REPORT

Moodie Light Rail Transit Extension

Environmental Project Report

Ottawa, Ontario

Presented to:

O-Train Planning Office

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List of Acronyms

ANSI ..... Area of Natural and Scientific Interest
AOO ..... Algonquins of Ontario
BRT ..... Bus Rapid Transit
CEA ..... Cumulative Effects Assessment
CEAA ..... Canadian Environmental Assessment Act
COSEWIC..... Committee on the Status of Endangered Wildlife in Canada
COSSARO ..... Committee on the Status of Species at Risk in Ontario
CWS ..... Canada-Wide Standards
dBA ..... decibels
dbh ..... Diameter at Breast Height
DFO ..... Department of Fisheries and Oceans
DND ..... Department of National Defence
EA ..... Environmental Assessment
EAA ..... Environmental Assessment Act (Ontario)
ELC ..... Ecological Land Classification
ESA ..... Endangered Species Act (Ontario)
ESA ..... Environmental Site Assessment (related to potential contamination)
EPR ..... Environmental Project Report
FLUDTA ..... Federal Land Use Design and Transaction Approval
GMP..... Greenbelt Master Plan
ha ..... hectare(s)
HLUI ..... Historic Land Use Inventory
km ..... kilometre(s)
km/h ..... kilometres per hour
LMSF..... Light Maintenance and Storage Facility
LRT ..... Light Rail Transit
LRV ..... Light Rail Vehicle
m ..... metre(s)
mg/m3 ..... milligrams per cubic metre
mm ..... millimetre(s)
mm/s ..... millimetres per second
MAH ..... Ministry of Municipal Affairs and Housing
MNRF ..... Ministry of Natural Resources and Forestry
MOECC ..... Ministry of the Environment and Climate Change
MSF ..... Maintenance and Storage Facility
MTCS ..... Ministry of Tourism, Culture and Sport
MTO ..... Ministry of Transportation of Ontario
NCC ..... National Capital Commission
NCR ..... National Capital Region
NHIC ..... Natural Heritage Info Centre
OP ..... Official Plan
OPA ..... Official Plan Amendment
PAC ..... Public Advisory Committee
PFCC ..... Plan for Canada's Capital
pphpd ..... People per Hour in the Peak Direction

PPS .....Provincial Policy Statement
PSW ..... Provincially Significant Wetland
ROW ..... Right-of-Way
RSO ..... Revised Statute of Ontario
RVCA .....Rideau Valley Conservation Authority
SAR ..... Species at Risk
SARA ..... *Species at Risk Act*
SWM ..... Stormwater Management
TMP..... Transportation Master Plan
TPAP .....Transit Project Assessment Process
TPSS .....Traction Power Substations

1. INTRODUCTION

1.1 Purpose of the Project

As part of planning for Stage 2 Light Rail Transit (LRT) program, an opportunity has been identified to extend LRT from the current planned western terminus of the Confederation Line (Bayshore Station), approximately 2.5 km further west to Moodie Drive (Moodie LRT) with an additional station and a Light Maintenance and Storage Facility (LMSF).

The Stage 2 LRT project is the cornerstone of the City of Ottawa's 2013 Transportation Master Plan (TMP). The plan builds on the Confederation Line Light Rail Transit Project, which is currently under construction, to extend the benefits of LRT farther west to Moodie.

1.2 Project Background

In November 2013, Council unanimously approved the City's 2013 Transportation Master Plan *(ACS2013-PAI-PGM-0193)* which set out the City's priority for transit and transportation infrastructure investments until the end of 2031, including a significant vision to extend rail farther east, west and south through the Stage 2 LRT Project.

Further to this approval, the City focused its efforts on advancing the planning for these LRT extensions. Specifically, three environmental assessment studies were conducted and consolidated into the *Stage 2 Light Rail Transit Environmental Assessment and Functional Design Report* approved by Council in July 2015 (ACS2015-CMR-OCM-0017). Within the Council report, it was understood that these were "intentionally high level in order to give maximum flexibility to the preliminary engineering team and the winning design build Project Proponent." High level is a reference to the functional level of design that is included in the EPR which is a planning level document and is not intended to represent detailed design work which will be undertaken by the successful proponent.

At the time, the western terminus of the Confederation Line West LRT Extension project was planned at Bayshore Station, with a large bus terminal and staging area facility to accommodate significant bus and passenger volumes transferring between buses and any proposed new transportation infrastructure and LRT. The West Transitway Extension from Bayshore Station to Moodie Drive is currently under construction as a BRT facility and is expected to open for revenue service in late 2017. As part of this project, a new rapid transit station is planned to be constructed on the south side of Corkstown Road, east of Moodie Drive. West of Moodie Drive, buses would use the existing bus-only shoulder lanes along Highway 417 to travel to/from Kanata.

Through Ottawa City Council approval of the *Stage 2 Implementation – Project Definition and Procurement Plan Report (ACS2017-TSD-OTP-0001)* in March 2017, Staff were directed to initiate an Environmental Assessment (EA) process to advance the conversion from BRT to LRT from Bayshore to Moodie, and identify locations for both a station and potential Light Maintenance and Storage Facility (LMSF).

The Confederation Line West LRT Extension Planning and EA Study included a LMSF to support operation of the Confederation Line East and West extensions. The study was undertaken with the understanding that the LMSF facility would provide for storage and light maintenance of trains, with heavy maintenance activities to take place at the existing Belfast LMSF site. The preferred option for this LMSF was on a National Capital Commission (NCC) owned property east of Woodroffe Avenue and north of a Canadian National Railway corridor, approximately 1.2 km south of Baseline Station. A LMSF at this location required a lengthy connecting track and was not ideal from an operational perspective.

Given Council's direction to consider the extension of LRT to Moodie, there was an opportunity to reconsider the location of this LMSF in the context of the required planning studies to support the extension.

The following are therefore the key objectives identified as part of this assignment:

- Identify a Recommended Plan for conversion of the West Transitway BRT Extension to LRT technology, including implementation of the grade separation at Holly Acres Road and a BRT/LRT transfer station at Corkstown Road;
- Undertake a site selection review to determine a preferred site for a LMSF to support Confederation Line East and West LRT extensions; and
- Undertake an EA process incorporating the above elements.

The spatial boundaries of the study area will vary depending on the environmental features investigated in order to: address environmental effects and operational issues; to accommodate coordination with relevant on-going studies and projects; and, to identify infrastructure needs and future connections.

1.3 Project Description

The extension of LRT to Moodie includes 2.5 kilometers of revenue service rail, a station at Moodie Drive and a LMSF located west of Moodie Drive between Corkstown Road and Highway 417. The alignment for the proposed LRT extension has been previously approved as part of the approved West Transitway Extension Bayshore Station to Moodie Drive project, and is currently under construction as a BRT facility, with revenue operation expected to commence in late 2017. The new station would be located partly on federal lands (National Capital Commission), while the LMSF would be built on provincial lands owned by the Ontario Ministry of Transportation (MTO) in a corridor already protected under an Individual Provincial EA.

The spatial boundaries of the study area will vary depending on the environmental features investigated in order to: address environmental effects and operational issues; to accommodate coordination with relevant on-going studies and projects; and to identify infrastructure needs and future connections.

This study will evaluate the conversion of this facility from BRT to LRT and include the siting of a station and an LMSF.

The rationale for extending LRT beyond the previously identified terminus at Bayshore, is to:

- Provide an LRT station in closer proximity to a large employment node (Department of National Defence complex); and

- Support a LMSF location in the west for the operation of the Stage 2 LRT Confederation Line East and West extensions with optimized operational and cost benefits.

1.4 Report Organization

Section 2 of this report outlines the Study Process, including a review of the applicable legislation and consultation activities. Section 3 specifically discusses project needs and opportunities. The Existing Environmental Conditions described in Section 4 provide the context for the Identification and Evaluation of Alternatives contained in Section 5. The Recommendation Plan is outlined in Section 6 and the Environmental Impacts of the Plan are identified in Section 7. The report ends with a section on Future Commitments outlining information and approvals relevant to the build aspect of the project.

2. STUDY PROCESS

2.1 Ontario Environmental Assessment Act, R.S.O. 1990

In June of 2008, the Transit Projects Regulation (*Ontario Regulation 231/08*) was created 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.

Originally the Moodie LRT Extension was planned in accordance with the addendum process outlined in the Regulation. Based on discussions with the MOECC, it was advised that the scope of the project to include an LMSF, was beyond what would be considered as an addendum and should be undertaken as a full Environmental Project Report (EPR). Therefore, in accordance with *Ontario Regulation 231/08* (*O.Reg. 231/08*) this EPR has been completed and made publicly available. As part of the assessment process, the EPR will be placed on public record for comment and review prior to Ministry of Environment and Climate Change (MOECC) approval. If there are concerns of provincial interest that cannot be resolved, a written objection may be made and sent to the Minister of the Environment and Climate Change for consideration.

Figure 2-1: Provincial EA Study Process

Pre-planning	Notice of Commencement	Notice of Completion	Ministers Review
• **Data collection** • **Alternatives** • **Impact assessment** • **Stakeholder consultation** • **Draft reports**	• Consultation with interested persons including regulatory agencies and Aboriginal Communities • Documentation (EPR)	• Public review of EPR by interested persons including regulatory agencies and Aboriginal Communities • Opportunities for objections to be sent to Minister regarding areas of provincial interest	• Review EPR • Consider any objections
	Up to 120 days	30 days	35 days

2.2 Canadian Environmental Assessment Act

Federal Canadian Environmental Assessment Act (CEAA) requirements are likely to be triggered based on the 2012 CEAA legislation based on the requirement for federal lands. Environmental impact assessments/evaluations would be required to ensure that there are no significant adverse environmental effects caused by the project.

The NCC owns land in the area and has been involved throughout the study process.

2.3 Consultation

Consultation with internal/external project stakeholders and the general public was undertaken to obtain input and feedback into the study and fulfill EA requirements. Meeting details including, agendas and materials, are contained in the *Consultation Report*.

Early, ongoing, and interactive consultation with stakeholders was critical to developing a Recommended Plan for the LRT extension and LMSF. Primary means of consultation was through establishment of a Public Advisory Committee (PAC) and Technical Advisory Committee (TAC). Two public information sessions were conducted to showcase the study and proposed recommendations to the general public.

The first, which took place on March 22, 2017, outlined the objectives for the project, the study area, the long list of potential locations for the LMSF options based on specific search criteria and functional requirements, possible LRT station locations, and the criteria for evaluating and screening station and LMSF options.

The second open house, held on June 13, 2017, provided recommendations for both the site of the LMSF – presented as “Option 2” on the east side of Moodie Drive, north of Highway 417, north-west of Abbott Point of Care and south of the Crystal Bay Centre for Special Education - and future Moodie LRT station (east of Moodie Drive on the north side of Highway 417).

Presentation of the recommended plan further to the initial two public consultations above took place at the City’s Finance and Economic Development Committee (FEDCO) and City Council in September 2017, and provided an additional opportunity for public input.

Project stakeholders identified included the following:

- City of Ottawa Stakeholders:
    - Transportation Services Department – O-Train Planning, Transportation Planning, OC Transpo (including Para Transpo), and Traffic Services
    - Planning, Infrastructure and Economic Development department – Planning Services, Infrastructure Services
    - Public Works and Environmental Services Department – Forestry and Surface Water Services, Roads Services
    - Emergency and Protective Services Department
    - Recreation, Cultural and Facility Services Department

- First Nations
- National Capital Commission (NCC)
- Ministry of Transportation (MTO)
- Department of National Defence (DND)
- Rideau Valley Conservation Authority (RVCA)
- Public Services and Procurement Canada (PSPC)
- Ministry of Natural Resources and Forestry (MNRF)
- City of Ottawa Ward Councillors and representatives (Ward 7 – Bay, Ward 8 - College)
- Adjacent property owners; Neighborhood and Community Associations; Condominium Associations
- Interest Groups such as Citizens for Safe Cycling; Ecology Ottawa
- City of Ottawa Advisory Committees (Accessibility; Environmental Stewardship)
- Utility companies
- Underground Utility Coordination Committee

Information was made available on the City of Ottawa website (www.ottawa.ca).

A Notice of Commencement was published August 24, 2017 in the Kanata Kourier-Standard, Manotick News, Nepean/Barrhaven News, Orléans News, Ottawa East News, Ottawa South News, Ottawa West News, Stittsville News, West Carlton Review, and Le Droit. A mail-out with the notice was also distributed by Canada Post to over 5,500 area households. The notice was also emailed to the stakeholders. Further, both the notice and the EPR document were available on Ottawa.ca. The Notice of Commencement contained information on how to obtain a copy of the draft EPR, which was presented to Committee (September 5) and Council (September 13), to review prior the Notice of Completion being published. The Notice of Completion was published on December 14, 2017 to initiate the start of the formal 30-day public review period followed by a 35 day Ministerial Review.

2.3.1 Indigenous Consultation

As part of the Stage 1 and Stage 2 LRT Projects, the City of Ottawa has an ongoing consultation with local First Nation groups including:

- Algonquins of Ontario Consultation Office;
- Algonquins of Pikwàkanagàn;
- Kitigan Zibi Anishinabeg First Nation; and
- Métis Nation of Ontario.

The Aboriginal Community Engagement Strategy for the Stage 2 LRT project has been developed to outline an approach to ongoing and effective consultation with First Nations to address the obligations of the crown and the proponent for the project. The ACES has been developed based on two key obligations:

- The Crowns Duty to Consult; and
- Proponent commitments made within the Environmental Assessment process.

Key areas of interest identified by First Nations included:

Algonquins of Ontario

- Thorough archaeological work. Study team committed to providing all archaeological reports done as part of the study.
- Interest in exploring opportunities to incorporate linkages to their history such as interpretive pathways, identifying trees and importance of access to water.
- All anticipated effects on traditional uses or cultural heritage resources will be identified and described as part of the EA process and subsequent detail design, and will be communicated to any potentially affected Aboriginal peoples and communities as they are identified.

Kitigan Zibi Anishinabeg

- Proximity to natural waterways such as Pinecrest Creek and the Ottawa River.
- Potential impacts on the health of these waterways during the course of the light rail transit extensions.
- Belief that water is sacred and essential for all life.

Quebec Métis

- No further interested in the study(ies).

As a result of the consultation undertaken, the following commitments were made in regards to the Environmental Assessments and resultant projects:

- Ongoing consultation with the Algonquins of Ontario regarding the scope and results of Archaeological Assessments.
- All anticipated effects on traditional uses or cultural heritage resources will be identified and described as part of the EA process and subsequent detail design, and will be communicated to any potentially affected Aboriginal peoples and communities as they are identified.
- Public Art Program: There is going to be a general call for artists for the art projects. To reach out to indigenous communities as part of this program, Stage 2 will coordinate an Indigenous Liaison Officer art consultant to hold workshops aimed at helping to build the capacity of local artists and artisans. This would benefit them in submissions for the calls for art, as well as beyond the Stage 2 LRT call for art. Also, Stage 2 has agreed to build upon the previous work done in the Stage 1 LRT work, by including the wayfinding symbol developed in Stage 1 for Pimisi station, and including it in all of the stations for the 3 extensions of the rail system. This Liaison Officer will also undertake general outreach.

Additional details regarding Indigenous consultation are contained in the *Consultation Report*.

2.3.2 Key Government Stakeholders

Several government agencies were directly involved with the development of the project and the EPR. They include:

- National Capital Commission as a landowner and approval authority
- Ministry of Transportation as a landowner and approval authority
- Ministry of the Environment and Climate Change as an approval authority

Meetings with the NCC and MTO were held on bi-weekly, and as-required, basis. Details of the meetings and feedback are contained in the Consultation Report.

2.3.3 Consultation Groups

A PAC was established to provide community input, concerns and feedback on the study process and conclusions as the EA work unfolded, prior to the Public Consultation meetings. The PAC was composed of representatives from Local Community Associations, City Advisory Committees, Advocacy Groups and Major Commercial Property Owners.

A TAC was created to provide discipline specific input and review draft materials, while also distributing information to colleagues as appropriate. The TAC was composed of a Working Group and included a separate Distribution List. The Working Group consisted of a number of City of Ottawa departments, the Rideau Valley Conservation Authority, Environment Canada – EPA Division, National Capital Commission and the Ministry of Natural Resources and Forestry.

Two PAC and two TAC meetings were held to obtain comments on the LRT Corridor and the LMSF, the results of which are discussed, in context in the ensuing sections.

2.3.4 Public Consultation

During the Notice of Commencement phase of the environmental assessment, copies of the project studies and consultation information were available to provide interested parties time to review and provide feedback prior to the formal 30-day public review period following the posting of the Notice of Completion.

Interested persons are invited to review the work completed to-date during the planning phase including a study summary, previous consultation efforts and reports presented to City Council which are available on the Stage 2 website (www.stage2lrt.ca).

Two public consultation sessions were held to obtain comments on the Moodie LRT and the LMSF, the results of which are discussed in this report contextually with the information that was presented at the meetings.

3. PROJECT NEED AND OPPORTUNITIES

3.1 Need for the Project

The Moodie LRT project is being undertaken as a component of the City of Ottawa transit system in accordance with the Official Plan (OP) and Transportation Master Plan (TMP) policies. This section discusses the need for rapid transit in the study area.

The City is currently constructing the West Transitway Extension, a BRT link between Bayshore Station and Moodie Drive with expected revenue service by the end of 2017.

The Stage 2 LRT project continues to proceed towards contract award in Q2 2018 with the major construction elements anticipated to start in early 2019. These major upcoming milestones are based on several years of planning work, and the roadmap to implementation as described in the *Stage 2 Implementation – Project Definition and Procurement Plan Report* (ACS2017-TSD-OTP-0001) approved by Council on March 8, 2017.The approval of the Stage 2 Implementation report provided the foundation for a competitive procurement process to take place for all three rail extensions.

The Stage 2 Implementation Report approved that both the extension to Moodie Station and a LMSF be incorporated into the Confederation Line extension procurement process.

3.2 Overview of Project Benefits

3.2.1 Expanded Rapid Transit Network

The 2.5 km extension of the LRT network to Moodie Drive will extend rapid transit coverage to the Crystal Beach community on the north side of Highway 417 and will locate an LRT station to within approximately 900 metres of the DND complex, a major employment hub. The LRT extension will allow the provision of a short-distance transit service from Moodie Station to the DND complex compared to bus service to the BRT station at Corkstown and a transfer at the LRT terminal station at Bayshore (or a 3-kilometer bus ride to Bayshore to avoid the BRT transfer at Corkstown).

3.2.2 Reduced Bus Trips

The Moodie LRT extension will decrease the number of bus trips between Moodie and Bayshore Stations by approximately 650 trips per weekday (200,000 trips annually). These bus trips will be replaced by quiet, electrically powered LRT vehicles.

3.2.3 Feeder Bus Savings

The operation of the LRT extension to Moodie Station will result in $12.5 M in feeder bus savings over a 20-year period. In addition, a capital cost savings of $1.8 m to $2.7 M will result due to the savings of 2-3 buses and the resulting decrease in fleet requirements. While there will be feeder bus savings, LRT operational costs to Moodie Station will exceed these, resulting in a net operating cost impact to the City.

3.2.4 Reduced Property Impacts at Bayshore Station

With the Stage 2 LRT extension to Moodie Station, the existing bus terminal at Bayshore Station on City-owned lands will be sufficient for bus operations. Alternatively, with LRT services terminating at Bayshore Station, the existing Bayshore Station bus terminal would have to be expanded, which would require the purchase of additional property to the west of the existing bus terminal, costs that would not otherwise be required. Further, the transit oriented development (TOD) potential of these lands can be realized more quickly than would be the case if the line terminates at Bayshore Station.

3.2.5 BRT Infrastructure

As noted previously, Stage 2 staff has confirmed, after a review of the existing BRT design and construction contract, that, to the greatest degree possible, the BRT infrastructure and alignment has been designed to be re-purposed for LRT operations. No changes to the existing BRT construction project currently underway are warranted and the line should proceed to open at the end of 2017 as planned.

As the Confederation West design and construction contract is not expected to be awarded until Spring/Summer 2018, it is likely that the earliest construction could start on the LRT extension to Moodie Station (if affordable after the receipt of Request for Proposal submissions), following detailed design, is 2020/2021 with revenue service expected in 2023.

3.2.6 Noise and Vibration

The expanded bus terminal at Bayshore is of concern to the Crystal Beach community to the north of the existing Bayshore Station. Stage 2 staff have undertaken a noise and vibration analysis of the expanded bus facilities.

From a Crystal Beach community perspective, the extension to Moodie Station would avoid the need for a large expansion of the Bayshore Station Further, an LRT extension to Moodie Station would trigger a grade separation at Holly Acres for safe and efficient LRT operations, and would result in the proposed Highway

417 noise wall at Holly Acres being constructed as part of the Moodie LRT extension project.

3.2.7 Proximity to Major Ridership Attractors

The Moodie Station LRT extension would bring an LRT station much closer to the DND complex expected to house 8,500 employees by 2020, as well as Abbott Point of Care s, which is directly north of the existing station.

3.2.8 Light Maintenance and Storage Facility (LMSF)

One of the major advantages of the Stage 2 extension of the Confederation Line to Moodie is the opportunity to locate an LMSF in the west end of the City to balance the east Belfast MSF (currently being expanded as part of the Stage 2). The provision of a purpose-built LMSF on the Bayshore/Moodie end of the Confederation West project is operationally superior and more cost effective than the initially proposed Woodroffe MSF site selected as part of the Confederation West EA. An LMSF along the revenues service portion of the Moodie Station LRT extension avoids the need to construct a non-revenue connection to the Woodroffe site from Baseline Station, with the resulting net capital cost and deadhead mileage savings. Furthermore, if a site can be found for an LMSF on the Moodie LRT extension (or failing that, as part of the Kanata LRT EA west of Moodie Station), the City's immediate interest in the Woodroffe MSF site can be abandoned. Finally, the construction of a westerly LMSF beyond Bayshore Station will reduce or eliminate the capital cost to provide interim overnight storage and cleaning facilities at Baseline Station that would be required for 2023 revenue service along with the Belfast MSF expansion in the east.

3.2.9 Ridership Forecasts

Ridership forecasts were developed for 2031 for the extension to Moodie Station. Peak point volumes on the Confederation Line (eastbound between Tunney's Pasture and Bayview) increase by about 2% with an LRT extension to Moodie Station. The combined daily boardings and alightings at Bayshore Station and Moodie Station increase by about 10% with an LRT extension to Moodie Station taking into account the fact that boarding and alighting at Bayshore Station drops by approximately 70% with this extension. Daily boardings and alightings at Moodie Station would total 4,900 in 2031, which is comparable to volumes at Rideau Station (5,300), Tunney's Pasture Station (4,200) and Blair Station (4,100) in 2031.

4. EXISTING ENVIRONMENTAL CONDITIONS

4.1 Study Area

The study area for the existing conditions may vary depending on the environmental feature which was investigated. Generally, however, the individual study area falls within the boundaries identified on Figure 4-1. This area includes the considerations for the siting of the LMSF within 750 m distance to main line. Lines illustrating both a 750m and 1000m setback from the main line (for LMSF siting purposes) are included in the Study Area map as a reference. This distance was based on the following key considerations:

- Vast majority of Canadian MSF's (light and heavy rail) are within 200 m of the mainline including all 5 existing TTC rail yards;
- Existing Belfast MSF is 525 m from main line;
- Woodroffe MSF (1200 m) is excessive, leading to LMSF search in Moodie LRT area;

Increased distances to the main line will result in:

- Increased labour costs to access the yard;
- Increased deadhead mileage for LRT vehicles/mileage costs;
- Increased maintenance costs for track, Overhead Catenary System (OCS), track bed, etc. and a decrease in the amount of time available for nightly maintenance of LRT infrastructure. The nightly maintenance window is 4-5 hours. If it takes an additional 15 minutes inbound and outbound to get from the yard to the mainline, the available nightly maintenance window is reduced 10-12.5% in perpetuity.

