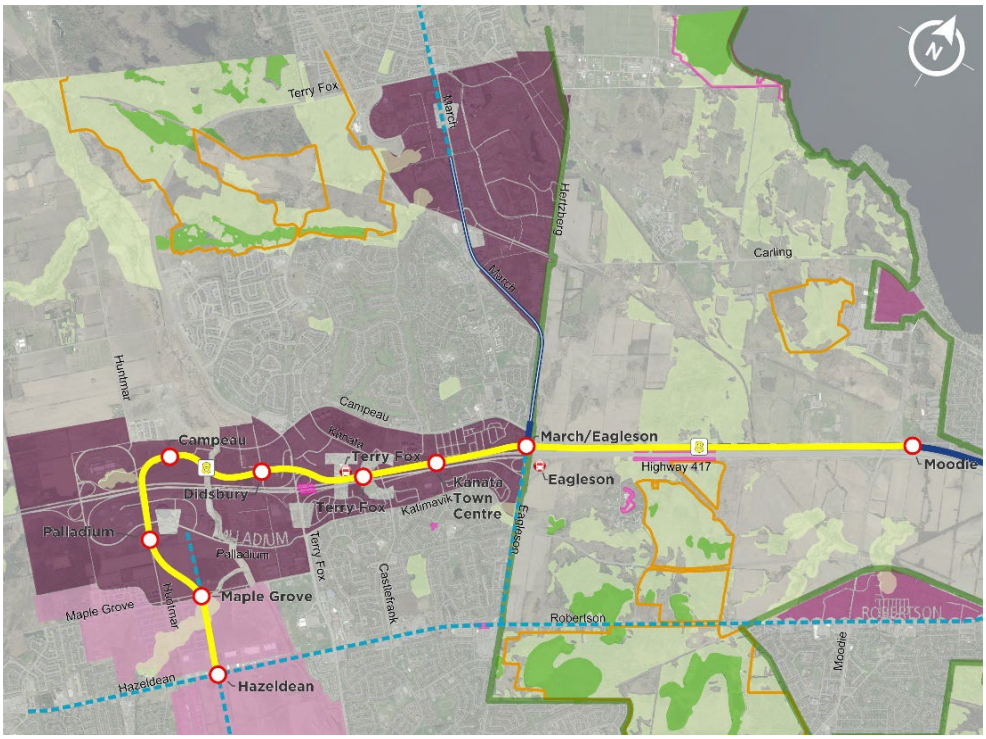


Figure 5-6: Corridor 8A

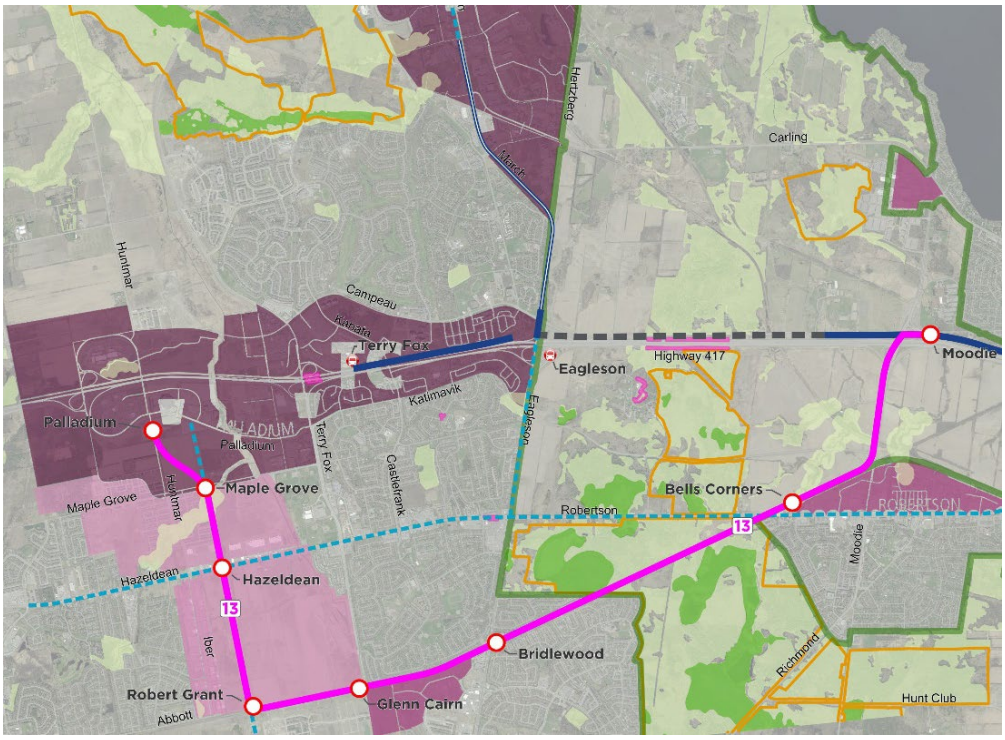


Figure 5-7: Corridor 13

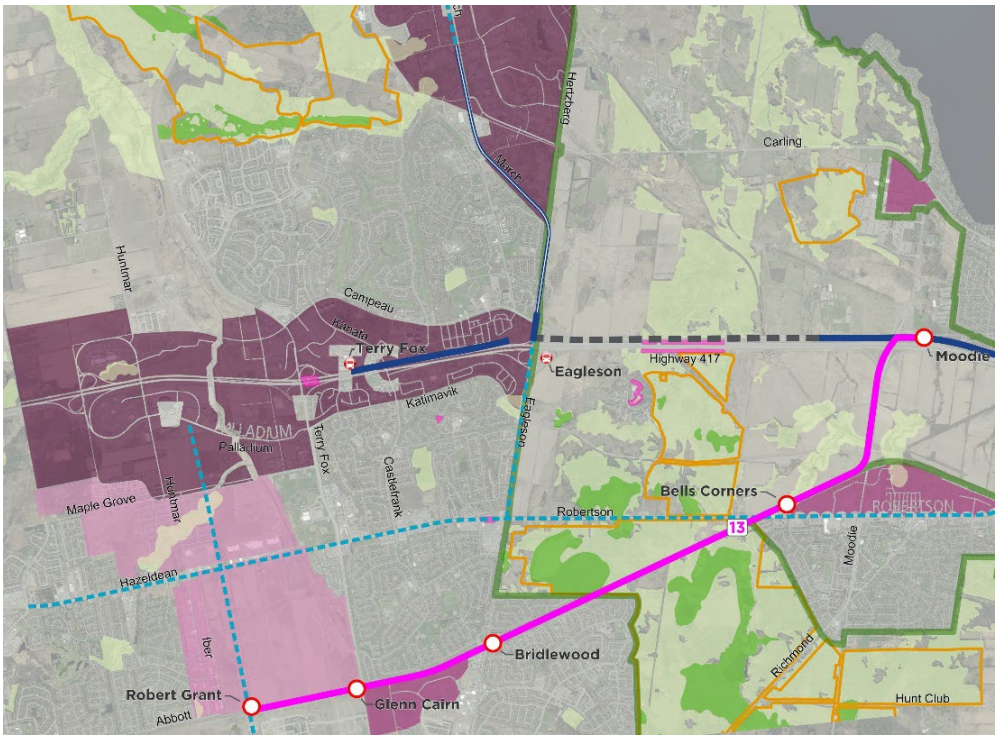


Figure 5-8: Corridor 13A

The corridor options were evaluated against the same criteria used in the initial evaluation. The proxy land use forecasts developed as part of the initial evaluation were replaced with actual ridership figures generated for each scenario using the City's TRANS model.

The results of the short-list evaluation are shown in Table 5-4 and subsequently summarized.

Table 5-4: Short List Corridor Options Evaluation Results

Analysis Criteria	Indicator and Detail	Route					
		Original 5	Truncated 5 (to Maxwell Bridge Road)	Original 8	Extended 8 (To Hazeldean)	Original 13	Truncated 13 (To Hazeldean and NS Arterial)
1. Ridership Potential & Network Connectivity		●	▲	●	●+	▲	■
	Travel time Palladium to Moodie	Longest	Longest - requires transfer at March/Eagleson	Shortest	Shortest	Moderate	Longest - requires transfer at March/Eagleson
	Potential to support good connections	Moderate. Connection at Eagleson would connect south Kanata services to the LRT west of the Greenbelt.	Moderate. Connection at Eagleson would connect south Kanata services to the LRT west of the Greenbelt. Does not serve Palladium area.	Greatest. North-south routes would connect to the LRT and provide good internal travel options.	Greatest. North-south routes would connect to the LRT and provide good internal travel options. Also Connects into Hazeldean Main Street area,	Limited. Requires duplicate bus service across Greenbelt along Highway 417.	Limited. Requires duplicate bus service across Greenbelt along Highway 417. Does not serve Palladium area.
	Ridership Forecasting	Total Transit: 13505 LRT: 10720	Total Transit: 13383 LRT: 10570	Total Transit: 13040 LRT: 10284	Total Transit: 13529 LRT: 10853	Total Transit: 15162 LRT: 13140	Total Transit: 15029 LRT: 12547
2. TOD & City Building opportunities		●	▲	●	●+	▲	■
	Connects to potential intensification opportunities as identified in the Official Plan and CDPs	Connects to edge of Mixed Use Centre west of March, and employment areas in Kanata North. Services the employment area evenly along March Road. Travels alongside edge of Urban boundary with no intensification foreseen, before connecting into the Mixed-Use and Employment lands at the terminus. Services the north, but does not provide service to intensification opportunities south of Highway 417	Connects to edge of Mixed Use Centre west of March, and employment areas in Kanata North. Services the employment area evenly along March Road. Services the north, but does not provide service to intensification opportunities south of Highway 417, or the Palladium area	Connects to Mixed Use Centre at March and runs centrally through the Mixed Use Centre until transitioning into the Employment / Mixed Use lands at the terminus. Provides spine along 417 for access to intensification opportunities both north and south of Highway 417.	Connects to Mixed Use Centre at March and runs centrally through the Mixed Use Centre until transitioning into the Employment / Mixed Use lands at the terminus. Provides spine along 417 for access to intensification opportunities both north and south of Highway 417. Now connects to Hazeldean Main Street area and intensification opportunities,	Travels along edge of Employment Lands and Arterial Mainstreet at Bell's Corners. West of Eagleson, the corridor serves some employment lands and Mixed Use, transitioning to the employment lands. Services the south, but does not provide service to intensification opportunities north of Highway 417	Travels along edge of Employment Lands and Arterial Mainstreet at Bell's Corners. West of Eagleson, the corridor serves some employment lands and Mixed Use, transitioning to the employment lands. Services the south, but does not provide service to intensification opportunities north of Highway 417, or at Palladium.

Analysis Criteria	Indicator and Detail	Route					
		Original 5	Truncated 5 (to Maxwell Bridge Road)	Original 8	Extended 8 (To Hazeldean)	Original 13	Truncated 13 (To Hazeldean and NS Arterial)
3. Natural Environment Impacts		■	●	●	●	▲	▲
	Total number of watercourse crossings	15	6	6	11	8	3
	Natural habitat (Natural heritage) within 120m (Ha)	67	11	12	17	56	40
	Degree of impact that the corridor would have on continuity, connectivity and wildlife linkages	Semi-urbanized context. Some new rail corridor interaction utilizes existing urbanized roadways elsewhere.	Semi-urbanized context. Some new rail corridor interaction utilizes existing urbanized roadways elsewhere.	Urbanized context. No new rail corridor interaction, existing urbanized roadways elsewhere.	Urbanized context. No new rail corridor interaction, existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.	Several crossings are away from development and introduce new urban form to a natural environment. Semi-urbanized context. Significant new rail corridor interaction, utilizes existing urbanized roadways elsewhere.
4. Social environment impacts		▲	●	●	●	■	■
	Total length (km) of each alignment through areas of known archaeological potential	9	3.9	3	3.7	7	5

Analysis Criteria	Indicator and Detail	Route					
		Original 5	Truncated 5 (to Maxwell Bridge Road)	Original 8	Extended 8 (To Hazeldean)	Original 13	Truncated 13 (To Hazeldean and NS Arterial)
	Impacts on Greenbelt identified resources, as per Greenbelt Master Plan (Nature of crossing, new barrier, scenic arrivals and views, NCC pathway interference)	- Crossing Greenbelt along Highway 417, transitions to March Road along westerly border of Greenbelt - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor, but provides new impermeable barrier along edge of Greenbelt - Transition to March Road interferes with identified view - Some interference with access to NCC pathways	- Crossing Greenbelt along Highway 417, transitions to March Road along westerly border of Greenbelt - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor, but provides new impermeable barrier along edge of Greenbelt - Transition to March Road interferes with identified view - Some interference with access to NCC pathways	- Crossing Greenbelt along Highway 417 - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor - Travels along scenic arrival route, may pose minor interference - Negligible pathway interference.	- Crossing Greenbelt along Highway 417 - Bundled with existing impermeable barrier (Highway 417), an approved infrastructure corridor - Travels along scenic arrival route, may pose minor interference - Negligible pathway interference.	- Crossing Greenbelt within existing road, railway, and trail corridors - New, impermeable barrier in Greenbelt through Core Natural Area - Crossing of 417 at Moodie obstructs protected view along scenic arrival route - Significant pathway interference, displaces Transcanada Trail.	- Crossing Greenbelt within existing road, railway, and trail corridors - New, impermeable barrier in Greenbelt through Core Natural Area - Crossing of 417 at Moodie obstructs protected view along scenic arrival route - Significant pathway interference, displaces Transcanada Trail.
	Sensitive uses in close proximity to the corridor (Amenity areas, retirement homes, day cares, care facilities)	Several care facilities and sensitive land uses along corridor, as well as residential amenity area.	Several care facilities and sensitive land uses along corridor, as well as residential amenity area.	No sensitive uses in close proximity; bundled with major transportation corridor.	No sensitive uses in close proximity; bundled with major transportation corridor.	Large amount of residential properties along corridor with amenity areas, day care facilities flank corridor	Large amount of residential properties along corridor with amenity areas, day care facilities flank corridor
5. Construction Complexity		■	▲	●	●	▲	▲
	Number of properties with potential to cause contamination within 150m (HLUI).	168	79	23	27	139	112
	Impact on transportation network capacity and functionality	Low	Low	None	None	Low	Low
	Degree to which existing infrastructure could be impacted	Minor	Minor	Minor	Minor	Negligible	Negligible

Analysis Criteria	Indicator and Detail	Route					
		Original 5	Truncated 5 (to Maxwell Bridge Road)	Original 8	Extended 8 (To Hazeldean)	Original 13	Truncated 13 (To Hazeldean and NS Arterial)
	Length of corridor (km) within problematic soil areas.	10	7	5	7	10	8
6. Capital and Operational costs		■	▲	●	▲	▲	●
	Runningway Lengths (km)	16.5	9.7	9.0	11.0	12.2	8.9
	Grade Separations	42	14	16	18	8	6
	Number of Potential Stations	13	9	5	7	8	5
Summary		■	▲	●	●+	■	■

For **Corridor 5**, the LRT would replace the March Road BRT and serve North Kanata. A major transfer is needed at March/Eagleson for buses serving the Town Center and South Kanata. The LRT would be bundled with the highway across the greenbelt. The route would affect the natural areas in the northwest, putting development pressure on the area. The long route is complex to construct and would be expensive to build and operate.

For **Corridor 5A**, the LRT would replace the March Road BRT and serve North Kanata, terminating at Innovation Park and Ride. A major transfer is needed at March/Eagleson for buses serving Kanata Town Centre and South Kanata. The LRT would be bundled with the highway across the greenbelt. The reduced length compared to Corridor 5 would be cheaper to build but would not serve riders as efficiently, requiring more transfers and supporting bus service.

Corridor 8 follows the previously approved BRT corridor and would serve the Town Center and Palladium areas and allow for an efficient transit network in Kanata. Bus transfer stations can be developed. The alignment has been protected through development areas west of Terry Fox, and has little impact on the natural or social environment. The relatively short route would be straightforward to build with low capital and operating costs.

Corridor 8A follows the previously approved BRT corridor and would serve the Town Centre and Palladium area with an extension to Hazeldean that increases connections to provide an efficient transit network in Kanata. Bus transfer stations can be developed at key locations. The alignment has been protected through development areas west of Terry Fox to Hazeldean Road, and has little impact on the natural or social environment. Extending the route would increase capital and operating costs but still be straightforward to build

Corridor 13 would parallel the former rail corridor that contains the Trans-Canada Trail. It would have a significant impact on the Greenbelt. Town Centre and North Kanata are not well served, and bus service is required to remain along Highway 417. Accommodating bus transfer facilities would be challenging. There is some potential to shape the development in Southwest Kanata, although most of the plans are already approved. Capital and operating costs are modest, with a moderate level of complexity.

Corridor 13A would parallel the former rail corridor that contains the Trans-Canada Trail, with a terminus at Robert Grant/Abbott. It would still have a significant impact on the Greenbelt. Kanata Town Centre and North Kanata are not well served, and bus service is required to remain along Highway 417. There is some potential to shape the development in Southwest Kanata, although most of the plans are already approved. Capital and operating costs for LRT are modest, with a moderate level of complexity but the requirement for parallel bus service will increase overall transit capital and operating costs for only a modest increase in ridership.

Results indicate that ridership is not a critical a differentiator as originally assumed, and there are relatively minor differences in ridership between the options. All scenarios provide for increased transit ridership versus the TMP base scenario (2031 Affordable Network).

As part of the additional corridor evaluation, a workshop was held with City Planning staff on June 15, 2017. This workshop reviewed the LRT technology and station typologies (elevated, at-grade, underground) being considered to provide an understanding of LRT station access and configuration impact on surrounding communities and development integration potential.

Following on from the workshop, city planning staff provided input as to major development potential along each of the three short-listed corridors. This potential is in addition to current OP land use projections and is focused on major vacant/underutilized sites within walking distance of proposed station locations.

Further analysis indicates that **Corridor 8A** is preferred for the following reasons:

- Provides rapid transit spine equally supporting all of Kanata;
- Supports approved transit corridors and development patterns;
- No significant environmental or social impacts; and,
- Extension to Hazeldean further increases ridership, improves network connectivity and provides additional transit-oriented development opportunities.

6. ALTERNATIVE DESIGN EVALUATION

6.1. MARCH ROAD STATION ALTERNATIVES

This area encompasses the LRT alignment through the March/Eagleson interchange with Highway 417, and the proposed March Station (Figure 1). The previous BRT EA study assessed a wide range of alternative alignments and station locations for BRT, with provision for conversion to LRT technology considered as one of the evaluation criteria. The Kanata LRT has therefore used this approved alignment as its starting point. However, with the change in technology from BRT to LRT, there are additional design considerations which need to be included, primarily the need for a bus terminal area to accommodate people transferring between bus and rail modes at the station. The alternative designs developed for March Station relate to the location and configuration of this facility and impacts it will have on adjacent land uses and connectivity.

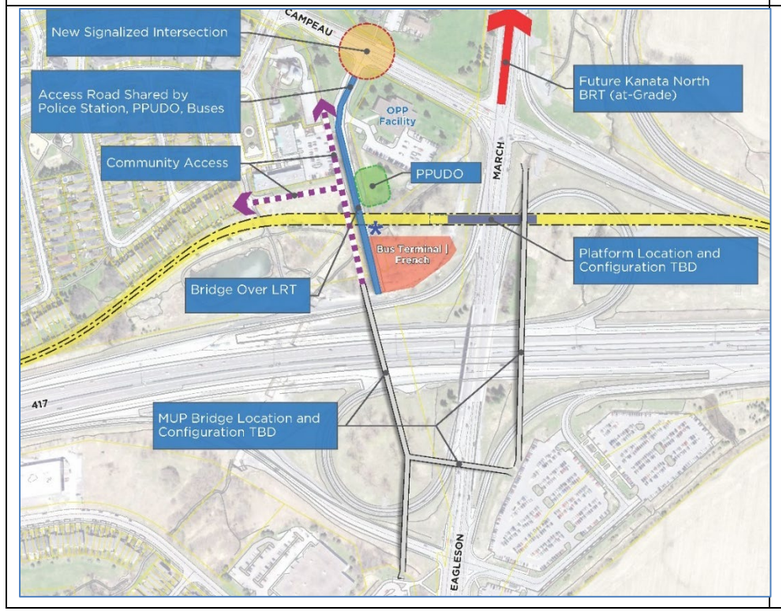
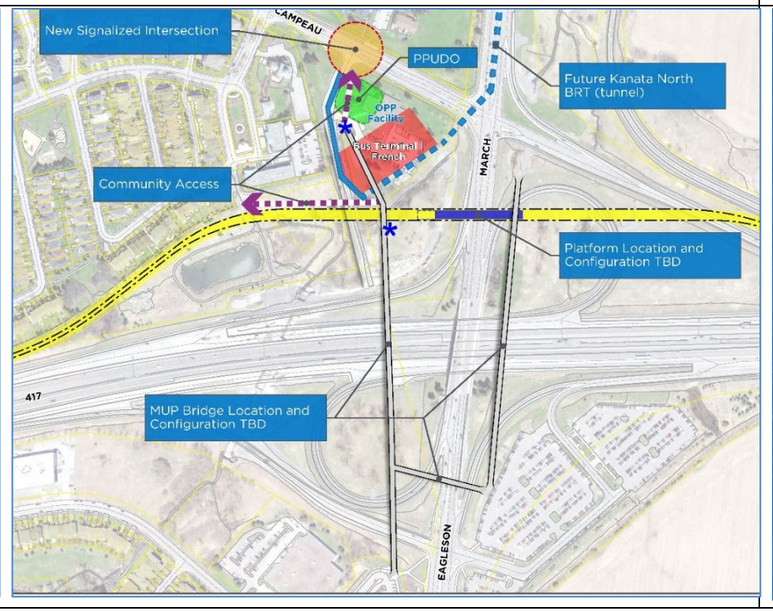
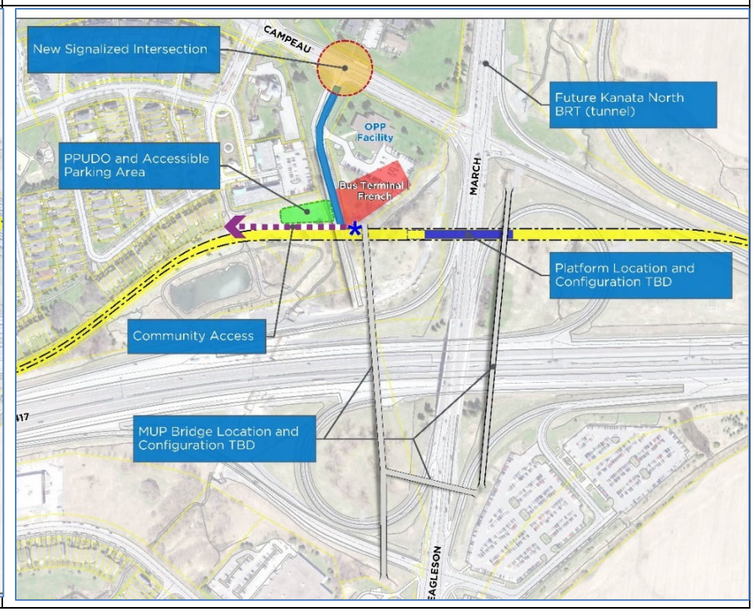
The original alignment is identified on Figure 6-1. Several options were developed based on the previously identified considerations and constraints and the following assumptions:

- In the short-term buses to/from the east will continue to use the shoulder lanes on Highway 417.
- The first construction will likely be the Transitway through the study area from Eagleson/March and westward to Terry Fox. This Transitway will carry the largest ridership volumes and will be the primary corridor in the area. The 2008 TMP does not provide any timeline for construction of the transitway between Moodie Drive and March/Eagleson interchange.
- The construction of the segregated facility on March Road will follow in the middle term, providing a higher level of service to the north, albeit at lower volumes of vehicles and passengers.
- Service to the areas south of Highway 417 and some local service to the north of the highway will also use Eagleson Station, but the passenger and vehicle volumes will be lower than the March Road volumes.
- Park and Ride facilities are currently located on the southeast and southwest quadrants of the interchange, with the southeast being the larger site. The southeast lot is partially on MTO lands and adjacent to the NCC Greenbelt, making any future development extremely unlikely.
- Options to alter or consolidate the park and ride facilities are dependent on the location of the Transitway station and local bus connections.

Figure 6-1: Previously Approved Alignment

Three alternative design concepts have been developed for this area (Table 6-1).

Table 6-1: March Road Station Alternatives

1. Bus terminal south of Watt's Creek	2. Bus terminal on OPP facility lands	3. Bus terminal north of LRT
		

6.1.1. EVALUATION OF MARCH ROAD STATION ALTERNATIVES

An evaluation of the Station options was undertaken based on professional judgement and a comparison of the three alternatives, as each design is very localized. Major constraints and opportunities are summarized below, and informed the selection of the preliminary preferred design.

1. Bus terminal south of Watt's Creek

In this alternative (Figure 2), the OPP Facility Access Road would be extended over the proposed LRT alignment and Watt's Creek on a new bridge structure, with a bus terminal located on MTO land between the creek, March Road and the westbound Highway 417 on-ramp. Buses, including local services and buses on the Kanata North BRT facility would access March Station at-grade via the Campeau/OPP Facility Access Road intersection, which would be signalized.

A redesign of the approved Kanata North BRT facility between March Station and Corkstown Road will need to be developed as the previous design had envisaged a grade-separated (tunnel) connection between March Road and the future East-West Transitway. This alternative is not compatible with that design given the need for the access roadway to the bus terminal to cross over the LRT alignment with sufficient clearance. The BRT segment between March Station and Corkstown Road is currently outside of the City's 2031 Affordable Rapid Transit Network, with initial implementation in this segment assumed as buses operating in mixed traffic, with access to the proposed East-West Transitway between March Station and Terry Fox via OPP Facility Access Road. It is assumed that this segment of East-West Kanata Town Centre BRT will be deferred in favour of building the Kanata LRT.

The major constraints for this option are summarized below:

- Bus and PPUDO access via OPP Facility Access Road may impact OPP response time
- New traffic signal at Campeau/Station Access will impact traffic operations at adjacent intersections.
- Kanata North BRT connection required to be at-grade versus planned grade-separation thru Campeau/March intersection.
- New single span bridge required over LRT alignment and Watt's Creek to access bus terminal.
- LRT alignment cuts off access to SWM facility north of Highway 417
- Requires some land from OPP facility for PPUDO
- Impact to OPP facility operations
- Medium cost due to new roadway overpass

2. Bus Terminal on OPP Facility Lands

In this alternative (Figure 3), the existing OPP facility would be relocated elsewhere and the land repurposed for the bus terminal.

Local buses would access the bus terminal via the Campeau/OPP Facility Access Road intersection, while the Kanata North BRT buses will access it via the grade-separated (tunnel) connection from March Road (previously designed and approved as part of the Kanata North BRT EA). The bus terminal would be located at an intermediate level below existing grade to reduce the grade required for the BRT connection access.

Potential exists with this design concept for the construction of an integrated transit-oriented development on top of the bus terminal, or provision of a park and ride structure to supplement or replace existing park and ride lots located on the south side of Highway 417.

The major constraints for this option are summarized below:

- Local bus and PPUDO access from Campeau may require signalization of the OPP Access Road /Campeau intersection.
- Bus terminal design will be constrained due to grade differences, location of creek
- LRT alignment cuts off access to SWM facility north of Highway 417
- Requires relocation of OPP facility entirely.
- Highest cost due to property acquisition and relocation of OPP facility, construction of below-grade bus terminal facility

3. Bus Terminal north of LRT

In this alternative (Figure 4), the bus terminal would be located primarily on lands occupied by the existing OPP facility parking lot, with displaced parking relocated elsewhere on the OPP site. Buses, including local services and buses on the Kanata North BRT facility would access March Station at-grade via OPP Facility Access Road, with a new signalized intersection provided between the existing Teron/Campeau and March/Campeau intersections.

A redesign of the approved Kanata North BRT facility between March Station and Corkstown Road will need to be developed as the previous design had envisaged a grade-separated (tunnel) connection between March Road and the future East-West Transitway. This alternative is not compatible with this design given the need for the access roadway to the bus terminal to cross over the LRT alignment with sufficient clearance. The BRT segment between March Station and Corkstown Road is currently outside of the City's 2031 Affordable Rapid Transit Network, with initial implementation in this segment assumed as buses operating in mixed traffic, with access to the proposed East-West Transitway between March Station and Terry Fox to be via OPP Facility Access Road. It is assumed that this segment of East-West Kanata Town Centre BRT will be deferred in favour of building the Kanata LRT.

The major constraints for this option are summarized below:

- Bus and PPUDO access via OPP Facility Access Road may impact OPP response time
- New traffic signal at Campeau/Station Access will impact traffic operations at adjacent intersections.
- Kanata North BRT connection required to be at-grade versus planned grade-separation thru Campeau/March intersection.

- Bus terminal may not be sufficiently sized to accommodate all requirements
- Requires relocation/reorganization of OPP parking area.
- Bus terminal is immediately adjacent to OPP facility
- Lowest cost

6.1.1.1. Recommendation

The preferred alternative is Alignment Option 1 as it:

- Minimizes impact on the OPP facility, Watt's Creek and adjacent lands
- Provides for a bus terminal immediately adjacent to the station
- Supports good station connectivity and access
- Cost effective

Additional work will be undertaken as part of station planning to consider:

- Station connectivity
- The location and design of a new pedestrian/cycling bridge over Highway 417 to the existing Park and Ride

6.2. TERRY FOX TO PALLADIUM ALTERNATIVES

The 2012 BRT EA defined an alignment for a rapid transit facility which extended west from Terry Fox Station into a short tunnel/grade separation which runs to the north of the Highway 417 westbound off-ramp at Terry Fox Drive, and then under Terry Fox Drive itself before emerging on the west side and returning to grade at the west leg of Didsbury Road. To reduce the amount of tunnel structure needed, it was proposed to end the west leg of Didsbury Road in a cul-de-sac north of the rapid transit corridor, and extend the west leg of Didsbury Road to serve the existing MTO works yard located along the north side of Highway 417 between the two (separate) legs of Didsbury Road. An at-grade crossing of the BRT alignment was proposed at the west leg of Didsbury Road.

After crossing the Carp River, the BRT alignment returned to grade, with another at-grade roadway crossing proposed where the future Riverchase roadway runs south from Campeau Drive to provide access to lands owned by Minto, and further south, Broccolini. West of Campeau Station the BRT alignment ran at grade for approximately 300 m through Minto's lands before rising up on an elevated structure and curving south to cross over Feedmill Creek, the Broccolini site and Highway 417 before entering into an elevated Palladium Station, located west of the Canadian Tire Centre, south of Cyclone Taylor Boulevard. This station location and design permitted a direct overhead pedestrian link to the west side of the arena.

The City of Ottawa has already acquired some of the right-of-way required for this segment of rapid transit corridor, generally the segment between Didsbury Road and the Carp River, and at the western end of the Minto site, from the future extension of Country Glen Way to Feedmill Creek.

With conversion to LRT technology, at-grade crossings identified near the proposed Didsbury and Campeau Stations need to be eliminated. It has been assumed that the LRT alignment will be largely elevated in all alternatives, except where noted, to preserve development access and allow for crossings of Feedmill Creek, Carp River and Highway 417.

South of Palladium Station, there are ongoing discussions between the City and developers/land owners in the area to refine the previous alignment for the North-South Arterial Roadway primarily to reduce the impact

on developable lands. The Kanata LRT corridor will run within this transportation corridor from a point south of Palladium Drive to Hazeldean Road. Each of the alignment alternatives ties into a new transition point located immediately south of Palladium Drive, on the east edge of lands owned by Urbandale Corporation. From here the LRT alignment would parallel the realigned North-South Arterial Roadway along its east side to Hazeldean Road.

Six (6) alternative alignments have been developed, starting from Didsbury Road and ending at Palladium Drive. Based on discussions with affected stakeholders (landowners/developers) in this section of the project, concerns with the approved BRT EA alignment regarding the impact to developable lands and need to grade separate were identified. Six alignment alternatives have been developed for this portion of the project:

1. Adjacent to Campeau
2. BRT EA modified
3. South of Feedmill Creek, East of Canadian Tire Centre
4. South of Feedmill Creek, West of Canadian Tire Centre
5. Parallel to Highway 417, West of Canadian Tire Centre
6. Parallel to Highway 417, East of Canadian Tire Centre

In 5 of the 6 options, the LRT alignment would be elevated above the surrounding lands west of the Carp River to maintain access, provide optimal LRT geometry and minimize impact to potential developable land. One option (Alignment 5), would permit a longer at-grade running way to be provided as it located on the southern edge of development lands west of the Carp River.

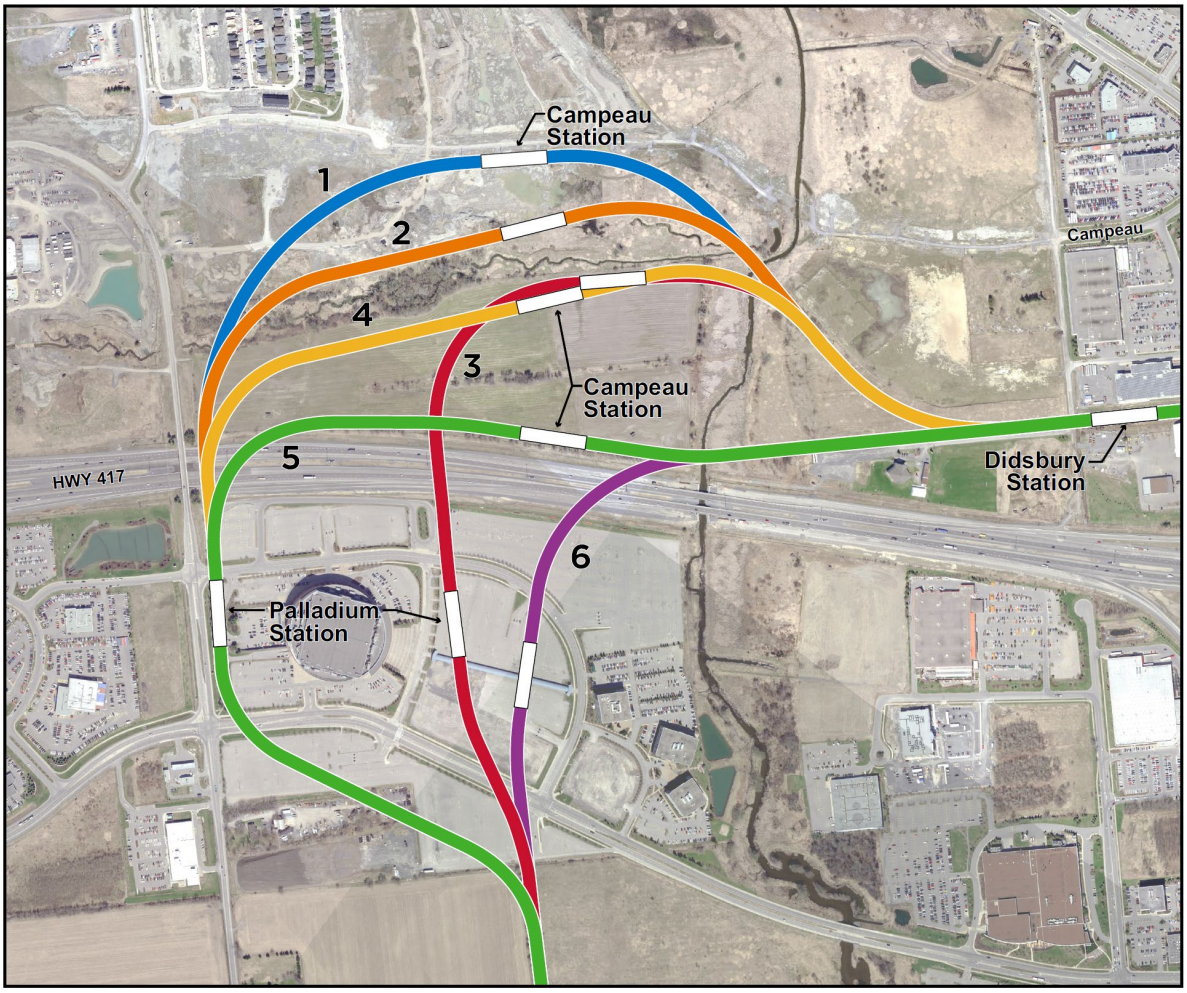


Figure 6-2: Alternative Designs Between Terry Fox Drive and Palladium Station

1. *Adjacent to Campeau*

This alternative would use the BRT EA alignment to cross over the Carp River. West of the Carp River the rapid transit alignment would be shifted closer to Campeau Drive, with a proposed station located immediately adjacent to the Campeau Drive right-of-way, west of Riverchase Drive. West of Campeau Station, the LRT alignment would curve south, and rejoin the BRT EA alignment to continue south over Highway 417 to Palladium Station. The alignment would be elevated on piers from the Carp River to Palladium Station to minimize development impacts and allow for the two proposed access roads into the Minto and Broccolini lands to pass under the proposed guideway. Campeau Station would be elevated, with an entrance at the southwest corner of the Campeau/Riverchase intersection. Transfers to/from local buses would be provided on-street along Campeau Drive, and a small Passenger pick-up and drop -off (PPUDO) facility provided adjacent to the station as part of the development.

2. *BRT EA Modified*

This alternative would closely follow the approved BRT EA alignment, however it would be shifted further south (adjacent to Feedmill Creek) to increase separation from Campeau Drive and provide increased development frontage along this roadway. The alignment would be elevated on piers from the Carp River to Palladium Station to minimize development impacts and allow for the two proposed access roads into the Minto and Broccolini lands to pass under the proposed guideway. An elevated LRT station would be provided where Riverchase Drive passes under the future LRT alignment. Connections to any local bus routes serving development lands south of Campeau Drive would likely be made on-street, with a small PPUDO facility provided to serve the station.

3. *South of Feedmill Creek, East of Canadian Tire Centre*

This alternative would deviate from the BRT EA alignment just east of the Carp River and run along the south side of Feedmill Creek, with a station located near Riverchase Drive. Immediately west of this station the alignment would curve south and cross over Highway 417 and enter Palladium Station, located on the east side of the CTC, adjacent to Frank Finnigan Way. The alignment would be elevated on piers from the Carp River to south of Palladium Drive, where it would join with the realigned North-South Arterial Roadway corridor. An LRT station would be provided where Riverchase Drive passes under the future LRT alignment. Connections to any local bus routes serving development lands south of Campeau Drive would likely be made on-street, with a small PPUDO facility provided to serve the station.

4. *South of Feedmill Creek, West of Canadian Tire Centre*

This alternative would deviate from the BRT EA alignment just east of the Carp River and run along the south side of Feedmill Creek, with a station located near Riverchase Drive, which will extend south from Campeau Drive to provide access to develop lands located between Carp River and Huntmar Drive. West of this station, the alignment would continue along the south side of Feedmill Creek before turning south to cross over Highway 417 and enter Palladium Station located on the west side of the CTC, south of Cyclone Taylor Boulevard, on the previously approved BRT EA alignment. The alignment would remain elevated from the Carp River to Palladium Station to minimize development impacts and allow for new roadway or pathway connections to pass beneath the LRT alignment to maintain access.

5. *Parallel to Highway 417, West of CTC*

This alternative would continue straight west from Didsbury Road, immediately north of Roger Neilson Way and cross over the Carp River south of the Stormwater management facility and north of Highway 417. West of the Carp River the LRT alignment would continue to run parallel to the north side of Highway 417, with a new station located to serve future development between the Carp River and Huntmar Drive. West of this station, the LRT alignment would curve to the south, crossing over Highway 417 on a curved structure and entering Palladium Station located on the west side of the CTC, south of Cyclone Taylor Boulevard, on the BRT EA alignment previously approved.

6. *Parallel to Highway 417, East of CTC*

This alternative would continue straight west from Didsbury Road, immediately north of Roger Neilson Way and cross over the Carp River south of the stormwater management facility on the east bank of the river. Once over the Carp River, the LRT alignment would curve to the south and cross over Highway 417 on a curved structure, before entering Palladium Station, located on the east side of the CTC, south of Cyclone Taylor Boulevard. No station would be provided in the quadrant north of Highway 417 between the Carp River and Huntmar Drive, and impact to development lands

would be limited to a small area on the west side of the Carp River. The alignment would be elevated from west of Didsbury Station to south of Palladium Drive. Access to development land and the stormwater facility at the west end of Roger Neilson Way may be impacted, with re-purposing of the original rapid transit corridor between Didsbury Road and the Carp River an option.

6.2.1. EVALUATION OF TERRY FOX TO PALLADIUM ALTERNATIVES

The evaluation criteria developed as part of the previous Kanata West and Kanata North BRT EA studies were adopted to assess the design alternatives for the Kanata LRT. Some criteria were modified to reflect differences between LRT and BRT technology requirements. In selecting an appropriate evaluation method for the study, consideration was given to a method, which would reflect:

- Sound planning principles;
- Project complexity;
- Varied community interests; and
- A traceable and defensible process.

Criteria were identified along with the indicator(s) used to qualify/quantify it. The criteria were developed from all key components of the existing environment. A comparative evaluation methodology was followed, with each alternative ranked from least preferred to most preferred among the six alternatives using the indicators identified. This method allows for the consideration of trade-offs in comparing one alternative against another.

The criteria were developed based on the impact to the existing natural and social environment that allowed the advantages and disadvantages to be determined. Evaluation criteria were chosen based on their ability to determine quantifiable and qualitative indicators important to compare alternatives.

The criteria along with their indicators were reviewed with the project consultation groups and presented to the public to ensure that they were appropriate and reflect the effects of the alternatives in relation to the study area. The evaluation criteria and indicators are presented in

Table 6-2: Evaluation Criteria for Alternative Designs between Terry Fox Drive and Palladium Station

Criteria Category	Criteria	Indicators
Transportation system Compatibility	Compatibility with Existing and Future Road System	• Compatibility with existing and proposed road system
	Compatibility with Existing and Future Transit Operations	• Ease of connections to existing and future local and rapid transit routes
		• Ability to provide required footprint for bus-rail transfer facilities, including access, bus platform and lay-up space.
	Multi-modal Integration	• Effectiveness of integration with other modes of travel, including walking, cycling, local transit, PPUDO and Park and Ride facilities

Criteria Category	Criteria	Indicators
		• Compatibility with existing and future bicycle/pedestrian networks
Ridership Potential	Maximize Ridership Potential	• Minimize travel time
		• Ability to influence TOD potential
		• Maximize catchment potential
Compatibility with Existing/ Planned Communities	Compatibility with Existing/ Planned Communities	• Displacement of, or loss of access to, existing land uses
		• compatibility with existing use of land
	Urban Design Potential	• Ability to incorporate streetscaping improvements, public art
		• Ability to create/support vibrant public spaces
		• Compatibility with existing visual environment
Social Environment	Effects on Built Heritage Features and Archaeology	• Impact on identified and/or potential archaeological resources (i.e., area of land/feature which will be affected)
		• Impact on identified heritage features including buildings and landscapes
	Effects on Noise Levels	• Qualitative measure of future noise impacts at sensitive receptors
	Effects on Air Quality Levels	• Qualitative measure of future air quality impacts at sensitive receptors
	Effects on Vibration Levels	• Qualitative measure of future vibration impacts at sensitive receptors
Natural Environment	Effects on natural heritage features	• Loss/impact on significant species (flora/fauna)
		• Potential impact on non-designated / un-evaluated natural areas (e.g. woodlots, fields, wetlands and habitats)
		• Potential impact on significant natural features (e.g. PSW, SWH, ANSI, UNAs)
Utility Impact	Effects on Municipal Services and Utilities	• Effects on infrastructure and utilities including new water crossings
		• Effects on existing and new crossings

Criteria Category	Criteria	Indicators
		• Effects on stormwater quality and quantity
Cost	Capital cost	• Estimated construction costs (including excavation/filling, lighting, signals, landscaping, associated infrastructure, construction complexity)
		• Potential throw away costs
	Land Acquisition cost and value	• Estimated value of all required land

The evaluation methodology used a combination of quantitative, qualitative and comparative assessment to evaluate each criteria area. For the purposes of consistency, the following definitions were utilized by the Study Team Table 6-3).

Table 6-3: Evaluation Terminology

Definition of Impacts	Terms describing:	
	Negative Impacts	Positive Impacts (i.e., Benefits)
The impact exists, but is of a magnitude small enough that it has little effect, or is of limited benefit; or has the least impact compared to all the alternatives. Best compliance, contribution or benefit.	Negligible	Greatest
The impact exists and is of relatively small physical magnitude or duration. Provides a moderate effect or contribution or benefit.	Minor	Good
The impact exists and has an effect that is relatively large, permanent or has the most impact when compared to other alternatives. Little to no contribution or benefit	Major	Limited

Each Analysis Criteria was summarized and assigned a preference depicted graphically

■ Least Preferred: Limited positive effect; Major impact; or Highest cost.

▲ Good positive effect; Minor impact; or Moderate cost.

● Most Preferred: Greatest positive effect; Negligible impact; or Lowest cost

Table 6-4 contains the evaluation inputs for each alternative, summarized in text form against each criteria and indicator.

Table 6-4: Terry Fox to Palladium Alternative Evaluation Results

Criteria Category	Criteria	Indicators	Adjacent to Campeau	BRT EA Modified	South of Feedmill, East of CTC	South of Feedmill, West of CTC	Parallel to Highway 417, West of CTC	Parallel to Highway 417, East of CTC
Transportation system Compatibility	Compatibility with Existing and Future Road System	• Compatibility with existing and proposed road system	• LRT assumed to be grade separated at all roadway crossings	• LRT assumed to be grade separated at all roadway crossings	• LRT assumed to be grade separated at all roadway crossings	• LRT assumed to be grade separated at all roadway crossings • Alignment requires adjustment of internal road system on Broccolini lands at Country Glen Way/E-W access from Huntmar.	• Conflict with Roger Neilson Way and Carp River SWM access • Campeau/Riverchase Station location adjacent to Highway 417; far from arterial road network; has some potential to tie-in with the internal road circulation system.	• Conflict with Roger Neilson Way and Carp River SWM access
	Compatibility with Existing and Future Transit Operations	• Ease of connections to existing and future local and rapid transit routes	• On-street connections to routes on Campeau at Riverchase/Campeau Station are convenient • West of CTC station provides good connections to local routes on Huntmar, Palladium	• On-street connections to routes on Campeau at Riverchase/ Campeau Station require short walk • West of CTC station provides good connections to local routes on Huntmar, Palladium	• On-street connections to routes on Campeau at Riverchase/ Campeau Station require walk • East of CTC station not as well located for long-term connections to local routes on Huntmar, Palladium	• On-street connections to routes on Campeau at Riverchase/Campeau Station require walk • West of CTC station provides good connections to local routes on Huntmar, Palladium	• No connections to routes on Campeau for local access north of Highway 417 • West of CTC station provides good connections to local routes on Huntmar, Palladium	• No connections to bus routes on Campeau for local access north of Highway 417 • East of CTC station not as well located for long-term connections to local routes on Huntmar, Palladium
		• Ability to provide required footprint for bus-rail transfer facilities, including access, bus platform and lay-up space.	• Riverchase/Campeau Station N/A • West of CTC Station location has better opportunity and access for bus terminal.	• Riverchase/Campeau Station N/A • West of CTC Station location has better opportunity and access for bus terminal.	• Riverchase/Campeau Station N/A • East of CTC station location not as suited to support bus terminal.	• Riverchase/Campeau Station N/A • West of CTC Station location has better opportunity and access for bus terminal.	• Riverchase/Campeau Station N/A • West of CTC Station location has better opportunity and access for bus terminal.	• East of CTC Station location not as suited to support bus terminal.
	Multi-modal Integration	• Effectiveness of integration with other modes of travel, including walking, cycling, local transit, PPUDO and Park and Ride facilities	• Campeau/Riverchase station has direct arterial road frontage, offers good opportunity to provide an integrated service with local transit running along Campeau Drive and existing/proposed cycling facilities. • Station on west side of CTC offers a good opportunity to provide an integrated service with local transit running along Huntmar Road and existing/proposed pedestrian/cycling facilities.	• Campeau/Riverchase station located in proximity to arterial road, offers good opportunity to provide with existing/proposed cycling facilities; integration with local transit is reduced. • Station on west side of CTC offers a good opportunity to provide an integrated service with local transit running along Huntmar Road and existing/proposed pedestrian/cycling facilities.	• Campeau/Riverchase station located south of Feedmill Creek, reducing potential for integration with surrounding road/pathway network. • Station on east side of CTC more challenging to integrate with local transit routes and existing/proposed cycling facilities.	• Campeau/Riverchase station located south of Feedmill Creek, reducing potential for integration with surrounding road/pathway network. • Station on west side of CTC offers a good opportunity to provide an integrated service with local transit running along Huntmar Road and existing/proposed pedestrian/cycling facilities.	• Campeau/Riverchase station located on south edge of development lands further from road network and pathways, decreasing integration opportunities. • Station on west side of CTC offers a good opportunity to provide an integrated service with local transit running along Huntmar Road and existing/proposed pedestrian/cycling facilities.	• No station north of Highway 417, much reduced opportunities for multi-modal integration. • Station on east side of CTC more challenging to integrate with local transit routes and existing/proposed cycling facilities.
		• Compatibility with existing and future bicycle/pedestrian networks	• Compatible with existing/proposed facilities	• Compatible with existing/proposed facilities. • Allows for integration with pathway along north side of Feedmill Creek	• Compatible with existing/proposed facilities	• Compatible with existing/proposed facilities	• Conflicts with pathway leading from Roger Neilson to Carp River	• Conflicts with pathway leading from Roger Neilson to Carp River

Criteria Category	Criteria	Indicators	Adjacent to Campeau	BRT EA Modified	South of Feedmill, East of CTC	South of Feedmill, West of CTC	Parallel to Highway 417, West of CTC	Parallel to Highway 417, East of CTC
	Total Criteria Category Score		●	●	▲	▲	▲	■
Ridership Potential	Maximize Ridership Potential	• LRT Geometry	• Provides for good alignment geometry, with larger radius horizontal curves	• Provides for good alignment geometry, with larger radius horizontal curves	• Provides for good alignment geometry, with larger radius horizontal curves	• Tighter curve radius required at Highway 417 crossing	• Tighter curve radius required at Highway 417 crossing	• Provides for good alignment geometry, with larger radius horizontal curves
		• Ability to influence TOD potential	• Excellent potential at Palladium, potential at Campeau/Riverchase is longer term	• Excellent potential at Palladium, potential at Campeau/Riverchase is longer term.	• Good potential at both station locations.	• Good potential at Riverchase/Campeau, excellent potential at Palladium	• Excellent potential at both station locations.	• No potential north of Highway 417, good potential at Palladium.
		• Maximize catchment potential	• Excellent potential for both residential and employment/commercial access.	• Excellent potential for both residential and employment/commercial access.	• Further from residents north of Campeau; Station east of CTC reduces potential.	• Good potential but further from residential north of Campeau.	• Less potential at Campeau/ Riverchase Station due to Highway on south side.	• Least due to one less station and location of Palladium Station east of CTC.
	Total Criteria Category Score		●	●	▲	▲	▲	■
Compatibility with Existing/ Planned Communities	Compatibility with Existing/ Planned Communities	• Displacement of, or loss of access to, existing and planned land uses	• Majority of land north of Highway 417 currently not developed • Formal planning application submitted by developer for lands north of Feedmill Creek, East of Huntmar • Located closest to existing residents north of Campeau. • Access to Campeau Drive from southern development lands requires additional underpass of LRT nearer to Huntmar. • Preliminary planning completed for lands south of Feedmill Creek with no formal applications submitted • Requires some site modifications (formal connection), but can provide high level of service directly to Canadian Tire Centre	• Majority of land north of Highway 417 currently not developed • Formal planning application submitted by developer for lands north of Feedmill Creek, East of Huntmar • Located closer to existing residents north of Campeau • Preliminary planning completed for lands south of Feedmill Creek with no formal applications submitted • Requires some site modifications formal connection, but can provide high level of service directly to Canadian Tire Centre	• Majority of land north of Highway 417 currently not developed • Preliminary planning completed for lands south of Feedmill Creek, no formal applications • Bisects development lands south of Feedmill Creek and located away from existing residents north of Campeau • Requires some site modifications and would displace existing pedestrian connection to Canadian Tire Centre, but can provide a high level of service to Canadian Tire Centre • Requires reorganization of existing lots associated with Canadian Tire Centre for development	• Majority of land north of Highway 417 currently not developed • Preliminary planning completed for lands south of Feedmill Creek with no formal applications submitted • Creates awkward development parcel south of Feedmill Creek and narrows remaining lands and located away from existing residents north of Campeau • Access to lands south of Feedmill Creek will require an underpass of the LRT Line • Requires some site modifications (formal connection), but can provide high level of service directly to Canadian Tire Centre •	• Bundled with Highway 417 • Majority of land north of Highway 417 currently not developed • Minimizes fragmentation of vacant development lands ad located away from existing residents north of Campeau. • Requires some site modifications (formal connection), but can provide high level of service directly to Canadian Tire Centre	• No significant land uses north of Highway 417 along this alignment • Minimizes fragmentation of vacant development lands however located away from existing residents north of Campeau • Requires modification to existing pedestrian connection to Canadian Tire Centre • Requires reorganization of existing lots associated with Canadian Tire Centre for development
		• Compatibility with existing use of land	• Bundled with existing transportation corridor along Campeau and Huntmar • Elevated guideway require developer to adjust development plans of planned development to take place • Limits frontage opportunities along Campeau Drive • Allows for the two proposed access roads into the adjacent development lands to pass under the proposed guideway. An additional access from Huntmar may need to be adjusted as	• Not bundled with existing transportation corridor north of highway 417 • Creates a shallower development parcel north or Feedmill Creek. • Elevated guideway require developer to adjust development plans of planned development to take place • Provides increased frontage opportunities along Campeau Drive • Allows for the two proposed access roads into the adjacent	• Not bundled with existing transportation corridors north of 417 • Elevated guideway would bisect development lands to the north of Highway 417 • Does not impact planned development north of Feedmill Creek, but provides a lower level of service to planned community, • Guideway would bisect the palladium area, posing challenge to potential future development	• Not bundled with existing transportation corridor • Elevated guideway could be integrated into future development plans for lands north of Highway 417 • Does not impact planned development north of Feedmill Creek, but provides a lower level of service to planned community • Balances the service to the OP designated Mixed-Use Centre south of Highway 417	• Bundled with existing transportation corridor along Highway 417 and Huntmar • Access can be provided from Huntmar without a crossing of the LRT line or Feedmill Creek • Located on the edge of planned development north of Highway 417 • Balances the service to the OP designated Mixed-Use Centre south of Highway 417	• Not bundled with existing transportation corridors • Located away from planned development north of 417 however includes underutilized lands (i.e. parking areas at the Canadian Tire Centre) • Minimizes loss of and fragmentation of vacant development lands north of 417 and south of Feedmill Creek • Guideway would bisect the palladium area development and

Criteria Category	Criteria	Indicators	Adjacent to Campeau	BRT EA Modified	South of Feedmill, East of CTC	South of Feedmill, West of CTC	Parallel to Highway 417, West of CTC	Parallel to Highway 417, East of CTC
			it will require an underpass of the guideway. • Balances the service to the OP designated Mixed-Use Centre south of Highway 417 • Located within planned development areas and nearer to residents north of 417 and includes underutilized lands (i.e. parking areas at Canadian Tire Centre)	development lands to pass under the proposed guideway • Balances the service to the OP designated Mixed-Use Centre south of Highway 417 • Located within planned and development areas, and nearer to residents north of 417 and includes underutilized lands (i.e. parking areas at Canadian Tire Centre)	• Does not balance the service to the OP designated Mixed-Use Centre south of Highway 417 • Located within planned development areas, however away from residents north of 417 and includes underutilized lands (i.e. parking areas at the Canadian Tire Centre)	• Located within planned development areas, however away from residents north of 417 and includes underutilized lands (i.e. parking areas at the Canadian Tire Centre)		will require reorganization of lands at the Canadian Tire Centre • Does not balance the service to the OP designated Mixed-Use Centre south of Highway 417 • Includes underutilized lands (i.e. parking areas at the Canadian Tire Centre) however closer to the eastern edge.
	Urban Design Potential	• Ability to incorporate streetscaping improvements, public art	• Station can be integrated with Campeau streetscape. Opportunity to leverage project to improve Campeau	• Reduced public aspect and potential to improve public spaces	• Minimal public aspect and potential to improve public spaces	• Reduced public aspect and potential to improve public spaces	• Reduced public aspect and potential to improve public spaces	• No station provided north of Highway 417
		• Ability to create/support vibrant public spaces	• Proximity to Campeau is positive • Highest potential to spur and support development in the area	• Some ability but station primarily fronts private lands	• Some ability but station primarily fronts private lands	• Some ability but station primarily fronts private lands	• Limited ability due to proximity to Highway	• No station provided north of Highway 417
		• Compatibility with existing visual environment	• Greater visual impact due to proximity to residential; longer elevated guideway required	• Can be designed to maximize compatibility with future visual environment	• Can be designed to maximize compatibility with future visual environment	• Can be designed to maximize compatibility with future visual environment	• Can be compatible with future visual environment; potential for at-grade corridor along Highway 417. Longer flyover of Highway bundled with Huntmar Crossing.	• Can be designed to maximize compatibility with future visual environment; Long flyover of Highway in proximity to river crossing.
	Total Criteria Category Score		▲	●	▲	▲	▲	■
Social Environment	Effects on Built Heritage Features and Archaeology	• Impact on identified and/or potential archaeological resources (i.e., area of land/feature which will be affected)	• Lands have been previously assessed and mitigated of archaeological concern. No additional assessment required	• Lands have been previously assessed and mitigated of archaeological concern. No additional assessment required	• Portions of the corridor have been previously assessed and mitigated of archaeological concern. Undisturbed lands identified as possessing archaeological potential not previously mitigated will required Stage 2 field investigations	• Portions of the corridor have been previously assessed and mitigated of archaeological concern. Undisturbed lands identified as possessing archaeological potential not previously mitigated will required Stage 2 field investigations	• Portions of the corridor have been previously assessed and mitigated of archaeological concern. Undisturbed lands identified as possessing archaeological potential not previously mitigated will required Stage 2 field investigations	• Portions of the corridor have been previously assessed and mitigated of archaeological concern. Undisturbed lands identified as possessing archaeological potential not previously mitigated will required Stage 2 field investigations
		• Impact on identified heritage features including buildings and landscapes	• No formally recognized cultural heritage resources are along this alignment. The alignment crosses a property with buildings over 40 years old, a cultural heritage evaluation report on 210 Huntmar Dr. is required.	• No formally recognized cultural heritage resources are along this alignment. The alignment crosses a property with buildings over 40 years old, a cultural heritage evaluation report on 210 Huntmar Dr. is required.	• No formally recognized cultural heritage resources are along this alignment. No further cultural heritage evaluation or assessment is required.	• No formally recognized cultural heritage resources are along this alignment. The alignment crosses a property with buildings over 40 years old, a cultural heritage evaluation report on 210 Huntmar Dr. is required.	• No formally recognized cultural heritage resources are along this alignment. The alignment crosses a property with buildings over 40 years old, a cultural heritage evaluation report on 210 Huntmar Dr. is required.	• No formally recognized cultural heritage resources are along this alignment. No further cultural heritage evaluation or assessment is required.
	Effects on Noise Levels	• Qualitative measure of future noise impacts at sensitive receptors	• Minor – Alignment closest to existing residential development north of Campeau.	• Negligible – No residential within 100 m.	• Negligible – No residential within 100 m.	• Negligible – No residential within 100 m.	• Minor – Alignment within 100 m of a place of worship, where noise maybe perceptible.	• Minor – Alignment within 100 m of a place of worship, where noise maybe perceptible.

Criteria Category	Criteria	Indicators	Adjacent to Campeau	BRT EA Modified	South of Feedmill, East of CTC	South of Feedmill, West of CTC	Parallel to Highway 417, West of CTC	Parallel to Highway 417, East of CTC
	Effects on Air Quality Levels	• Qualitative measure of future air quality impacts at sensitive receptors	• Negligible – The LRT vehicle has no direct emissions. Small potential for fugitive dust impacts during construction.	• Negligible – The LRT vehicle has no direct emissions. Small potential for fugitive dust impacts during construction.	• Negligible – The LRT vehicle has no direct emissions. Small potential for fugitive dust impacts during construction.	• Negligible – The LRT vehicle has no direct emissions. Small potential for fugitive dust impacts during construction.	• Negligible – The LRT vehicle has no direct emissions. Small potential for fugitive dust impacts during construction.	• Negligible – The LRT vehicle has no direct emissions. Small potential for fugitive dust impacts during construction
	Effects on Vibration Levels	• Qualitative measure of future vibration impacts at sensitive receptors	• Minor – Alignment within 75 m of existing residents, where minor vibrations maybe perceptible.	• Negligible – No residential within 75 m.	• Negligible – No residential within 75 m.	• Negligible – No residential within 75 m.	• Minor – Alignment within 75 m of residents, where minor vibrations maybe perceptible.	• Minor – Alignment within 75 m of residents, where minor vibrations maybe perceptible.
	Total Criteria Category Score		▲	●	●	●	▲	▲
Natural Environment	Effects on natural heritage features	• Loss/impact on significant species (flora/fauna)	• Carp River may contain habitat suitable for Species at Risk	• Carp River may contain habitat suitable for Species at Risk	• Carp River may contain habitat suitable for Species at Risk	• Carp River may contain habitat suitable for Species at Risk	• Carp River may contain habitat suitable for Species at Risk	• Carp River may contain habitat suitable for Species at Risk
		• Potential impact on non-designated / un-evaluated natural areas (e.g. woodlots, fields, wetlands and habitats)	• Cross the Carp River and Feedmill Creek (two crossings) riparian corridor. • Impact to warm water systems • Impacts due to slope crossing and slope stabilization	• Cross the Carp River and Feedmill Creek (two crossings) riparian corridor • Runs parallel in close proximity to the Feedmill Creek riparian corridor and an unevaluated wetland • Impact to warm water systems • Impacts due to slope crossing and slope stabilization	• Cross the Carp River riparian corridor • Runs parallel in close proximity to the Feedmill Creek riparian corridor • Impact to warm water systems • Impacts due to slope crossing and slope stabilization	• Cross the Carp River riparian corridor • Runs parallel in close proximity to the Feedmill Creek riparian corridor and an unevaluated wetland • Impact to warm water systems • Impacts due to slope crossing and slope stabilization	• Crosses Carp River riparian corridor • Impact to warm water systems • Impacts due to slope crossing and slope stabilization	• Crosses Carp River riparian corridor • Impact to warm water systems • Impacts due to slope crossing and slope stabilization
		• Potential impact on significant natural features (e.g. PSW, SWH, ANSI, UNAs)	• No impact to significant natural features	• No impact to significant natural features	• No impact to significant natural features	• No impact to significant natural features	• No impact to significant natural features	• No impact to significant natural features
	Total Criteria Category Score		▲	▲	▲	▲	●	●
Utility Impact	Effects on Municipal Services and Utilities	• Effects on infrastructure and utilities including new water crossings	• Negligible	• Negligible	• Negligible	• Negligible	• Negligible	• Negligible
		• Effects on existing and new crossings	• Negligible	• Negligible	• Negligible	• Negligible	• Negligible	• Negligible
		• Effects on stormwater quality and quantity	• Negligible	• Negligible	• Negligible	• Negligible	• Negligible	• Negligible
Cost	Capital cost	• Estimated construction costs (including excavation/filling, lighting, signals, landscaping, associated infrastructure, construction complexity)	• Length: 2906m • 2 Elevated Stations • Tangent crossing Highway 417	• Length: 2790m • 2 Elevated Stations • Tangent crossing Highway 417	• Length: 2121m • 2 Elevated Stations • Tangent crossing Highway 417	• Length: 2600m • 2 Elevated Stations • Skewed crossing Highway 417	• Length: 2443m • 1 Elevated, 1 At-grade Station • Skewed crossing Highway 417	• Length: 1589m • 1 Elevated Station • Skewed crossing Highway 417
		• Potential throw away costs	• none	• none	• potential for conflict with future redevelopment of CTC lands	• none	• none	• potential for conflict with future redevelopment of CTC lands

Criteria Category	Criteria	Indicators	Adjacent to Campeau	BRT EA Modified	South of Feedmill, East of CTC	South of Feedmill, West of CTC	Parallel to Highway 417, West of CTC	Parallel to Highway 417, East of CTC
	Land Acquisition cost and value	• Estimated value of all required land	• New ROW required • Majority of impacts are along edge of parcels, some vacant development lands remain. • Comparatively moderate to other options	• New ROW required • Majority of impacts are along edge of parcels, some vacant development lands remain. • Comparatively moderate to other options	• New ROW required • Majority of impacts are along edge of parcels, some vacant development lands remain. • Comparatively large to other options	• New ROW required • Impacts are located central to parcels, bisecting development lands and creating new parcels. • Comparatively moderate to other options	• New ROW required • Majority of impacts are along edge of parcels, including Highway 417. some vacant development lands remain. • Comparatively low to other options	• New ROW required • Some Impacts are located central to parcels, bisecting development lands and creating new parcels. • Comparatively large to other options
	Total Criteria Category Score		▲	▲	▲	▲	▲	●
SUMMARY SCORE			▲	●	▲	▲	▲	■

Each of the alternative alignments is technically feasible, but have different issues and opportunities associated with them. The largest issue to address is potential integration with planned development on development lands west of the Carp River, between Campeau Drive to the north, Highway 417 to south and Huntmar Drive to the west, as well as potential redevelopment of the lands associated with the Canadian Tire Centre, located south of Highway 417, east of Huntmar Drive and on either side of Palladium Drive.

The preliminary preferred alternative is Alignment Option 2 (Figure 6-3) as it:

- Makes best use of the previously approved rapid transit corridor and lands which the City has already acquired;
- Places Campeau/Riverchase Station far enough north to serve the area effectively by providing good access to existing and proposed residential and employment/commercial lands north of Highway 417;
- Provides for exceptional access and visibility of rapid transit to the surrounding community by providing a station in proximity to an arterial roadway;
- Can be integrated along south edge (i.e. backside) of planned Minto development, and;
- Provides for a tangent crossing of Highway 417, reducing construction cost and complexity.

Figure 6-3: Recommendation: Terry Fox to Palladium Alignment

6.3. LIGHT MAINTENANCE AND STORAGE FACILITY

Belfast Maintenance and Storage Facility (MSF) is being constructed as part of Confederation Line LRT. To support Stage 2 LRT City Council has also approved a Light Maintenance and Storage Facility (LMSF) site west of Moodie Drive.

The Moodie LMSF is capable of future expansion to support Kanata LRT, but extending LRT to Kanata requires analyzing additional LMSF options to determine the optimal site to serve the full network.

Typical LMSF activities include:

- Interior/exterior cleaning
- Minor repairs (seats, windows, doors)
- Daily inspection and servicing
- Operator hand-off/hand-over
- Overnight storage of trains

6.3.1. ALTERNATIVE LMSF SITES

Alternative locations for an LMSF were identified using the following site characteristics:

- **Topography and Grade:** The facility needs to be located on a level surface to maintain a constant catenary height and, as a safety precaution, to prevent vehicle movement in the event of brake failure.
- **Essentially Vacant**
- **Size:** ideally be a single area of 12 ha and not several disconnected parcels of land.
- **Natural Environment:** avoid geographical, environmental and historical importance
- **Connections:** The facility should be located within 750 m of the LRT corridor
- **Track Redundancy and Reversal:** The area provided should allow a design and layout of the MSF Trackwork that will not block or hinder the movement of Light Rail Vehicles (LRVs) in the event of an LRV failure. Single points of failure and stub ended tracks (both storage yard and shop) are to be avoided to the fullest extent possible.

Nine (9) MSF sites meeting the above-noted site characteristics were identified for evaluation:

- Moodie (Existing Stage 2 LRT Site, to be constructed as part of the City's Stage 2 LRT project)
- Minto (Site 1)
- Broccollini (Site 2)
- South of Car Park (Site 3)
- Urbandale (Site 4)
- Ottawa Works Yard (Site 5)
- Richcraft (Site 6)
- Fernbank West (Site 7)
- Fernbank East (Site 8)

Figure 6-4 shows the Moodie LMSF site as proposed to be constructed as part of the Stage 2 LRT project. Other potential locations are illustrated in Figure 6-5.

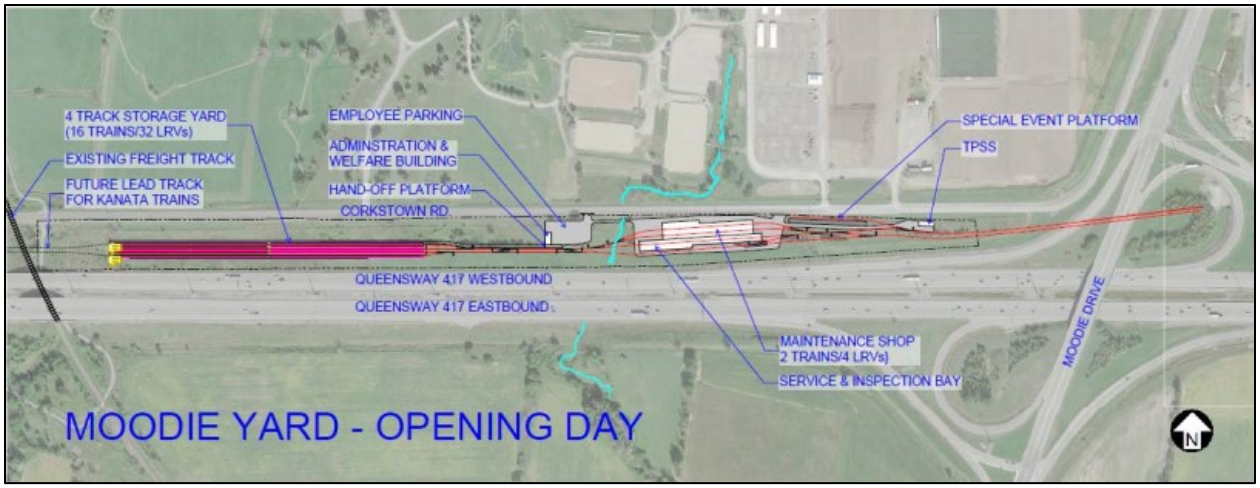


Figure 6-4: Moodie LMSF, Opening Day (2023)

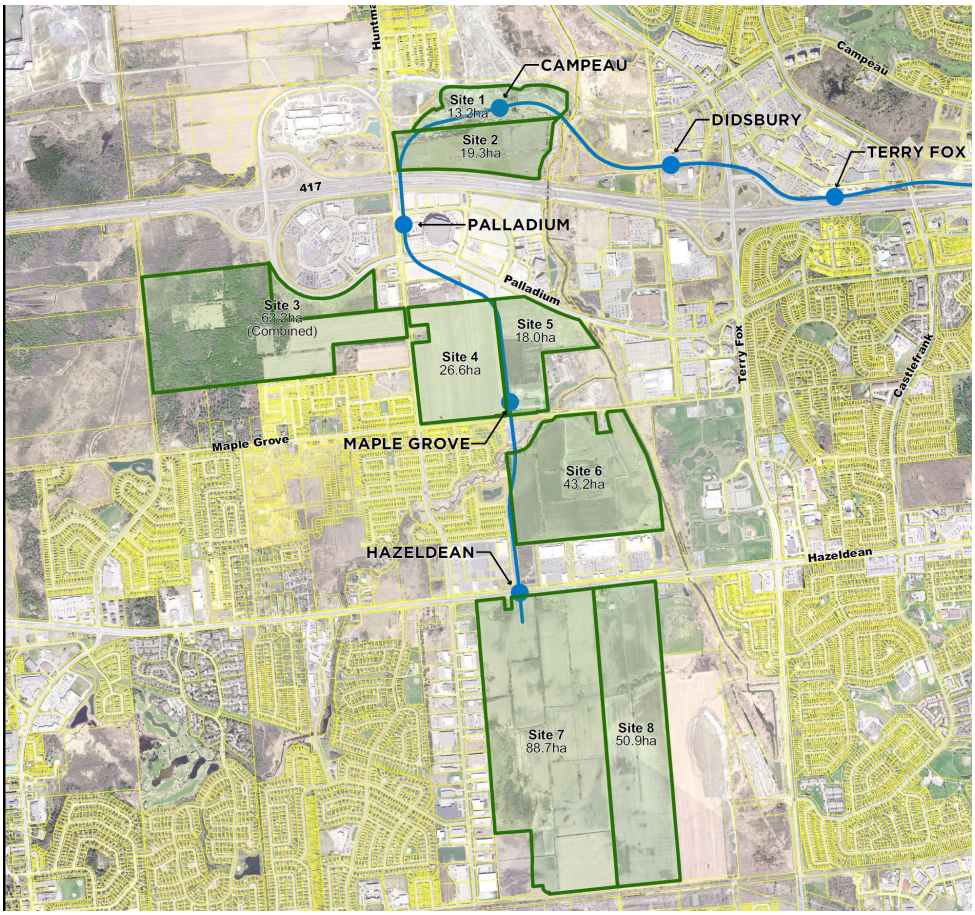


Figure 6-5: LMSFAlternative Sites

6.3.2. LMSF EVALUATION

Site evaluation criteria were developed to assess the alternative sites based on available information. The evaluation criteria were developed in consultation with the NCC and are described below based on four primary categories. They are primarily based on the same criteria applied in previous studies, including the West LRT and Stage 2 LMSF. Some of the criteria used in the previous evaluations were not used as they did not differentiate between the Kanata LRT LMSF alternatives due to different existing conditions (i.e., geological faults are not present in the study area). The criteria and indicators/measurements are contained in Table 6-5.