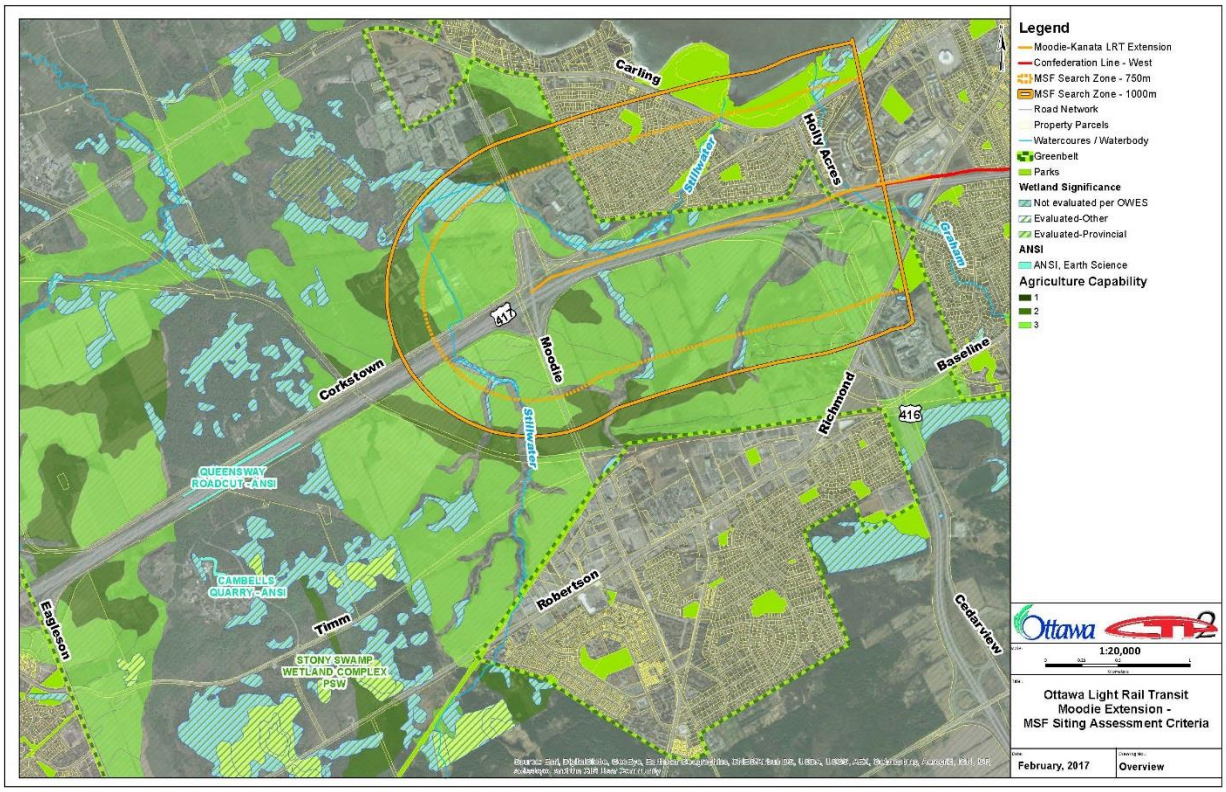


Figure 4-1: Study Area

4.2 Social Environment

4.2.1 Federal Planning Policies

The *National Capital Act*, 1985, gives the NCC the responsibility to "prepare plans for and assist in the development, conservation and improvement of the National Capital Region…". The 2013 Greenbelt Master Plan, which sets out the planning policies for the use and development of all Greenbelt lands, is one of the plans that has been prepared to fulfill this requirement. Additionally, the NCC is mandated to "coordinate the development of public lands in the National Capital Region (NCR)", which includes reviewing all changes of land, use, construction, demolition or other works on federal lands in the region. The NCC carries out this function through its Federal Land Use and Transaction Design processes.

4.2.1.1 NCC Plan for Canada's Capital

The Parliament of Canada passed the *National Capital Act* in 1985. This Act established the NCC, a Crown corporation whose responsibility is "to prepare plans for and assist in the development, conservation and improvement of the National Capital Region in order that the nature and character of the seat of the

Government of Canada may be in accordance with its national significance." (R.S.C. 1985, c. N-4, s. 10.1).

The renewed mandate of the NCC, implemented in 2013, has brought into focus the importance of successful long-term planning and decisive stewardship actions to ensure that the Capital is worthy of its important national role. The Plan for Canada's Capital (PFCC) is the preeminent planning document of the NCC and its Capital Planning Framework.

The PFCC outlines a framework for the continued evolution of the Capital to ensure it remains a welcoming and beautiful place, and that it makes Canadians proud.

The PFCC notes that in 2067, the Greenbelt will remain a fundamental part of the region's vast network of natural spaces, in the midst of an urbanized region. The projected population increase will have an impact on the Greenbelt, as those green open lands will become more of a rarity. Much of the growth within the City of Ottawa could take place in communities adjacent to the Greenbelt. Key policy direction for the Greenbelt are identified in the PFCC for the next 50 years, and include:

- Where new infrastructure must cross the Greenbelt since it is demonstrated that there is no other viable alternative, the NCC will encourage clustering of the infrastructure in corridors to avoid further fragmentation of the land base. Any proposed new transportation infrastructure must be evaluated through the cumulative effects assessment process the NCC has jointly established with the City of Ottawa. The Moodie Transit corridor was included in this study in 2012.

With regards to policy directions related to the Capital and the regional economy over the next 50 years the PFCC states that:

- Changes to federal accommodations will include locating facilities near readily available transit, and retrofitting or replacing buildings with more energy efficient design will contribute to regional sustainability and reduce environmental impacts; and

- In all aspects of its mandate, the NCC will support the use and development of smart technologies, and the sharing and exchange of information through partnerships with other federal agencies and the municipalities, when appropriate.

4.2.1.2 NCC 2013 Greenbelt Master Plan

The Plan for Canada's Capital is the high-level strategic plan for all federal lands in the Capital, while the master plans such as the Greenbelt Master Plan (GMP) provide more specific policy direction to guide area planning, development and management decisions. The 1996 GMP established land use strategies to provide recreation and attractive landscapes, to improve damaged and abandoned lands, to secure natural spaces and to support agriculture and forestry. The 2013 GMP takes into account the extent to which the Greenbelt is

presently meeting these objectives and looks ahead to where the Greenbelt could be in 2067.

The GMP takes an integrated land use planning approach that incorporates ecological, economic and social factors in Plan proposals and policies. The GMP sets policies for:

- Protected ecologically significant habitats;
- A connected system of natural lands;
- Sustainable farming;
- Capital experiences, achieved through completion of a recreational pathway system and offering of visitor features such as trails, protected views and interpretation areas;
- Greenbelt profile and environmental leadership; and
- Federal and non-federal facilities which respect the Greenbelt roles of Natural Environment, Sustainable Agriculture and Capital Experiences and Recreation and which demonstrate sustainable design and operations.

As indicated on the Greenbelt Concept – Capital Context figure in the GMP, the Study Area is located on a Capital Arrival Route. The GMP's strategic statements present four main roles of the Greenbelt – Natural Environment; Sustainable Agriculture; Capital Experiences and Recreation; and Facilities. The Facilities Role of the GMP is further broken down and summarized as a series of goals including:

Non-Federal Facilities: Encourage existing building facilities to be environmentally sound and to adapt their structure and operations to support other Greenbelt roles; do not allow new non-federal facilities and phase out existing facilities over time.

Sustainable Transportation and Infrastructure: Ensure that environmental best management practices are applied in the design, operation and maintenance of existing infrastructure. Do no permit new infrastructure unless there is demonstration that there are no alternatives outside of the Greenbelt and no net loss will result to ecological or overall Greenbelt integrity.

These goals place a focus on federal facilities while discouraging non-federal facility development on Greenbelt lands, particularly municipal roads or infrastructure, or non-federal types of facilities (institutional, commercial or residential).

As indicated on Figure 5.2 of the GMP, the Study Area is comprised of Natural Link and Non-Federal Facility and Operations Land Designations (2013). A Natural Link designation is applied to natural and regenerating areas that connect Core Natural Areas to each other. These areas may be natural or semi-natural in character, providing many resources for species, abut are not of

sufficient size of quality to provide for all habitat requirements or ecological functions.

Prohibited activities in Natural Link areas include:

- New facility areas;
- Motorized access along recreational trails; and
- Any other uses that would negatively impact or interfere with existing and developing natural link functions. Seasonal restrictions may occur for some of the Allowable Activities and Uses.

Prohibited activities and uses on Non-Federal Facility and Operations land designations include:

- Major expansions of existing non-federal facilities; and
- New facilities on new sites.

Transportation and transportation infrastructure within the GMP framework is identified in Section 6.7 of the GMP. The Plan notes that, in general, transportation infrastructure has considerable impacts on the Greenbelt environment, including noise, visual nuisance, habitat loss and fragmentation, and pollution of air, water and land. Devaluation of the landscape and of natural areas in terms of their recreation and tourism value can also be a significant economic factor. The NCC is committed to achieving sustainable transportation that complies with environmental conservation best practices in the Greenbelt, through collaboration with partners and stakeholders. The NCC will promote and give preference to sustainable, safe and active transportation infrastructure that is consistent with the vision, roles and goals of the Greenbelt and is in accordance with the following policies:

a) Future transportation infrastructure projects that are proposed to be located within or adjacent to the Greenbelt will be considered according to the categories determined through the Cumulative Effects Assessment Study.

b) Work with the City of Ottawa, and other authorities to ensure that projects listed, are planned from the earliest stage to ensure early consultation and collaboration with, and consideration of the impact of the NCC.

c) Apply the “No net loss” ecological principle to transportation infrastructure projects, through identification and implementation of appropriate mitigation measures. Off-site restoration may be sought where on-site restoration cannot be achieved.

d) Required, of proponents, of any future new transportation infrastructure or improvement to existing transportation infrastructure, a thorough assessment of the loss in environmental value resulting from any such proposal(s), such assessment to include a cumulative effects component.

e) Work with the City of Ottawa and other jurisdictions with the aim of closing unopened road allowances and existing low volume roads in the Greenbelt.

f) Give priority to transport demand management measures when assessing new infrastructure proposals that respond to increasing demand for access to and within the Greenbelt.

g) Apply context sensitive design best practices to transportation infrastructure projects that aim to conserve Greenbelt natural and visual resources. Take landscape ecology principles into account in order to achieve ecological connectivity and wildlife safety. Include measures that seed to "blend" the infrastructure project into the Greenbelt landscape and protect views. Require the incorporation of wildlife-friendly designs and crossing facilities, where appropriate, in transportation infrastructure projects that affect natural areas on the Greenbelt.

h) Work with proponents of transportation infrastructure projects to ensure the provision of a symbolic and distinctive sense of place and arrival, to and through the Greenbelt.

i) Discourage Park-and-Ride facilities from locating within the Greenbelt.

j) Identify and implement measures to mitigate the deficiencies of existing transportation corridors and other structures and their impacts upon terrestrial and aquatic habitat.

k) Encourage the reduction or elimination of unnecessary lighting along transportation routes and at facilities in the Greenbelt to help achieve a night sky quality, without compromising safety.

l) Work with stakeholders to monitor and evaluate the extent of fragmentation caused by transportation projects, and determine the effectiveness of mitigation measures.

m) Maintain and enhance the continuity of recreational pathways and natural links in the planning, design and function of transportation infrastructure.

The Study Area is in the Shirley's Bay Sector, while south of the Queensway, lands are within the Stony Swamp Sector. Watt's Creek is an important natural link connecting Stony Swamp to Shirley's Bay. The view of the Capital from Highway 417 over the escarpment is the Greenbelt's most dramatic, and needs protection, to support the quality of this important Capital Arrival. It is noted that the edge facility of the PSPC Carling Campus, planned as future DND headquarters at Carling and Moodie, will continue to demonstrate desired Greenbelt edge characteristics through landscaping and green building practices. The GMP notes to protect and improve visual quality along Moodie Drive through maintenance of existing vegetation and planting of trees/shrubs and use of other context-sensitive design features, and enhance scenic route quality.

4.2.1.3 Assessment of Cumulative Effects of Transportation Infrastructure on the National Capital Greenbelt

The *Assessment of Cumulative Effects of Transportation Infrastructure on the National Capital Greenbelt* (2012) was undertaken in partnership with the NCC and the City of Ottawa to identify projects within the TMP and other transportation projects that could have an impact on the environmental integrity of the federal Greenbelt lands.

The Study developed and implemented a cumulative effects framework and made recommendations for the study of future transportation projects. Thirty projects (transit and roads) within and/or adjacent to the Greenbelt were identified over the planning horizon to 2031. The West Transitway Extension from Bayshore Station to Moodie Drive with a station at Moodie Drive was one of the projects.

Two categories of projects were defined, with Category 1 projects having the greatest potential contribution to cumulative effects, especially within Core Natural Areas and Natural Area Linkages. The Moodie Transit Corridor was identified as a Category 2 by the *Joint Study to Assess Cumulative Effects of Transportation Infrastructures on the National Capital Greenbelt.* Category 2 projects are those that have a lower potential for generating significant adverse cumulative effects on the Greenbelt, and could proceed subject to EA completion, mitigation and compensation measures, and NCC FLUDA process.

4.2.2 Provincial Policy

The *Provincial Policy Statement* (PPS), 2014, is authorized under Section 3 of the *Planning Act*, R.S.O. 1990. 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;
- The planning for and protection of corridors and right-of-ways for transportation infrastructure and transit to meet current and projected needs;
- 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;
- 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;

- Restricting development and site alteration in or adjacent to significant natural areas unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions;

- Restricting development and site alteration in habitat of endangered or threatened species except in accordance with provincial and federal requirements;

- 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; and

- Conserving heritage and significant cultural heritage landscapes.

4.2.3 City of Ottawa Official Plan and Transportation Master Plan

The City of Ottawa Official Plan (OP) provides a vision for the future growth of the city and a policy framework to guide the city's physical development to the year 2031. The City of Ottawa's OP is a legal document that addresses matters of provincial interest defined by the Planning Act and the Provincial Policy Statement. This document was adopted by City Council in May 2003, and approved by the Minister of Municipal Affairs and Housing in November 2003. Two following major updates to the OP were adopted as part of a comprehensive review of the City's OP completed in 2013. 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.

The Study Area lands are "Greenbelt Rural" as identified on Schedule B of the City of Ottawa OP (2003). Lands designated Greenbelt Rural on Schedule B are to be used for farming, forestry, recreation and small-scale commercial uses directly related to rural activities within the Greenbelt, such as bed and breakfasts, farm-gate sales, and farmer and artist markets. Lands designated Greenbelt Rural, and located adjacent to a Greenbelt Employment and Institutional Area, may also be used for operational uses ancillary to the main permitted uses in the Greenbelt Employment and Institutional Area, provided ancillary uses have limited employment associated with them.

The Plan serves as a basis for and provides guidance on a wide range of municipal activities. A number of City of Ottawa OP land use designations, as noted on Figure 4-2, affect the study corridor. 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*, R.S.O. 1990, 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).

The 2013 Transportation Master Plan (TMP) builds on the work of previous plans carried out in 2003 and 2008. It is the City's blueprint for planning, developing and operating its walking, cycling, and transit and road networks over the next two decades. Key areas of focus for the 2013 TMP include supporting transit-oriented development. The plan also identifies a number of modifications to road and transit infrastructure priorities to account for adjustments in growth patterns, emerging issues and strategic opportunities.

4.2.4 Land Use

Land uses in the area include a combination of Greenbelt and residential. Key federal facilities in the Greenbelt include: DND Carling Campus; Abbott Point of Care and Wesley Clover Parks.

The DND Carling Campus is located north of Highway 417 and south of the Ottawa River, at the southwest corner of the Carling Avenue/Moodie Drive intersection. The site lies partially within the NCC Greenbelt which surrounds the central urban core of the Region.

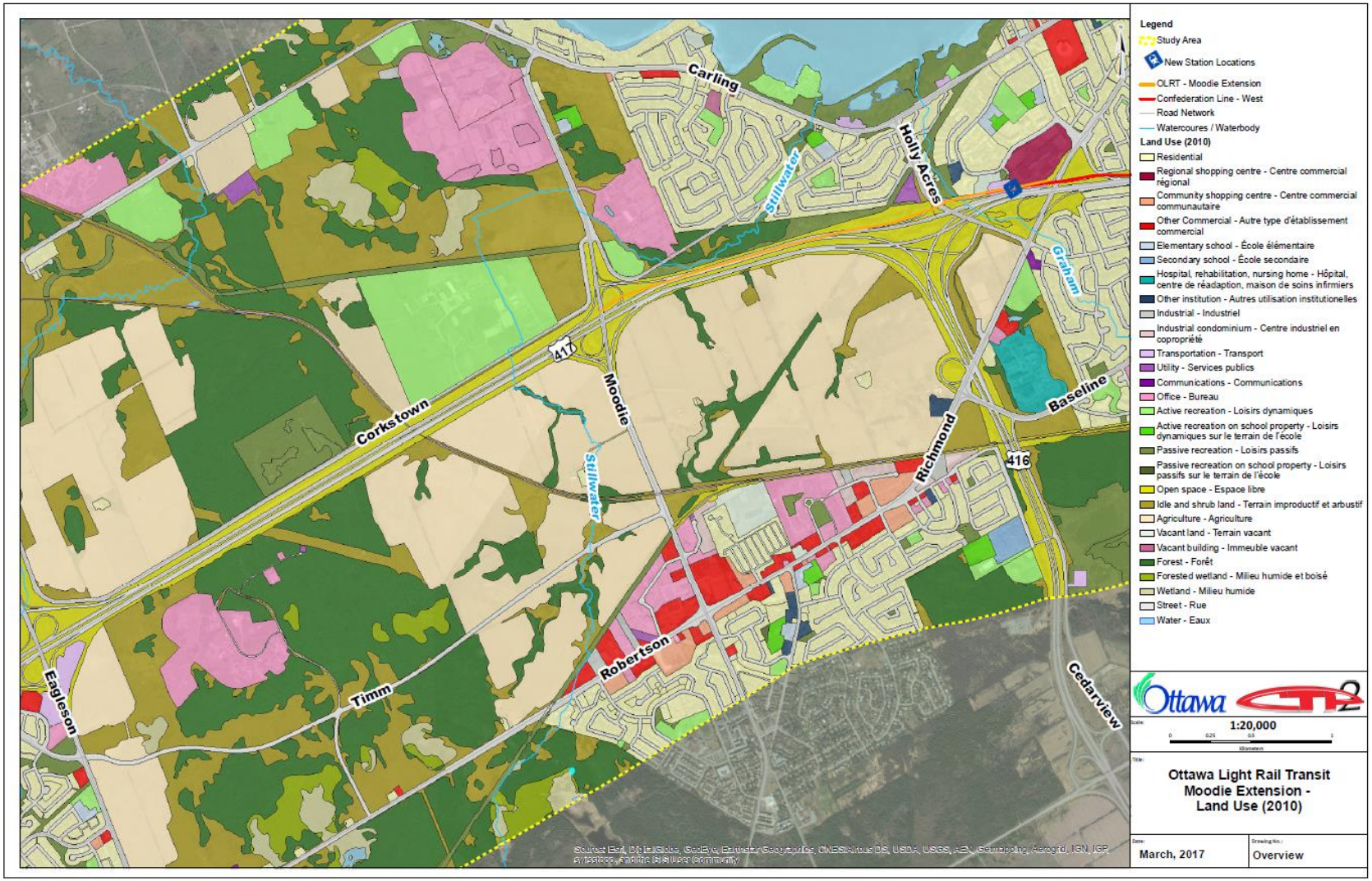


Figure 4-2: Land Use

The DND Carling Campus is a 28 ha property, plus 121 ha of Greenbelt land which is leased from the NCC on a 99 year lease. Following the 2010 purchase of the Campus, and with the creation of Shared Services Canada in August 2011, Public Services and Procurement Canada (PSPC), DND, and Shared Services Canada (SSC) completed a thorough analysis of DND's IT and occupation requirements.

PSPC is collaborating with DND and SSC on consolidating a large part of the DND's headquarters function at the Carling Campus. The design and re-fit work started in early 2014. The consolidation of Defence Team members is expected to be complete within approximately six years. The first phase of migration has commenced.

Abbott Point of Care has a manufacturing building at the north east intersection of Highway 417 and Moodie. The facility is located on lands leased from the NCC.

Wesley Clover Parks are recreational park lands located at the north-west intersection Moodie and Highway 417. Wesley Clover Parks was established in 2014 when the Wesley Clover Foundation took over operations of the former Nepean National Equestrian Park, and the adjacent Ottawa Municipal Campground.

4.2.4.1 Aesthetics and Recreation

From an aesthetic and recreational perspective, three distinct corridors within the study area (MRC, 2012) were identified. It was determined that the aesthetic value of the study area is high to the north of the Highway 417, which enhances the experiences of both commuter and recreational users of the Watts Creek recreational pathway that meanders through the Stillwater Creek Valley.

The Watts Creek recreational pathway extending between Moodie Drive and Holly Acres Road is the dominant recreational feature in the northern corridor (bordered by Crystal Beach-Lakeview Community and Highway 417). The alignment of the pathway traverses through a variety of landscapes characterized by open meadow at both the easterly and westerly limits and a woodlot within the main portion of the corridor (MRC, 2012).

The pathway is an integral link in the overall recreational system, connecting westerly to Kanata and easterly to the recreational pathway traversing adjacent to the Ottawa River toward Andrew Haydon Park. The pathway is heavily utilized throughout the year and connects to the Trans Canada Trail at both the east and west.

4.2.5 Agricultural Capability

Much of the land in the study area is under active agricultural use. A key principle of federal and provincial policies is the protection of agricultural lands. The Canada Land Inventory (CLI) agriculture mapping illustrates the varying

potential of a specific area for agricultural production. It indicates the classes and subclasses according to the Soil Capability Classification of Agriculture, which is based on characteristics of the soil as determined by soil surveys.

The CLI maps have 7 classes of agricultural capability. The classes indicate the degree of limitation imposed by the soil in its use for mechanized agriculture.

Classes	Description
Class 1	Soils in this class have no significant limitations in use for crops.
Class 2	Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.
Class 3	Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.
Class 4	Soils in this class have severe limitations that restrict the range of crops or require special conservation practices.
Class 5	Soils in this class gave very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible.
Class 6	Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible.
Class 7	Soils in this class have no capacity for arable culture or permanent pasture.
Class 0	Organic Soils (not placed in capability classes).

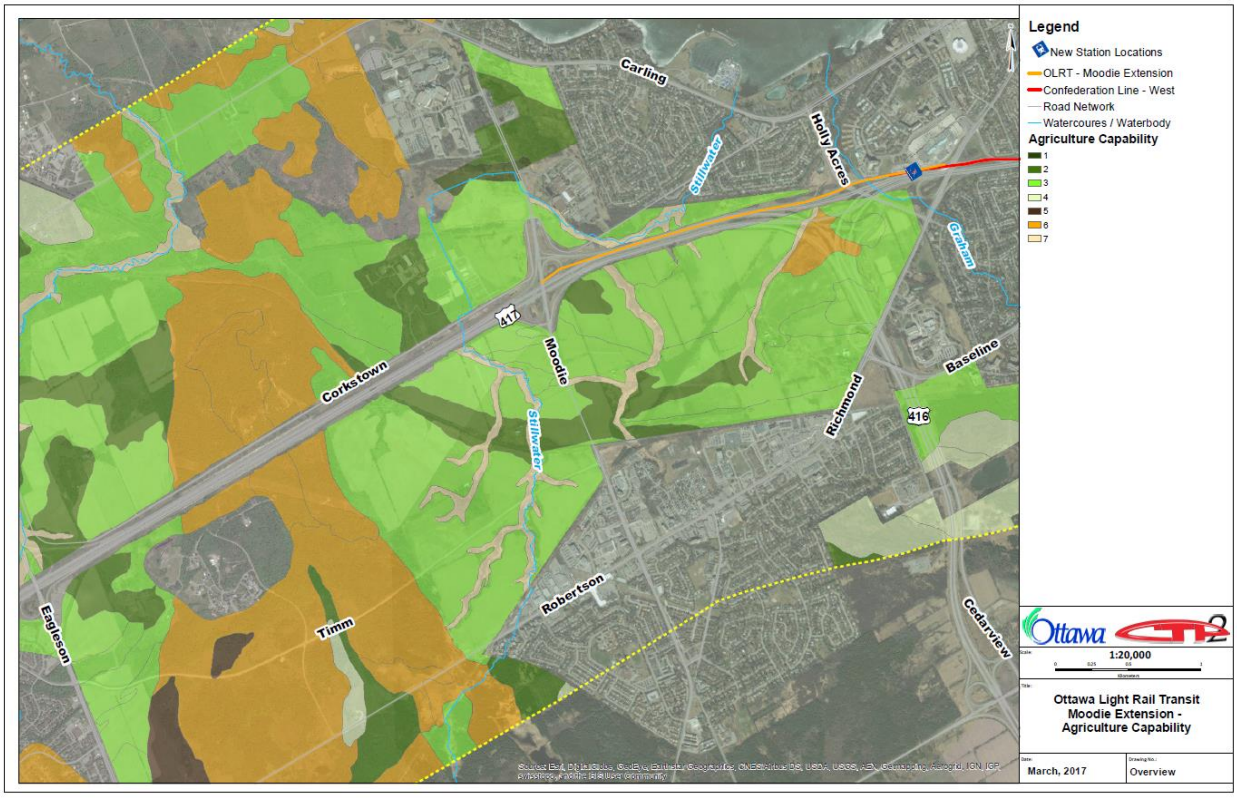


Figure 4-3: Agricultural Capability

4.2.6 Land Ownership

Lands within the Highway 417 ROW, which extends along Highway 417 and within the Moodie Drive interchange, are owned by the MTO. Lands north of the MTO ROW are owned by the NCC. Privately owned lands are located mostly within the northeast portions of the study area.

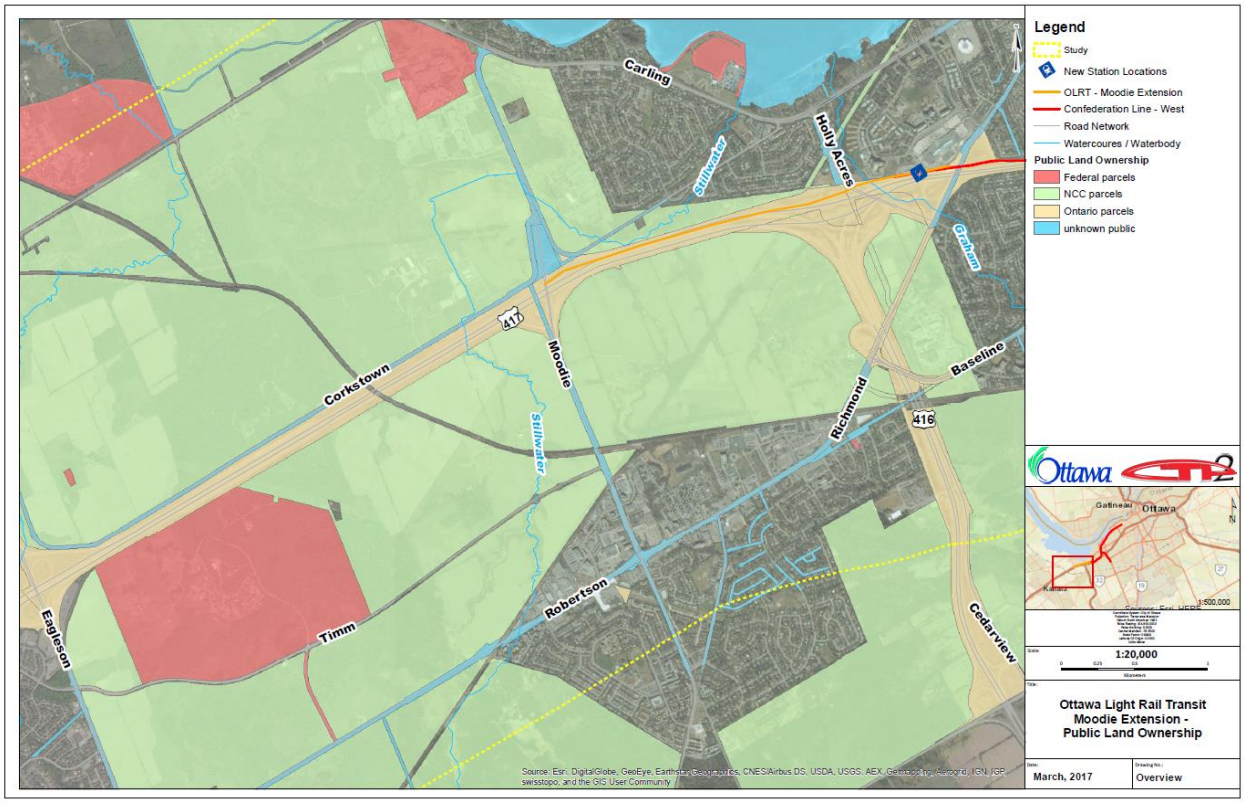


Figure 4-4: Land Ownership

4.2.7 Aboriginal Land Claims

The proposed project area is located within the boundaries of a comprehensive land claim filed in 1991 by the AOO. On June 12, 2015, the AOO and the Governments of Canada and Ontario announced that their Negotiators had initialed a proposed Agreement-in-Principle (AIP). This is a key step toward a Final Agreement that will clarify the rights of all concerned and open up new economic development opportunities for the benefit of the AOO and their neighbours in the Settlement Area in eastern Ontario.

On March 17, 2016 the AOO announced the results of the ratification vote on their proposed AIP with the Governments of Ontario and Canada. The tripartite ratification vote was conducted by an independent Ratification Committee with members appointed by the AOO, Ontario and Canada. Of those ballots cast, over 90 per cent voted in favour of the AIP and the continuation of negotiations towards the terms of a Final Agreement based on the AIP.

It is noted that no properties identified within the ratified AIP are within the study area (Figure 4-5).

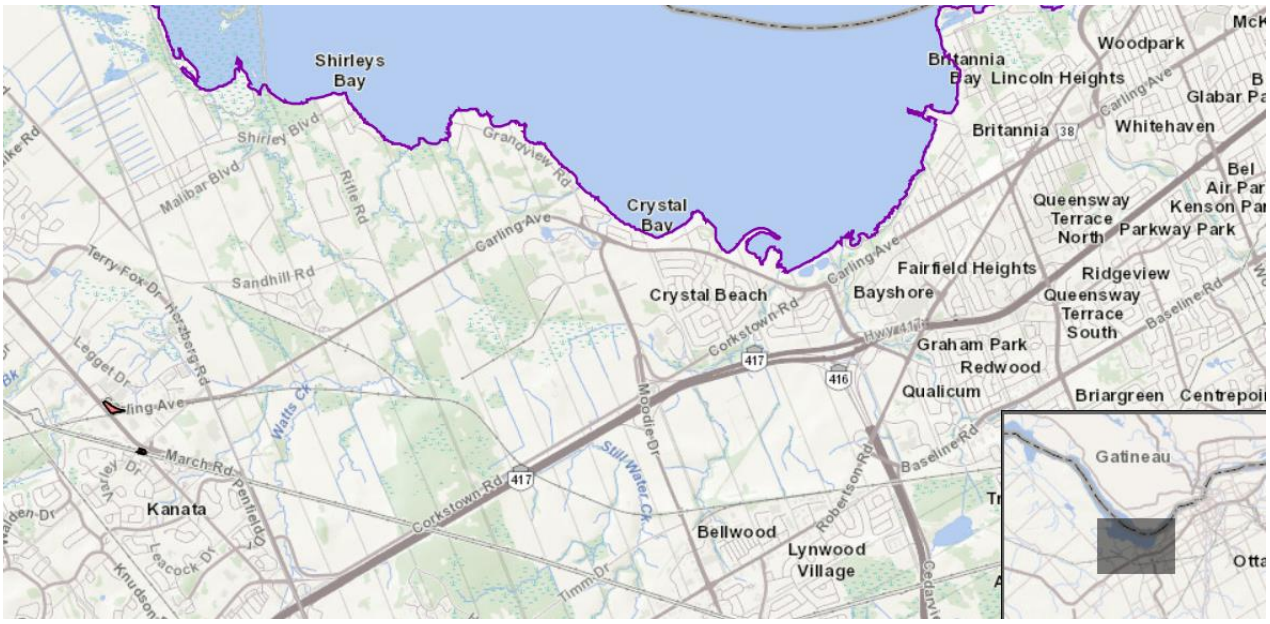


Figure 4-5: Localized AIP Map

4.2.8 Archaeological Potential

Stage 1 and Stage 2 Archaeological Assessments were completed for the West Transitway Extension EPR (MRC, 2012). The study area for these studies, completed by Golder Associates was a 3 km corridor extending from Bayshore Station to west of Moodie Drive, with a focus on areas north and south of Hwy 417.

This assessments recommended that no additional archaeological investigations are required for the West Transitway corridor located between Bayshore Station and west of Moodie Drive. Areas adjacent to Highway 417 were identified as disturbed within the context of the assessment.

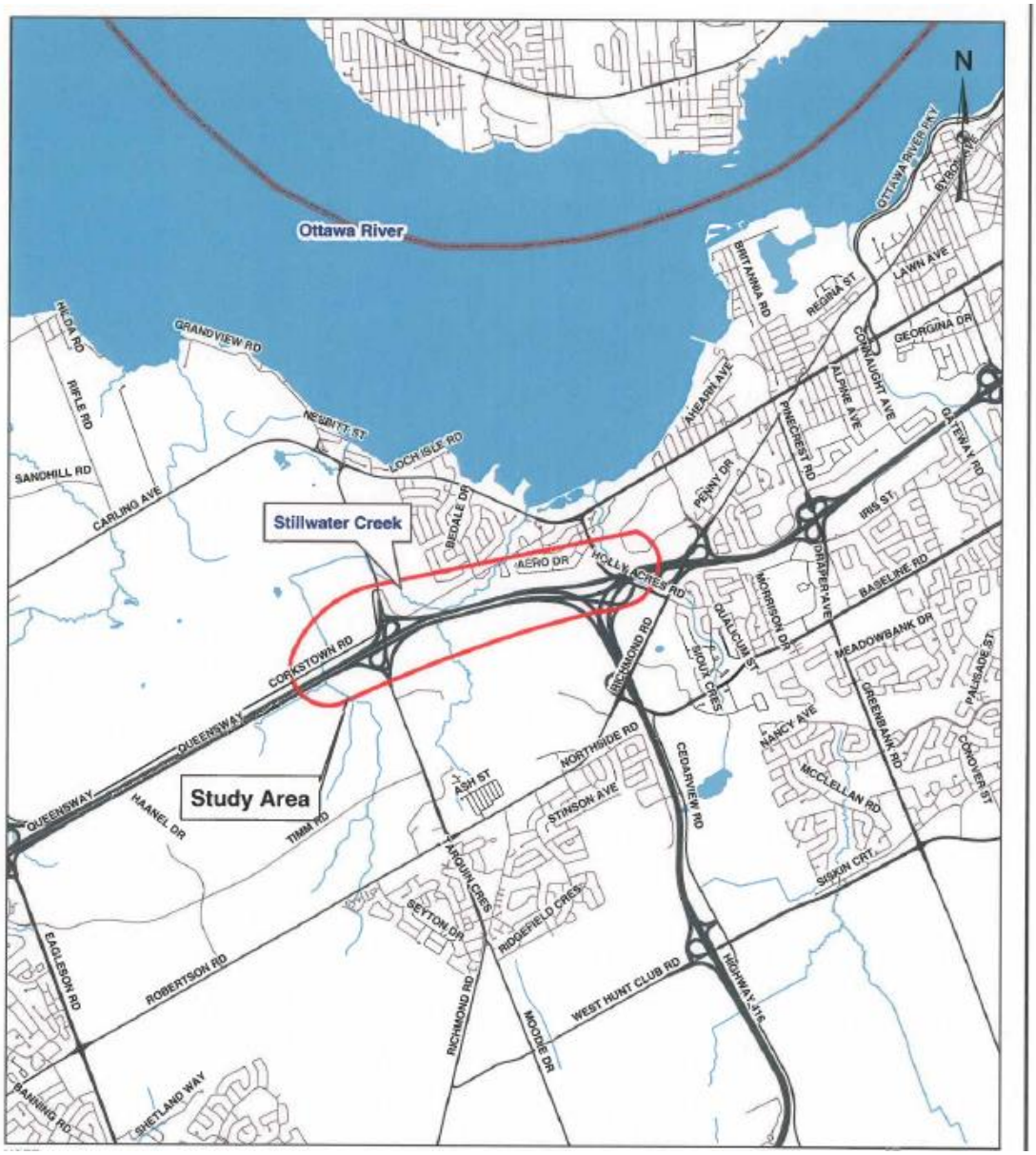


Figure 4-6: Archaeological Assessment Study Area

4.2.9 Cultural Heritage Resources

The cultural heritage of the study area reveals extensive farm use dating back to the early part of the nineteenth century but did not identify any registered heritage buildings.

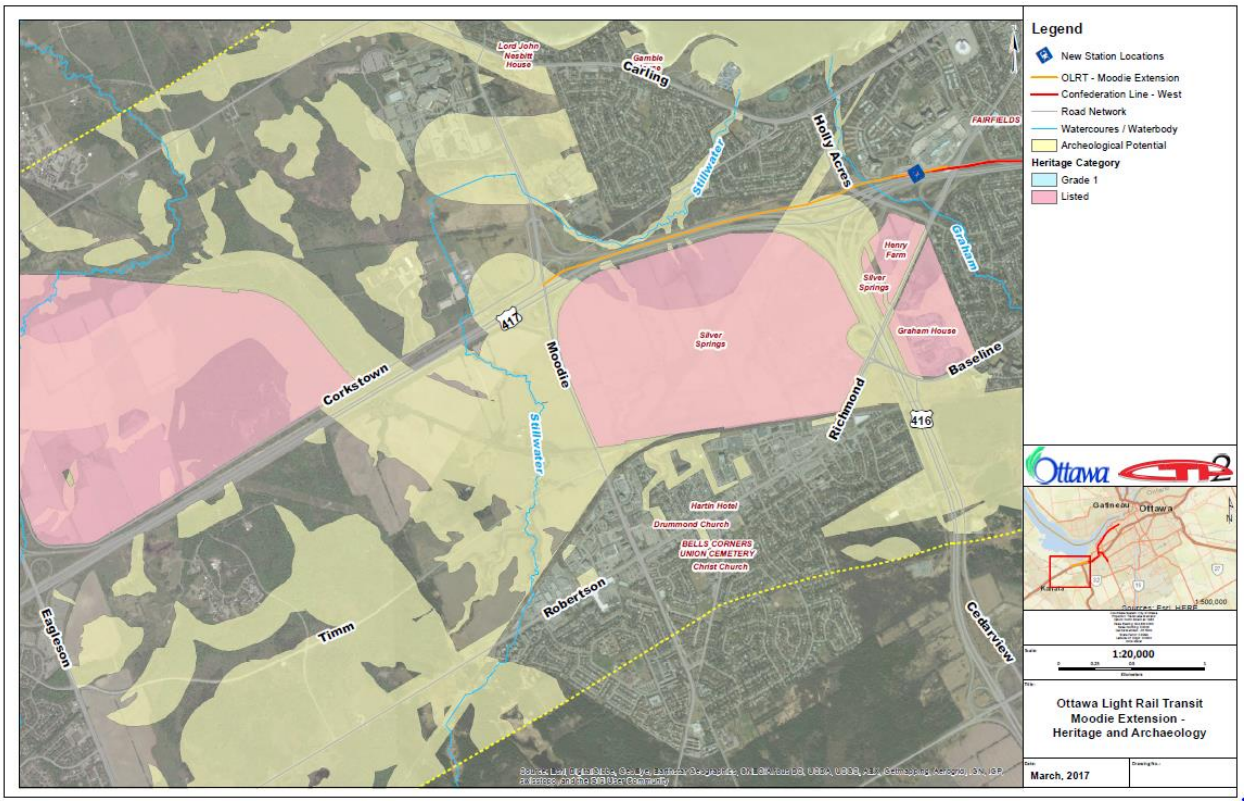


Figure 4-7: Heritage

4.2.10 Air Quality

An assessment of air quality was performed for common pollutants using peak hour traffic volumes during the WTE EPR (MRC, 2012). A computer model of the study area was used to evaluate relevant air quality parameters to calculate pollutant concentrations at specified points (MRC, 2012). Although traffic volumes are expected to increase trends indicate that emission factors will decrease due to improved pollution control technologies. LRT is expected to generate less air pollutants than BRT.

4.2.11 Noise

Noise analyses undertaken during the planning process of the WTE (MRC, 2012) found that the dominant source of roadway noise is, and will continue to be, Highway 417. The noise is generated by a combination of engine and brake operation from vehicles, as well as from the interaction of vehicle tires with the roadway surface; and effect that increases proportionally with speed. The highest noise levels occur at receptors closest to Highway 417, with levels diminishing with increasing distance from the noise source (MRC, 2012).

4.2.12 Vibration

Existing ground vibrations due to vehicular traffic were measured at three locations in the study area at the time of the WTE EPR. Measured vibration levels were considered to be low and of no consequence with respect to human perception and structural or cosmetic damage thresholds for buildings and other structures (MRC, 2012).

DND and Abbott Point of Care indicated there were no sensitive equipment that needed to be considered with respect to vibration.

4.2.13 Views and Vistas

Capital arrivals are described in the NCC Greenbelt Master Plan as providing:

- a symbolic and recognizable introduction to, and exit from, the Capital and the Greenbelt along major roads, scenic routes and rail lines;
- clearly marked and highly visible gateways to the Capital for visitors arriving from all directions; and
- creating a sense of welcome and distinct entry to Canada's Capital, in keeping with the scenic attributes of the Capital and its natural setting.

The view of the Capital from Highway 417 over the escarpment is the Greenbelt's most dramatic, and needs protection, to support the quality of this important Capital Arrival.

4.3 Transportation

4.3.1 Transit Network

Ottawa's Ultimate Transit Network (Figure 4-8) includes a combination of LRT, BRT and Transit Priority measures designed to encourage a sustainable transportation mode split target of 50% (10% for walking, 5% for cycling, 26% for transit, 9% for automobile passenger) by 2031.

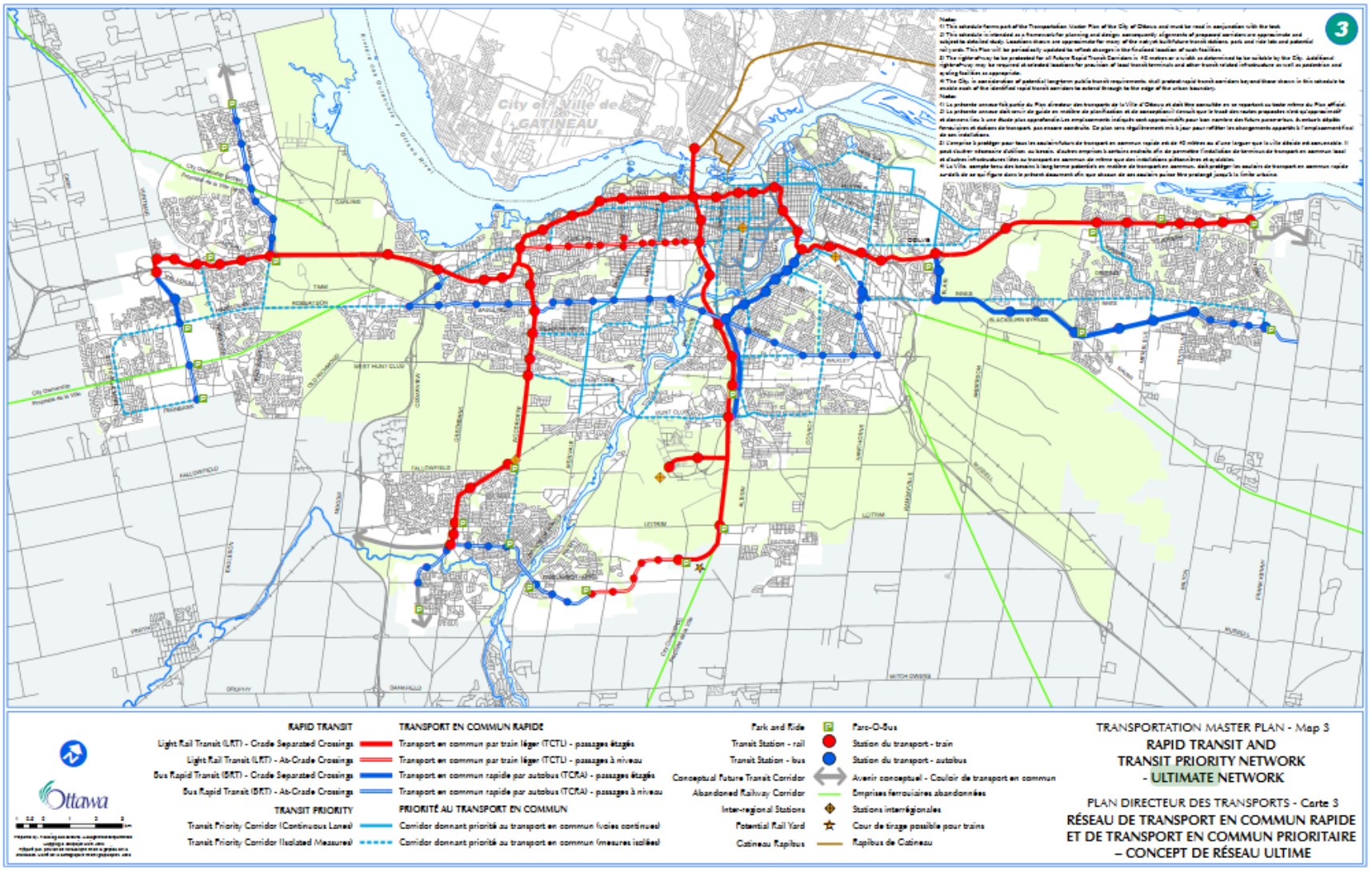


Figure 4-8: Ultimate Transit Network

4.3.2 Road Network

The primary road network in the study area is comprised of the following main transportation corridors. Figure 4-9 depicts the corridors in relation to existing and proposed transit stations:

- Highway 417;
- Moodie Drive;
- Holly Acres Road;
- Highway 416/417 Interchange; and
- Corkstown Road

4.3.3 Pedestrian and Cycling Networks

A mixed use recreational pathway owned, operated and maintained by the NCC extends the length of the study area, meandering from Holly Acres Road along the length of Stillwater Creek Valley to Corkstown Road. There are opportunities to improve connectivity to the overall pathway network and to destination points such as the shopping Centre, Moodie Transit Station and the community of Bell's Corners in the south west (Figure 4-9).