Table 6-5 : Site Evaluation Criteria

Criteria	Indicator/Measurement
Social Environmental Characteristics	
Effects to local residents	Minimizes effects on visual intrusion, noise air quality, vibration
Site safety	Ability to restrict/control access to the LMSF
Transportation network	Minimizes effects on existing and future transportation network.
Existing land uses	Minimizes effects on existing and planned land uses
Heritage / Culture	Minimizes effects on areas identified or having potential for archaeological or cultural significance
Bio-Physical Environmental Characteristics	
Soil types	Geotechnical characteristics to support a facility of this type
Contaminated Materials	Minimizes potential to encounter contaminated materials
Key natural features	Minimizes effects on key terrestrial/aquatic systems and features, including SAR
Greenbelt	Minimizes effects on Greenbelt (core natural areas, linkages, views and vistas, lighting)
Floodplains	Lowest proximity to floodplains and the possibility of flooding
Facility Operations	
LMSF Site Servicing	Availability and ease of providing site services (hydro, water, gas, sewer) to the LMSF site.
LRT Operations	Provides operational flexibility, minimizes deadhead time
Economics	
Property Ownership and Acquisition	Minimizes costs based on land use types and number of property owners

Each criteria was summarized and assigned a preference depicted graphically:

- Least Preferred: Limited positive effect; Major impact; or Highest cost.
- Good positive effect; Minor impact; or Moderate cost.
- Most Preferred: Greatest positive effect; Negligible impact; or Lowest cost

Table 6-6: LMSF Evaluation Summary Table

Site Number / Site	Moodie	1 Minto	2 Broccolini	3 South of car park	4 Urbandale	5 Ottawa Works yard	6 Richcraft	7 Fernbank West	8 Fernbank East
Social Environmental Characteristics									
Effects to local residents	●	■	●	●	■	■	■	■	■
	No adjacent residential development	Adjacent to residential development	No adjacent residential development	Can be buffered from residential development	Planned for residential development	Adjacent to planned residential development	Planned for residential development (site plan approval)	Planned for residential development	Planned for residential development
Site safety	●	▲	●	●	▲	●	▲	▲	▲
	Good ability to restrict/control access to the LMSF	Moderate ability to restrict/control access to the LMSF due to proximity to residential development and access	Good ability to restrict/control access to the LMSF	Good ability to restrict/control access to the LMSF	Moderate ability to restrict/control access to the LMSF due to surrounding residential development	Good ability to restrict/control access to the LMSF	Moderate ability to restrict/control access to the LMSF due to surrounding residential development	Moderate ability to restrict/control access to the LMSF due to surrounding residential development	Moderate ability to restrict/control access to the LMSF due to surrounding residential development
Transportation Network	●	▲	▲	■	▲	●	▲	●	▲
	Low impacts on existing and future transportation network	Moderate impacts on transportation network. Restricts access opportunities to adjacent lands	Moderate impacts on transportation network. Difficult site access	High impacts on transportation network. Lead tracks would need to be grade separated crossing several roads and pathways	Moderate impacts on transportation network. Tracks are elevated and access to an at grade LMSF would be difficult	Low impacts on existing and future transportation network	Moderate impacts on transportation network accessing surrounding development and crossings planned development	Low impacts on existing and future transportation network if LMSF is bundled with Robert Grant Ave.	Moderate impacts on transportation network accessing surrounding development and crossings planned development
Land uses	▲	■	●	■	■	●	■	■	■
	Requires small amount of land from NCC (currently leased to Wesley Clover Park) but would not disrupt operations	Conflicts with pending site plan submission	No current site plan applications	Conflicts with pending site plan submission	Conflicts with pending site plan submission	No current site plan applications	Conflicts with draft approved site plan submission	Conflicts with pending site plan submission	Conflicts with pending site plan submission
Heritage / Culture	●	●	■	●	●	●	●	●	▲
	Does not impact areas of archaeological potential	Does not impact areas of archaeological potential	Potential impact on areas identified as having archaeological potential	Does not impact areas of archaeological potential	Does not impact areas of archaeological potential	Does not impact areas of archaeological potential	Does not impact areas of archaeological potential	Does not impact areas of archaeological potential	Potential impact on designated heritage building
Bio-Physical Environmental Characteristics									

Site Number / Site	Moodie	1 Minto	2 Broccolini	3 South of car park	4 Urbandale	5 Ottawa Works yard	6 Richcraft	7 Fernbank West	8 Fernbank East
Soil types	●	▲	▲	▲	▲	▲	▲	●	●
	No identified soil restrictions	Deep (unstable) clay soils	Deep (unstable) clay soils	Deep (unstable) clay soils	Deep (unstable) clay soils	Deep (unstable) clay soils	Deep (unstable) clay soils	Moderate clay soils	Moderate clay soils
Contaminated Materials	●	●	●	●	●	■	●	●	●
	No areas of potential contaminated materials identified	No areas of potential contaminated materials identified	No areas of potential contaminated materials identified	No areas of potential contaminated materials identified	No areas of potential contaminated materials identified	Historical land use indicates potential for contaminated materials to be present	No areas of potential contaminated materials identified	No areas of potential contaminated materials identified	No areas of potential contaminated materials identified
Key natural features	▲	▲	●	●	●	●	●	●	●
	Proximity to Bobolink habitat	Proximity to Feedmill Creek ancestral channel	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR	Low/no impact to key terrestrial/aquatic systems, features, and individuals including SAR
NCC Greenbelt	■	●	●	●	●	●	●	●	●
	Requires NCC Greenbelt lands and interrupts views	No Greenbelt impacts	No Greenbelt impacts	No Greenbelt impacts	No Greenbelt impacts	No Greenbelt impacts	No Greenbelt impacts	No Greenbelt impacts	No Greenbelt impacts
Floodplains	●	▲	▲	●	●	●	●	●	●
	Within area of Stillwater Creek floodplain which is already developed	Within Feedmill Creek regulated floodplain	Within Feedmill Creek regulated floodplain	No floodplain restrictions	No floodplain restrictions	No floodplain restrictions	No floodplain restrictions	No floodplain restrictions	No floodplain restrictions
Facility Operations									
LMSF site Servicing	●	●	▲	●	●	●	●	●	●
	Services available	Services available	Currently unserviced	Services available	Services available	Services available	Services available	Services available	Services available
LRT Operations	●	▲	▲	■	▲	▲	▲	▲	▲

Site Number / Site	Moodie	1 Minto	2 Broccolini	3 South of car park	4 Urbandale	5 Ottawa Works yard	6 Richcraft	7 Fernbank West	8 Fernbank East
	Consolidates system operations, dispatch, maintenance and storage requirements	Additional system operational requirements for dispatch, storage and maintenance	Additional system operational requirements for dispatch, storage and maintenance	Additional system operational requirements for dispatch, storage and maintenance. Longest deadhead distance	Additional system operational requirements for dispatch, storage and maintenance	Additional system operational requirements for dispatch, storage and maintenance	Additional system operational requirements for dispatch, storage and maintenance	Additional system operational requirements for dispatch, storage and maintenance	Additional system operational requirements for dispatch, storage and maintenance
Economics									
Property	●	●	●	▲	●	●	●	●	●
	Single owner – limited land requirements	Single owner	Single owner	Multiple owners	Single owner	Single owner	Single owner	Single owner	Single owner

Based on the preceding evaluation the preferred LMSF alternative is to expand the Moodie facility to accommodate the requirements of the LRT network, including the extension to Kanata.

Key features of the Moodie LMSF include:

- No impact to local residents
- No impact to the transportation network, or any planned or existing land uses
- No significant site constraint such as impacted soil, heritage features, or floodplain
- Close to the LRT line
- Requires some NCC property
- Requires realignment of Corkstown Road

6.4. CONSULTATION

6.4.1. CONSULTATION GROUP MEETINGS (MAY 2017)

Study Consultation Group meetings were held on May 11, 2017, and May 16, 2017 to review the Evaluation of Alternative Corridors. A formal presentation was given outlining the work done to date, including the documentation of existing conditions, the identification of potential corridors, the corridor screening methodology, and the preliminary preferred corridor.

The Agency Consultation Group (ACG) meeting was held between 9:30 and 11:30 at Ottawa City Hall on May 11, 2017. Twenty-six (26) members of the ACG were in attendance representing the varied interests of the City of Ottawa and other review agencies, including the National Capital Commission and RVCA.

The Business Consultation Group (BCG) meeting was held between 1:30 and 3:30 at the Beaverbrook Library on May 16, 2017. Twelve (12) members of the BCG were in attendance representing the varied interests in the study area, including the Kanata North Business Park, and the Ottawa Senators.

The Public Consultation Group (PCG) meeting was held between 6:30 and 8:30 at the Beaverbrook Library on May 16, 2017. Ten (10) members of the PCG were in attendance representing the varied interests of the Healthy Transportation Coalition, and multiple community associations throughout the corridor.

6.4.2. PUBLIC OPEN HOUSE

A Public Open House was held on Monday, June 5, 2017 at the Kanata Recreation Complex, Hall A, from 5:30 to 8:30 pm to provide the public the opportunity review and provide feedback on the results of the evaluation of alternative corridors, as well as the documentaiton of existing conditions. The open house included display panels, a presentation and a question and answer session. Representatives from the study team were available to answer questions. A total of 119 people signed-in over the course of the evening.

A total of 17 Comment-Questionnaires were returned during or following the Open House. Following the consultation events, a total of 67 emails were received from the general public following the Public Open House. All comment-questionnaires and emails were examined and tabulated to record feedback received and to better understand the opinion of those who had reviewed the materials presented. The following are the most frequently discussed issues or concerns from the comment-questionnaires and emails, in order:

- Expressed support for Corridor 8 (47 Responses)
- Do not support Corridor 13 (17 Responses)
- Concerned about the impact of Corridor 13 on the recreational, social, and access to the Trans Canada Trails (17 Responses)
- Consider how to provide a supporting transit network to better serve Kanata & Stittsville (10 Responses)
- Extend corridor 8 beyond CTC, towards Hazeldean (10 Responses)
- Do not support Corridor 5 (4 Responses)
- Expressed support for Corridor 13 (4 Responses)
- Construct LRT as soon as possible (4 Responses)
- Support for the approach of the study (4 Responses)
- Kanata North Business Park needs improved transit service (4 Responses)

Notification for the Public Open House included:

- Advertisements in the EMC community newspaper and in LeDroit;
- Announcement on the City web page;
- Email notification to identified First Nations representatives, as well as agency, business, and public consultation groups;
- Email notification to all those who had requested to be added to the study master mailing list; and
- Subsequently, all Open House display boards were posted to the City web pages after the event.

6.4.3. CONSULTATION GROUP MEETINGS (SEPTEMBER 2017)

Following the Public Open House, additional Consultation Group meetings were held on September 19, 2017, and September 21, 2017 to review the additional analysis of Alternative Corridors, as well as the evaluation of designs. A formal presentation was given outlining the work done to date, including the documentation of existing conditions, the identification of potential corridors, the corridor screening methodology, and the preliminary preferred corridor.

The Agency Consultation Group (ACG) meeting was held between 9:30 and 11:30 at Ottawa City Hall on September 19, 2017. Twenty-four (24) members of the ACG were in attendance representing the varied interests of the City of Ottawa and other review agencies, including the National Capital Commission and RVCA.

The Business Consultation Group (BCG) meeting was held between 1:30 and 3:30 at the Hazeldean Public Library on September 21, 2017. Nine (9) members of the BCG were in attendance representing the varied interests in the study area, including the Kanata North Business Park, the Kanata Central BIA, and various developers along the preferred corridor.

The Public Consultation Group (PCG) meeting was held between 6:30 and 8:30 at the Hazeldean Public Library on September 21, 2017. Eleven (11) members of the PCG were in attendance representing the varied interests of the Citizens for Safe Cycling, the Accessibility Advisory Committee, and multiple community associations throughout the corridor.

7. UPDATED EXISTING CONDITIONS

This section of the report provides an update of the existing environmental conditions incorporating additional investigations undertaken for the preferred alternatives. This additional information has been compiled in order to inform the impact assessment of the Recommended Plan.

7.1. SOCIAL ENVIRONMENT

7.1.1. ARCHAEOLOGICAL POTENTIAL

A Stage 1 archaeological assessment was completed for the preferred corridor. A buffer measuring 100 metres on either side of the proposed alignment (Figure 7-1) is included to provide flexibility in determining the final alignment and corresponding construction disturbance areas such as staging areas, and temporary access roads. The Stage 1 Archaeological Assessment can be found in **Appendix B: Supporting Reports**.

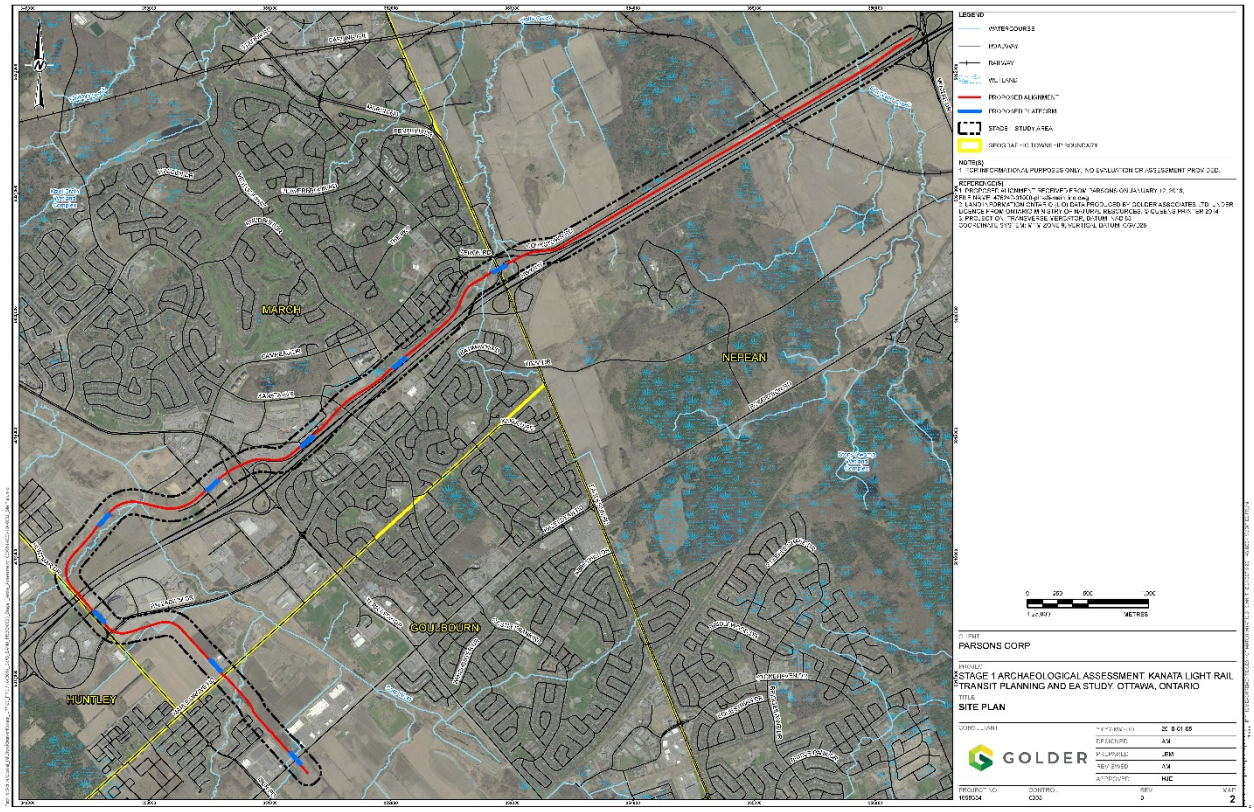


Figure 7-1: Stage 1 Archaeologic Assessment Study area

The primary objectives of this Stage 1 archaeological assessment were to identify known archaeological resources within and in the vicinity of the study corridor, to provide information on previous archaeological investigations conducted in the area, to assess the archaeological potential of the study area and to provide recommendations as to whether any additional archaeological investigations are required.

A search of the MTCS Past Portal ASDB for all sites within two kilometres of the study area was completed on 22 December 2017. The MTCS also provided a list of all registered sites within the vicinity of the project corridor which was received on 3 January 2018, and provided additional documentation of registered archaeological sites within the vicinity of the study area.

A number of factors are employed when determining archaeological potential within a particular area. In addition to the proximity to known archaeological sites, factors for determining archaeological potential for Indigenous and Euro-Canadian historical resources include watershed area (primary and secondary watercourses), distance from water, drainage patterns, identification of historic water sources (e.g. beach ridges, river beds, relic creeks, ancient shorelines, etc.), elevated topography, identification of significant physiological and geological features (e.g. knolls, drumlins, eskers, plateaus, etc.), soil geomorphology, distinctive land formations (e.g. mounds, caverns, waterfalls, peninsulas, etc.), known burials sites and cemeteries, biological features (distribution of food and animal resources before colonization), features identifying early Euro-Canadian settlements (e.g. monuments, structures, etc.), historic transportation routes (e.g. historic roads, trails, portages, rail corridors, etc.) and properties designated and/or listed under the Ontario Heritage Act. Local knowledge from Indigenous communities and heritage organizations, as well as consultation of available historical and archaeological literature and cartographic resources, aids in the identification of features triggering archaeological potential.

These criteria are based on the MTCS Standards and Guidelines for Consultant Archaeologists (2011) and were used to identify archaeological potential for the study area under investigation. Based on the attributes defined in the MTCS Standards and Guidelines for Consultant Archaeologists (2011) for determining archaeological potential within a project landscape, the entire study area is determined to possess the potential for archaeological resources.

However, properties which have been previously assessed for archaeological resources and sufficiently mitigated and cleared by the MTCS are no longer considered to possess archaeological potential. The figures below delineate the previously assessed areas documented in reports which have been accepted as MTCS compliant and entered into the Public Register of Archaeological Reports. The areas with remaining archaeological potential are shown below in Figure 7-2.

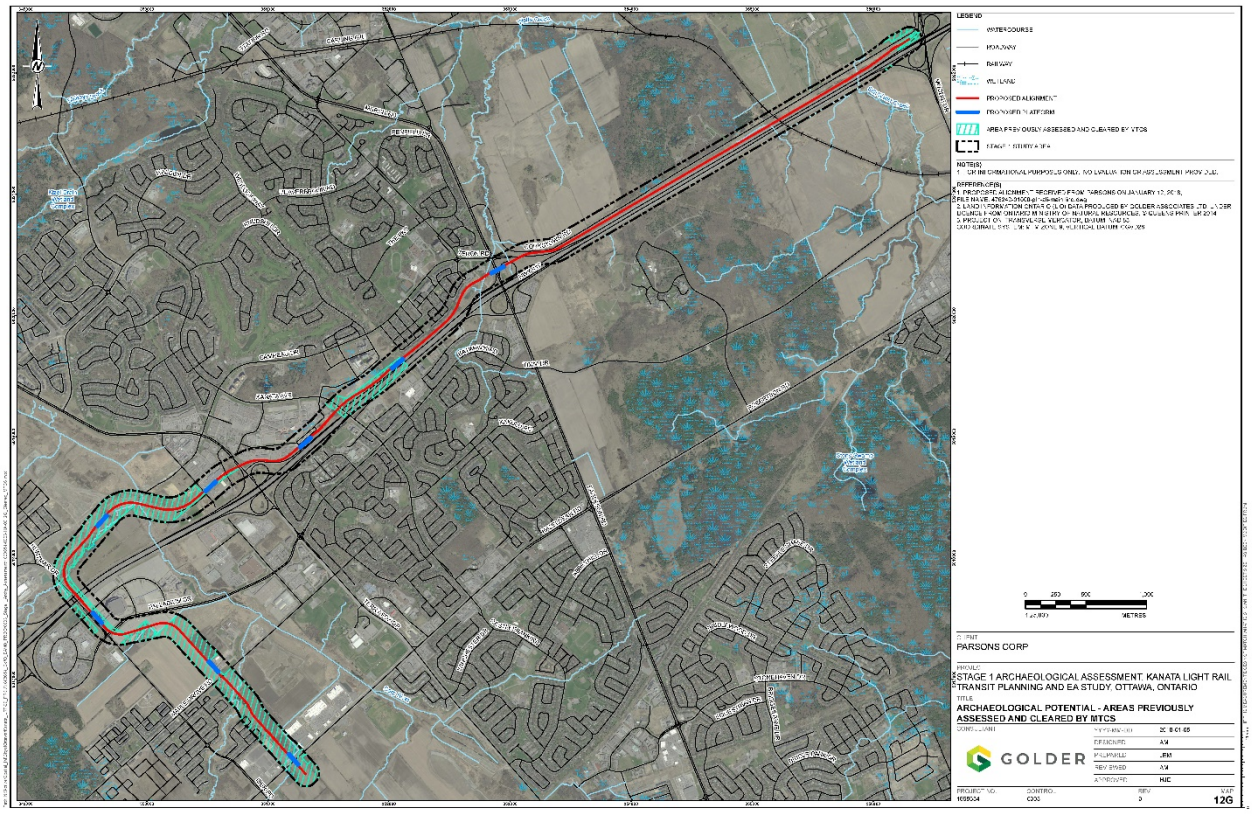


Figure 7-2: Overview of remaining archaeological potential

Further recommendations from the Stage 1 archaeological assessment include;

1. Known archaeological sites determined to possess Cultural Heritage Value or Interest (CHVI) identified in the present study area that have not been completely mitigated or deemed to merit further investigation should be avoided.
2. A Stage 2 assessment should be completed for registered site BhFx-2 to define the spatial extent of the site and determine the significance of the lithic scatter prior to any additional disturbances to the area
3. A stage 3 archaeological investigation should be completed at the Bradley Farm site (BhFx-47) and James Farm site (BhFx-49) prior to any potential project impacts to the existing landscape at these site locations.
4. All lands on Maps 13A to 13 F (Golder Associates 2018) not identified for additional assessment are considered to have been sufficiently mitigated during previously completed archaeological assessments and no additional archaeological assessment are recommended for these areas, and
5. Additional archaeological investigations may be required if future construction, and/or other development related activities extend beyond the boundary of the proposed alignment or surrounding study area buffer defined in the Stage 1 Archaeology Assessment Report.

7.1.2. CULTURAL HERITAGE

A Cultural Heritage Overview Report (CHOR) was completed to determine the effects of the proposed undertaking on potential cultural heritage resources. The scope of this CHOR was defined by guidance outlined in the Ministry of Tourism, Culture and Sport (MTCS) Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist (2016; the MTCS Checklist). The MTCS Checklist provides a screening tool to identify all known or recognized cultural heritage resources. Following the MTCS Checklist, extensive background research was undertaken, City of Ottawa heritage planning staff were consulted, field investigations undertaken, and screening level evaluations completed. This informed the assessment of impacts of the Recommended Plan.

The CHOR found that there are currently no known listed or designated heritage properties within the project corridor and there are no known heritage monuments or markers within, or adjacent to, the study area boundaries. This CHOR found that the study area:

- is within the watershed of the Ottawa River — a Canadian Heritage River;
- contains one property —210 Huntmar Drive — with buildings or structures over 40 years old; and,
- the Nepean Rural section of the study area is within the Greenbelt and is part of an area identified by the NCC as the Western Farmland cultural landscape

The study area is over 1.5 km south of the Ottawa River at its nearest point and there is no evidence of any connection between any properties in the study area and the Canadian Heritage River. No evidence of any significant connection between any properties crossed by the Project and the heritage values of the Ottawa River were found during background research of field investigation. The study area is not connected to the River for early exploration of Ontario, French settlement of Canada, transportation, resource harvesting, riparian settlement, recreation, water power, or water related industrial development in Ottawa.

210 Huntmar Drive is a long, narrow property with its short axis fronting Huntmar Drive. It includes a barn and shed and a house –all over 40 years old— surrounded by trees that also line the back and sides of the property. On the basis of the background study and field investigations conducted for the CHOR, this property was determined not to be of CHVI.

The NCC has recognized the Greenbelt as a medium-scale cultural landscape. This landscape in the Nepean Rural section of the study area is defined by the rural character observed around Corkstown Road, where the road has a rural cross section with grass covered swales, wood telephone poles, gravel shoulders and two-lane width Characteristics of the rural cultural heritage landscape in, and adjacent to, the Project include:

- The historic and ongoing agricultural land use activities represented by the equestrian centre, fields and woodlot in the landscape;
- The field and ditch patterns on along Corkstown Road that demonstrate the historic rural landscape;
- Rural roadscape with two-lane width, wood telephone poles, gravel shoulders, grass covered swales and level railway crossing.

7.1.3. AIR QUALITY, NOISE, AND VIBRATION

In 2017 a further assessment of the proposed Kanata LRT project was completed to evaluate possible air quality impacts from the Kanata LRT project study area. The new LRT system will be electrically powered and will not produce any emissions on its own. Overall, air quality will improve despite an increase in traffic volumes related to anticipated growth based on future development due to the improvements in vehicle technology, more stringent government regulations and the introduction of electric rail to displace the City's existing Bus Rapid Transit (BRT) system. However, the Kanata LRT Maintenance and Storage Facility (MSF) is expected to generate emissions consistent with a light industrial use building. The impacts on air pollution levels would be evaluated and controlled if necessary, through detailed design and project implementation phase of the project.

Air quality impacts are not expected to be significant as a result of the MSF as it will be used for cleaning and other light maintenance activities. The air quality assessment of the Transit terminals indicates that there will be no significant impacts from the Kanata LRT stations. The only expected source of emissions would be from heating equipment. For terminal stations, where extended bus idling is expected to occur, more detailed studies of air quality impacts should be considered around the station during detailed design.

7.2. BIOLOGICAL NATURAL ENVIRONMENT

A Natural Environment Existing Conditions Report was completed for the area within 120 m of the Kanata LRT preferred alignment from Moodie Drive to Hazeldean Road. This report describes the results of background review and field investigations completed November 24 and 28, 2017, as well as April 11, 2018. The intent of these studies was to generally characterize the existing conditions within the study area and identify potential areas of concern. An overview of natural features found within or nearby the project corridor is shown on Figure 7-3.

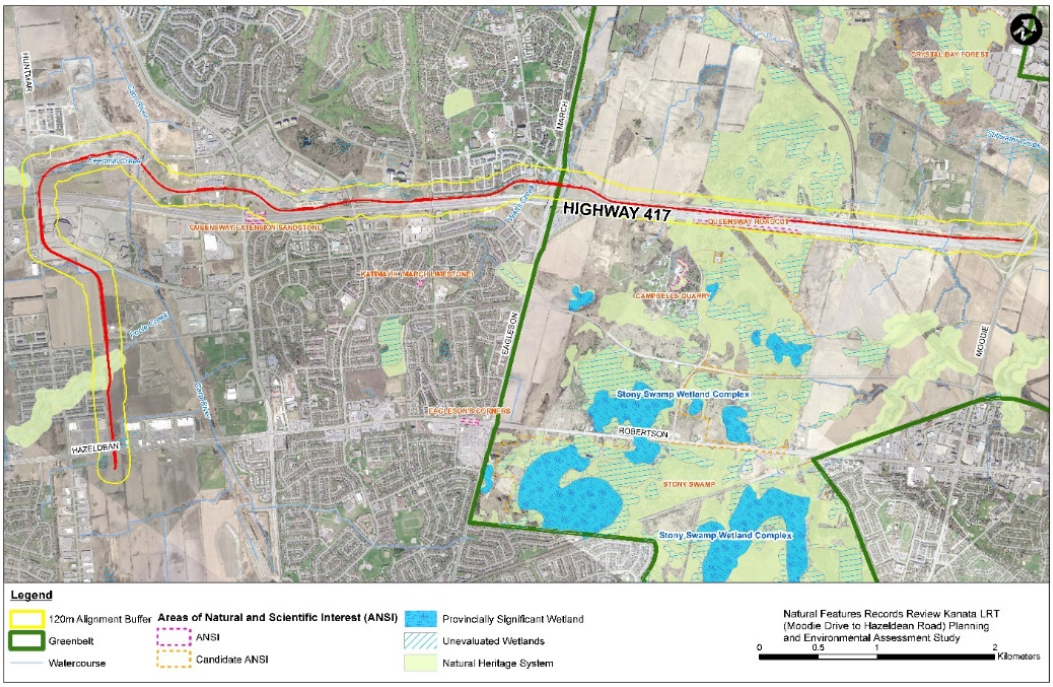


Figure 7-3: Natural Features

7.2.1.1. Natural Heritage System

The Kanata LRT study area is a mixed-use area, comprising of agricultural lands, residential and commercial properties with small pockets of natural areas (e.g., thickets, meadows, and woodland communities). The study area from Moodie Drive to March Road consists of the NCC Greenbelt. This area is composed of agricultural, recreation, forested, and idle land uses. The study area from March Road to Hazeldean Road is predominately an urban environment with residential, commercial, and institutional developments. The background review and correspondence with the Kemptville district MNRF identified designated natural areas occurring within 120 m of the preferred alignment.

Table 7-1: Summary of Natural Heritage Designations summarizes the natural heritage features and land use designations that occur within 120 m of the preferred alignment. Greater detail regarding these natural heritage features are available within Appendix B.

Table 7-1: Summary of Natural Heritage Designations

Natural Heritage Feature	Designation	Source/Schedule
Natural Heritage System	NCC Greenbelt Core Natural Area Natural Link Natural Environment Area	NCC (2013) City of Ottawa (2013) Schedule L3 and Schedule B
Significant Woodland	NCC Greenbelt Core Natural Area Natural Link Natural Heritage System Natural Environment Area	NCC (2013) City of Ottawa (2013) Schedule L3 and Schedule B
Significant Valleyland	Natural Heritage System Major Open Space	City of Ottawa (2013) Schedule L3 and Schedule B
Queensway Roadcut	Earth Science ANSI NCC Greenbelt Natural Environment Area	MNRF (2017) City of Ottawa (2013) Schedule L3 and Schedule B
Queensway Extension Sandstone	Earth Science ANSI	MNRF (2017)
Stony Swamp	Candidate Life Science ANSI Significant Woodland Provincially Significant Wetland Natural Heritage System NCC Greenbelt and Core Natural Area Natural Environment Area	MNRF (2017) City of Ottawa (2013) Schedule L3 and Schedule B; NCC (2013)
Kanata Town Centre Core Park	Urban Natural Area	Muncaster and Brunton (2005)
North of Maple Grove	Urban Natural Area	Muncaster and Brunton (2005)
Palladium Interchange	Urban Natural Area	Muncaster and Brunton (2006)
Poole Creek North of Hazeldean	Urban Natural Feature	Muncaster and Brunton (2006) City of Ottawa (2013) and Schedule B
Natural Heritage System	NCC Greenbelt, Natural Environment Area	City of Ottawa; Schedule L3 and Schedule B

Natural Heritage Feature	Designation	Source/Schedule
Significant Woodland4.1.2	NCC Greenbelt, Natural Heritage System, Natural Environment Area	City of Ottawa; Schedule L3 and Schedule B
Significant Valleyland	Natural Heritage System, Major Open Space	City of Ottawa; Schedule L3 and Schedule B
Queensway Roadcut	Earth Science ANSI, NCC Greenbelt, Natural Environment Area	MNRF and City of Ottawa; Schedule L3 and Schedule B
Queensway Extension Sandstone	Earth Science ANSI	MNRF
Stony Swamp	Candidate Life Science ANSI, Significant Woodland and Provincially Significant Wetland, Natural Heritage System, NCC Greenbelt, and Natural Environment Area	MNRF and City of Ottawa; Schedule L3 and Schedule B
Kanata Town Centre Core Park	Urban Natural Area	Muncaster and Brunton (2005)
North of Maple Grove	Urban Natural Area	Muncaster and Brunton (2005)
Palladium Interchange	Urban Natural Area	Muncaster and Brunton (2006)
Poole Creek North of Hazeldean	Urban Natural Feature	Muncaster and Brunton (2006), Schedule B

7.2.2. SPECIES AT RISK

A screening was completed for SAR identified as potentially occurring in the study area. The screening for potential SAR and Species of Conservation Concern was based on the observed existing conditions and the identified presence of suitable habitat within the study area. Screening for SAR has been completed through the use existing available wildlife databases, consultation with the MNRF, DFO SAR Mapping, and City of Ottawa resources. The results of the SAR screening and discussion of species identified as having potential to be present within the study area and/or confirmed to be present through other field studies are shown in Appendix B (Natural Heritage Existing Conditions report). A total of 12 species listed as threatened or endangered have potential to occur within the study area, as well as 12 species of special concern.

- **Butternut (*Juglans cinerea*)**

  Butternut is designated as endangered under the ESA and the SARA. Suitable habitat is present within the study area and four healthy Butternut trees were documented during field investigations. The area surrounding Poole Creek is known to contain more than 1,000 Butternut trees (personal communication with Amy MacPherson, City of Ottawa, October 23, 2018). In Ontario, Butternut generally grows alone or in small groups in deciduous forests, in moist soil; intolerant of shade. Response received from the MNRF indicates the potential for them to be present.

- **American Eel (*Anguilla rostrata*)**

  The American Eel is designated as endangered under the ESA but has no status under the SARA. Suitable habitat is present within the study area as it has a broad diversity of habitats from large lakes to small rivers (SARO 2018). Response received from the MNRF and records of occurrence from NHIC indicates the potential for them to be present. Mississippi Valley Conservation captured a single American Eel in Poole Creek in 2018 (personal communication with Amy MacPherson, City of Ottawa, October 23, 2018).

- **Western Chorus Frog (Pseudacris triseriata)**

  Western Chorus Frog is not at risk under the ESA, however is designated as threatened under the SARA. Western Chorus Frog is an amphibian species only protected on federal lands. There are federal lands containing suitable habitat present within the study area. Suitable habitat may include roadside ditches or temporary ponds in fields; swamps or wet meadows; woodland or open country with cover and moisture; small ponds and temporary pools. They require vernal (non-permanent) pools for breeding.

- **Blanding's Turtle (Emydoidea blandingii)**

  Blanding's Turtle is designated as threatened under the ESA and the SARA. There is suitable habitat present within the study area. Critical habitat features include wetlands, watercourses, and water bodies within 2 km of any occurrence record, plus upland terrestrial habitat up to 240 m from those features. Quiet lakes, streams and wetlands with abundant emergent vegetation is also suitable, however they are also known to travel across upland forests to reach wetlands. Response received from the MNRF indicates the potential for them to be present. Recent observations of this species have been recorded in the Upper Poole Creek corridor, in the Carp River downstream of the study area, and in a wetland north of the Wesley Clover Park equestrian centre (personal communication with Amy MacPherson, City of Ottawa, October 23, 2018).

- **Bank Swallow (Riparia riparia)**

  Bank Swallow is designated as threatened under the ESA and the SARA. This species receives protection on private, provincial and federal lands. In addition, individuals, nests, and eggs, are protected under the MBCA. There is suitable habitat present within the study area. Bank Swallows prefer to build nests near water in steep sand, dirt, or gravel banks, in burrows dug near the top of the bank, including road embankments and potentially excavated soil piles at construction sites. Response received from the MNRF indicates the potential for them to be present and records confirm their presence in the 2005 OBBA.

- **Barn Swallow (Hirundo rustica)**

  Barn Swallow is designated as threatened under the ESA and the SARA. This species receives protection on private, provincial and federal lands. In addition, individuals, nests, and eggs, are protected under the MBCA. There is suitable habitat present within the study area. Barn Swallows are frequently found foraging over farmlands or rural areas. They prefer to nest in cliffs, caves, rock niches, buildings or other man-made structures (including bridges and culverts). They could typically be found feeding in open country near a body of water. Response received from the MNRF indicates the potential for them to be present and records confirm their presence in the 2005 OBBA.

- **Bobolink (Dolichonyx oryzivorus)**

  Bobolink is designated as threatened under the ESA and the SARA. This species receives species and habitat protection on private, provincial and federal lands. In addition, individuals, nests, and eggs, are protected under the MBCA. There is suitable habitat present within the study area. Bobolink prefer large, open expansive grasslands (>10 ha) with dense ground cover as they build their nests on the ground. Response received from the MNRF indicates the potential for them to be present and records confirm their presence in the 2005 OBBA and the NHIC database. Bobolink was observed within the southern portion of the study area and documented in Muncaster (2007a and 2007b) and TSH (2006). The presence of Bobolink was also discussed within *West Transitway Connection: Terry Fox Drive to Fernbank Road Environmental Project Report* (Delcan 2012).

- **Eastern Meadowlark (Sturnella magna)**

  Eastern Meadowlark is designated threatened under the ESA and the SARA. This species receives protection on private, provincial and federal lands. In addition, individuals, nests, and eggs, are protected under the MBCA. There is suitable habitat present within the study area. Eastern Meadowlark prefers open grassy meadows at least ≥ 5 ha in size as well as farmland, pastures, and hayfields with elevated singing perches. The Eastern Meadowlark will also inhabit cultivated lands and weedy areas with trees, such as old orchards adjacent to open grassy areas. Response received from the MNRF indicates the potential for them to be present and records confirm their presence in the 2005 OBBA and the NHIC database. Eastern Meadowlark was observed within the southern portion of the study area and documented in Muncaster (2007a and 2007b) and TSH (2006). The presence of Eastern Meadowlark was also discussed within *West Transitway Connection: Terry Fox Drive to Fernbank Road Environmental Project Report* (Delcan 2012).

- **Little Brown Myotis (Myotis lucifugus)**

  Little Brown Myotis is designated as endangered under the ESA and the SARA. There is suitable habitat present within the study area. They prefer to roost in hollow trees or buildings, feeding primarily in wetlands and forest edges. Response received from the MNRF indicates the potential for them to be present.

- **Eastern Small-footed Myotis (*Myotis leibii*)**

  This bat species is designated as endangered under the ESA and SARA. There is suitable habitat present within the study area. They roost in a variety of habitats such as, rock outcrops, hollow trees and other structures. This species of bat change roosting locations daily (SARO 2018). Response received from the MNRF indicates the potential for them to be present.

- **Tri-colored Bat (*Perimyotis subflavus*)**

  This bat species is designated as endangered under the ESA and SARA. There is suitable habitat present within the study area. They typically inhabit forested areas where it forms day roosts and maternity colonies in mature forests. Occasionally it occupies barns or other structures. This species of bat is very rare with scattered distribution (SARO 2018). Response received from the MNRF indicates the potential for them to be present.

- **Northern Myotis (*Myotis septentrionalis*)**

  Northern Myotis is designated as endangered under the ESA and the SARA. There is suitable habitat present within the study area. They prefer to roost under loose bark in hollow trees. They will hunt within forests, particularly below the canopy. Response received from the MNRF indicates the potential for them to be present.

The following are species that have potential to be present within the study area through field investigations and the presence of preferred habitat, as well as through consultation with the MNRF and search of available wildlife databases. The following species are designated as special concern under one or both the ESA and SARA. As species of special concern, there is no protection under these acts for the species listed, however, some receive protection under alternative Acts (e.g. MBCA and/or *Fish and Wildlife Conservation Act*).

- Monarch
- West Virginia White
- River Redhorse
- Bridle Shiner
- Snapping Turtle
- Eastern Milksnake
- Common Nighthawk
- Red-headed Woodpecker
- Eastern Wood-pewee
- Wood Thrush
- Golden-winged Warbler
- Grasshopper Sparro

7.3. PHYSICAL ENVIRONMENT

7.3.1. GEOLOGICAL ENVIRONMENT

In 2018, Golder Associates Ltd. assessed the potential functional design and construction issues along the Kanata LRT alignment track and its associated structures based on the anticipated subsurface conditions. The geotechnical overview was based on the conceptual design and provided the following recommendations:

1- The CN Rail Overpass structure will need to be supported on deep foundations, such as driven H-piles, since the clay soils do not have sufficient bearing resistance to support relatively high loaded shallow foundations. Ground improvements to reduce settlement may be required around the western approach embankments to the CN Crossing.

2- West of the CN overpass, and Station 19+400, lightweight fills may be required at least along part of this alignment to reduce settlements. From Station 19+400 to Station 18+480, the LRT alignment will likely extend through the existing rock cut and some widening/deepening of the rock cut will likely be required.

3- There could be a requirement for lightweight fills or ground improvements (e.g. preloading and surcharging) along part of this section to reduce settlement where Highway 417 reaches March Road exit.

4- Where the Station under March Road and Watt's Creek is located through the existing fill materials, peat and clay, shoring materials may need to (due to cost savings) consist of internally braced steel sheet piling or steel soldier pile and timber lagging to reduce settlement. A box culvert is preferable for the crossing of Watt's Creek.

5- At the storm water management pond (at about station 16+900 and also north of Kanata Town Station) consideration should be given to lowering the alignment profile here if feasible to reduce the potential that other measures to stabilize the slopes might be required.

6- A retaining wall up to 3 meters in height will be required on the north side of the corridor as it passes under the pedestrian bridge and approaches the Kanata Town Station. Other additional geotechnical requirements in this area may include lowering the grade and using raft slab to support the tracks and the retaining wall might be feasible.

7- The subsurface conditions at Kanata Avenue Underpass consists of thin overburden over shallow sandstone and limestone (or possibly dolostone) bedrock. The proposed underpass can likely be supported on shallow foundations placed on the surface of the bedrock.

8- Near the Terry Fox Station subsurface conditions consist of fine layers of existing fill and glacial till. The proposed station structure can be supported on shallow foundations placed on the surface of the bedrock.

9- Subsurface conditions at Terry Fox Drive, Didsbury Roads (east and west) and Disdbury Station consist of shallow sandstone bedrock and then the bedrock drops to unknown depths. Conceptual measures that should be considered at this location include, but are not limited to:

   a. building retaining walls (at certain locations),
   b. shallow foundations at key locations,
   c. significant dewatering at excavations,
   d. implementation of raft slabs, and
   e. various measures to control flow of groundwater during construction (e.g. grouting)

10- Along the Carp River Crossing (station 13+770 to 11+700), geotechnical recommendations along this alignment include supporting the trackway on piles, or using retaining walls and lightweight fills.

11- At the Maple Grove, Poole Creek Crossing and Hazeldean Stations, the subsurface conditions are indicated to consist of stiff weathered clay, likely to be underlain by compressible clay soils. The structure for the crossings will need to be supported by deep foundations and light weight fills where required.

7.3.2. CONTAMINATION AND HAZARDOUS MATERIALS

Further study included a review of a site history and records, a windshield survey, and data evaluation. There were twenty-two (22) Potentially Contaminating Activities (PCAs) with "high" to "low" relative potential environmental risk according to their likelihood of impacting construction activities. These particular PCAs which have been identified in the Kanata LRT study area have the potential to have adversely impacted the subsurface and those with "medium" to "high" potential risk required further assessment to determine the potential to impact design and construction of the Kanata LRT.

A summary of the Potentially Contaminating Activities are presented in Table 7-2: Summary of Potentially Contaminating Activities (PCAs) Located in the Study Area.

Table 7-2: Summary of Potentially Contaminating Activities (PCAs) Located in the Study Area.

Site No*	Potentially Contaminating Activity (PCA)
High Risk	
1	De-icing of Transportation corridors (i.e. road salt contamination) Note: Salt impacts from roadway de-icing activities are likely along/nearby all roadways within the study area. If salt contaminated material is excavated and removed from site, these exceedances must be considered when determining how to re-use or where to disposal of the material
Medium Risk	
2	Former rail lines crossing study area between Eagleson Road and Moodie Drive
3	Land between Corkstown Road and Highway 417, south of the Abbot Point of Care – Unknown source of TCE contamination
4	1655 Maple Grove Road – Maple Grove Works Yard (USTs and ASTs) and Snow Disposal Facility
5	Highway 417 – Various spills along roadway and shoulder/ditch *Note: Potential former spills, both recorded and un-recorded, may exist along all roadways within the study area. The busier the roadway, the higher the potential for existing spills. Highway 417 has been especially noted based on the high number of recorded spills along/nearby the highway.
Low Risk	
6	411 Corkstown Road – Wesley Clover Parks Campground
7	401 Corkstown Road – Wesley Clover Parks Equestrian Park
8	1 Haanel Drive – CANMET Research Complex
9	115 Roland Michener Drive and Earl Grey Drive (various locations)- Kanata Centrum Shopping Centre
10	214 Didsbury Road – Kanata Patrol Yard
11	8000 Campeau Drive – Kanata Ford Sales automobile retailer
12	570 Terry Fox Drive – Petro Canada Gas Station
13	500 Terry Fox Drive – Canadian Tire Gas Station
14	225 Huntmar Drive – Esso Gas Station, USTs
15	2500 Palladium Drive- Palladium Autopark
16	1000 Palladium Drive – Canadian Tire Centre
17	150 Katimavik Road – Computer equipment manufacturing
18	260 Hearst – Manufacturing Businesses (various items)
19	750 Palladium Drive – manufacturing of electronics, equipment and/or furniture
20	10 Hearst Way – Commercial, industrial and Provincial businesses or organizations
21	50 Colchester Square – Select Tailor Dry Cleaning
22	8211-8231 Campeau Drive – Commercial Retail Use

* Please refer to the Contamination Overview Study (Appendix B) for the location of the numbered sites listed above.

8. RECOMMENDED PLAN

This section of the Report describes the Recommended Plan for the Kanata LRT project, which encompasses all elements required to support design, construction and operation of the extension of the Confederation Line west from Moodie Station to Hazeldean Station. In accordance with Section 9.2 (2) of the TPAP regulation, the alignment and LMSF described herein are considered to be the final description of the recommended plan, to the functional design level. The preferred method of carrying out the undertaking is described and other potential methods, if considered, are also discussed.

Upon MECP approval, detailed design will begin to advance the final description to a higher level of detail. The footprint of the alignment, the study corridor examined, and the evaluation of effects will remain the same. The Transit Project that is to be implemented and exempted from Part II of the Environmental Assessment Act will be consistent with the description of the Transit Project presented herein.

Should any changes be made in subsequent design phases that are inconsistent with this final description and change any potential impacts of the project, the proponent will be subject to the addendum process and subject to MECP approval. The proponent will, as per the regulation, be required to complete an addendum, or a revised TPAP Project Report.

The proposed Kanata LRT extension ultimately consists of 11 km of new LRT extending west from Moodie Drive to Hazeldean Road, with eight stations.

Alignment

- The Kanata LRT Extension will comprise approximately 11 km of LRT alignment.
- Most of the alignment is within a corridor identified for rapid transit in previous studies
- Approximately 6 km will be at-grade.
- Approximately 1.5 km will be below-grade in an open cut.
- Approximately 3.5 km will be on elevated structure or embankment
- A fully exclusive LRT right-of-way is required to provide for a fast and reliable transit service
- Pedestrian and cyclist crossings and connections are being planned to provide access to and from local communities.

Stations

The LRT project will include 8 rapid transit stations, of which:

- 4 will be at-grade;
- 2 will be in open-cut sections;
- 4 will be elevated.

Station designs will carry on the common look and feel of stations being constructed as part of the City's Confederation Line and will:

- Provide for safe, efficient and accessible access to rapid transit
- Have convenient pedestrian and cycling connections to and from surrounding communities
- Integrate with the character of existing and future communities
- Fulfill AODA, Building Code and City of Ottawa Accessibility design standards including the implementation of redundant elevators.

Public washrooms are currently proposed at March and Hazeldean Stations. These stations will either be terminus stations or serve as major transfer stations between rail and other major rapid transit corridors. If an interim terminus station is identified and built, it will require a public washroom as per the Ontario Building Code.

Connectivity

Station connectivity to surrounding communities is a key consideration of this project design. The main priority for station access is pedestrian and cycling activity, to encourage use of these sustainable modes for first/last kilometer access to transit. New and improved links will be identified for inclusion in the project or prioritization as part of the City's Pedestrian and Cycling Plans. A parallel multi-use pathway will be provided via a combination of existing and new linkages.

Bus connections at stations will occur via new or existing bus terminals at major stations, where large volumes of passengers will be transferring and local bus services begin/end. On-street bus stops for local routes will support transfers at other stations where appropriate.

Pick-up and Drop-off activity will be accommodated via either formal (off-street) or informal (on-street) facilities, located and scaled to match local demand and the community context.

Park and Ride facilities will be provided at the following stations:

- March (existing Park and Ride)
- Terry Fox (existing Park and Ride)
- Palladium (expansion of existing Park and Ride)
- Hazeldean (new Park and Ride)

Light Maintenance and Storage Facility

- Expansion of the proposed Moodie Light Maintenance and Storage Facility (LMSF) to be constructed as part of the Stage 2 LRT project will support LRT operations on the Kanata LRT Extension as well as overall LRT system growth beyond the 2031 horizon year.

Transit Operations

LRT service will operate as an extension of the Confederation Line. The design of the line will support frequent operation of trains. In practice, the splitting of service at Lincoln Fields between trains for Kanata and Baseline will limit service frequency on each branch, generally to half of the combined level of service which can be provided east of Lincoln Fields (e.g. 3 minute peak service on the combined section of line will result in 6 minute service on each branch). Given that the core of the line through downtown is designed to permit ultimate train operation as frequent as every 1 minute and 45 seconds, train frequencies as high as 3.5 minutes could be operated on each branch. This would result in a line capacity of 12,000 persons per hour per direction (pphpd) for the Kanata LRT, which is more than sufficient to meet anticipated demand beyond the City's 2031 TMP horizon year. The design of Lincoln Fields Station, being constructed as part of the City's Stage 2 LRT project will provide a third track and platform, enabling a shuttle or overlapping service to be operated when required (e.g. during times of low train frequency, to maintain a minimum level of service across the network). Train frequencies in off-peaks and weekends on the Kanata LRT extension will range from 10-15 minutes. Cross-over tracks will be provided at key locations along the line to permit turnback of trains or single track working during maintenance periods. A tailtrack at Hazeldean Station will allow for temporary storage of trains during off-peak hours or in case of a train failure.

Bus routes (both local and rapid transit) will connect to the LRT at key locations to facilitate passenger transfers and provide a seamless network serving Kanata. The Kanata North BRT between Corkstown Road and Solandt Road, identified as part of the City's Affordable Rapid Transit Network, will connect to March Station. This facility will provide for frequent and reliable bus connections between the LRT, the Kanata North Business Park and Morgan's Grant areas of Kanata. Implementation of the segment of BRT along March

Road between Corkstown Road and March Station is recommended as part of the Kanata LRT project to provide for a seamless connection to the LRT. At Hazeldean Station, an at-grade median BRT will extend south along the future North-South Arterial to serve the Fernbank community.

8.1. RECOMMENDED DESIGN

This section provides a more detailed description of the LRT project elements, including alignment, stations, structures, multimodal connections.

The proposed LRT corridor, station locations, and MSF are broadly illustrated in Figure 8-1. The Recommended Plan has been advanced to a functional level of design, which permits identification of infrastructure footprint, property requirements, broad impacts, and cost estimates which can be evaluated as part of the assessment of effects, with appropriate mitigation measures developed where necessary. It is anticipated that the project will be completed under a similar approach to the Confederation Line and that a private sector partner will be sought by the City of Ottawa to undertake more advanced design work, as well as construction and maintenance of the project, with the City responsible for daily operation of the LRT system.

Figure 8-1: Kanata LRT Alignment and Station Locations

8.1.1.1. Moodie Station – March Station

Moodie Station will be the terminus of the Stage 2 LRT project, expected to commence revenue service in the latter part of 2023. As part of the Stage 2 LRT project, a Light Maintenance and Storage Facility (LMSF) will be constructed west of Moodie Drive, on lands located between Highway 417 and Corkstown Road. The Kanata LRT extension will start at the point where the yard leads for the LMSF diverge from the mainline track, approximately 200 m west of Moodie Drive. West of this point, the tracks for the Kanata LRT will parallel Highway 417 and be located between the LMSF and the highway and follow the highway grade as it rises, continuing west to cross over the Canadian National Railway (CNR) Beachburg Subdivision, and then descending the hill to the west as it continues to parallel Highway 417. As the LRT approaches March Road, it continues along the north side of the highway, curving slightly north to follow the westbound highway off-ramp and descending below existing grade into an open cut. The alignment then passes underneath the existing westbound highway ramps before entering March Station.

8.1.1.2. March Station

March Station will be located south of the existing March/Campeau intersection, with the station platforms spanning under March Road. This configuration generally matches the previous station design identified as part of the Kanata North BRT Planning and EA Study, completed in 2012. Modifications to this approved plan to accommodate a change from bus to rail technology include provision of a bus terminal facility, to be located on the west side of March Road and south of the LRT alignment. As part of development of the Recommended Plan, the proposed PPUDO location on the east side of Provincial Police Lane (originally identified as part of the preferred design alternative) was relocated to the west side of Provincial Police Lane to be on City-owned land, further reducing impacts to the existing OPP facility.

The station will include a new Multi-Use Pathway structure spanning over Highway 417 to connect the proposed LRT station with the existing Eagleson Park and Ride lots, located on the east and west sides of Eagleson Road, south of Highway 417. To provide for improved community connectivity, as well as to serve transit riders accessing LRT via the Park and Ride facility, the new MUP overpass is proposed to be located on the west side of the March/Eagleson overpass, with an overhead crossing of Eagleson Road provided south of Highway 417 to connect to the east Park and Ride lot.

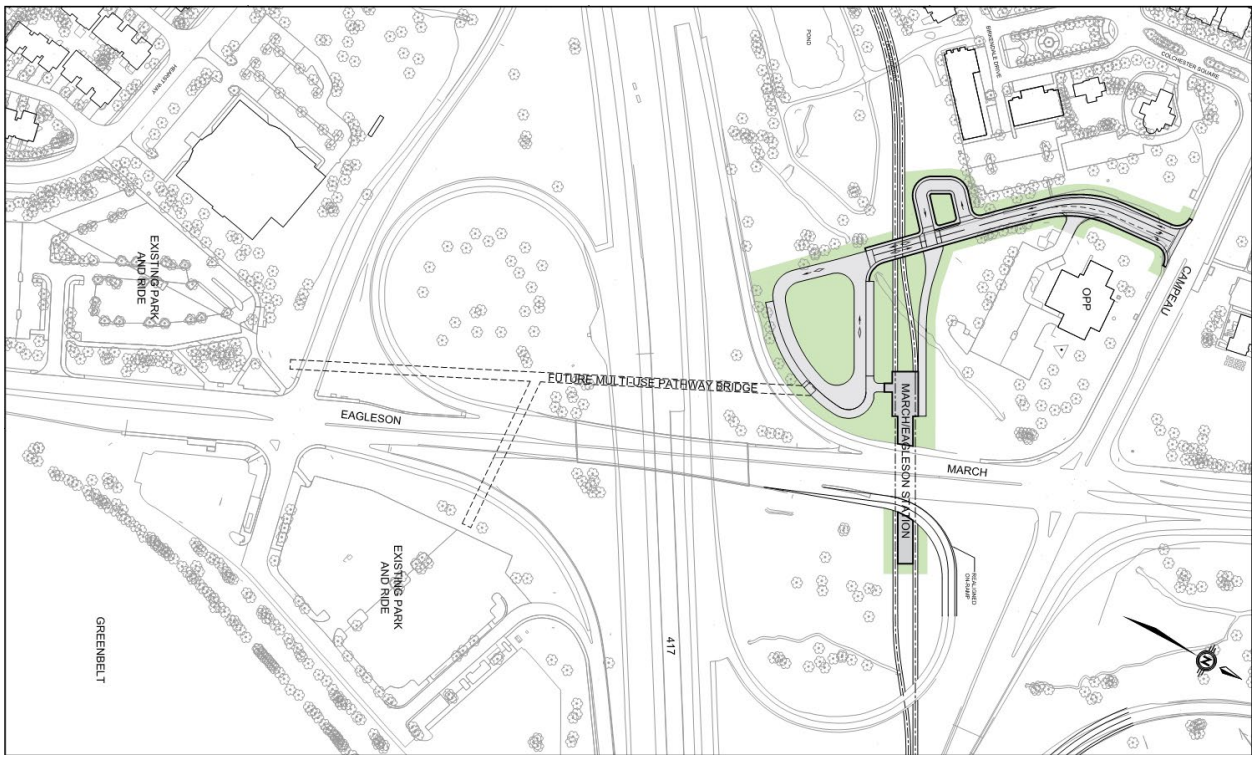


Figure 8-2: March Station

West of March Station, the LRT returns to grade and curves around the north side of an existing stormwater management pond before returning to parallel Highway 417 approximately 500 m west of March Road.

8.1.1.3. Kanata Town Centre Station

Kanata Town Centre is located 1100 m west from March Station, where the existing MUP overpass of Highway 417 connects Gray Crescent to Kanata Town Centre. The station will be accessed via a new station house to be built on the west side of the MUP overpass. Local station facilities will include curbside PPUDO facilities located on-street along Gray Crescent, and on the south side of the MUP overpass, near the Hearst Way/Whitney Drive intersection.

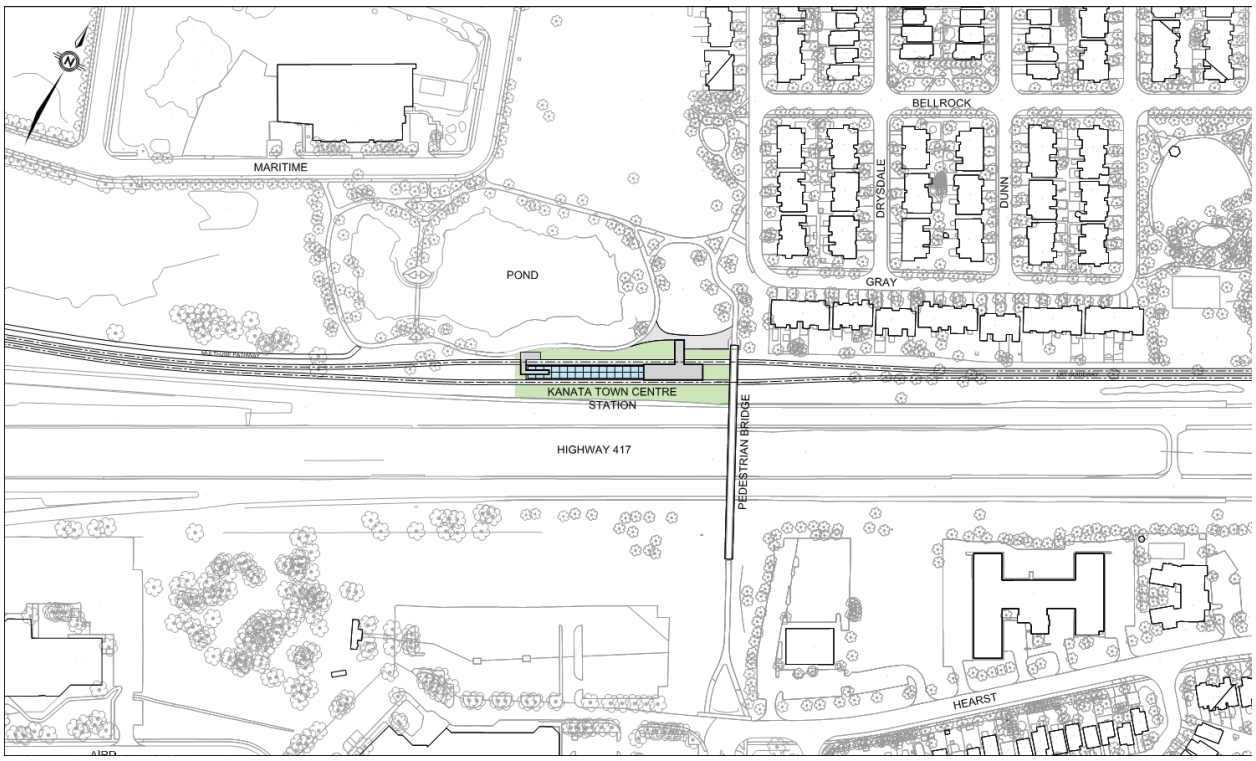


Figure 8-3: Kanata Town Centre Station

West from Kanata Town Centre Station, the LRT will continue to run parallel and to the north of Highway 417. At the Kanata Avenue westbound off-ramp, the alignment will curve north slightly and pass under Kanata Avenue using a structure pre-built to accommodate rapid transit. West of Kanata Avenue the alignment will then curve south, again paralleling Highway 417 and entering Terry Fox Station.

8.1.1.4. Terry Fox Station

Terry Fox Station is located 1 km west from Kanata Town Centre Station, and is an existing Transitway station, located adjacent to the Kanata Centrum development. The existing station consists of a 200 m long centre island bus platform, with a 550 space park and ride lot. The new LRT platforms will be located in the area between the existing bus platforms and Highway 417, with new overhead walkways connecting the LRT platforms to the bus platforms, which will continue to be used for local transit services. Cross-over tracks are provided to the east of the station to allow for turnback of trains at this station.

The station will include a MUP overpass across Highway 417 located at the east end of the station area. This MUP crossing would connect to McGibbon Park, located on the south side of Highway 417.

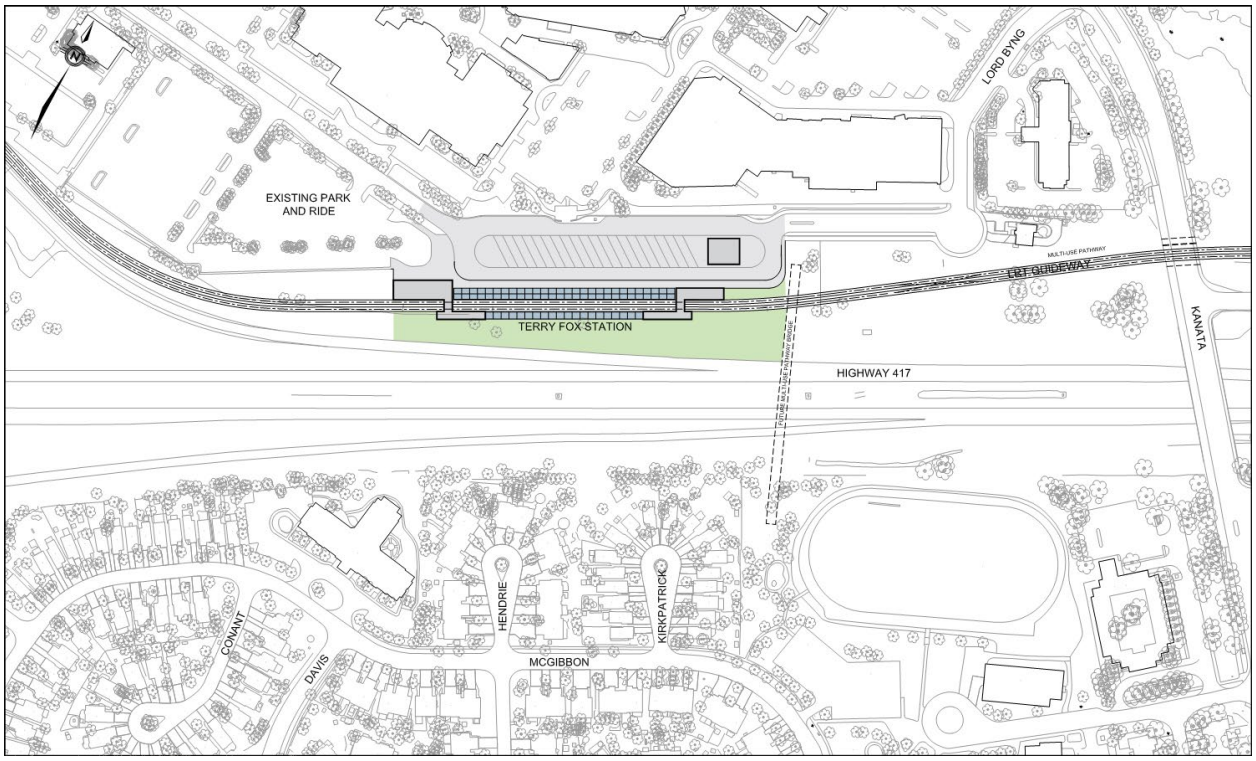


Figure 8-4: Terry Fox Station

West of Terry Fox Station, the LRT tracks will descend below grade in an open cut, following the curve of the westbound Highway 417 Terry Fox off-ramp and then crossing under Terry Fox Drive at a point approximately 200 m north of Highway 417. West of Terry Fox Drive, the LRT alignment will remain in an open cut, passing under Didsbury Road (east) and then into Didsbury Station, located between the two legs of Didsbury Road. The previous BRT plan closed the east leg of Didsbury Road and had an at-grade crossing of the BRT at the west leg of Didsbury Road. Given the need for complete grade separation between LRT and other modes, extension of the open cut section is needed to maintain access to surrounding properties.

8.1.1.5. Didsbury Station

Didsbury Station is located 900 m west from Terry Fox Station, in an open cut section. A station house located on the east side of Didsbury Road would provide access from street level to the LRT platforms. A curbside PPUDO will be provided to accommodate local demand, with primary means of access to be walking and cycling.

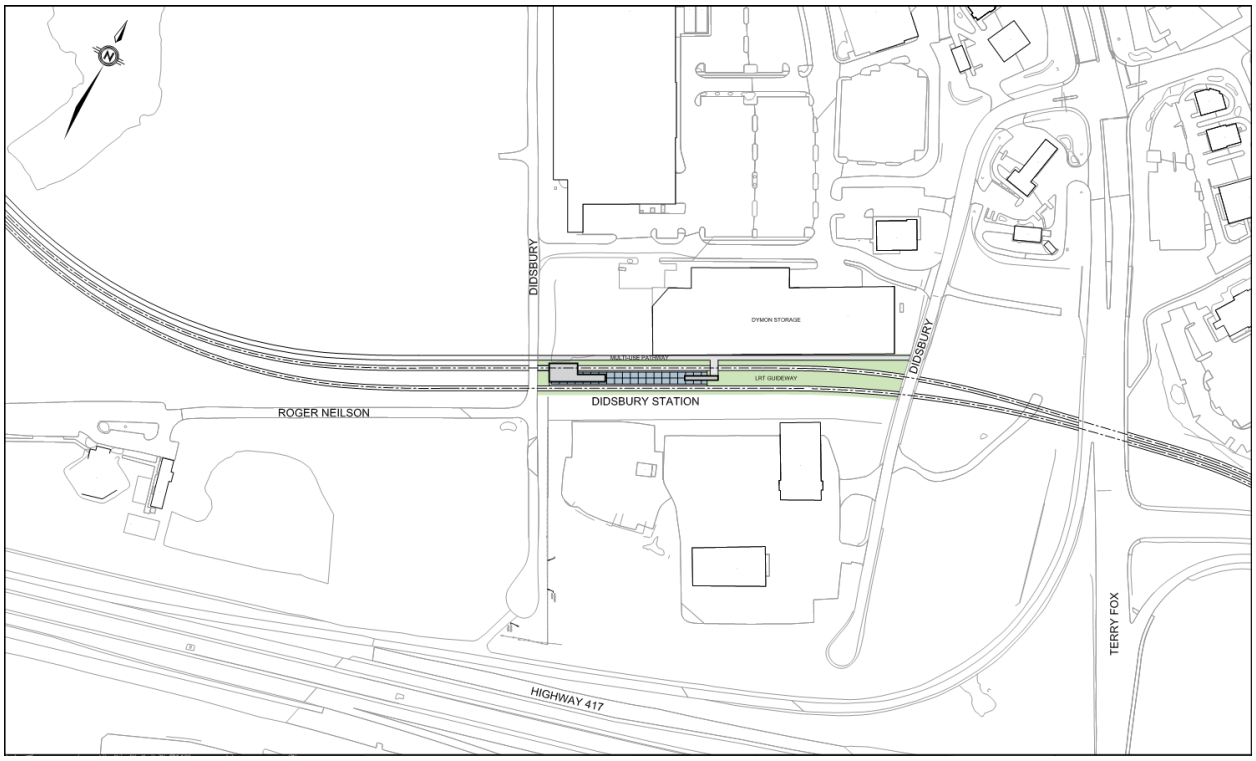


Figure 8-5: Didsbury Station

West of Didsbury Station, the LRT alignment will follow the previously approved BRT corridor and curve north, away from Highway 417 before crossing over the Carp River. West of the Carp River the LRT alignment will remain elevated, likely on a long viaduct structure to allow for road and pathway access underneath. The previous BRT plan had one at-grade roadway crossing located in this area, which will need to be eliminated to accommodate LRT. The LRT alignment through this area has been modified slightly from the previous BRT alignment to address property impacts. The new alignment will be further south and be located adjacent to the Feedmill Creek corridor, largely outside the floodplain and regulatory limits except where it crosses Feedmill Creek. Further work will be required to determine future limits of the creek zone and how the LRT, creek and adjacent development will interact.

8.1.1.6. Campeau Station

Campeau Station is located 1 km west from Didsbury Station where the future Riverchase Drive extension will be built extending south from Campeau Drive to serve development lands north and south of Feedmill Creek. The station will be on an elevated structure with access from street level. An informal PPUDO facility will be provided on-street along Riverchase Drive, with on-street bus stops provided if future local transit service is operated on Riverchase Drive. A mid-block pedestrian/cycling crossing will be constructed in the vicinity of the station to allow the parallel MUP to cross Riverchase Drive and provide access to the PPUDO and potential bus stops on the east side of the roadway. Integration of Campeau Station with adjacent development to the north will be considered further based on timing of both the LRT and future development.

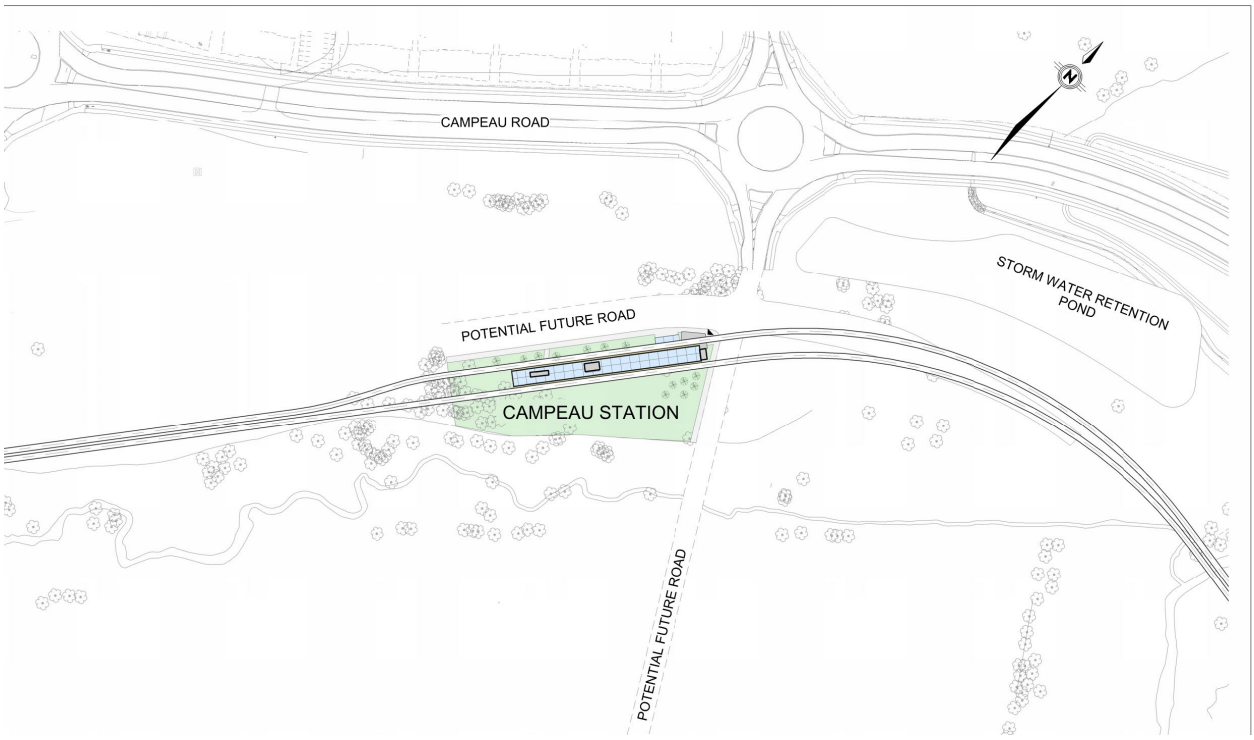


Figure 8-6: Campeau Station

West from Campeau Station the LRT alignment will parallel Feedmill Creek on its north side before curving south and crossing over the creek and then Highway 417 to enter Palladium Station. The LRT alignment will remain elevated through this corridor segment.

8.1.1.7. Palladium Station

Palladium Station is located 1 km west from Campeau Station, on the west side of the existing Canadian Tire Centre, between Cyclone Taylor Drive and Palladium Drive. The station will be elevated, with sufficient clearance to provide for an elevated pedestrian walkway extending from the west side of the CTC at the 2nd floor elevation. This station location and configuration was previously developed as part of the BRT EA. Modifications required as part of the LRT project include a new local bus terminal, PPUDO and park and ride lot with approximately 250 located on the west side of Huntmar Drive (accessed via an overhead walkway over Huntmar). Additional park and ride spaces may be provided on the existing CTC site (relocation of existing park and ride) dependent on ridership demand and future redevelopment of the CTC.