4.3.4 Traffic

The analysis of existing conditions (Appendix A) was divided between the three corridors evaluated for the study: Holly Acres Road, Corkstown Road and Moodie Drive. The peak direction of traffic on Holly Acres Road is generally southbound, in both the AM and PM peak hours.

- The traffic volumes on Holly Acres Road south of Highway 417 tend to be higher than those north of Highway 417 due to the presence of the Highway 416-417 eastbound off-ramps on Holly Acres. The majority of the traffic from this ramp is destined south to Richmond Road. North of Highway 417 the volumes are lower, with most traffic destined for Carling Avenue. All signalized intersections along Holly Acres Road operate acceptably in the AM and PM peak hours. No intersection has an overall LOS worse than LOS 'C' and no individual movement has a LOS worse than LOS 'D'. No excessive delays or vehicle queues are anticipated along this corridor.

- The peak direction of traffic on Corkstown Road is generally eastbound in the AM peak hour and westbound in the PM peak hour. This corresponds with the general flow of traffic in Ottawa, as commuters tend to be inbound to downtown in the morning and outbound during the afternoon. The volumes on Corkstown Road are in order with a collector roadway, and generally do

not exceed 200 vehicles per direction per hour in any peak hour. Count data indicates there are approximately 15 cyclists per hour on Corkstown Road in the AM peak period, and 20 cyclists per hour in the PM peak period. Anecdotally, pedestrian and cyclist activity in the area is higher during the weekends, related to travel along the adjacent NCC Watt's Creek Pathway. It should be noted that the Carling Avenue/Corkstown Road intersection is an Intersection Pedestrian Signal (IPS) with STOP control on Corkstown Road. When a pedestrian activates this signal, a red signal indication is displayed for Carling Avenue allowing pedestrians to cross and northbound left-turning vehicles to clear the intersection. All intersections in the Corkstown Road corridor operate well in both peak hours, with no intersection or individual movement operating with an overall LOS lower than LOS 'D'. No delays or excessive queues are expected along Corkstown Road under existing conditions.

- The peak direction of traffic on Moodie Drive is generally northbound in the AM peak hour and southbound in the PM peak hour. There were no cyclists counted on Moodie Drive south of Corkstown Road, likely due to the lack of a physically separated cycling facility, as well as the high traffic volumes on the Moodie Drive overpass over Highway 417. North of Corkstown Road the volumes range from 15 to 60 cyclists per day. The increase in cyclists is likely due to the presence of the east-west Trans Canada Trail, which crosses Moodie Drive at the intersection of Corkstown Road.

- Most intersections in the Moodie Drive corridor operate well, with the exception of the intersection of Moodie Drive / Carling Avenue in the AM peak hour. The level of service at this intersection is LOS 'E' in the AM peak hour, mainly due to the high volume of northbound left turners (763 vehicles in the AM peak, LOS 'F'). All other movements at this intersection operate well in both peak hours. Besides the northbound left turn at Carling Avenue, the only other turning movement along Moodie Drive that operates poorly is the eastbound left turn at the intersection with the Highway 417 eastbound ramps. This movement has 472 vehicles in the AM peak hour, resulting in a LOS 'F'.

Figure 4-9: Transportation Corridors

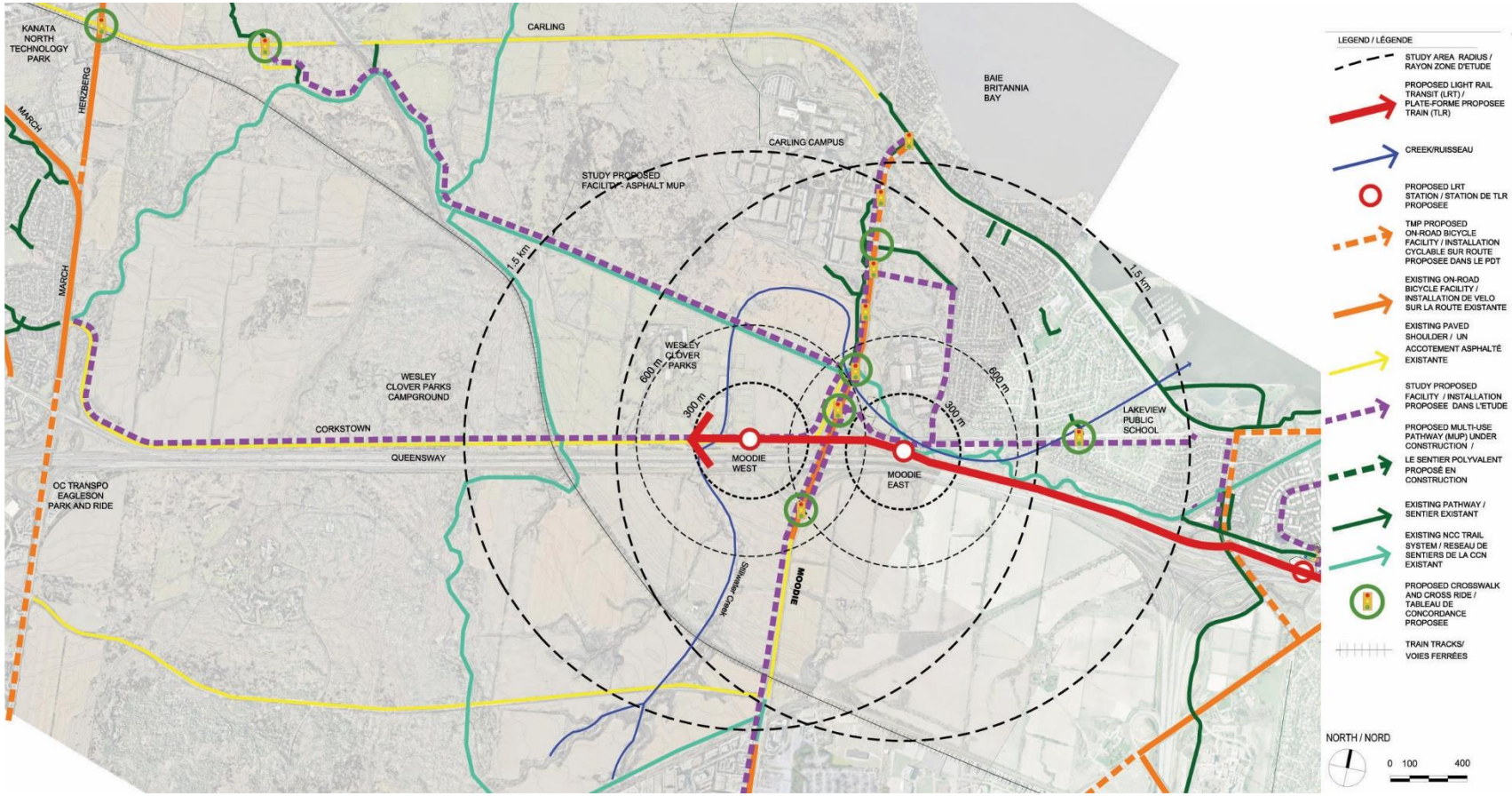


Figure 4-10: Pedestrian and Cycling Connections

4.4 Infrastructure and Utilities

4.4.1 Water Distribution System

The City of Ottawa has constructed the Zone 3W Watermain, a 1050 mm diameter watermain, to convey potable water from the Ottawa River Parkway on Carling Avenue to Eagleson Road. This watermain extends from the Ottawa River Parkway on Carling Avenue down the west-bound lane of Carling to Corkstown Road, continues west along Corkstown Road and finally turns south and crosses Highway 417 just west of Stillwater Creek (MRC, 2012). Additionally, there is a 400 mm watermain located within the Corkstown Road ROW, located under the north shoulder of the road.

4.4.2 Sanitary Sewers

The Watts Creek 1950 mm diameter sanitary gravity sewer extends from Corkstown Road northeast of the Moodie interchange to just west of Holly Acres Road. The sewer is located approximately 25 m north of Highway 417 westbound lanes and is assumed to be at a depth of 5-6 m below ground (MRC, 2012). This sewer conveys flow to a pumping station just west of Holly Acres Road, where twin 1050 mm sanitary forcemains exit the pumping station, head south and cross under the existing Holly Acres Road S-W and Richmond N-W ramps and under Highway 417 (MRC, 2012). A 450 mm sanitary sewer crosses Corkstown Road from the north approximately 50 m east of Stillwater Creek then heads east, following the road alignment (Figure 4-11).

4.4.3 Storm Drainage

The drainage catchments of the watercourses (Stillwater Creek and Graham Creek) within the study area are comprised of predominantly natural headland areas combined with highly urban downstream watershed areas. For the smaller local crossings, the catchment areas are largely composed of highway ROW. The slopes in the area are relatively flat, ranging from 0-5% and the majority of the soils in the study area are Rideau clay with some shallow bedrock. Throughout the study limits, the roadside vegetation located within and immediately adjacent to the Transitway ROW is mostly long grasses and bushes. (MRC, 2012). Runoff from the existing Highway 417 generally sheet drains to the north to ditches or swales, sometimes intermittent, which convey drainage to overland flow path locations which direct runoff to the nearby watercourses. There is an existing MTO pond located in the eastern portion of the Moodie Drive interchange which accepts drainage from approximately 14 ha of nearby lands, including 9 ha of MTO ROW, and ultimately discharges to Stillwater Creek via a constructed wet swale. (MRC, 2013). The overall hydrologic conditions are illustrations in Figure 4-12.

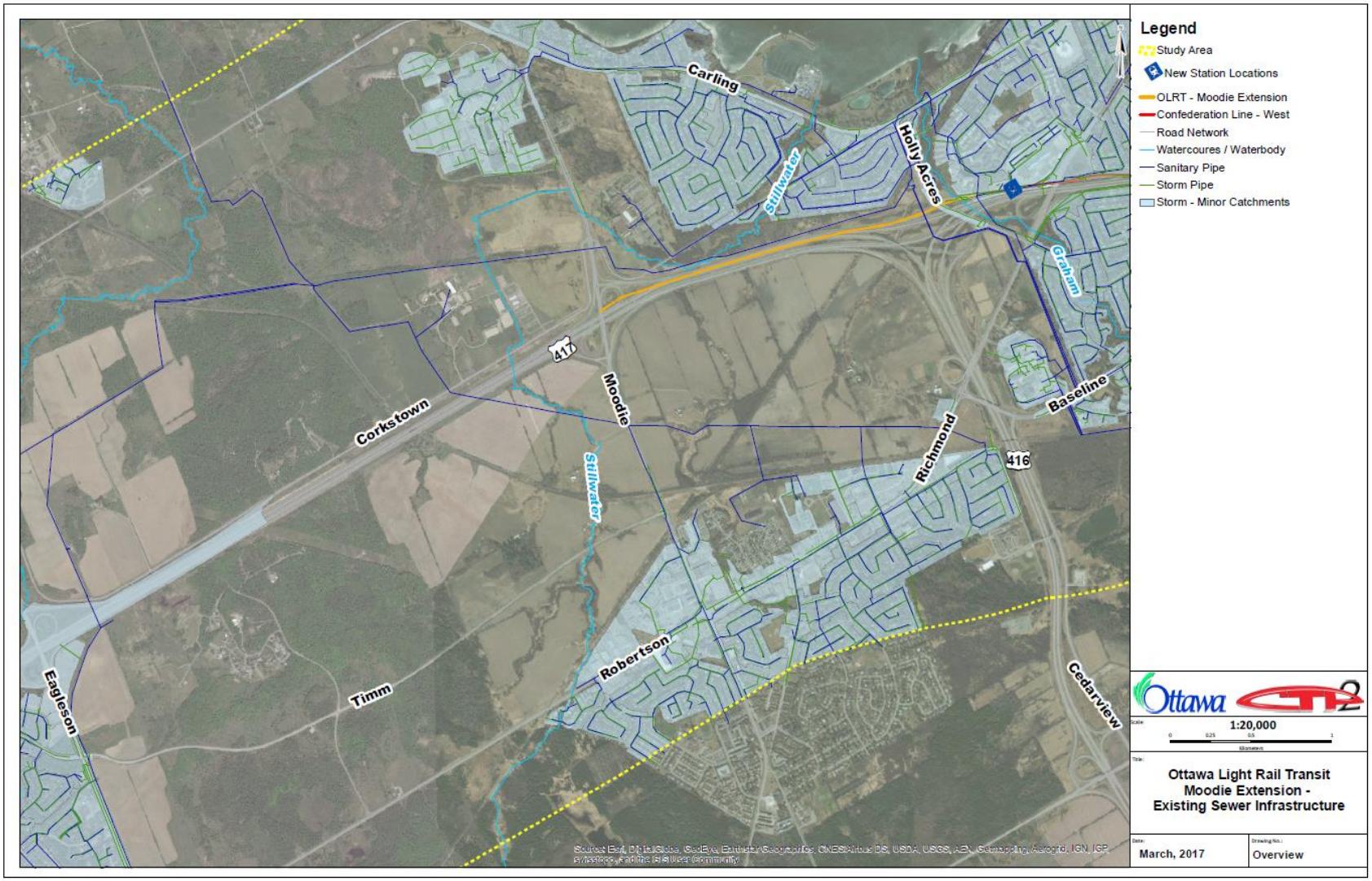


Figure 4-11: Major Sanitary Sewers

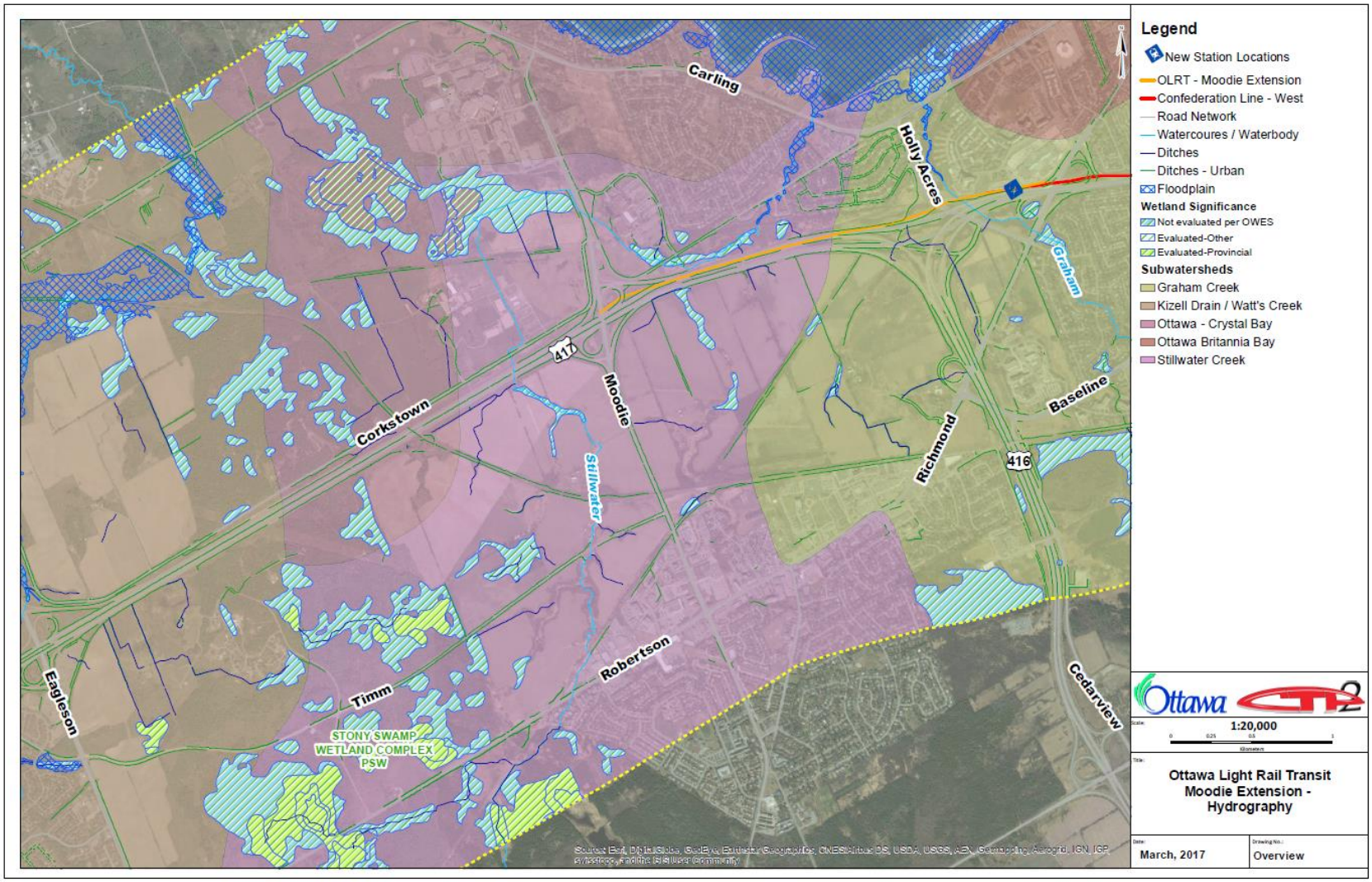


Figure 4-12: Hydrologic Conditions

The West Transitway Extension from Bayshore Station to Moodie Drive EPR developed the 100-year floodplain for the area. The Moodie Station is located on the east side of Moodie Drive and along the realigned Corkstown Road. Stillwater Creek from Area 2 passes through a culvert under Moodie Drive (Culvert 117430) and winds along behind the Abbott Point of Care facility. The channel is winding with some weeds, while the floodplain ranges from dense brush and weeds, scattered brush and weeds, trees with light undergrowth, or short grass associated with the open space and ball fields.. Along with excerpts from the HEC-RAS River Analysis System "Hydraulic Reference Manual" including the Manning's "n" values that were utilized.

Stillwater Creek passes under Corkstown Road (Culvert 117460) through an open bottom concrete box culvert with an inside width of 3.6 meters, a rise of 2.1 meters and a length of 17 meters. The creek then passes through a 1.5 meter diameter 10 meter long corrugated metal pipe culvert that passes under the Watts Creek Pathway/Trans Canada Trail (the multi-use path) before reaching the confluence with Area 1 of Stillwater Creek. The creek is then conveyed along the north side of the West Transitway.

Outlets for small catchment areas are treated with a micro-pool. This system involves the excavation of a small sump at the outlet and lining that sump with erosion protection (i.e., rip rap). This sump will help provide primary treatment and will act as a depository for coarse settled sediments.

As of December 2017, the BRT is in the process of completing construction and operation is anticipated to commence prior to the end of the year. Operations and functions of the stormwater management system for the BRT will be confirmed prior to hand over to the City.

4.4.4 Other Utilities

There are a number of aerial hydro line crossing Highway 417 west of Moodie Drive. (MRC, 2012)

The MRC, 2012 EPR determined that a Bell, Rogers, and Telus communications plant is found along the property line of homes on the south side of Aero Drive along the abandoned rail corridor. The presence of Bell ducts along the Highway 417 ROW just south of the property line were identified on drawings for the Watts Creek Gravity Sewer, but were not identified as part of a preliminary circulation issued by MRC as part of the WTE EPR (MRC, 2012).

High mast light poles and a newly constructed CCTV highway camera site, service Highway 417 for the length of the study area. The CCTV highway camera site is located in the vicinity of the Holly Acres S-W interchange ramp and is part of the extension of the MTO Compass system (MRC, 2012).

A 150 mm Enbridge Gas main is located within the Corkstown Road ROW.

4.5 Bio-Physical Environment

4.5.1 Greenbelt Master Plan

A large component of the Study area is within the NCC Greenbelt. The Greenbelt Master Plan identifies several key natural features within the Shirley's Bay (Figure 4-13) and Stoney Swamp (Figure 4-14) sectors. Features include: Wetlands; Forests; Core Natural Areas; and the natural and regenerating areas that connect Core Natural Areas to each other.

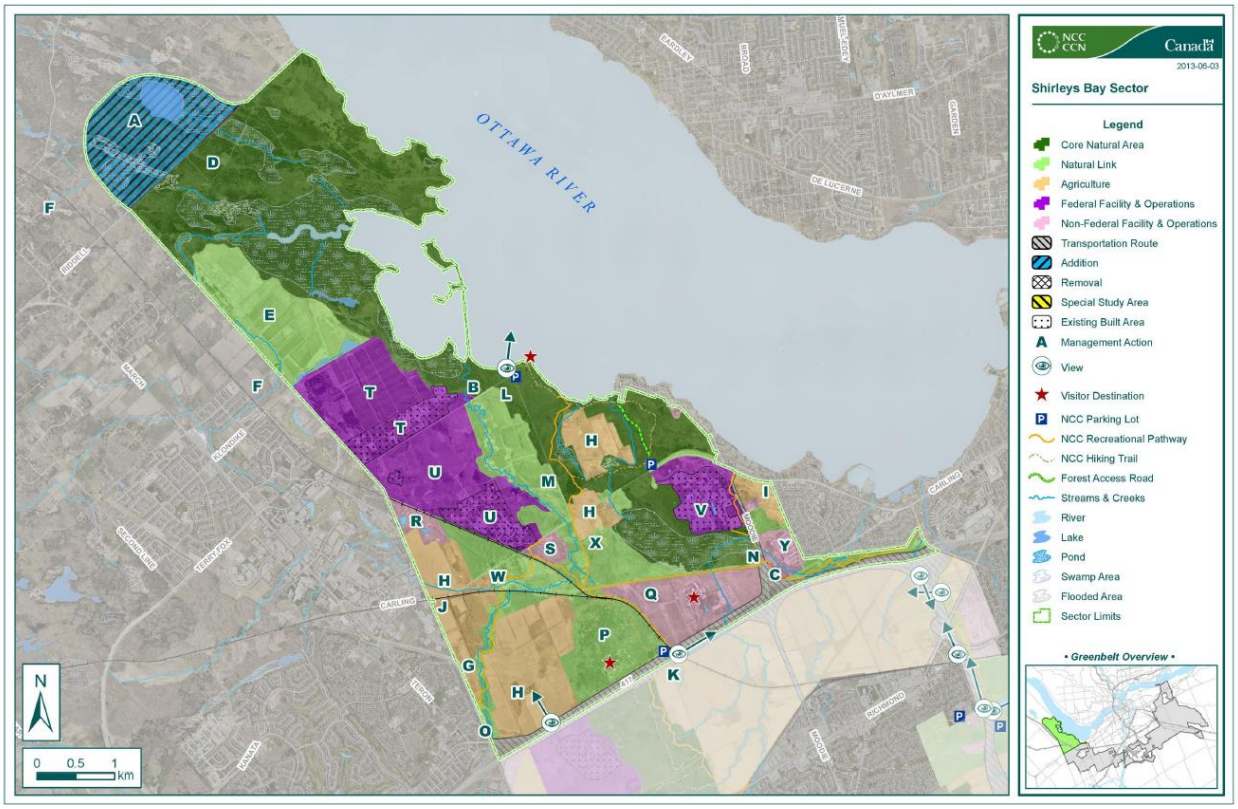


Figure 4-13: Shirleys Bay Sector

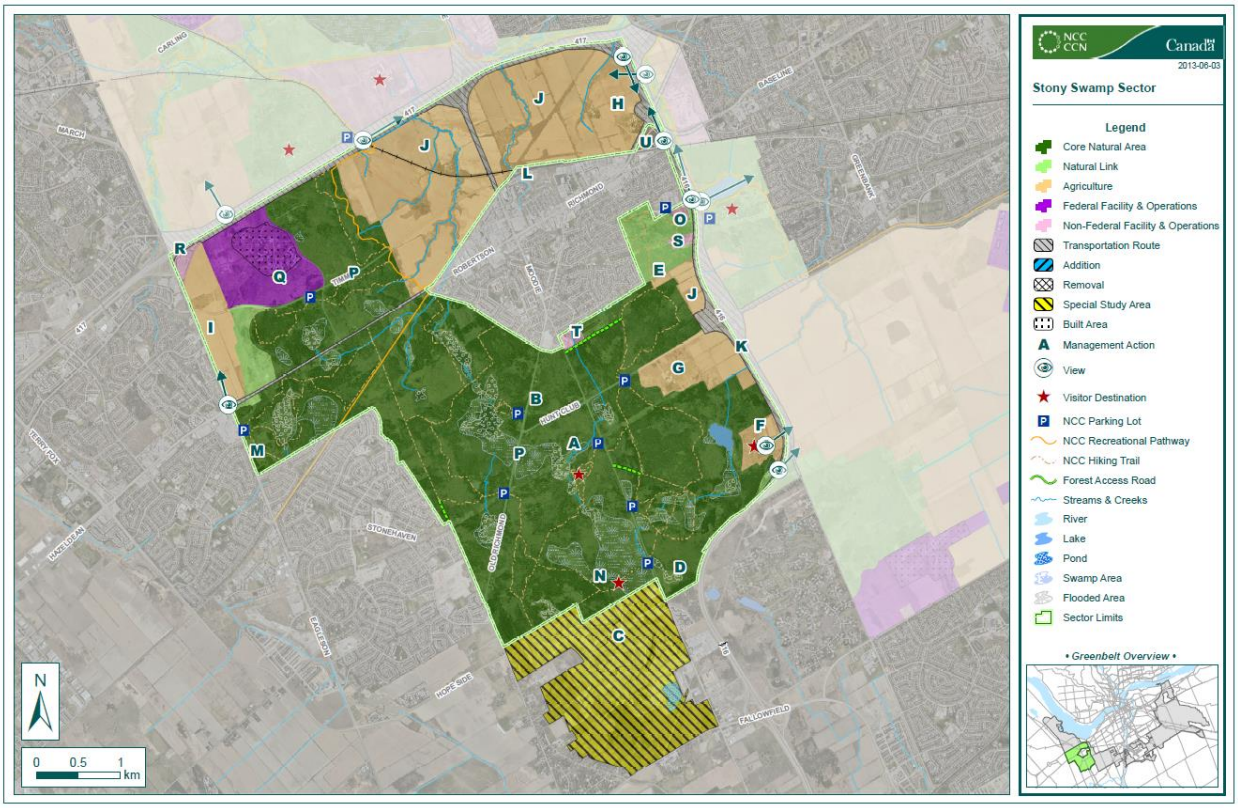


Figure 4-14: Stoney Swamp Sector

4.5.2 Aquatic Environment

4.5.2.1 Surface Water

The study area from Bayshore Station to Moodie Drive lies within the boundaries of both the Graham Creek watershed in the east and the Stillwater Creek watershed in the west. Graham Creek's drainage area is south of Highway 417 which drains the communities bounded by Highway 417 to the north, Hunt Club road to the south, Greenbank Road to the east and Highway 416 to the west and ultimately discharges to the Ottawa river just east of Holly Acres road. Stillwater Creek has a drainage area of 23 km^2 which drains the communities of Bell's Corners and Crystal Beach/ Lakeview, as well as the Stony Creek Conservation area and ultimately discharges to the Ottawa River just east of the Britannia Yacht Club. (MRC, 2012)

There are also a number of minor watercourses in the study area which comprise the tributaries to the main creeks. (MRC, 2012)

4.5.2.2 Fisheries

Field surveys by Ecoplans' fishery staff were conducted in 2009 for the WTE EPR completed by MRC in 2012. The general character of the watercourses crossed by the WTE route alternatives was recorded and preliminary sensitivities

identified based on the combination of secondary source and field reconnaissance information.

MRC reports that Stillwater Creek is considered Type 2 fish habitat as defined by MNR's Fish Habitat Protection Guidelines (2012). Type 2 habitat is important but generally abundant and includes feeding areas and areas of unspecialized spawning habitat.

Crossings specific to the West Transitway Extension are described in the Environmental Project Report (MRC, 2012). A summary is provided below.

Stillwater Creek – west of Moodie Drive: Stillwater Creek flows north under Highway 417 through a 5 m box culvert and under Corkstown Road through a 4 m box culvert. Flow is permanent and no barriers to fish movement were observed by Ecoplans. No sensitive habitat features (e.g. spawning or nursery habitat) were identified in the reach. The channel and banks are densely vegetated with overhanging grasses and herbaceous vegetation. Warmwater baitfish are reported in this reach, including brook stickleback, creek chub, central mudminnow, white sucker, northern redbelly dace, common shiner, and blacknose shiner.

Stillwater Creek – along Highway 417: This reach forms a part of the main branch of Stillwater Creek and flows from west to southeast from around the Moodie Drive/Highway 417 interchange, and along the north side of Highway 417. At the time of the WTE EPR, barriers to upstream fish movement were noted including blocked culverts at the Corkstown Road crossing and a collapsed retaining wall (MRC, 2012).

Stream morphology is dominated by 'flats' with occasional pools present throughout the reach. In many cases the pools contain submergent vegetation and abundant baitfish were observed during WTE field studies. Warmwater baitfish noted in this reach include fathead minnow, northern redbelly dace, central mudminnow and brook stickleback (MRC, 2012).

Tributary A of Stillwater Creek – 20 m downstream of Hwy 417 crossing: The southern bank of the main branch and tributary are lined with rip rap, and the northern bank is characterized by exposed bedrock. No barriers to upstream fish movement were observed, and no sensitive habitat features were identified. Warmwater baitfish reported within this reach include white sucker, brook stickleback, creek chub, fathead minnow, mottled sculpin, blacknose dace and central mudminnow (MRC, 2012).

Tributary B of Stillwater Creek – 110 m downstream of Hwy 417 ROW: Woody debris and fallen trees along the banks and in the channel have created seasonal barriers to upstream movement. A 'nickpoint' or 30 cm channel drop is present at the confluence with Stillwater Creek that creates a permanent barrier to fish movement upstream into the tributary. No fish were observed in the tributary, and no refuge habitat or sensitive habitat features were noted during field visits for the WTE. Tributary B of Stillwater Creek does not likely support direct fish use due to the flow and channel characteristics as described (MRC, 2012).

Tributary C of Stillwater Creek – through Hwy 417 ROW: No fish were observed in the watercourse during the 2009 WTE field investigations. That being said, in 2001, Ecoplans observed creek chub (warmwater baitfish) within the channel downstream of the recreational train. Although the culvert at the trail is slightly perched, it had a small 'rocky ramp' leading into the culvert outlet and was not therefore considered a barrier to fish movement (MRC, 2012).

Stillwater Creek – at the Hydro Corridor: The downstream section of the channel, located within the residential area, is lined by bedrock fragments and rip-rap bank protection (MRC, 2012). Potential spawning, rearing or nursery habitat was observed within this reach for baitfish. Baitfish species including sculpin, central mudminnow, white sucker, common carp, common shiner, spottail shiner, mimic shiner, creek chub, pearl dace, brook stickleback, bluegill, yellow perch, and johnny darter have all been observed. This assemblage of species reflects the proximity of this sampling station to the Ottawa River and the use of the lower reaches of Stillwater Creek by Ottawa River fish species (MRC, 2012).

Graham Creek: Abundant organic debris and leaf litter was observed on the streambed during WTE field investigations. This leaf litter was covering some of the finer substrates and offered some instream cover for baitfish. Poor water clarity and turbid flow was observed in 2009. No sensitive habitat features were observed during the field visit and no fish were captured. Species reported to occur in this reach include white sucker, longnose dace, creek chub, johnny darter and sculpin species. MRC notes that American eel (COSEWIC - Special Concern, MNRF – Endangered) has been captured near the mouth of Graham Creek, approximately 670 m downstream of the WTE study area (MRC, 2012).

Tributary A of Graham Creek: A rock check dam likely impedes seasonal movement of fish upstream, and has created a stagnant backwater area immediately upstream. There are some overhanging trees, but the channel primarily has full sun exposure. During WTE field visits, Ecoplans observed small pool areas where baitfish appeared to be forming nests in the large substrate. Brook stickleback have been identified within the reach downstream of the rock check dam (MRC, 2012).

4.5.3 Terrestrial Environment

4.5.3.1 Designated Natural Heritage Features

No Provincially Significant Wetlands (PSWs) are present north of Highway 417. The Stony Swamp Wetland Complex is located approximately 5 km upstream (south) of Highway 417 and west of the railway line.

The Stillwater Creek Valley is located north of Highway 417 and is designated by the MNRF as an unevaluated wetland. This site is recognized for the narrow ravine in a deep clay plain dominated by Sugar Maple – Black Maple (MRC, 2012).

Queensway Road Cut Areas of Natural or Scientific Interest (ANSI) – Earth Sciences: 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 Areas of Natural or Scientific Interest (ANSI) – Earth Sciences Cambell'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 Campbells Quarry. A large quantity of sandstone from this site was used in the construction of the Parliament Buildings.

The section of Stillwater Creek that flows between Corkstown Road and Highway 417 was designated a Regional Life Science ANSI with very large specimens (<100 cm diameter at breast height) of regionally uncommon Black Maple (*Acer nigrum*) (RVCA, 2015). Only provincially significant ANSIs are considered to be of provincial interest and have status under the Provincial Policy Statement. Regionally significant ANSIs identified in the past, do not have this status.

4.5.3.2 Natural Vegetation

The study area generally consists of altered landscapes associated with active agriculture, existing transportation facilities, and residential and commercial development. Vegetation within these areas is dominated by tolerant old-field species with occasional tree clusters and hedgerows. Remnant natural vegetation communities within the study area are limited to the Stillwater Creek valley north of Highway 417 between Moodie Drive and Holly Acres Road. Natural vegetation in communities south of the Queensway are limited to narrow riparian vegetation along watercourses and agricultural swales, surrounded by active agriculture within the NCC Greenbelt.

Species and communities were considered with respect to their Provincial (or subnational) conservation status Conservation status ranks are used by the Natural Heritage Information Centre (NHIC) to set conservation priorities for rare species and natural communities. These ranks are not legal designations. Factors considered in assigning provincial ranks are the total number of known, extant sites in Ontario, and the degree to which they are potentially or actively threatened with destruction.

- **S1 Critically Imperiled**—Critically imperiled in Ontario because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.

- **S2 Imperiled**—Imperiled in Ontario because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province.

- **S3 Vulnerable**—Vulnerable in Ontario due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

- **S4 Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors. [5taxa; partially tracked in Ontario]

- **S5 Secure**—Common, widespread, and abundant in Ontario.

- **SH Possibly Extirpated (Historical)—**Species occurred historically in Ontario, and there is some possibility that it may be rediscovered. Its presence in the province has not have been verified in the past 20 or more years. [60 taxa]

- **SX Presumed Extirpated**—Species is believed to be extirpated from Ontario. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

- **? Inexact or Uncertain**—Denotes inexact or uncertain numeric rank. Rank ranges, e.g. S2S3, indicate that the Ontario rank is either S2 or S3, but that the information currently available is insufficient to determine which rank applies. Rank ranges (e.g. S2S3) are sometimes used to indicate known rank based on number of occurrences (e.g. S2) and predicted rank with additional field surveys (e.g. S3).

A total of 12 vegetation community types were identified within the Study Area, including cultural meadow, cultural woodland, deciduous forest and meadow marsh. One community located along the banks of Stillwater Creek is a mosaic that includes elements of Fresh-Moist Sugar Maple – Black Maple Deciduous Forest, a provincially rare vegetation community type (S3? Ranking). Several very large Black Maple specimens are located within this community.

Review of background sources determined that a total of three (3) provincially rare and/or regionally significant species have been confirmed in the vicinity of the study area. Pitch Pine (*Pinus rigida*), regionally ranked as S2?, Pale-bellied Frost Lichen (*Physconia subpallida*), endangered, and Ram's-head Lady's-slipper (*Cypripedium arietinum*), regionally ranked as S3, are known to occur in the area (refer to Natureserve Explorer 2015 for details on SRanks). With the exception of the last occurrence of Ram's-head Lady's-slipper recorded in 1997, the other provincially rare and regionally significant species have not been observed in the area since 1969.

4.5.3.3 Wildlife

As part of the WTE EPR, Ecoplans completed avian surveys for the study area in 2009. The purpose of the avian surveys was to gather breeding bird data, note migratory use and evaluate natural areas for avian habitat potential. Avian biologists identified a total of twenty-three bird species within the study area. The majority are habitat generalist, disturbance-tolerant, urban-adapted species including American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), Red-winged blackbird (*Agelaius phoeniceus*), and Song sparrow (*Melospiza melodia*).

Based on field visits completed by Ecoplans in 2009, three *area sensitive* bird species were observed in the Stillwater Creek valley: Cooper's hawk (*Accipiter cooperii*) and the Pileated woodpecker (*Hylatomus pileatus*) were observed within the forested portion of the valley and Savannah sparrow (*Passerculus sandwichensis*) in the surrounding cultural meadow habitat (MRC, 2012).

The following bird species were recorded by Morrison Hershfield, during 2017 surveys; American Goldfinch (*Cardeulis tristis*), American Robin (*Turdus migratorius*), Black-capped Chickadee (*Poecile atricapillus*), Common Grackle (*Quiscalus quiscula*), Common Yellowthroat (*Geothlyphis trichas*), European Starling (Sturnus vulgaris), Great-horned Owl (*Bubo virginianus*), House Finch (*Carpodacus mexicanus*), Northern Cardinal (*Cardinalis cardinalis*), Red-winged blackbird (*Agelaius phoeniceus*), and Song Sparrow (*Melospiza melodia*).

The WTE EPR notes that an apparently abandoned colony of heron or cormorant nests was observed within the study area approximately 25-30 m north of the Highway 417 ROW. This "heronry" was not considered to be an active breeding colony in 2009 or in follow-up site visits in 2010 and 2017. No special protection of the heronry is/was warranted.

In addition to avian surveys, Ecoplans completed a general wildlife habitat assessment for the study area in 2009. Supplemental wildlife observations were made during all field visits. The study area was found to provide habitat for a range of common, generalist wildlife species that are tolerant of urban and semi-urban and rural/agricultural conditions. It is noted that aquatic and riparian areas are likely to provide some habitat for waterfowl, blue herons, and mammals as well as some reptile and amphibian species.

The Stillwater Creek Valley north of Highway 417 can be expected to support a greater number of wildlife species given the higher habitat quality and diversity. This valley also likely functions for wildlife movement.

Six common mammal species, all of which are disturbance-tolerant and adapted to urban areas were observed during field surveys in 2009 and 2017. These species include Beaver (*Castor canadensis*), Eastern Cottontail (*Sylvilagus floridanus*), Eastern Grey squirrel (*Sciurus carolinensis*), Raccoon (*Procyon lotor*) and White-tailed Deer (*Odocoileus virginianus*). Other species reported to likely occur in the study area include Coyote (*Canis latrans*), Striped skunk (*Mephitis mephitis*), Red squirrel (*Tamiasciurus hudsonicus*), Muskrat (*Ondatra zibethicus*), Eastern chipmunk (*Tamias striatus*) and Red fox (*Vulpes*; MRC, 2012).

No significant wildlife habitat features were identified by the MNRF within the WTE EPR study area (MRC, 2012). There is no forest 'interior' habitat present within the study area (MRC, 2012).

The MNR did not identify any animal movement corridors within the study area (MRC, 2012). However, Ecoplans examined wildlife movement opportunities visually at a landscape level and determined that opportunity for wildlife movement is provided by the Stillwater Creek Valley. The portion of this system, located north of Highway 417 and east of Moodie Drive is generally less disturbed with much greater natural vegetation cover, habitat diversity and

wildlife habitat elements than other watercourses and areas within the study area (MRC, 2012).

Herpetofauna habitat is present generally, along the watercourses and associated riparian areas within the study area (MRC, 2012). These areas provide habitat for localized breeding and movement of common amphibian and reptile species.

Two amphibian species, the Northern Leopard frog (*Lithobates pipiens*) and Spring peeper (*Pseudacris crucifer*), were observed during 2009 field visits in the Stillwater Creek Valley. Although breeding habitat is present in the Stillwater Creek valley floodplain, vernal pools were not observed.

Background sources (NHIC) also contain records of Blanding's Turtle (*Emydoidea blandingii*) and Snapping Turtle, designated as threatened and special concern respectively, by both the federal and provincial governments, within 10 km of the study area.

Although no reptiles were observed, two turtle species are reportedly observed by members of the public: Snapping Turtle (*Chelydra serpentine*) and Midland Painted Turtle (*Chrysemys picta marginata*).

4.5.4 Physical Environment

4.5.4.1 Bedrock Geology and Surficial Geology

The subsurface conditions vary considerably along the WTE alignment, and can be summarized as follows (MRC, 2012):

- The eastern portion of the alignment, near Holly Acres Road, is generally underlain by surficial random fill material overlying silty clay and clayey silt, followed by sand, glacial till, and dolomitic and sandstone bedrock. The bedrock surface is at about 25-34 metres below ground surface (m.b.g.s.).

- Beneath the central portion of the site, the depth to the bedrock surface decreases significantly and the rock surface is as shallow as 2-5 m.b.g.s. The overburden materials generally consist of silty clay and clayey silt, overlying a thin veneer of glacial till. The bedrock in this area of the site consists of sandstone.

- The bedrock surface deepens at the west around Moodie Drive, where the rock surface is at a depth of about 10-15 m.b.g.s. The overburden materials generally consist of silty clay overlying glacial till. The bedrock in this area consists of sandstone. It is noted that limited information on the subsurface conditions in the western portion of the alignment is available as the WTE EA investigation only included widely spaced boreholes suitable for functional design.

  There are several geological faults that are present in the Study Area (Figure 4-15).

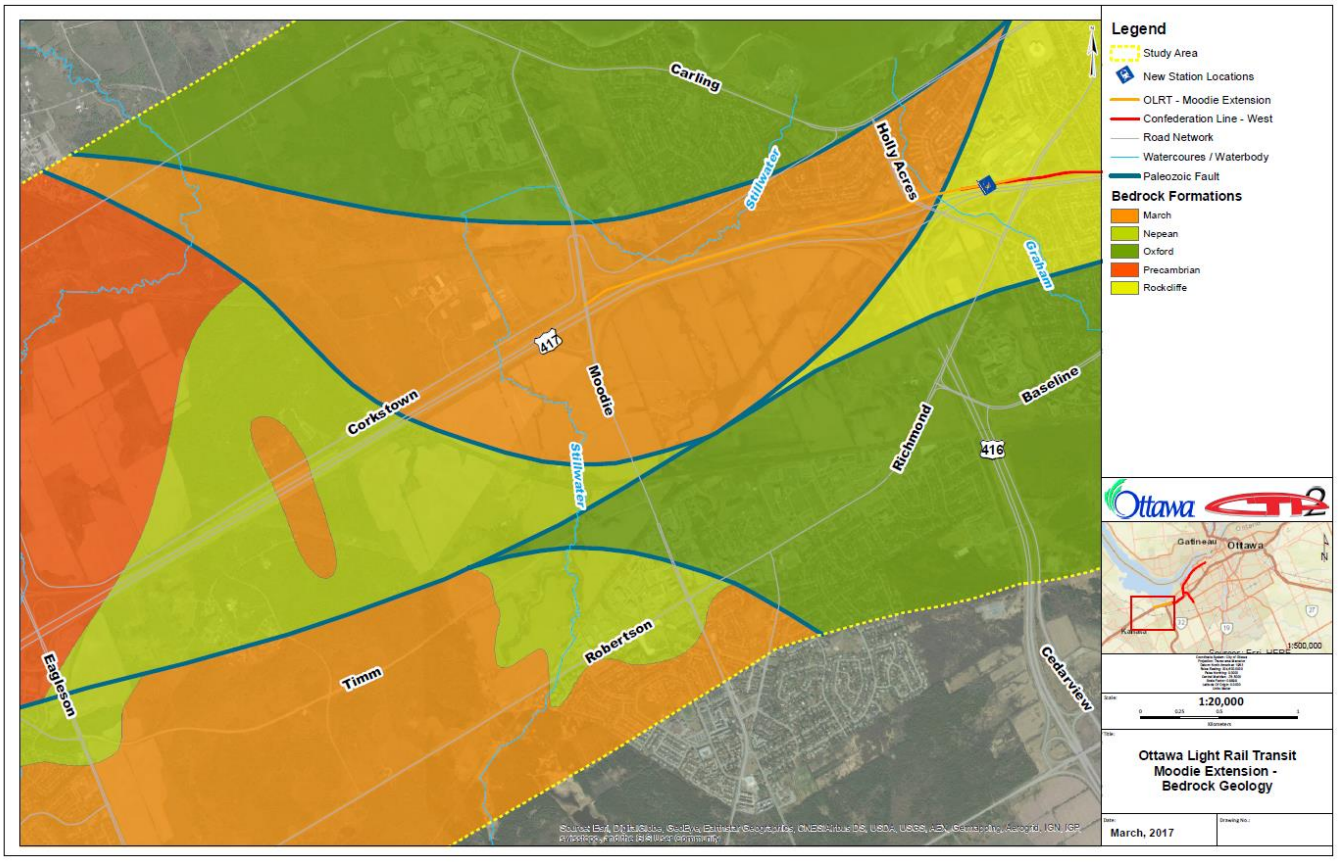


Figure 4-15: Geological Faults

4.5.4.2 Groundwater

As described in the WTE EA, Table 4-1 below outlines the groundwater levels recorded at different locations within the study area (MRC, 2012).

Table 4-1: Groundwater Levels within the Study Area

Location	Groundwater Levels (m.b.g.s.)
Holly Acres Road	2-7
Graham Creek Tributary Culvert	2-5
West of Graham Creek Tributary Culvert to East of Transit Station	0-3
Transit Station	1-2
Moodie Drive Crossing	1-3

4.5.4.3 Contamination and Hazardous Materials

The Historical Land Use Information (HLUI) is collected and has been provided by the City of Ottawa. HLUI is defined based on a listing of activities according to the 1980 Canadian Standard Industrial Classification, where the activity conducted on a property was considered to have the potential to contaminate that property. The HLUI was developed based solely on historical land use activities and does not contain any information on actual property condition normally determined through the environmental site assessment (ESA) process and/or site remediation. The inclusion of a property in the HLUI does not necessarily mean that property is contaminated, simply that is has a possibility or likelihood of contamination.