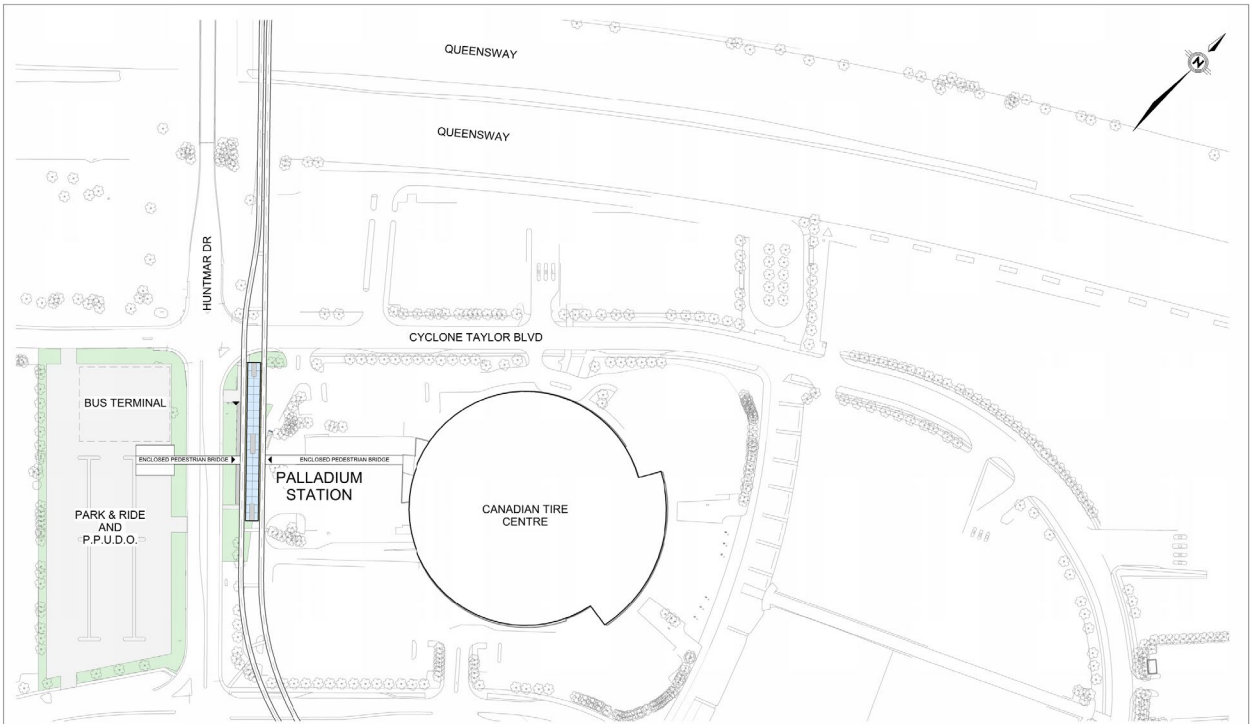


Figure 8-7: Palladium Station

South of Palladium Station, the LRT alignment remains elevated, crosses over Palladium Drive and then curves to the east running over lands currently used for parking. The previously approved BRT corridor has been modified south of Palladium Drive to reduce impact to adjacent landowners and allow for sufficient lot depth from Palladium Drive to permit future development. At a point between Palladium and Maple Grove the future North-South Arterial and rapid transit corridors will join together and continue south towards Maple Grove Road. The LRT alignment will be largely elevated, returning to grade for a short section before rising up again to enter Maple Grove Station and pass over Maple Grove Road.

8.1.1.8. Maple Grove Station

Maple Grove Station is located 1200 m south of Palladium Station, on the north side of Maple Grove Road and west side of the intersection with the future North-South Arterial. The LRT platforms will be elevated above street level. A station house will be located at street level with stairs and elevators providing access between the street and the LRT platforms. Local bus connections and PPUDO activity will be accommodated on-street, east of the North-South/Maple Grove intersection.

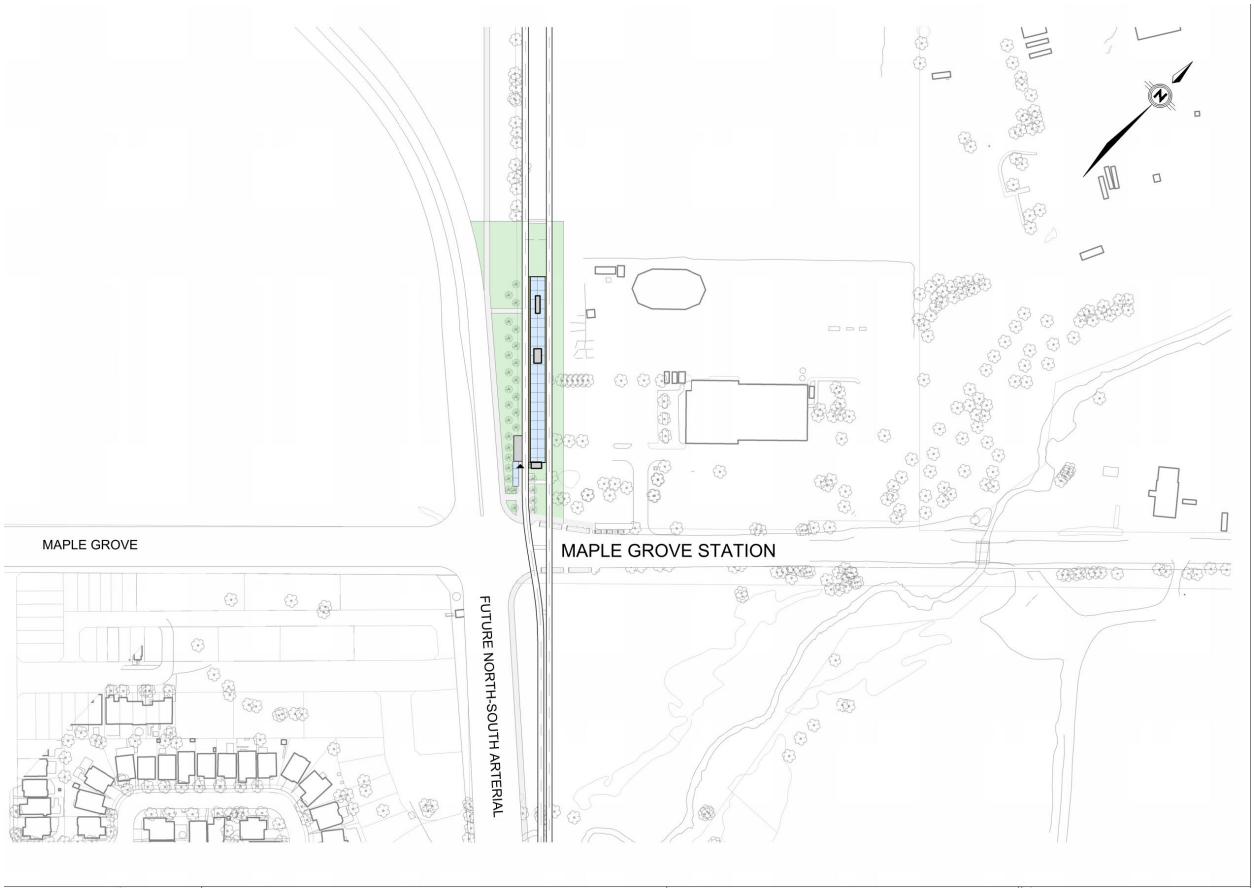


Figure 8-8: Maple Grove Station

South of Maple Grove Station the LRT alignment will remain elevated to cross over Poole Creek. South of Poole Creek the alignment will continue elevated on the east side of the future North-South Arterial and continue to Hazeldean Station.

8.1.1.9. Hazeldean Station

Hazeldean Station is located 1 km south from Maple Grove Station and will be an elevated station spanning over Hazeldean Road, per the configuration proposed in the previous BRT EA. Two park and ride lots were identified as part of the BRT EA at this station location, providing approximately 650 spaces. Modifications proposed as part of the LRT EA include repurposing the south Park and Ride lot to accommodate a local bus terminal, which will serve buses connecting between the LRT terminus and Stittsville as well as the Fernbank community via the proposed at-grade median busway which will continue south along the future North-South Arterial. The south park and ride lot will be expanded to maintain the previously identified number of park and ride spaces at this location.

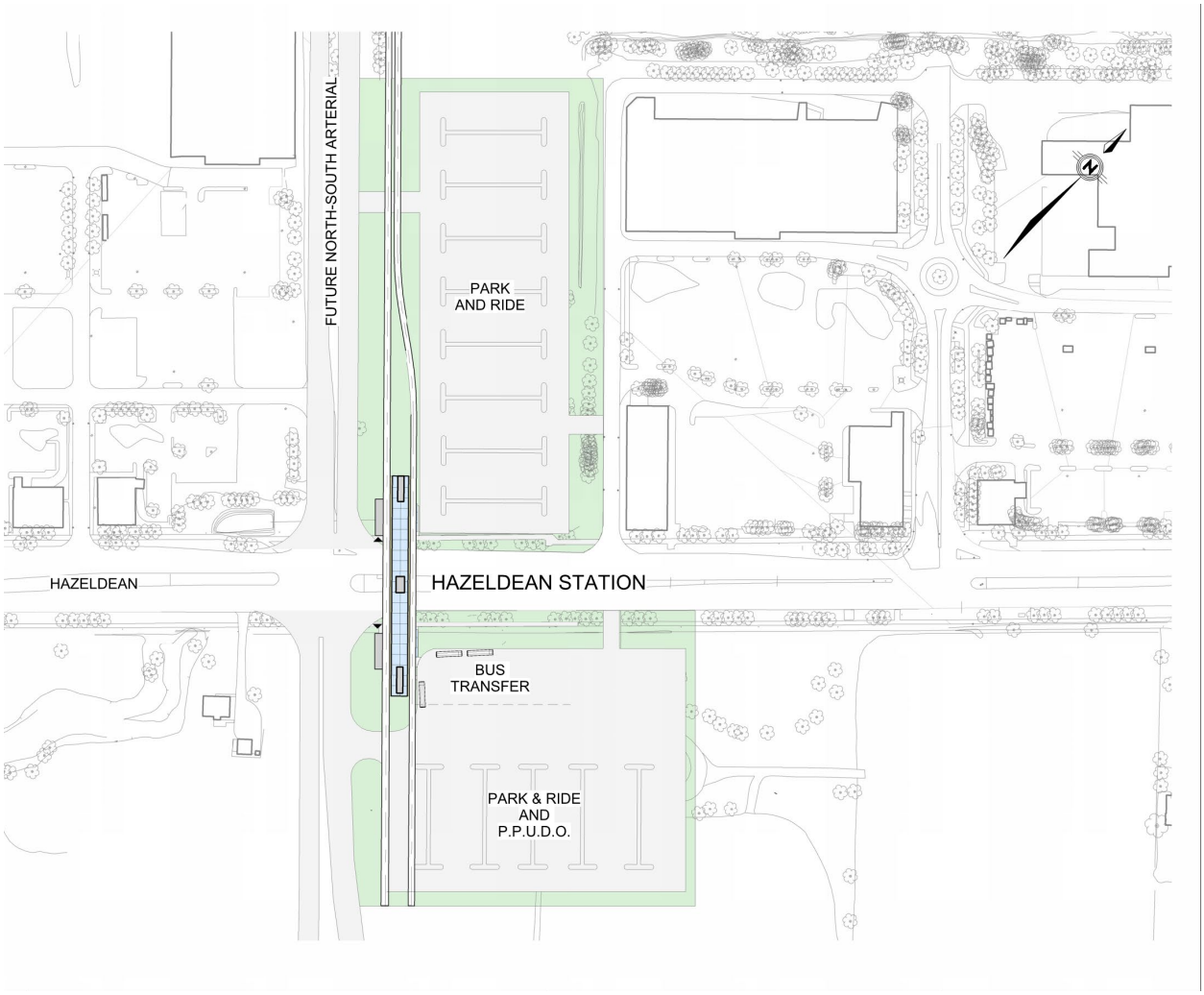


Figure 8-9: Hazeldean Station

8.1.2. SPECIAL TRACKWORK

Special trackwork is required along the LRT alignment to support reliable train operations under both regular and degraded operating conditions. Special trackwork facilities and locations were determined based on conceptual LRT operational requirements and will be further refined during detailed design of the project. Initial special trackwork facilities identified include:

- An additional crossover and realigned switches located in the vicinity of the Moodie LMSF to permit access to the LMSF from the west and allow for train reversal within the LMSF without fouling the mainline tracks;
- Crossover tracks located at Terry Fox, Palladium and Hazeldean Stations to permit turnback operations and single track working at reduced train frequencies; and,
- Tailtracks located at Hazeldean Station to allow for temporary storage of trains (1 per track) during off-peak hours or in the event a disabled train needs to be removed from service.

8.1.3. TRACTION POWER SUBSTATIONS

A dedicated dual redundant electrical supply is required to provide power to the trains that will run along the line, as well as for the operation of station facilities, communications and safety equipment and lighting. The connections between the Hydro Ottawa power distribution grid and the LRT system occur at regularly spaced electrical substations (referred to as traction power substations - TPSS). These substations house the electrical machinery (transformer/rectifiers, switches and circuit panels) needed to convert high voltage AC power supplies from the main electrical grid in support operation of the LRT system. They are housed in single story buildings sized approximately 60 m^2 and require service vehicle access. Substations will be provided at-grade, and must be located in close proximity to the LRT line.

To meet power requirements, multiple TPSS are required along the line to distribute power in an efficient manner. The Confederation Line uses 1500 V DC power to power the trains. A maximum spacing of 1.5 km to 2.0 km between electric substations is estimated. Based on the recommended plan, six TPSS are likely to be required as follows:

- 2.0 km west of Moodie Station (access via Corkstown Road);
- March Station;
- Terry Fox Station;
- West of Didsbury Station (access from Roger Neilson Way)
- Palladium Station; and
- Hazeldean Station

The final location and configuration of electrical substations will be determined during subsequent phases of design and in collaboration with staff from Hydro One and Hydro Ottawa. Wherever possible, the co-location of substations with station facilities will be pursued.

8.1.4. LIFE SAFETY

Provision of life safety features and systems will be governed predominately by standards developed through implementation of Stages 1 and 2 of Ottawa's LRT network, which reflect those developed by the National Fire Protection Association (NFPA). This includes fire detection and voice alarm systems, smoke control and ventilation systems, communications systems, firefighting equipment and fire fighters facilities, emergency lighting, and construction materials. NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems (NFPA 130) provides fire and life safety requirements for passenger railway stations and guideways. Detailed requirements of these systems will be investigated at the preliminary design stage of the project. Below is an overview of the major elements to be provided.

8.1.4.1. Emergency Access and Egress

Each LRT station will have two separate and independent means of egress from the platform to permit evacuation of passengers during emergency events. These may be configured as regular access routes or emergency-only routes.

A walkway will be provided along the LRT alignment to allow for passenger egress along the line in the event of an emergency. This walkway will also allow maintenance workers to access the corridor without obstructing normal LRT operations. The ballast serves as the walkway away from structures along at-grade runningway segments, while in stations and other structures, the walkway surface will be of a uniform, slip resistant design and constructed of non-combustible materials.

8.1.4.2. Communications

A centralized Operation Control Centre (OCC) will already be in place at the time of Kanata LRT extension implementation to support operation of the Confederation Line opening in 2019. The OCC will communicate with, supervise, and co-ordinate all personnel and trains operating on the system during normal operations and be responsible for incident management in co-operation with Emergency Services personnel. Communications points will be provided on all trains and at multiple points within stations to allow passengers to contact operating staff in the event of an emergency. Emergency operating plans and contingencies will be developed as part of implementation of the system.

8.1.5. STATION ELEMENTS

8.1.5.1. Location and Spacing

There will be eight new LRT stations included as part of the Kanata LRT project.

- March (with MUP overpass to existing Eagleson Park and Ride)
- Kanata Town Centre
- Terry Fox (with reconstruction/repurposing of existing bus station facilities)
- Didsbury
- Campeau
- Palladium
- Maple Grove
- Hazeldean

Station designs will have a common look and feel to those being built for the Confederation Line, including:

- Provide for safe, efficient and accessible access to rapid transit;
- Have convenient pedestrian and cycling connections to and from surrounding communities;
- Integrate with the character of existing residential and green space areas.
- Fulfill AODA, Building Code and City of Ottawa Accessibility design standards including the implementation of redundant accessibility

8.1.5.2. Entrances

Station entrances will be located to provide efficient access to stations from surrounding communities and streets. Access from a public right-of-way and through public lands and green spaces will be provided, with additional access through existing or future private lands or developments considered to improve integration of LRT with the community.

Accessibility

All stations will be fully accessible and designed to meet universal access requirements, including elevator redundancy (meaning a suitable alternate to be used the event of an elevator breakdown, such as a second elevator or a suitable ramp structure All stations will be designed to accommodate redundant accessibility.

Concourse

In multi-level stations, a concourse level may be provided to assist in wayfinding and internal circulation. Given the need to protect a fare-paid zone within the station, concourse level permits circulation within the station, particularly where side platforms are provided, to permit passengers to cross from one platform to the other within the fare paid area.

LRT Platform

At each station platform facilities will be provided for passengers to board or alight from the trains. There are two possible configurations; side platforms or centre platform. Each site has been evaluated to determine which configuration provides the best passenger service with minimal impacts to track geometry, existing and future structures, utilities, connectivity and property.

The platforms will provide a common set of passenger amenities including waiting areas, seating, sheltered areas for weather protection, passenger information (including signage and next train arrival messages), passenger security features (including designated waiting areas) and vertical circulation to concourse or station entry buildings.

Ultimate length 120 m long platforms will be protected for, consistent with the current Confederation Line stations. Initial platform lengths may be shorter (90 or 100 m) depending on train consist size at opening day.

Multi-modal Connections

Station Connectivity to surrounding communities is a key consideration in project planning:

- The main priority for station access is pedestrian and cycling activity,
- New/improved links to be identified, and
- Parallel pathway facilities to be provided via a combination of existing and new linkages.

Bicycle Facilities

Bicycle parking will be provided at all station locations. The number of spaces will be determined through detailed design and stakeholder input however space has been reserved at each station to provide the facilities. The City will review the need for bike-share at stations but the provision of bike-share will depend on availability of services and negotiations with City and service providers.

Bus Connections

Bus connection activity will occur at most stations. Off-street bus terminals are provided at major stations, where large volumes of passengers will be transferring and local services begin/end. In busier transfer stations, specifically the terminus stations, a fare paid area can be provided for multimodal connections to be made with ease. Where transfer volumes are low or where local services continue past the station (rather than terminating) on-street bus stops outside the fare paid area may be used. OC Transpo have provided preliminary ideas for the modification of area bus routes once the LRT is operational, and the locations and scale of bus connection facilities will match OC Transpo needs and the community context.

Passenger Pick-up and Drop-off

Passenger pick-up and drop-off exists in a formal or informal way at the majority of Transitway stations, and is being planned for as part of the Kanata LRT Extension. Formal facilities will be provided at major stations to serve broader needs, with off-street facilities proposed where space is available. Informal, limited facilities will be available at other stations to serve more local needs and to spread activity and limit scale at any one location. These facilities may include designated curb space on adjacent streets in the vicinity of an LRT station.

Life Safety Features

Providing a safe and secure system for passengers and others in the station areas is important. Stations have been designed using the CPTED (Crime Prevention through Environmental Design) guidelines, which encourage designers to create spaces that are naturally safe, free of blind corners, dead ends or areas where people can congregate without being seen. Stations should also provide for long sightlines so passengers can see their next destination and see if there are others on the route or at that destination. In addition to the physical layout of the station, they will be equipped with features to assist persons in the event of emergency, including CCTV, communications, designated waiting areas and public telephones. Live connections to transit control staff will also be provided in the fare collection zone so that passengers experiencing difficulties with accessing the line can communicate with OC Transpo staff.

Fare Collection

Fare collection standards and typical equipment have been developed as part of the Confederation Line project by OC Transpo. Stations will be designed to accommodate fare collection equipment (barriers, ticket vending machines, and help point). Stations will be unstaffed, with customer assistance provided remotely.

Community Integration

Stations function best when they are integrated in their adjacent communities. Stations should connect to local streets, pathways and sidewalks and entrances should be constructed in a way to help passengers orient themselves. Station facilities will be sized to meet the passenger needs and to be compatible with other buildings in the area. Lower volume community stations will be smaller than high volume stations with large bus transfer facilities.

Public Art

Public art is an important component of the project and will be accommodated within station and runningway elements of the system. The City of Ottawa has policy requiring that an amount equal to 1% of an infrastructure project's hard costs be dedicated to the provision of public art. An allowance has therefore been included in project costing for public art. In addition to the provision of stand-alone pieces of artwork throughout the system, public art will be integrated into the architectural elements of stations and runningways.

8.1.6. RUNNINGWAY ELEMENTS

The LRT runningway will consist of new at-grade, elevated and below-grade segments.

Track

In at-grade segments, track will generally be laid on ties and ballast. In below-grade and elevated segments, track will be directly fixed to the concrete deck. Where vibration control is required, measures such as ballast mats and resilient track fasteners will be used.

Service/Emergency Access

Access points to allow service or emergency vehicles to gain access to the LRT corridor will be provided at key points along the LRT corridor. A walkway will be provided within the LRT alignment to allow evacuation of passengers in an emergency and to allow maintenance workers to access the corridor without disruption to normal operations.

Overhead Power Supply

LRT trains will run on electrical power, delivered along the line from electrical substations via overhead wires commonly referred to as an Overhead Catenary System (OCS). LRVs obtain power from the OCS by means of a device called a pantograph, attached to the roof of the LRV.

The OCS will be mounted on support poles located between or to the side of the tracks. Exact location of support poles will be determined during detailed design of the alignment.

8.1.7. TRANSIT OPERATIONS

LRT service will operate as an extension of the Confederation Line. The design of the line will support frequent operation of trains. In practice, the splitting of service at Lincoln Fields between trains for Kanata and Baseline will limit service frequency on each branch, generally to half of the combined level of service which can be provided east of Lincoln Fields (e.g. 3 minute peak service on the combined section of line will result in 6 minute service on each branch). Given that the core of the line through downtown is designed to permit ultimate train operation as frequent as every 1 minute and 45 seconds, train frequencies as high as 3.5 minutes could be operated on each branch. This would result in a line capacity of 12,000 persons per hour per direction (pphpd) for the Kanata LRT, which is more than sufficient to meet anticipated demand beyond the City's 2031 TMP horizon year. The design of Lincoln Fields Station, being constructed as part of the City's Stage 2 LRT project will provide a third track and platform, enabling a shuttle or overlapping service to be operated when required (e.g. during times of low train frequency, to maintain a minimum level of service across the network). Train frequencies in off-peaks and weekends on the Kanata LRT extension will range from 10-15 minutes. Cross-over tracks will be provided at key locations along the line to permit turnback of trains or single track working during maintenance periods. A tailtrack at Hazeldean Station will allow for temporary storage of trains during off-peak hours or in case of a train failure.

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8.1.8. LIGHT MAINTENANCE AND STORAGE FACILITY

As outlined in Section 6.0, the preferred LMSF solution to support operation of the Kanata LRT Extension the Moodie LMSF site, which will be constructed as part of the Stage 2 LRT project. It should be noted that the Environmental Project Report for the Confederation Line West LRT Extension (Bayshore to Moodie) EA Study, including the LMSF, received approval from the MECP in February 2018. This approved project includes the ultimate LMSF footprint needed to support operation of the Kanata LRT Extension and increased fleet requirements for the Confederation Line LRT as a whole.

8.2. PROJECT SCOPE

The following sections present details regarding the specifics of the project components and are provided solely for illustrative purposes. This project description constitutes a final decision, as approved by the Ottawa City Council on May 9, 2018 at this point in functional design.

8.2.1. OVERVIEW

The project will involve the following major construction and operation components:

- At-grade LRT segments;
- Elevated LRT segments;
- Below-grade LRT segments;
- Road, rail and water crossings;
- Eight LRT stations (March, Kanata Town Centre, Terry Fox, Didsbury, Campeau, Palladium, Maple Grove and Hazeldean Stations);
- Six TPSSs; and,
- Expansion of the Moodie Drive Light Maintenance and storage facility.

Ancillary works include the construction of special trackwork (pocket tracks, crossovers) and traction power substations (TPSS). The locations of TPSSs are tentative at this time and will be finalized as part of detailed project design.

Table 8-1 summarizes the scope of the project including project phases and anticipated project components to complete the works. A more detailed description of the associated activities and physical works are provided below.

Table 8-1: Scope of the Project Including Project Phases and Descriptions

Project Phase/ Components	Description
Pre-Construction and Preparation	
Prior to the start of construction, more detailed planning and design needs to be completed to advance the project. Detailed Geotechnical, Hydrogeological, Archaeological and Built Heritage, Architectural, Air Quality, Noise and Vibration, and Ecological Investigations will be completed to further determine existing conditions for the study area including the area immediately surrounding the alignment. Geotechnical investigations will confirm construction methods to be used. Preliminary and detailed engineering design of the entire project, including design review, peer review and Value Engineering studies will be completed to obtain permits and approvals from federal, provincial and other agencies. Property acquisition including temporary and permanent project needs for station facilities and alignment as well as below-grade easements will be undertaken.	
Site Preparation	Works will include utility and infrastructure relocations (watermain, storm and sanitary sewers). Implementation of mitigation measures as required including the identification and protection of existing conditions which are to remain (vegetation, buildings, pavement, utility lines etc.). Clearing and grubbing trees and vegetation within the grading limits for the construction project. Site preparation activities will occur throughout the project area and occur prior to the commencement of demolition or heavy construction activity. All activities will be subject to required construction management plans, which will be completed prior to the commencement of any project activity. Sanitary and storm sewer replacements are standard procedure for the City of Ottawa, and as such will adhere to stormwater best management practices, set by the Ontario Ministry of Environment.
Removal/modification of existing infrastructure	Construction of the project includes the conversion of approximately 9 km of existing Transitway from BRT to LRT technology. Demolition and modification of existing infrastructure to support implementation of the new LRT system is therefore spread throughout the project area. Where existing grade and alignment do not need to be altered, it is proposed that tracks for the LRT be laid over top of the existing pavement on a layer of ballast. Existing roadway and sidewalk pavements obstructing the construction of the guideway elements will be removed as part of pre-construction activities. Equipment and methods of removal and hauling that will protect underlying pavement or existing pavement that is not designated for removal will be used. Obstructions encountered in the construction of the guideway elements that could hinder the installation or construction of the guideway will be removed. Obstructions may include but are not limited to pipes, conduits, ductbanks, foundations, debris, poles and other similar objects. Existing catch basins could be re-used as existing drainage would remain the same, with screens placed over the catch basin lids to prevent ballast from washing away. Changes to existing drainage would be required where existing Transitway elevation requires modification (e.g. to increase overhead clearances at structures). At Transitway stations which will be remaining largely in their current configuration, existing platforms will be lengthened and widened, with the LRT tracks placed in the centre by-pass lanes. Tracks will be fixed to a concrete slab through the station areas

	to assist with maintenance. Station elevators and amenities will be upgraded. Existing station canopies and shelters will be removed and replaced with new platform canopies. All materials (including any hazardous materials) removed will be disposed of in accordance with City Standards and OPSS. Any materials stored on-site will have precautions undertaken to prevent adverse effects on adjacent watercourse, groundwater, and migration of materials off-site or allow the development of nuisance conditions.
Temporary Structures	Temporary structures necessary for the completion of project works include construction roads and site accesses; on-site treatment or off-site disposal of contaminated soils and water if required; a water management pump station for dewatering activities if required; and construction staging areas. The contractor will be responsible for the installation, maintenance, and removal of any temporary facilities necessary to access individual work sites, including but not limited to fences, gates, construction, granular, silt fences and traffic control devices.
Construction	
Complete removal or demolition	Specific elements of the existing Transitway and other infrastructure along the new portions of the route will need to be removed. This will include roadway and sidewalk pavements, signs, lighting and traffic signal controls in some areas. Existing station infrastructure will be removed at existing stations such as Terry Fox. Some existing utilities will be affected, but not all elements will be completely removed as the typical procedure is to cut, cap and fill unused sewer pipes. The contractor will be responsible for the demolition and removal of the infrastructure elements in full compliance with all applicable standards and procedures. Construction management and material handling plans will be required. Where hazardous materials are suspected, appropriate plans to contain the hazard and prevent public exposure will be implemented.
Construction of new LRT Below-grade segments and stations	Several portions of the corridor will be placed below grade, through March Station and from west of Terry Fox Station to west of Didsbury Station. Given the local ground conditions and the preference for a shallow tunnel system, the work will be done with either open cut or cut and cover techniques. Functionality of existing roadways impacted by cut and cover will be maintained during construction using temporary decking, typically consisting of timber decking or precast concrete panels, supported by the excavation shoring system. The trenched segment through Didsbury Station is an example of open cut, with the station remaining open air. Existing pedestrian connections in the areas using cut and cover techniques will be maintained throughout the construction period. In this construction technique a steel frame and timber decking is placed over the excavation (once it is deep enough) to allow traffic to return to the street while work continues underneath. This will be documented in the contractors Traffic Management Plan. There will be some lane restriction in place when the construction is active to remove excavated material and bring in construction materials. The use of a tunnelling

	machine or a road header is not expected based on the length of proposed excavation and soil conditions in the study area.
Construction of new at-grade LRT segments and stations.	At-grade sections will employ typical track on tie and ballast, with sub-grade to provide drainage. At At-grade stations, platforms and station facilities (entrance buildings, stairs, escalators and elevators) will be constructed. Fully enclosed platform canopies spanning over the platforms and tracks will be provided.
Construction of above-grade LRT segments and stations	Elevated LRT components will be constructed in such a way as to minimize community disruption including requirements that the contractor comply with all applicable standards and procedures. The work will be sequenced and timed to minimize impacts on the transit network, cycling routes, pedestrian pathways, and adjacent local roads and access. Elevated LRT segments will be constructed from the Carp River to Hazeldean Station. Based on soil conditions and desire to minimize property requirements, elevated LRT segments will generally be constructed using a viaduct system rather than embankments. Elevated stations will include at-grade station facilities (entrance buildings, service rooms) with stairs, escalators and elevators providing vertical circulation between the station entrance and elevated platform at track level. Fully enclosed platform canopies spanning over the platforms and tracks will be provided.
Expansion of Moodie LMSF	Site excavation and grading, drainage, installation of overhead electrical supply, track laying, construction of maintenance and storage structures/buildings, associated road access and parking lot, installation of security features, lighting and communication systems, transportation and storage of construction materials and equipment, installation of landscaping elements
Associated Infrastructure	Trenching for installation or relocation of storm sewers, water mains, and other buried services and utilities such as intersection hardware.
Other works	Pouring concrete for curbs, pathway connections and medians. Laying of granular and application of hot mix asphalt, and the installation of lighting and traffic signals. There will also be clearing and grubbing of vegetation in some areas, and restorative planting, sodding, and general landscaping activities.
Ancillary Works	Ancillary works include the construction of special trackwork (pocket tracks, crossovers) and TPSS. The following areas have been identified for TPSS: • Between Moodie and March Station • In the vicinity of March Station • In the vicinity of Terry Fox Station • In the vicinity of Didsbury Station • Palladium Station • Hazeldean Station TPSS may be integrated into proposed station buildings or be provided as stand-alone structures along the LRT alignment. Each TPSS will require approximately 60 m^2 of floor area. Facilities provided as part of each TPSS consists primarily of electrical switching equipment used to convert high voltage power from the Hydro Ottawa distribution grid, to medium voltage power used to supply the LRT vehicles via the Overhead Catenary System.

Site clean-up and restoration	Final grading and top soil application Installing remaining landscape features such as sodding or hydra-seeding, public art installations, tree and shrub plantings and street furniture (if any).
Operation and Maintenance	
Provision of Light Rail Transit service	Scheduled operation of the Kanata LRT Extension - providing regular, high level of service to users.
Maintenance of Stations	Regular and as needed building maintenance and rehabilitation as needed. Winter maintenance will include snow clearance and salting/sanding pedestrian areas. Maintenance to ensure public safety (changing of lights, security checkups).
Maintenance of Way	Maintenance of rails, LRT infrastructure along alignment, and maintenance of overhead electrical system. Storm drainage system repairs, drainage structure maintenance/clean-out.
Maintenance of Major Structures	Infrastructure maintenance/rehabilitation on an as needed and scheduled basis.
Light Maintenance Facility	Routine vehicle cleaning and light maintenance.
Decommissioning / Abandonment	
Decommissioning is not applicable to the proposed project given that the facility is part of the City's long-term transportation vision and is considered permanent within the plan horizon. However, decommissioning of any project component, if required will be undertaken in accordance with the environmental impact policies and legislation in effect at that time.	

8.2.2. CONSTRUCTION

Primary tasks associated with construction of the project have been identified in the table above. The varying conditions along the corridor will require that several different construction methods be used to complete the project. Construction of the Kanata LRT Extension is likely to follow the same process as the current Confederation Line, with a private sector partner responsible for the final design, construction, and maintenance of the project, with OC Transpo operating the service. The contractor selected by the City will be responsible for developing construction plans and designs which meet contractual requirements, which includes defining the means and methods of construction.

Traffic and Transit Diversions during Construction

During construction of the LRT system, traffic diversions will need to be implemented to permit construction work to occur on various project elements. The duration and extent of traffic diversions will vary from location to location and include lane closures and temporary detours. Complete closure of existing roadways or transit facilities is not anticipated based on the current level of design.

During the detailed design phase the final detour plans will be closely coordinated with construction staging. Routes for any diversions will be determined in consultation with the City of Ottawa and the contractor completing the works and be communicated to the public in advance of implementation (e.g. through consultation or mobility management plans).

Confederation Line Operations during Construction

The operation of the Confederation Line should not be impacted by construction of the extension, although there may be a need for some service disruption during commissioning activities, when the entire line will need to be tested to ensure integration of systems.

Site Clean-up and Restoration

The contractor will be responsible for restoring or rehabilitating any disturbed areas extending beyond the limit of the works, including but not limited to: paving, planting or sodding. These areas will be cleaned of debris and have any temporary paving or structures removed and replaced with planting soil in accordance with the detailed design and project specifications.

8.2.3. OPERATION

Light Rail Operation

Activities associated with the operation of the Kanata LRT include general operation of trains along the alignment which will occur in accordance with the operating standard developed and agreed to between the City and contractor selected to maintain the LRT system. Operations will generally be from early morning to late evening, 365 days a year. Service levels will vary through the day to reflect demand, with more trains during weekday peak hours and fewer during weekday off-peak and weekends.

A detailed operating plan will be developed prior to opening of the line for revenue service and adjusted as ridership patterns develop and establish themselves. Operating plans will address LRT operations under a variety of different scenarios (normal, emergency, special events) and will be consistent with those developed for the Confederation Line.

Bus Operation

The Kanata LRT Extension will be fully integrated with the City's existing transit network. Existing bus routes which currently operate on Highway 417 will be displaced by the new LRT. These routes will need to be truncated at the terminal stations of the LRT, reorganized to better serve the local communities around stations and reallocated to improve service outside of the LRT corridor.

While the final bus route configuration cannot be planned in detail at this time, as the exact arrangement of routes and service frequencies are dependent on the level and types of services being operated when the system opens, preliminary planning at each station has identified the need for bus connection facilities. Each of the stations has sufficient space to meet the likely demand for connecting bus routes.

Near the end of the construction period, OC Transpo, as part of on-going service planning processes, will finalize the BRT and local bus routings to provide connections with the new LRT line, reflect the new operating philosophy, respond to ridership growth and changes in ridership patterns and meet the operating budget requirements in place at the time. After construction ends and the LRT is in service changes to the bus network will be part of OC Transpo's annual service planning process.

8.2.4. PROPERTY REQUIREMENTS

The Kanata LRT requires 20 hectares of additional property throughout the corridor, consisting of public and private landowners primarily on vacant and unoccupied land. Existing buildings and residential homes are unaffected. Stakeholder consultations were held with property owners whose lands are significantly impacted by this project.

Hydro Ottawa and/or other utilities will require land rights that are not included in the proposed area requirements.

8.3. STAGING AND IMPLEMENTATION

Based on ridership projections from the City's Regional Transportation Model, and projected cost estimates developed for the project it is anticipated that the Kanata LRT Extension will be implemented in three major phases. This will largely be dependent on funding availability and will be revisited at the time of project implementation.

1. Moodie Station – Terry Fox Station. This 6 km segment is largely at-grade and provides improved rapid transit service along the corridor with highest projected 2031 transit ridership and links the designated growth area of Kanata Town Centre to Ottawa's LRT system. Stations at March, Kanata Town Centre and Terry Fox would be constructed as part of this phase. The existing bus terminal and Park and Ride at Terry Fox Station will serve this interim LRT terminus, with BRT and local transit routes connecting here to serve Kanata until the LRT is extended further. This phase provides connections to the proposed Kanata North BRT, as well Park and Ride lots at March and Terry Fox Stations. The existing retail uses around Terry Fox Station represent significant opportunity for transit-oriented development to support ridership and meet City objectives with respect to land use planning.
2. Terry Fox Station – Palladium Station. This 3 km segment is largely elevated, with a 1 km open cut section between Terry Fox and Didsbury Station. Stations at Didsbury, Campeau and Palladium would be built as part of this phase, with an expanded Park and Ride and new bus terminal constructed at Palladium Station to serve this interim terminus. Stations at Didsbury and Campeau will serve existing and potential development lands located at west of Terry Fox Drive and north of Highway 417, while Palladium Station will serve the Canadian Tire Centre and/or redevelopment of lands in that area.
3. Palladium Station – Hazeldean Station. This 2 km segment is largely elevated as well, with some short at-grade sections. This final phase of the Kanata LRT Extension brings rapid transit closer to the Stittsville and Fernbank communities and provides a connection to the proposed Fernbank BRT which will run in the median of the future North-South Arterial. A new bus terminal and Park and Ride facility would serve this ultimate LRT terminus.

8.4. PROJECT COSTS

Detailed costing of the project has been carried out based on the Recommended Plan. Costing information includes an estimate for property acquisition, design, project management, construction, vehicles, and contingency. Experience during the Confederation Line preliminary engineering and procurement process has also shown that, in the case of large scale infrastructure projects, it is beneficial to avoid breaking down the cost estimate to its various components (runningway, guideway, track tunnel, etc), including the contingency. By keeping the project costs whole, the City will be in a better position to drive competitive tension through the preliminary engineering and procurement phases.

Even though the Kanata LRT is beyond the City's 2031 Affordable Rapid Transit Network, the study examined how the project could be implemented in sections if and when funding is available. The proposed staging priority is based on ridership and capital cost. Cost for design, construction, property, public art, and contingencies in 2017 dollars (Class C estimate) is summarized according to the proposed implementation and staging plan below.

Table 8-2: Kanata LRT Extension Estimated Capital Cost

Staging Priority	Capital Cost
1. Moodie Station to Terry Fox Station	$710 M
2. Terry Fox Station to Palladium Station	$640 M
3. Palladium Station to Hazeldean Station	$500 M
Total Project Cost	**$1.85 B**

Consistent with the Confederation Line project, and subject to the procurement model selected, an affordability cap will be set during procurement to drive the project teams to maximize competitive tension and use flexibility and innovation to maximum value at lowest cost.

8.5. CONSULTATION ON THE RECOMMENDED PLAN

The study is being undertaken in accordance with the transit project assessment process (TPAP) as prescribed in Ontario Regulation 231/08, Transit Projects. The complete consultation program is documented in Section 2 of this TPAP Report, with a summary of the consultation related to the Recommended Plan included here for reference. For meeting notes and consultation summary reports, please consult **Appendix A**.

8.5.1. CONSULTATION GROUP MEETINGS

Study Consultation Group meetings were held on November 21 and November 23, 2017 to review the Recommended Plan. A formal presentation was given outlining the work done to date, including the additional evaluation of corridors, finalizing the preferred corridor, the evaluation of preliminary designs along the preferred corridor and Light Maintenance and Storage Facility sites, and the preliminary Recommended Plan.

The Agency Consultation Group (ACG) meeting was held between 9:30 and 11:30 at Ottawa City Hall on November 21, 2017. Twenty-five (25) members of the ACG were in attendance representing the varied interests of the City of Ottawa and other review agencies, including the National Capital Commission (NCC), Department of National Defence (DND) and the Rideau Valley Conservation Authority (RVCA).

The Business Consultation Group (BCG) meeting was held between 2:30 and 4:30 at the Beaverbrook Library on November 23, 2017. Nine (9) members of the BCG were in attendance representing the varied interests in the study area, including local land owners and the Kanata Central BIA.

The Public Consultation Group (PCG) meeting was held between 6:30 and 8:30 at the Beaverbrook Library on November 23, 2017. Two (2) members of the PCG were in attendance; a member of the Technical Advisory Committee of Kanata, and a local City Councillor.

8.5.2. PUBLIC OPEN HOUSE

A Public Open House was held on Thursday, December 7, 2017 at the Kanata Recreation Complex, Hall A, from 5:30 to 8:30 pm to provide the public the opportunity review and provide feedback on the preliminary Recommended Plan. The open house included display panels, a presentation and a question and answer session. Representatives from the study team were available to answer questions. A total of 104 people signed-in over the course of the evening.

A total of 15 Comment-Questionnaires were returned during or following the Open House. Following the consultation events, a total of 8 emails were received from the general public following the Public Open House. All comment-questionnaires and emails were examined and tabulated to record feedback received and to better understand the opinion of those who had reviewed the materials presented. The following are the most frequently discussed issues or concerns from the comment-questionnaires and emails, in order:

- Support for preliminary recommended plan (13)
- Build Kanata LRT sooner than proposed (9)
- Concern with station locations/travel time between Campeau and Palladium (3)
- Park and Ride locations/size (2)
- Accommodate future commuter rail connections (2)
- Add spur to serve Kanata North (2)
- Eagleson Station design (2)

Notification for the Public Open House included:

- Advertisements in the EMC community newspaper and in LeDroit;
- Announcement on the City web page;
- Email notification to identified First Nations representatives, as well as agency, business, and public consultation groups;
- Email notification to all those who had requested to be added to the study master mailing list; and
- Subsequently, all Open House display boards were posted to the City web pages after the event.

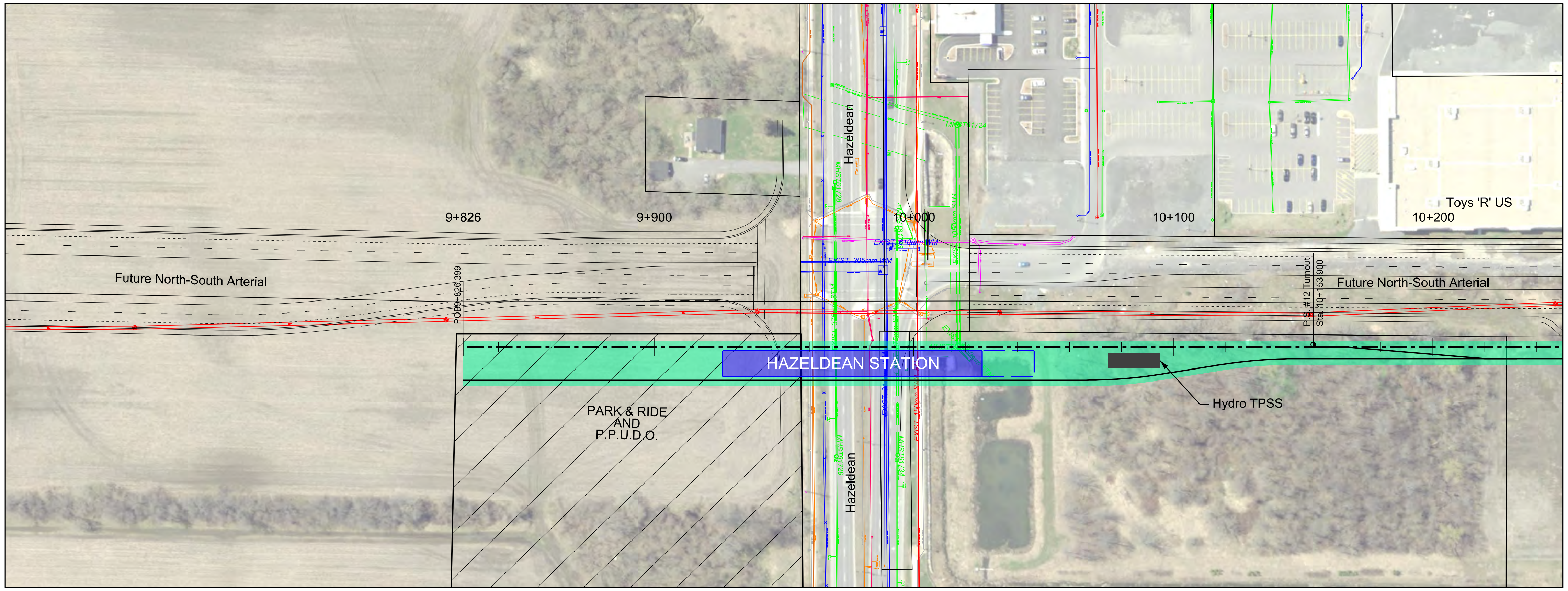
8.5.3. TRANSPORTATION COMMITTEE

On Wednesday, May 2, 2018 City of Ottawa Transportation Committee recommended that City Council approve the Recommended Plan, and direct staff to commence and file the Environmental Assessment process and documentation based on the functional design and file the respective Environmental Study Reports in accordance with the Ontario Transit Regulation 231/08. This recommendation was made unanimously.

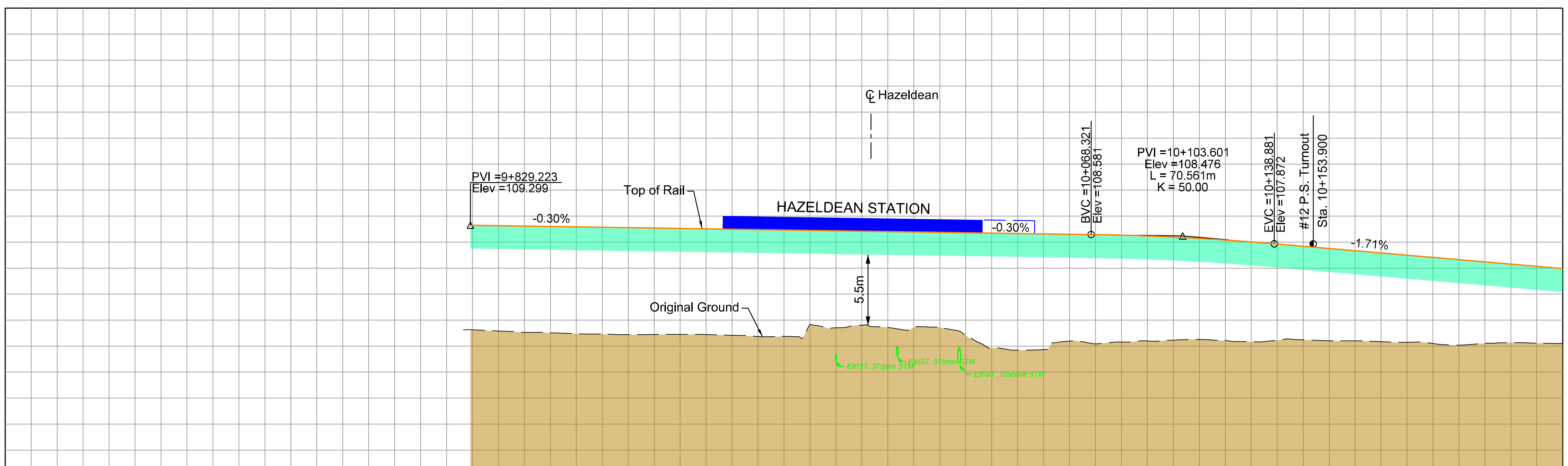
8.5.4. OTTAWA CITY COUNCIL

On Wednesday, May 9, 2018 Ottawa City Council unanimously approved the Recommended Plan, and directed staff to commence and file the Environmental Assessment process and documentation based on the functional design and file the respective Environmental Study Reports in accordance with the Ontario Transit Regulation 231/08.

8.6. RECOMMENDED PLAN DRAWINGS



Note:
Pathways are conceptual and are subject to change.



Station	Original Ground	Top of Rail
9+820		
	101.16	109.27
	101.03	109.21
	100.92	109.15
9+900	100.89	109.09
	100.90	109.03
	100.74	108.97
	101.68	108.91
	101.61	108.85
10+000	101.41	108.79
	100.82	108.73
	99.68	108.67
	100.38	108.61
	100.32	108.53
10+100	100.46	108.39
	100.44	108.16
	100.45	107.85
	100.40	107.51
	100.34	107.17
10+200	100.20	106.83
	100.21	106.48
	100.22	106.14

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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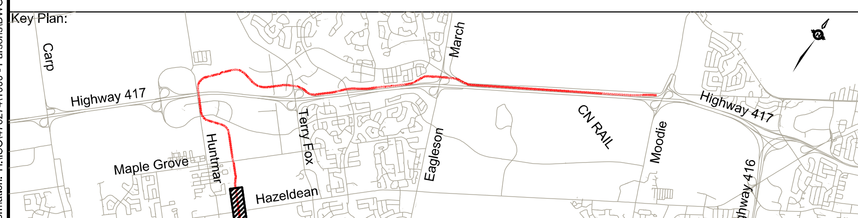
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL: 0m 20 40 80 120 160
VERTICAL: 0m 4 8 16 24 32

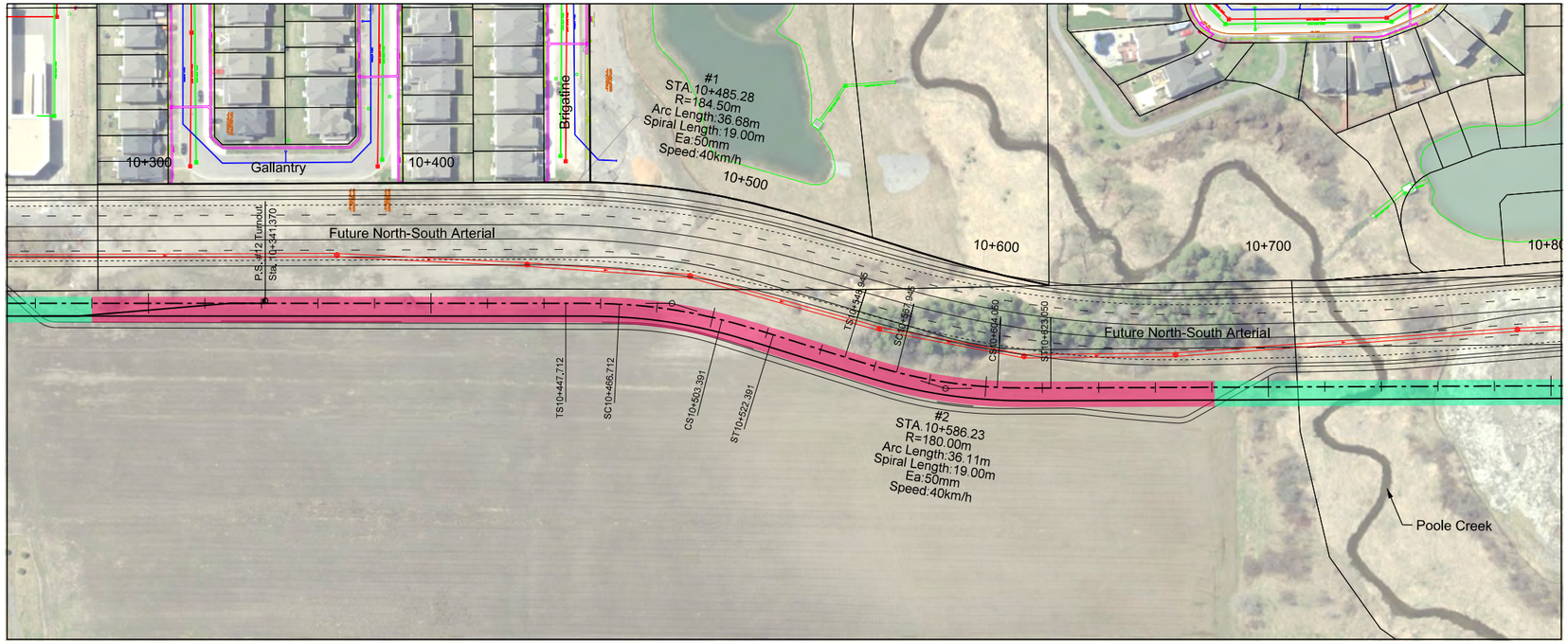
Ottawa PARSONS

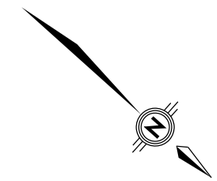
Plan and Profile

Hazeldean Station
Limit of Kanata
LRT to 10+250

Revision:

Sheet: 1





Note:
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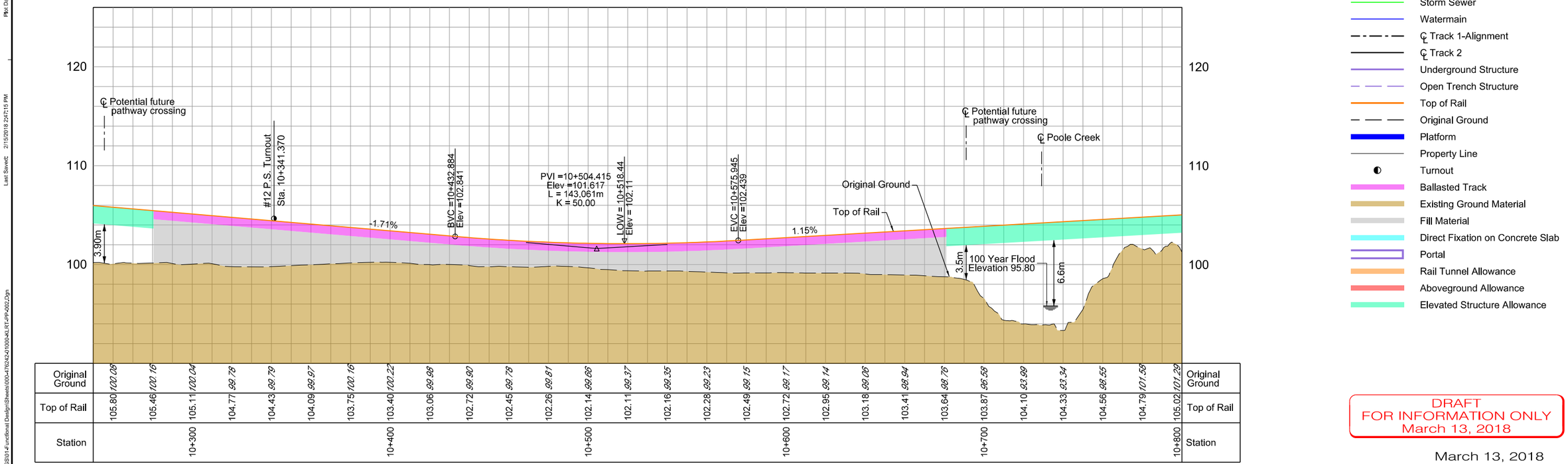

Original Ground	100.08	100.16	100.04	99.78	99.79	99.97	100.16	100.22	99.98	99.90	99.78	99.81	99.66	99.37	99.35	99.23	99.15	99.17	99.14	99.06	98.94	98.76	98.58	98.99	99.34	98.55	97.58	97.29	Original Ground
Top of Rail	105.80	105.46	105.11	104.77	104.43	104.09	103.75	103.40	103.06	102.72	102.45	102.26	102.14	102.11	102.16	102.28	102.49	102.72	102.95	103.18	103.41	103.64	103.87	104.10	104.33	104.56	104.79	105.02	Top of Rail
Station			10+300					10+400					10+500					10+600						10+700					10+800	Station

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
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- Aboveground Allowance
- Elevated Structure Allowance

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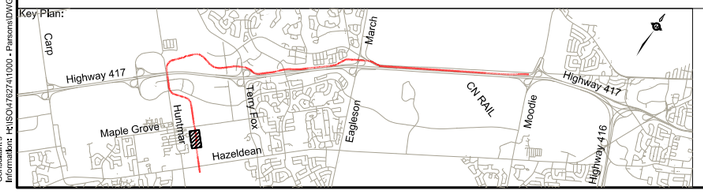
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Section:

Plan and Profile

10+250 to 10+800

Revision:

Sheet: 2

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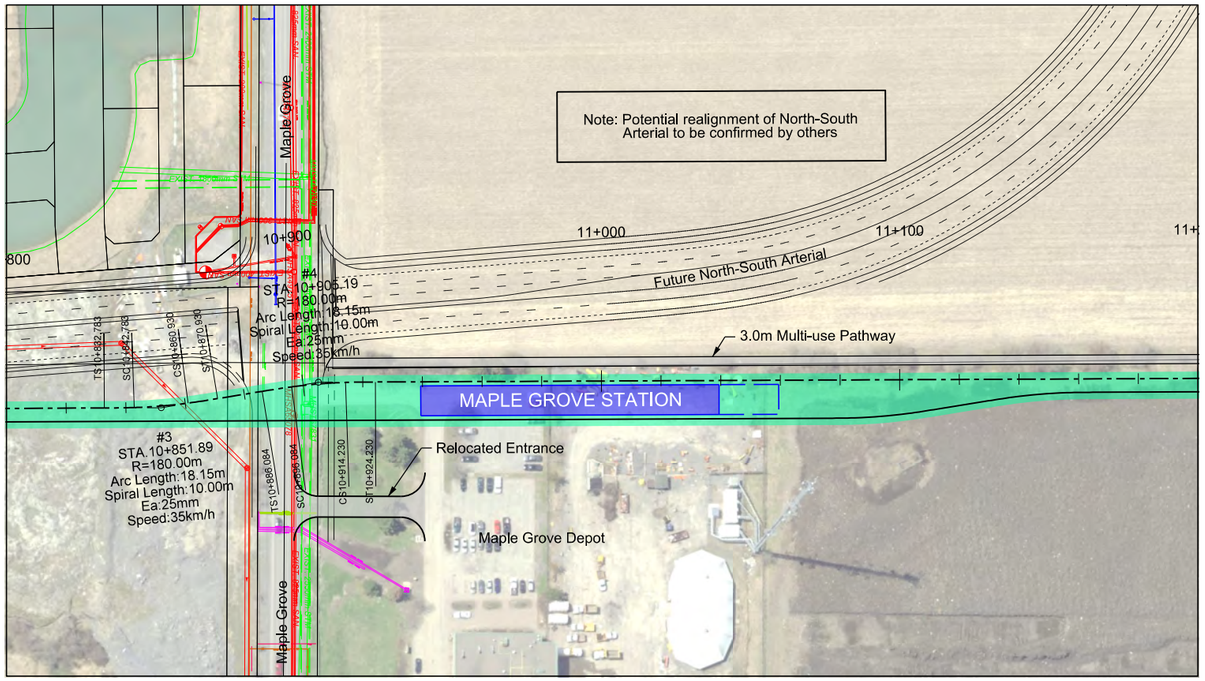

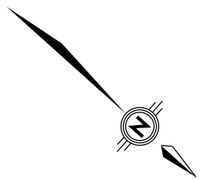

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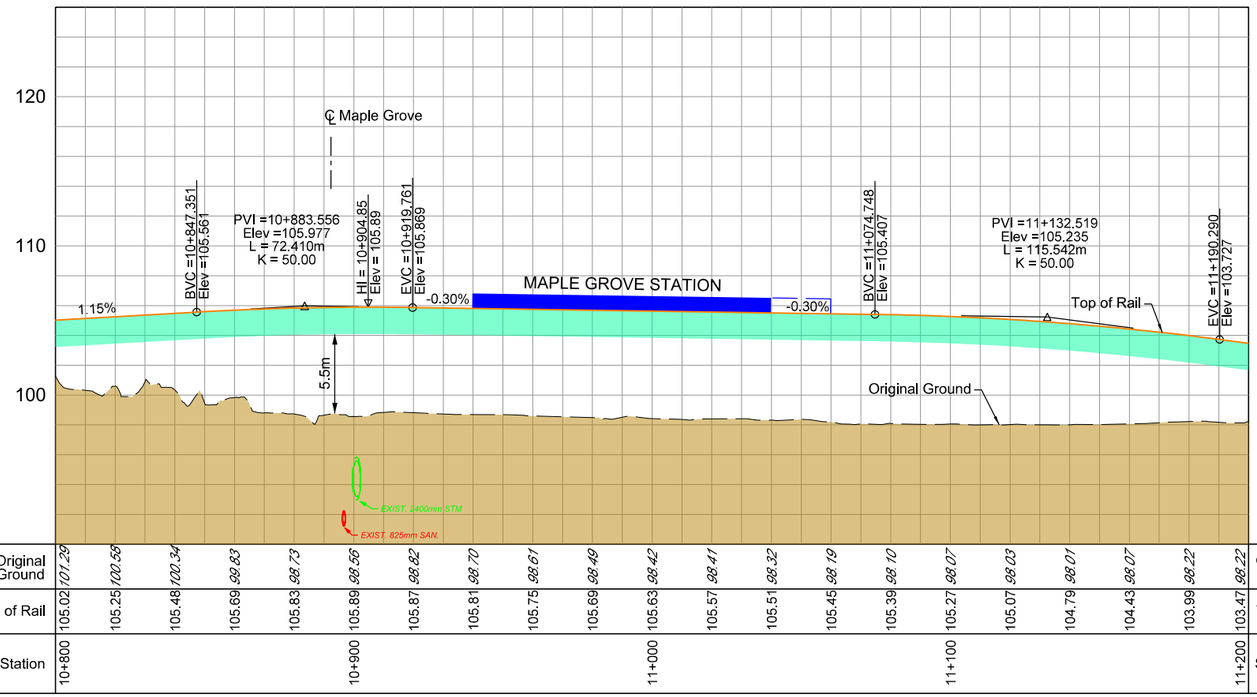

Station	10+800					10+900					11+000					11+100					11+200	Station
Top of Rail	105.02	105.25	105.48	105.69	105.83	105.89	105.87	105.81	105.75	105.69	105.63	105.57	105.51	105.45	105.39	105.27	105.07	104.79	104.43	103.99	103.47	Top of Rail
Original Ground	101.29	100.58	100.34	99.83	98.73	98.56	98.82	98.70	98.61	98.49	98.42	98.41	98.32	98.19	98.10	98.07	98.03	98.01	98.07	98.22	98.22	Original Ground

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
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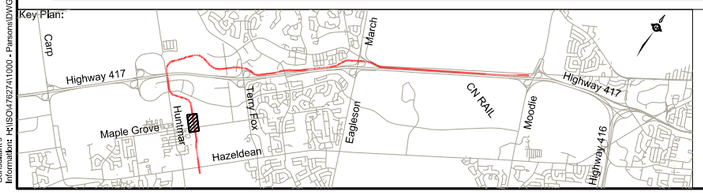

Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

Maple Grove Station
10+800 to 11+200

Revision:

Sheet: 3

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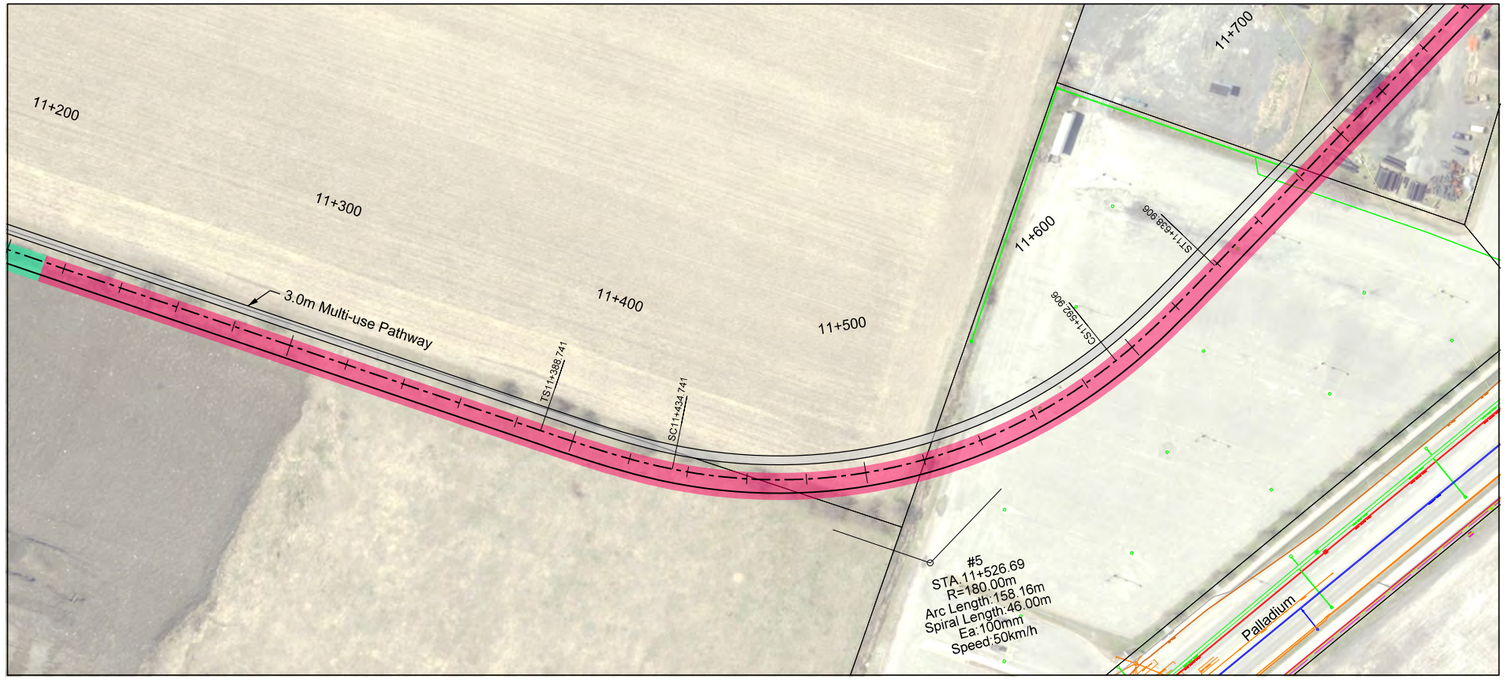

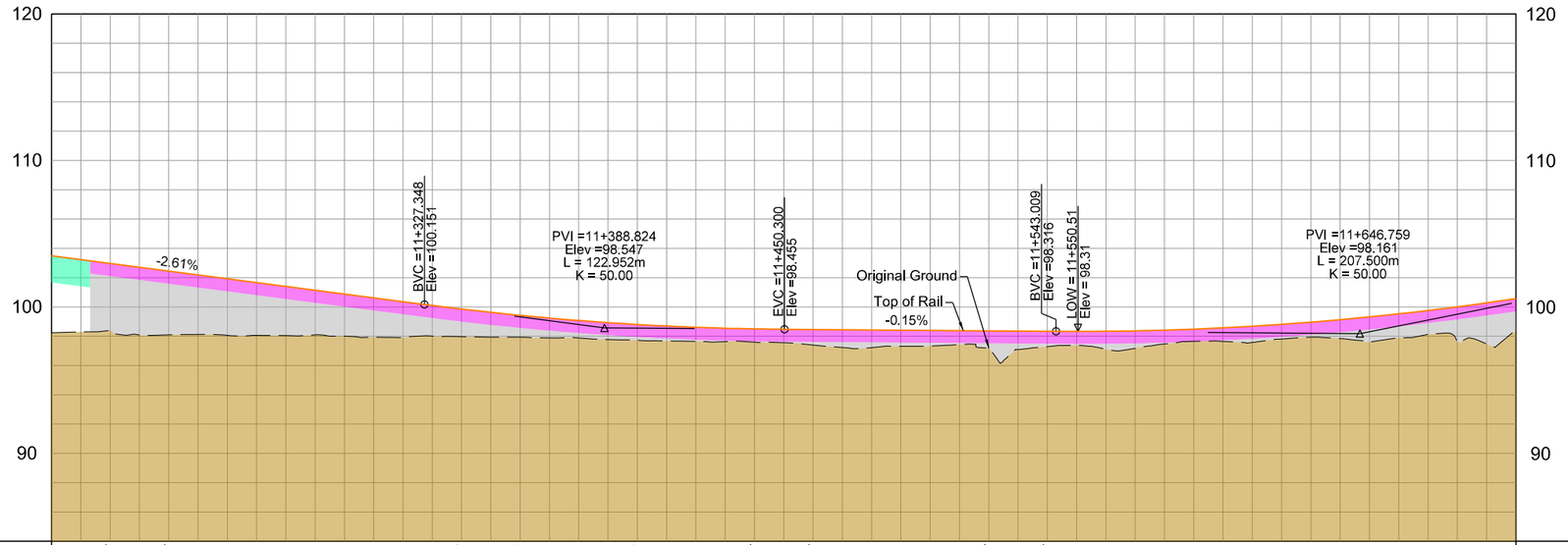

Original Ground	98.22	98.37	98.07	98.04	98.03	97.99	97.88	97.95	97.91	97.86	97.71	97.63	97.57	97.37	97.20	97.30	97.17	97.27	97.09	97.46	97.63	97.79	97.82	97.88	97.80	98.29	Original Ground
Top of Rail	103.47	102.95	102.43	101.91	101.39	100.86	100.34	99.84	99.41	99.05	98.78	98.59	98.48	98.44	98.41	98.38	98.35	98.32	98.32	98.40	98.56	98.79	99.11	99.51	99.99	100.55	Top of Rail
Station	11+200					11+300					11+400					11+500					11+600					11+700	Station

Note:
Pathways are conceptual and are subject to change.

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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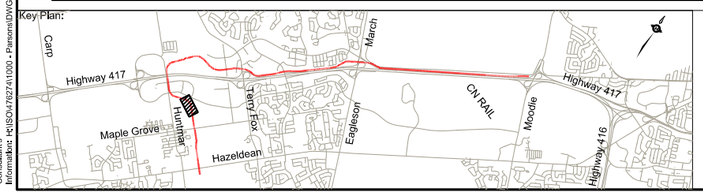
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

11+200 to 11+700

Revision:

Sheet: 4

Consultant's Information: H:\ISO\476274\1000 - Parsons\DWGS\01-Functional Design\Sheets\000\476242-R1000-04LRT-PP-0004.Dgn
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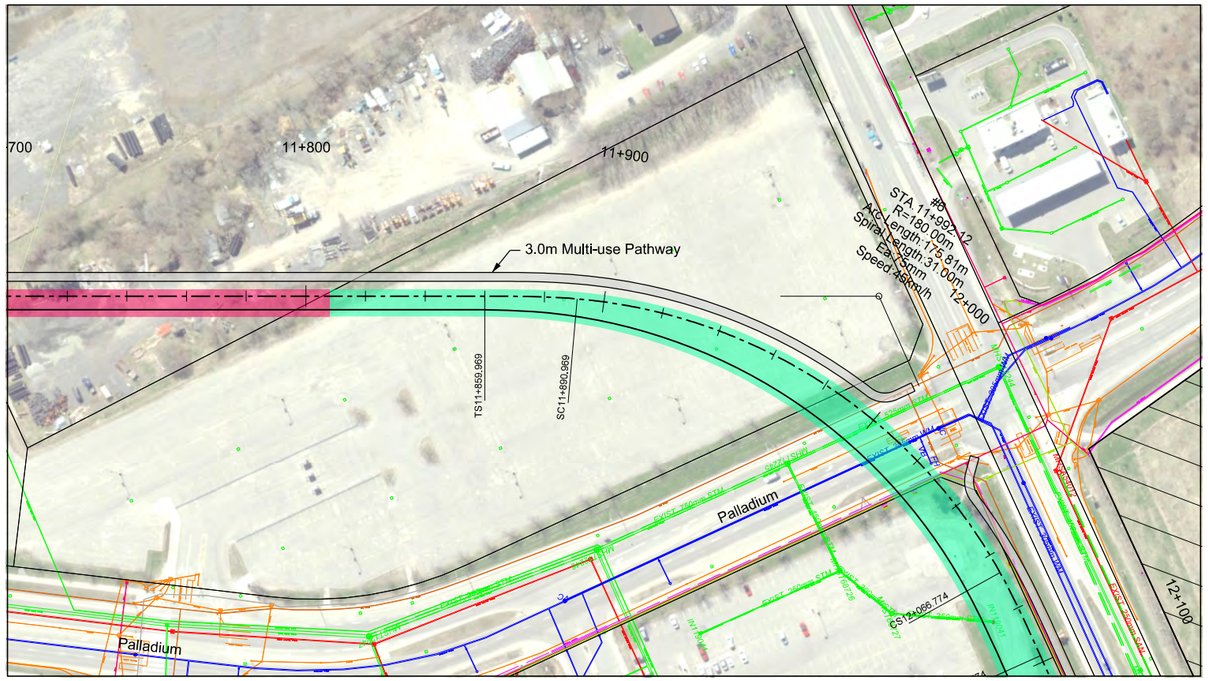
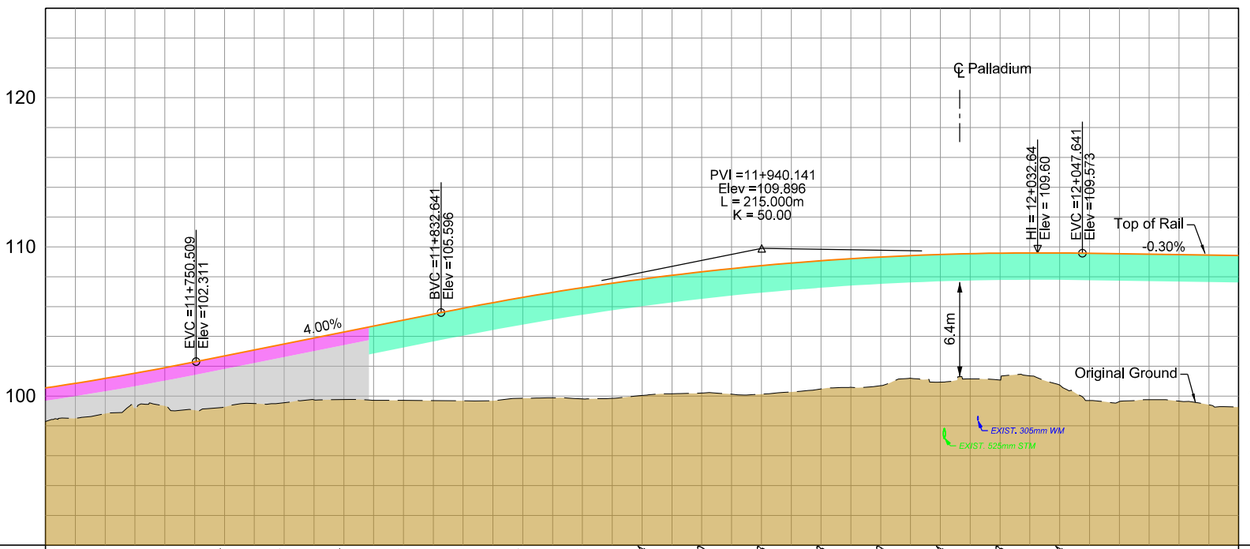
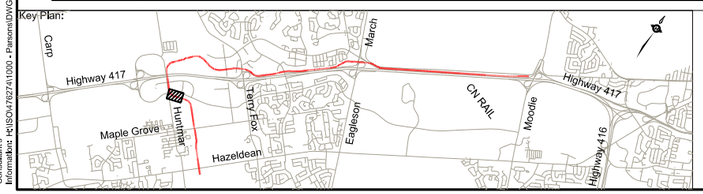




Original Ground	98.29	98.82	99.34	99.27	99.55	99.77	99.71	99.69	99.85	99.81	100.04	100.20	100.13	100.48	100.69	100.94	101.08	100.74	99.63	99.66	99.26	Original Ground
Top of Rail	100.55	101.18	101.90	102.69	103.49	104.29	105.09	105.88	106.62	107.27	107.84	108.33	108.74	109.07	109.32	109.49	109.58	109.59	109.54	109.48	109.42	Top of Rail
Station	11+700					11+800					11+900					12+000					12+100	Station

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Note:
Pathways are conceptual and are subject to change.

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Plan and Profile

11+700 to 12+100

Revision:

Sheet: 5

Plot Date: 3/13/2018 3:13:43 PM
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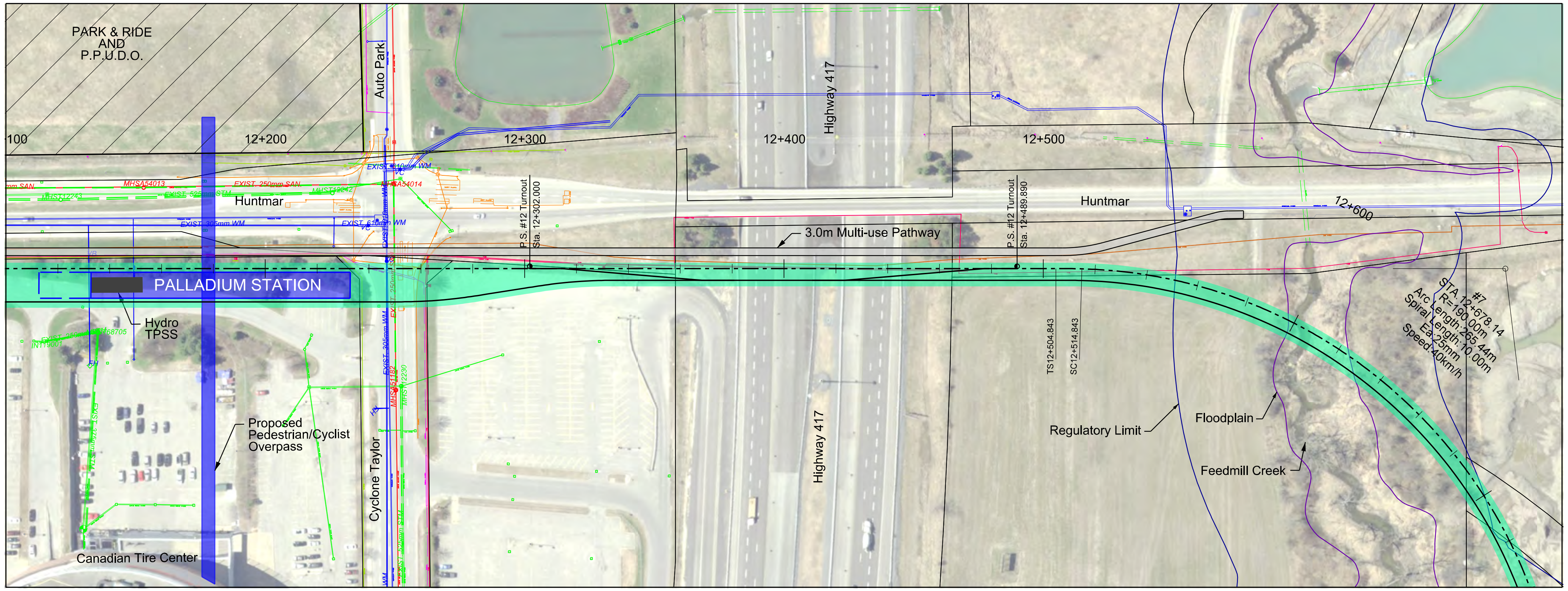
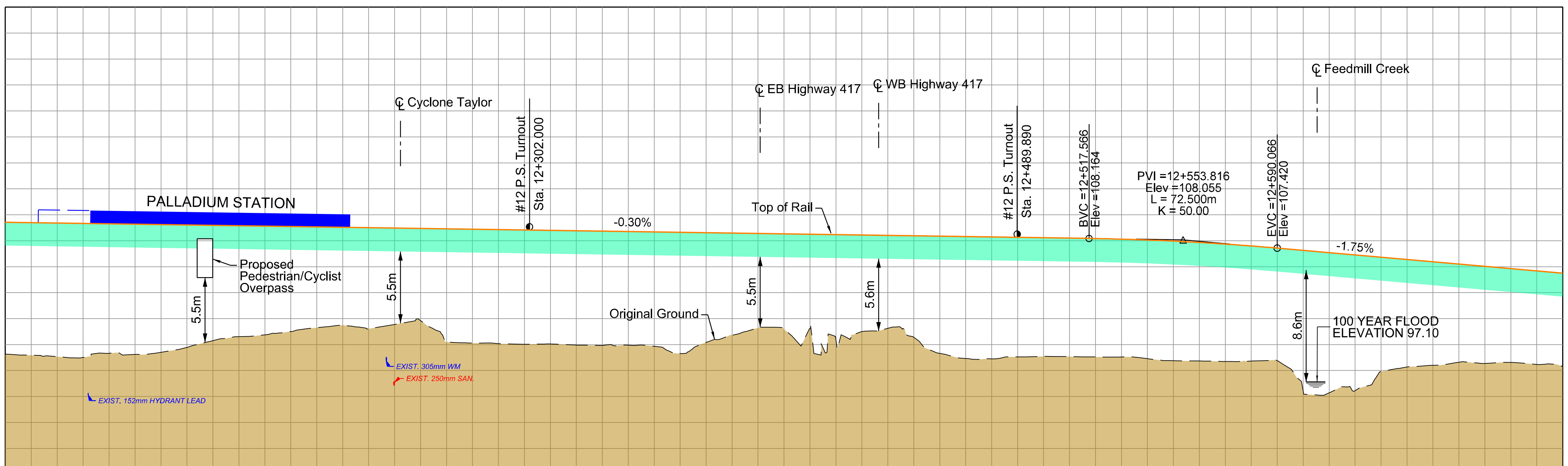


Note:
Pathways are conceptual and are subject to change.



Original Ground	99.26	99.06	99.32	99.39	100.29	100.74	101.29	101.21	101.84	100.11	100.01	99.95	99.94	99.30	100.73	101.19
Top of Rail	109.42	109.36	109.30	109.24	109.18	109.12	109.06	109.00	108.94	108.88	108.82	108.76	108.70	108.64	108.58	108.52
Station	12+100					12+200					12+300					12+400

Original Ground	100.43	101.23	99.31	98.90	99.08	99.04	98.91	98.73	98.73	96.48	96.44	98.27	98.63	98.62	98.29
Top of Rail	108.46	108.40	108.34	108.28	108.22	108.16	108.05	107.86	107.59	107.25	106.90	106.55	106.20	105.85	105.50
Station					12+500					12+600					12+700

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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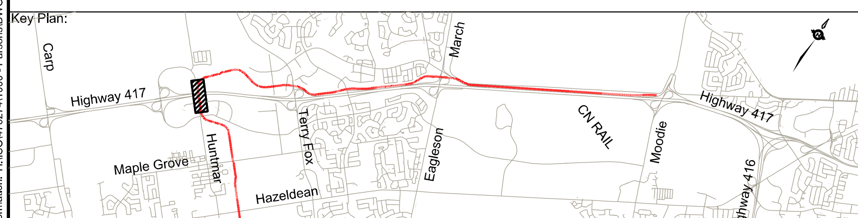
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension
Hazeldean Road to Moodie Drive

HORIZONTAL 0m 20 40 80 120 160
VERTICAL 0m 4 8 16 24 32

Ottawa PARSONS

Plan and Profile

Palladium Station
12+100 to 12+700

Revision:

Sheet: 6

Plot Date: 3/13/2018 3:13:49 PM
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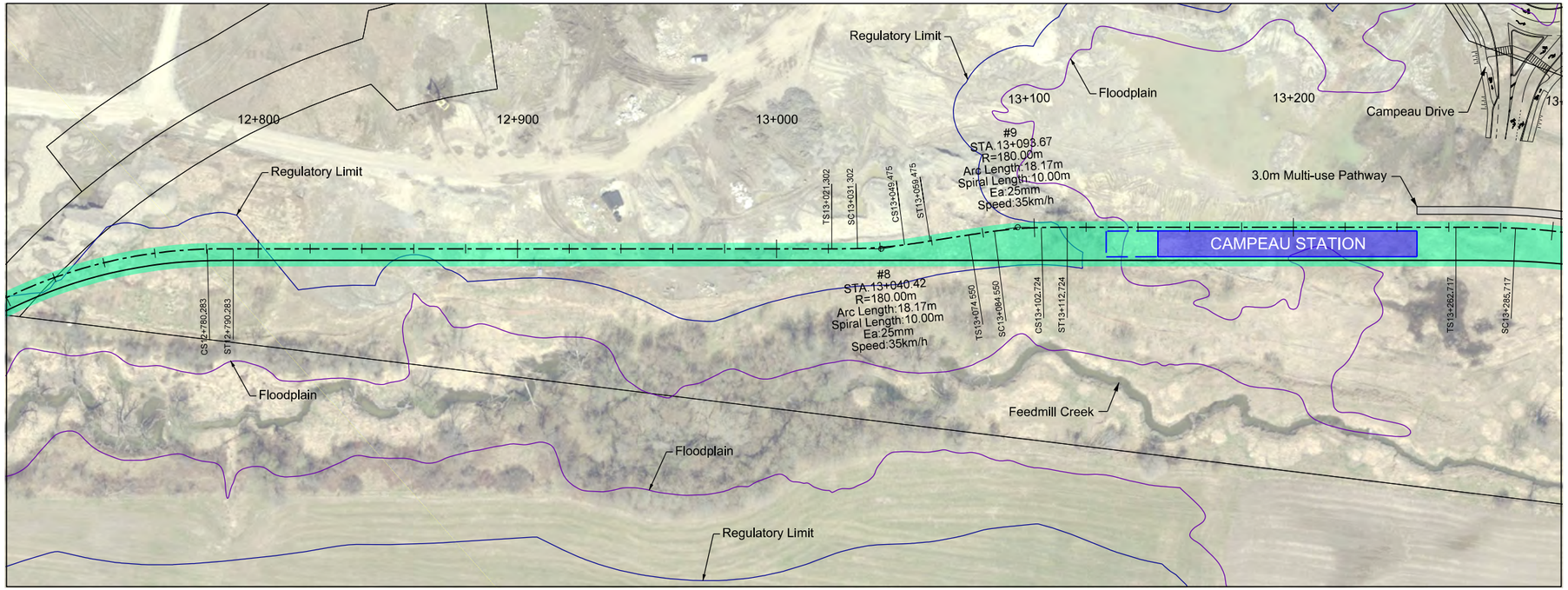
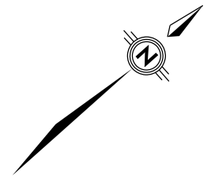
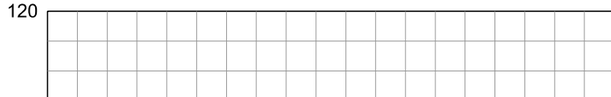




Note:
Pathways are conceptual and are subject to change.



Original Ground	106.29	106.37	104.72	103.31	102.85	100.44	97.18	96.14	96.37	96.87	97.38	97.60	97.67	97.50	97.42	97.94	97.94	97.32	98.48	102.41	99.45	95.72	94.59	94.23	94.34	94.63	94.49	95.08	94.95	94.26	94.23	Original Ground
Top of Rail	105.50	105.15	104.80	104.45	104.10	103.75	103.40	103.10	102.89	102.75	102.68	102.62	102.56	102.50	102.44	102.38	102.32	102.26	102.20	102.14	102.08	102.02	101.96	101.90	101.84	101.78	101.72	101.66	101.60	101.54	101.48	Top of Rail
Station	12+700					12+800					12+900					13+000					13+100					13+200						13+300	Station

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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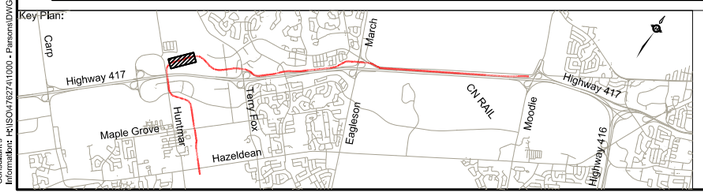
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

Campeau Station
12+700 to 13+300

Revision:

Sheet: 7

Plot Date: 3/13/2018 3:13:54 PM
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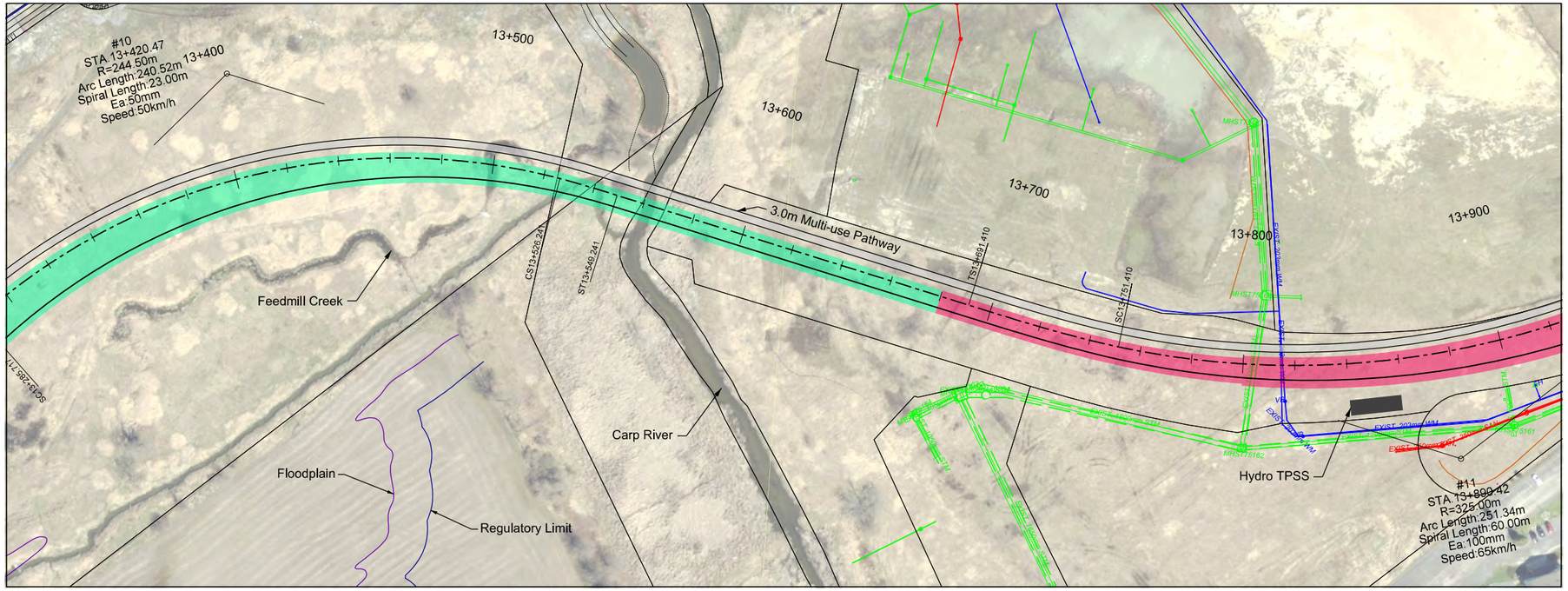
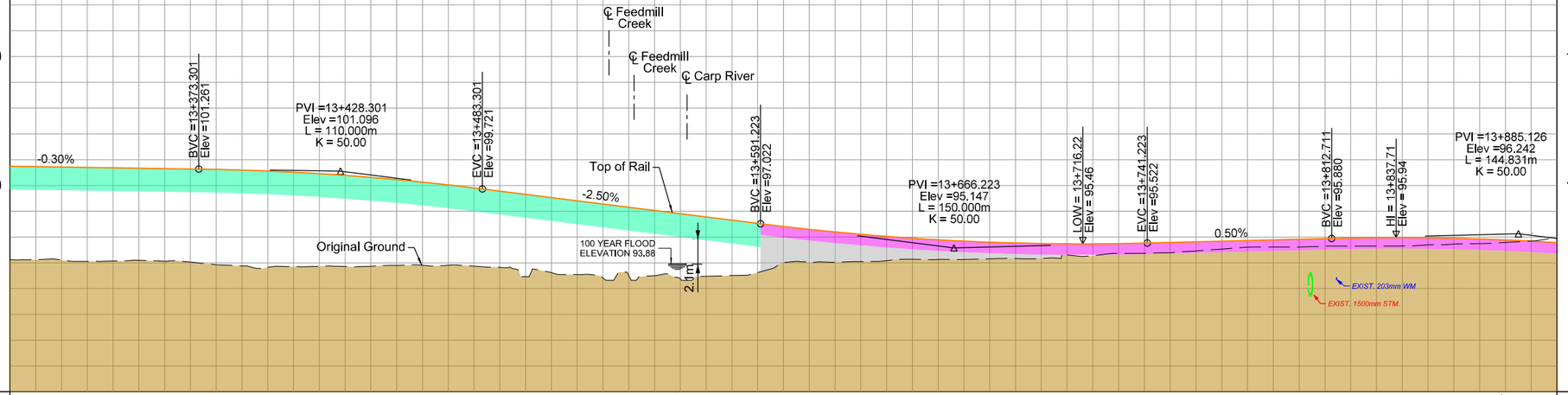


Note:
Pathways are conceptual and are subject to change.

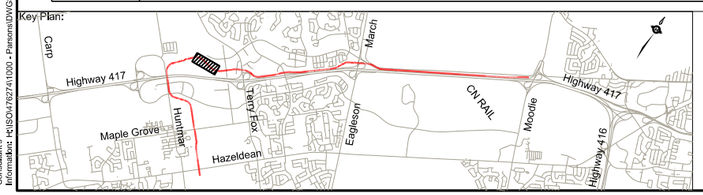
Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance



Original Ground	94.23	94.21	94.12	94.12	93.85	93.63	93.72	93.72	93.80	93.73	92.92	93.09	93.06	92.75	93.01	94.00	94.04	94.16	94.24	94.30	94.31	94.53	94.72	94.90	95.20	95.21	95.28	95.30	95.44	95.57	95.91	Original Ground
Top of Rail	101.48	101.42	101.36	101.30	101.24	101.11	100.90	100.62	100.25	99.80	99.30	98.80	98.30	97.80	97.30	96.81	96.39	96.04	95.78	95.59	95.49	95.46	95.52	95.62	95.72	95.82	95.91	95.94	95.89	95.76	95.55	Top of Rail
Station	13+300					13+400					13+500					13+600						13+700				13+800					13+900	Station

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

DRAFT
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Plan and Profile

13+300 to 13+900

Revision:

Sheet: 8

Plot Date: 3/13/2018 3:14:09 PM
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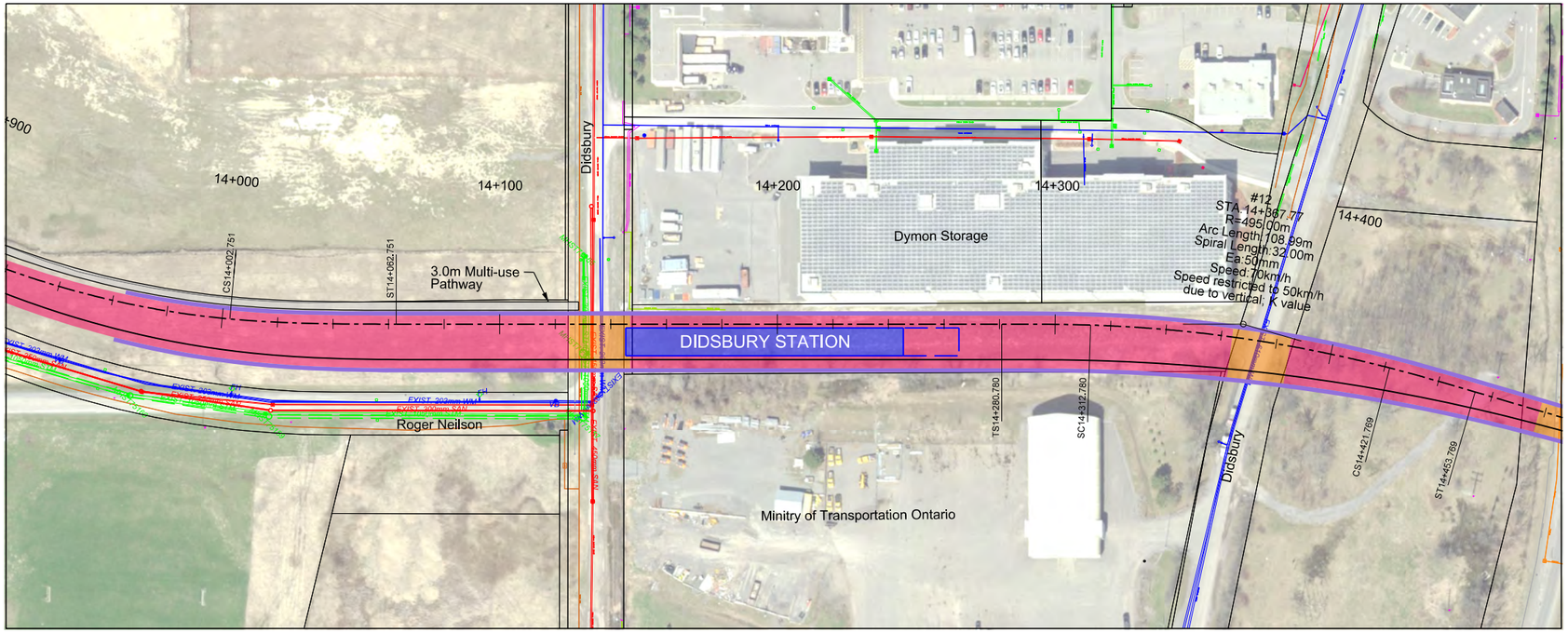

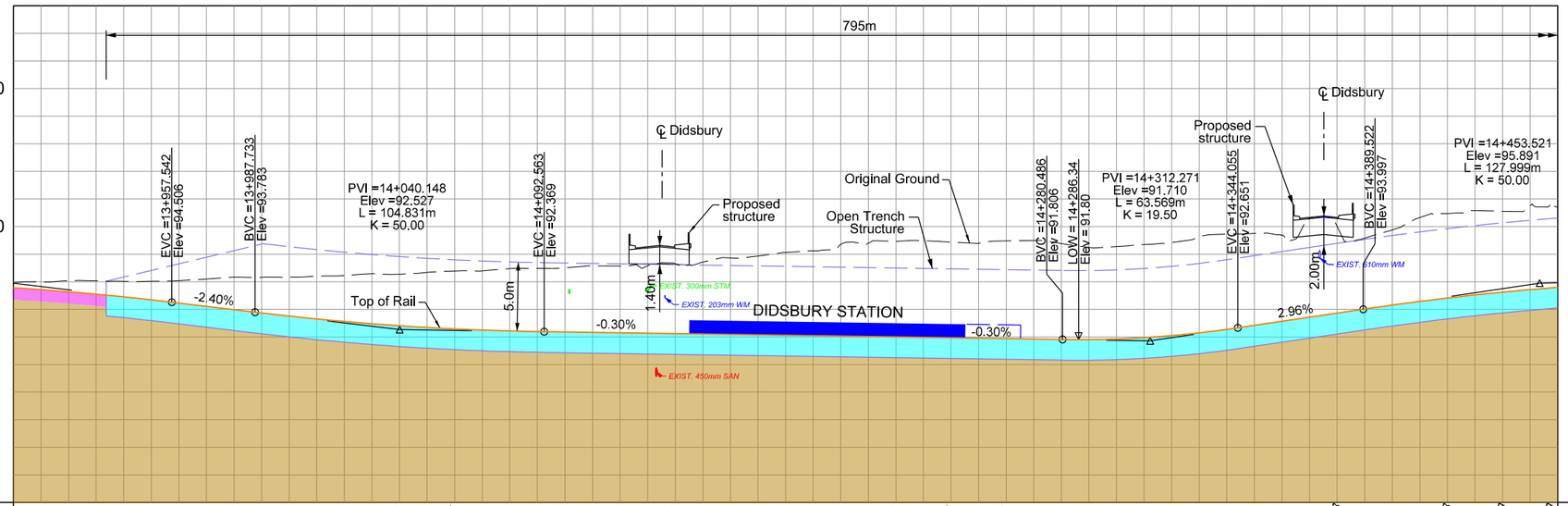

Original Ground	95.91	96.06	96.02	96.06	96.33	96.32	96.44	96.54	96.77	96.94	97.01	97.13	97.31	97.72	98.11	98.68	98.93	98.87	98.95	98.76	98.53	98.84	99.44	99.36	100.03	99.74	100.93	101.09	101.39	Original Ground
Top of Rail	95.55	95.27	94.90	94.45	93.97	93.50	93.11	92.80	92.57	92.42	92.35	92.29	92.23	92.17	92.11	92.05	91.99	91.93	91.87	91.81	91.84	92.09	92.54	93.12	93.72	94.30	94.81	95.24	95.59	Top of Rail
Station	13+900					14+000					14+100					14+200					14+300					14+400				Station

Note:
Pathways are conceptual and are subject to change.

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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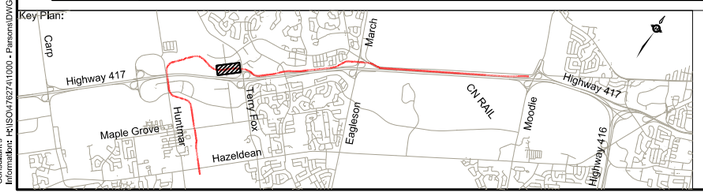
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension
Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Section:

Ottawa PARSONS

Plan and Profile

Didsbury Station
13+900 to 14+460

Revision:

Sheet: 9

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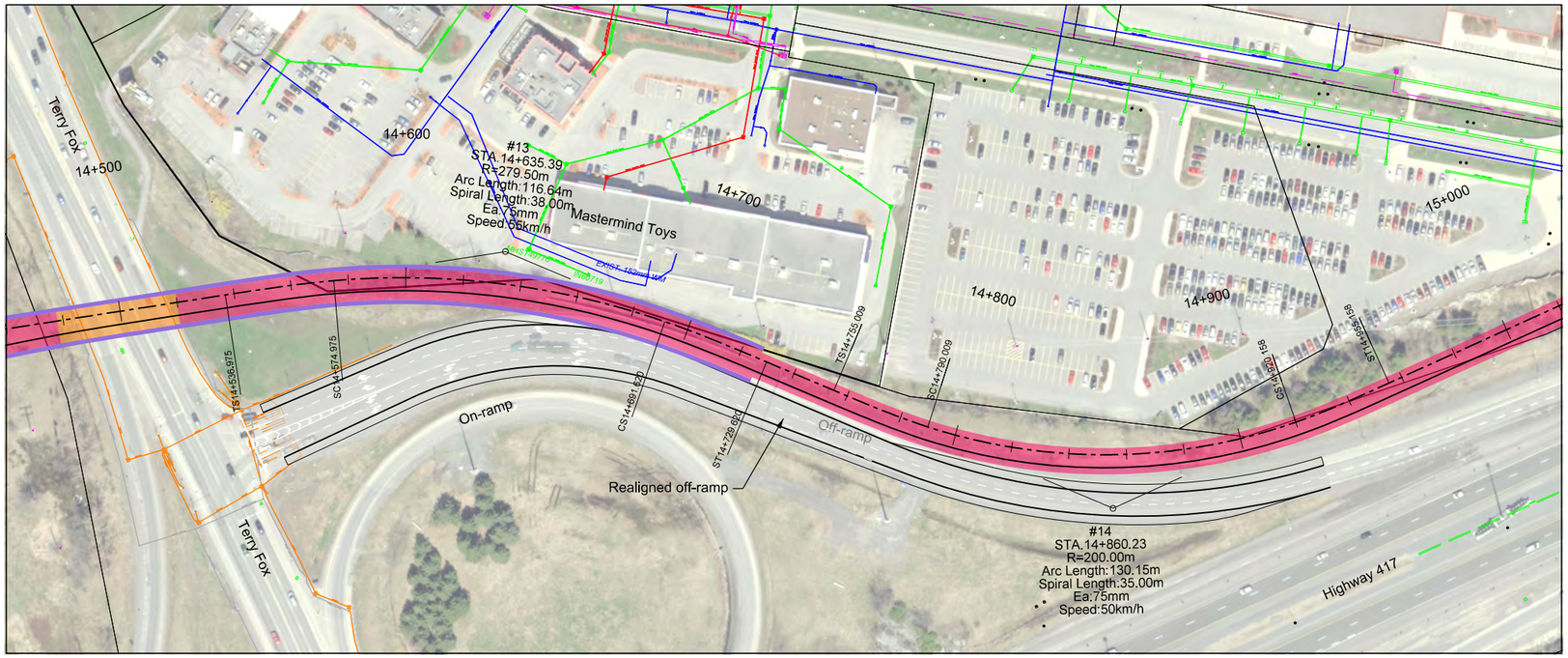
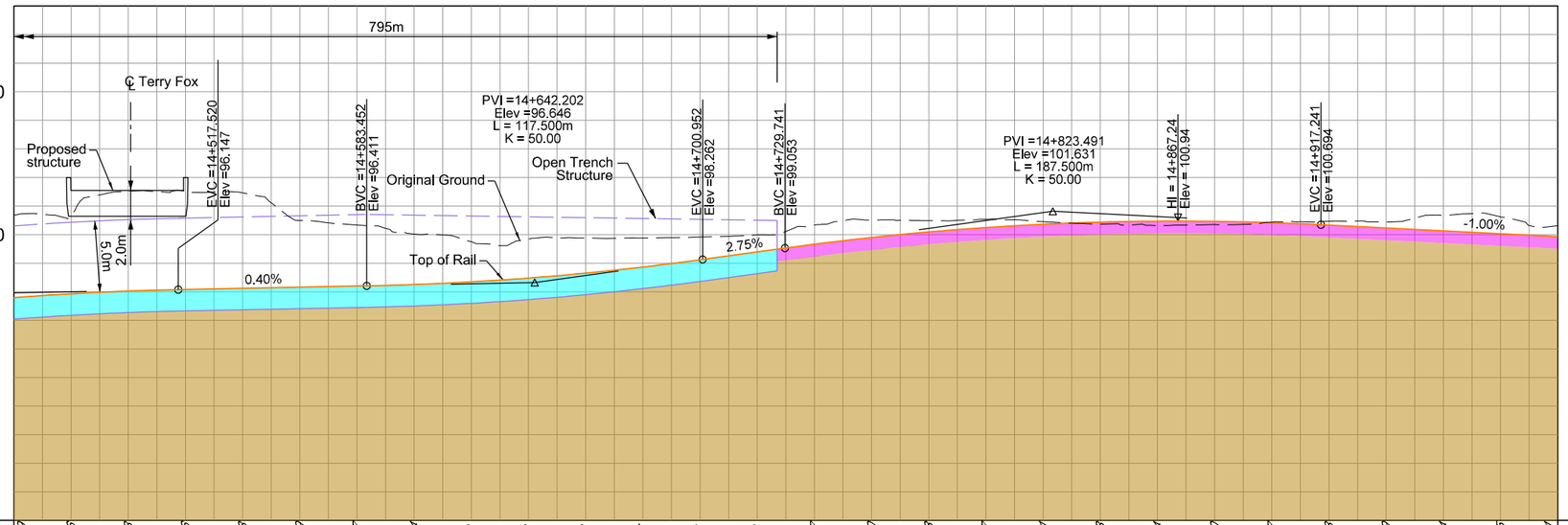


Note:
Pathways are conceptual and are subject to change.



Original Ground	101.39	101.36	103.03	102.96	102.93	100.99	100.67	100.04	99.50	99.68	99.75	99.77	99.84	99.99	100.67	101.00	100.98	101.07	100.91	100.73	100.64	100.70	100.87	100.93	101.25	100.41	Original Ground
Top of Rail	95.59	95.86	96.05	96.16	96.24	96.32	96.40	96.50	96.69	96.96	97.30	97.73	98.24	98.79	99.32	99.79	100.18	100.49	100.72	100.87	100.94	100.93	100.84	100.67	100.07	99.87	Top of Rail
Station			14+500					14+600					14+700					14+800						14+900			15+000	Station

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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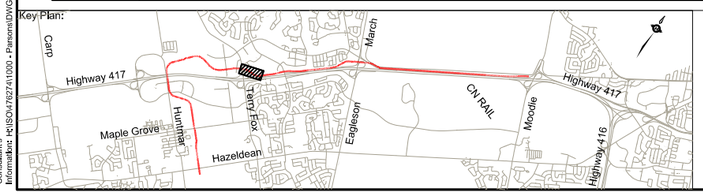
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

14+460 to 15+000

Revision:

Sheet: 10

Plot Date: 3/13/2018 3:14:10 PM
Last Saved: 2/21/2018 1:16:05 PM
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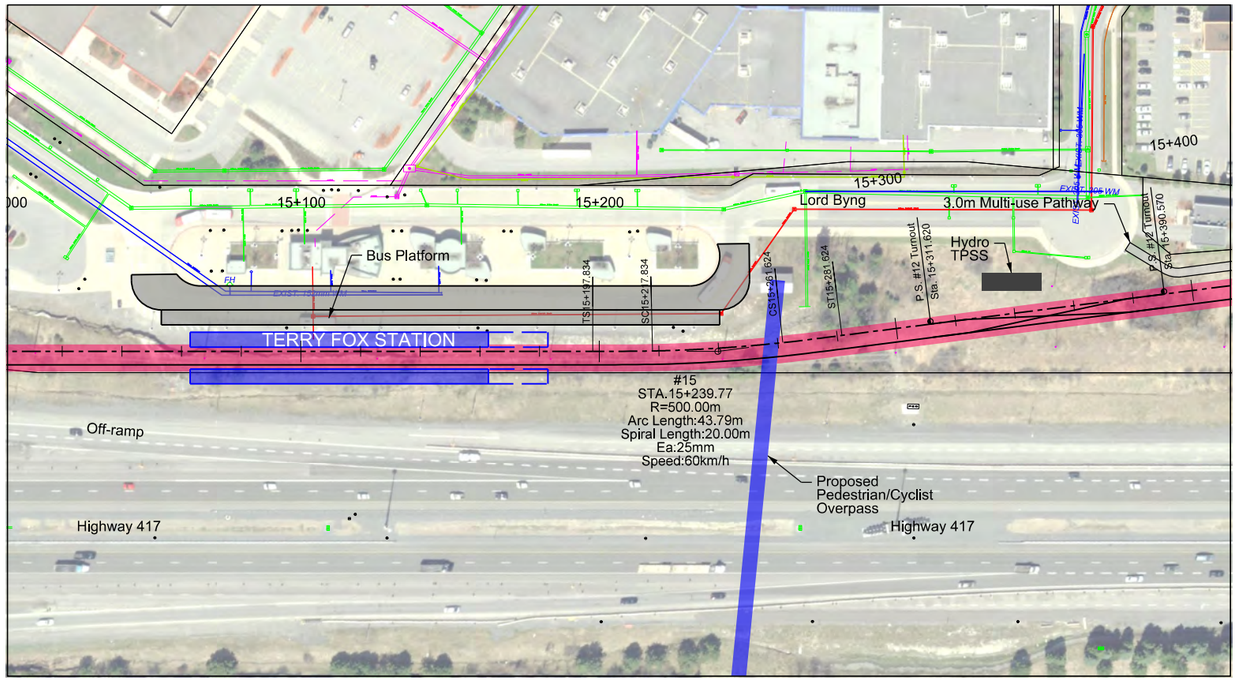
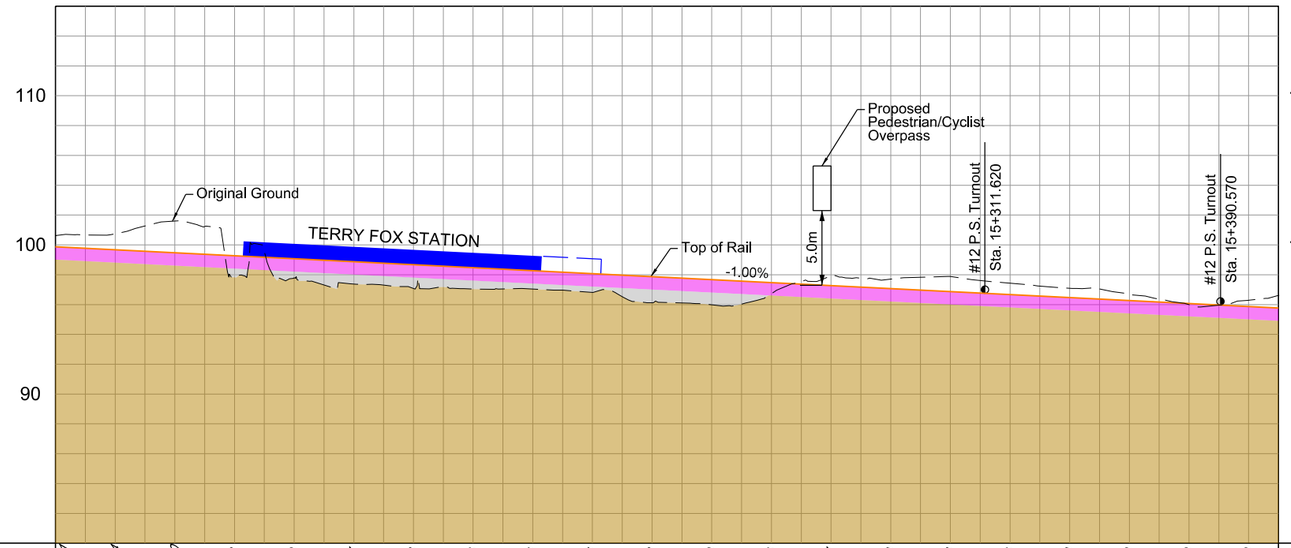
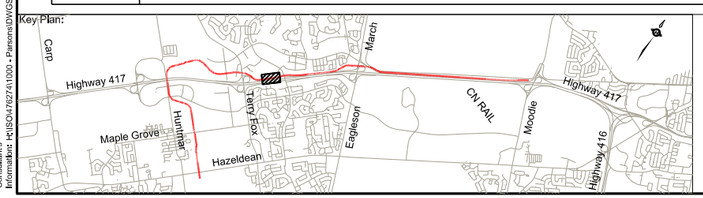




Original Ground	100.41	100.74	101.60	97.82	97.79	97.37	97.08	97.03	97.04	96.81	96.12	95.99	96.73	97.87	97.70	97.88	97.43	97.10	96.69	95.99	96.29	Original Ground
Top of Rail	99.87	99.67	99.47	99.27	99.07	98.87	98.67	98.47	98.27	98.07	97.87	97.67	97.47	97.27	97.07	96.87	96.67	96.47	96.27	96.07	95.87	Top of Rail
Station	15+000					15+100					15+200					15+300					15+400	Station



Note:
Pathways are conceptual and are subject to change.

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

DRAFT
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
VERTICAL
0m 4 8 16 24 32

Ottawa PARSONS

Plan and Profile

Terry Fox Station
15+000 to 15+410

Revision:

Sheet: 11

Consultant's Information: H:\SO\476\27411000 - Parsons\DWGS\01-4-Functional Design\Sheets\000-476242-021000-ALRT-PP-011-Dgn
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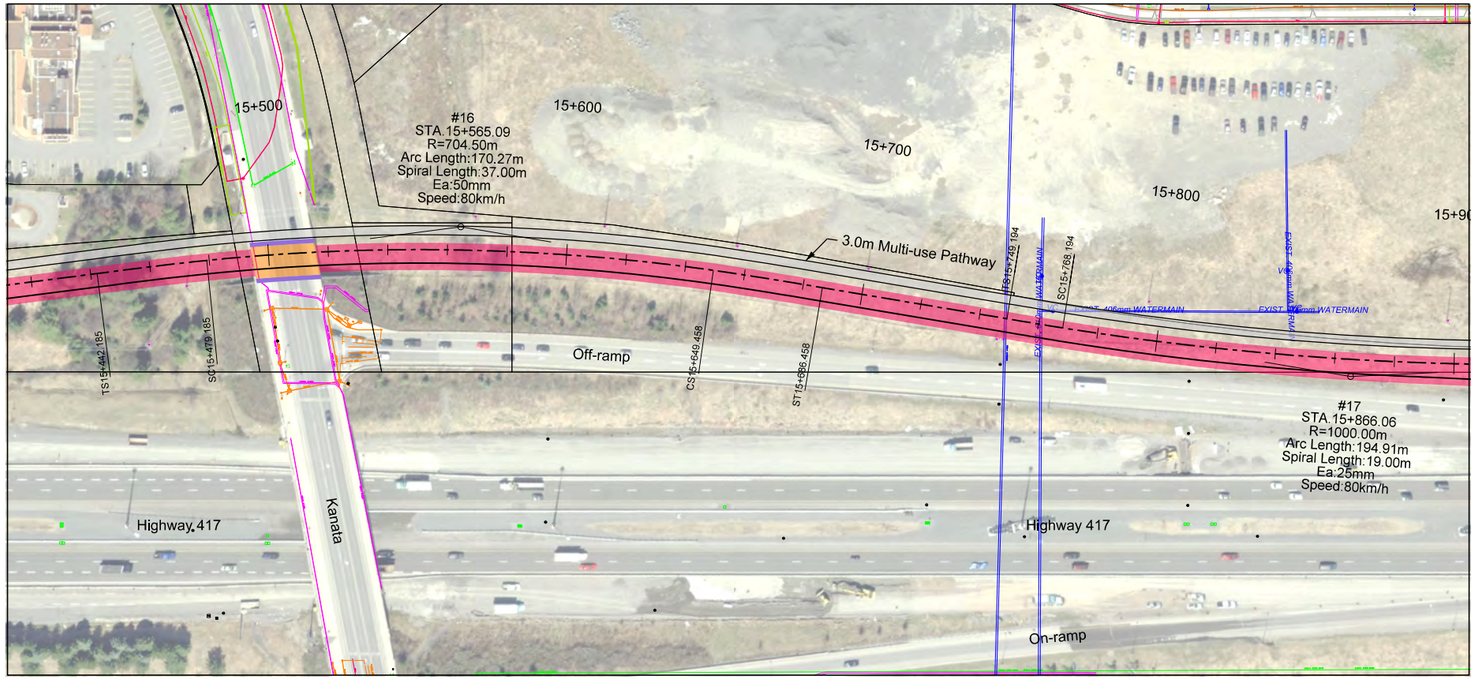
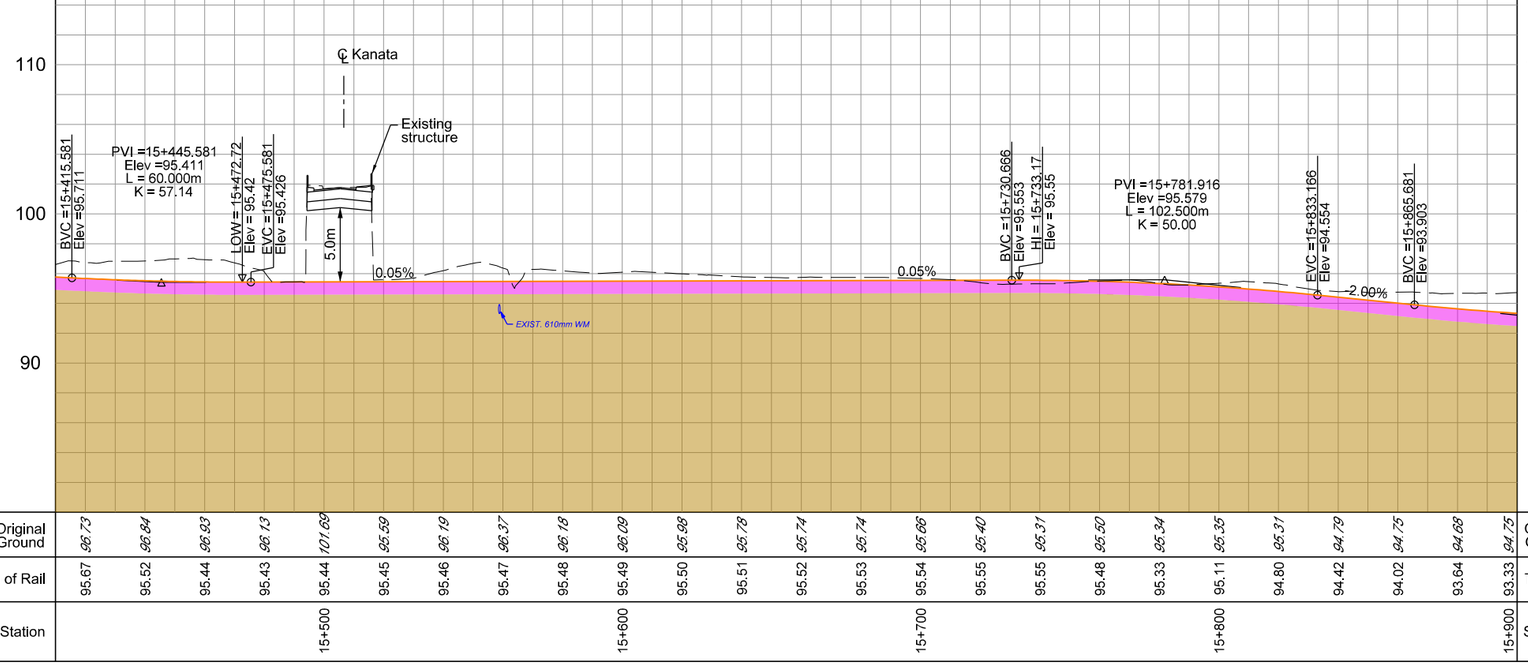
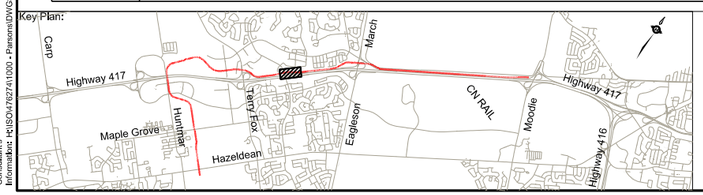




Original Ground	96.73	96.84	96.93	96.13	101.69	95.59	96.19	96.37	96.18	96.09	95.98	95.78	95.74	95.74	95.66	95.40	95.31	95.50	95.34	95.35	95.31	94.79	94.75	94.68	94.75	Original Ground
Top of Rail	95.67	95.52	95.44	95.43	95.44	95.45	95.46	95.47	95.48	95.49	95.50	95.51	95.52	95.53	95.54	95.55	95.55	95.48	95.33	95.11	94.80	94.42	94.02	93.64	93.33	Top of Rail
Station					15+500					15+600					15+700					15+800					15+900	Station

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Note:
Pathways are conceptual and are subject to change.

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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March 13, 2018

March 13, 2018

Plan and Profile

15+410 to 15+900

Revision:

Sheet: 12

Consultant's Information: H:\ISO\47627\41000 - Parsons\DWGS\01-Functional Design\Sheets\000-47624241000-ALRT-PP-012.Dgn
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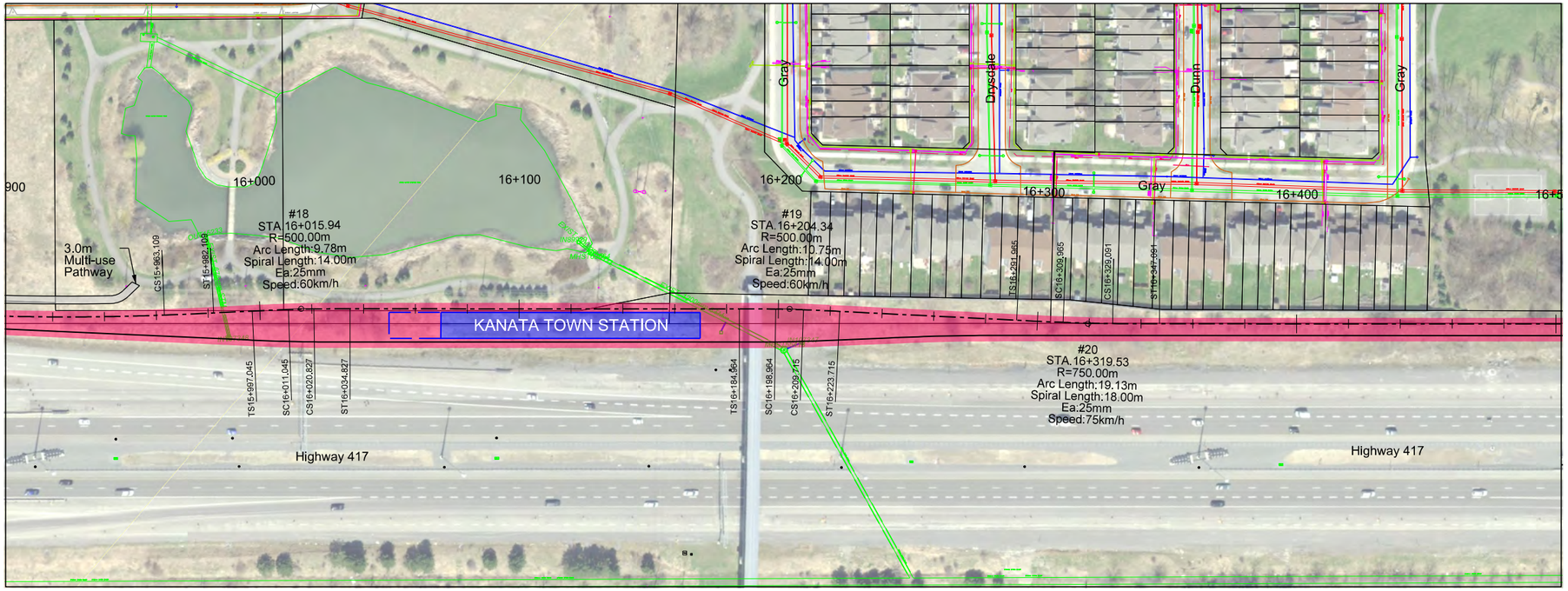
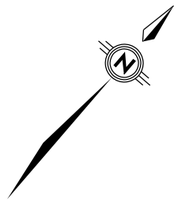
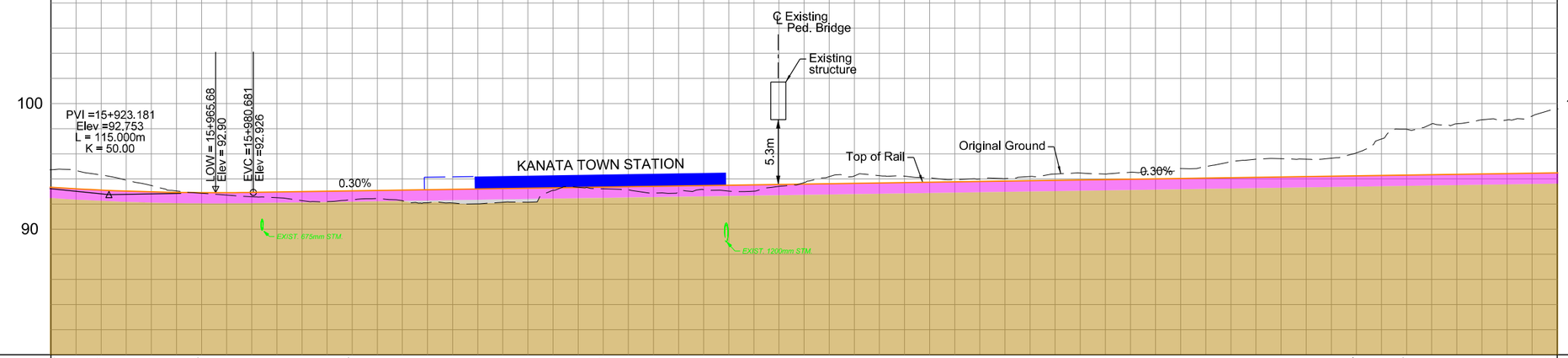




Note:
Pathways are conceptual and are subject to change.



Original Ground	94.75	94.31	93.48	92.85	92.58	92.28	92.35	92.26	92.09	92.14	93.08	93.21	92.88	93.14	93.02	93.70	94.22	94.22	93.94	94.03	94.39	94.39	94.66	94.98	95.56	95.56	96.07	97.95	98.38	98.69	99.61	Original Ground
Top of Rail	93.33	93.11	92.97	92.91	92.92	92.98	93.04	93.10	93.16	93.22	93.28	93.34	93.40	93.46	93.52	93.58	93.64	93.70	93.76	93.82	93.88	93.94	94.00	94.06	94.12	94.18	94.24	94.30	94.36	94.42	94.48	Top of Rail
Station	15+900					16+000					16+100					16+200					16+300					16+400						16+500	Station

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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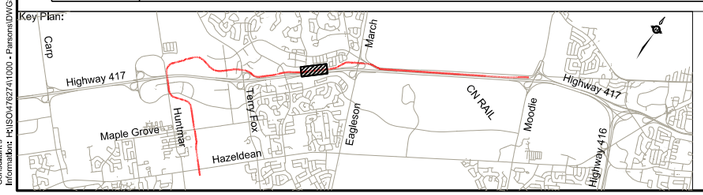
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

Kanata Towns Station
15+900 to 16+500

Revision:
Sheet: 13

Consultant's Information: H:\ISO\476274\1000 - Personnel\DWGS\01-Functional Design\Sheets\000\476242-A1000U40LRT-PP-0113.Dgn
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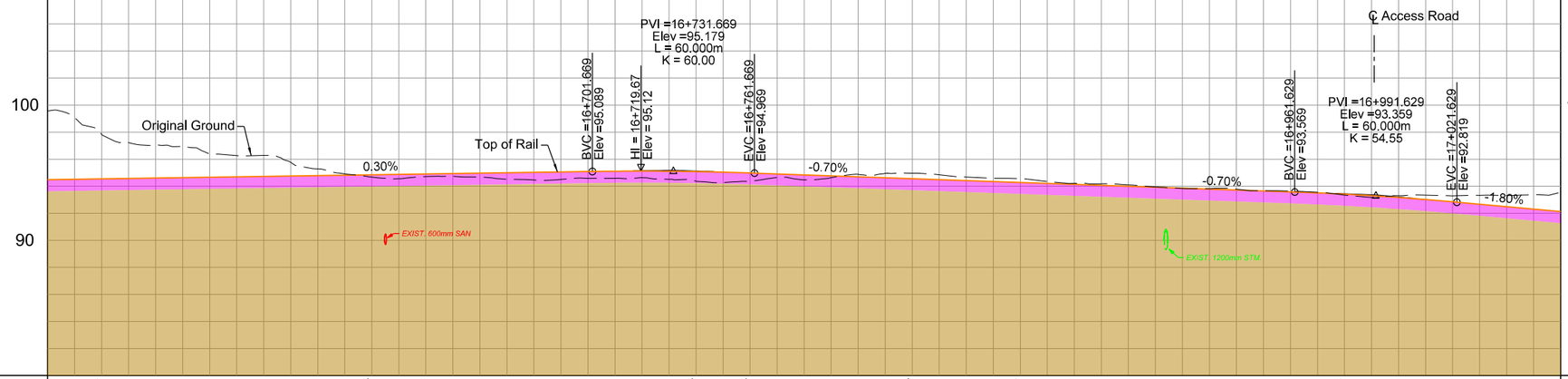
Note:
Pathways are conceptual and are subject to change.

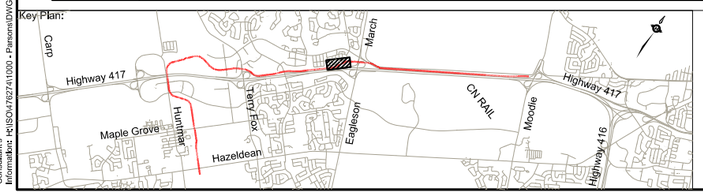
Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance



Original Ground	98.61	97.85	97.02	96.38	96.28	95.28	94.67	94.71	94.69	94.46	94.53	94.63	94.37	94.37	94.46	94.88	94.97	94.68	94.55	94.21	94.10	93.83	93.78	93.64	93.35	93.30	93.29	93.31	93.56	Original Ground
Top of Rail	94.48	94.54	94.60	94.66	94.72	94.78	94.84	94.90	94.96	95.02	95.08	95.12	95.08	94.98	94.84	94.70	94.56	94.42	94.28	94.14	94.00	93.86	93.72	93.58	93.41	93.17	92.85	92.49	94.29	Top of Rail
Station	16+500					16+600					16+700					16+800					16+900					17+000				Station

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
VERTICAL
0m 4 8 16 24 32

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FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Plan and Profile

16+500 to 17+060

Revision:

Sheet: 14

Plot Date: 3/13/2018 3:14:31 PM
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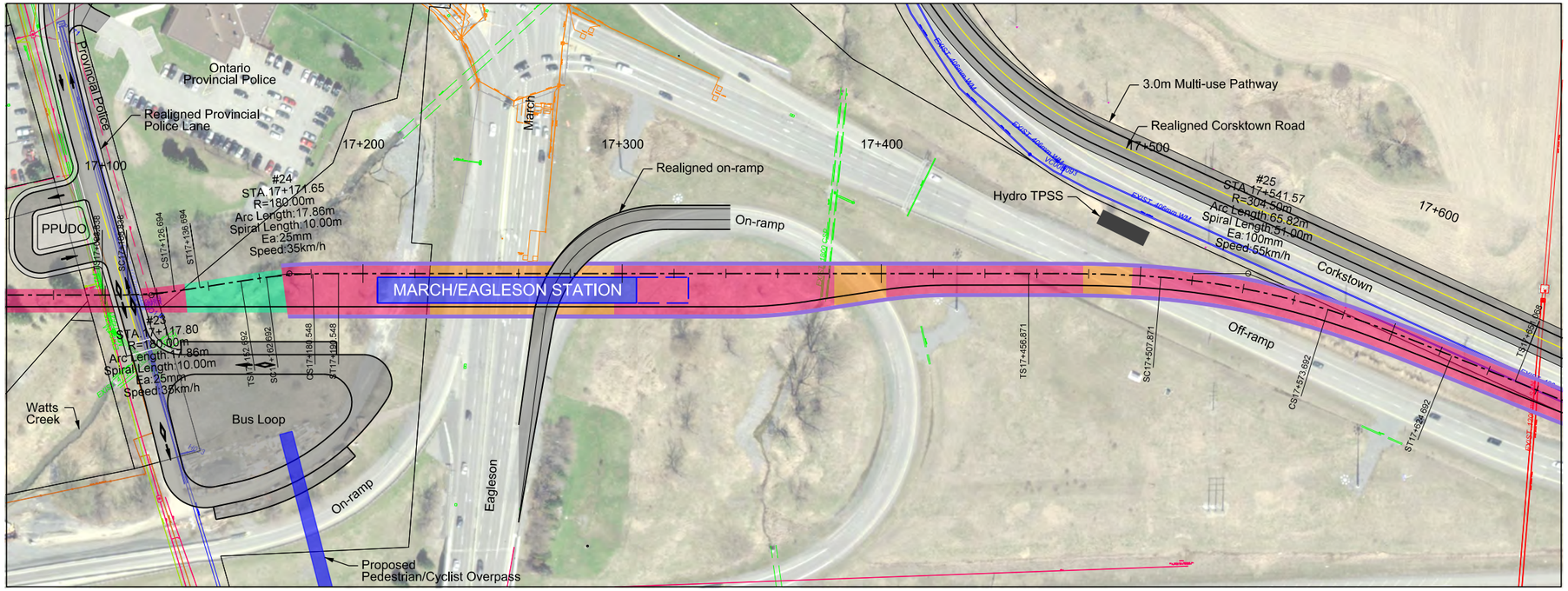
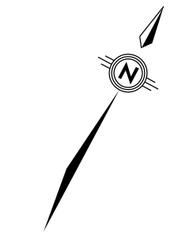
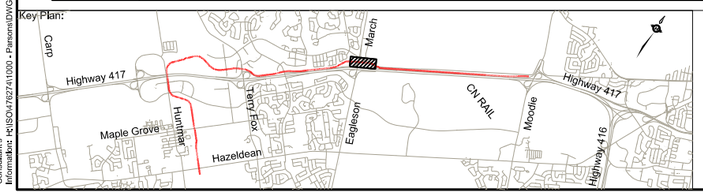




Note:
Pathways are conceptual and are subject to change.

Original Ground	93.34	93.62	92.22	92.06	89.79	87.45	91.90	92.04	92.76	96.08	96.09	95.77	95.01	92.56	92.33	91.76	92.77	93.14	92.18	92.37	92.34	93.17	93.04	91.81	93.11	93.55	93.65	93.59	93.76	93.65	93.89	Original Ground
Top of Rail	94.20	91.77	91.41	91.05	90.71	90.42	90.19	89.99	89.79	89.59	89.39	89.19	88.99	88.79	88.59	88.39	88.19	88.07	88.03	88.07	88.19	88.39	88.67	89.02	89.46	89.98	90.58	91.25	91.94	92.58	93.14	Top of Rail
Station			17+100					17+200					17+300				17+400						17+500					17+600				Station

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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March 13, 2018

March 13, 2018

Ottawa PARSONS

Plan and Profile

March/Eagleson Station
17+060 to 17+660

Revision:

Sheet: 15

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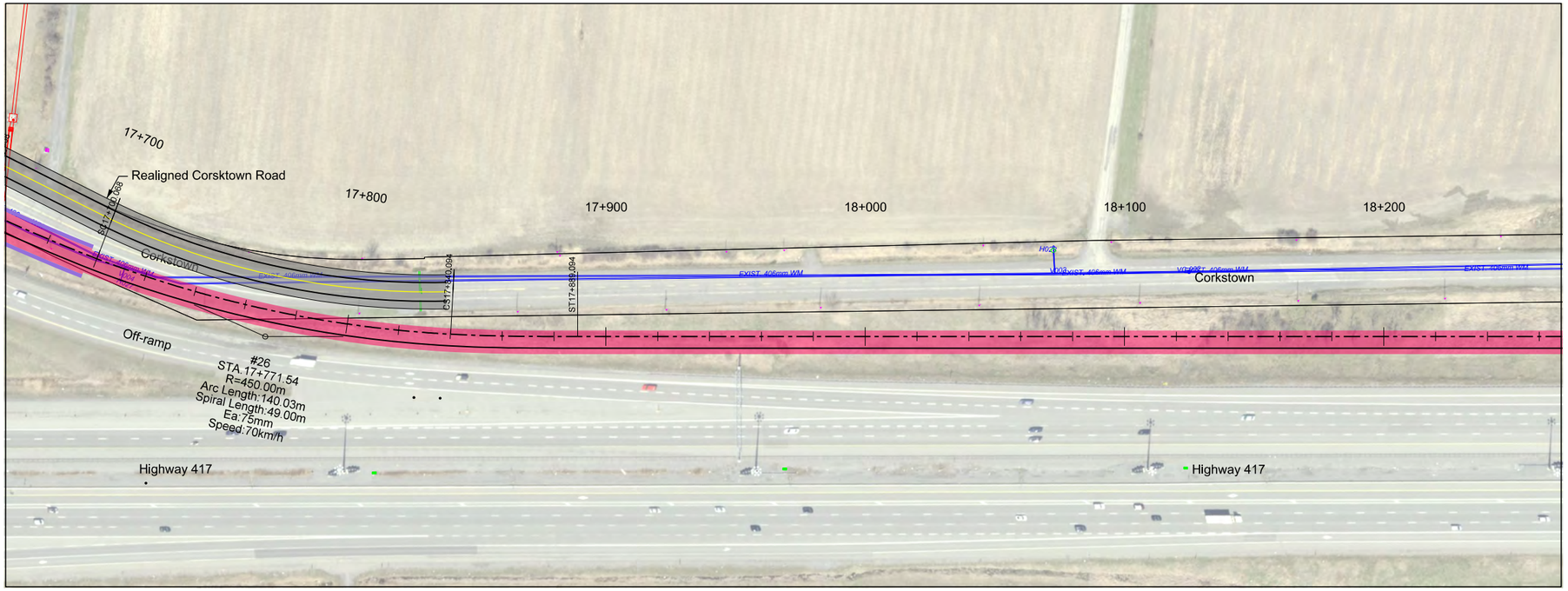

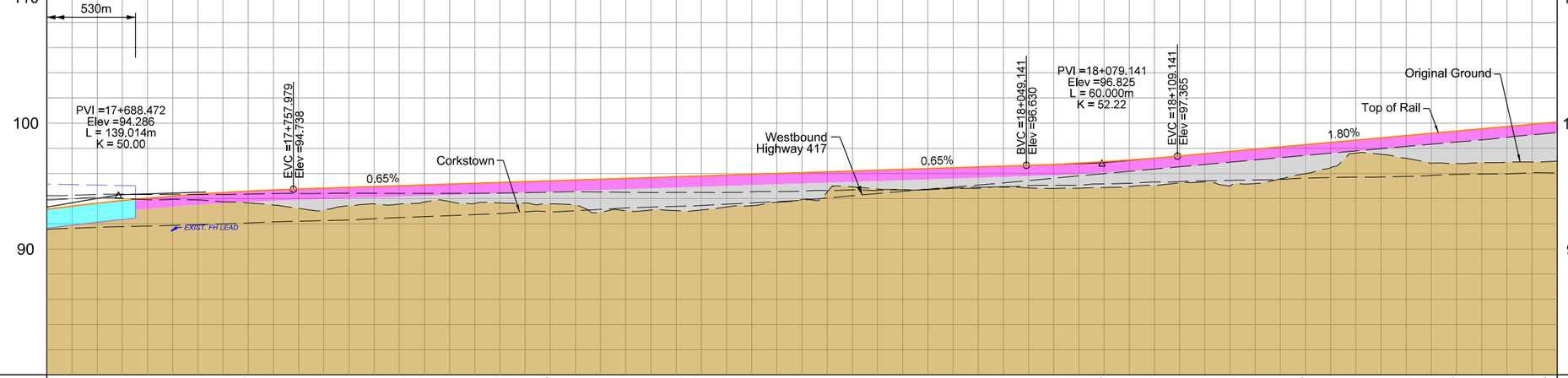

Original Ground	93.89	94.09	93.92	93.88	93.65	93.21	93.43	93.56	93.76	93.65	93.57	92.91	93.08	93.08	93.43	93.92	94.03	94.71	94.80	94.91	94.80	94.87	95.05	95.33	95.19	95.97	97.60	97.20	96.77	96.88	96.97	Original Ground
Top of Rail	93.14	93.62	94.02	94.35	94.59	94.75	94.88	95.01	95.14	95.27	95.40	95.53	95.66	95.79	95.92	96.05	96.18	96.31	96.44	96.57	96.71	96.92	97.21	97.56	97.92	98.28	98.64	99.00	99.36	99.72	100.08	Top of Rail
Station			17+700					17+800					17+900					18+000						18+100					18+200				Station

Note:
Pathways are conceptual and are subject to change.

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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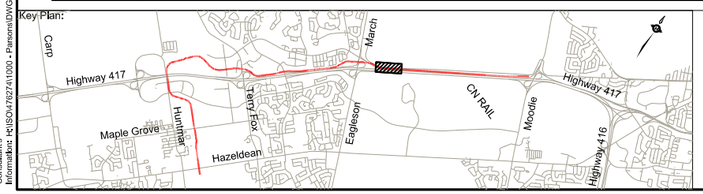
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

17+660 to 18+260

Revision:

Sheet: 16

Consultant's Information: H:\ISO\476274\1000 - Personnel\DWGS\01-Functional Design\Sheets\000\476242-A1000-04LRT-PP-2116.Dgn
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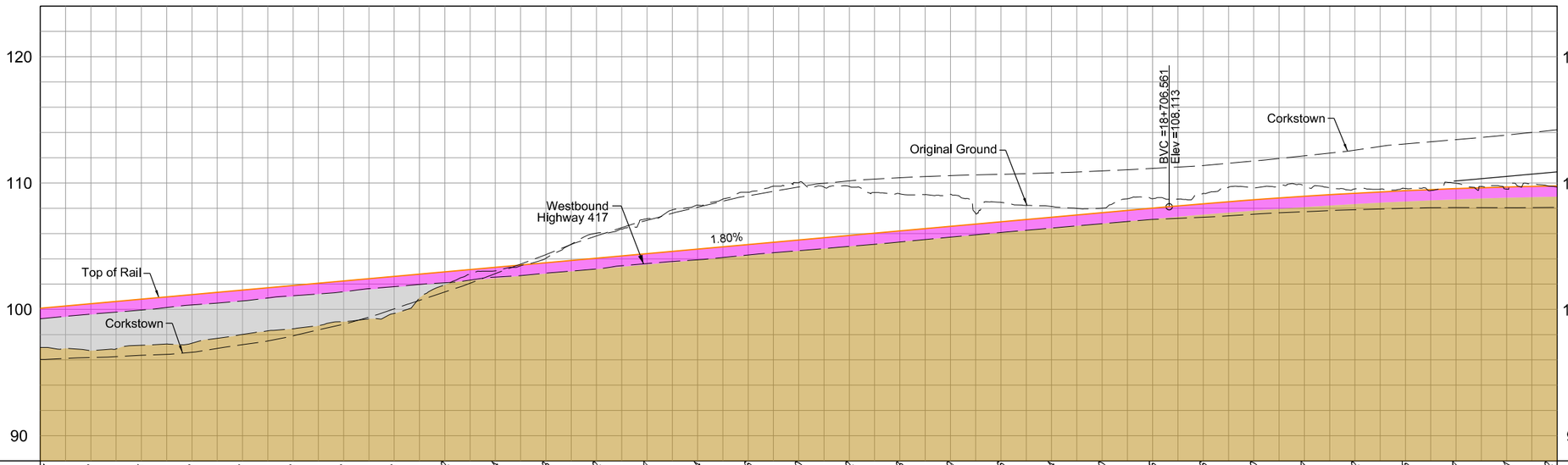

Original Ground	96.97	96.72	97.15	97.32	98.01	98.46	99.02	99.66	101.92	103.04	104.03	106.02	107.17	108.24	109.26	110.00	109.72	109.13	109.09	108.46	108.14	108.00	108.75	108.16	108.60	108.77	109.52	109.55	109.97	109.51	109.72	Original Ground
Top of Rail	100.08	100.44	100.80	101.16	101.52	101.88	102.24	102.60	102.96	103.32	103.68	104.04	104.40	104.76	105.12	105.48	105.84	106.20	106.56	106.92	107.28	107.64	107.99	108.35	108.66	108.94	109.18	109.38	109.54	109.67	109.76	Top of Rail
Station			18+300					18+400					18+500					18+600						18+700					18+800				Station

Note:
Pathways are conceptual and are subject to change.