Figure 4-16: Historical Land Use Information, demonstrates parcels that have been registered to the HLUI within the general study area.

Figure 4-16: Historical Land Use Information

4.6 Key Constraints

Based on the collation of the existing conditions, there are several key factors / constraints that need to be considered. These are illustrated in the following 2 figures.

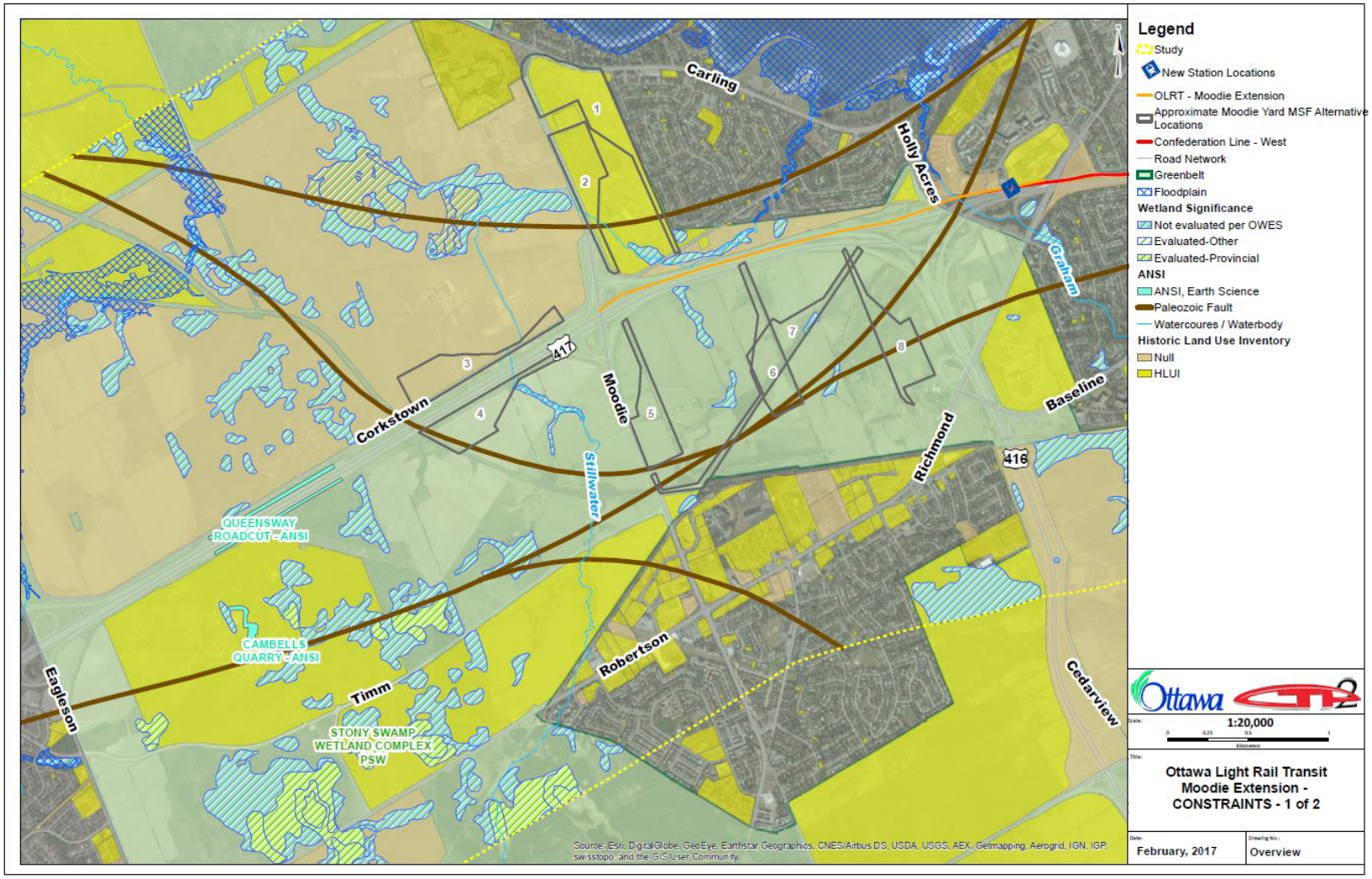


Figure 4-17: Key Considerations 1 of 2

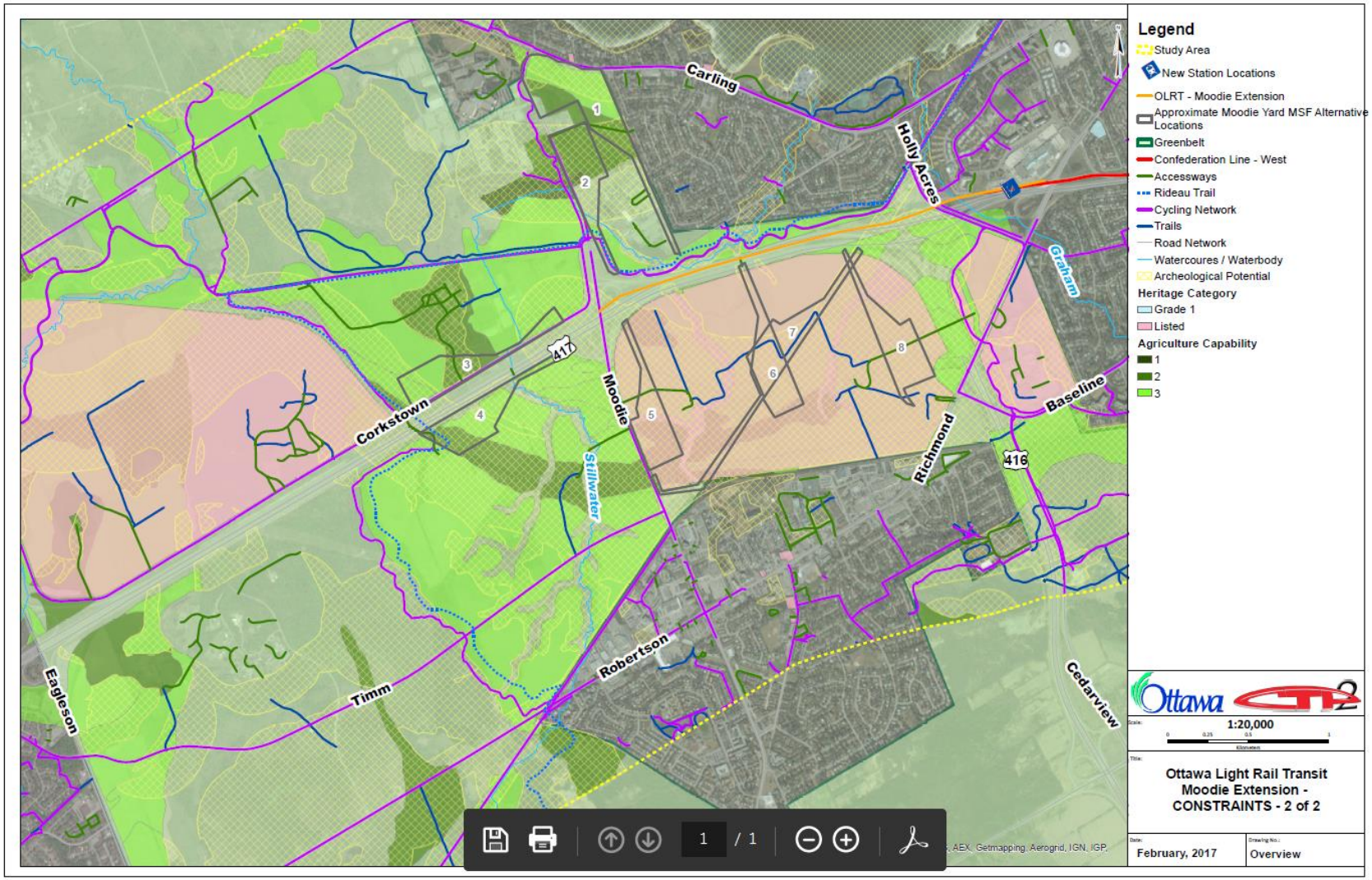


Figure 4-18: Key Considerations 2 of 2

5. DEVELOPMENT AND EVALUATION OF ALTERNATIVES

The Moodie LRT consist of 2 principle components: conversion of the existing BRT to LRT; and the LMSF.

5.1 Moodie BRT Corridor

The previous West Transitway Extension EPR identified a corridor and alignment for BRT between Bayshore Station and Moodie Drive, with a new station located east of Moodie Drive, adjacent to Corkstown Road. This study considers changes necessary to support the conversion to LRT technology, including a redesign of the proposed Corkstown Station to support BRT/LRT transfer facilities. No alternative corridors were examined. Modifications required to support the conversion will include an assessment of the following components and identification of any required modifications:

- LRT alignment requirements;
- Grade separation at Holly Acres (separate EPR);
- Corkstown Station design;
- Bayshore Station (Separate EPR);
- Parallel Multi-use Pathway facilities;
- Traction power supply;
- Drainage and stormwater management; and,
- Impact Assessment and mitigation.

5.1.1 Station Locations

Two main options for potential station locations were considered within certain parameters required by the project. Functional requirements were identified to support the bus facilities and the Moodie LRT station. The bus facilities/passenger pick up and drop off (PPUDO) requirements included:

- 9 bus platforms;
- Fare paid bus terminal;
- 14 lay-by spaces;
- Bus operators building; and,
- 4 PPUDO spaces to provide for local community needs.

The requirements for the Moodie LRT station itself included:

- Common Look and Feel as Stage 1;

- LRT platform (initially 90 metres in length, protection for 100 metres);
- Likely a side platform station but City will leave this to contractor to decide;
- Redundant elevators;
- Escalators serving the entrance and platforms;
- 4 PPUDO spaces to provide for local community needs;
- LRT Operator facility;
- LRT support service facilities;
- Fare paid entrance;
- Emergency exit facilities; and,
- Public washrooms.

Figure 5-1 provides an overview of the station options considered as part of the evaluation:

Figure 5-1: Moodie LRT Station Options

Table 5-1: Station Location Evaluation

Criteria	Option 1 – East of Moodie	Option 2 – West of Moodie
Connectivity (pedestrians and cyclists)	Provides a direct connection from the existing NCC Trail to the Station entry. Proximity to residential community to the northeast and office complex to the north, and is within the 600 m walking distance radius. Crossing Moodie is required to connect the Station and DND complex to the northwest.	New MUP and sidewalks required to provide connection to Station, with existing on-road cycling facilities. Offset from the adjacent residential community to the northeast with no residential or office zoning within 600 m walking distance of station. Direct connection to DND campus (do not have to cross Moodie Drive), however, farther distance.
Preferred	✓	
Road Network Modifications	Same in both station scenarios. To accommodate a station site east of Moodie Drive, approximately 560 m of the existing Corkstown Road will need to be realigned.	Same in both station scenarios. To accommodate a station site west of Moodie Drive approximately 500 m of Corkstown Road will need to be realigned.
Preferred	✓	✓
Bus travel time, quality of service, bus transfers and commuter parking	Assumes all buses must access Moodie Station via Corkstown Road. For Kanata BRT services, distance is 1.2 km for inbound; 800 m for outbound. For DND transit service, distance is 1.4 km (inbound and outbound). Inbound buses require left-turn across Moodie to access station. There is some potential with MSF Site 4 that the planned inbound bus access driveway from Moodie Drive could be retained, reducing inbound bus travel distance to 800 m. The BRT platforms can be configured to provide cross-platform connections between buses and trains using the north track. Bus lay-up activity can be accommodated within the terminal area. Station configuration constrained by limited site. Potential Park and ride and PPUDO are distant from	Assumes inbound buses can access the LRT station via a new transit-only connection forming a 4th (west) leg at the Moodie/Hwy 417 westbound off-ramp intersection. For Kanata BRT services, distance is 800 m for inbound, with direct access assumed to the Highway 417 on-ramp (negligible travel distance). Inbound buses require left-turn across Moodie to access station. For DND transit service, distance is 1.6 km (inbound and outbound). The BRT platforms can be configured to provide cross-platform connections between buses and trains using the north track. Bus lay-up activity can be accommodated within the terminal area. PPUDO facility would be located adjacent to station entrance. Able to optimize station configuration for bus to

	LRT station.	potential Park and ride, PPUDO access. Best option for bus access and commuter parking.
Preferred		✓
Land Use	Impact to soccer fields due to Corkstown re-alignment.	Impact to Wesley Clover Park to facilitate station facilities such as bus laybys and PPUDO
Preferred	✓	
Views and vistas	Combination of existing roadway network, including Moodie Drive overpass, reduces the visual impact of the Station from Hwy 417, the Capital Arrival & Scenic Entry route.	Location of Station has higher visibility from the Capital Arrival and Scenic Entry on Hwy 417.
Preferred	✓	
Station Catchment Area	Some employment/residential within 600 m Potential redevelopment/intensification on Abbott lab site.	No employment/residential within 600 m Potential to directly serve special events at Wesley Clover Park
Preferred	✓	
Overall preferred	✓	

A future east side Moodie Station location was identified through this evaluation as the preferred option for several reasons, including:

- Some re-use of existing BRT facilities;
- Bundling of infrastructure;
- Provides better connection to NCC trails;
- More accessible to the residential community and Abbott Point of Care based on the 600 metre catchment area;
- Shorter distance for DND transit service;
- Less impact on views and vistas/lower visibility for “capital arrivals”; and,
- Lower impact on existing land uses.

The reconfiguration required for Corkstown Road was similar in all options (either west of Moodie or east of Moodie), and therefore was not a deciding factor.

5.2 Moodie Park & Ride

With the approval of the Stage 2 Implementation report, a motion was approved to direct staff to consider a park and ride at the future Moodie LRT station.

Subsequent review has resulted in not recommending a new large park and ride lot at this location for several reasons, including:

- Lack of space immediately adjacent to Moodie LRT station;
- A parking deck would likely be required given space constraints;
- Parking deck may be underutilized once LRT is extended to Kanata, with the potential for significant throw away capital costs; and,
- Would encourage additional traffic across the Greenbelt and is contrary to City and NCC policy.

However, there is the potential to provide a limited/short term paid (“Gold Permit”) park and ride re-using the existing Abbott Point of Care surface lot **if** unused spaces are available. Discussions to assess the feasibility of implementing this additional parking will continue to be explored through the in-market period and a final recommendation will come before Committee and Council at the time of the Confederation Line Extension contract award. No new park and ride facilities are planned to be constructed.

5.3 LMSF Alternatives

5.3.1 Guiding Principles

To support future rail operations on the Confederation Line (including the Stage 2 East and West extensions, with consideration of the future extension of the line to Kanata) a new LMSF is required. A LMSF site selection will be undertaken to identify potential LMSF sites in the vicinity of Moodie Drive.

Updated fleet requirement information is needed to determine the size and specific design requirements of the LMSF. Updated fleet requirements will be developed based on the following operational scenarios:

- Stage 2 Opening Day (Bayshore/Baseline – Trim);
- Stage 2 Opening Day (with LRT extension to Moodie);
- 2031 (with LRT extension to Moodie);
- 2031 (with LRT extension to Kanata); and
- 2048 (with LRT extension to Kanata).

The site selection process includes sites along the proposed extension from Bayshore to Moodie Drive. Should an appropriate site not be identified in the vicinity of the proposed terminus at Moodie Drive, the LMSF component of this study could be deferred and included in the scope of work for the Kanata LRT Extension EA currently underway.

This process includes:

- Identify MSF Design Requirements;
- Develop Alternative Sites;
- Select Selection;
- Preferred Site; and
- Impact Assessment and Mitigation.

5.3.2 MSF Design Requirements

Maintenance facilities typically consist of a covered building which contains a repair area, an overhead crane, workshops, offices, control centre, maintenance pits, train wash and painting area. The building has a number of service tracks running through the building which permits vehicles to exit normal service and to be stabled inside the building.

The number of vehicles within the building and the space required is dependent on the expected maintenance requirements of the vehicles. A storage yard is required to provide an area in which the vehicles can be stored safely in a protected environment and maintains ease of access for daily cleaning activities, routine safety checks, advertising changes and minor maintenance activities.

For reasons of safety, the facility requires a separate electrical system to that of the main line. The Traction Power Sub-Station (TPSS) provides this local power and will be of sufficient size and configuration to ensure that a number of vehicles can operate simultaneously within the yard area and also to provide power to the maintenance facility building. To prevent public access, the maintenance facility and yard area will be enclosed within a secure perimeter fence.

Table 5-2: Calculation of Western MSF Required Capacity

Source of Forecast	Belfast Capacity		Belfast Plus Baseline Capacity		Estimated Fleet Size Trim / Kanata / Baseline (3)			Belfast Only – Western MSF Required Yard Size			Belfast Plus Baseline Capacity – Western MSF Required Yard Size		
	A(1)	B(2)	A(1)	B(2)	2023	2031	2048	2023	2031	2048	2023	2031	2048
Unsmoothed, +5% peak point capacity	62	66	84	94	112	126	138	46-50	60-64	72-76	18-28	32-42	44-54
Unsmoothed, +10% peak point capacity	62	66	84	94	122	134	148	56-60	60-68	82-86	28-38	40-50	54-64
Unsmoothed, +15% peak point capacity	62	66	84	94	126	148	160	60-64	82-86	94-98	32-42	54-64	66-76

1. 62 vehicle capacity at Belfast/22 vehicle capacity at Baseline
2. 66 vehicle capacity at Belfast/28 vehicle capacity at Baseline
3. Based on fleet size calculations by Tim Potens dated October 24, 2016. Fleet size calculations based on C. Wheeler e mail dated Oct 19 ,2016 which are based on +5 %,+10 % and + 15 % increases in peak point ridership attributable to the Kanata LRT extension

As indicated in Table 5-2 the fleet size to 2048 has been estimated with a Kanata LRT extension, as well as various impacts on the size of the vehicle fleet.

As a comparator, the Woodroffe MSF site search was based on accommodating 96 vehicles (24,000 passengers per hour per direction (pphpd), 62 at Belfast) and was later reduced in size to 81-87 vehicles based on a more detailed fleet evaluation, which happened after the site selection work was completed.

The 5, 10 and 15 % increase in peak point ridership attributable to the Kanata LRT was somewhat arbitrary based on multiplying the percentage increase in peak point ridership attributable to the Moodie extension by a factor of 2-7 times

to reflect the impact of the Kanata LRT. An alternative assessment considered the 4100 passengers that arrive at Bayshore and the resulting peak point increase in ridership attributable to Kanata LRT from these riders. Based on this approach, the impact of the Kanata LRT on peak point ridership was approximately 1600 passengers per hour in 2031 which represents a 12% increase in peak point ridership in 2031 compared to the July unsmoothed forecast (Trim - Moodie). As a result, the worst case assumption of a 15% increase in peak point ridership was determined to be reasonable and was utilized as the approach for site search purposes.

5.3.2.1 Facility Operations

Turnaround Loops: A turnaround loop is beneficial for continuous and efficient operation and localized testing of the Light Rail Vehicle (LRV) and its associated systems.

Municipal Services, Utilities and Power: The LMSF and yard area require adequate drainage and positioning away from flood areas so as to: minimize track corrosion and track bed degradation; maximize safety of personnel from ice build-up in the winter or flooding during snowmelt and rainstorms; and prevent potential shock hazards from electrical system failure.

Efficiency: Road access is required for delivery of consumables and the retrieval of waste products generated by maintenance. The choice of site also needs to consider the location of the various M&S facility components to ensure that they are suitably located to maximize the efficiency of daily internal operations.

Track Redundancy and Reversal: The area provided should allow a design and layout of the LMSF Trackwork that will not block or hinder the movement of LRVs in the event of an LRV failure.

5.3.2.2 System Operations

System Connectivity: (Proximity to the intended new line): The ideal location for the LMSF is as close to the proposed alignment as possible. Of important note is the potential location of the facility near a station, which provides major benefits and efficiencies during commissioning.

Efficiency: Close proximity to the proposed alignment is also beneficial because it prevents additional wear and tear on vehicles, reduces maintenance schedules, and also minimizes non-revenue ‘dead-heading’ movements of trains.

Freight Rail Connectivity: The positioning of the LMSF should take into account the potential delivery of equipment and vehicles by rail, if feasible.

5.3.3 Alternative LMSF Sites

Alternative LMSF locations identified using the following site characteristics for a site within 750m of the main line:

Site Characteristics

- **Topography and Grade**

  The maintenance 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.

- **Land Use Compatibility**

  The land chosen for the site would require the appropriate zoning to ensure ease of planning and acceptance by the public.

- **Expansion Capability**

  The land chosen for the site would ideally be a single area of 16 ha and not several disconnected parcels of land. Some sites may be examined that are smaller than this given unique development potential, such as connections with existing facilities.

- **Environment**

  *Social: C*onsideration the effects to local residents (noise, vibration, visual, lighting) but also unauthorized access to the facility for reasons of safety and security.

  Biological: Any choice of site should minimize the impact on its natural environment.

  Physical: The selection of the site will require analysis to ensure that any faults, if present, are dormant.

  A further important aspect of the site selection process is the proximity to floodplains and the possibility of flooding.

Facility Operations

- **Turnaround Loops**

  A turnaround loop is beneficial for continuous and efficient operation and localized testing of the Light Rail Vehicle (LRV) and its associated systems.

- **Municipal Services, Utilities and Power**

  The MSF and yard area require adequate drainage and positioning away from flood areas so as to: minimize track corrosion and track bed degradation; maximize safety of personnel from ice build-up in the winter or flooding during snowmelt and rainstorms; and prevent potential shock hazards from electrical system failure.

- **Efficiency**

  Road access is required for delivery of consumables and the retrieval of waste products generated by maintenance. The choice of site also needs to consider the location of the various M&S facility components to ensure that they are suitably located to maximize the efficiency of daily internal operations.

- **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 LRVs in the event of an LRV failure.

Systems Operations

- **System Connectivity** (Proximity to the intended new line)

  The ideal location for the MSF is as close to the proposed alignment as possible. Of important note is the potential location of the facility near a station, which provides major benefits and efficiencies during commissioning.

- **Efficiency**

  Close proximity to the proposed alignment is also beneficial because it prevents additional wear and tear on vehicles, reduces maintenance schedules, and also minimizes non-revenue 'dead-heading' movements of trains.

- **Freight Rail Connectivity**

  The positioning of the MSF needs to take into account the potential delivery of equipment and vehicles by rail, if feasible.

Costs

- **Capital Costs**

  The capital cost of the site is dependent upon the civil work expected and will vary with topography and location.

  Additional capital costs include the relocation of utilities and services, demolition, soil remediation, grading costs, landscaping, natural habitat reinstatement, road and pathway relocation, and reconstruction of roads.

- **Operating and Maintenance (O&M) Costs**

  To reduce the overall operational and maintenance costs, the layout of the MSF yard is critical to ensure maximum operational efficiency.

- **Property Ownership and Acquisition**

  The sites chosen should reflect the lowest acquisition cost for the designated zone. The purchase of separate parcels of land from multiple owners is complex and should be avoided if possible.

  Based on broad these principles 8 sites were identified that could reasonably accommodate the design requirements of the LMSF (Figure 5-2)

Figure 5-2: Candidate LMSF Sites

5.3.4 Site Selection

Site evaluation criteria have been developed according to four main categories of site attributes: Site Characteristics; Facility Operations; System Operations; and Costs and are consistent with those characteristics used in the evaluation of Confederation Line West.