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
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- Platform
- Property Line
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- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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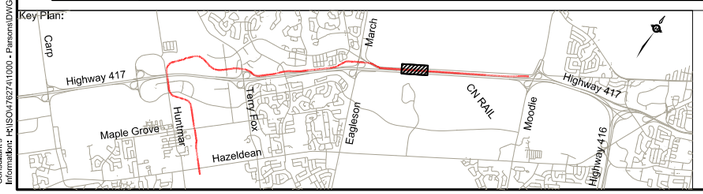
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

17+660 to 18+260

Revision:

Sheet: 17

Consultant's Information: H:\ISO\476027\41000 - Parsons\DWGS\01-Functional Design\Sheets\000\476242-01000-A4L-RT-PP-017.Dgn
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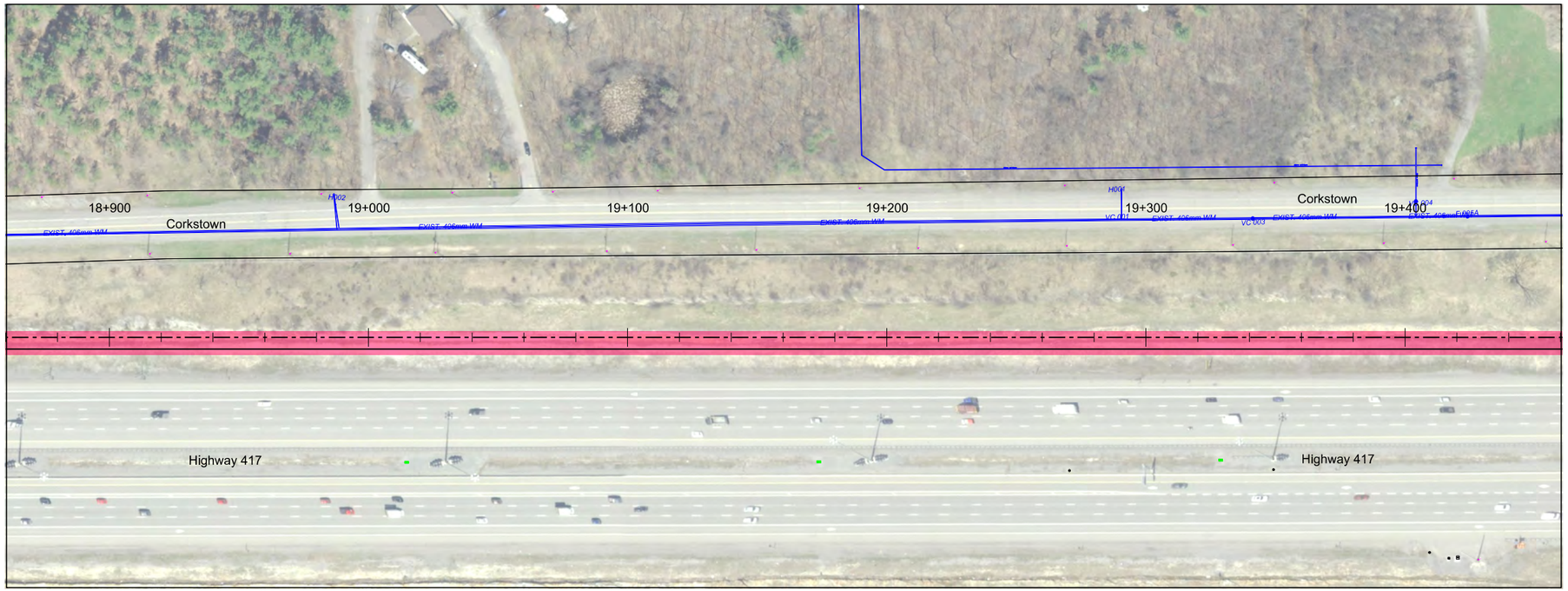
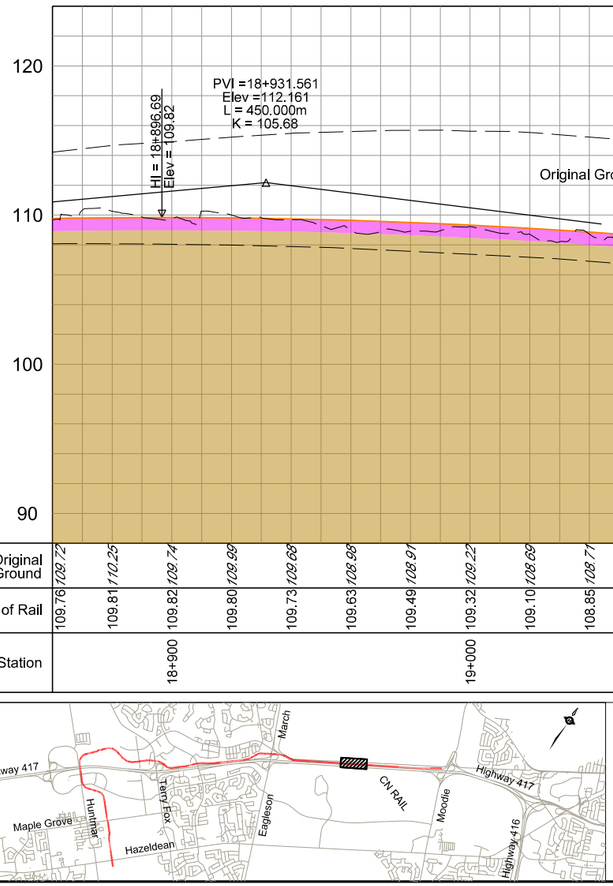


Note:
Pathways are conceptual and are subject to change.



Station	Original Ground	Top of Rail
18+900	109.72	109.76
	110.25	109.81
	109.74	109.82
	109.99	109.80
	109.68	109.73
	108.98	109.63
	108.91	109.49
19+000	109.22	109.32
	108.69	109.10
	108.71	108.85
	107.98	108.56
	107.72	108.23
19+100	107.50	107.87
	107.27	107.46
	107.02	107.02
	105.78	106.54
	106.28	106.05
19+200	105.85	105.56
	104.98	105.07
	104.61	104.58
	103.56	104.08
	102.72	103.59
19+300	102.38	103.10
	101.50	102.61
	101.33	102.12
	100.07	101.63
	99.41	101.13
19+400	98.97	100.64
	98.38	100.15
	97.99	99.66
	97.36	99.17

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:

Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

18+860 to 19+460

Revision:

Sheet: 18

Consultant's Information: H:\ISO\476027\41000 - Parsons\DWGS\01-Functional Design\Sheets\000\476242\41000\40-LRT-PP-2018.Dgn
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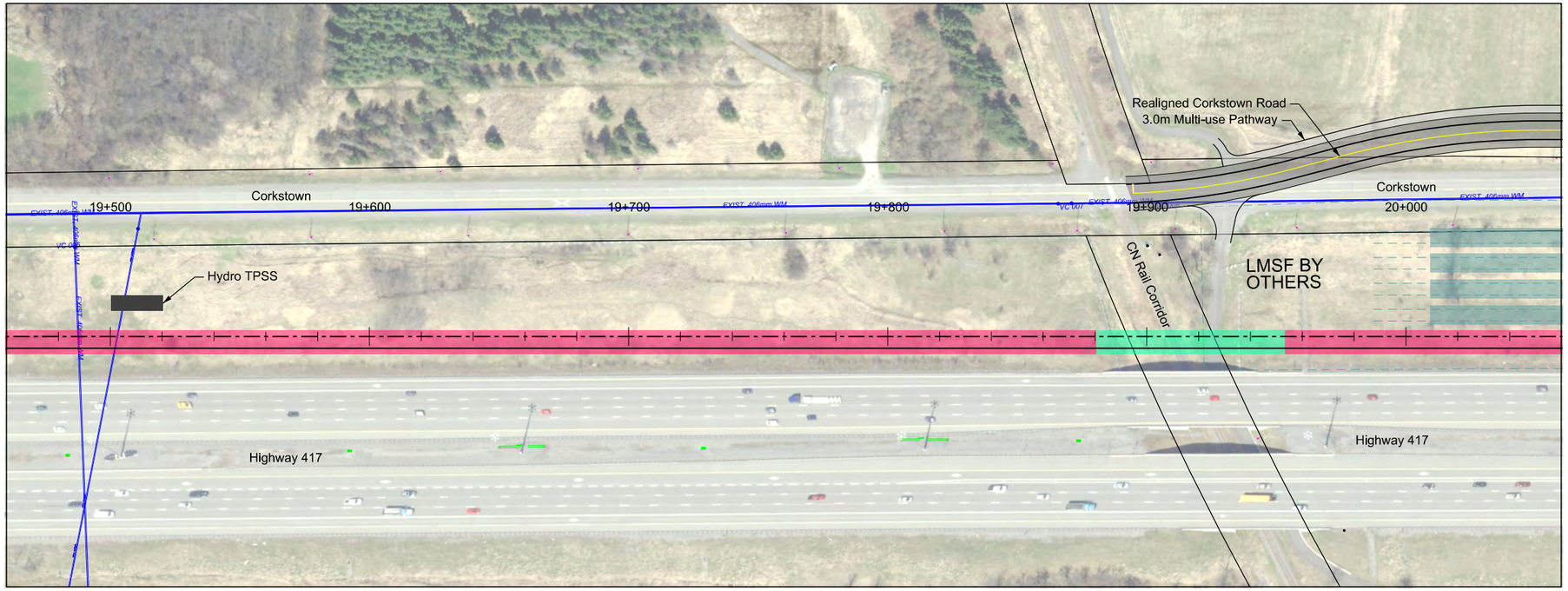


Note:
Pathways are conceptual and are subject to change.

Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

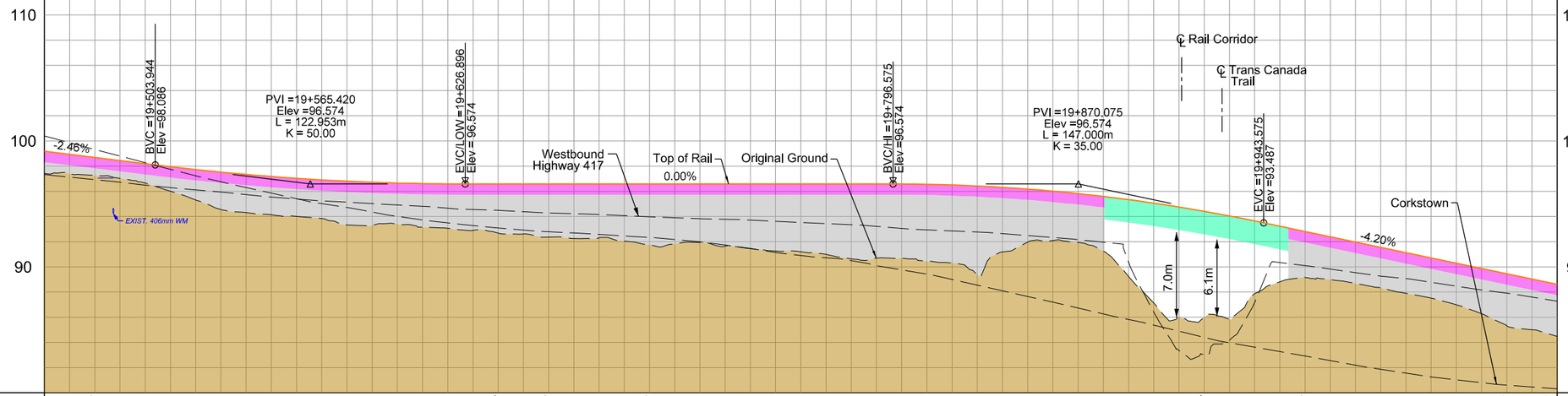
Ottawa PARSONS

Plan and Profile

19+460 to 20+060

Revision:

Sheet: 19



Original Ground	97.36	97.25	96.64	95.29	94.30	93.99	93.32	93.39	93.06	92.67	92.35	92.30	91.75	91.92	91.43	91.19	90.63	90.68	90.30	91.18	92.09	91.23	87.12	85.97	87.86	89.15	88.68	87.89	86.98	85.31	84.35	Original Ground
Top of Rail	99.17	98.67	98.18	97.72	97.33	97.02	96.79	96.65	96.58	96.57	96.57	96.57	96.57	96.57	96.57	96.57	96.57	96.57	96.50	96.30	96.00	95.58	95.05	94.40	93.64	92.80	91.96	91.12	90.28	89.44	88.60	Top of Rail
Station			19+500					19+600					19+700					19+800					19+900					20+000				Station

Legend:

- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
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- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

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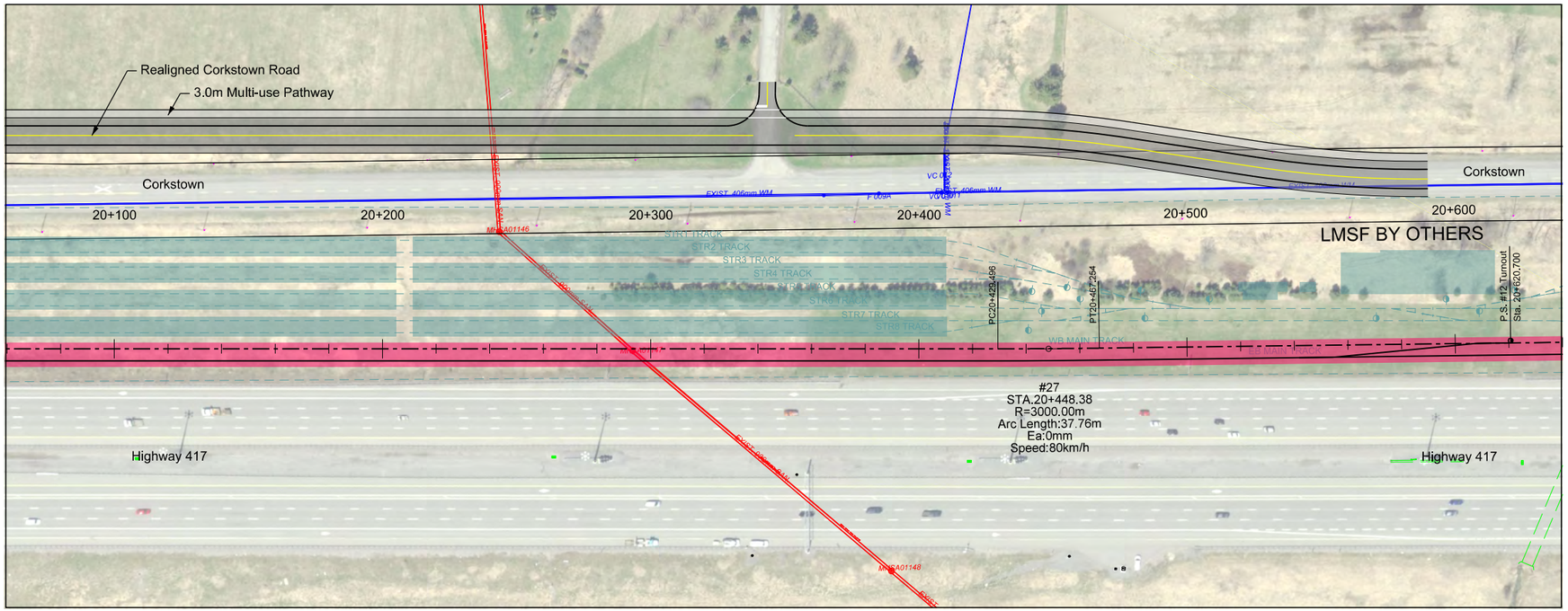
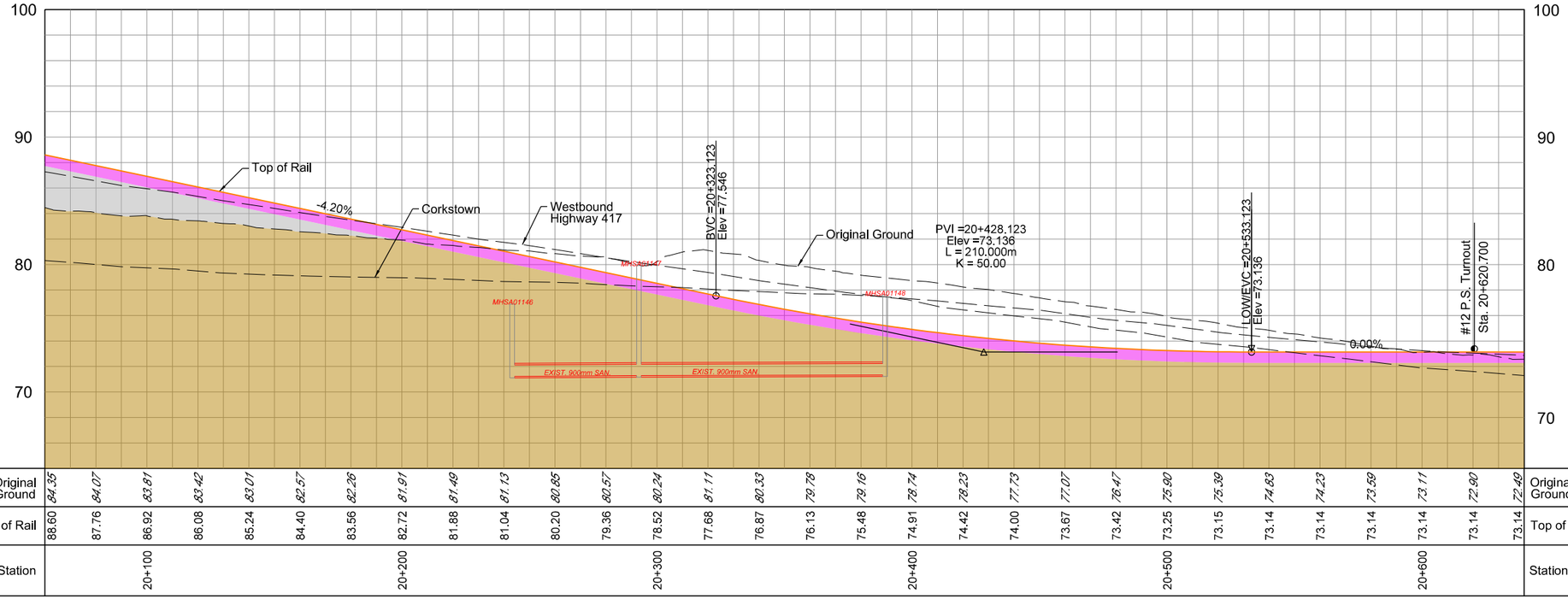
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018





Original Ground	84.35	84.07	83.81	83.42	83.01	82.57	82.26	81.91	81.49	81.13	80.85	80.57	80.24	81.11	80.33	79.78	79.16	78.74	78.23	77.73	77.07	76.47	75.90	75.39	74.83	74.23	73.59	73.11	72.90	72.49	Original Ground
Top of Rail	88.60	87.76	86.92	86.08	85.24	84.40	83.56	82.72	81.88	81.04	80.20	79.36	78.52	77.68	76.87	76.13	75.48	74.91	74.42	74.00	73.67	73.42	73.25	73.15	73.14	73.14	73.14	73.14	73.14	73.14	Top of Rail
Station			20+100					20+200					20+300					20+400						20+500					20+600			Station

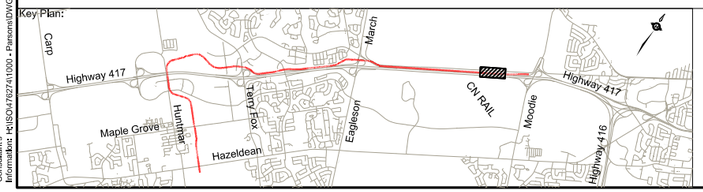
Note:
Pathways are conceptual and are subject to change.

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

DRAFT
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:



Confederation Line Kanata LRT Extension

Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

20+060 to 20+640

Revision:

Sheet: 20

Plot Date: 3/13/2018 3:15:03 PM
Last SaveIC: 3/13/2018 2:56:09 PM
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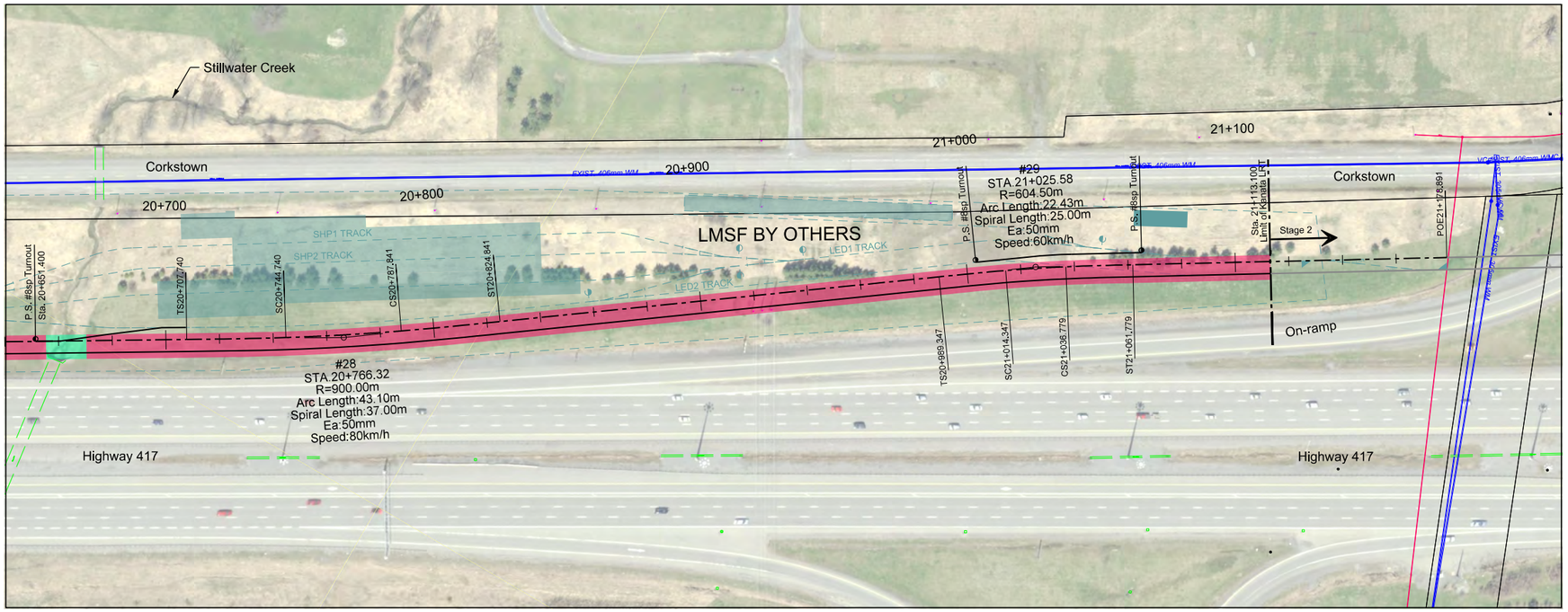
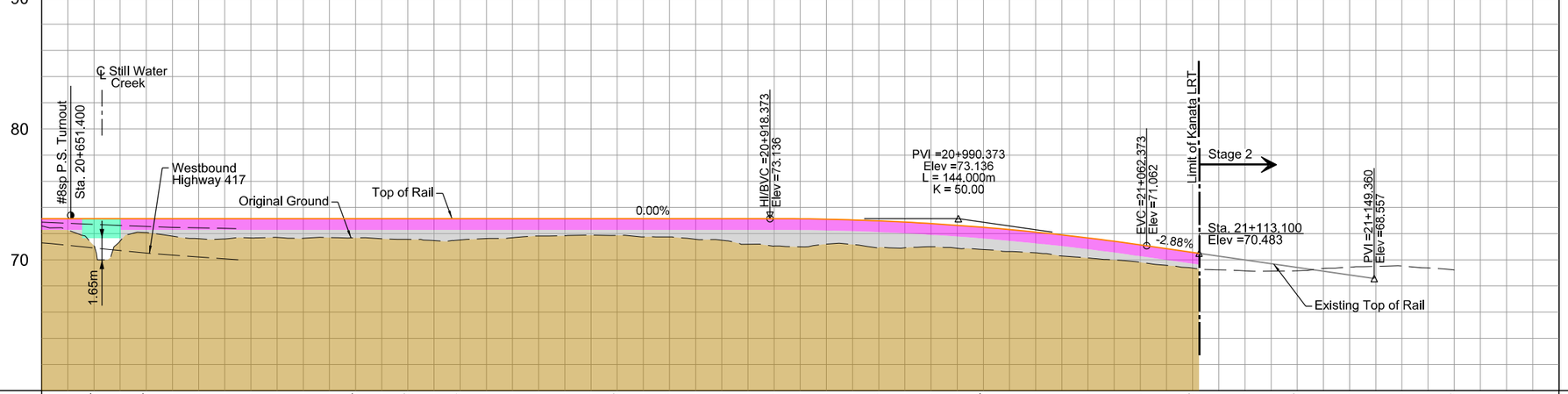




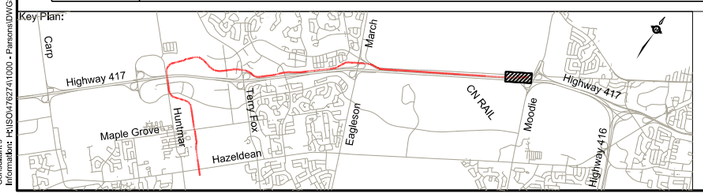
Original Ground	72.49	71.07	72.07	71.60	71.66	71.63	71.67	71.55	71.51	71.68	71.83	71.85	71.74	71.49	71.04	71.19	70.94	70.99	70.77	70.52	70.13	69.80	69.35	69.14	69.15	69.43	69.52	69.21	Original Ground
Top of Rail	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.14	73.09	72.96	72.76	72.47	72.10	71.66	71.13	70.55	69.98	69.40	68.83			Top of Rail
Station				20+700					20+800					20+900					21+000					21+100				21+180	Station

Note:
Pathways are conceptual and are subject to change.

Legend:
- Hydro
- Sanitary Sewer
- Storm Sewer
- Watermain
- ℄ Track 1-Alignment
- ℄ Track 2
- Underground Structure
- Open Trench Structure
- Top of Rail
- Original Ground
- Platform
- Property Line
- Turnout
- Ballasted Track
- Existing Ground Material
- Fill Material
- Direct Fixation on Concrete Slab
- Portal
- Rail Tunnel Allowance
- Aboveground Allowance
- Elevated Structure Allowance

DRAFT
FOR INFORMATION ONLY
March 13, 2018

March 13, 2018

Key Plan:


Confederation Line Kanata LRT Extension
Hazeldean Road to Moodie Drive

HORIZONTAL
0m 20 40 80 120 160
0m 4 8 16 24 32
VERTICAL

Ottawa PARSONS

Plan and Profile

20+640 to Limit of Kanata LRT

Revision:
Sheet: 21

Consultant's Information: H:\ISO\476274\1000 - Personnel\DWGS\01-Functional Design\Sheets\000-476242-A1000-04LRT-PP-221.Dgn
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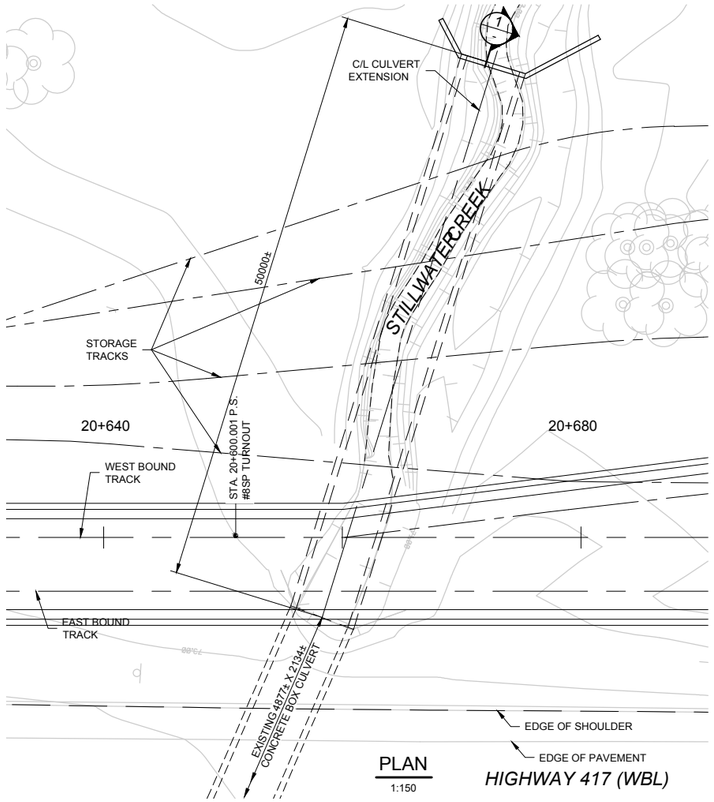

PLAN
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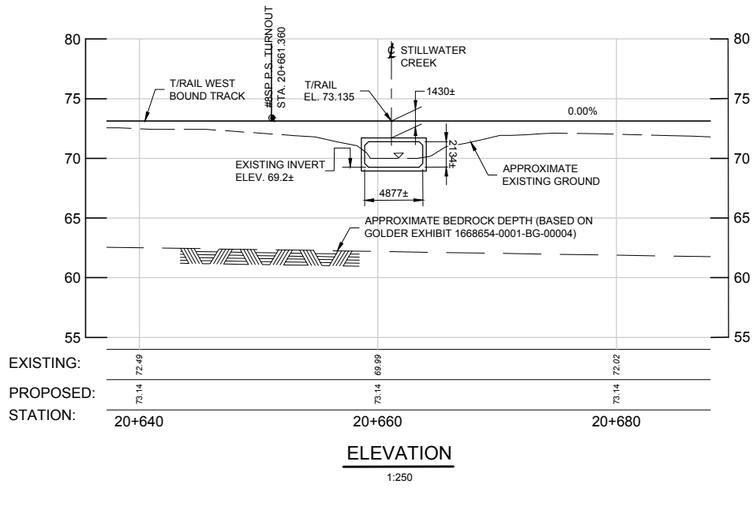
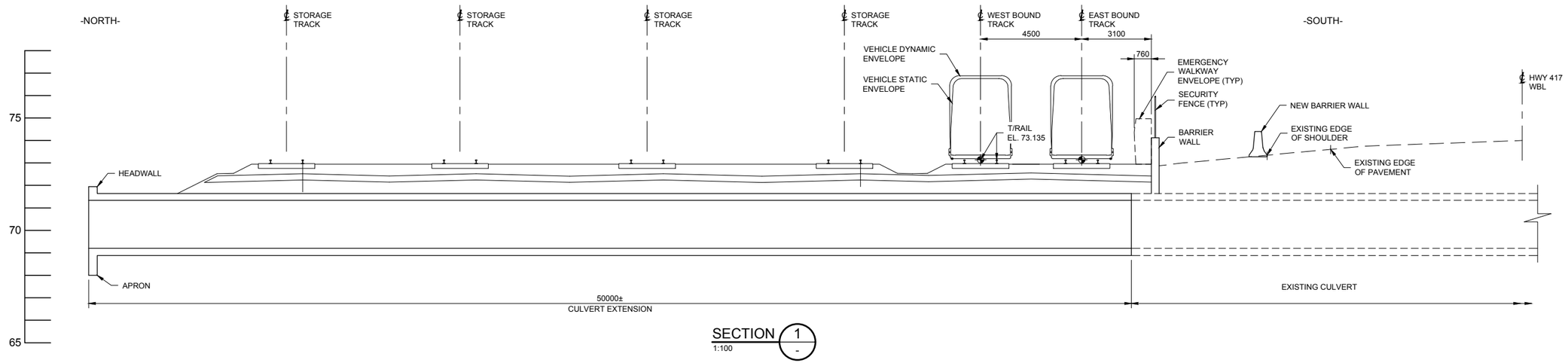


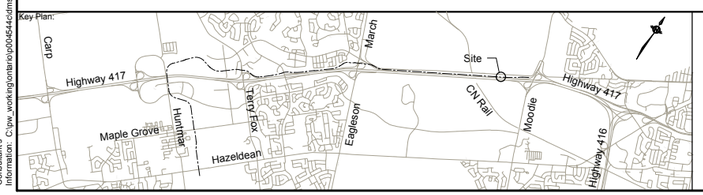
ELEVATION
1:250



SECTION 1
1:100

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
15-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Stillwater Creek Culvert Extension
Preliminary General Arrangement

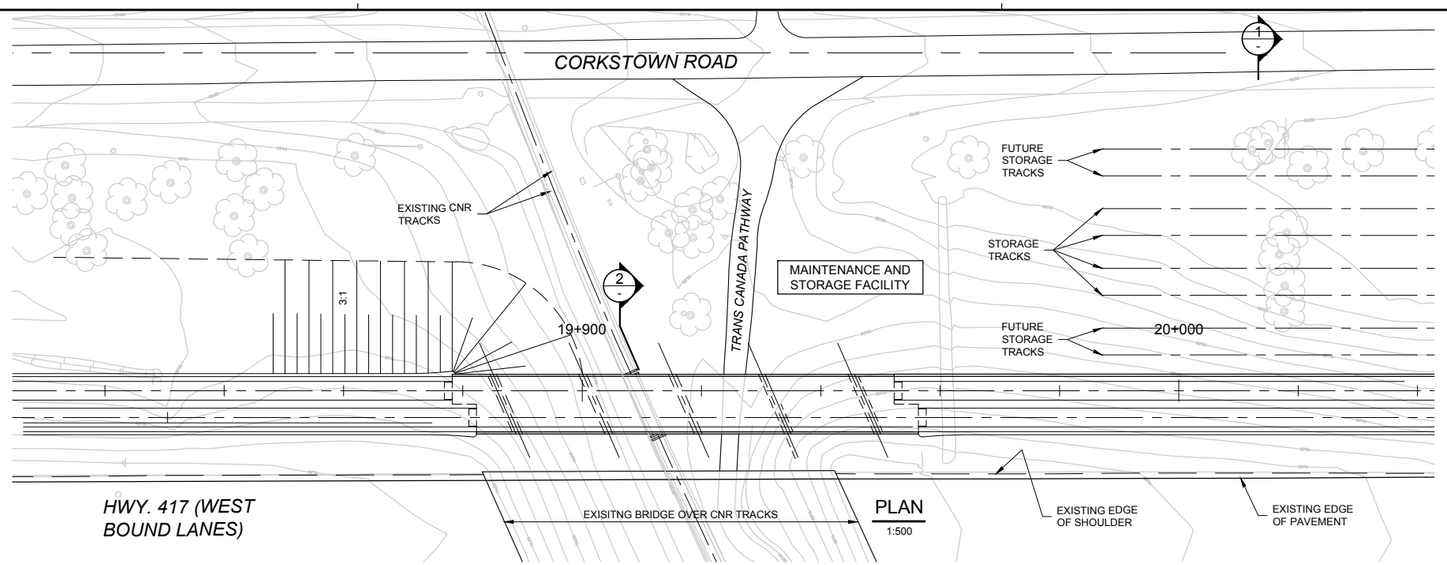
Revision:

Sheet: S01-1

Plot Date: 15-Feb-18
Last Saved: 2/15/2018 2:18:12 PM
Consultant's Information: C:\pw_working\ontario\p0045440\dms\01572\Stillwater Creek GA.dwg

PRELIMINARY
FOR DISCUSSION PURPOSES
ONLY
15-Feb-18

NORTH FOR CONSTRUCTION



PLAN
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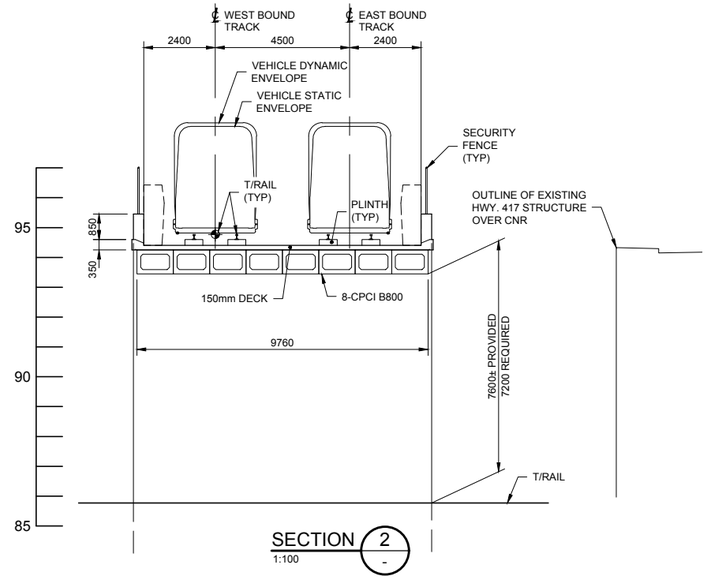

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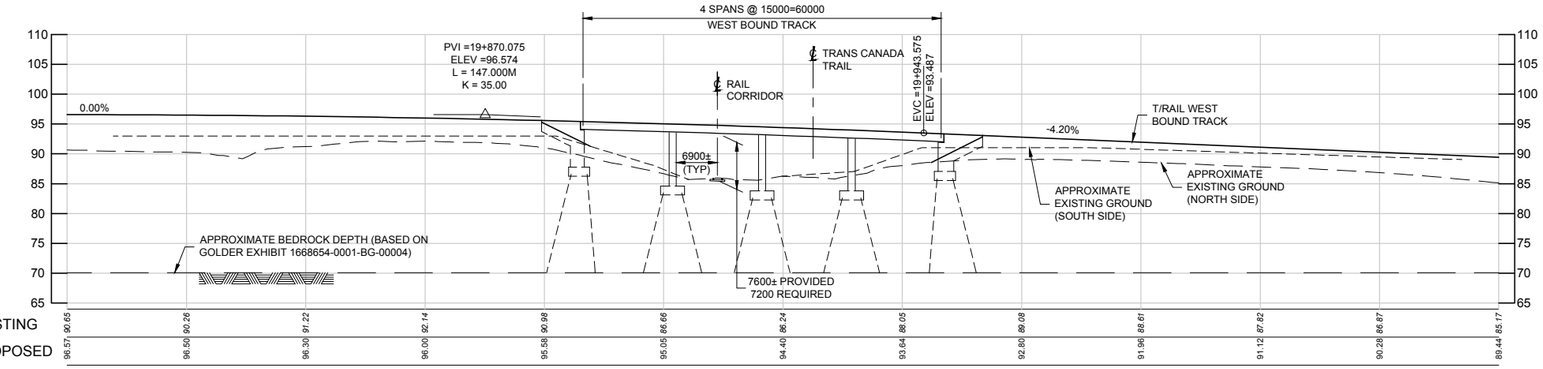
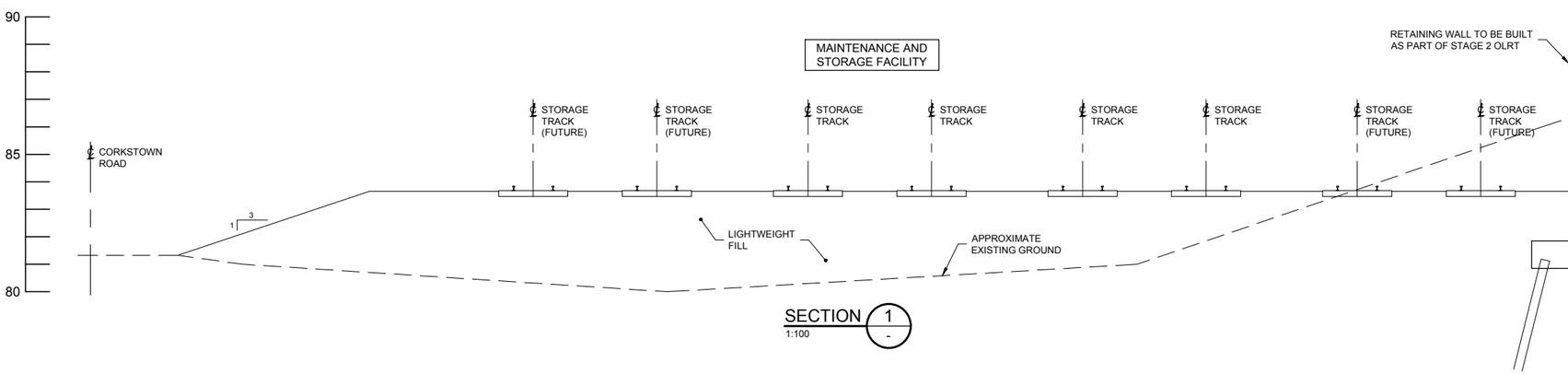


ELEVATION
1:500



SECTION 1
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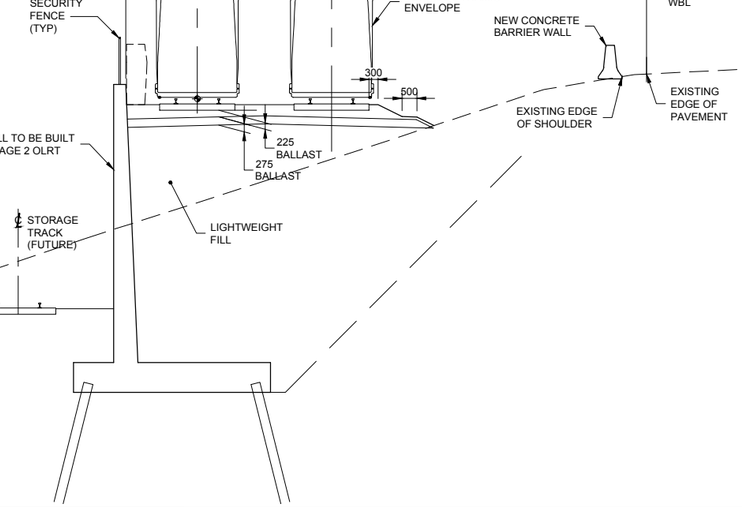

Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

VIA Rail Overpass

Preliminary General Arrangement

Revision:

Sheet: S02-1

Plot Date: 15-Feb-18
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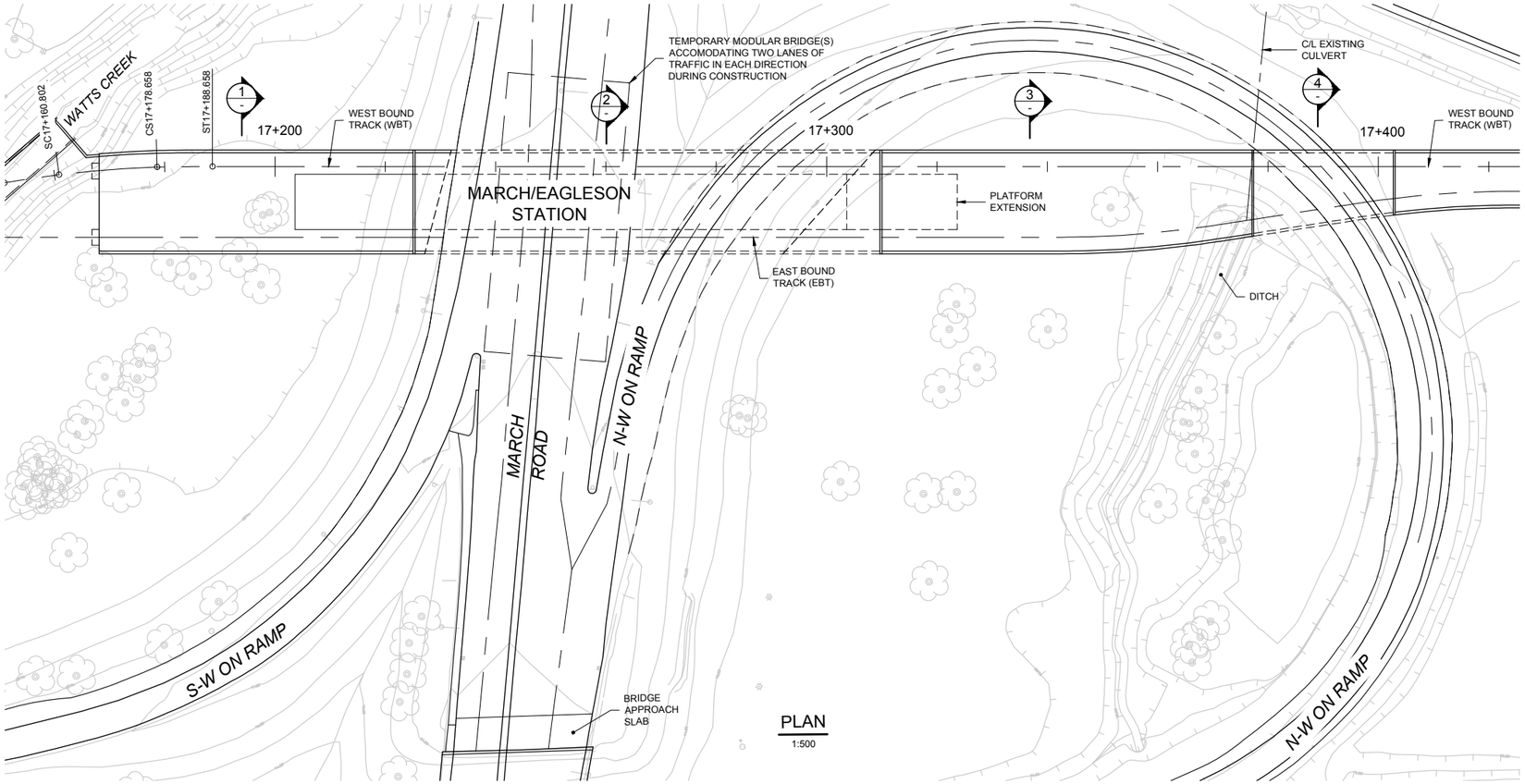
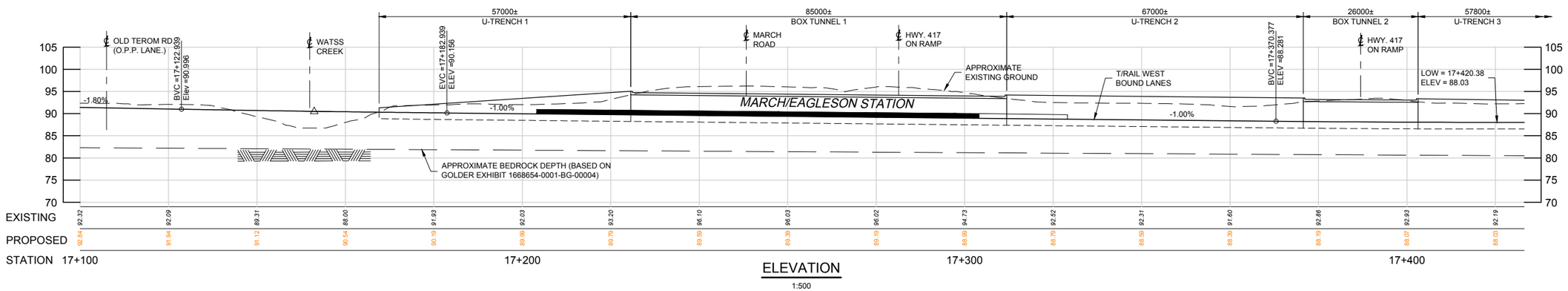


PLAN
1:500



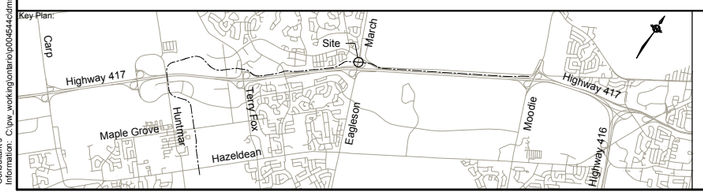
ELEVATION
1:500

NOTES:

1. STATION BUILDINGS ARE NOT SNOWN. REFER TO ARCHITECTURAL DRAWINGS.
2. N-W ON RAMP AND S-W ON RAMP TO BE CLOSED OR DIVERTED DURING CONSTRUCTION.

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
8-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

March Rd. / Eagleson Rd.

Preliminary General Arrangement I

Revision:

Sheet: S03-1

Plot Date: 15-Feb-18

Last Saved: 2/8/2018 9:34:05 AM

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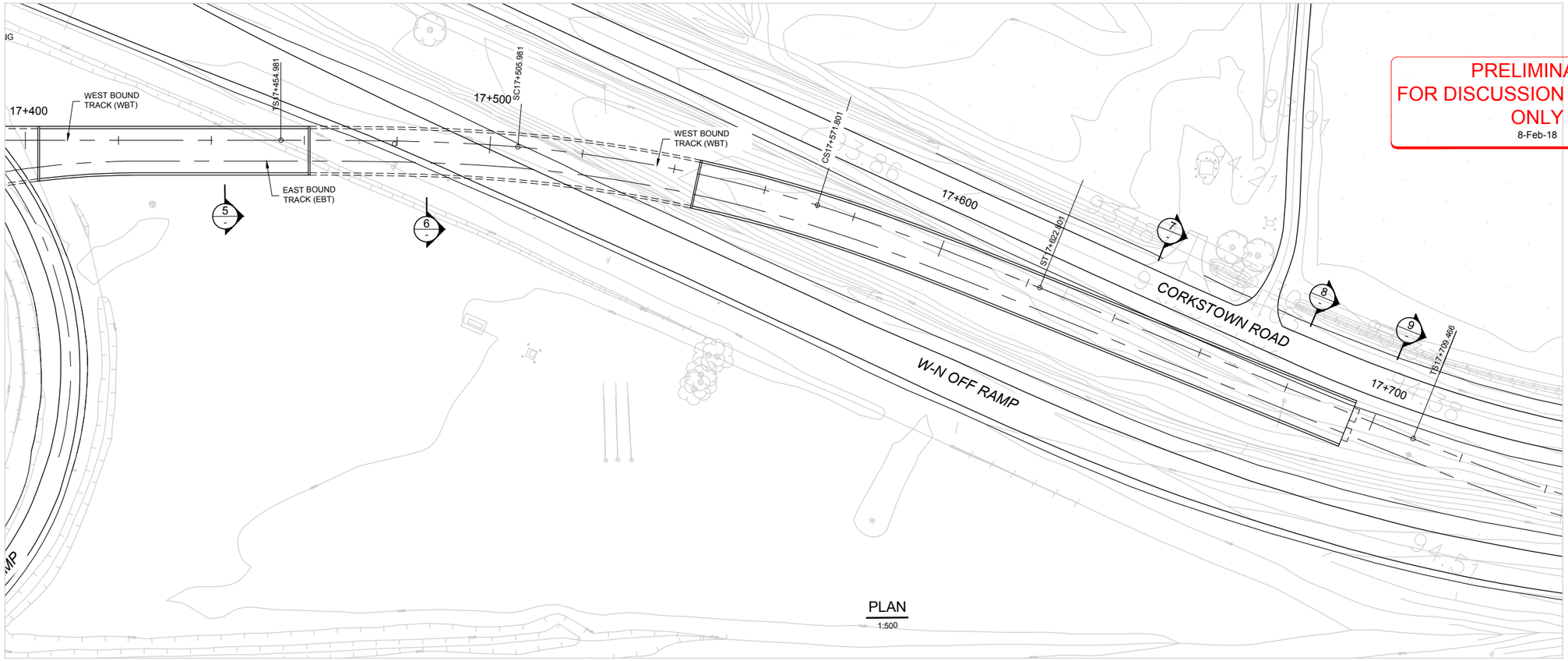
NORTH FOR CONSTRUCTION

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
8-Feb-18



PLAN
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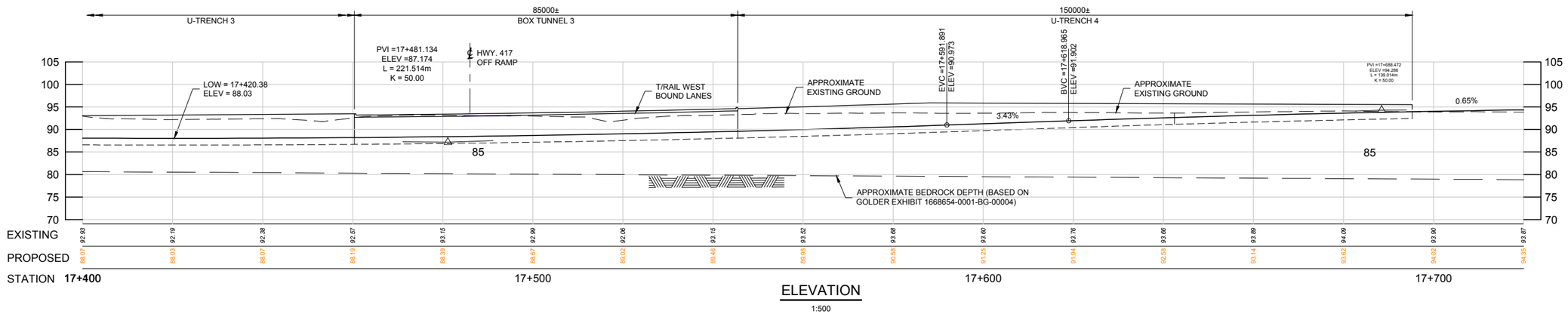
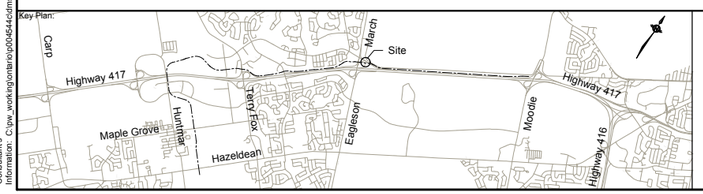


ELEVATION
1:500

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

March Rd. / Eagleson Rd.

Preliminary General Arrangement II

Revision:

Sheet: S03-2

Plot Date: 15-Feb-18

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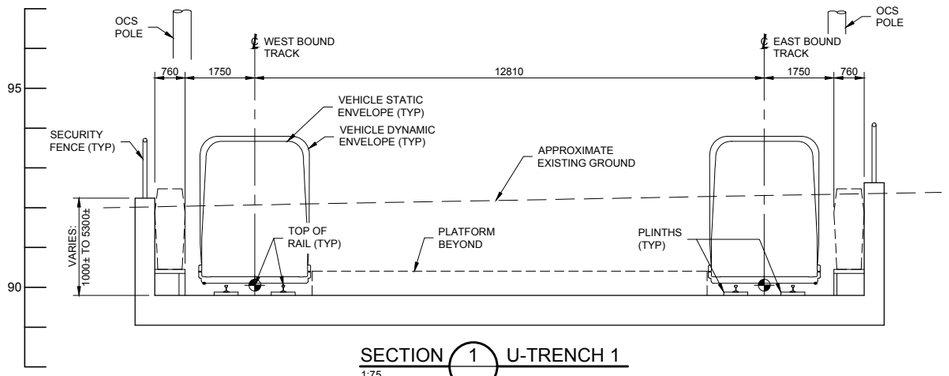
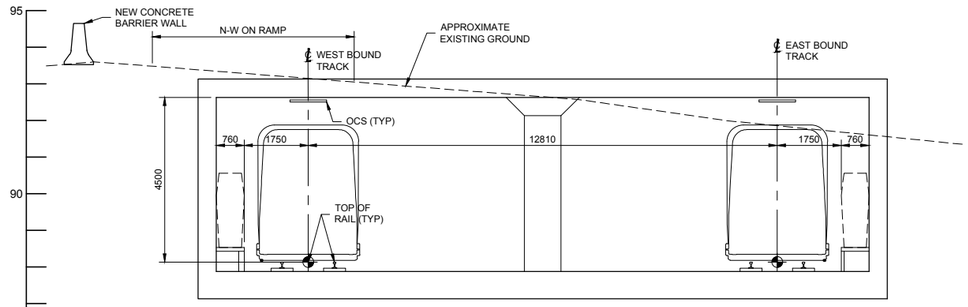
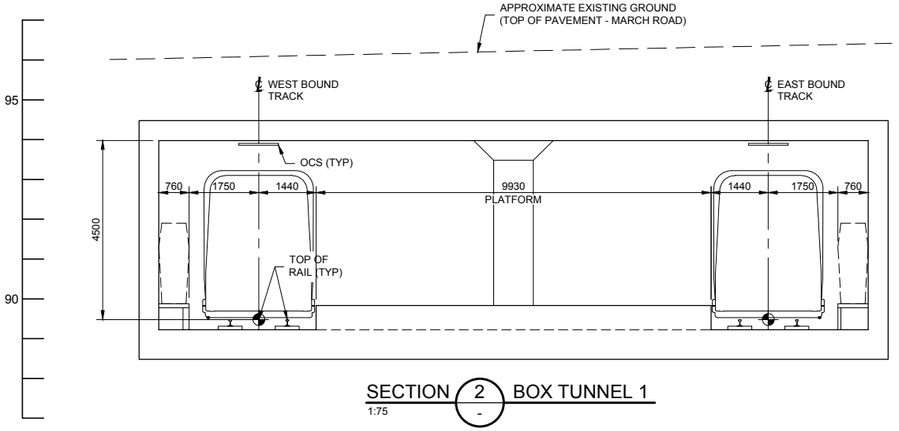


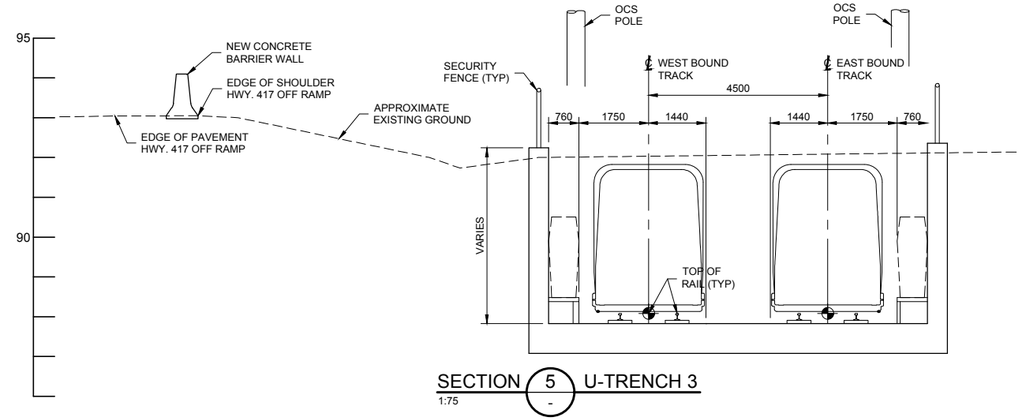
SECTION 1 U-TRENCH 1
1:75



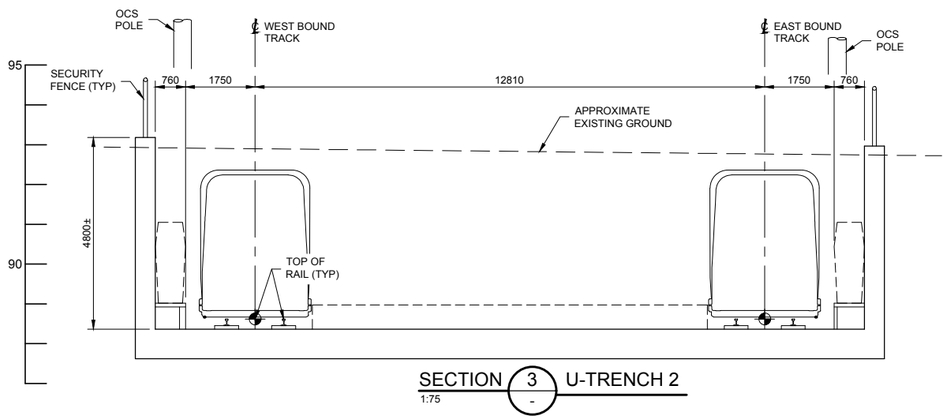
SECTION 4 BOX TUNNEL 2
1:75



SECTION 2 BOX TUNNEL 1
1:75

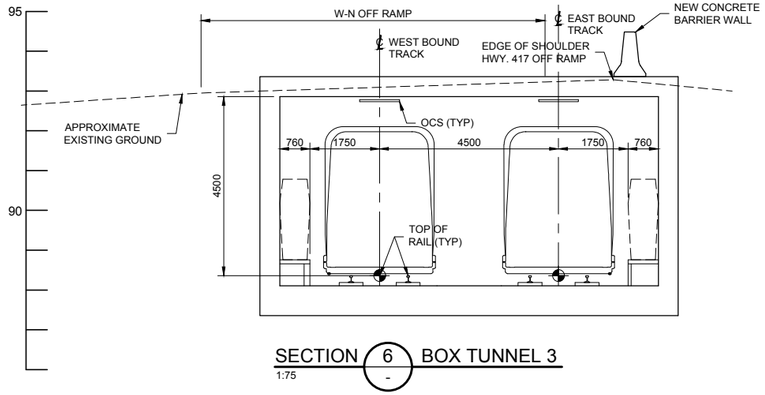


SECTION 5 U-TRENCH 3
1:75

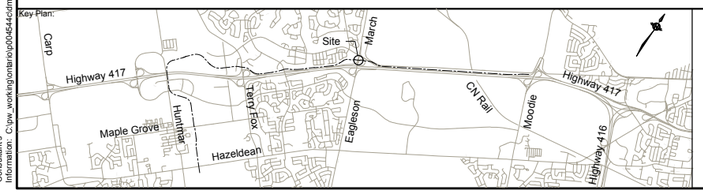


SECTION 3 U-TRENCH 2
1:75

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
8-Feb-18



SECTION 6 BOX TUNNEL 3
1:75



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

March Rd. / Eagleson Rd.

Preliminary General Arrangement III

Revision:

Sheet: S03-3

Plot Date: 15-Feb-18
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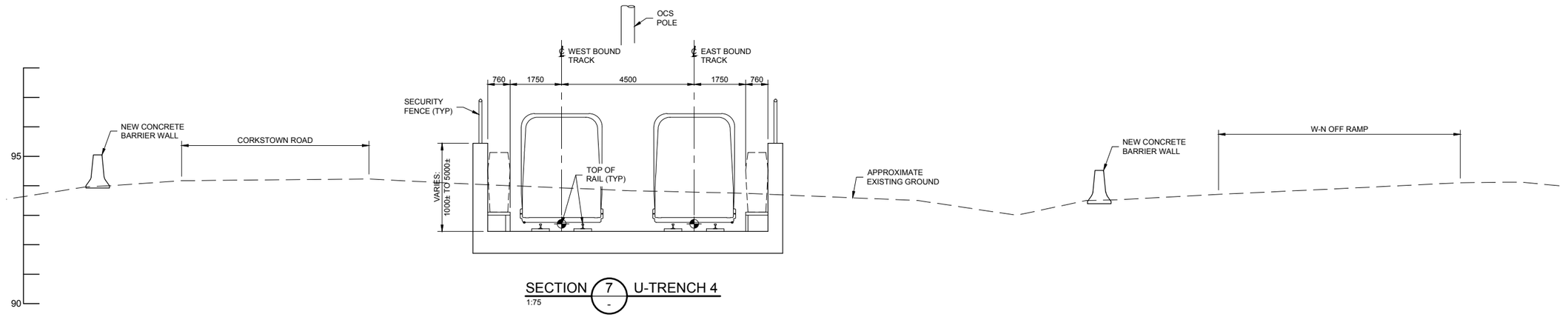
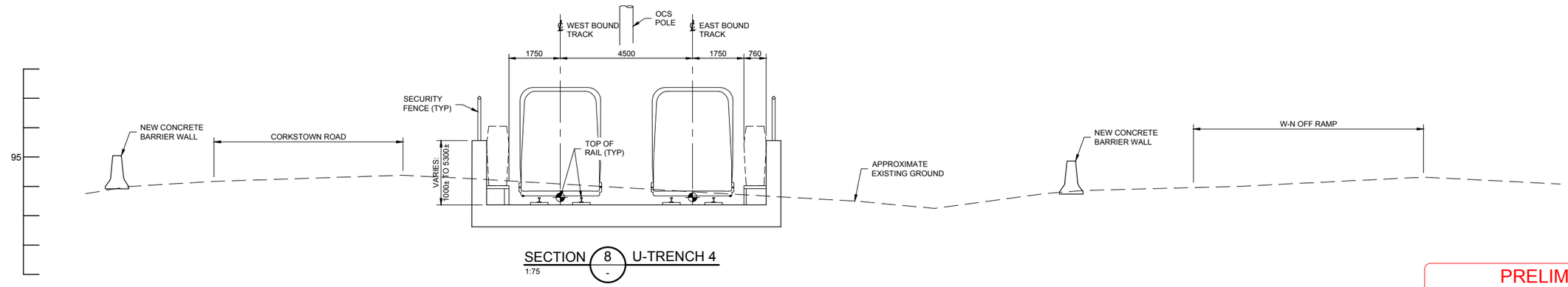
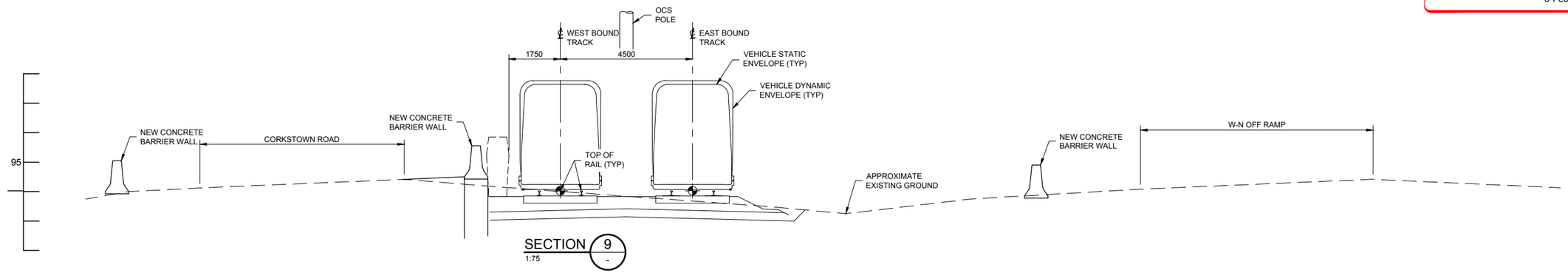


SECTION 7 U-TRENCH 4
1:75



SECTION 8 U-TRENCH 4
1:75



SECTION 9 U-TRENCH 4
1:75

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
8-Feb-18

Key Plan:

Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

March Rd. / Eagleson Rd.

Preliminary General Arrangement IV

Revision:

Sheet: S03-4

Plot Date: 15-Feb-18

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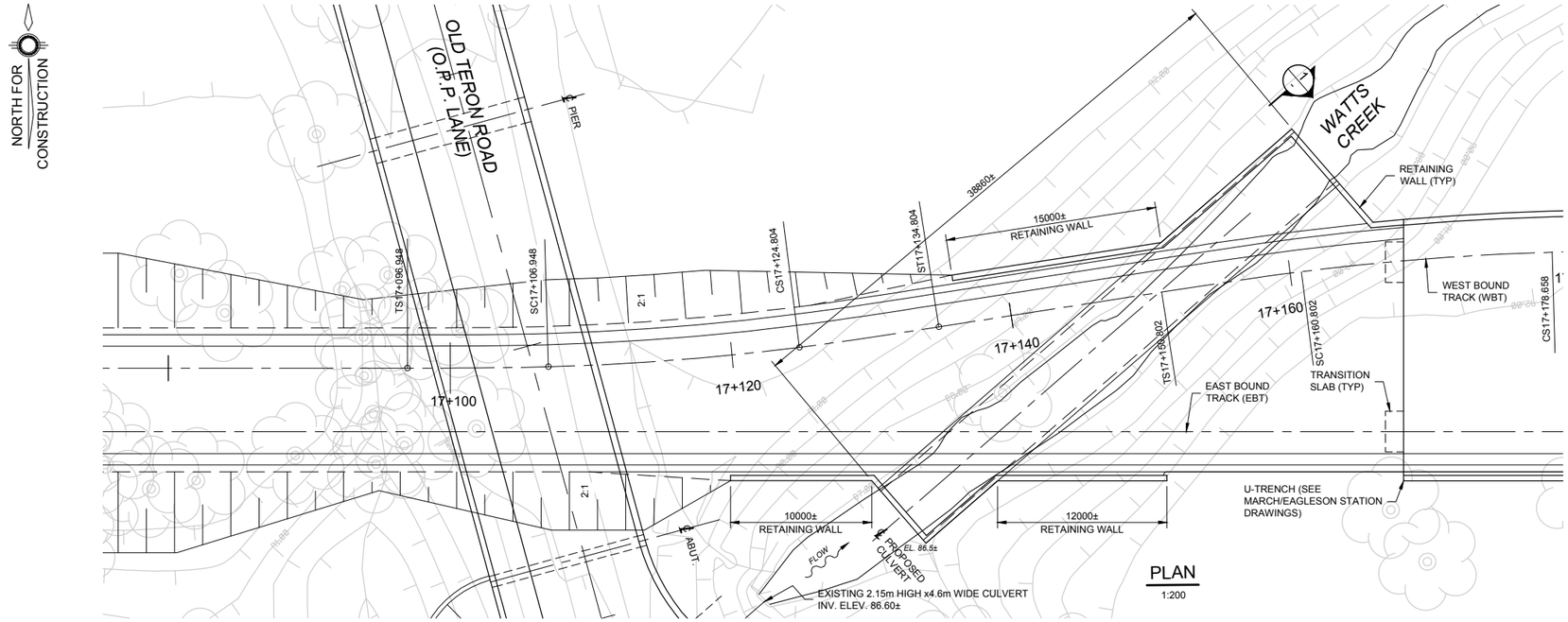
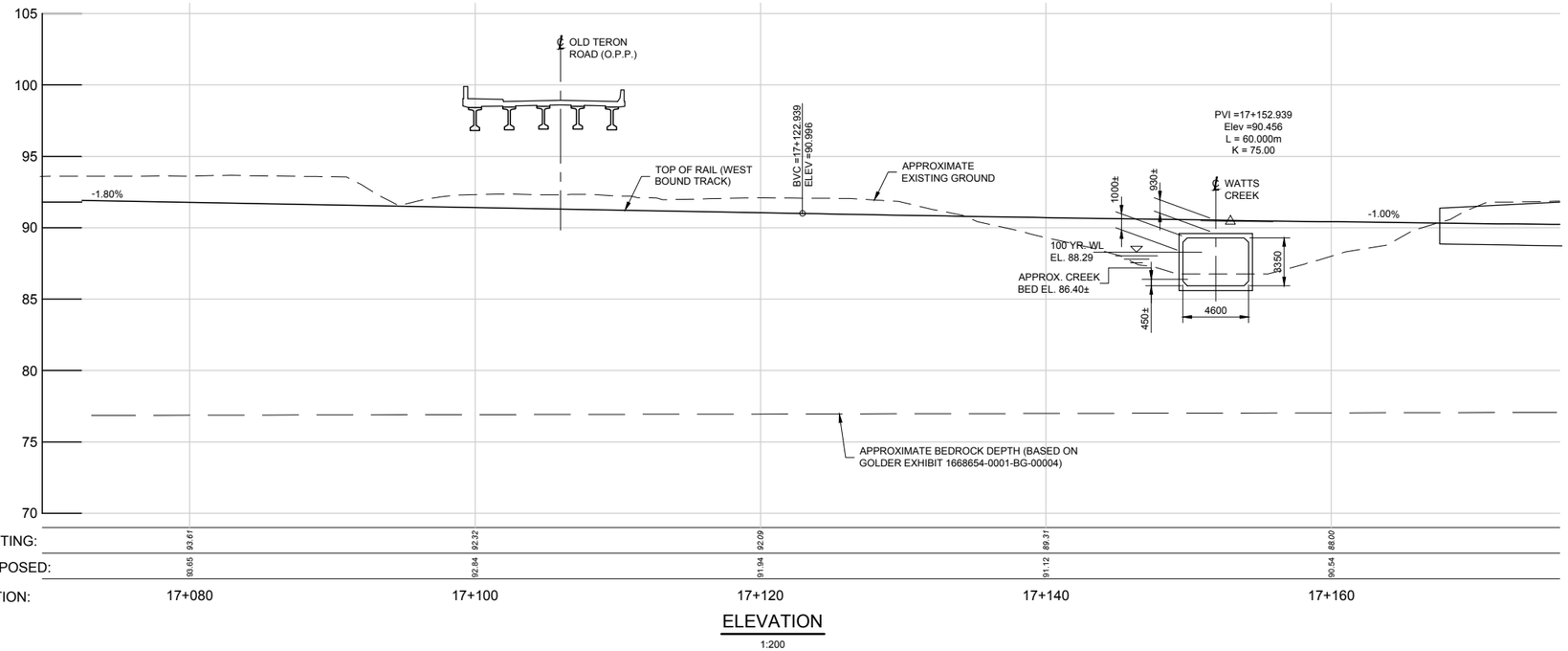


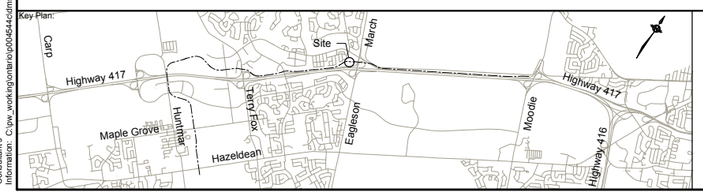
PLAN
1:200



ELEVATION
1:200

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
15-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Watts Creek Culvert

Preliminary General Arrangement I

Revision:

Sheet: S04-1

Plot Date: 16-Feb-18
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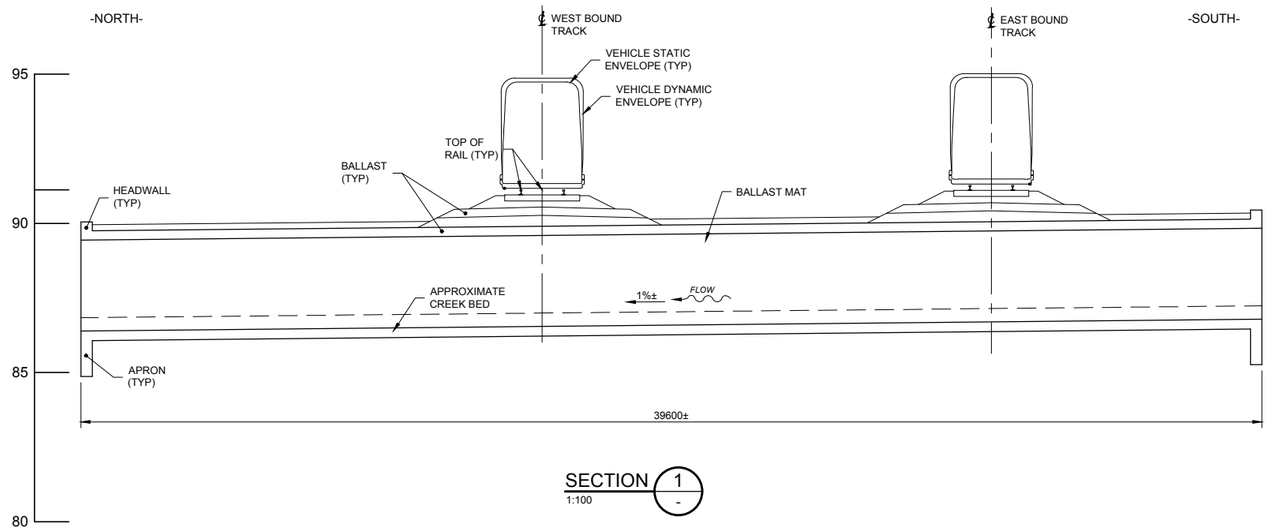

SECTION 1
1:100

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
15-Feb-18

Plot Date: 16-Feb-18
Last Saved: 2/15/2018 4:45:05 PM
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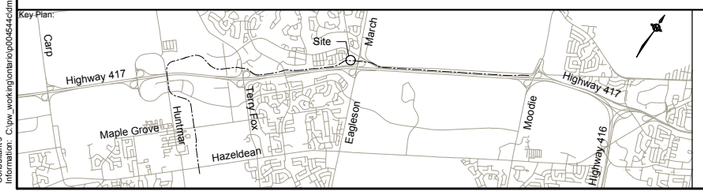
Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

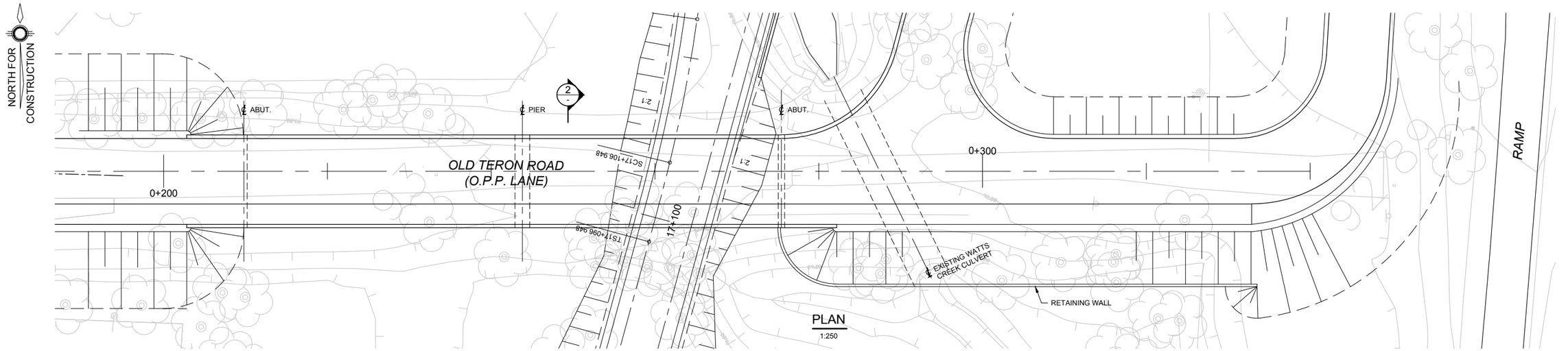
Ottawa PARSONS

Watts Creek Culvert

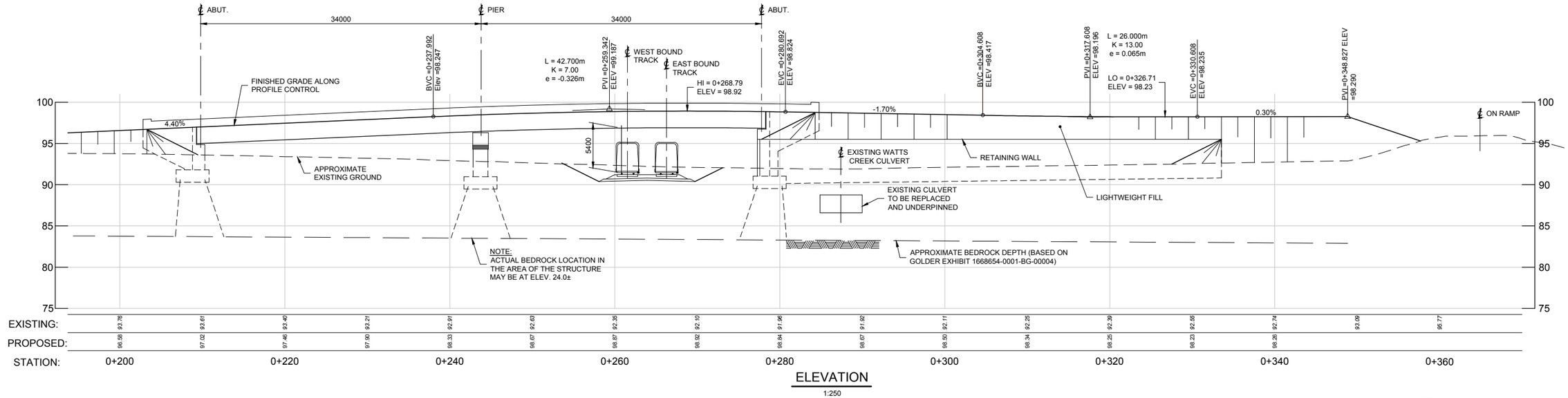
Preliminary General Arrangement II

Revision:

Sheet: S04-2

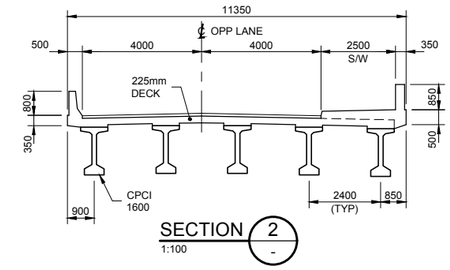


PLAN
1:250



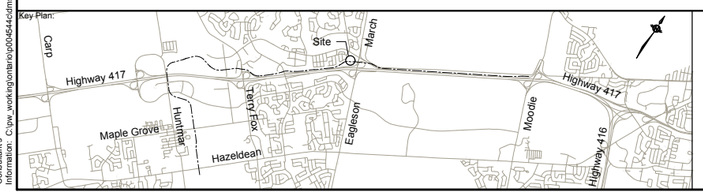
ELEVATION
1:250

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
16-Feb-18



SECTION 2-
1:100

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

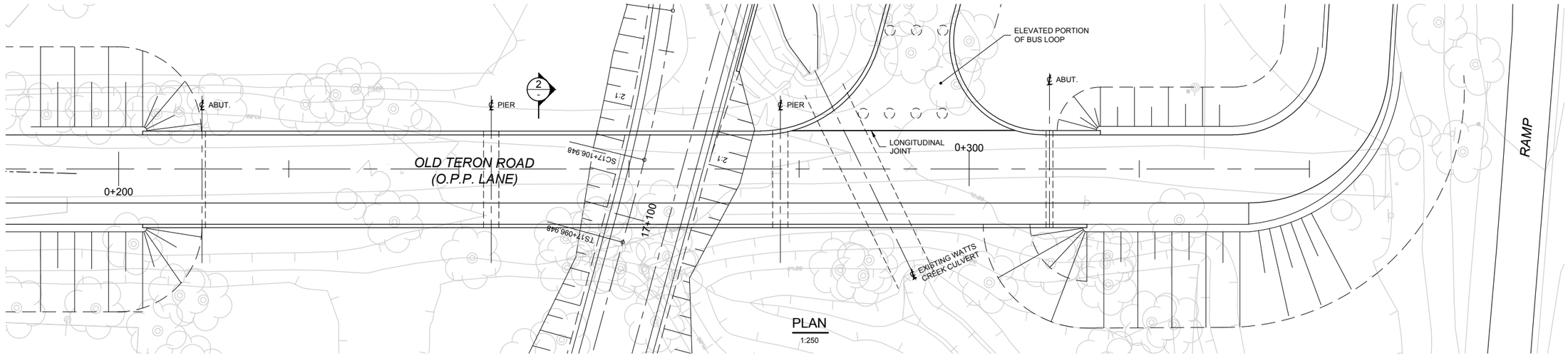
OLd Teron Road (OPP Lane) Bridge
Preliminary General Arrangement Option A

Revision:

Sheet: S04-3A

Consultant's Information: C:\pw_working\ontario\ojo\004544cdms\67797\Watts Creek GA.Dwg
Last Saved: 2/16/2018 8:52:58 AM
Plot Date: 16-Feb-18

NORTH FOR CONSTRUCTION



PLAN
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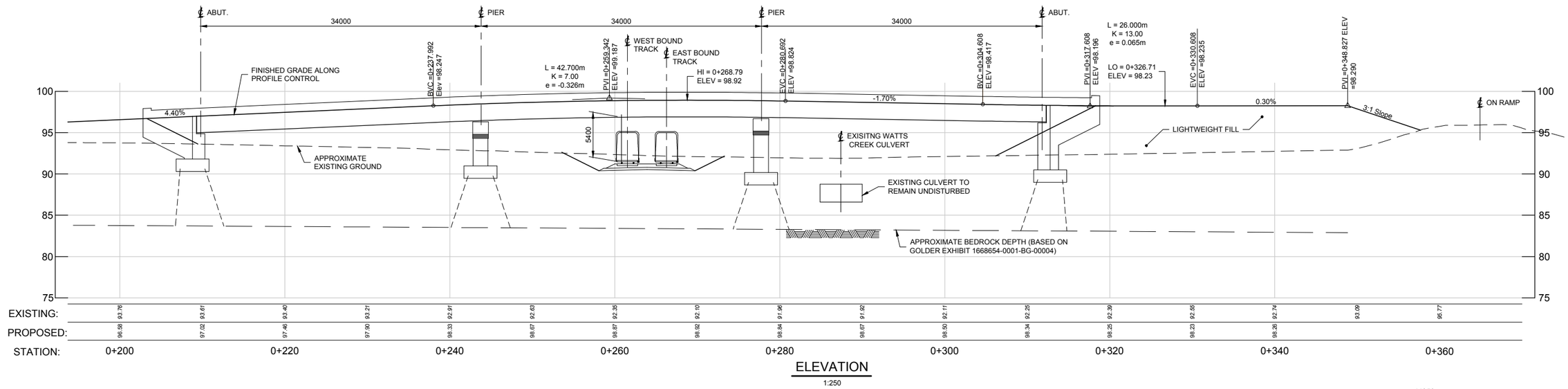

ELEVATION
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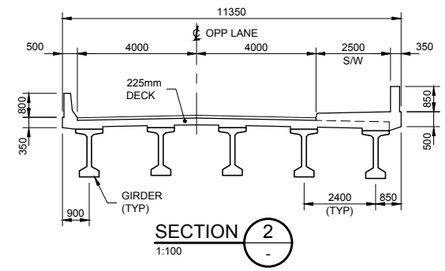
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
16-Feb-18



SECTION 2-
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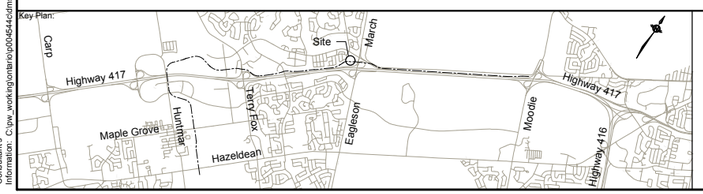
Key Plan:



Confederation Line Kanata LRT Extension

Moodie Drive to Hazeldean Station

Ottawa PARSONS

OLd Teron Road (OPP Lane) Bridge

Preliminary General Arrangement Option B

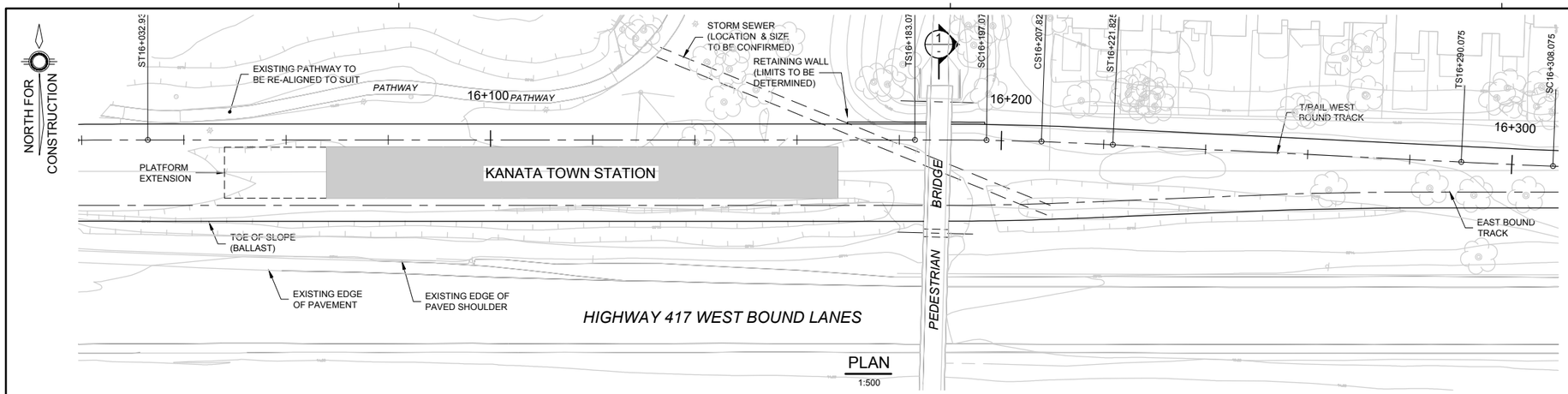
Revision:

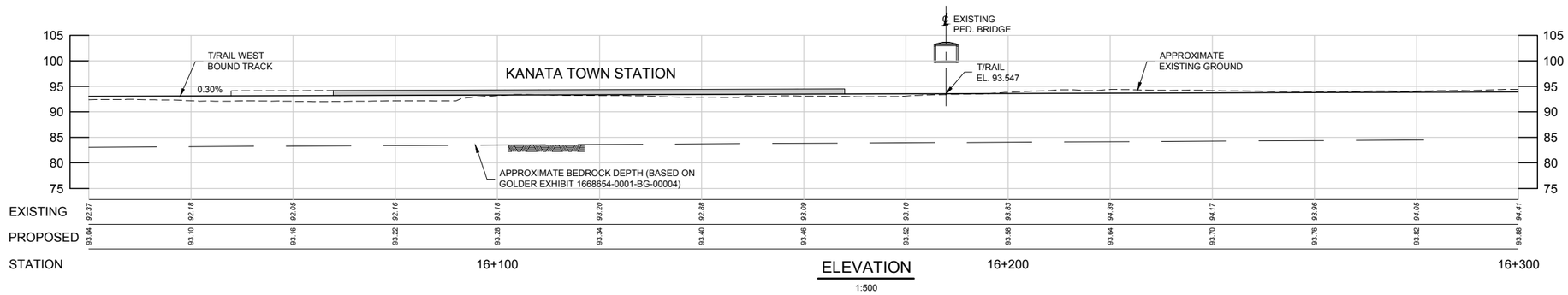
Sheet: S04-3B

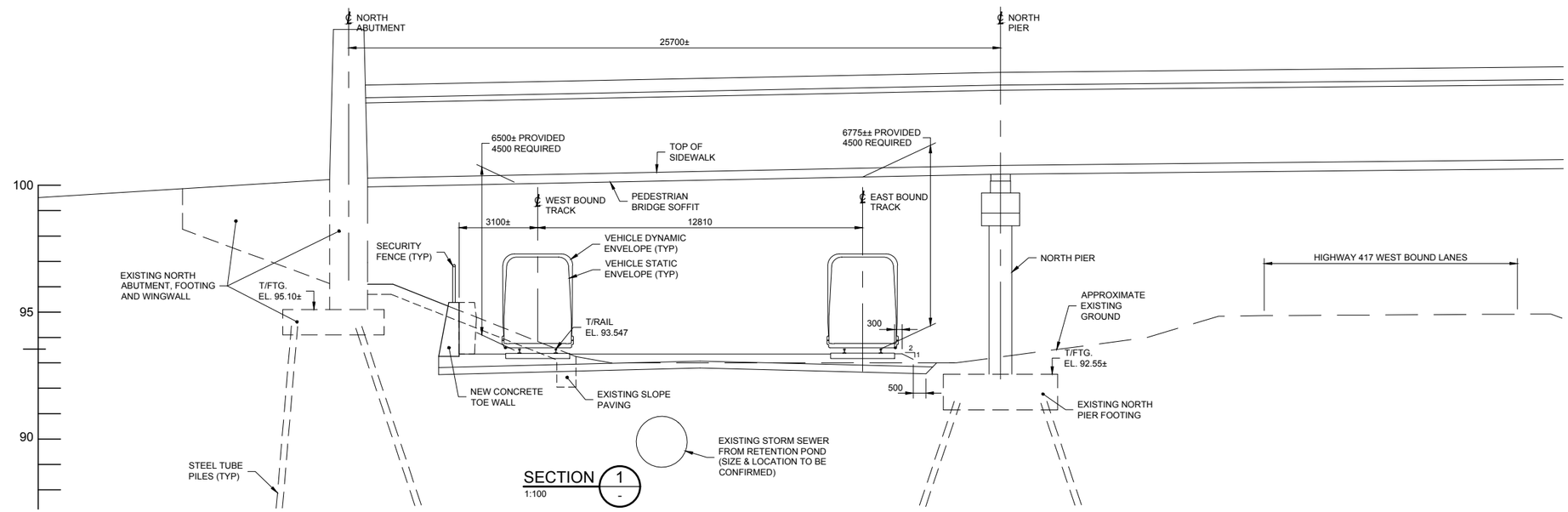
Consultant's Information: C:\pw_working\ontario\p0045644\cdms07797\Watts Creek GA_Option B.dwg

Plot Date: 20-Feb-18

Last Saved: 2/16/2018 3:41:04 PM

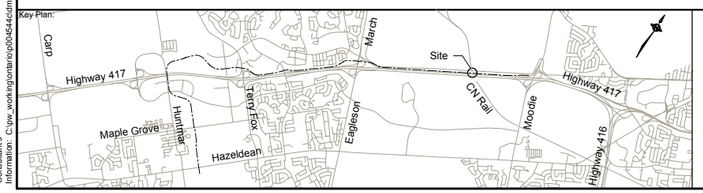






PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
8-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

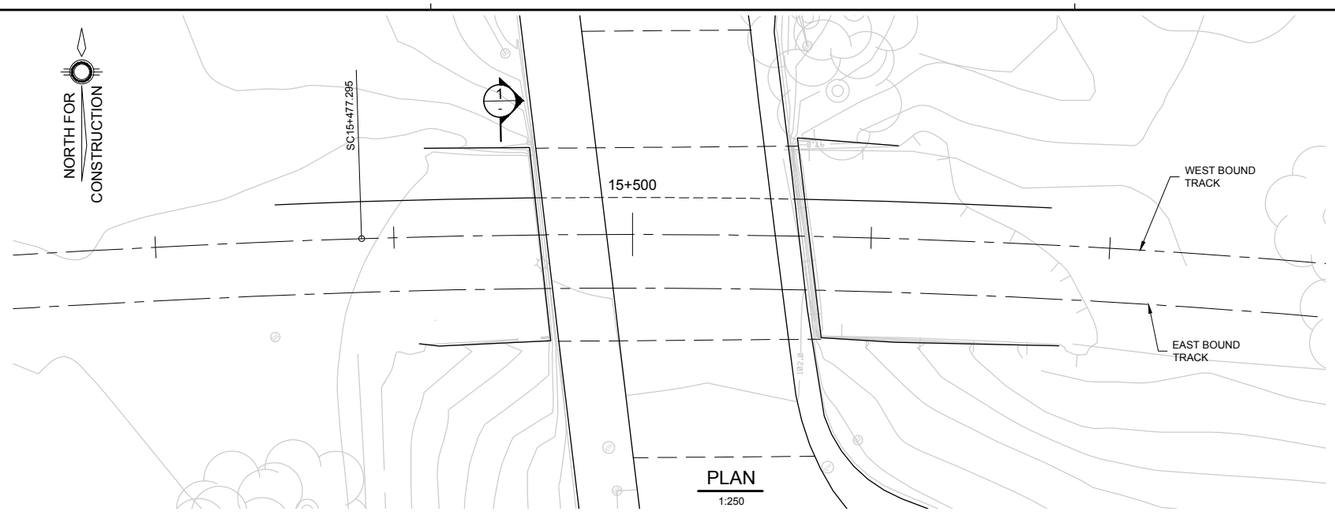
Ottawa PARSONS

Existing Pedestrian Bridge over Hwy. 417
Preliminary General Arrangement

Revision:

Sheet: S05-1

Plot Date: 16-Feb-18
Last Saved: 2/8/2018 9:18:56 AM
Consultant's Information: C:\pw_working\ontario\opb04544.cdm\s01569\Ped Bridge Over Hwy 417 GA.dwg



PLAN
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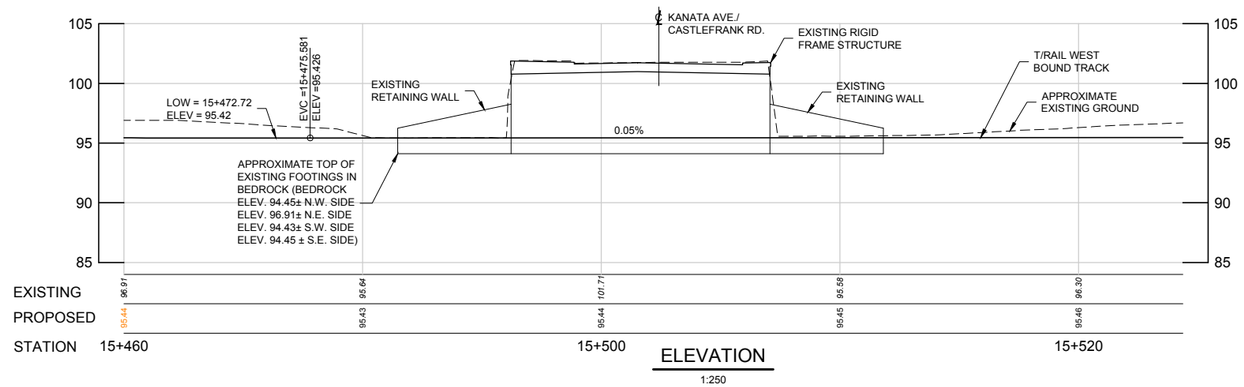
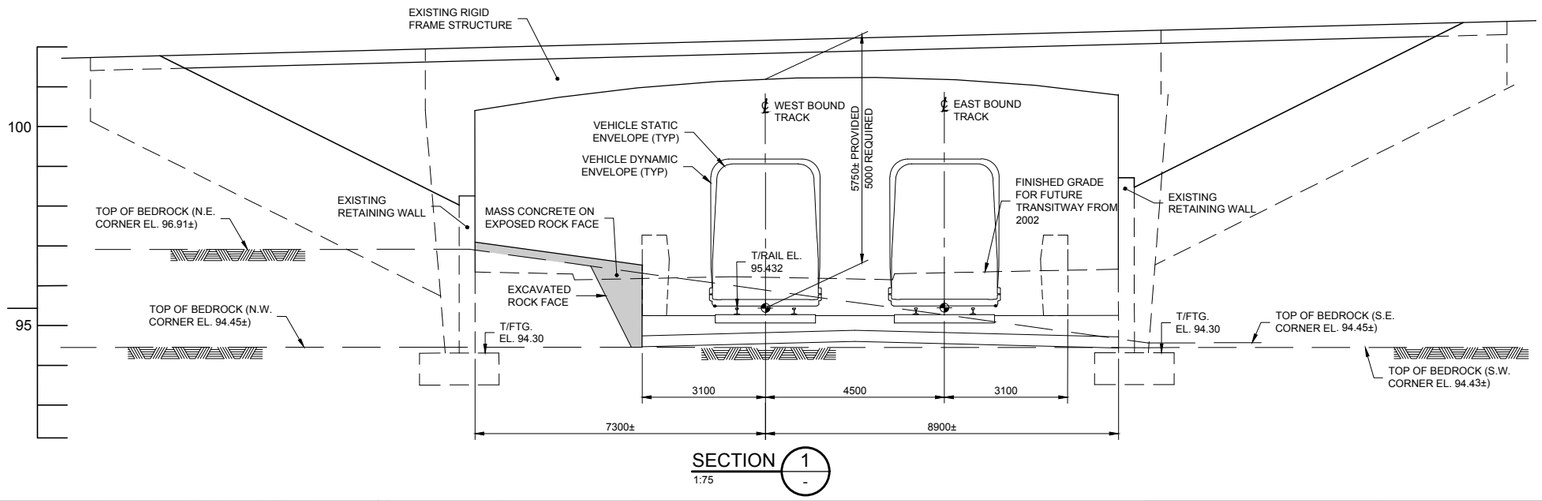


ELEVATION
1:250



SECTION 1
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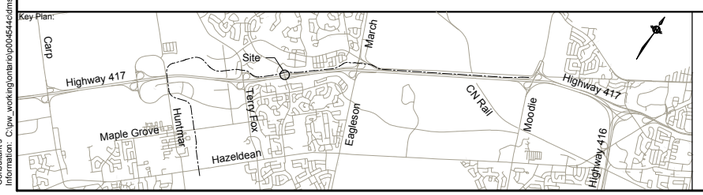
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
16-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Kanata Ave./Castlefrank Rd. Overpass

Preliminary General Arrangement

Revision:

Sheet: S06-1

Plot Date: 16-Feb-18
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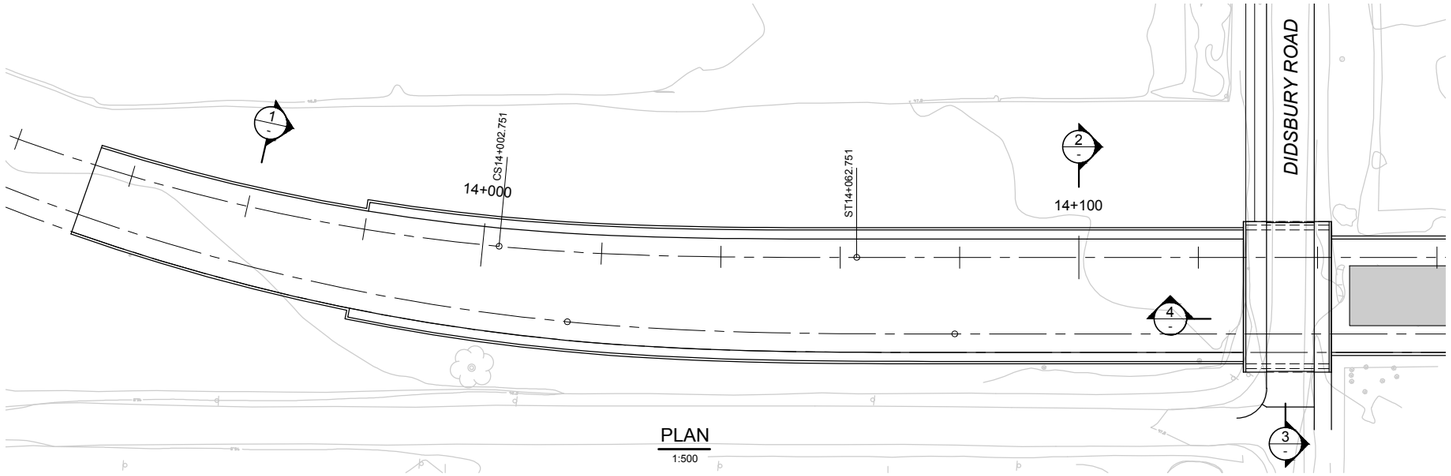

PLAN
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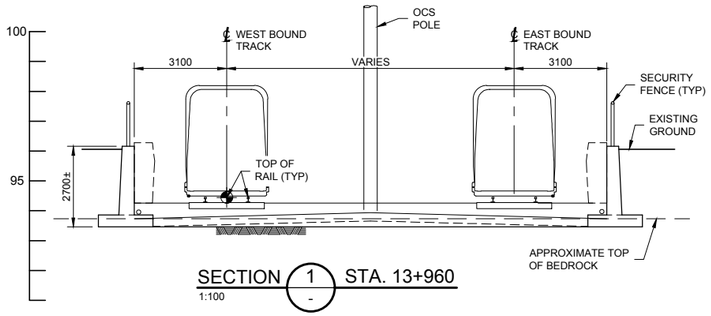
NOTES:
1. STATION BUILDINGS ARE NOT SHOWN. REFER TO ARCHITECTURAL DRAWINGS.



SECTION 1 STA. 13+960
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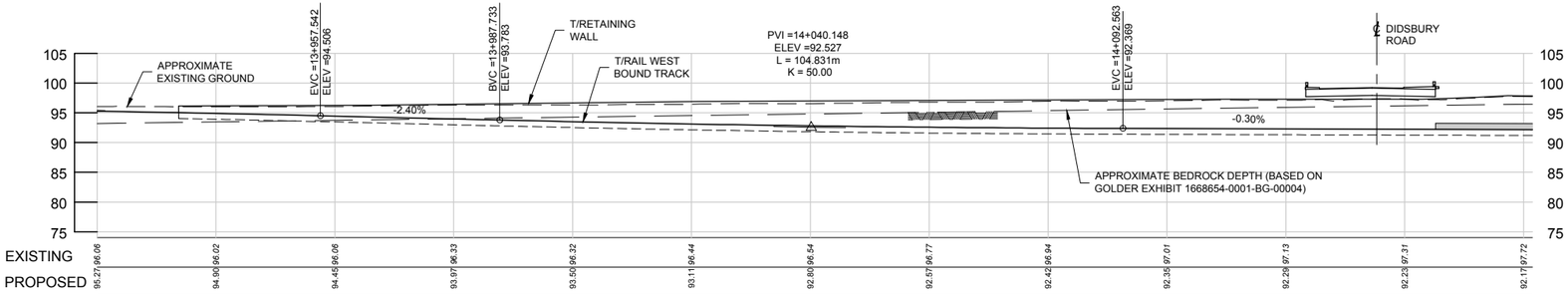
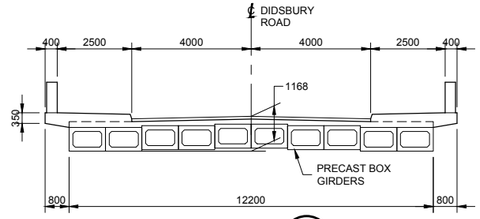


STATION 13+800 14+000 14+100

ELEVATION
1:500



SECTION 4
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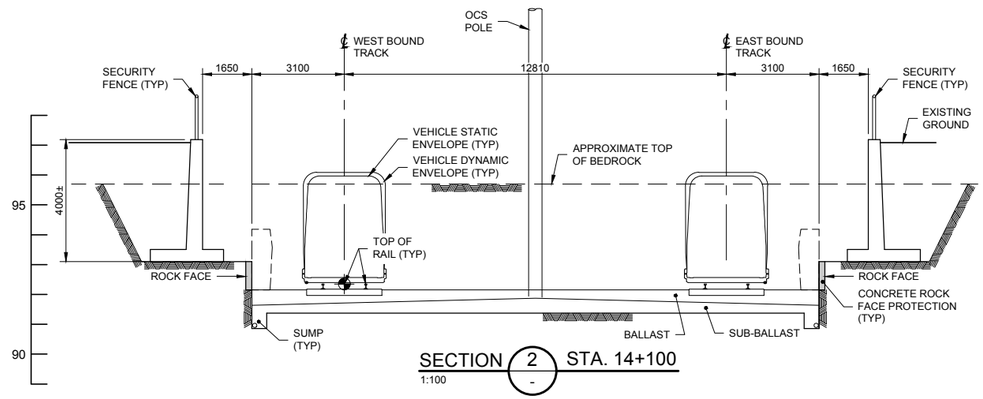
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
20-Feb-18



SECTION 2 STA. 14+100
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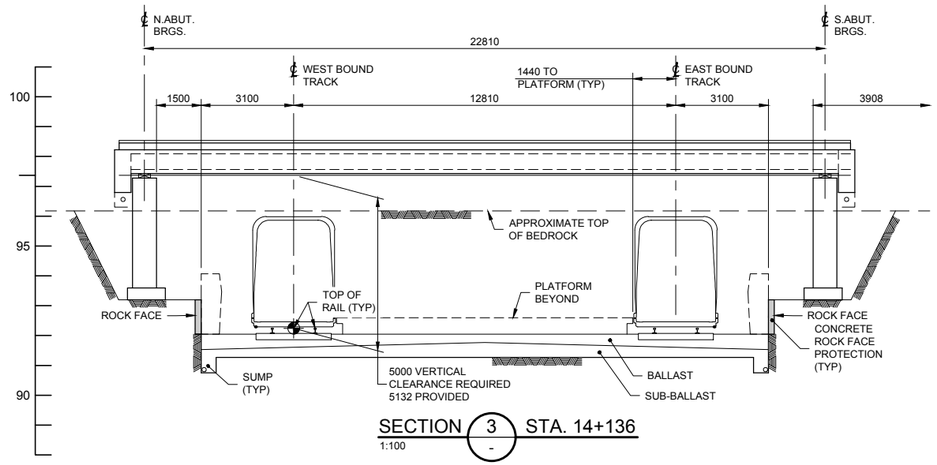
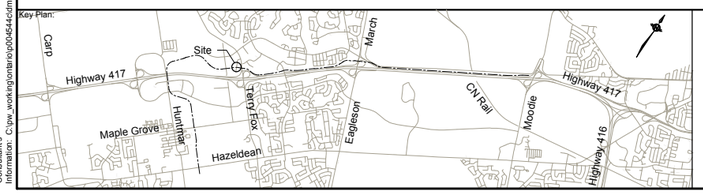


SECTION 3 STA. 14+136
1:100

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Terry Fox - Didsbury Road

Preliminary General Arrangement I

Revision:

Sheet: S07-1

Consultant's Information: C:\pw_working\ontario\olp\d04544\cidms\d1566\Terry Fox GA.Dwg
Last Saved: 2/20/2018 11:04:51 AM
Plot Date: 20-Feb-18

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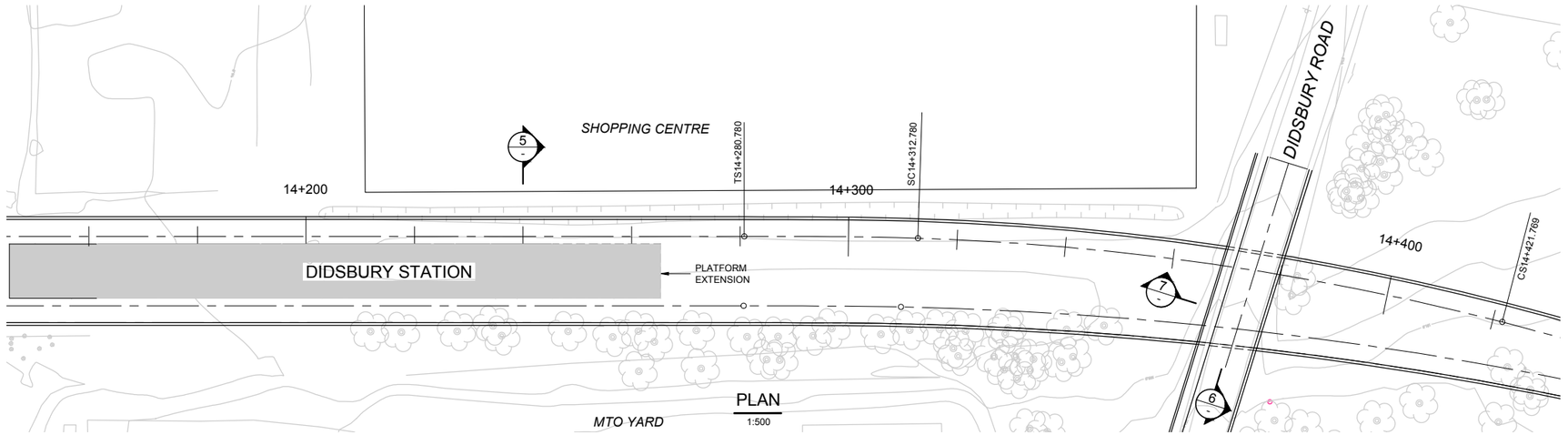

PLAN
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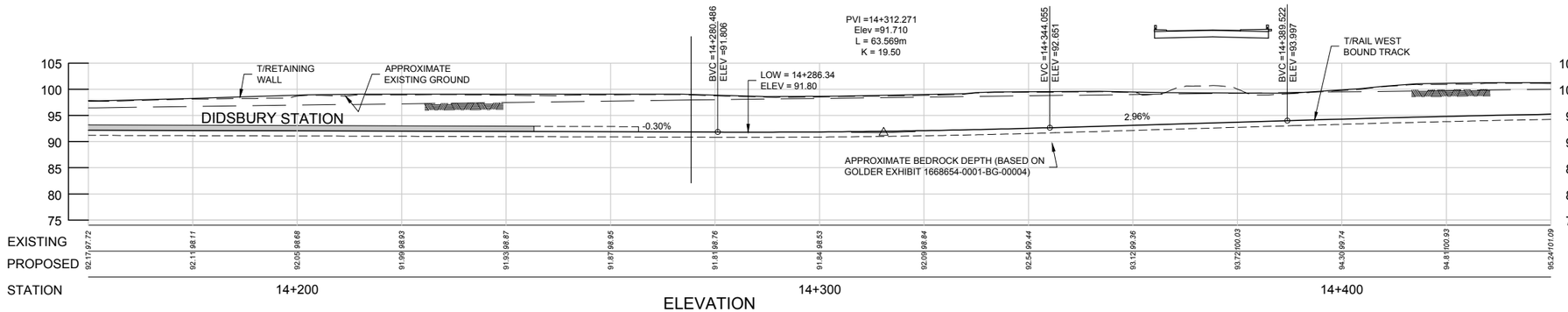
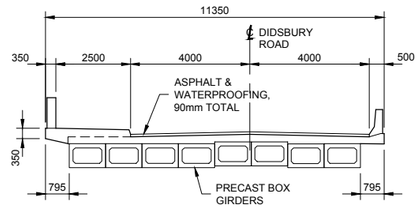


ELEVATION
1:500

NOTES:

1. STATION BUILDINGS ARE NOT SHOWN. REFER TO ARCHITECTURAL DRAWINGS.

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
20-Feb-18



SECTION 7
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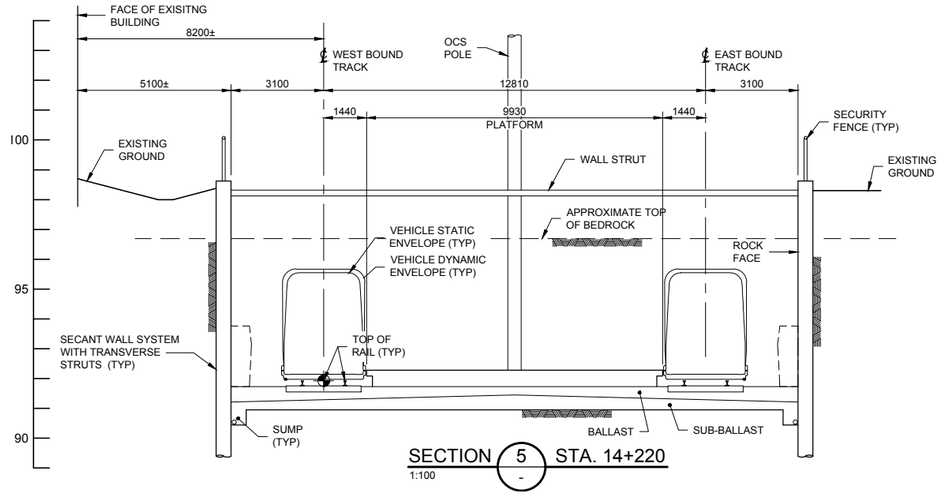
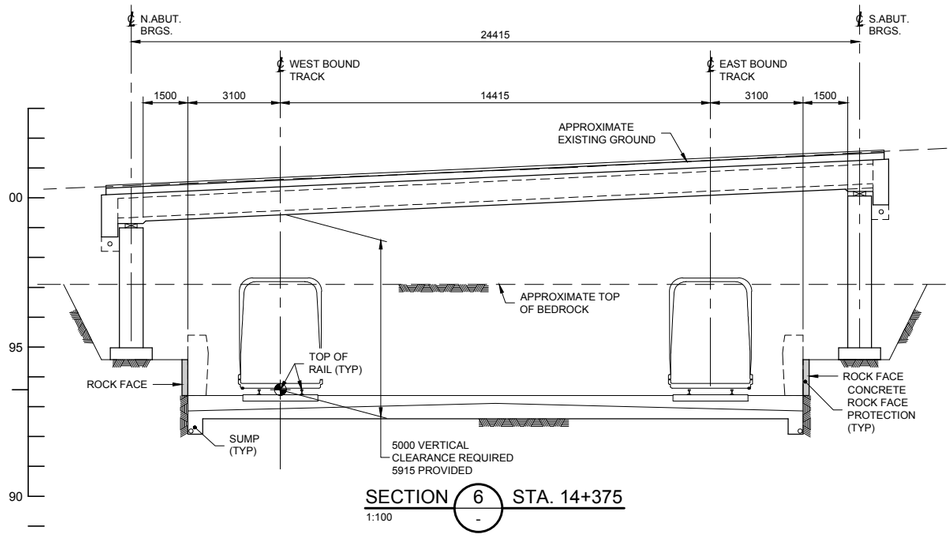


SECTION 5 STA. 14+220
1:100



SECTION 6 STA. 14+375
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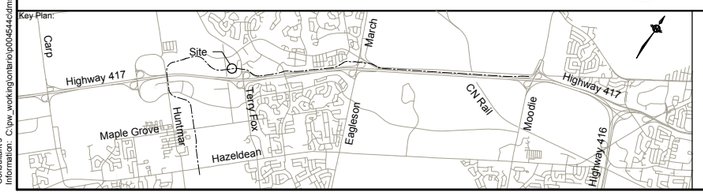
Key Plan:



Confederation Line Kanata LRT Extension

Moodie Drive to Hazeldean Station

Ottawa PARSONS

Terry Fox - Didsbury Station

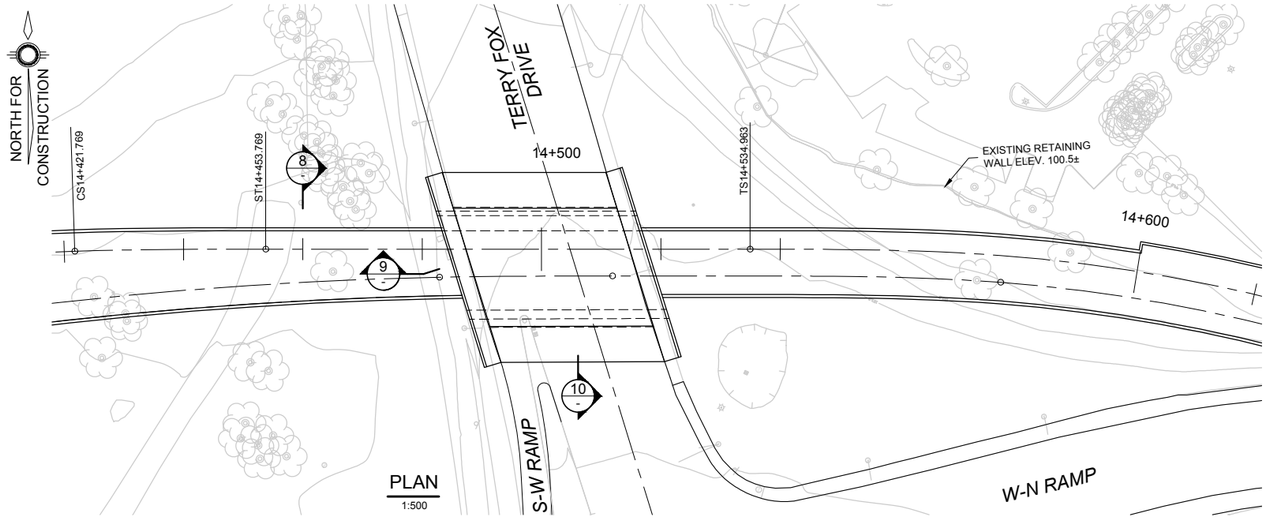
Preliminary General Arrangement II

Revision:

Sheet: S07-2

Plot Date: 20-Feb-18
Last Saved: 2/20/2018 11:04:51 AM
Consultant's Information: C:\pw_working\ontario\p0045\4\cdm\d1566\Terry Fox GA.Dwg

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
20-Feb-18



PLAN
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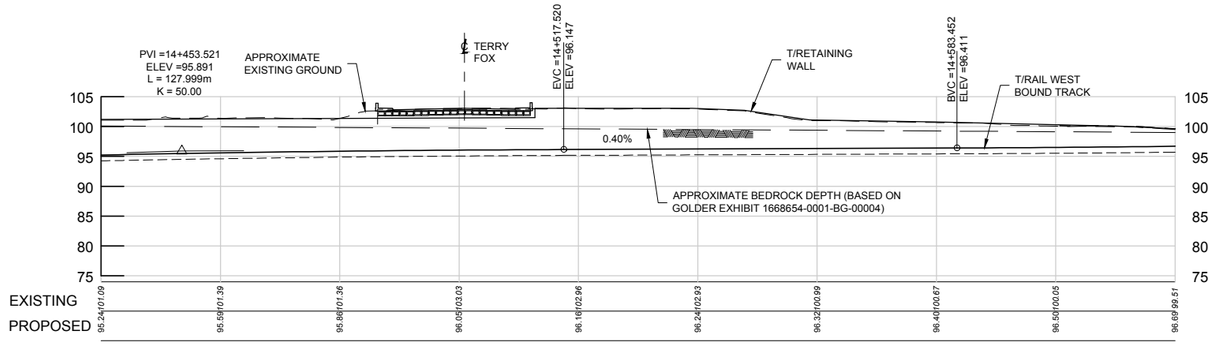

ELEVATION
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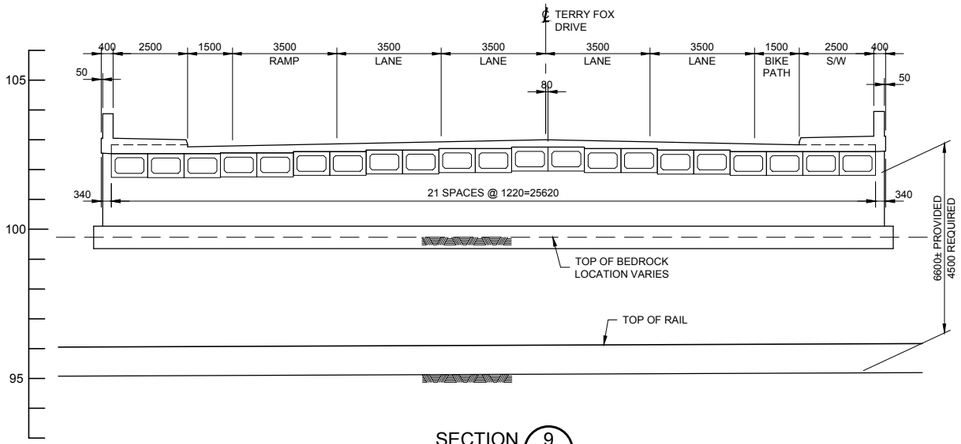

SECTION 9
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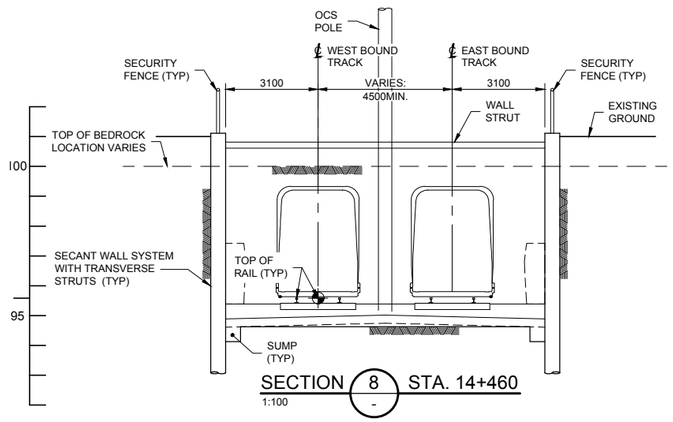

SECTION 8 STA. 14+460
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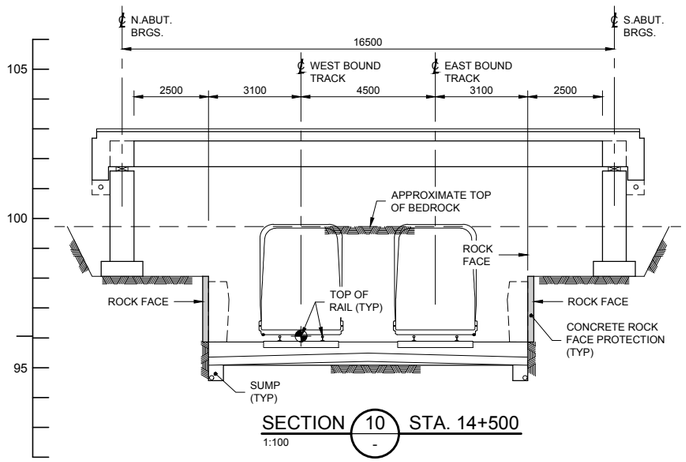

SECTION 10 STA. 14+500
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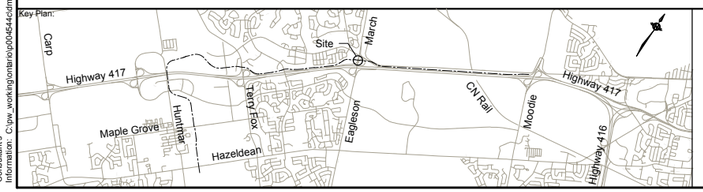
Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Teery Fox Overpass
Preliminary General Arrangement III

Revision:
Sheet: S07-3

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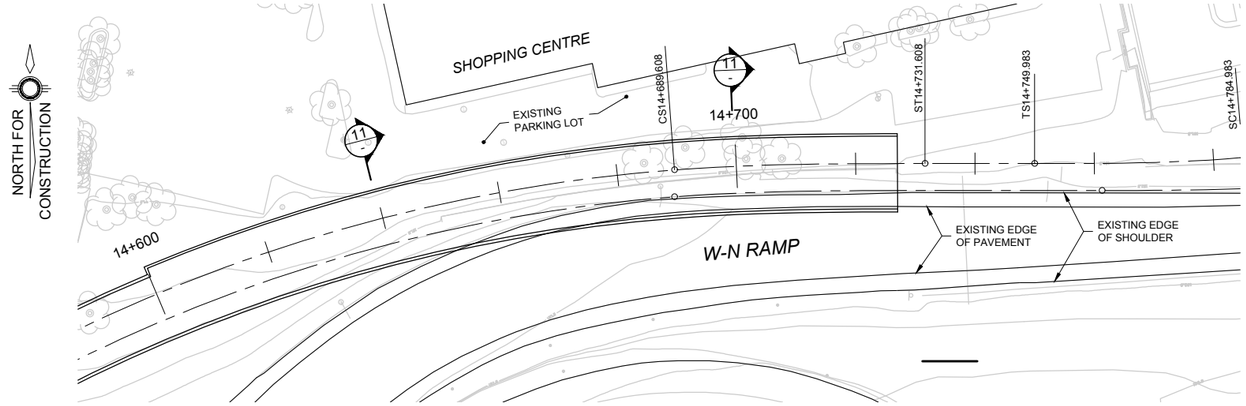
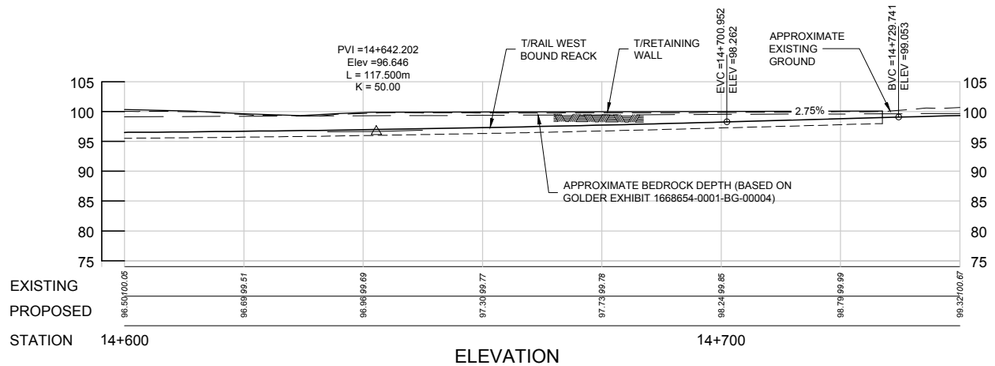
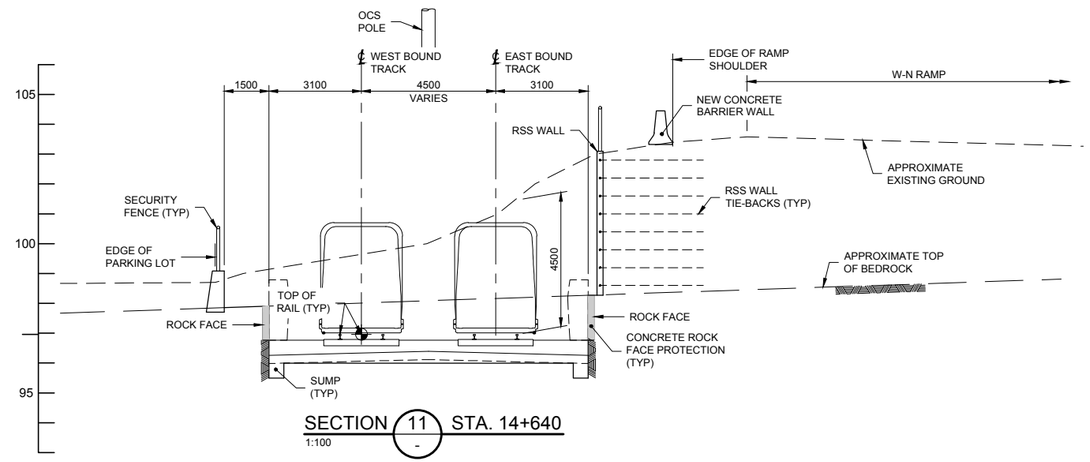
Last Saved: 2/20/2018 11:04:51 AM
Plot Date: 20-Feb-18





ELEVATION
1:500



SECTION 11 - STA. 14+640
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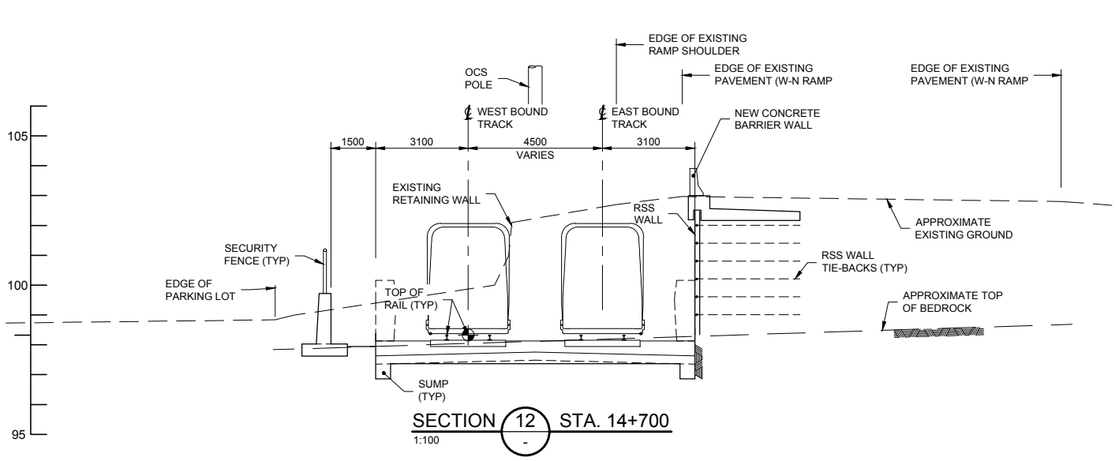
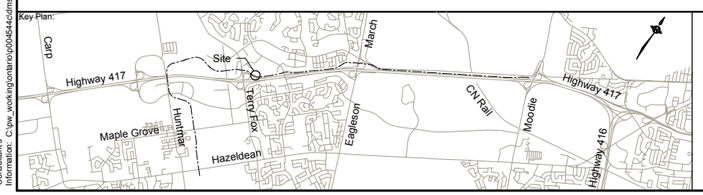


SECTION 12 - STA. 14+700
1:100

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
20-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Terry Fox

Preliminary General Arrangement IV

Revision:

Sheet: S07-4

Plot Date: 20-Feb-18
Last Saved: 2/20/2018 9:23:38 AM
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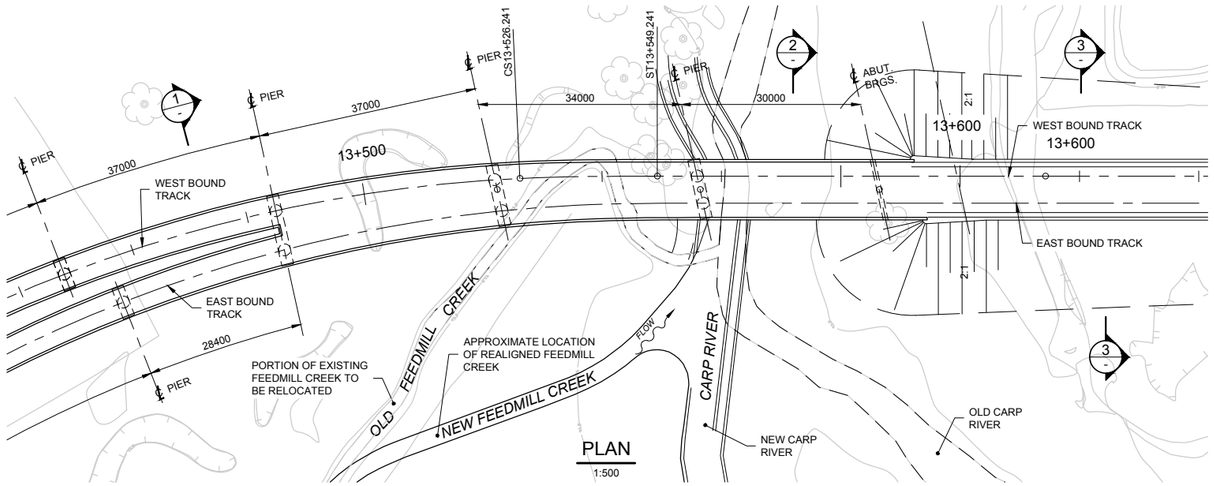
NORTH FOR CONSTRUCTION



PLAN
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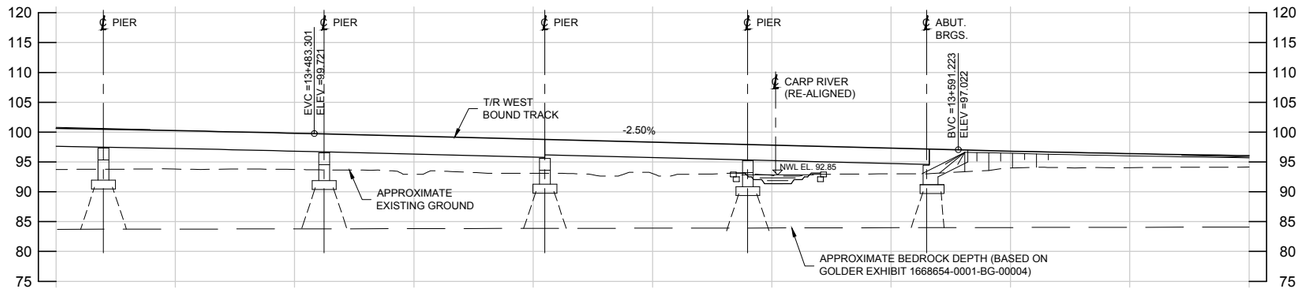

ELEVATION
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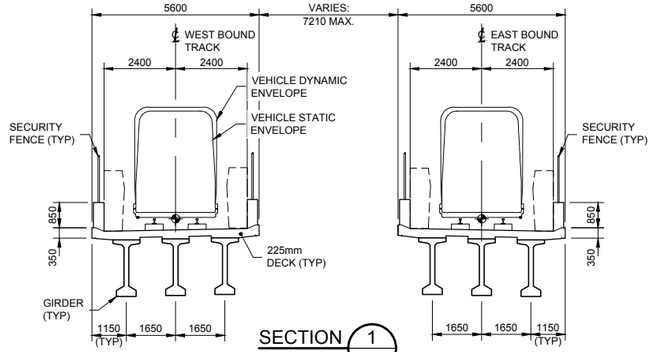

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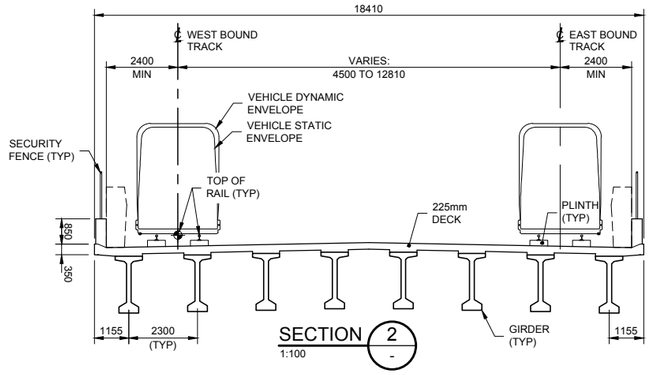

SECTION 2
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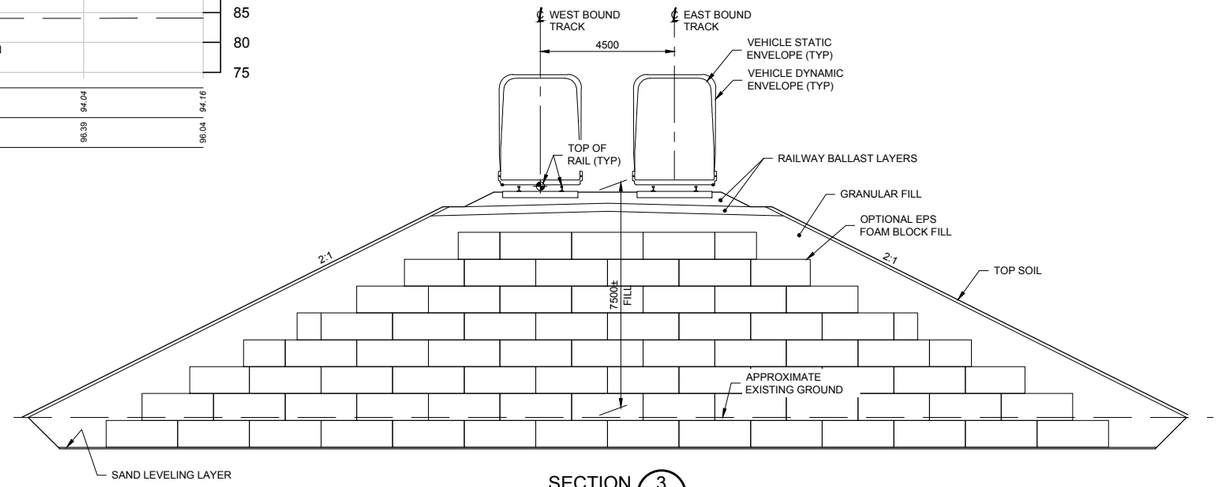
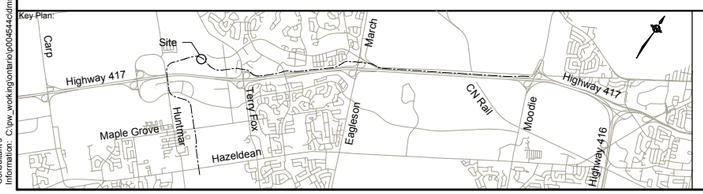


SECTION 3
1:100

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
20-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Carp River

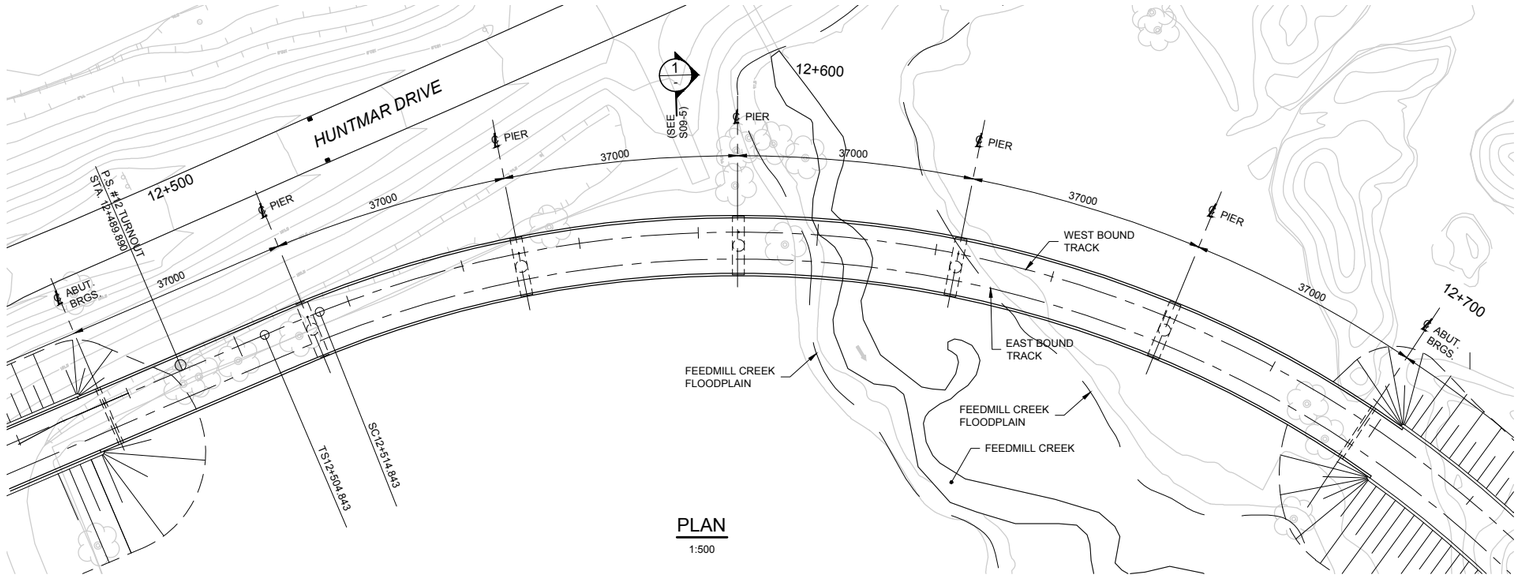
Preliminary General Arrangement

Revision:

Sheet: S08-1

Plot Date: 20-Feb-18
Last Saved: 2/20/2018 4:28:04 PM
Consultant's Information: C:\pw_working\ontario\p00454\d\md01570\Carp River GA.dwg

NORTH FOR CONSTRUCTION



PLAN
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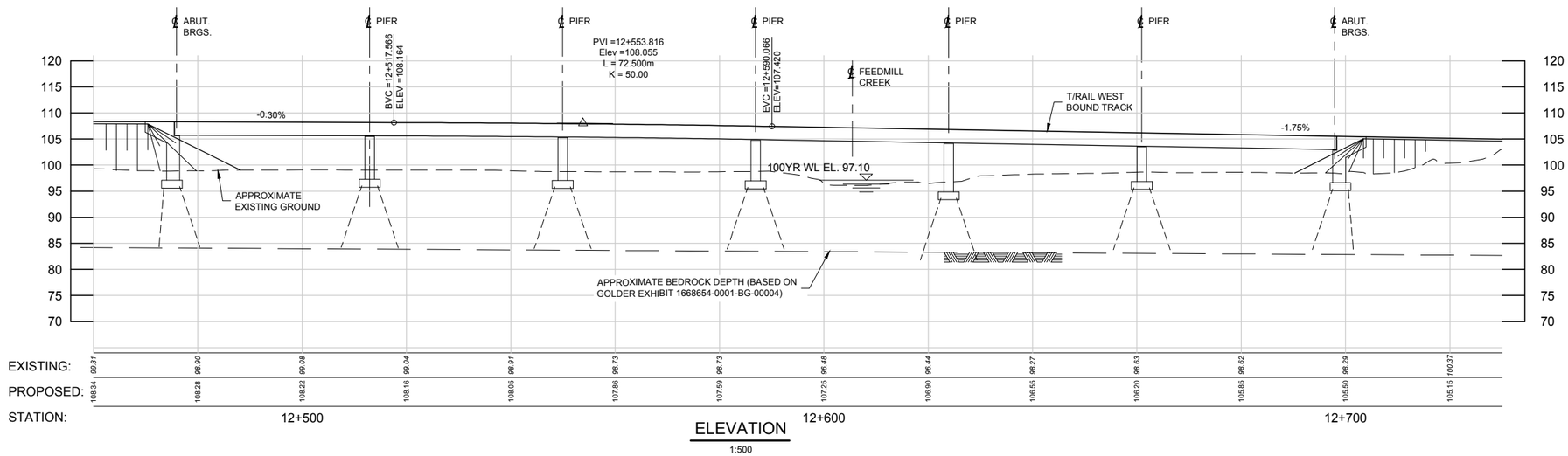
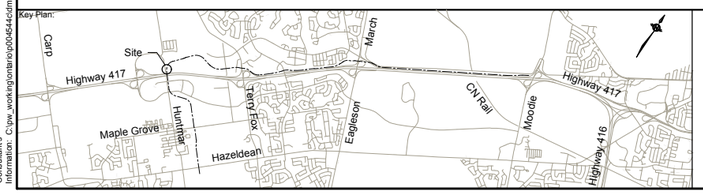
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
14-Feb-18



ELEVATION
1:500

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Feedmill Creek

Preliminary General Arrangement I

Revision:

Sheet: S09-1

Plot Date: 20-Feb-18
Last Saved: 2/20/2018 2:23:39 PM
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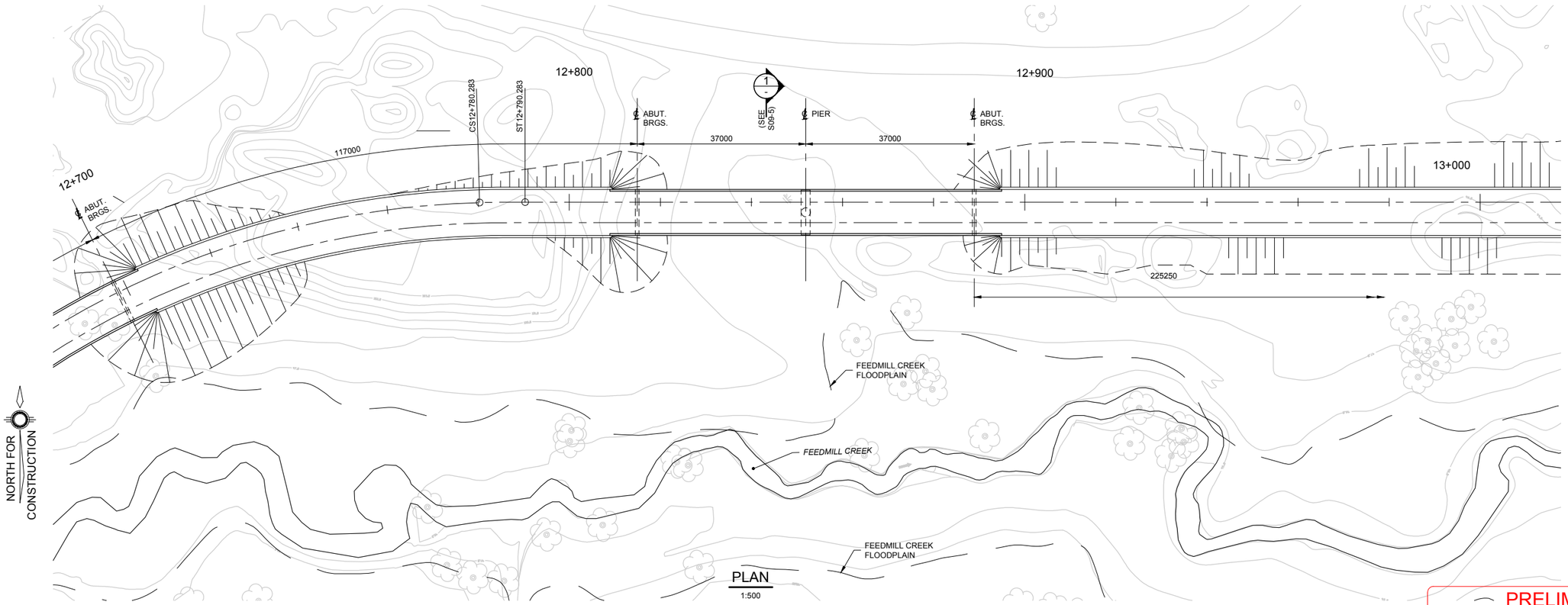
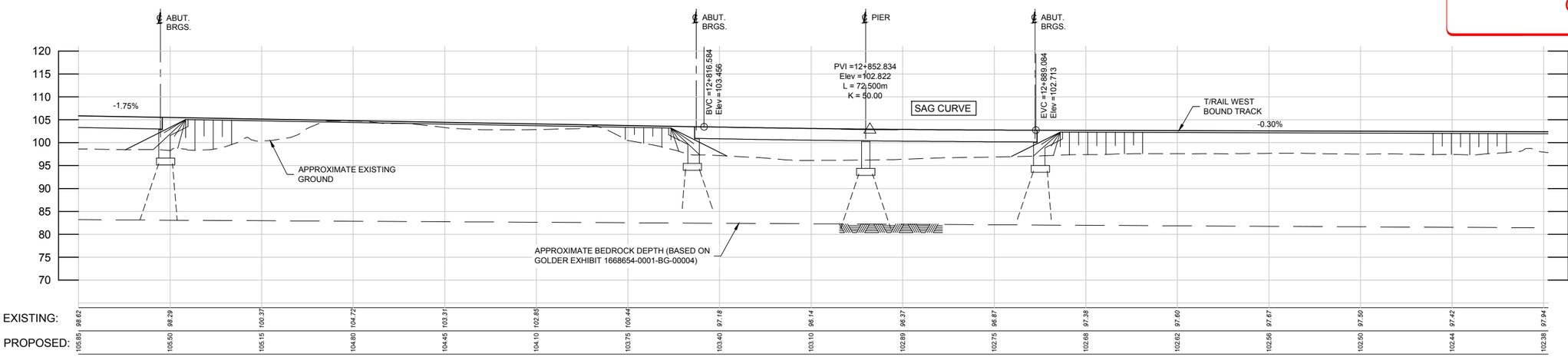