5.3.4.1 Selection of Short-listed Sites

Site evaluation criteria were developed to screen the alternative sites based on desk top information, to develop a short list to be subject to additional investigations and evaluation. The evaluation criteria are described below based on four primary categories.

Table 5-3 : LMSF 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 access to the MSF
Agricultural capacity	Minimizes effects on Class 1-3 agricultural lands or land under active use
Transportation network	Minimizes effects on existing and future transportation network.
Pedestrian/cyclists	Minimizes effects on existing and future pedestrian movements
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
Impacted Materials	Minimizes potential to encounter impacted materials
Key terrestrial features	Minimizes effects on key terrestrial systems and features
Key aquatic features	Minimizes effects on key aquatic systems and features
Geological faults	Avoids areas of active faults
Flood risk	Lowest proximity to floodplains and the possibility of flooding
Facility Operations	
Expansion Capability	Ability to stage/expand facility
MSF Site Servicing	Access to Municipal Services, Utilities and Power Extent of reuse of existing infrastructure
Existing services	Minimizes conflicts with Municipal Services, Utilities and Power
Road access	Maximizes accessibility for, to, and from the MSF
Efficiencies during commissioning	Closest proximity to the proposed alignment as possible
LRT Station location	Ease of connection to future LRT station/mainline and BRT integration
BRT Station location	Maximizes integration with BRT station
Economics	
Capital Costs	Minimizes class D construction cost estimate
Property Ownership and Acquisition	Minimizes costs based on land use types and number of property owners

The following descriptions were used for the purposes of consistency in the following qualitative review of LMSF alternative locations.

Table 5-4: Evaluation Terminology

	Terms describing:		Definitions
	Negative Impacts	**Positive Impacts (i.e., Benefits)**	
Best meets criteria	Minor/ Low	Greatest	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. Greatest compliance, contribution or benefit.
Somewhat meets criteria	Some/Moderate	Good	The impact exists and is of relatively low magnitude. Provides a moderate effect or contribution or benefit.
Does not meet	High/Major	Limited	The impact exists and has an effect that is relatively large, or has the most impact when compared to other alternatives. Little to no contribution.

LMSF Option #1 (East of Moodie, near Carling):

Social Environmental Characteristics

Immediately adjacent to existing community; highest potential for disruption.

Major noise impacts likely and potential for some vibration impacts, particularly with the multitude of track switches in close proximity to several residential properties on Ullswater Drive and Solva Drive. Also adjacent to Crystal Bay Centre for Special Education. Potential for residual noise impacts even with extensive mitigation measures.

Corkstown Road will need to be grade-separated (assume road over rail) at yard lead. This would impact the existing Abbott Point of Care facility intersection with Corkstown, requiring relocation or elimination. A minor realignment of existing internal driveway for Abbott facility would be required, with potential impact on parking area. Assume trackage beyond Moodie Station is not required, therefore no impact to proposed BRT access to/from Moodie Drive being built as part of the BRT project.

Existing NCC Capital Pathway would need to be grade-separated across yard lead or realigned to cross via Corkstown Road. Impact to rural character of the pathway experience will result.

Situated on Class 2 and 3 Agricultural lands with existing agricultural uses.

Interrupts accessways.

Disruption of existing agricultural land uses, however no effect on facilities.

Partial archaeological potential.

No impact on built heritage resources or cultural landscapes.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that the site is underlain by relatively compressible silty clay overlying relatively dolostone bedrock of the Oxford formation at depths ranging from about 5 to 25 m. The rock is relatively deeper over the centre as compared to the areas near the site limit. The relatively compressible clay may result in higher costs for structure foundations since piling may be required. There is also a potential that ground improvement (such as preloading or ultra-lightweight fills, for examples) could be required if grade raise heights exceed 1 m.

Geological Faults – The published information does not indicate that there any geological faults crossing the site.

Key Aquatic Features – Major impact to the main channel of Stillwater Creek as the lead track will need to cross the channel at the junction with mainline tack. Impacts may result from watercourse crossing footprint or channel realignment.

Key Terrestrial Features – within moist grassland area which may contain sensitive grassland birds, and one threatened SAR – Western Chorus Frogs. Adjacent forested area thus provides diversity of habitats.

Impacted Materials- Proposed site is a historical Land Use Inventory (HLUI) identified property and is adjacent to Nortel land uses. Current and former land uses have or had the potential to cause contamination in the soil, groundwater or surface water. Therefore, potential to encounter impacted material is relatively high.

Facility Operations

The site has good access from Carling Avenue. Operations needs are met for the current fleet size, however future expansion would be difficult at best.

LRT Station location could function in the vicinity of the current location of the BRT Station. Station Location Options 1 and 3 are compatible with this LMSF location; No station impact for future extension of LRT directly to the west. Proposed roadway site access to Carling Avenue is acceptable. Secondary access can be provided to private roadway serving Abbott Point of Care facility.

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Conceptual ladder track design limits operating flexibility and may be subject to single-point failure. Hand-off of trains would be remote from Administration building

Mainline Access: Single access route to/from mainline restricts operating flexibility. Length of yard lead track may require a second crossover to improve operational flexibility. Assuming that the LRT Station is west of the Yard Lead, westbound trains serving Corkstown as a terminal station require a reversing move on the mainline from Corkstown back to yard, running reverse against westbound traffic.

Requires a lengthy lead track from the main line and a grade crossing. The grade crossing would require the realignment and construction of the access road (driveway) to the Crystal Bay Centre for Special Education to meet public safety requirements.

Utilities

Water, sewer and telecom services are close and available on Carling Avenue. Gas service can be accommodated from Moodie Drive. The LMSF would have a considerable power demand and there is only one option for connection where primary power supply can would be provided via a 44 kV overhead line near the intersection of Moodie Dr. and Corkstown Rd. There would be no major existing utility relocations required for this option.

Property Ownership and Acquisition

There is one implicated property, owned by NCC. The NCC property is partially leased office. No structures appear to be impacted based on 2014 aerial photography.

LMSF Option #2 (East of Moodie, north of soccer fields):

Social Environmental Characteristics

Close proximity to existing residents with some potential for disruption.

Potential for major noise impacts to residential properties on Ullswater Drive and Solva Drive, as well as Crystal Bay Centre for Special Education. Noise mitigation will likely be required.

Access restrictions will be required; Access and egress from Abbott Point of Care will need to be highly altered/restricted.

Corkstown Road will need additional realignment to avoid yard lead/mainline junction – assume road would cross over tracks.

NCC Capital Pathway will need to be realigned to cross over yard lead with on separate bridge or on realigned Corkstown Road.

Impact to BRT access to/from Moodie Drive being constructed as part of Transitway extension would be expected.

Partially situated on Class 2 Agricultural lands without existing agricultural uses.

Does not interrupt pedestrian/cycling network.

Peripheral disruption to land use; minor disruption to facilities (access).

Partial archaeological potential.

No impact on built heritage resources or cultural landscapes.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that the site is underlain by relatively incompressible sands and glacial till overlying dolostone bedrock of the Oxford formation at depths ranging from about 1 to 5 metres (from south to north). Structure foundations may potentially be supported on shallow foundations.

Geological Faults – The published information does not indicate that there any geological faults crossing the site.

Key Aquatic Features – Major impact to the main channel of Stillwater Creek as the LMSF tracks will need to cross the channel between Moodie Drive and Abbott Point of Care centre. Impacts may result from watercourse crossing footprint or channel realignment.

Key Terrestrial Features – within Stillwater Creek floodplain and ravine, with several regionally significant features and forested corridor. Adjacent moist grassland area may contain sensitive grassland birds. One threatened SAR – Western Chorus Frogs is within 300 m of the site. Adjacent forested area thus provides diversity of habitats. Low potential to support SAR Bat maternity roosting.

Impacted Materials - The proposed site is a HLUI identified property and current or former land uses have or had the potential to cause contamination. Potential sources of contamination include: a former rail line in the southern extent of the proposed site, running northeast to southwest, and former activities associated with the industrial park at 185 Corkstown Road (formally occupied by Nortel). Volatile organic compound (VOC) impacts were discovered at the industrial park, and was remediated in 2004 to MOECC standards. Potential to encounter impacted material is relatively high.

Facility Operations

Site access off of Moodie Drive is good. This option requires three grade crossings for the westbound yard lead at considerable cost. The yard storage could be doubled and the shop is also expandable, but most probably to only 150% of its current capacity. Expansion would require purchase of additional lands in the vicinity of the baseball and soccer pitches.

LRT Station location could function in the vicinity of the current location of the BRT Station. Station Location Options 1 and 2 are compatible with this MSF location; No station impact for future extension of LRT directly to the west.

Proposed site access to Moodie Drive does not meet intersection and access design guidelines. Access can be shifted further north, though it would no longer line up with existing signalized intersection, and be in conflict with existing Crystal Bay Centre for Special Education driveway.

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Conceptual ladder track design limits operating flexibility and may be subject to single-point failure. Hand-off of trains would be remote from Administration building

Mainline Access: Single access route to/from mainline restricts operating flexibility. Westbound trains able to serve Moodie station and then proceed directly into yard. Final mainline crossover location will determine impact of eastbound trains leaving LMSF. Current crossover location requires eastbound leaving trains to run reverse against traffic through the station, potentially conflicting with westbound trains and creating passenger confusion at this side-platform station. Consideration can be given to locating right-handed single crossover between eastern yard lead turnout and station platform.

Utilities

Most services are available on Moodie Drive including water, hydro, gas and telecom. A new sanitary sewer would need to be built connecting to the 900 mm trunk near the intersection of Corkstown and Moodie. Primary power supply can be provided via a 44 kV overhead line near the intersection of Moodie Dr. and Corkstown Rd. There would be no major existing utility relocations required for this option.

Property Ownership and Acquisition

There is one implicated property, owned by NCC. The NCC property is leased office. No structures appear to be impacted based on 2014 aerial photography.

LMSF Option #3 (West of Moodie north of Queensway):

Social Environmental Characteristics

Removed from adjacent residential communities.

Low impact for disruption to existing residents.

Noise and vibration impacts likely to be low.

Access and egress from Equestrian Park will need to be altered.

Requires two new rail/road crossings of Corkstown Road.

Potential impact to CN Beachburg Spur if LRT mainline and yard are at existing grade. Can be addressed through relocation of proposed west yard lead.

Extension of mainline LRT track will impact BRT access to/from Moodie Station to be constructed as part of Transitway project.

No impact to pedestrian/cycling network – assume existing paved shoulder facility on Corkstown Road will be maintained.

Situated on Class 2 and 3 Agricultural lands without existing agricultural uses.

Major disruption of Equestrian Park; moderate disruption to facilities .

Partial archaeological potential.

No impact on built heritage resources or cultural landscapes.

Facility Operations

Access to Corkstown does not meet intersection and access design guidelines. Westbound lead is not ideal and requires a reverse move to depart from the yard to the west. This condition could be corrected with purchase of additional lands to accommodate a loop track to the northeast, in association with the tail track. The property in question is currently utilized by Wesley Clover Parks. Addition of this loop would also solve the internal operational problem of having LRVs comingling with rubber tired vehicles and, while this geometry would improve site access for large delivery vehicles, it would not improve the less than desirable proximity to the (presumed) at-grade crossing of the western lead. Access can be shifted further west especially if grade separation of yard access track/Corkstown is required. Secondary access to Corkstown can be provided at east end of site.

LRT Station location could function in the vicinity of the current location of the BRT Station. All Station Option Locations are compatible with this LMSF location; No station impact for future extension of LRT directly to the west.

Utilities

Servicing on Corkstown Road includes water and Telecom. Gas service would need to be connected to the main on Moodie Drive which is approximately 1 km away. Primary power supply can be provided via a 44 kV overhead line near the intersection of Moodie Dr. and Corkstown Rd. This location has the LMSF building footprint over the existing 900mm Nepean Collector sewer, which would require its relocation. Sanitary service could be provided at the relocated collector sewer.

LMSF Option #4 (West of Moodie/Regional Road 59 south of Queensway):

Social Environmental Characteristics

Removed from adjacent residential communities.

Low impact for disruption to existing residents.

Noise and vibration impacts likely to be low.

Limited access restriction will be required.

Requires crossing of Highway 417 with yard tracks. Proximity and angle of crossing of westbound highway lanes will impact design and cost of crossing.

Lengthy site access roadway from Moodie Drive.

Situated on Class 2 and 3 Agricultural lands with existing agricultural uses.

Does not interrupt pedestrian/cycling network.

Disruption of existing agricultural land uses, however no effect on facilities.

Partial archaeological potential.

No impact on built heritage resources or cultural landscapes.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that most of the site is underlain by relatively compressible silty clay, although a small part of the central portion of the site may be underlain by sand and glacial till. The sand, till and clay is indicated to overlie relatively sandstone and dolostone bedrock of the March formation at depths ranging from about 5 to 10 metres. Structures could potentially be founded on shallow foundations or may need to be supported on piles. There is also a potential that ground improvement (such as preloading or ultra-lightweight fills, for examples) could be required if grade raise heights exceed 1 m, particularly along the entrance alignment to this option and at the west end of the site.

Geological Faults – The published information does not indicate that there are any geological faults crossing the site.

Key Aquatic Features – Major impact to main channel of Stillwater Creek as the LMSF tracks and access road will need to cross the channel south of Highway 417 and will impact tributary of Stillwater Creek that is located parallel to Highway 417. Impacts may result from watercourse crossing footprint or channel realignment.

Key Terrestrial Features – within agricultural area, adjacent treed creek. No known key habitats, but creek may provide wildlife corridor.

Impacted Materials - Land use for proposed site is agricultural, therefore environmental impacts associated with pesticide is possible. Potential to encounter impacted material is relatively low.

Facility Operations

Provides good access to and from the mainline under all operational scenarios. The yard storage could be doubled and the shop is also expandable to match the storage capacity.

Roadway access to Moodie Drive does not meet intersection and access design guidelines (too close to a freeway off ramp terminal). Can be adjusted through design, likely requiring additional property/impact to agricultural land. Secondary road access difficult to provide (potential emergency access to Corkstown Road via Capital Pathway under Highway 417).

LRT Station location could function in the vicinity of the current location of the BRT Station. This LMSF site is compatible with Station Options 1 and 2; No station impact for future extension of LRT directly to the west.

Utilities

There are no services close to this location. Servicing for water, hydro, gas and telecom would come from Moodie Drive north of Highway 417 and would increase costs greatly. Just like option 3 this site is located on top of the existing 900mm Nepean Collector which could service the facility, but would need some relocation.

Operations & Maintenance

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Hand-off of trains would be remote from Administration building

Mainline Access: Single access route to/from mainline restricts operating flexibility. Mainline connections and crossovers allow for pull-ins and pull-outs in any direction while minimizing potential interference with mainline operation. Requires construction of a complex grade separation over or under Highway 417. This option also requires the construction of the longest access road and utility distribution and, as noted above, does not resolve site access from Moodie Drive and the off ramp from Highway 417.

Property Ownership and Acquisition

There are two implicated properties, owned by NCC and MTO. The NCC property is leased agriculture. No structures appear to be impacted based on 2014 aerial photography.

LMSF Option #5 (East of Moodie/Regional Road 59, south of Queensway):

Social Environmental Characteristics

Close proximity to single existing residence; some potential for disruption.

Potential for major noise impacts requiring noise mitigation. Vibration impacts likely to be low.

Access restrictions will be required; Access and egress from single residence will need to be altered.

Requires crossing of Highway 417 and interchange ramps. Location of junction with mainline is sufficient distance north of highway to reduce crossing complexity.

Yard lead cuts off BRT access from Moodie Drive being built as part of BRT project.

Does not interrupt pedestrian/cycling network.

Situated on Class 3 Agricultural lands with existing agricultural uses.

Disruption of existing agricultural land uses, minor disruption facilities (access). Creates land locked parcels.

Partial archaeological potential.

The barn complex at Silver Springs Farm is a Federally Recognized Heritage Building. The facility and access road disrupt the continuity of the larger farm setting, which should be evaluated as a Cultural Landscape. The property has very high local significance and should be avoided.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that the site is underlain by relatively compressible silty clay overlying strong sandstone and dolostone bedrock of the March formation at depths ranging from about 5 to 15 m. The rock is relatively deeper over the centre as compared to the site limits of the MSF. The relatively compressible clay may result in higher costs for structure foundations since piling may be required. There is also a potential that ground improvement

(such as preloading or ultra-lightweight fills, for examples) could be required if grade raise heights exceed 1 m.

Geological Faults – The published information does not indicate that there are any geological faults crossing the site.

Key Aquatic Features – Moderate impact to tributary channel of Stillwater Creek as the LMSF will be positioned across the tributary with potential low/indirect impacts to main channel of Stillwater Creek. Impacts may result from watercourse crossing footprint or channel realignment.

Key Terrestrial Features – within agricultural area, adjacent small watercourse. No known key habitats, and currently impacted by Highway 417 and Moodie.

Impacted Materials- Land use for proposed site is agricultural, therefore environmental impacts associated with pesticide use is possible. Potential to encounter impacted material is relatively low.

Facility Operations

The yard storage could be doubled and the shop is also expandable, but most probably to only 150% of its current capacity. Yard ladder and lead arrangement provide maximum flexibility with no single-point failure. Roadway access to Moodie Drive is acceptable. Secondary access to Moodie can also be provided, or emergency-only access to/from Highway 417 eastbound on-ramp.

LRT Station location may be able function in the vicinity of the current location of the BRT Station though grade separation strategy to cross the Queensway will affect the function and location of the station. Station Location Option One (1) is compatible with this MSF location, Station Options 2 may not be compatible with this MSF Option; No station impact for future extension of LRT directly to the west.

Utilities

There are services located on Moodie Drive for water, sewer and telecom close to this location. Servicing for gas is located either north of Highway 417 on Moodie Drive or south at Fitzgerald Road. Like previous options the existing 900mm Nepean Collector could service the facility, but would need some relocation. Power supply would remain as originating north of Highway 417 and would escalate costs over locations north of the highway.

Operations & Maintenance

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Conceptual ladder track

design limits operating flexibility and may be subject to single-point failure. Hand-off of trains would be remote from Administration building

Mainline Access: Single access route to/from mainline restricts operating flexibility. Conceptual location of mainline crossover west of Corkstown Station requires moderate reverse running on the mainline for westbound trains serving Moodie station. Main line access requires the construction of modification of existing BRT structures to accommodate the crossing of Highway 417 and navigating the westbound Highway 417 onramp. Consideration can be given to the addition of turnouts for the yard leads. Access to the agricultural property to the east is cut off and would have connection, if track geometry allows. Yard leads appear to be reconstructed along with rerouting utilities serving the property elevated over Highway 417/Moodie Drive Interchange. Steep grades coming into yard can be problematic.

Property Ownership and Acquisition

There are two implicated properties, owned by NCC and MTO. The NCC property is leased agriculture. No structures appear to be impacted based on 2014 aerial photography.

LMSF Option #6 (Far East of Moodie/Regional Road 59, south of Queensway):

Social Environmental Characteristics

Removed from adjacent residential communities; low impact for disruption to existing residents.

Potential for low/moderate noise impacts from main facility and access road to the west.

Limited access restriction will be required.

Requires crossing of Highway 417. Proximity and angle of connection to westbound highway lanes will create complex crossing design.

Lengthy access road from Moodie Drive.

Situated on Class 3 Agricultural lands with existing agricultural uses.

Does not interrupt pedestrian/cycling network.

Disruption of existing agricultural land uses, no disruption to facilities.

Partial archaeological potential.

The barn complex at Silver Springs Farm is a Federally Recognized Heritage Building. The facility and access road disrupt the continuity of the larger farm

setting, which should be evaluated as a Cultural Landscape. The property has very high local significance and should be avoided.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that the site is underlain by relatively compressible silty clay overlying bedrock at depths ranging from about 5 to 10 m. The bedrock over the northern two-thirds of the site is indicated to consist of strong sandstone and dolostone of the March formation while the southern part of the site is underlain by moderately strong sandstone and dolostone with weak shale interbeds of the Rockcliffe formation. The relatively compressible clay may result in higher costs for structure foundations since piling may be required. There is also a potential that ground improvement (such as preloading or ultra-lightweight fills, for examples) could be required if grade raise heights exceed 1 m.

Geological Faults – The published information indicates that that a geological fault crosses the southern third of the site, in a roughly northeast to southwest direction.

Key Aquatic Features – Moderate impact to tributary channel of Stillwater Creek near Highway 417 due to adjacent LMSF lead track and major impact to main channel of Stillwater Creek due to access road. The access road may be able to cross at an existing agricultural crossing, however, crossing upgrades and channel impacts are anticipated as a result of new road. Impacts may result from crossing upgrades and potential channel modifications.

Key Terrestrial Features – within agricultural area, adjacent treed creek. No known key habitats, but creek and wide hedgerow may provide wildlife corridor.

Impacted Materials- Land use for proposed site is agricultural, therefore environmental impacts associated with pesticide is possible. Potential to encounter impacted material is relatively low.

Facility Operations

Location of roadway access to Moodie is acceptable. Secondary access (emergency-only) could be provided from eastbound Highway 417. The access road is considerably longer than for any other scheme except for Option 7, crossing multiple agricultural properties in a way that would make portions of these properties impractical to use. Without significant property purchase, the storage yard and shop capacities could be increased by 150%.

LRT Station location could function in the vicinity of the current location of the BRT Station. All Station Option Locations are compatible with this LMSF location; No station impact for future extension of LRT directly to the west.

Utilities

There are no services close to this location. Servicing for water, hydro and telecom would come from Moodie Drive which is approximately 1km. The closest gas main is either located north of the Highway 417 on Moodie Drive or south at Fitzgerald Road. The existing 900mm Nepean Collector sewer is located south of this location and could provide a sewer service. Servicing this location along with Option 7 are easily the most expensive and difficult of all options. There would be no major existing utility relocations required for this option.

Operations & Maintenance

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Conceptual ladder track design limits operating flexibility and may be subject to single-point failure. Hand-off of trains would be remote from Administration building.

Mainline Access: Single access route to/from mainline restricts operating flexibility. Conceptual location of mainline crossover east of Moodie Station requires lengthy reverse running move for eastbound trains entering yard. Westbound trains serving Moodie station requires moderate distance of reverse running on mainline to yard lead turnout. The geometry of the yard leads as they cross Highway 417 require construction of a complex and extensive structure or structures. The option presently includes lead tracks of moderate length in comparison with other schemes. Through detailed design these could be shortened. In addition, to locating the crossover closer to yard lead connection and the track access costs, the lengthy access road will add to the development cost and will require a drainage structure crossing Stillwater creek. The roadways proximity to the creek (parallel in some places) and its location within the drainage boundary of the creek, suggest that roadway construction costs would be high. Yard leads would be elevated over the Highway 417/Moodie Drive Interchange. Steep grades coming into yard can be problematic.

Property Ownership and Acquisition

There are two implicated properties, owned by NCC and MTO. The NCC property is leased agriculture. No structures appear to be impacted based on 2014 aerial photography.

LMSF Option #7 (West of 416, south of Queensway):

Social Environmental Characteristics

Removed from adjacent residential communities; low impact for disruption to existing residents.

Potential for low/moderate noise impacts from main facility and access road.

Limited access restriction will be required.