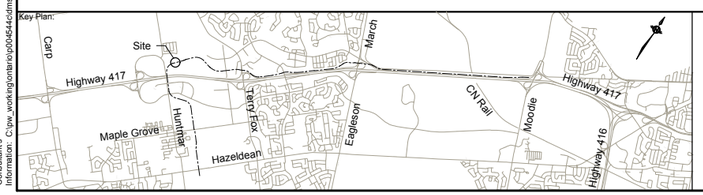
PLAN
1:500



ELEVATION
1:500

PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
14-Feb-18

Key Plan:



Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Feedmill Creek

Preliminary General Arrangement II

Revision:

Sheet: S-09-2

Plot Date: 20-Feb-18

Last Saved: 2/20/2018 2:23:39 PM

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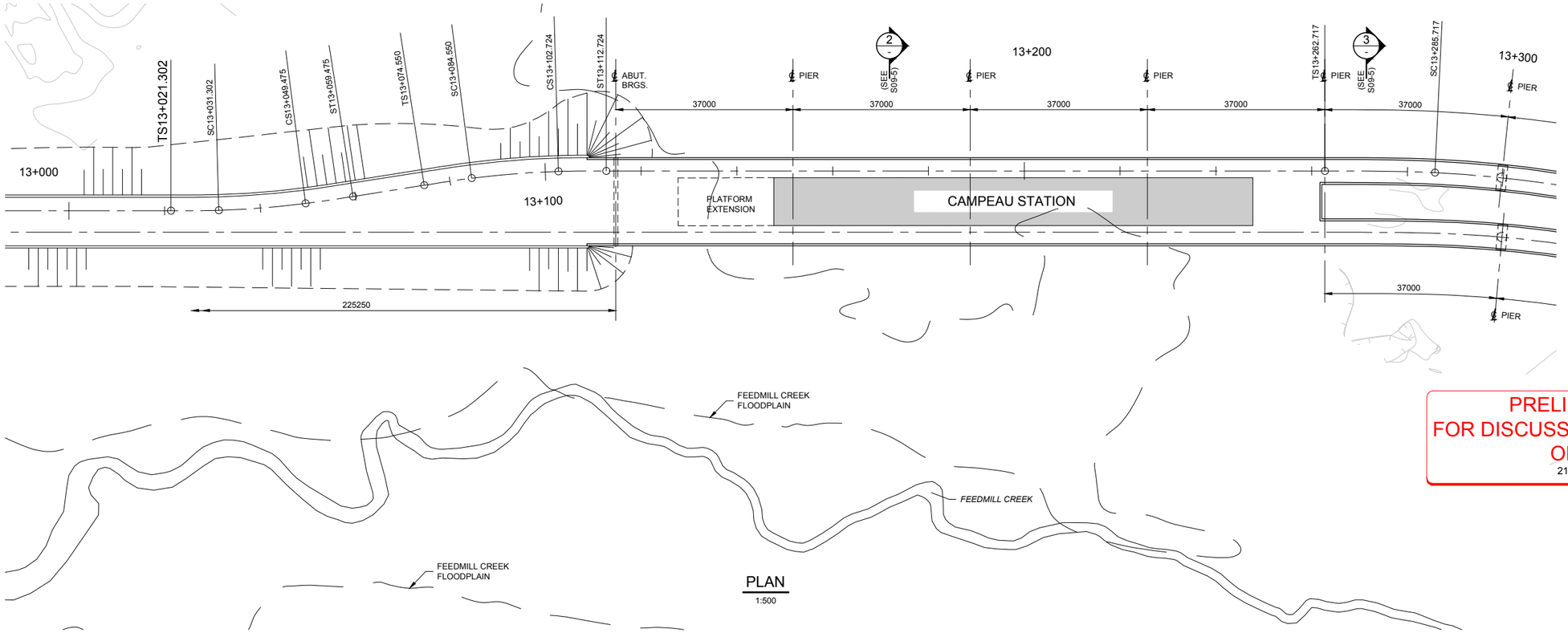
NORTH FOR CONSTRUCTION



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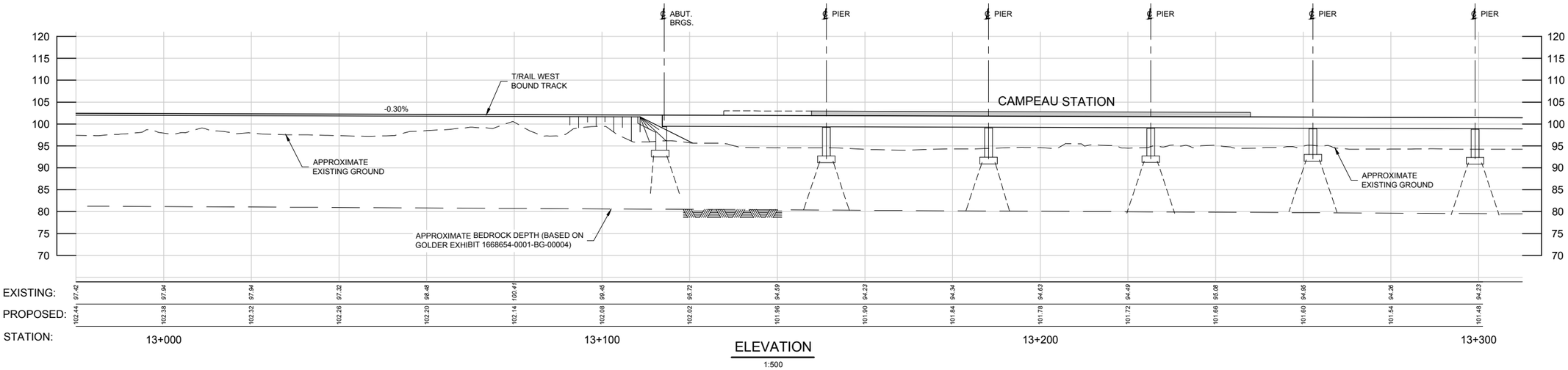
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
21-Feb-18



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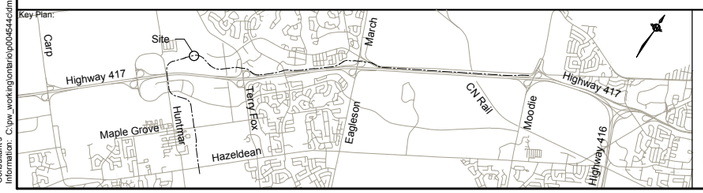

Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Feedmill Creek

Preliminary General Arrangement III

Revision:

Sheet: S09-3

Plot Date: 21-Feb-18

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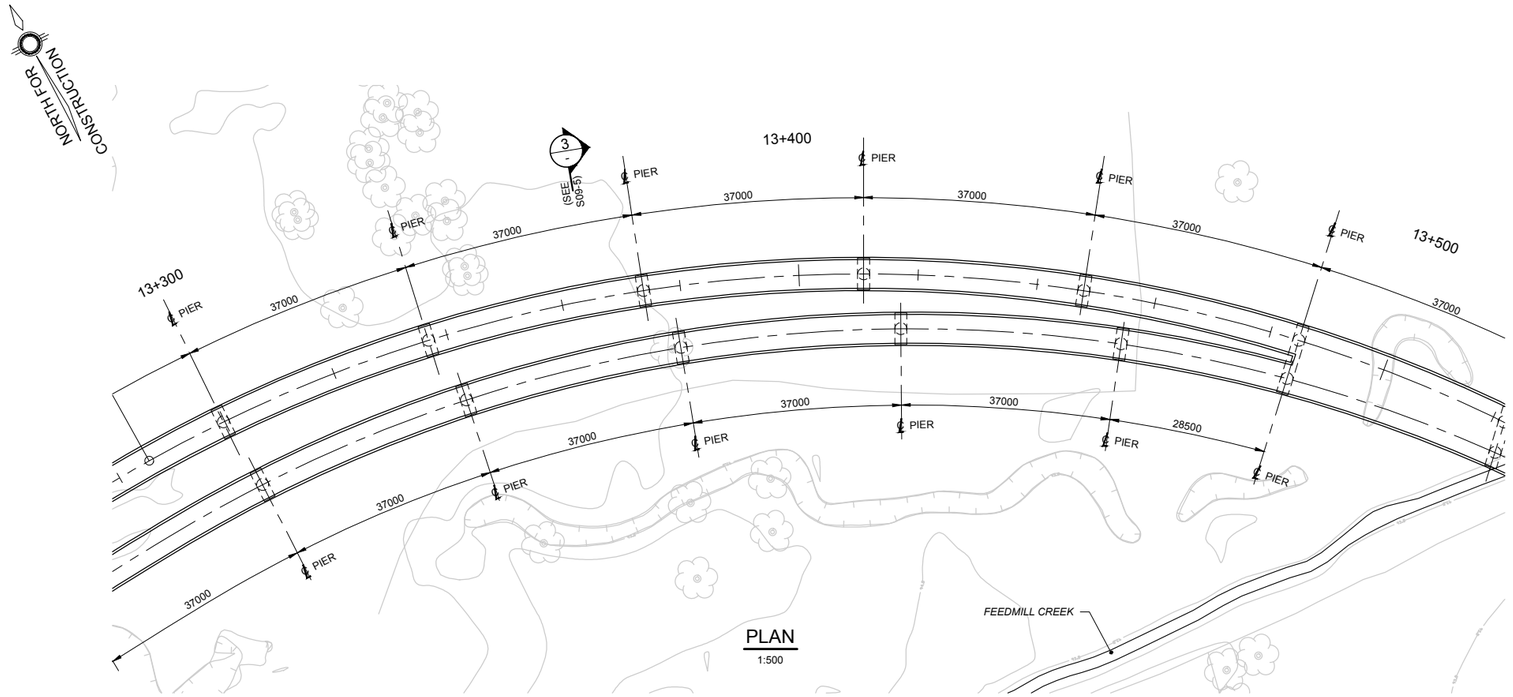

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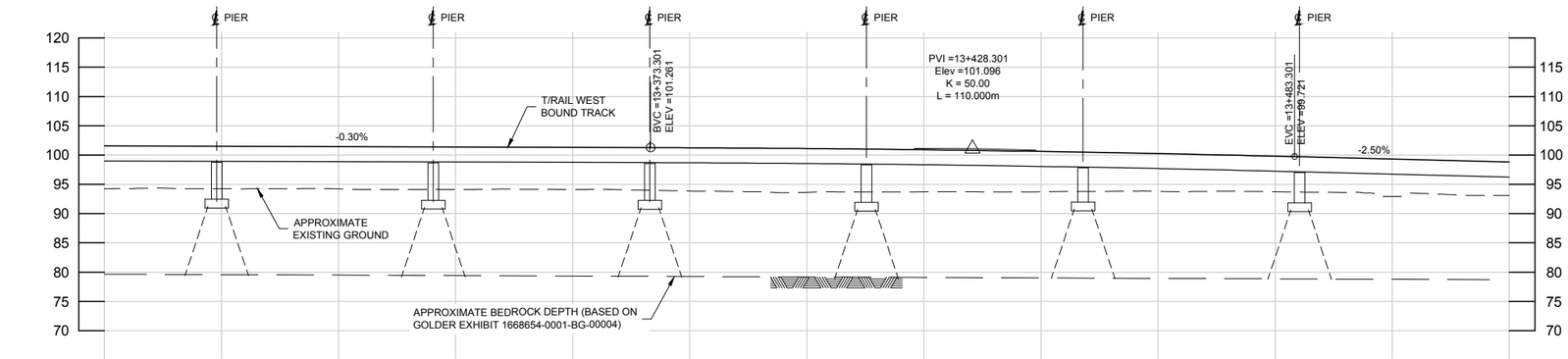

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PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
14-Feb-18

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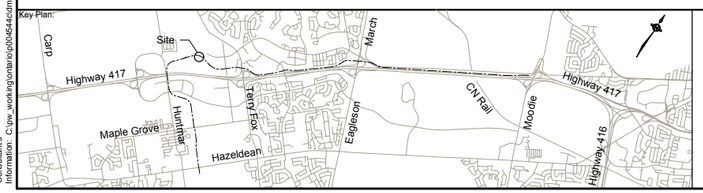

Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Feedmill Creek

Preliminary General Arrangement IV

Revision:

Sheet: S09-4

Plot Date: 20-Feb-18
Last Saved: 2/20/2018 2:23:39 PM
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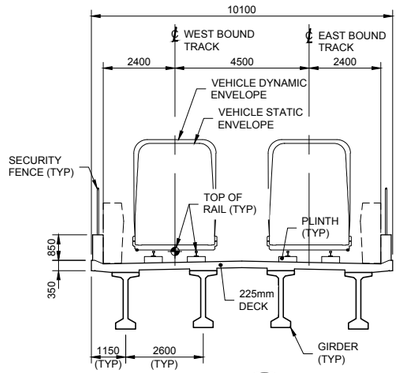

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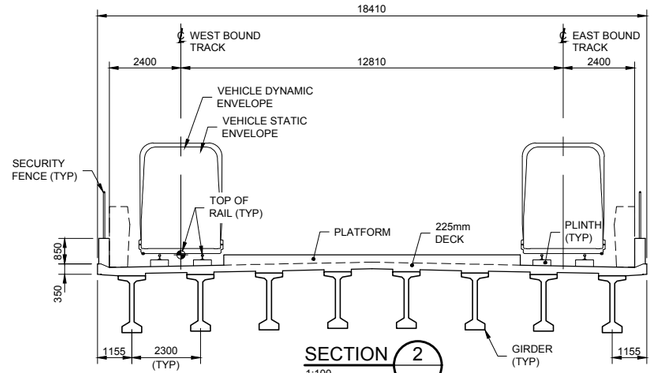

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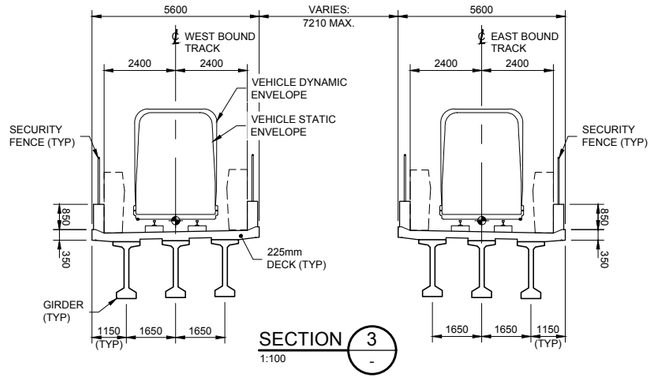

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PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
14-Feb-18

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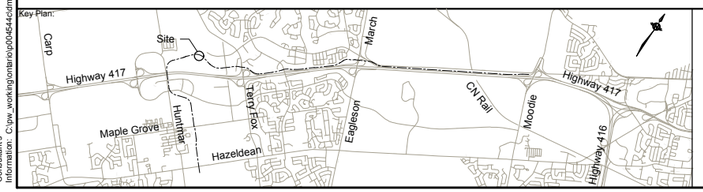

Confederation Line Kanata LRT Extension

Moodie Drive to Hazeldean Station

Ottawa PARSONS

Feedmill Creek

Preliminary General Arrangement V

Revision:

Sheet: S09-5

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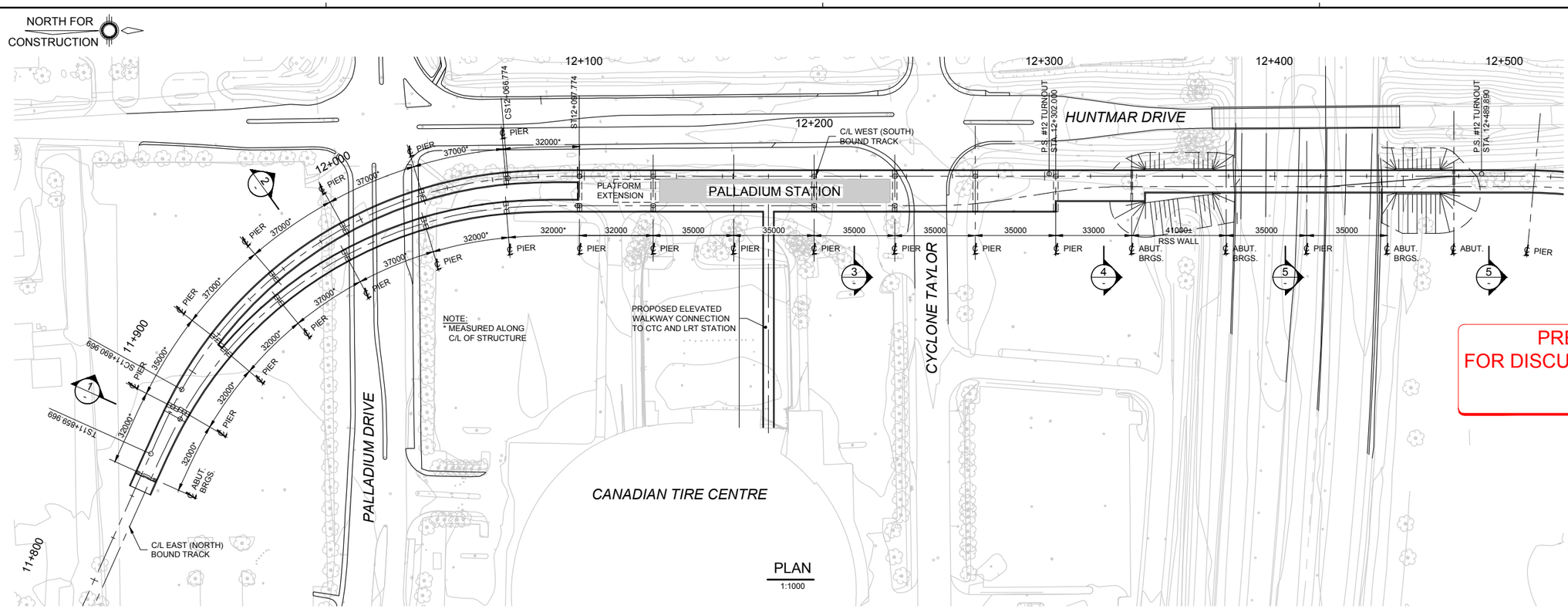
Plot Date: 20-Feb-18



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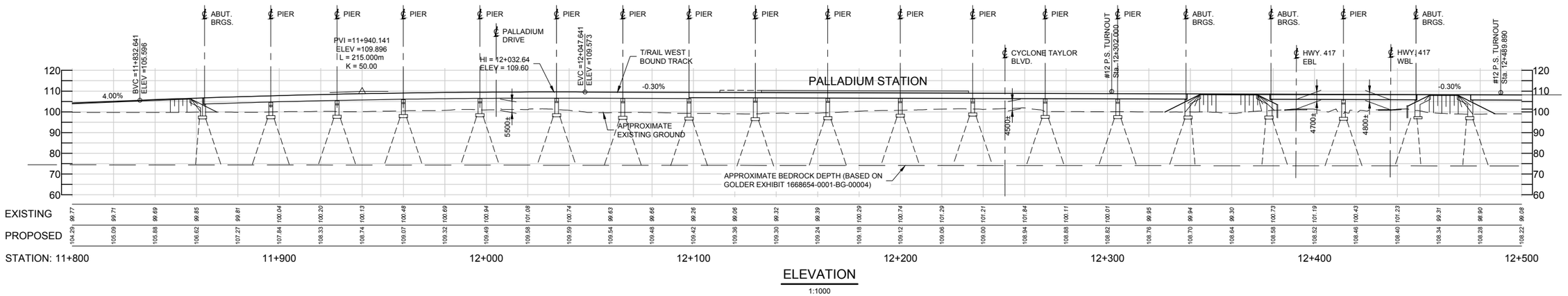
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
16-Feb-18



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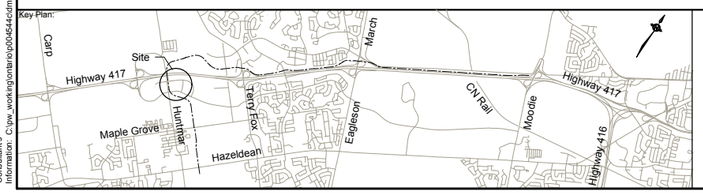

Confederation Line Kanata LRT Extension
Moodie Drive to Hazeldean Station

Ottawa PARSONS

Palladium Station & Hwy. 417 Overpass

Preliminary General Arrangement I

Revision:

Sheet: S10-1

Plot Date: 18-Feb-18
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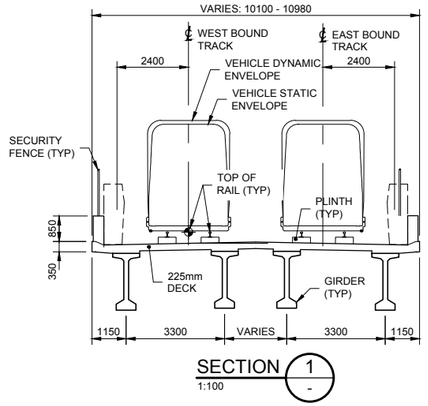

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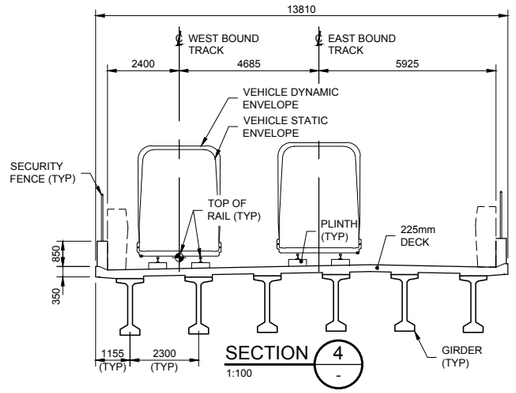

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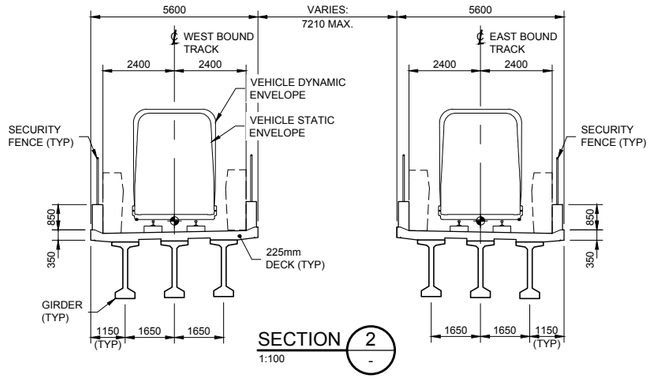

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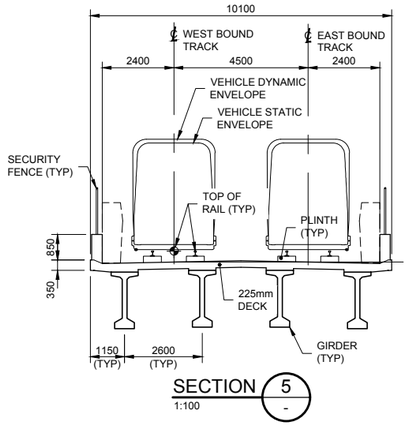

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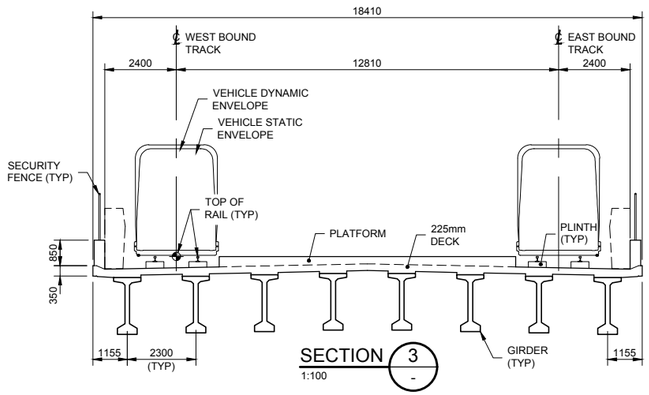

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PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
16-Feb-18

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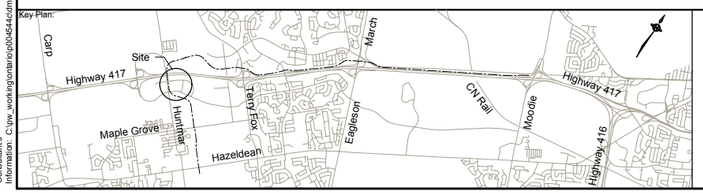

Confederation Line Kanata LRT Extension

Moodie Drive to Hazeldean Station

Ottawa PARSONS

Palladium Station & Hwy. 417 Overpass

Preliminary General Arrangement II

Revision:

Sheet: S10-2

Consultant's Information: C:\pw_working\ontario\ojo0045444\dms81609\Hwy 417 GA.dwg
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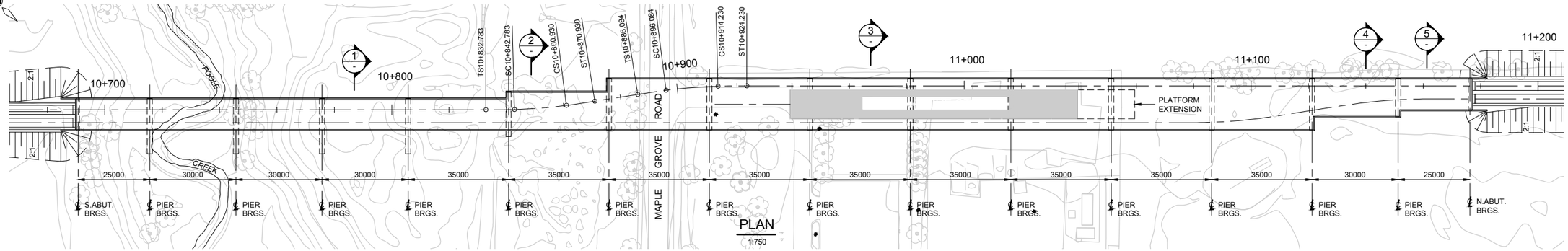
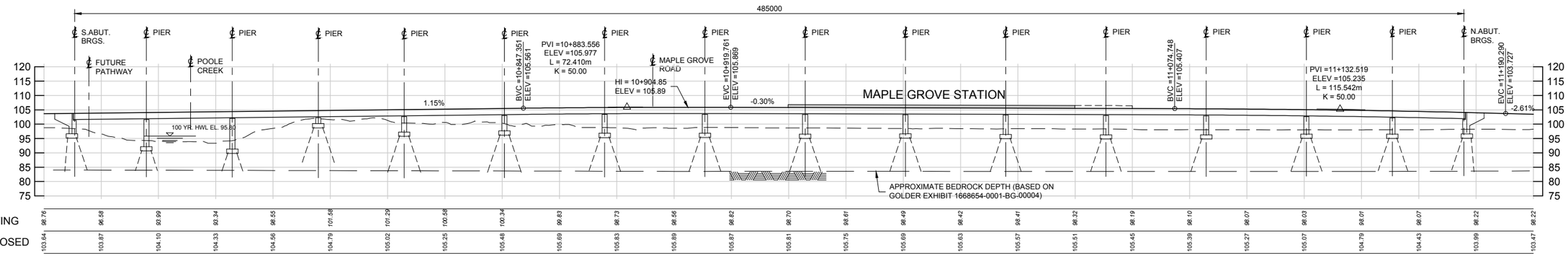
Plot Date: 18-Feb-18

NORTH FOR CONSTRUCTION

NOTES:

1. STATION BUILDINGS ARE NOT SNOWN. REFER TO ARCHITECTURAL DRAWINGS.





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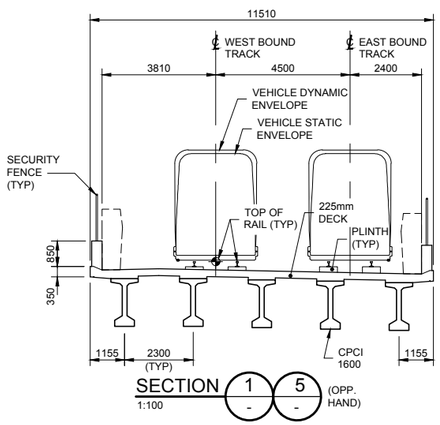

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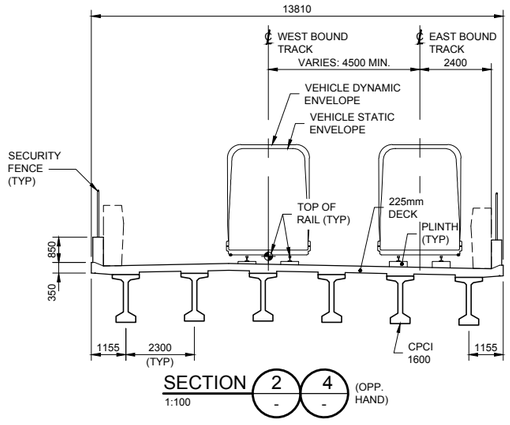

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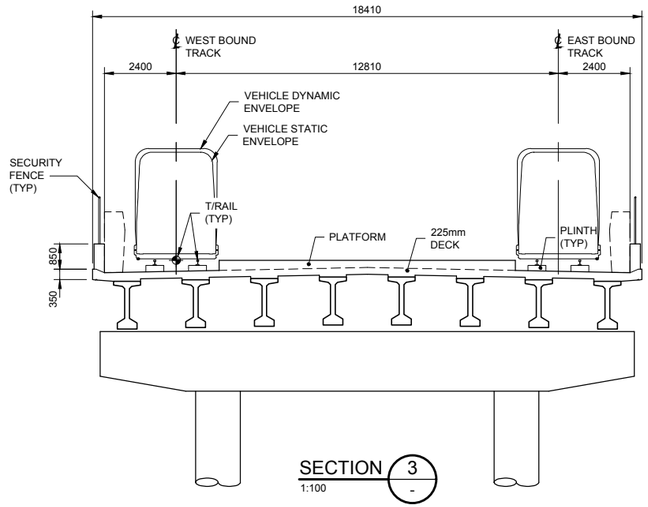

SECTION 3 -
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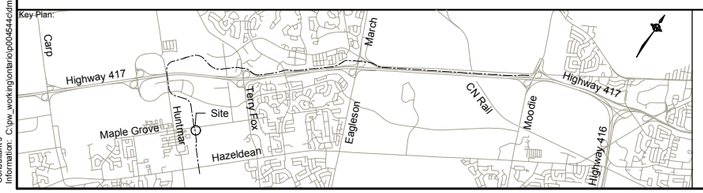
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
16-Feb-18



Confederation Line Kanata LRT Extension

Moodie Drive to Hazeldean Station

Ottawa PARSONS

Mapple Grove Rd - Poole Creek Bridge

Preliminary General Arrangement

Revision:

Sheet: S11-1

Plot Date: 16-Feb-18

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Consultant's Information: C:\pw_working\ontario\olp\d0454\d\dms91610\Maple Grove GA.dwg

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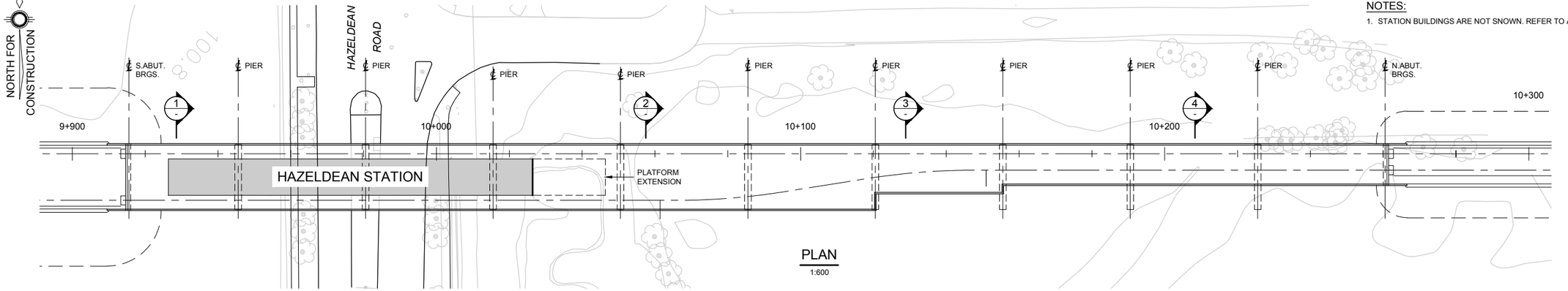

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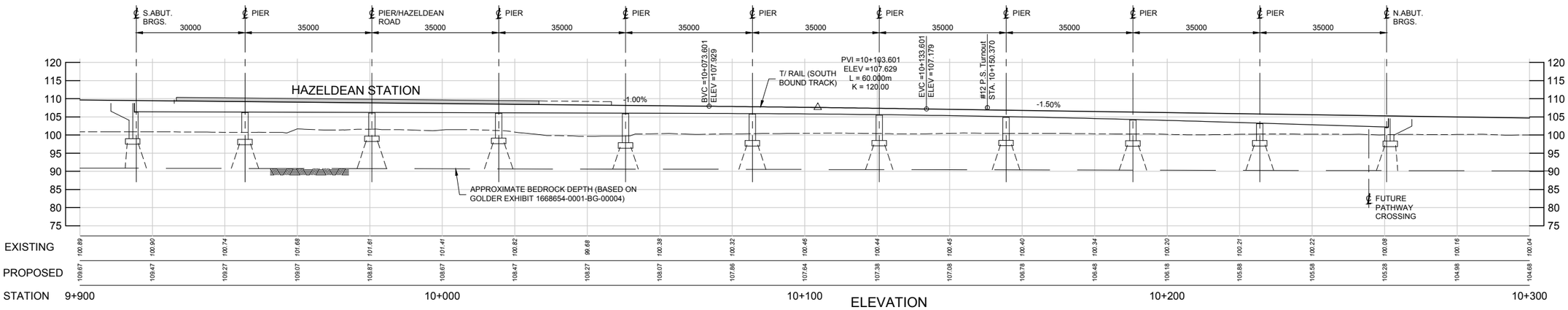

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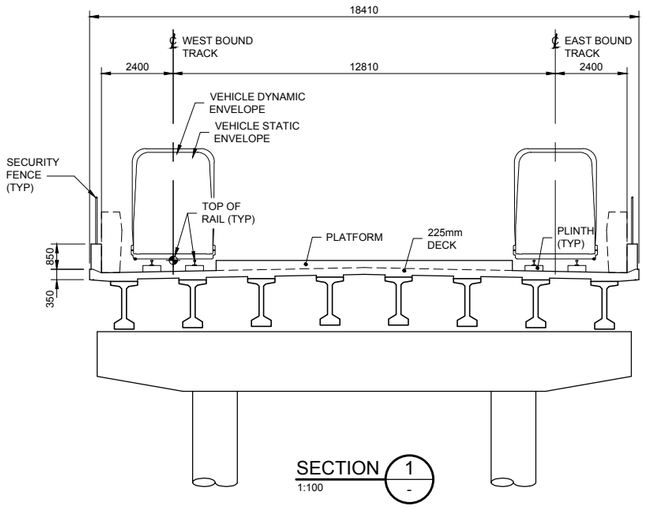
PRELIMINARY
FOR DISCUSSION PURPOSES ONLY
8-Feb-18



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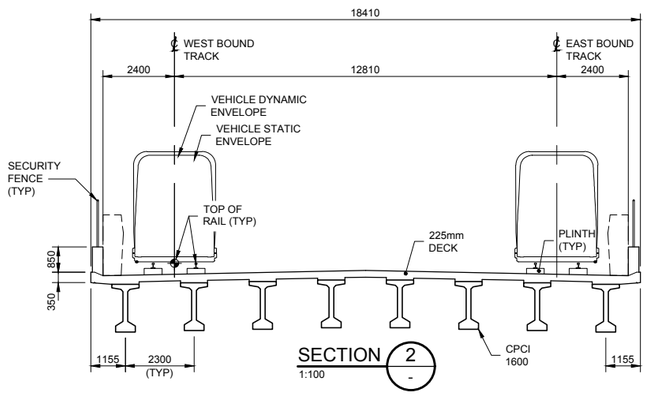

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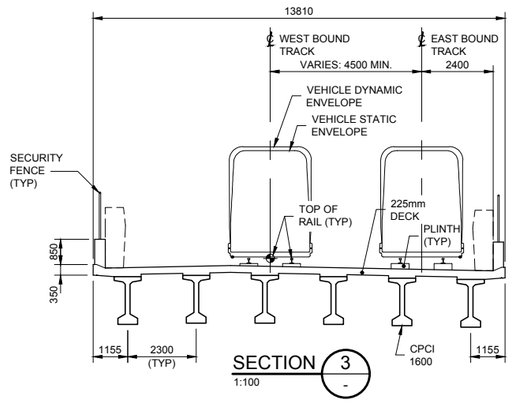

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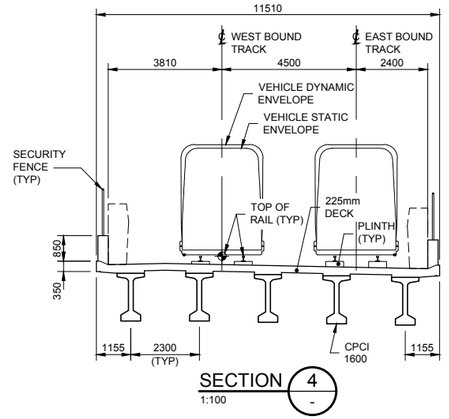

SECTION 4
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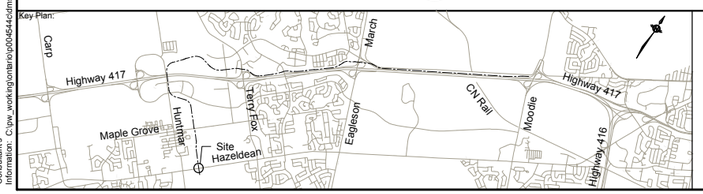

Confederation Line Kanata LRT Extension

Moodie Drive to Hazeldean Station

Ottawa PARSONS

Hazeldean Station

Preliminary General Arrangement

Revision:

Sheet: S12-1

Plot Date: 16-Feb-18

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Consultant's Information: C:\pw_working\ontario\p0045445\dms\315671\hazeldean GA.dwg

9. ASSESSMENT AND EVALUATION OF IMPACTS

9.1. ASSESSMENT AND EVALUATION APPROACH

The values and features identified in the existing conditions were used as the basis for assessing the effects of the Recommended Plan on the social, natural, economic, Infrastructure and transportation environments. The impact analysis involved applying the following steps, as presented in Table 9-1. The steps identified below are documented in Table 9-3: Assessment of Environmental Effects.

Table 9-1: Impact Assessment Approach

Step 1	Identify and analyze instances where the project may interact with existing environmental conditions.
Step 2	Acknowledge predetermined project activities that act as *built-in mitigation* measures.
Step 3	Identify the *residual* environmental effects, if any.
Step 4	Identify opportunities for further *site specific mitigation* of residual effects, if possible/practical.
Step 5	Determine the *significance of the residual* environmental effects, after further mitigation.

Professional judgement and experience formed the basis for identifying environmental effects and mitigation measures. The analysis was based on comparing changes to the existing environment including pre-construction, construction and operation.

9.2. PROJECT INTERACTIONS

In order to understand the project interactions with the environment it is necessary to consider all phases of the project, including pre-construction/design; construction; and operation. The following table (Table 9-2) highlights the key activities associated with each phase of the project. To assess the impacts of the recommended plan, the effects of the activities described below will be considered within the context of the existing conditions.

Table 9-2: Project Components by Phase

Preconstruction / Site Preparation
Field Investigations
Completion of detailed design and contract drawings
Acquisition of land required for the right-of-way and supporting infrastructure
Delineation of the construction area, including identification and protection of existing fences, trees, landscaping, natural features, bench marks, buildings, pavement, and surface and/or underground utility locates.
Identification of construction staging areas.
Design and implementation of appropriate Best Management Practices (i.e. Erosion and Sediment Control) prior to beginning construction related activities.

Construction
Relocating hydro, telephone, and utilities for construction
Clearing and grubbing trees and vegetation within the grading limits for the construction project
Installation of traffic management measures
General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)
Construction of any below-grade Alignment segments (Construction of trenches, dewatering requirements, etc)
Construction of any above-grade Alignment segments (construction of piers, embankments, etc)
General Construction of Stations (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for stations)
Construction of Associated Infrastructure (Retaining walls, structures, park and rides, pedestrian bridges, TPSS, etc)
Removal of excavated materials
Restoration and rehabilitation of any disturbed areas extending beyond the limits of the works
Operation
Provision of Rapid Transit Service
Maintenance of major structures
Maintenance of way
Maintenance of stations

9.3. BUILT IN MITIGATION MEASURES

In this assessment, “built-in mitigation” is defined as actions and design features incorporated in the pre-construction, construction, and operational phases, which have the specific objective of lessening the significance or severity of environmental effects that may be caused by the project. They include standard construction practices and Best Management Practices (BMPs).

The KLRT will be designed and implemented with the benefit of contemporary planning, engineering, and environmental management practices. Regard shall be had for the legislation, policies, regulations, guidelines, and best practices of the day. Where possible, mitigation measures will be prescribed in the construction contracts and specifications.

Examples of practices that should be employed, based on current standards, are described below. These measures can be considered “built into” the subsequent Recommended Plan. They will be updated and refined during the pre-construction, construction, and operation phases of the project.

Construction Waste Management Plan

During construction there will be some excess materials that must be disposed of away from the project site. These may include but are not limited to concrete rubble, asphalt, waste steel/metal structural components, earth, and road right-of-way appurtenances such as signs, lighting and utility poles. During the detailed design stage a *Construction Waste Management Plan* will be developed to ensure that surplus material is recycled wherever practical and to describe the methods to be used by the contractor for disposal of all other surplus material in accordance with provincial or local municipal practices and guidelines.

Noise, Air Quality and Vibration –BMP for Construction

Varied construction activities along the KLRT corridor are expected to create isolated and short term noise, air quality and vibration impacts on the environment. The construction manager will be required to develop a strategy for mitigating the effects according to good practices intended to satisfy, as feasible, the fugitive dust limits specified in O.Reg. 419, the noise limits specified in MECP NPC-115 and NPC-118 and City of Ottawa By-laws for Noise; and MECP NPC-119 and NPC-207 for ground vibrations. For the detailed noise, air quality and vibration impact assessment, consult **Appendix B: Supporting Reports**. Contractor to implement air quality BMPs and will be responsible for implementing a mitigation strategy with the intent on satisfying the requirements for Ontario Regulation 419. A list of common mitigation strategies adapted to the current project includes, but is not limited to, the following:

Air Emissions BMPs:

- Monitor wind conditions, and plan operations to take advantage of calm wind periods;
- Minimize site storage of granular material in height and extent;
- Locate storage piles in sheltered areas that can be covered;
- Provide movable wind breaks;
- Use water spray and dust suppression techniques to control fugitive dust; and
- Cover haul trucks and keep access routes to the construction site clear of debris.
- Equipment to be kept in good working order and will not unnecessarily idle.
- Dust suppressants will be applied as warranted.
- Streets will be cleaned as per existing municipal standards.

Noise and Vibration BMPs:

- Limit speeds of heavy vehicles within and approaching the site;
- Provide compacted smooth surfaces, avoiding abrupt steps and ditches;
- Install movable noise barriers or temporary enclosures, around blast sites for instance;
- Keep equipment properly maintained and functioning as intended by the manufacturer; and
- If required, implement a blast design program prepared by a blast design engineer.
- Contractor to ensure that Municipal Noise By-Law is not contravened and will be responsible for preparing a mitigation strategy with the intent of satisfying MECP NPC - 115
- Temporary road surfaces will be maintained so as to minimize bumps and rough surfaces.

Emergency Services Response Plan

The preparation of an *Emergency Response Plan* to be used by the contractor will be included to allow full access to emergency services during the construction period, so that at any given time there is a method to access all adjacent land uses. Additionally, the *Emergency Response Plan* should include provisions for providing temporary services to end users in the event of a construction related service outage or other service disruption.

Health and Safety Plan

The preparation of an Occupational Health and Safety Plan by the contractor before any work begins will be required, to ensure that proper protocols and recommendations are in place to protect workers against personal injury or loss of life.

Lighting Plan

A *Lighting Plan*, in accordance with municipal standards, will be prepared during the detailed design process. This plan will include lighting fixtures and illumination along the various sections of the corridor. A lighting audit of the preferred lighting design plan may be conducted to ensure clear sight lines and appropriate illumination. The *Lighting Plan* may be subject to review and approval by appropriate federal agencies for any federally impacted lands.

Public Communications Plan

The purpose of the *Public Communications Plan* is to keep the public informed about the work in progress and the end result of the construction activities. Residents and other stakeholders must be kept aware of scheduled road disruptions, interruptions to other services and other construction related details in advance so that their activities can be planned with reduced disruption. The plans should detail how to communicate the information to the public, what information should be disseminated, and in which project stages the communications should take place.

Archaeological Resources

If undocumented archaeological resources are impacted by project work, all activities impacting these resources must cease immediately, MTCS must be notified, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists.

If human remains are encountered, all activities must cease immediately and the local police as well as the Cemeteries Regulation Unit of the Ministry of Government and Consumer Services must be contacted. In situations where human remains are associated with archaeological resources, MTCS should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act."If a discovery occurs on federal lands, the appropriate federal agency shall also be notified.

Built Heritage Resources and Cultural Heritage Landscapes

The rural character of the area will not be destroyed by this project. Nor will any heritage attributes be isolated, have adverse shadows cast on them, or will any significant views or vistas be obstructed. The LRT will be built within an existing transportation corridor and could provide a beneficial impact by creating views from the train windows of the rural landscape north of the rail line.

However if mitigation measures are implemented adverse impacts from alteration of the landscape can be mitigated. The landscape can be restored. Once restored, the rural profile of Corkstown Road is not predicted to be adversely affected during operation of the LRT. The road

will not be used to access an LRT station and therefore not expected to experience increased traffic volume. The rural character of the roadscape can be maintained.

However there are mitigation measures which can be implemented during various phases of the project to mitigate potential adverse effects including:

- **Prior to construction**:
  - **Conduct Heritage Documentation Report:** The existing landscape should be documented with georeferenced photographs and described in a heritage documentation report.
  - **Incorporate landscape features into detailed design:** Landscape features such as mature trees should be retained and incorporated into detailed design as much as is practical.
- **During construction:**
  - The gravel shoulder and shallow ditches along either side of the Corkstown Road should be maintained.
- **After construction**:
  - **The** rural profile and heritage attributes of the Corkstown Road should be restored to their pre-construction conditions and revegetate the roadsides with native grass species.

Safety/Security

All elements of design shall incorporate principles of *Crime Prevention through Environmental Design*. Safety/security measures may include but will not be limited to:

- Pedestrian Control - Implement measures to control and direct the safe and secure movement of pedestrians in and around the new KLRT median infrastructure;
- Right-of-Way Encroachment – Deter people or objects from interfering with the safe operation of the RTC; and
- Lighting – Provide enhanced lighting to ensure security and visibility in key 24 hour use zones.

Station Integration

Stations should be treated as civic elements that will help to establish urban character in the surrounding communities. Visually unique stations, with variations of material or form, will facilitate way-finding for riders, and can be integrated into the surrounding landscape context. All stations should also have appropriate signage, directions, seating, and enclosed waiting areas for the thermal comfort of riders in all seasons and weather conditions.

Overall goals of user and community acceptance can be broken down into specific landscape design principles:

- Way Finding – Provide signage and landmarks that facilitate the navigation and use of the KLRT;
- Perceived Disturbance – Employ measures to minimize noise, and visual disturbances, to adjacent properties;

- Branding – Introduce landscape elements that identify and promote the KLRT as part of a larger transportation network.

9.3.2. TRANSPORTATION

Traffic Management, Access and Pedestrian Control Plan

Traffic detours and lane reductions will be required during construction of the KLRT. A *Traffic Management, Access and Pedestrian Control Plan* will be developed and implemented by the contractor in the construction phase for all construction related detours that require rerouting of pedestrians, cyclists, motorists, and transit users. The *Traffic Management, Access and Pedestrian Control Plan* shall be monitored by the City.

9.3.3. BIOLOGICAL ENVIRONMENT

Dewatering Management Plan

This plan is to identify methods of management and environmental protection measures and procedures for the management and/or discharge of dewatering activities and/or waste waters which are directly derived from construction activities, such as concrete curing water, drill waste cutting material and clean-up water. At a minimum, a Dewatering Management Plan must be in place for excavations within areas identified as or suspected as having contaminated groundwater. Contaminated water must be contained and treated prior to disposal. No contaminated groundwater shall be discharged to the environment.

During construction, there may be a requirement for dewatering activities. A Dewatering Management Plan shall include, but not be limited to, the following:

- how groundwater control for the Project will be performed in compliance with Environmental Laws;
- procedures for conducting all monitoring as required in the Project permits and approvals;
- additional impact assessments and acquisition of appropriate approvals prior to discharging groundwater into adjacent natural environments from an area of known or suspected groundwater contamination;
- procedures for addressing any complaints received related to groundwater control activities;
- no groundwater from an area of known or suspected groundwater contamination should be discharged to the environment without the completion of an impact assessment and the appropriate approvals; and
- Reporting procedures to document how all groundwater management activities and best practices have been implemented.

If improperly abandoned wells are encountered, these would be decommissioned in accordance with the regulations. The presence/conditions of wells within the anticipated radius of influence of dewatering would be assessed in more detail as part of detailed design or for a PTTW application/EASR Water Taking Plan.

The area is supplied with municipal water and private water supply wells are not anticipated to be impacted. If encountered, groundwater supply wells that may be at risk due to construction activities would be monitored and Contingency Plans developed to provide temporary alternate water supply should the need arise.

Management of Contaminated Materials

The MECP and the construction manager are to be notified immediately upon discovery of any contaminated material encountered within the construction area. If contaminated materials or contaminated groundwater are encountered within the construction limits, these are to be removed and disposed of in accordance with all applicable acts and regulations. Contaminated materials if encountered should not be placed within areas where they may enter surface water features. Treatment and discharge of contaminated groundwater is to be in accordance with applicable legislation and regulations (e.g., Provincial Water Quality Objectives (MOECC, 1994)) to ensure that it can be discharged without causing an environmental impact/impairment/adverse effect.

Contaminated soil may be encountered and possibly contaminated groundwater. Groundwater supply wells that may be at risk due to construction activities should be monitored and Contingency Plans developed to provide temporary alternate water supply should the need arise.

Stormwater Management

Stormwater management will consist of quality and quantity control of runoff from the guideway, new stations, and new park and ride facilities consistent with the MECP guidelines, and City of Ottawa Sewer Design Guidelines (2012) and should provide an enhanced level of sediment removal. Measures will consist of a variety of lot level controls where appropriate including enhanced grass swales, and stormwater storage and treatment facilities. There is municipal preference for gravity fed outlets around March Road Station and Didsbury Station. Stormwater management plans shall consider, among other matters, the maintenance, restoration and protection of downstream aquatic ecosystems as necessary based on site specific requirements identified through aquatic habitat impact assessments, including conformance to any existing rehabilitation plans maintenance of temperature regimes, and as per federal or provincial agency permit/approval requirements. Any works or fill within the Regulatory (1:100 year) flood plain will need to address a cut fill balance in accordance with the requirements and approvals from the MVC/RVCA.

Culvert crossings of the guideway where there is an existing embankment, will be replaced to meet capacity requirements. New culvert crossings of the guideway shall be designed to meet capacity requirements in accordance with the following:

- City of Ottawa Sewer Design Guidelines, October 2012;
- Ministry of Transportation Ontario (MTO) Highway Drainage Design Standards, January 2008;
- Ministry of Transportation (MTO) Drainage Management Manual, 1997; and
- American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering 2011 (four volumes).

Erosion and Sediment Control Plan

The purpose of the Erosion and Sediment Control Plan is to determine the degree of erosion and sedimentation of drainage receptors or watercourses that may occur under normally anticipated weather conditions during the full life-cycle of the project, and to develop and implement mitigative strategies to control any foreseen areas determined to have a pre-disposition to the problem. This

includes: the identification of planting and slope rounding specifications within the contract tender; identifying and specifying seeding and sodding locations; identifying areas requiring slope benching or retaining structures in the detailed design process; identifying and specifying mitigation measures to be applied during construction, as well as contingency plans for emergencies or inclement weather conditions; and post construction monitoring and mitigative practices. The Erosion and Sediment Control Plan, once prepared, will propose monitoring measures to ensure the effectiveness of mitigation.

Environmental Protection Plan

It will be the responsibility of the contractor to ensure that no contamination, waste or other substance, which may be detrimental to the natural environment (particularly to aquatic life or water quality), will enter the natural environment as either a direct or indirect result of construction. In this regard, any floating debris resulting from construction which accumulates on watercourse beds and watercourse banks is to be immediately cleaned up and disposed of. Any spills or contamination, waste or other substances which may be detrimental to the natural environment, including aquatic life or water quality, will also be immediately cleaned up.

Any work which will cause or be the cause of discharge to watercourses is to be prohibited. At all times, construction activities are to be controlled in a manner that will prevent entry of deleterious materials to watercourses. In particular, construction material and debris, excess material, and empty containers are to be stored away from watercourses and the banks of watercourses. The Environmental Protection Plan, once prepared, will propose monitoring measures to ensure the effectiveness of the plan.

Excavated and Imported Materials Management Plan

This plan describes the management of all excavated and imported materials generated as part of the Works, i.e. soil, rock, solid waste, liquid waste, hazardous waste, and contamination. Management of excavated and imported materials includes, but is not limited to, excavation, handling, transportation, testing, on-site re-use, off-site re-use, disposal, and/or ultimate disposition. The Excavated and Imported Materials Management Plan shall be written by a Qualified Person within the meaning of section 5 of Ontario Regulation 153/04. The Excavated and Imported Materials Management Plan shall be written with due consideration for "Management of Excess Soil – A Guide for Best Management Practices" (MOE, January 2014).

The MECP and construction manager are to be notified immediately upon discovery of any contaminated material encountered within the construction area. If contaminated materials or contaminated groundwater are encountered within the construction limits, these are to be removed and disposed of in accordance with all applicable Federal and Provincial Acts and Regulations. Treatment and discharge of contaminated groundwater is also to be in accordance with applicable legislation and regulations, and municipal by-laws.

Exclusionary Fencing

Exclusion fencing should be installed prior to working in or around natural areas, to prevent wildlife from entering work zones. If wildlife does enter a work zone it should be carefully relocated prior to commencing work. Permits may be required for relocation of SAR or aquatic species.

Landscape Plan

A *Landscape Plan* to compensate for vegetation and tree removal will be prepared during the detailed design and implemented during the construction phase. The *Landscape Plan* will be completed and signed by a full member of the Ontario Association of Landscape Architects and will clearly identify existing plant material to be retained, removed or relocated on site and will

propose vegetation to be planted on site. The plan will identify species including its common and botanical names, size, total quantity, and its condition or special *requirements.* The Landscape Plan should consider the findings of the Cultural Heritage Overview Report in any work pertaining to Corkstown Road and the Western Farmland Cultural Landscape.

Spills Response and Action Plan

A *Spills Response and Action Plan* will be prepared and adhered to by the contractor. Spills or discharges of pollutants or contaminants will be reported immediately. To avoid the release of any deleterious substances during construction activities, the construction manager must ensure that the operation and refueling and maintenance of equipment with the use of toxic materials are performed off-site. Additionally, an adequate supply of clean-up materials shall be on site with a work crew that is fully trained to prevent and respond to accidental spills. Clean up shall be initiated quickly to ensure protection of the environment. In the event of a spill, MECP Spills Action Hotline shall be contacted (1-800-268-6060), as well as the NCC if appropriate.

Species at Risk

The SARA and OESA protected species list are updated periodically to add new species or revise species status. Legislation updates should be reviewed and an update of the potential species present and their associated habitat should be completed prior to construction. Protection afforded to any species shall be in accordance with appropriate federal/provincial jurisdiction. If a SAR is observed during construction, in the construction zone, the MNRF / ECCC are to be contacted immediately and operations modified to avoid any negative impacts to the species or their habitat until further direction is provided by the governing authority.

Timing Windows

All activities related to the construction should avoid certain timing windows dependent on the wildlife that is potentially impacted.

- *Migratory Bird Convention Act, 1994* and *Fish and Wildlife Conservation Act, 1997* - it is recommended that any vegetation removal that may be required take place outside of the breeding bird season for this region (April 1st to August 31st). In most cases nest searches during the nesting season (April 1st to August 31st) are not recommended within complex habitats, as the ability to detect nests is largely low while the risk of disturbance to active nests is high. Disturbance increases the risk of nest predation and abandonment by adults. Therefore, nest searches are not recommended unless nests are known to be easy to locate without disturbing them. Nests searches may be completed during the nesting period (April 1st to August 31st) by a qualified biologist within 'simple habitats' (CWS 2014). Simple habitats refer to habitats that contain few likely nesting spots or a small community of migratory birds.
- *Fisheries* - Should there be *in-water works* such as that associated with culvert extensions for watercourses, confirmation of in–water construction timing windows with MNRF is necessary prior to any construction works. For potential fish relocation work, a License to Collect Fish for Scientific Purposes is required from the MNRF as well. To protect fish spawning activity, there are specific in–water works timing window restrictions. Consultation with MNRF should be continued to provide updated information on the timing restrictions at the time of design.

- *Turtles* are actively nesting in June and early July. Caution should be taken during the active season (April 1 – October 30) of any given year by thoroughly sweeping the area before works begin to help encourage any turtles within the area to move away. Additional consultation with the MNRF may also provide species-specific mitigation, if required.

Tree Conservation Report

The purpose of the *Tree Conservation Report* is to retain as much natural vegetation as possible, including mature trees, stands of trees, and hedgerows, using a "design with nature" approach to planning and engineering. This report will identify and describe the vegetative cover on the site prior to development, and will provide a professional opinion as to the priority that should be given to the conservation of the treed areas on site. The TCR will recommend appropriate protection measures for trees to be retained, and compensation measures for trees to be removed. It may also identify trees suitable for transplanting, or suggest enhancement plantings.

Together with the *Landscape Plan*, the *Tree Conservation Report* will identify trees that will be retained where feasible, and new trees that will be planted to contribute to the City's forest cover target and to address a site's tree loss. The *Tree Conservation Report* will be in accordance with the City of Ottawa Tree Conservation Report Guidelines.

Wildlife Protection Measures

All personnel should be briefed about wildlife protection measures at the outset of the project. The briefing needs to provide an overview of the mitigation measures that are being used at the site, as well as instructions on what do to if and when wildlife are encountered during the work. It should also include information on any species at risk that may be present, and what to do if one is seen. In general it should address:

- General provisions – e.g., do not harm, feed or unnecessarily harass wildlife; drive slowly and avoid hitting wildlife where possible; keep site tidy and secure
- Species at risk – basic identification tips for and species most likely to be encountered at the site)

Contact information for: Project biologist, ECCC, MNRF Extra care and precaution will be taken during the turtle nesting season in June and early July, and the hibernation season from mid-October to mid-March

Refer to the City of Ottawa's Protocol for Wildlife Protection during Construction for other recommendations and mitigations.

(http://documents.ottawa.ca/sites/documents.ottawa.ca/files/documents/construction_en.pdf).

9.3.4. PHYSICAL ENVIRONMENT

Geotechnical Considerations

Geotechnical investigations will be required to confirm groundwater and subsurface conditions and potential impacts that will need to be considered in the detailed design phase of the project. Geotechnical investigations will also be required to undertake the alignment, station, and elevated structure design. Foundation investigation will be required for structural design of below- and above-grade structures, culvert extensions etc.

9.4. ASSESSMENT AND EVALUATION RESULTS

The study of environmental effects considers the interaction of the project (i.e., project activities) with the environment. Pre-construction, construction and operational activities were assessed. Professional judgement, analysis and experience formed the basis for identifying environmental effects and mitigation measures. The analysis was based primarily on comparing the existing environment with the anticipated future environment, during and after construction.

The prediction of effects considered the interaction between the project and associated activities on the environment. Within this context, the following process was used:

1. **Determine impacts and mitigation**

   Describe the interaction between the project activities and environmental components, and describe any related mitigation measures.

2. **Determine residual effects, if any**

   Identify environmental effects that remain following the implementation of mitigation measures. Professional judgement and expertise is used to determine significance as a function of these criteria.

3. **Determine the significance of the impact, considering residual effects**
   Potential residual environmental effects are assessed as to their significance including the following considerations:

   - *Magnitude of residual effect* - Small/ moderate/ large. . . .
   - *Reversibility of residual effect* - Reversible/ irreversible
   - *Geographic extent of residual effect* - Immediate/ local/ regional.
   - *Duration of residual effect* - Short-term/ medium-term/ long-term
   - *Frequency of residual effect* - Once/ intermittent/ continuous

   Subsequently, residual environmental effects are categorized according to the following definitions:

   Significant
   Major Impact (widespread/permanent): Potential effect could jeopardize the long term sustainability of the resource/feature. Impact assessment should consider the long term sustainability of the resource taking into consideration the: magnitude, reversibility, geographic extent, duration and frequency of the effect.

   Not Significant
   Moderate Impact: Effects that are reversible (i.e., that after the project activity is removed or stopped, the integrity of the resource/feature would be resumed. Effect could result in a decline of a resource in terms of quality/quantity, such that the impact is considered moderate in its combination of magnitude, aerial extent, duration, and frequency.
   Minimal: Potential effect is small, localized, and limited to the construction phase of the project

   The above definitions of significance were adopted for use in this assessment because many of the impacts cannot be quantified in absolute terms, although changes and trends can be predicted. The definitions provide guidance and are intended to minimize personal bias.

Study boundaries serve to focus the scope of the assessment such that a meaningful analysis of potential impacts arising from the proposed project can be made. Project boundaries are defined by the spatial and temporal limits of the proposed project activities, and their zones of influence.

4. **Monitoring Requirements**

Monitoring is important to verify the accuracy of the prediction to the environmental effect. Monitoring measures determine what effects have actually occurred following project implementation, and may result in the modification of mitigation measures to improve their effectiveness. Typically monitoring that may occur during this project could be inspection, surveillance and compliance monitoring. The mitigation plans, to be prepared will detail, the component specific monitoring requirements to be carried forward into design and construction. In addition, future permits may contain monitoring requirements for the project.

9.5. IMPACT ASSESSMENT

Table 9-3 describes the potential effects, prescribed mitigation measures, residual effects and their significance, and monitoring recommendations for the recommended plan.

Table 9-3: Assessment of Environmental Effects

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Social Environment											
Planning Policies	Provision of Rapid Transit Service	The project provides a rapid transit corridor, with a high level of connectivity and supporting active transportation facilities. As such, it is in accordance with the policies and objectives of: • The OP (Section 4.2.1.1 .2 of this Report); • The TMP(Section 4.2.1.1 .2 of this Report); and, • The PPS (Section 4.2.1.1 .2 of this Report). The project is also in accordance with other guiding policies.	• None required	None identified	Large	Reversible	Local	Long-term	Continuous	**Positive**	None identified
Land Use	Provision of Rapid Transit Service	The project will serve a diversity of commercial and mixed-use developments, residential areas, and other major destinations such as: • Kanata Town Centre; • Canadian Tire Centre; • The Palladium Area; • Future development land, including those outlined in the Kanata West Concept Plan and Fernbank Community Design Plan; and The Kanata North Business park, via the provision of a rapid transit connection with the Kanata North Business Park.	• None required	None identified	Large	Reversible	Local	Long-term	Continuous	**Positive**	None identified

Land Ownership	Acquisition of land required for the right-of-way and supporting infrastructure.	The project will require NCC property.
		
		Permanent alteration of NCC land
			• Nature of land acquisition to be determined in subsequent detailed design phase, in collaboration with the NCC, as part of the Federal approvals process.
			• Develop and implement a *Public Communications Plan* in consultation with the NCC.
			• Development of/or alteration to NCC lands including implementation of mitigation measures will be subject to review under the *Federal Land Use, Design and Land Transaction Application*.
			• Completion of an Environmental Effects Analysis, in accordance with Section 67 of the *Canadian Environmental Assessment Act, 2012* which may include but will not be limited to:
			  • The reinstatement of NCC lands to NCC satisfaction at the end of the proposed project.
			  • The identification of the vegetation that needs to be grubbed, prune or removed on NCC lands. All trees that are going to be identified as “to be kept” by the NCC must be protected up to their drip line. The NCC may also request a replacement of any trees that are lost as a result of construction related activities, resulting in a net gain.
			  • SARA subsection 79(2) requires that impacts on all SARA Schedule 1 listed species at risk, including special concern species, be adequately assessed and mitigated wherever there is an EA responsibility, such as in this case where there is a Canadian Environmental Assessment Act, 2012 (CEAA 2012) section 67 responsibility by the NCC to assess impacts in relation to federal lands.
			• The identification of the location and approximate footprint of any excavation work on NCC lands.
				Loss of lands.	Moderate	Irreversible	Immediate	Long-term	Continuous	**Moderate**	In accordance with FLUDA and CEAA, 2012 approved documents.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
	Acquisition of land required for the right-of-way and supporting infrastructure	The project will require approximately 19.55 Ha of property. Partial and/or full property takings within the identified footprint. Changes to current site configuration	• Compensation to land owner as per City of Ottawa practices and policies. • Some property requirements are from vacant lands, and will be acquired through the Site Planning process. • Landscaping restoration and replacement, where applicable	Loss of lands	Moderate	Irreversible	Immediate	Long-term	Continuous	**Moderate**	Ongoing consultation with stakeholders.
Land Ownership	Acquisition of land required for the right-of-way and supporting infrastructure	Lands may be temporarily required from adjacent property owners for construction staging and laydown areas.	• The construction staging and laydown areas as well as right-of-way requirement on private property will be minimized where practical. • Compensation as per City of Ottawa practices and policies. • Return properties to pre-construction conditions following the works. • *Public Communications Plan*	Temporary loss and disturbance of lands may be an inconvenience to directly affected land owners.	Moderate	Reversible	Immediate	Short-term	intermittent	**Minimal**	Ongoing consultation with stakeholders.
Aboriginal Land Claims	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	There have not been any parcels of land identified in the Agreement-in-Principle within the study area.	• Continued engagement and consultation with aboriginal groups in subsequent detail design phase. .	None expected	NA	NA	NA	NA	NA	**None expected**	As per ongoing consultation with Aboriginal stakeholders.

Archaeological Potential	General Construction of Alignment Construction of any below-grade Alignment segments General Construction of Stations Construction of Associated Infrastructure	Potential for disturbance of archaeological resources from ground disturbance during construction.	• All portions of the study area identified as possessing archaeological potential that have not been mitigated by previous archaeological investigations will require additional archaeological assessment. • Should relic shorelines be discovered or identified within the study area boundary it would represent an indication of potential Indigenous occupation and land use and a significant trigger for recommending for additional archaeological investigations. • Where additional assessment has been recommended, and no previous assessment has been completed, the additional assessment should consist of a Stage 2 field investigation compliant with the MTCS S*tandards and Guidelines for Consultant Archaeologists (2011*). These investigations should be completed early in the detail design phase to inform project details. • All land recommended for Stage 2 assessment which has been sufficiently disturbed to have removed the potential for archaeological resources will require visual inspection and photographic documentation during the Stage 2 assessment to be completed when climatic conditions are sufficient to meet the MTCS Standard. • A Stage 2 assessment should be completed for registered site BhFx-2 to define the spatial extent of the site and determine the significance of the lithic scatter prior to any additional disturbances to the area • A Stage 3 archaeological investigation should be completed at the Bradley Farm site (BhFx-47) and James Farm site (BhFx-49) prior to any potential project impacts to the existing landscape at these site locations. • If any artifacts of aboriginal interest or human remains are encountered during the development of this project the Algonquins of Ontario Consultation Office will be contacted in addition to the Ministry of Consumer Services and	Reduced potential for disturbance of archaeological resources during construction.	Moderate	Irreversible	Immediate	Medium-term	Continuous	**Moderate**	As required by additional Archaeological Assessment(s).

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
			engaging a licensed consultant archaeologist. • Any future Stage 2 and 3 Archaeological Assessment reports will be sent, in draft to the AOO.								
Archaeological Potential		Potential for disturbance of unknown archaeological resources from ground disturbance during construction.	• In the event that human remains are found, the *Funeral, Burial and Cremation Services Act, 2002* requires that any person discovering human remains must immediately notify the police at the Ministry of Consumer Services (416-326-8393) • Should previously unknown archaeological resources discovered, they may be a new archaeological site, and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological work	Potential for disturbance of unknown resources.	Moderate	Irreversible	Immediate	Short-term	Continuous	**Moderate**	As per licensed archaeologist, if necessary.
Cultural Heritage Resources	General Construction of Alignment Construction of any below-grade Alignment segments General Construction of Stations Construction of Associated Infrastructure	Potential for disturbance of potential archaeological sites with Cultural Heritage Value or Interest (CHVI) from ground disturbance during construction.	• Known archaeological sites determined to possess Cultural Heritage Value or Interest (CHVI) identified in the present study area that have not been completely mitigated, or deemed to merit further investigation, should be avoided. Should these sites not be avoidable, additional archaeological investigations will be required prior to any project impacts to these areas. This includes, but is not limited to, registered sites BhFx-2, BhFx-47 and BhFx-49. • CHVI was identified for registered site BhFx-2 and additional assessment was recommended in the original project report (Swayze 2000). A Stage 2 assessment should be completed in this location in an attempt to define the spatial extent of the site and determine the significance of the lithic scatter prior to any additional disturbances to the area.	Reduced potential for disturbance of archaeological resources during construction.	Moderate	Irreversible	Immediate	Medium-term	Continuous	**Moderate**	As required by additional Archaeological Assessment(s).

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Cultural Heritage Resources	Construction of Associated Infrastructure	Construction of the LRT could adversely impact the rural character of Corkstown Road and cultural heritage resources within the NCC Greenbelt; specifically the Western Farmlands cultural landscape (extending from Moodie Drive to Eagleson Road/ March Road).	• The existing landscape should be documented with georeferenced photographs and described in a Heritage Documentation Report. • Landscape features such as mature trees should be retained and incorporated into detailed design as much as is practical • Maintain the rural character of Corkstown Road. Revegetate areas with native species as needed.	None anticipated.	Small	Reversible	Local	Short-term	Intermittent	**Minimal**	None anticipated.
Landscape Character	Provision of Rapid Transit Service	The LRT has the potential to alter the landscape character of the areas through which it travels through.	• Operation of the LRT is bundled with transportation corridors (Highway 417, Campeau Road, Huntmar Drive, and the future North-South Arterial). • Much of the alignment is through an urban setting, or land slated for development. The LRT will integrate well within an urban environment • A *Landscape Plan* completed during detailed design will consider the findings of the CHOR, and provide for integration into the surrounding naturalized landscapes.	Integration into surrounding landscapes.	Small	Irreversible	Immediate	Long-term	Continuous	**Minimal**	None anticipated
Air Quality	General Construction of Alignment. General Construction of Stations. Construction of Associated Infrastructure.	Increase in suspended dust particles during construction may be an irritant to adjacent residents and passers-by.	• Air quality BMPs	Temporary irritant to residents and other corridor users.	Small	Reversible	Immediate	Short-term	Intermittent	**Minimal**	Monitor complaints
	Provision of Rapid Transit Service	Heating equipment at stations may cause some emissions. Bus operations at terminal stations may generate some emissions.	• Future vehicle emissions are expected to decrease as vehicle technology improves, producing better overall air quality from existing conditions. • Air emissions for expanded operations at the terminal stations, will be assessed and controlled during the detailed design and project implementation phases of the project according to MECP and City of Ottawa requirements • Reduction in the number of diesel buses operating in the area. • The introduction of electric rail.	The project will result in an improvement in air quality.	Moderate	Reversible	Regional	Long-term	Continuous	**Positive**	None anticipated

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Air Quality	Operation of the expanded LMSF.	The expanded LMSF is expected to generate emissions consistent with a light industrial use building.	• Air emissions for the LMSF will be assessed and controlled during the detailed design and project implementation phases of the project according to MECP and City of Ottawa requirements	As the LMSF is only anticipated to be used for cleaning and other light maintenance activities, the impacts are not expected to be significant.	Small	Reversible	Local	Long-term	Intermittent	**Minimal**	None anticipated
Noise	General Construction of Alignment General Construction of Stations Construction of Associated Infrastructure	Noise levels in the corridor will temporarily increase during various phases of construction.	• Implement Noise Control BMPs	Increased noise may be a temporary irritant to residents and other corridor users.	Small	Reversible	Immediate	Short-term	Intermittent	**Minimal**	Monitor complaints
	Provision of Rapid Transit Service	Operation of the project may contribute to the overall noise levels.	• At all receptors contributions of the LRT are below the established ambient noise levels, therefore no mitigation is required as part of the project. LRT is not contributing to the overall noise levels. • Receptors with elevated noise levels due to Highway 417 already have noise barriers in place that currently meet the City of Ottawa's maximum height for retrofit considerations,	None anticipated.	NA	NA	NA	NA	NA	**None expected**	None anticipated.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	Level of Significance	
Noise	Operation of the Stations	Operation of the stations may contribute to the stationary noise levels.	• Given the location of the stations being away from sensitive receivers, any increase in noise levels between existing and future conditions would be negligible. • Many stations are located in busy commercial areas • Stations in undeveloped land will benefit from the site planning process to prevent impacting future dwellings. • Stations are in close proximity to Highway 417 or major arterial roadways; as such, any increase in bus activity would likely be overcome by roadway traffic noise. • The impacts on stationary noise levels would be evaluated, and controlled if necessary, through detailed design and project implementation phase of the project.	None anticipated.	NA	NA	NA	NA	NA	**None expected**	None anticipated.
	Operation of the expanded LMSF	Operation of the expanded LMSF may contribute to the stationary noise levels. Noise from the LMSF was calculated to be potentially up to 45 dBA during the daytime period at the noise sensitive area associated with the campgrounds at 411 Corkstown Road	• This calculation does not exceed the ENCG criteria for stationary noise, but should be taken into consideration during detailed design. • In conformance with the MECP and City of Ottawa ENCG, the facility would be subject to a detailed stationary noise analysis during detailed design and project implementation. Potential noise mitigation strategies include offsetting layover tracks as far as possible from the Wesley Clover Camp Ground, or incorporating attenuation measures around the perimeter of the property.	Insignificant increases to noise in the vicinity of the campgrounds at 411 Corkstown Road.	Small	Reversible	Immediate	Long-term	Intermittent	**Minimal**	As per additional analysis during detailed design.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Vibration	General Construction of Alignment. General Construction of Stations. Construction of Associated Infrastructure.	Ground vibrations generated from construction may be occasionally disruptive to adjacent land owners.	• Contractor to implement mitigation strategy with the intent of satisfying MECP-119 • Contractor to ensure acceptable vibration limits are enforced by maintaining construction equipment. • Temporary road surfaces will be maintained so as to minimize bumps and rough surfaces. • Pre-construction surveys may be conducted for adjacent property owners.	Increased vibration may be a temporary irritant to residents and uses of the corridor.	Small	Reversible	Immediate	Short-term	Intermittent	**Minimal**	As per mitigation strategy to be developed by contractor.
	Provision of Rapid Transit Service	Ground vibrations from the operation of the project and associated infrastructure may cause ground vibrations that would be disruptive to residents and users of the corridor.	• Predicted vibration levels are below the criterion of 0.1 mm/s RMS, no mitigation will be required. • Vibration levels as a result of the Kanata LRT project generally do not exceed the level commonly considered perceptible by most building occupants • As vibration levels are low, correspondingly regenerated noise levels are also expected to be acceptable.	None anticipated.	NA	NA	NA	NA	NA	**None expected**	None anticipated.
Views and Vistas	Provision of Rapid Transit Service	The LRT has the potential to alter the views and vistas of the areas through which it travels through.	• The LRT is bundled with transportation corridors (Highway 417, Campeau Road, Huntmar Drive, and the future North-South Arterial), and does not consist of any significant above-grade elements that will obscure views into Ottawa or Gatineau.	None anticipated.	NA	NA	NA	NA	NA	**None expected**	None anticipated.
Part 4: Transportation Environment											
Transit Network	General Construction of Alignment. General Construction of Stations. Construction of Associated Infrastructure.	Construction activities may result in detours and lane reductions. Construction activities will potentially slow traffic and be a possible irritant to transit users along the corridor. Transit may be detoured onto nearby arterials or major roads such as Highway 417 or Campeau Drive.	• Contractor to implement a *Construction and Traffic Management Plan* in consultation with OC Transpo to minimize the effects on traffic flow. • A public notification program should be implemented by the City and OC Transpo for any temporarily detoured transit routes/stops.	Possible delays in travel time during construction may be an irritant to transit users.	Moderate	Reversible	Local	Short-term	Once	**Minimal**	Monitor Complaints and Travel Times
Transit Network	Provision of Rapid Transit Service	Provision of high level of public transportation from Moodie Station to Hazeldean Station.	• None required.	Improved transit service. Improved transit user experience.	Large	Reversible	Local	Long-term	Continuous	Positive	None identified

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
	Maintenance of major structures Maintenance of way Maintenance of stations	Maintenance activities may require temporary lane closures, detours, and track and station closures.	• Contractor to implement a *Construction and Traffic Management Plan* for any maintenance work with substantial delays. • A public notification program should be implemented by the City and OC Transpo for any temporarily detoured transit routes/stops.	Disruption to transit service during maintenance activities	Moderate	Reversible	Local	Short-term	Once	**Minimal**	As per *Traffic and Transit Management Plan* and *Public Communications Plan.*
Road Network	General Construction of Alignment. General Construction of Stations. Construction of Associated Infrastructure.	Construction activities are anticipated to slow traffic and be a possible irritant to road users. Possible detours may direct traffic onto nearby arterials or major roads such as Highway 417 or Campeau Drive.	• Construction phasing to minimize effects on traffic • A *Construction and Traffic Management Plan* will be prepared and implemented by the Contractor. • A *Public Communications Plan* will be implemented by the City. • Contractor to ensure road safety for all corridor users.	Possible delays during construction may be an irritant to road users.	Moderate	Reversible	Local	Short-term	Once	**Minimal**	Monitor complaints
	Provision of Rapid Transit Service	Increase of vehicular, pedestrian and cyclist demand in and around the LRT stations and park and rides, specifically • March/Eagleson Station • Terry Fox Station • Palladium Station • Hazeldean Station	• Localized roadway modifications as described in the Recommended Plan • Operational analysis during detailed design	Increased levels of vehicular, cyclist and pedestrian traffic in the vicinity of stations, and park and rides.	Small	Reversible	Immediate	Long-term	Intermittent	**Minimal**	As per additional analysis.
Pedestrian and Cycling Network	General Construction of Alignment. General Construction of Stations. Construction of Associated Infrastructure (Pedestrian overpasses, multi-use pathways, and intersection improvements).	Construction activities may cause disruption/detours to pedestrian and cyclist movement.	• Key pedestrian and cycling routes should be maintained • Temporary pathway connections will be discussed with the appropriate federal agency (i.e. NCC)) • Contractor to implement a *Construction and Traffic Management Plan* to minimize the effects on traffic flow and to ensure roadway safety for all users	Temporary inconvenience to pedestrians and cyclists	Moderate	Reversible	Local	Short-term	Once	**Minimal**	Monitor Complaints
Pedestrian and Cycling Network	Provision of Rapid Transit Service	Increased active transportation modal split due to higher order pedestrian and cyclist facilities parallel to alignment and connecting from stations. Improved connections to existing pathway systems and cycling routes.	• Pedestrian and cycling facilities designed to best management practices at time of detailed design.	Improved facilities for pedestrians and cyclists within the corridor.	Large	Reversible	Local	Long-term	Continuous	**Positive**	None identified

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Railways	General Construction of Alignment.	Construction of CNR railway crossing may require the railway to be closed intermittently.	• Detailed design in accordance with CNR standards and any permitting requirements. • Scheduling of construction activities to be determined with railway operators.	Disruption to railway operations during construction activities	Moderate	Reversible	Regional	Short-term	Once	**Minimal**	Maintain communications with CNR stakeholders. Acquire necessary permits.
Goods Movement	General Construction of Alignment. General Construction of Stations. Construction of Associated Infrastructure.	Traffic delays and detours may cause delay or disturbance to corridors used for goods movement (truck routes).	• Construction phasing to minimize effects on traffic • A *Construction and Traffic Management Plan* will be prepared and implemented by the Contractor. • A *Public Communications Plan* will be implemented by the City.	Temporary construction detours and delays.	Moderate	Reversible	Local	Short-term	Once	**Minimal**	As per *Construction Traffic Management Plan*
Infrastructure and Utilities											
Water Distribution System	General Construction of Alignment.	LRT infrastructure appears to be in vertical or horizontal conflict with existing water distribution system at the following locations; 1) 203mm watermain (13+815) 2) 203mm watermain (14+136) 3) 610mm watermain (14+375) 4) 610mm watermain (15+760) 5) 406mm watermain (15+760) 6) 1067mm watermain (17+110) 7) 406mm watermain (17+700) 8) 406mm watermain (19+490)	1) Remove and replace and conform to TC E-10 2) Remove and replace and conform to TC E-10 3) Remove and replace and conform to TC E-10 4) Remove and replace and conform to TC E-10 5) Remove and replace and conform to TC E-10 6) Remove and replace and conform to TC E-10 7) Remove and replace and conform to TC E-10 8) Remove and replace and conform to TC E-10	Disruption to level of service during watermain construction activity.	Small	Reversible	Local	Short-term	Once	Minimal	A stray current assessment report should be prepared addressing stray current mitigation and protection of infrastructure adjacent to guideway. Vibration monitoring on major watermains should be undertaken during construction
Sanitary Sewer System	General Construction of Alignment.	LRT infrastructure appears to be in vertical or horizontal conflict with existing sanitary sewer system at the following locations; 1) 450mm sanitary sewer (14+133) 2) 600mm sanitary sewer (16+625) 3) 1200mm sanitary sewer (17+660) 4) 900mm sanitary sewer (20+300)	1) Protect and conform to TC E-10 2) Protect and conform to TC E-10 3) Protect and conform to TC E-10 4) Remove and replace and conform to TC E-10	Disruption to level of service during sewer construction activity.	Small	Reversible	Local	Short-term	Once	Minimal	A stray current assessment report should be prepared addressing stray current mitigation and protection of adjacent infrastructure

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Storm Drainage System	General Construction of Alignment.	LRT infrastructure appears to be in vertical or horizontal conflict with existing storm drainage system at the following locations; 1) SWM pond at Hazeldean Station 2) 1500mm dia. Storm sewer (13+805) 3) 300mm dia. Storm sewer (14+130) 4) 1050mm dia. Storm sewer (14+130) 5) 675mm storm sewer (15+985) 6) 1200mm storm sewer (16+170) 7) 1200mm storm sewer (16+915) 8) 675mm storm sewer (17+100) 9) 1800mm culvert (17+380)	1) Reconfigure/relocated pond to suit proposed station and site 2) Protect and conform to TC E-10 3) Remove, replace to reconnect to re-aligned 1050mm storm sewer 4) Re-align so it flows westward along the north side of guideway and conform to TC E-10 5) Protect and conform to TC E-10 6) Re-align to suit and conform to TC E-10 7) Protect and conform to TC E-10 8) Re-align to suit and conform to TC E-10 9) Remove, direct flow westward along southside of guideway to Watts Creek	Disruption to level of service during storm drainage construction activity For item 9) Reduction in drainage area to watercourse downstream of 1800mm culvert (17+380) after flow redirection may impact biological environment	Small	Reversible Item 9 is not reversible	Local	Short term Item 9 is long-term	Once Item 9 is long-term	Moderate	A stay current assessment report should be prepared.
Utilities	Relocating hydro, telephone, and utilities for construction	Existing utilities in conflict with the alignment will be relocated. Relocations may cause some short term disruptions to existing services.	• Construction to be coordinated with utility companies to minimize impact and reduce duplication in construction activities.	Potential for short-term disruptions during construction.	Small	Reversible	Local	Short-term	Intermittent	**Minimal**	Monitor complaints
	General Construction of Alignment.	Excavations have the potential to disrupt provision of utilities and cause unintentional service disruptions if locations of utilities are not known.	• Construction to be coordinated with utility companies. • Utility locates completed prior to excavations.	Potential for unintentional service disruptions is reduced.	Small	Reversible	Local	Short-term	Intermittent	**Minimal**	None required
Biological Environment											
Surface Water	Field Investigations General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Input of deleterious substances and water quality via spills/leaks in all watercourses intersecting/adjacent to alignment. Decrease in water quality in: • Stillwater Creek • Watts Creek • Carp River • Feedmill Creek • Poole Creek	• Regular maintenance of roadway infrastructure. • Spills Response and Action Plan • Environmental Protection Plan • Debris control measures to manage any falling debris. • Ensure machinery is in good working conditions, free of fluid leaks. Inspections should be conducted daily. • Equipment should be refueled at least 30 m from slopes and surface water. Designated refueling areas should be implemented for all sites.	Potential contamination from accidental spills/leaks	Small	Reversible	Immediate	Short-term	Once	**Minimal**	As per *Spills Action and Response Plan*: and *Environmental Protection Plan*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Surface Water	Field Investigations General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Sedimentation may occur within river banks/bottoms in all watercourses intersecting/adjacent to alignment due to construction activities. Decrease in water quality in: • Stillwater Creek • Watts Creek • Carp River • Feedmill Creek • Poole Creek	• Erosion and Sediment Control Plan. • Silt/construction fencing surrounding work zones adjacent to watercourses to limit the area of disturbance. • Store all stockpiled materials away from watercourses. • Remove all stockpiled material following construction. • Minimize vegetation clearing around watercourses as much as possible and only that necessary to accommodate construction. • Consult with regulatory agencies such as DFO, MNRF, MVCA, and RVCA regarding details of construction methods and proposed mitigation measures. •	Minor degradation of water quality.	Small	Reversible	Immediate	Short-term	Once	**Minimal**	Regular inspection as outlined in the *Erosion and Sediment Control Plan*
	Provision of Rapid Transit Service	Increase in impervious surfaces along the corridor, such as park and ride lots, bus transfer stations, and general station areas. Increased runoff resulting in sedimentation that may impact water quality in: • Stillwater Creek • Watts Creek • Carp River • Feedmill Creek • Poole Creek	• Stormwater Management Plan • Erosion and Sediment Control Plan • Environmental Protection Plan • The Landscape Plan will provide for soft-landscaping in the vicinity of project elements to contribute to permeable groundcover.	Sedimentation within the watercourses.	Small	Reversible	Immediate	Short-term	Once	**Minimal**	Regular inspection as outlined in the *Erosion and Sediment Control Plan* As per *Environmental Protection Plan*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Aquatic Environment	Field Investigations General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Sedimentation may result due to construction activities. Decrease in water quality may affect fish and fish habitat in: • Stillwater Creek • Watts Creek • Carp River • Feedmill Creek • Poole Creek • All watercourses	• Erosion and Sediment Control Plan • Store all stockpiled material away from watercourses. • Remove all stockpiled material following construction. • Silt/construction fencing at work areas near watercourses to limit areas of disturbance. • Minimize vegetation clearing around watercourses as much as possible, necessary to accommodate construction. • Consult with regulatory agencies such as DFO, MNRF, MVCA, and RVCA regarding details of construction methodology and proposed mitigation measures.	Minor degradation of water quality.	Small	Reversible	Immediate	Short-term	Once	Not significant: Minimal	Regular inspection as outlined in the *Erosion and Sediment Control Plan* As per *Environmental Protection Plan*
Aquatic Environment	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Input of deleterious substances and water quality via spills/leaks. Decrease in water quality due may impact fish and fish habitat in: • Stillwater Creek • Watts Creek • Carp River • Feedmill Creek • Poole Creek • All watercourses	• Spills Response and Action Plan • Environmental Protection Plan • Debris control measures to manage any falling debris. • Ensure machinery is in good working condition, free of fluid leaks. Inspections should be conducted daily. • Refueling of equipment should be conducted at least 30 m from slopes and surface water. Designated refueling area should be implemented for the site. • Regular maintenance of roadway infrastructure	Potential contamination of watercourses	Small	Reversible	Immediate	Short-term	Once	Not significant: Minimal	As per *Spills Response and Action Response Plan* As per *Environmental Protection Plan* Monitor clean-up operations

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Fisheries	Field Investigations General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Construction of Associated Infrastructure (Culverts, overpass structures)	Temporary disturbance and/or loss of site-specific habitat. Potential loss of fish habitat due to new bridges/culverts in: • Stillwater Creek • Watts Creek • Carp River • Feedmill Creek • Poole Creek	• Avoid in-water work to the extent possible. • Minimize the area of in-water alteration to the extent possible. • Complete Fisheries Self-Assessment prior to undertaking in-water work. • Follow in-water construction timing restrictions (March 15 to July 15). • If coffer dams are required the Contractor will develop a Dewatering Management Plan in consultation with regulatory agencies, if required. • Use of cofferdams must be done in consultation with regulatory authorities and constructed with clean, approved materials. • Contractor to develop and implement an Erosion and Sediment Control Plan. • Consult with regulatory agencies such as DFO, MNRF, MVCA, and RVCA regarding details of construction methodology and proposed mitigation measures.	Minor disturbance of fish and aquatic habitat. No in-water works anticipated.	Small	Reversible	Immediate	Short-term	Once	Minimal	Regular inspection as outlined in the *Erosion and Sediment Control Plan* As per *Environmental Protection Plan* As per *Dewatering Management Plan*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Terrestrial Environment	Clearing and grubbing trees and vegetation within the grading limits for the construction project	Clearing and grubbing activities throughout KLRT corridor and Park and Ride areas will result in the loss of existing trees, shrubs and grass.	• Ecological Site Assessment prior to construction. • Erosion and Sediment Control Plan to be implemented prior to vegetation removal. • Minimize vegetation clearing to the extent possible and limited to within the construction footprint. • Replace vegetation in accordance with Landscape Plan. • Protection of identified natural features and individual specimens with exclusion fencing to define construction footprint. • Replacements to be with native varieties and/or salt tolerant species as appropriate. • Store any stockpile materials and equipment within the construction footprint. • . Salvage existing native vegetation where possible, especially sensitive species (i.e. SAR and/or provincially/regionally rare plants) for transplanting within the study area.	Loss of vegetation within the KLRT corridor and Park and Ride lots will disturb/displace wildlife and wildlife habitat and increase fragmentation.	Small	Reversible	Immediate	Medium-term	Once	Not significant: Moderate	As per *Environmental Protection Plan, Erosion and Sediment Control Plan, Landscape Plan* As per *Tree Conservation Report* Monthly on-site inspection during construction to monitor for target tree/vegetation removal, silt fencing quality and effectiveness, and to ensure no damage to adjacent trees and natural areas. Repair silt fencing if damaged. Monitor health of new plantings during the warranty period.
Wildlife	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Construction activities may generate conditions causing local urban wildlife to temporarily avoid the area.	• Ecological Site Assessment to be conducted prior to construction as part of Species at Risk Overview. • Delineation of construction area to limit area of disturbance. • Tree Removal and Landscape Plan to preserve and replace affected habitat.	Minor avoidance of the construction zone by urban wildlife.	Small	Reversible	Immediate	Short-term	Once	Not significant: Minimal	As per *Ecological Site Assessment* As per *Tree Conservation Report* As per *Landscape Plan*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Wildlife	Clearing and grubbing trees and vegetation within the grading limits for the construction project	Migratory birds and their nests could be disturbed by vegetation removal during construction.	• Vegetation removal should occur outside of the breeding bird season (April 1 to August 31). • Removal of isolated trees or areas of low complexity habitat may proceed in the nesting season provided a qualified biologist completes a bird nest survey and confirms the absence of active nests. If an active nest is found, a buffer should be applied around the nest. The buffer size will be dependent on the species.	Minor avoidance of the area by migratory birds.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per City's *Protocol for Wildlife Protection during Construction* Guide. Daily sweeps of the construction areas.
	Clearing and grubbing trees and vegetation within the grading limits for the construction project	Bat maternity colonies could be displaced or destroyed by vegetation removal (i.e. cavity trees) during construction.	• Ecological Site Assessment to be conducted prior to construction. • Tree removal should occur outside the bat roosting season (April 1 to August 31) within areas that have been identified as confirmed Significant Wildlife Habitat for Bat Maternity Colonies. A tree cavity density survey should be completed prior to construction during the detail design phase to determine significance. • Consultation with the MNRF may be required to determine additional mitigation, compensation measures, and monitoring.	Minor avoidance of the area by roosting bats.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per City's *Protocol for Wildlife Protection during Construction* Guide. As per *Ecological Site Assessment* Monitor the removal of suitable cavity trees.
	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Turtles and their nests could be disturbed by construction activities.	• Ecological Site Assessment to be conducted prior to construction. • Caution should be taken during the turtle nesting season in June and early July as turtles use embankments and other terrestrial sites for nesting. During the active season (April 1 – October 30), MNRF recommends a thorough sweep of the area before works begin to encourage any turtles using the site to move away.	Minor avoidance of the area by turtles.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per City's *Protocol for Wildlife Protection during Construction* Guide. As per *Ecological Site Assessment* Daily sweeps of the construction areas.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Wildlife	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Provision of Rapid Transit Service	Snakes and their hibernacula could be disturbed by construction and operation activities. Loss of habitat in: - candidate snake hibernacula areas	• Ecological Site Assessment to be conducted prior to construction. • Caution should be taken during snake emergence (warm days in early spring) within areas that have been identified as confirmed Significant Wildlife Habitat for Reptile Hibernacula. A snake emergence survey should be completed during detail design in areas identified as candidate/potential habitat	Minor avoidance of the area by snakes.	Small	Reversible	Immediate	Short-term	Once	Not significant: Minimal	As per City's *Protocol for Wildlife Protection during Construction* Guide. As per *Ecological Site Assessment* Daily sweeps of the construction areas.
	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Clearing and grubbing trees and vegetation within the grading limits for the construction project	Potential loss or fragmentation of candidate/confirmed significant wildlife habitat (SWH).	• During detailed design phase of the project consultation with MNRF and Ecological Site Assessment should be completed to confirm candidate SWH and determine potential impacts, if any. • wildlife habitat connectivity should be maintained or enhanced using best practices at this significant location and throughout the project footprint.	Loss of significant wildlife habitat if determined to be present.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per *Ecological Site Assessment*

Species at Risk	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Clearing and grubbing trees and vegetation within the grading limits for the construction project	General - Seven Species at Risk have potential to occur within the study area and may be temporarily disturbed. Their habitat may be affected by construction. They include: -Western Chorus Frog – there is suitable habitat of roadside ditches, temporary ponds in fields, swamps or wet meadows/woodlands. -Bank Swallow – there is suitable habitat of sandy banks along Poole Creek and potential stockpiled materials. -Barn Swallow – there is potential nesting habitat on buildings, bridges and box culverts. -Bats (Little Brown Myotis, Eastern Small-footed Myotis, Tricolored Bat, and Northern Myotis) – there is suitable habitat of forested areas with cavity trees, and old barns.	• Mitigation measures outlining timing window restrictions on construction will also help protect Species at Risk. • *Landscape Plan* • *Tree Conservation Report* • Conduct an *Ecological Site Assessment* to confirm presence of Species at Risk and significant habitat. Targeted surveys may be required. • It is recommended that construction timing occur outside of the bird breeding season (April 1st to August 31st) to eliminate impacts to breeding Species at Risk birds, where possible. Where not possible, additional mitigation of nest searches be completed, as described above. • For Barn Swallow, if construction is proposed on an existing bridge or culvert, a search for inactive/active nests is recommended. In the event a nest is discovered MNRF should be further consulted on whether the activity should be registered under O. Reg. 242/08 (ESA). • Preventative measures (e.g. covering excavated soils) should be employed to deter opportunistic species such as Bank Swallow from nesting on stockpiled materials at the construction site. • The *Erosion and Sediment Control Plan* should also be implemented prior to construction works. Exclusionary fencing should be installed and will act as a wildlife barrier to deter species of Western Chorus Frog from entering the construction area. • For Species at Risk bats, it is recommended for cavity tree density surveys to be completed within forested areas where vegetation is proposed for removal. Tree removal in suitable bat maternity habitat (identified through cavity tree surveys) should not be conducted during the bat roosting period of June 1st to July 31st. If not possible, acoustic monitoring should be completed prior to vegetation removal to determine	Potential disturbance of species at risk.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per the *Ecological Site Assessment* and in consultation with agencies. As per *Tree Conservation Report* *As per the Landscape Plan* As per the *Erosion and Sediment Control Plan*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
			the presence/absence of bat maternity roost colonies. Additional mitigation and compensation measures may be required based on the results of targeted surveys and MNRF consultation. Methods to determine bat habitat and maternity roosts will follow the criteria in *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNRF 2011) and *Survey Protocol for Species at Risk Bats within Treed Habitats for Little Brown Myotis, Northern Myotis, and Tri-colored Bat* (MNRF 2017). • Protection afforded to any identified SAR shall be in accordance with appropriate federal/provincial jurisdiction. • All on-site staff should undergo environmental awareness training to be able to identify the potential SAR that could be encountered. • If SAR are observed during construction, the MNRF Kemptville District officeis to be immediately contacted and operations modified to avoid any negative impacts to the species or their habitat until further direction is provided by the MNRF. • Consultation with MNRF, CWS, ECCC, NCC to identify any permits/approvals required. • If necessary, permits to be obtained under ESA or SARA.							

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Species at Risk	Clearing and grubbing trees and vegetation within the grading limits for the construction project	Butternut - Potential loss of mature Butternut trees within the local populations of the community, specifically in Feedmill Creek riparian area, north of Highway 417 and elsewhere as determined during Ecological Site Assessment.	• *Ecological Site Assessment* to be conducted prior to construction. • Survey of the identified Butternut trees should be conducted prior to construction and during detail design phase. If necessary a site-specific mitigation plan will be developed. • Avoid removal of Butternut trees and protective fencing should be installed around each tree. • A butternut health assessment should be conducted by a certified Butternut Health Assessor on all butternuts proposed for removal. • Registration or permitting under the ESA may be required and compensation plans developed.	Loss of existing Butternut trees to be replaced in accordance with mitigation plan.	Small	Reversible	Immediate	Short-term	Once	Not significant: Minimal	As per *Ecological Site Assessment*. As per *Tree Conservation Report* As per *Landscape Plan* Monitor the removal of Butternut trees. Monitor health of new plantings.
	Clearing and grubbing trees and vegetation within the grading limits for the construction project	Bobolink and Eastern Meadowlark - Potential loss of grassland habitat for breeding birds of Bobolink and Eastern Meadowlark	• *Ecological Site Assessment* to be conducted prior to construction. • Further consultation with the MNRF regarding the implications of development. • Additional surveys to follow MNRF's Bobolink Survey Protocol to determine presence of species and their habitat. • Registration or permitting under the ESA may be required and compensation plans developed. • Vegetation removal should occur outside of the breeding bird season (April 1 to August 31). • Removal of isolated trees or areas of low complexity habitat may proceed in the nesting season provided a qualified biologist completes a bird nest survey and confirms the absence of active nests. If an active nest is found, a buffer should be applied around the nest. The buffer size will be dependent on the species.	Minor avoidance of the area by Bobolink and Eastern Meadowlark. Loss of site-specific habitat.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per *Ecological Site Assessment.*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Species at Risk		American Eel – temporary disturbance or potential loss to aquatic habitat of Poole Creek.	• *Ecological Site Assessment* to be conducted prior to construction. • Further consultation with the MNRF regarding the implications of development, ongoing research initiatives, and Notice of Activity under the ESA (2007). • There is potential for construction activities to indirectly affect American Eel through the release or dispersal of materials into the water. Mitigation to minimize or eliminate potential effects are provided in the "Aquatic Environment" and "Fisheries" section. • In the event in-water work is required, Best Management Practices are provided in the "Aquatic Environment" and "Fisheries" section above. As well, it is recommended to not place crossing materials or operate machinery on the bed of a waterbody where critical habitat or residences of American Eel occur. If the riparian area has been identified as critical habitat for American Eel, riparian vegetation should not be removed.	Loss of site-specific habitat. Temporary disturbance to aquatic habitat	Small	Reversible	Immediate	Short-term	Once	Minimal	As per *Ecological Site Assessment.* Regular inspection as outlined in the *Erosion and Sediment Control Plan* As per *Environmental Protection Plan* As per *Dewatering Management Plan* As per *Spills Response and Action Response Plan*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Species at Risk	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Blanding's Turtle – temporary disturbance or potential loss of overwintering and nesting habitat within Poole Creek, Carp River, and wetlands adjacent to Wesley Clover Park.	• The *Ecological Site Assessment* should be carried out to determine presence of the species throughout the study area. • The *Erosion and Sediment Control Plan* should be implemented, and exclusionary fencing should be installed and act as a wildlife barrier to deter Banding's Turtles from entering the construction area. • If Blanding's Turtle are discovered, the MNRF is to be contacted immediately and further consultation will be required. • Caution should be taken during the turtle nesting season in June and early July as turtles use embankments and other terrestrial sites for nesting. During the active season (April 1 – October 30), MNRF recommends a thorough sweep of the area before construction works begin to encourage any turtles using the site to move away.	Minor avoidance of the area by Blanding's Turtle. Loss of site-specific habitat.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per *Ecological Site Assessment.* As per *Erosion and Sediment Control Plan*
Designated Natural Heritage Features	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Clearing and grubbing trees and vegetation within the grading limits for the construction project	Potential disturbance and loss of Poole Creek and Feedmill Creek significant valleyland areas.	• Ecological Site Assessment • Erosion and Sediment Control Plan • Further consultation with MVCA and City of Ottawa (Natural Systems unit).	The KLRT elevated structure within the sections of Poole Creek and Feedmill Creek may cause disturbance and loss to significant valleylands.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per *Ecological Site Assessment* As per *Erosion and Sediment Control Plan.*
	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Clearing and grubbing trees and vegetation within the grading limits for the construction project	Potential disturbance and loss of significant woodland within the Natural Heritage System, east of Moodie Drive and north of Highway 417.	• Ecological Site Assessment • Tree Conservation Report • Erosion and Sediment Control Plan • Minimize footprint of disturbance to significant woodland during construction	May cause disturbance to significant woodlands.	Small	Reversible	Immediate	Short-term	Once	Minimal	As per *Tree Conservation Report, Ecological Site Assessment, and Erosion and Sediment Control Plan.*

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Designated Natural Heritage Features	Clearing and grubbing trees and vegetation within the grading limits for the construction project	Clearing and grubbing activities within the Queensway Roadcut Earth ANSI areas will result in the loss of existing trees, shrubs and grass.	• Ecological Site Assessment prior to construction. • Erosion and Sediment Control Plan to be implemented prior to vegetation removal. • Minimize vegetation clearing to the extent possible and limited to within the construction footprint. • Replace vegetation in accordance with Landscape Plan. • Protection of identified natural features and individual specimens with exclusion fencing to define construction footprint. • Replacements to be with native varieties and/or salt tolerant species as appropriate. • Store any stockpile materials and equipment within the construction footprint. • Salvage existing vegetation where possible, especially sensitive species for transplanting practices within the study area. • Consult with regulatory agencies such as MNRF regarding details of construction methodology and proposed mitigation measures.	Loss of vegetation within the Queensway Roadcut Earth ANSI	Small	Reversible	Immediate	Medium-term	Once	Moderate	As per *Environmental Protection Plan, Erosion and Sediment Control Plan, Landscape Plan* As per *Tree Conservation Report* Monthly on-site inspection during construction to monitor for target tree/vegetation removal, silt fencing quality and effectiveness, and to ensure no damage to adjacent trees and natural areas. Repair silt fencing if damaged. Monitor health of new plantings during the warranty period.
Designated Natural Heritage Features	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments)	Some widening/deepening of the Queensway Roadcut Earth ANSI will likely be required.	• Ecological Site Assessment prior to construction. • Minimize alterations to the Queensway Roadcut the extent possible and limited to within the construction footprint. • Restoration strategy to be developed during next phases of the project • Consult with regulatory agencies such as MNRF regarding details of construction methodology and proposed mitigation and restoration measures.	Modifications to the Queensway Roadcut Earth ANSI	Moderate	Irreversible	Immediate	Long-term	Once	**Moderate**	As per restoration strategy.
Physical Environment											

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Bedrock and Surficial Geology	Construction of Associated Infrastructure (CN Rail Overpass Bridge and west approach embankment)	Difficulty in constructability due to the clay soils having insufficient bearing resistance to support relatively highly loaded shallow foundations, and the embankment on the approach being underlaid with compressible clay.	• Additional investigations during detailed design. • The CN Rail overpass bridge structure will need to be supported on deep foundations, such as driven steel H-piles • Considering the proximity to the highway and the requirement to limit settlement of the adjoining roadway surface, ground improvement (such as preloading and surcharging) may not be practical and lightweight fills may be the preferred solution. If lightweight fills are used, 2 horizontal to 1 vertical side slopes may be achievable, but for planning purposes, 3 horizontal to 1 vertical side slopes should be assumed to avoid limiting the design options in the future.	Increased cost to construct overpass	Moderate	Reversible	Immediate	Long-term	Once	**Minimal**	As per additional investigations.
Bedrock and Surficial Geology	General Construction of Alignment (Between CN Railway Bridge and March Station)	Difficulty in constructability due to potential settlement and the extent of an existing rock-cut.	• Additional investigations during detailed design. • Lightweight fills may be required at least along part of this alignment to reduce settlements, depending on the height of fill and separation distance between the track embankment and the roadway surface. If lightweight fills are used, 2 horizontal to 1 vertical side slopes may be achievable but for planning purposes, 3 horizontal to 1 vertical side slopes should be assumed to avoid limiting the design options. • Some widening/deepening of the rock cut will likely be required. the minimum separation distance between the face of a near-vertical rock cut in the expected sandstone bedrock should be at least equal to the height of the rock cut	Increased cost to construct alignment.	Moderate	Reversible	Immediate	Long-term	Once	**Minimal**	As per additional investigations.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Bedrock and Surficial Geology	General Construction of Alignment (March Station) General Construction of Stations (March Station)	Difficulty in constructability due to complex ground conditions including compressible clay, and deep depth to bedrock. Shoring through the existing fill materials, peat and clay materials may be challenging. Given the soft nature of the silty clay at this site, basal instability within the excavations may be an issue	• Additional investigations during detailed design. • Multiple structures are required to accommodate this alignment and station • Considering the depth of the trench/box structures, it may be feasible to found the trench and box structures (and station) on the grey silty clay, provided the structures are designed as raft slabs. • The shoring may therefore need to consist of internally braced steel sheet piling or steel soldier pile and timber lagging, although rock fill or other obstructions in the March Road embankment may make sheet piling impractical. Soldier piles would also need to extend through the clay deposit to the glacial till which could be at depths of 40 metres or more. • Deeper shoring may be required. At all locations, protection of the clay subgrade, which will be extremely sensitive to any disturbance, will be required. • It may be practical to install temporary bridges on piles along March Road and the ramps which would allow open excavation for construction of the trench and box structures. • The finished floor and structure walls will likely require frost protection to reduce the potential for freezing/thawing of the unweathered clay soils and damage to the structures or heaving/settlement of the track and overlying roadways. • The grade separation structure for OPP Road will need to be supported on deep foundations. The 6 to 10 metre high approach embankments will therefore likely need to be constructed using ultra-lightweight fills (i.e., EPS) to reduce the potential impacts to the existing watermain.	Increased cost to construct March Station.	Moderate	Reversible	Immediate	Long-term	Once	**Minimal**	As per additional investigations.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Bedrock and Surficial Geology	General Construction of Alignment (Between Kanata Avenue and Terry Fox Station) General Construction of Stations (Terry Fox Station)	Difficulty in constructability due to complex ground conditions including shallow permeable bedrock and silty sands.	• Additional investigations during detailed design. • Stiff watertight shoring will likely be required. This could consist of secant pile shoring or slurry walls that would extend to surface of the bedrock at depths of up to about 15 metres. • The finished structure walls and floor will likely require frost protection to reduce the potential for freezing of the clay soils and damage to the structures or heaving/settlement of the track and overlying roadways	Increased cost to construct alignment and Terry Fox Station.	Moderate	Reversible	Immediate	Long-term	Once	**Minimal**	As per additional investigations.
Slopes and Ravines	General Construction of Alignment (Between March Station and Kanata Town Centre Station)	Difficulty in constructability due to slopes adjacent to existing storm water management pond.	• Slope stability analysis should be prepared and reviewed during detailed design. • Consideration should be given to lowering the alignment profile, or implementing stabilization measures.	Increased cost to construct alignment and Terry Fox Station.	Moderate	Reversible	Immediate	Long-term	Once	**Minimal**	As per additional analysis.
Groundwater	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Construction of any below-grade Alignment segments (i.e., Construction of trenches, dewatering requirements)	Some groundwater inflow should be expected during excavations.	• Additional investigations during detailed design. • A Permit-To-Take-Water from the MECP is required for rates of groundwater inflow in excess of 400,000 L/day. • All water to be removed from excavations shall be treated prior to disposal. No sediment laden water is permitted to enter any watercourse. • Discharge in accordance with laws, regulations and by-laws. • Contractor to develop and implement an *Erosion and Sediment Control Plan* • Contractor to develop *Wastewater Management Plan*	Minor groundwater inflow is not anticipated to adversely affect adjacent sites and will be manageable.	Moderate	Reversible	Immediate	Medium-term	Once	**Minimal**	As per additional analysis.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Groundwater	General Construction of Alignment (March Station) General Construction of Stations (March Station)	Difficulty in constructability due to groundwater conditions. Settlement of the overlying roadways, particularly over short distances close to the trench/box structures, may occur due to disturbance, stress relief and temporary construction dewatering.	• Additional investigations during detailed design. • A Permit-To-Take-Water from the MECP is required for rates of groundwater inflow in excess of 400,000 L/day. • All water to be removed from excavations shall be treated prior to disposal. No sediment laden water is permitted to enter any watercourse. • No contaminated groundwater shall be discharged to the environment. • Discharge in accordance with laws, regulations and by-laws. • Contractor to develop and implement an Erosion and Sediment Control Plan • Contractor to develop Wastewater Management Plan • The structure walls could likely be designed as drained structures. Given the net unloading effect of the tunneled section, the low permeability of the clay soils, and the absence of structures within the anticipated radius of influence of permanent dewatering, it is unlikely that the 2-4 metres of groundwater level lowering in this area would result in significant impacts.	Minimal groundwater inflows and settlements during construction.	Moderate	Reversible	Immediate	Medium-term	Once	**Minimal**	As per additional analysis.

Environmental Condition	Project Activity	Potential Environmental Effect	Site-Specific Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Significance						Monitoring Recommendation
					Magnitude	*Reversibility*	*Geographic Extent*	*Duration*	*Frequency*	**Level of Significance**	
Groundwater	General Construction of Alignment (Between Kanata Avenue and Terry Fox Station) General Construction of Stations (Terry Fox Station)	Difficulty in constructability due to groundwater conditions. Excavation into the highly permeable sandstone bedrock, as will be required over the eastern portion of the trench, would require significant temporary construction dewatering that could extend over considerable distances. Limited groundwater lowering within the near surface bedrock at the eastern limit may be relatively low risk.	• Additional investigations during detailed design. • A Permit-To-Take-Water from the MECP is required for rates of groundwater inflow in excess of 400,000 L/day. • All water to be removed from excavations shall be treated prior to disposal. No sediment laden water is permitted to enter any watercourse. • Discharge in accordance with laws, regulations and by-laws. • Contractor to develop and implement an Erosion and Sediment Control Plan • Contractor to develop Wastewater Management Plan • The finished structure should be designed to be watertight to reduce the potential for long term groundwater lowering that could affect surrounding roadways, structures or utilities. Measures to counteract buoyancy and drainage for the finished structure will therefore also be required.	Minimal groundwater inflows and settlements during construction.	Moderate	Reversible	Immediate	Medium-term	Once	**Minimal**	As per additional analysis.
Contaminated and Hazardous Materials	General Construction of Alignment (Site excavation, transportation and storage of material, pouring of concrete and laying of ballast material for alignment segments) Construction of any below-grade Alignment segments (Construction of trenches, dewatering requirements, etc)	Excavation could encounter unexpected contaminated materials.	• Undertake appropriate Environmental Site Assessments to confirm contamination. • The MECP and construction manager are to be notified immediately upon discovery of any contaminated material encountered within the construction area. If contaminated materials or contaminated groundwater are encountered within the construction limits, these are to be removed and disposed of in accordance with all applicable Federal and Provincial Acts and Regulations. Treatment and discharge of contaminated groundwater is also to be in accordance with applicable legislation and regulations, and municipal by-laws. • No contaminated groundwater shall be discharged to the environment	Management of contaminated materials	Small	Reversible	Immediate	Short-term	Once	**Minimal**	As per results of Environmental Site Assessment(s)

9.6. CLIMATE CHANGE

Transportation infrastructure in the Ottawa area and other regions of Ontario is currently designed and operated to handle a broad range of climate impacts, all based on experience with historic climate. However, because of climate change, the historical information used for infrastructure planning and design, as well as for purposes of ongoing operations and maintenance, is becoming less and less relevant, posing additional challenges for its sustainability, reliability, effectiveness, and costs for servicing.

The 2014 Provincial Policy Statement (PPS), issued by the Ontario Ministry of Municipal Affairs and Housing under the Planning Act, requires that planning authorities support climate change mitigation and adaptation through land use and development. In October of 2017, the Ministry of the Environment, Conservation and Parks (MECP) issued a new guide titled *Considering Climate Change in the Environmental Assessment Process*. This guide supports the 2014 PPS, as well as the province's *2016 Climate Change Action Plan*, by setting out the ministry's expectations for including climate change in environmental assessment studies. The guide advises that climate change impact considerations are part of responsible planning and due diligence, and that considerations should include, at a high level, three key components:

- A review of the project's potential for producing greenhouse gas emissions;
- An assessment of the project's vulnerability to climate change; and
- The impact of the project on the environment's adaptive capacity.

Full details of the Climate Change Vulnerability and Adaptation Assessment for the Kanata LRT EA Study are contained in **Appendix B: Supporting Reports**.

9.6.1. CLIMATE CHANGE ADAPTATION – KEY CONCEPTS AND METHODOLOGIES

This memo provides a screening level climate risk assessment of the Kanata LRT project, considering modeled climate change projections and comparing projected future conditions to historic conditions for selected climate event variables.

The methodology used takes into consideration the PIEVC Protocol (Engineers Canada) and the MECP's *Guide to Considering Climate Change in the EA Process*. The approach involves developing a list of climate variables (e.g. rain, snow) and a list of project components (e.g. rail, stations), and undergoing a systematic review of the potential interactions between each one.

Given that the Kanata LRT project is still at the planning stage and finer details of the project cannot be confirmed at this time, this work is being completed as a high-level risk assessment that does not implement the full methodology of the PIEVC Protocol.

9.6.2. CLIMATE CHANGE PROJECTIONS

9.6.2.1. Daily Average Temperature

Temperatures in the Ottawa area are projected to increase in future. Overall, annual daily average, maximum, and minimum temperatures are projected to increase at similar rates. All three variables are projected to increase on average between 2.4 and 3.1 degrees by 2050, and between 3.3 and 5.8 degrees by 2080.

This increase in temperature would have an impact on the number of heating and cooling degree days. Degree days represent the accumulated difference in temperature above or a below a standard temperature (18°C in this case), and are used to assess the need for space heating or cooling. As shown in Tables 2 and 3, heating degree days may decrease by 20% to 36%. Cooling degree days may increase by 97% to 258%.

9.6.2.2. Extreme Heat Days

Along with an increase in average daily temperatures, an increase in extreme temperatures is projected for the study area under the RCP 4.5 and 8.5 climate scenarios. This can be observed in the projections for the number of days with daily maximum temperatures above 30ºC, which may increase from an annual average of 12 days, historically, to between 33 and 37 days in 2050 and to between 42 and 69 days in 2080.

9.6.2.3. Precipitation

Extreme precipitation is one of the most difficult climate change variables to project, however it is also one of the most important in terms of impacts to infrastructure. In general, according to current projections under the RCP 4.5 and 8.5 climate scenarios:

- Total annual precipitation would increase; and
- Extreme precipitation would increase at a faster rate than total annual precipitation.

The total annual precipitation is projected to increase by up to 11% in 2080, the average maximum 24hr precipitation is expected to increase by 17% in that same time frame. Another way to look at this is to consider the distribution of precipitation events throughout the year. The 11% increase in total annual precipitation would predominantly occur in the form of extreme rain events.

9.6.2.4. Average and Extreme Snowfall

The historical total annual snowfalls for the Ottawa CDA station. A downward trend can be identified in the historical data, and this generally aligns with projections for annual increases in temperature. Further, the increase in annual daily average temperature is not distributed evenly throughout the year, but rather will impact the winter season disproportionately compared with all other seasons.

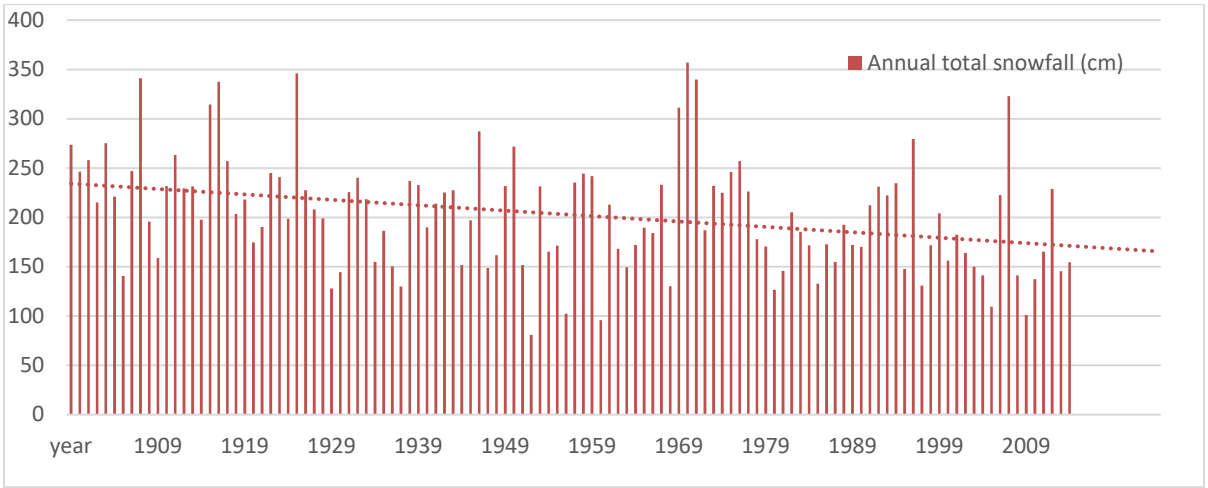

Figure 9-1: Historical Annual Total Snowfall (cm), Ottawa CDA

9.6.2.5. Freeze-thaw Cycles

The ensemble of projections for both the moderate and high concentration pathways (RCPs) show a noticeable decrease in the number of days with freeze-thaw cycles in 2050 and 2080. The months of April and October would see 62% to 95% fewer freeze-thaw cycles on average under the RCP 4.5 and 8.5 climate scenarios. December, January, and February would all see an increase in freeze-thaw cycles. The month of March would continue to see the most days with freeze-thaw cycles in 2080.

9.6.2.6. Freezing Rain

A few studies have been conducted to look at the impacts of climate change on freezing rain. An Environment and Climate Change Canada study by Cheng et. al. (2007) concluded that freezing rain events are very likely to increase in northern, eastern, and southern Ontario in the coming century. The study concluded that eastern Ontario is likely to see a 60% and 95% increase in freezing rain event frequency by 2050 and 2080, respectively, during the months of December, January, and February. The study projected that the frequency of freezing rain events would remain unchanged for the months of November, March, and April.

9.6.2.7. Wind

Similar to freezing rain, wind is considered a complex climate variable, requiring detailed and costly modelling. Therefore, the number of projection sources for this climate variable are limited. One Environment and Climate Change Canada study by Cheng et. al. (2012) looked at increases in daily and hourly wind gusts for various regions of Ontario, including eastern Ontario. The results suggests modest increases in wind gusts are likely in the coming decades. Wind gusts over 70 km/h will see the highest increase in frequency, occurring 23% to 46% more often than current conditions.

9.6.2.8. Water Balance

During risk assessment meetings held with the City, drought was identified as a climate variable with potential interactions with project components. Although difficult to obtain a clear measure of predicted increase frequency or duration of drought periods, a look at water balance projections provides context for qualitative projections. Figure 9-2 shows projected water deficits and surpluses for every month of the year, as computed and graphed by CCHIP. Water deficits exist when potential evapotranspiration is greater than actual evapotranspiration. Results for the RCP 4.5 and 8.5 climate scenarios show that water surplus in the region would increase during the winter months (December to March), while water deficits will increase from May to October, with pronounced deficits in July and August.

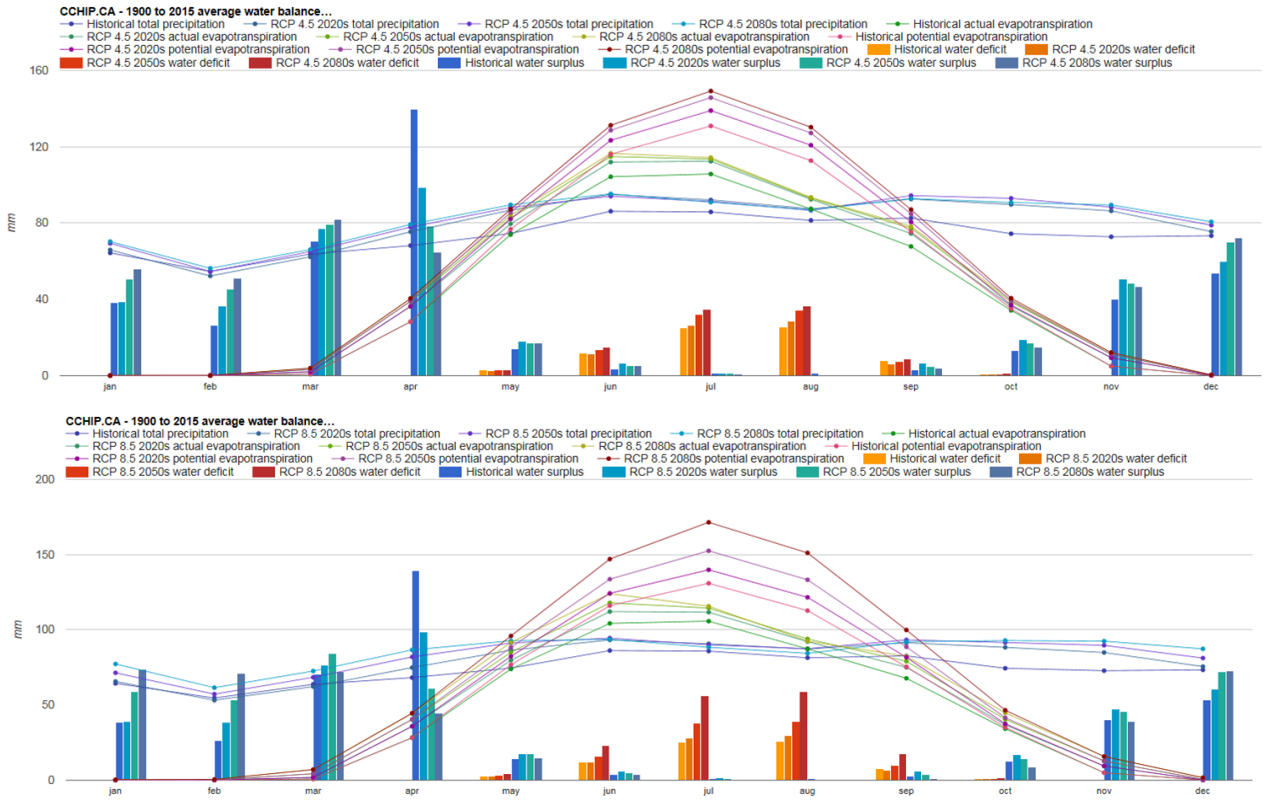

Figure 9-2: Water Budget Projections, RCP 4.5 (top) and RCP 8.5 (bottom), Ottawa CDA.

9.6.2.9. Lightning

Lightning is a complex variable, related to precipitation and temperature. An initial desktop review of current climate science on lightning and future changes to its frequency or intensity found no consensus on projections. During risk assessment working meetings held for this study, it was agreed that the implications of a direct lightning strike on the system should be considered as part of the design, regardless of change in probability of occurrence.

9.6.2.10. Rainfall Intensity Duration Frequency

Intensity Duration Frequency (IDF) relates rainfall intensity with its duration and frequency, and is used for flood forecasting and drainage design. This parameter was cited during working meetings held with the City of Ottawa as one that could have direct impacts on the design, in particular when sizing sewers, stormwater management facilities, and watercourse crossings.

For this parameter, the IDF_CC tool, developed by Western University and the Institute for Catastrophic Loss Reduction, was used to project the change in total 24-hour precipitation for various design return periods. The results project a 19-22% increase in the 5-year, 24-hour rainfall amount, and a 17-30% increase in the 100-year, 24-hour rainfall amount.

9.6.2.11. Combined Variables

The combination of certain climate variables can, in some cases, intensify the interaction with project components and increase the risk. For example, extreme rain events may combine with strong winds, which could result in debris being blown into streams and blocking flow through a culvert.

For this study, a qualitative assessment of the potential impact of combined variables on infrastructure resiliency was discussed in the working meetings held with the City of Ottawa. Combined variables should continue to be considered throughout the design of the project.

9.6.3. CLIMATE CHANGE RISK ASSESSMENT

Risk assessment of climate change vulnerabilities is a multi-disciplinary process that should consider a broad base of expertise and professional experience. In order to ensure a multi-disciplinary process, two half-day working meetings were conducted with the study team and City of Ottawa staff, including a number of professionals with wide-ranging expertise related to the design, construction, operation, and maintenance of transit projects. Meeting participants were introduced to concepts of climate change vulnerability and adaptation and were given the opportunity to explore and discuss the issues of potential infrastructure vulnerability, resilience, and risk in the context of projected climate change.

During the first working meeting, participants were introduced to the Kanata LRT EA scope and recommended design and presented with the methodology selected for the climate change vulnerability assessment. Participants were invited to ask questions and provide feedback on the project definition, climate variables, climate data, and infrastructure components identified.

In between the two working meetings with the City, a working meeting with design consultants from the Kanata LRT EA study team was conducted to complete a planning / screening level risk assessment. The risk assessment process that was followed is summarized in the following steps.

- Identify potential interactions between infrastructure components and climate factors;
- Assess the probability of a negative event occurring (low to high);
- Assess the severity of an event, assuming it happens (low to high);
- Determine risk level (Risk = Probability x Severity); and
- Categorize risk levels (low, medium, high).

The group systematically reviewed each project component against each climate factor and discussed the probability and severity of the potential interactions. Some of the potential hazards identified include: extreme rain impacts to track, guideway, bridges, culverts, and underground structures; freezing rain impacts to overhead wires, catenary systems, roadways and walkways; extreme heat impacts to steel rails and public health; and extreme wind impacts to landscaping and emergency access routes.

During the second City working meeting, the study team updated participants on material presented during Meeting #1 as well as the preliminary conclusions and recommendations drawn from the risk assessment process. Additional climate data, gathered as a result of the feedback received during Meeting #1, was reviewed and discussed.

The conclusions and recommendations of the risk assessment were presented at the second working meeting with the City (Figure 9-2).

9.6.4. CARBON FOOTPRINT ASSESSMENT

A carbon footprint assessment is a scientific procedure for calculating the greenhouse gas emissions from the production of a material or product, or associated with an activity or process. GHG accounting typically takes into account six GHG's: carbon dioxide (CO_2), methane (CH_4), sulfur hexafluoride (SF_6), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). To compare the impacts of multiple greenhouses gasses, carbon footprint assessments convert the calculated emissions for each GHG into a carbon dioxide equivalent (CO_2-eq). Carbon footprint assessments consider environmental impacts through the lens of climate change from GHG emissions. Athena software was used to conduct the Kanata LRT carbon footprint assessment. Athena software and data is developed by the Athena Sustainable Materials Institute. The Athena suite of software is ISO 14040 and 14044 compliant and specifically designed for conducting LCAs of construction projects within North America.

This assessment aims to evaluate the carbon footprint of infrastructure components that are known or can be reasonably assumed for the KLRT, including track, guideway, station components, and major watercourse crossings. The carbon footprint of the various assemblies as listed in section 2.1 are presented in the table and graphic below:

Table 9-4: Global Warming Potential Tonnes CO2e for Kanata LRT

	Raised Platforms	Parking	Buildings	Rails	Total
Global Warming Potential (T CO_2e)	13800	3666	3500	8300	29266

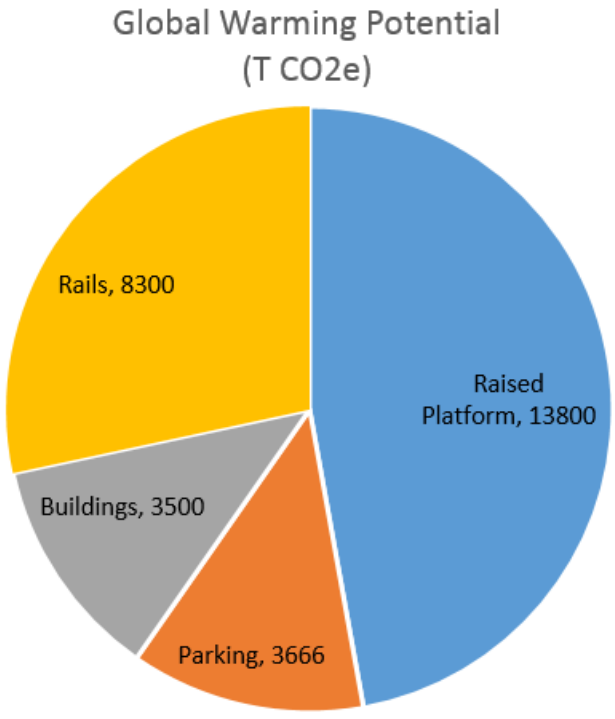

Figure 9-3: Global Warming Potential Tonnes CO2e for Kanata LRT

The total embodied carbon footprint of the project is estimated at approximately 30,000 T CO_2e. As not all project elements were included in the assessment may be somewhat of an underestimate. For perspective, a typical car in Canada produces about 4.6 T CO_2e per year. Accordingly, the embodied effects of the systems studied equal the use of about 6000 cars for one year. The GHG reductions that will be achieved over the lifespan of the Kanata LRT by the switch from diesel buses and the modal shift from private vehicles to electric rail far outweighs the embodied carbon footprint of the Kanata LRT.

Carbon footprint reduction can be achieved by:

- material substitutions
- system substitutions
- material ingredients, and
- a focus on durability.

There are numerous opportunities that can be investigated during the design and construction phases of the project that would result in embodied effects reductions without sacrificing performance. It's important to keep durability and practicality of design at the forefront when evaluating various climate change mitigation measures. Materials with low up-front carbon footprint but reduced longevity or frequent maintenance needs could have a higher footprint when considering their entire lifecycle. In addition to embodied emissions resulting from earlier repairs to or replacements of less durable system components, repairs that require suspension of LRT service would temporarily negate GHG reductions achieved from the shift to electric rail.

Another important contributor to emissions related to the construction of the LRT system is the fuel consumption of construction equipment. In other light rail projects, such as the Sydney LRT, these emissions accounted for up to 25% of construction emissions (materials, for comparison, accounted for another 71%). Implementing low-carbon work practices where suitable, such as the use of low-carbon fuels in vehicles and equipment, use of fuel-efficient or electric equipment, as well as regular maintenance and inspection of equipment will help further optimize fuel efficiency and reduce construction emissions.

Design teams should understand and consider the embodied effects through comparisons of proposed materials and systems as the design progresses.

Table 9-5: Preliminary Recommendations for Climate Change Adaptation

ID #	Infrastructure Component	Potential Functional Design / Environmental Assessment Considerations:	Potential Preliminary Design / Detail Design Considerations:	Potential Maintenance / Operations Considerations
1	**Track / Guideway, (Incl. Ballast and Drainage)**	• Linear drainage is a key concern for this component. Increased peak runoff could result in larger trackside ditches or other drainage components, having implications on property requirements.	• Extreme heat could increase likelihood of steel rail buckling. • Temperature projections / thermal expansion should be considered during design.	• Assess / monitor climate change implications for maintenance / operations planning and standards. • Develop Standard Operating Procedures (SOPs) for: a. Monitoring b. Response Plans c. Contingency / Back-up Plans d. Restoration / Lessons Learned
2	**Bridges - Underpasses / Overpasses**	• Crossings over Poole Creek, Feedmill Creek and Carp River are well above the high water level. Crossings over Watts Creek and Stillwater Creek have less flexibility, and should be designed with consideration for increased extreme precipitation and potentially increased risk of flooding. Need to assess possible design / property implications.	• Continue to consider climate change implications during design (e.g. peak design storms, flood mapping for extreme events, stress testing of designs, IDF curves for future conditions).	
3	**Bridges / Culverts - Over Water**			
4	**Retaining Structures**	Low Risk (Consider further at Preliminary / Detail Design)		
5	**Overhead Contact / Catenary Systems**	• Document issues for consideration at Preliminary / Detail Design.	• Overhead wire design (or maintenance) to consider projected temperature conditions to avoid sagging wires. • Overhead wires design to consider potential increases in freezing rain and extreme wind.	
6	**Power Distribution (Cabling, Troughs, Raceway, Terminal Units)**	Low Risk (Consider further at Preliminary / Detail Design)		
7	**Power Supply (Substations) Ground Level and Underground**	• Document issues for consideration at Preliminary / Detail Design	• Substations in low lying areas should be assessed for flood risk / inundation from increased extreme precipitation.	
8	**Communications Systems**	Low Risk (Consider further at Preliminary / Detail Design)		
9	**Emergency Systems (Exit Doors and Windows, Access Roads, Routes)**	• Document issues for consideration at Preliminary / Detail Design.	• Station and emergency exit near March/Eagleson are below grade and could be at risk of flooding. • Emergency Plans should consider projected future climate conditions.	
10	**Stations - Buildings, HVAC Systems**	• Document issues for consideration at Preliminary / Detail Design.	• Extreme heat should be considered when choosing materials and designing buildings and systems (e.g. HVAC). • Extreme precipitation could have implications for rooftop and site drainage design. • Design of site drainage should consider extreme precipitation events and, where applicable, ensure that mechanical rooms are protected.	
11	**Bus Terminal and Passenger Pick-up and Drop-Off Facilities**			
12	**Park and Ride Lots**			
13	**Pedestrian and Cycling Facilities**	• Document issues for consideration at Preliminary / Detail Design.	• Consider potential drainage / flooding effects of extreme precipitation.	
14	**Landscaping**	• Document issues for consideration at Preliminary / Detail Design.	• Design should consider future climate change conditions (landscaping composition, tolerance to changing climate, growth rates, and invasive species). • Tree planting should consider implications of broken off limbs or downed trees.	
15	**Stormwater Management Facilities**	• Sizing/design of SWM facilities should consider accommodation of and/or resilience to projected extreme rainfall events. • Consider property implications at EA Stage. • Consider future environmental implications to receiving watercourses at EA Stage.	• Design should consider future climate change conditions.	

9.7. CUMULATIVE IMPACTS

The Kanata LRT primarily follows a corridor defined in several previous studies. This corridor was developed with consideration for bundling infrastructure in corridors to reduce loss and fragmentation of habitat and decline in biodiversity. As noted in the Joint Study to Assess Cumulative Effects of Transportation Infrastructures on the National Capital Greenbelt – Study Report undertaken by the NCC and the City of Ottawa (AECOM, 2012), the fundamental notion behind cumulative effects assessment is that if proposed projects are evaluated individually, the broader perspective may be overlooked. The corridor has been identified and protect in the City of Ottawa TMP and several planning studies for in excess of a decade. The City TMP and Official Plan, have served to identify the project and provide a context for consideration of the cumulative impacts and integration with other projects.

10. FUTURE COMMITMENTS

The Kanata LRT EA has been undertaken under the Transit Project Assessment Process. During the Preliminary Planning and Transit Project Assessment phase of the process, the City of Ottawa worked with the Public and Technical Agencies to address environmental concerns and issues. The potential impacts, mitigation measures and the associated net impacts were identified, evaluated and assessed as documented in the previous sections. The ensuing implementation and design process will need to be implemented in accordance with the conditions noted in this Report. This section outlines the future commitments that inform the development and implementation of the project.

10.1. PROPERTY ACQUISITION

The preferred alternative for the Kanata LRT alignment is primarily within the right-of-way of the Kanata North BRT owned by the City of Ottawa. Some additional lands are required from adjacent land owners where the alignments have been modified.

The LMSF is within MTO lands which have previously been identified in the Moodie LRT EPR. Full expansion of the LMSF will require land from the NCC.

The acquisition of temporary property needs, including temporary construction easements, will proceed as definitive property plans are developed.

10.2. DESIGN DETAILS

The project as illustrated in this preferred alternative is functional in nature. Refinements to the preferred alternative will continue in subsequent stages of design to achieve the following:

- Improve operating characteristics;
- Reduce future maintenance requirements;
- Minimize construction related impacts;
- Reduce capital and operating costs; and,
- Minimize impacts to adjacent properties.

Refinements to the preferred alternative will be subject to the commitments and amending procedures outlined in the Transit Project Regulation.

10.3. APPROVALS

The TPAP Report under the Ontario *Environmental Assessment Act*, R.S.O. 1990 does not constitute approval under other legislation required to construct the project. Specific approvals will be required for components of the project. The following is a list of approvals and permits that may be required and associated agencies that should be consulted.

10.3.1. FEDERAL

- Federal Land Use, Design and Transaction Approval (NCC);
- CEAA Section 67 (NCC); and
- Species at Risk Act permits (ECCC).

10.3.2. PROVINCIAL

- Environmental Compliance Approval for infrastructure (MECP);
- Permit-to-Take-Water (MECP);
- Ontario Endangered Species Act, 2007 (MNRF, MECP);
- Ontario Regulation 174/06 and 153/06 Development, Interference, with Wetlands and Alterations to Shorelines and Watercourses Regulation (RVCA and MVCA, respectively);
- Encroachment Permits (MTO); and
- Public Lands Act, R.S.O. 1990.

Additional approval requirements will be considered and discussed with the approval agencies. In general approval in principle, have been sought during the EA process.

10.3.3. MUNICIPAL

- Temporary Encroachment Permits
- Road Modification Approval
- Noise By-Law Exemption

10.4. STATEMENT OF COMPLETION

The TPAP is completed when the proponent submits a Statement of Completion to the Director of the Environmental Assessment and Approvals Branch of the MECP and the MECP Regional Director, excluding any unforeseen circumstances that may require a change to the transit project.

The proponent will submit the Statement of Completion under one of the following circumstances:

- The Minister gives a notice allowing the proponent to proceed with the project in accordance with the TPAP Report;
- The Minister gives a notice allowing the proponent to proceed with the project in accordance with the TPAP Report, subject to conditions;
- The Minister gives a notice requiring further consideration of the transit project and
- Subsequently gives a notice allowing the proponent to proceed with the project in accordance with a Revised TPAP Report; or
- The Minister gives no notice within 65 days of the proponent giving the Notice of Completion.

The Statement of Completion must indicate that the proponent intends to proceed with the transit project in accordance with either the:

- TPAP Report;
- TPAP Report subject to conditions set out by the Minister; or
- Revised TPAP Report.

The proponent will also post the Statement of Completion on its project website. Construction or installation of the transit project subject to the TPAP cannot begin until the requirements of the TPAP have been met. Subject to these requirements, the transit project may proceed, subject to any other required approvals.

10.5. MODIFYING THE RECOMMENDED PLAN

This Report is based on a functional design level of detail for the Moodie LRT Planning and Environmental Assessment Study. The functional design level does not provide as much detail as will be available during later stages of preliminary and detailed design. Nonetheless, the functional design does provide a sufficient level of detail to assess the environmental effects of the Recommended Plan. The effects identified in the environmental assessment are considered reliable for the Minister of the Environment and Climate Change to base a decision regarding approval of the proposed project.

Some aspects of the Recommended Plan may be subject to change as detailed plans are developed. Changes may arise in terms of study area conditions, the development of new technology or mitigation measures, cost control, or the identification of previously unknown information. These changes may be consistent with the TPAP Report in that they:

- Do not fundamentally affect the identified impact or mitigation measures;
- Do not change the landowner notification requirements; and,
- Do not include additional approval agencies.

All changes that are inconsistent with the TPAP Project Report require an addendum however not all changes require a Notice of Environmental Project Report Addendum. If the proposed change to the project is not anticipated to be significant (i.e., minor change), the City will consult with appropriate agencies and potential stakeholders to finalize the design of the undertaking and all mitigation measures required. Should a minor change be required, the City will prepare an addendum to the Environmental Project in accordance with Section 15(1) of the TPAP legislation. The addendum to the TPAP Report will contain the following information:

- A description of the change and the reasons for the change;
- The proponent's assessment and evaluation of negative impacts that the change might have on the environment;
- A description of any measures proposed by the proponent for mitigating the negative impacts that the change might have on the environment; Documentation of any agency or public consultation undertaken concerning the change; and
- A statement of whether the proponent is of the opinion that the change is a significant change to the transit project, and the reasons for the opinion.

The proponent will be responsible for assessing the significance of the proposed change(s), which will be reviewed by the MECP. The proponent's assessment will generally be based on further technical assessments and consideration of applicable policy as well as public and agency input as required.

This does not apply to a change that is required to comply with another Act or regulation.

If the proponent is of the opinion that a change described in the addendum is a significant change to the project, the proponent shall prepare a Notice of TPAP Project Report Addendum. The Notice will contain the following:

- A description of the change.
- The reasons for the change.
- Information as to where and how members of the public may examine the addendum and obtain copies.

- A statement that there are circumstances in which the Minister has authority to require further consideration of the change to the transit project, or to impose conditions on the change, if he or she is of the opinion that,
    - the change may have a negative impact on a matter of provincial importance that relates to the natural environment or has cultural heritage value or interest, or
    - the change may have a negative impact on a constitutionally protected aboriginal or treaty right.
- A statement that, before exercising the authority referred to above, the Minister is required to consider any written objections to the change received within 30 days after the notice is first published.

The notice must be provided to the Director and Regional Director of the MECP, as well as every property owner within 30 metres of the site of the change, Aboriginal communities that were given a Notice of Commencement, and any other person the proponent determines may be interested in the change to the project. The process and timelines following the Notice are the same as the process leading to the Notice of Completion.

11. CONCLUSION

A project such as the extension of LRT to Kanata has the potential to change the surrounding environments. The purpose of this environmental assessment is to guide and predict these changes and recommend measures to minimize the negative effects and enhance or broaden the positive environmental effects.

In this study, the existing conditions were documented, alternative solutions were considered, alternative corridors and designs were identified and evaluated, and a Recommended Plan of the Preferred Design was developed. Throughout the process, the study benefited from extensive public and agency consultation including meetings with the Agency, Business, and Public Consultation Groups, two open houses, as well as individual stakeholder and community meetings. The study also was subject to a civic dialogue, including media reporting, which culminated in the City of Ottawa Transportation Committee recommendations and Council approval. Through these meetings, the Study Team was able to identify and mitigate, where possible, localized impacts for both users and residents/landowners immediately adjacent to the proposed project. This involvement also created public and agency confidence in the Recommended Plan, as well as the process that led to relevant decisions.

During the construction phase, the overall corridor will be an active construction site. Traffic disruptions, noise, dust, and visual interruptions will be inevitable. Ongoing communications by the City of Ottawa with the affected public will go a long way in alleviating potential concerns and ensuring that timely information about the project is shared. Following the construction phase, there will be many positive effects such as increased transit capacity and adjacent pedestrian and cycling facilities. The project will also provide an opportunity to improve the visual environment at the entry ways into the nation's capital. While the project has the potential to have effects on the human and biophysical environments during construction in the vicinity of the project, these effects can be largely mitigated with prescribed design features and sound environmental management. Through incorporating the mitigation measures recommended by this study, no significant adverse environmental effects are expected to result.

In accordance with the provisions of the Ontario Transit Projects Assessment Process (TPAP), the study results are documented in this Environmental Project Report, which will be made available for public review once finalized. During this period, there will be an opportunity for an individual or group to provide a written submission to the Minister of the Environment, Conservation and Parks. All submissions must clearly indicate that an objection is being submitted and must describe any negative impacts to matters of provincial importance (natural/cultural environment) or on constitutionally protected Aboriginal or treaty rights.

Informed by this EPR, this project will culminate in the completion of detailed designs, specifications, and tender documents, as well as other associated approvals for the initial stage of construction. The detailed project mitigation features and plans will be created during the detailed design phase. The project will then be tendered and constructed in accordance with the plans and details.

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