Requires crossing of Highway 417. Location of crossing is challenging due to grade differences between Highway 417 and the Highway 416/Highway 417 ramps, the number of structures needed, and proximity of connection to highway.

Lengthy access road from Moodie Drive required.

Situated on Class 3 Agricultural lands with existing agricultural uses.

Does not interrupt pedestrian/cycling network.

Disruption of existing agricultural land uses, no disruption to facilities.

Partial archaeological potential.

The barn complex at Silver Springs Farm is a Federally Recognized Heritage Building. The facility and access road disrupt the continuity of the larger farm setting, which should be evaluated as a Cultural Landscape. The property has very high local significance and should be avoided.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that the site is underlain by relatively compressible silty clay overlying bedrock at depths ranging from about 5 to 10 m. The bedrock is indicated to consist of strong sandstone and dolostone of the March formation. The relatively compressible clay may result in higher costs for structure foundations since piling may be required. There is also a potential that ground improvement (such as preloading or ultra-lightweight fills, for examples) could be required if grade raise heights exceed 1 m.

Geological Faults – The published information indicates that a geological fault crosses just south of the site, in a roughly northeast to southwest direction.

Key Aquatic Features – Moderate impact to tributary channel of Stillwater Creek near Highway 417 due to adjacent MSF lead track and major impact to main channel of Stillwater Creek due to access road. The access road may be able to cross at an existing agricultural crossing, however, crossing upgrades and channel impacts are anticipated as a result of new road. Impacts may result from crossing upgrades and potential channel modifications.

Key Terrestrial Features – within agricultural area, adjacent wide hedgerow. No known key habitats, and currently impacted by Highway 417 and Highway 416.

Impacted Materials- Land use for proposed site is agricultural, therefore environmental impacts associated with pesticide use is possible. An oil spill (220 liters) occurred in 1993, approximately 800 to 900 meters away from the proposed site, at the Holly Acres Road/Highway 417 interchange and soil contamination was confirmed. Potential to encounter impacted material is relatively low.

Facility Operations

Location of roadway access to Moodie Drive is acceptable. Secondary (emergency-only) access to Highway 416 southbound on-ramp could be provided but may be problematic due to roadway geometry. Like Option 6 the access road is considerably longer than for any of the other schemes, crossing multiple agricultural properties in a way that would make portions of these properties impractical to use. Through property purchase, the storage yard and shop capacities could be increased by at least 200%. While it would be longer it might be advisable to construct the access road along the old railroad right of way, thereby avoiding Stillwater Creek. This would also keep the affects to impacted agricultural lands to a minimum.

LRT Station location could function in the vicinity of the current location of the BRT Station. All Station Option Locations are compatible with this MSF location; No station impact for future extension of LRT directly to the west.

The geometry of the yard leads as they cross Highway 417 require construction of perhaps the most complex array of structures of any scheme. The option presently includes lead tracks of moderate length in comparison with other schemes. Through detailed design these could be shortened. In addition to the track access cost, the lengthy access road will add to the development cost and will require a drainage structure crossing Stillwater creek. The roadway's proximity to the creek (parallel in some places) and its location within the drainage boundary of the creek, suggest that roadway construction costs would be above average. An attractive collateral opportunity presents itself as affording the connection of the Trans Canada Trail to the Watts Creek pathway (also known as the Tans Canada Trail) on the north side of Highway 417 through this system of LRT crossing structures.

Utilities

There is little difference between the requirements of this option and Option 6, which are easily the most difficult and expensive of all. There would be no major existing utility relocations required for this option.

Operations & Maintenance

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Conceptual ladder track design limits operating flexibility and may be subject to single-point failure. Hand-off of trains would be remote from Administration building.

Mainline Access: Single access route to/from mainline restricts operating flexibility. Length of yard lead track may require a second crossover to improve operational flexibility. Assuming the LRT Station location is west of yard lead, westbound trains serving Moodie station require reverse move on mainline, ideally supported by a crossover immediately east of the station. Site plan does not show crossovers on mainline immediately before the yard lead turnouts. These should be added to minimize any reverse running of westbound trains from and to the LMSF. Yard leads would be elevated over Highway 417 and Highway 416 ramps. Steep grades coming into yard can be problematic.

Property Ownership and Acquisition

There are three implicated properties, owned by NCC (1) and MTO (2). The NCC property is leased agriculture. No structures appear to be impacted based on 2014 aerial photography.

LMSF Option #8 (West of 416 near Baseline Road, south of Queensway):

Social Environmental Characteristics

Close proximity to single existing residence; some potential for disruption.

Major noise impacts likely, particularly with multitude of track switches in close proximity to residential property directly to the south. Potential for residual noise impacts even with extensive mitigation measures. Low risk of vibration impacts.

Access restrictions will be required; Access and egress from single residence will need to be altered.

Requires crossing of Highway 417. Slightly better location than option 7 but still challenging due to ramp grades/geometry and proximity of connection to highway.

Situated on Class 3 Agricultural lands with existing agricultural uses.

Interrupts accessways – accessway would need to be relocated.

Disruption of existing agricultural land uses, minor disruption to facilities (access).

Partial archaeological potential.

The barn complex at Silver Springs Farm is a Federally Recognized Heritage Building. The facility and access road disrupt the continuity of the larger farm setting, which should be evaluated as a Cultural Landscape. The property has very high local significance and should be avoided.

Bio-Physical Environmental Characteristics

Soil Types – The published information indicates that the centre of the site is underlain by relatively incompressible glacial till and silty clay deposits are indicated to exist at the south and west ends of the site. The till and clay are indicated to overlie moderately strong sandstone and dolostone with weak shale interbeds of the Rockcliffe formation at depths ranging from about 3 to 5 m, with locally deeper rock at the north and south areas of the site (about 5 to 10 m depth). The majority of the structures could potentially be founded on shallow foundations although the relatively compressible clay may result in higher costs for structure foundations at the north and south ends of the site. There is also a potential that ground improvement (such as preloading or ultra-lightweight fills, for example) could be required if grade raise heights exceed 1 m, particularly along the entrance alignment to this option and over the southern third of the site.

Geological Faults – The published information indicates that a geological fault crosses the entrance alignment, in a roughly northeast to southwest direction.

Key Aquatic Features – Low impact to drainage tributaries of Stillwater Creek as the LMSF will avoid crossing any watercourses and will only be built adjacent to drainage channels. Likely indirect impacts only to result from construction of LMSF.

Key Terrestrial Features – within agricultural area, between two treed areas. Currently impacted by Highway 417 and Highway 416, however treed areas and hedgerows provide some opportunity for wildlife cover and diversity of habitats adjacent the field.

Impacted Materials- Land use for proposed site is agricultural, therefore environmental impacts associated with pesticide use on the fields is possible. An oil spill (220 liters) occurred in 1993, approximately 600-700 meters away from the proposed site, at the Holly Acres Road/Highway 417 interchange and soil contamination was confirmed. Potential to encounter impacted material is relatively low.

Facility Operations

Roadway access via existing unpaved private driveway to Robertson Road will require upgrades to private access, sharing of driveway with agricultural uses. Secondary (emergency-only) road access could be provided to Highway 416 on-ramp but may be problematic due to roadway geometry. Through property

purchase, the storage yard and shop capacities could be increased by at least 200%.

LRT Station location could function in the vicinity of the current location of the BRT Station. All Station Option Locations are compatible with this MSF location; No station impact for future extension of LRT directly to the west.

Operations & Maintenance

Yard Flow: Yard layout provides good flow between shop/storage tracks and yard lead tracks. Loop track allows for turning vehicles. Conceptual ladder track design limits operating flexibility and may be subject to single-point failure. Hand-off of trains would be remote from Administration building.

Mainline Access: Single access route to/from mainline restricts operating flexibility. Length of yard lead track may require a second crossover to improve operational flexibility. Assuming the Station location is west of yard lead, westbound trains serving Moodie station requires reverse move on mainline, ideally supported by a crossover immediately east of station. Yard leads will be elevated over Highway 417and Highway 416 ramps. Steep grades coming into yard can be problematic.

The geometry of the yard leads as they cross highway 417 require construction of a complex array of structures. In addition to the track access cost, the lengthy access road will add to the development cost and will require a drainage structure crossing Stillwater creek. The roadway's proximity to the creek (parallel in some places) and its location within the drainage boundary of the creek, suggest that roadway construction costs would be above average. The economic impact to the two farms immediately on either side of the proposed facility has the potential to affect the cost of the property.

Utilities

The site is not near any gas, water or sewer services so these utilities would be difficult and expensive. Further consultation with Hydro Ottawa is required to verify how the high power demands of an LMSF facility can be serviced for this location, and may require servicing from Hydro One connecting to the nearest high voltage transmission line. There would be no major existing utility relocations required for this option.

Property Ownership and Acquisition

There are three implicated properties, owned by NCC (1) and MTO (2). The NCC property is leased agriculture. No structures appear to be impacted based on 2014 aerial photography.

Station Location Considerations

Station Location Option #1 (East of Moodie, south of Corkstown)

LRT Station location could function in the vicinity of the current location of the BRT Station. BRT Station would be converted to an LRT transfer station. Bus platforms expanded to the east to accommodate the expanded needs of the bus facility; Bus layby facility would need to be constructed to the north of Corkstown Road to maintain the entire passenger facility south of Corkstown Road. Station entry and PPUDO would be located near the western end of the station property. Bus access would be from Corkstown via the intersection of Moodie Drive and Corkstown Road; No station impact for future extension of LRT directly to the west.

Station Location Option #2 (West of Moodie, south of Corkstown)

LRT Station would not be located in the vicinity of the BRT bus platforms. This Option locates the station west of Moodie Drive north of Highway 417. In this location, the bus platforms and bus layby are contained within one contiguous area. All bus and public access would be via the existing intersection at Moodie Drive and Corkstown Road. Corkstown Road would be shifted to the north and reconstructed to allow for construction of the LRT transfer station with a contiguous fare paid zone. New structures will need to be constructed to grade separate the LRT from vehicular traffic at the Moodie Drive/Queensway interchange.

Table 5-5: Screening Evaluation Summary

	Social							Bio-Physical					Operations						Economics		
	Local residents	Site safety	Agricultural	Road Network	Pedestrian /cyclists	Existing land uses	Heritage / Culture	Soil types	Impacted Materials	Terrestrial features	Aquatic features	Geological faults	Servicing	Existing Services	Road Access	LRT Station	BRT Station	Capital	Property
Site 1: (East of Moodie, near Carling)	×	•	×	•	×	✓	•	×	×	×	×	✓	✓	✓	✓	✓	•	$	✓
Site 2: (East of Moodie, north of soccer fields)	•	•	•	•	•	•	•	✓	×	×	×	✓	✓	✓	•	✓	•	$$	✓
Site 3: (West of Moodie north of Queensway)	✓	•	•	•	✓	×	•	•	✓	•	×	✓	•	×	✓	✓	✓	$$	•
Site 4: (West of Moodie/Regional Road 59 south of Queensway)	✓	✓	×	✓	✓	✓	✓	•	✓	✓	×	✓	×	×	•	•	•	$$	•
Site 5: (East of Moodie/Regional Road 59, south of Queensway)	•	•	×	✓	•	•	×	×	✓	✓	•	✓	•	×	✓	•	✓	$$	•
Site 6: (Far East of Moodie/Regional Road 59, south of Queensway)	✓	✓	×	•	✓	✓	×	•	✓	•	×	×	×	✓	•	✓	✓	$$	•
Site 7: (West of 416, south of Queensway)	✓	✓	×	•	✓	✓	×	•	✓	✓	×	•	×	✓	•	✓	✓	$$$	•
Site 8: (West of 416 near Baseline Road, south of Queensway)	•	•	×	•	•	✓	×	•	✓	•	✓	•	×	✓	•	✓	✓	$$$	•

LEGEND:

- ✓ Best Meets Criteria
- • Somewhat Meets Criteria
- × Does not Meet Criteria

Alternatives were NOT carried forward if:

- Did not meet 25% of the criteria
- Had effects that were not mitigable or required features that were not readily implementable

Based on the above evaluation 3 sites were shortlisted and carried forward for further consideration.

Figure 5-3: Shortlisted Sites

5.4 Consultation

5.4.1 Advisory Committee Meetings

TAC and PAC meetings were held – February 13 and March 6, 2017 respectively to review the preliminary results prior to the Public meeting. Presentation and notes are contained in the Consultation Report.

The first public meeting was held on March 22, 2017 with a total of 93 attendees. General comments on the project included are contained in Table 5-6

Table 5-6: Public Meeting #1 Comments and Responses

Comment	Response
Siting of the station(s)	The options will be evaluated during the next phase of the project
Siting of the Park & Ride	At this point in the study we are at the stage of considering the recently received council direction to assess the possibility of a park and ride
Noise, vibration, sound barrier	Appropriate noise and vibrations studies will be undertaken at for the preferred alternative
Bus routing and ease of access to LRT	Bus routing details will be confirmed as part of OC Transpo operational assessment. The station will include a bus layby area for connections to on-road routes
Traffic and bus implications and safety	Bus routing and connectivity with signalized crossings will be addressed
Affordability and feasibility	It has been determined that there is likely appropriate budget for the conversion to LRT
Pathway connections (pedestrians and cyclists)	The LRT station will be the subject of a connectivity study similar to those held on the other Stage 2 LRT stations
School and local residents	The Stage 2 Team will meet with the school and stakeholders
Consultation	Additional consultation opportunities will be available
Drainage / floodplain	Drainage details will be included in the next stage when the foot print details are available. Consultation will be ongoing with the NCC and RVCA

6. UPDATED EXISTING CONDITIONS

This section of the report provides an update of the existing environmental conditions as well as additional investigations undertaken. The information below provides updated information that has emerged as the study progressed as well as focused surveys to assist in the evaluation and selection of the short-listed alternatives.

6.1 Fish and Fish Habitat

Fish and fish habitat screening surveys were conducted by CTP2 on April 13, 2017 at each of the three shortlisted Moodie LMSF alternatives which included:

Option 2 – Located to the east of Moodie Drive, north of Abbott Point of Care property.

Option 3 – Located adjacent to Wesley Clover Parks along the north side of Highway 417.

Option 4 – Located on agricultural properties south of Highway 417, west of Moodie Drive.

The fish and fish habitat screening surveys included fish community sampling through visual observation and dip-netting, as well as documentation and categorization of the fish habitat within the vicinity of each LMSF alternative including any potentially important areas (i.e. nursery, rearing, spawning etc.).

6.1.1 Option 2 – Field Surveys

Within the study area at LMSF Option 2, Stillwater Creek flows southeast from a box culvert under Moodie Drive between the Abbott Point of Care building and Moodie Drive right-of-way (ROW). Approximately 75 m downstream of the Moodie Drive box culvert, a clear span pedestrian footbridge existed that crossed Stillwater Creek. Much of this survey reach was straight with little to no sinuosity and provided moderate quality fish habitat as the substrates consisted of gravel, sand and clay with some cobble present at a scour pool located 10 m downstream of the box culvert. At the footbridge, the channel was 2.5 m wide with a water depth of 0.65 m. The channel banks were well vegetated with grasses, rushes and cattails which provided cover and shading along banks. A drainage channel/swale drained to Stillwater Creek approximately 25 m downstream from the Moodie Drive box culvert and extended to the north from Stillwater Creek to the entrance road of Abbott Point of Care (channel length approximately 145 m). At the time of the 2017 survey, there was no flow observed within the drainage channel, but rather contained standing, stagnant water. This drainage channel is likely intermittent (dry during summer months) and provides low quality indirect fish habitat. The riparian habitat of the drainage channel and Stillwater Creek near Moodie Drive was primarily open grass with little to no mature riparian trees which resulted in limited stream shading.

The final reach that was assessed at the LMSF Option 2 study area included a segment of Stillwater Creek between the first footbridge downstream of Moodie Drive (described above) and a second footbridge that was approximately 275 m downstream of the Moodie Drive box culvert. Immediately upstream of the second footbridge was a weir structure spanning the width of the channel (measured at 7.5 m). The difference in water surface elevation between the upstream and downstream sides of the weir was approximately 0.3 m, which may present a potential barrier to upstream fish passage during periods of low flow. The channel reach between the two footbridges had a width of 2.5 m with an average water depth of 0.7 m. This reach consisted of gravel, cobble and scattered boulder substrate with sand and soft clay along the channel banks. The coarse substrate along with dense grasses overhanging the channel banks provided quality habitat throughout this reach. Approximately half of the reach was shaded by mature riparian trees, primarily willows, near the second footbridge (furthest downstream from Moodie Drive). At the time of the 2017 spring survey, only Brook Stickleback (Culaea inconstans) were captured between the two footbridges. Based on background information provided by the RVCA, fish community sampling that took place in May and July, 2013, near the second foot bridge resulted in the captured of Brook Stickleback, Central Mudminnow (Umbra limi), Creek Chub (Semotilus atromaculatus), Fathead Minnow (Pimephales promelas), Northern Redbelly Dace (Chrosomus eos) and White Sucker (Catostomus commersonii) (RVCA, 2013). This section of Stillwater Creek was also noted as ”Moderately Sensitive”, however, “Highly Sensitive” fish habitat exists downstream of the study area based on the presence of Mottled Sculpin (Cottus bairdii) and Pearl Dace (Margariscus margarita) as well as confirmed spawning habitat (RVCA, 2013). Overall, the reaches of Stillwater Creek within the LMSF Option 2 study area provided quality habitat for bait/forage fish community with potential spawning habitat for White Suckers and other bait/forage fish.

6.1.2 Option 3 Field Surveys

The watercourse present within LMSF Option 3 study area included the main channel of Stillwater Creek that flowed north under Highway 417 and Corkstown Road before flowing through Wesley Clover Park. The length of open channel between Highway 417 and Corkstown Road was approximately 60 m and meandered through channel banks that were primarily vegetated with grasses and shrubs, lacking mature riparian trees. Access to this channel segment was limited due to property fencing restrictions. Channel morphology within this reach was primarily a continuous run. Based on a short section of channel at the inlet of the Corkstown Road culvert, the substrate consisted of cobble, gravel, clay and sand with some scattered boulder.

Approximately 20 m downstream of the Corkstown Road culvert outlet, Stillwater Creek turned east and flowed parallel to Corkstown Road for 100 m before

turning north and flowing between the Wesley Clover Park equestrian area and parking lot. This section of Stilllwater Creek was deeply incised with channel banks showing signs of active erosion and scouring. The channel banks were densely vegetated with grasses and scattered mature riparian trees were present throughout the downstream reach. The channel morphology was a continuous run with an average width of approximately 1.5 m and an average depth of 0.7 m. Substrates consisted of clay, muck, sand, gravel and scattered cobble and the water was turbid at the time of the 2017 survey. The instream habitat was primarily instream and overhanging grasses and woody debris along with some minor bank undercutting. At the time of the 2017 survey, two bait/forage fish species were captured including Creek Chub and Brook Stickleback. Additional species that are known to exist within Stillwater Creek in the vicinity of LMSF Option 3 include Central Mudminnow, Fathead Minnow, Northern Redbelly Dace, Brassy Minnow (Hybognathus hankinsoni) and White Sucker (RVCA, 2013). Similar to the fish habitat within the LMSF Option 2 study area, the RVCA has classified the fish habitat at LMSF Option 3 as “Moderately Sensitive”. Overall, the main channel of Stillwater Creek within LMSF Option 3 study area provided quality bait/forage fish habitat with no sensitive areas identified as the habitat characteristics were homogenous throughout.

6.1.3 Option 4 Field Surveys

The LMSF Option 4 study area included the main channel of Stillwater Creek, upstream of Highway 417, as well as a tributary of Stillwater Creek that flowed east, parallel to Highway 417, and drained into Stillwater Creek approximately 25 m upstream of the Highway 417 culvert inlet. The main channel of Stillwater Creek was well defined as it meandered through agricultural fields with well vegetated banks consisting primarily of grasses within the first 100 m upstream of Highway 417 before transitioning to dense riparian shrubs and mature trees. In general, the habitat and channel characteristics of Stillwater Creek in the Option 4 study area were similar to those observed in the Option 3 study area. The tributary that drained into the main channel of Stillwater Creek within the Option 4 study area was confined between the Highway 417 eastbound lane embankment to the north and agricultural fields to the south. Although the channel meandered slightly through the grassy banks, it was generally straight (historically channelized) throughout the entire length that was assessed. Scattered sections of riffles and pools were present with the majority of the channel being a run with an average water depth of 0.35 m and average width of 0.8 m. There were tile drain outlets from the agricultural fields approximately 70 m upstream of the tributary confluence with Stillwater Creek which were emitting water at the time of the 2017 survey. Throughout the tributary the substrate was a mixture of sand, muck, gravel and cobble. The dense instream and overhanging vegetation provided shade and habitat cover throughout the channel. At the upstream limit of the tributary, the channel flowed from a culvert under a gravel access road and railway tracks. During the spring 2017 survey two species of bait/forage fish were

captured within the tributary and included Creek Chub and Brook Stickleback. Both species were captured/observed throughout the entire length of channel surveyed (approximately 500 m). Previous fish community sampling by RVCA within Stillwater Creek in May and July, 2013, near the Highway 417 culvert inlet resulted in the capture of six (6) bait/forage fish species including Brook Stickleback, Central Mudminnow, Creek Chub, Fathead minnow, Northern Redbelly Dace and White Sucker (RVCA, 2013). Overall, the LMSF Option 4 study area encompassed a short section of the main Stillwater Creek channel and a long section of tributary, both of which support bait/forage fish community directly.

6.1.4 Species at Risk (SAR)

For all three LMSF alternatives, there were no aquatic SAR identified within Stillwater Creek or its tributaries based on background data and spring 2017 field investigations.

6.2 Terrestrial Environment

Updates to the conditions related to the terrestrial environment were undertaken with field surveys in 2017.

6.2.1 Species at Risk

In order to determine the species to consider for this analysis, background information from a variety of sources and the results of previous studies were reviewed for occurrence records of SAR within 10 km of the study area. Species "designated" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and/or listed under the Canadian *Species at Risk Act*, and species that are "designated" by the Committee on the Status of Species at Risk in Ontario (COSSARO) and/or are listed under the Ontario *Endangered Species Act, 2007,* were the focus of this analysis. Spring field investigations were conducted in 2017 by CTP2, in order to ground-truth the background information collected as well as to improve upon the knowledge of the terrestrial SAR and SAR habitat existing conditions within and adjacent to the study area. Below is an overview of the observations documented during the 2017 field investigations.

FLORA - No federally and/or provincially designated SAR plant species were observed within the study area.

INVERTABRATES – The only SAR invertebrate likely to occur within the project area is Monarch (*Danaus plexippus*), which is listed both federally and provincially as special concern. No Monarch caterpillars or adults were observed during 2017 field investigations. However, the host plant for Monarch caterpillars – Common Milkweed (*Asclepias syriaca*) – is present within the Right of Way adjacent to Moodie Drive, Corkstown Road, and Highway 417. Best management

practices should be implemented in order to protect the breeding habitat of this species.

HERPETOFAUNA – A review of background sources determined that Western Chorus Frog, the only federally threatened SAR amphibian with occurrence records in the area, had not been recorded within 10 km of the study area, however, field investigations were conducted to verify its presence based on habitat availability. Eleven survey stations were used to cover the study area and placed in areas where habitat was available for the species. Surveys consisted of visiting each survey station three (3) times during the day, following the province of Quebec's protocol, no less than 15 days apart, during the spring, and were aimed at detecting the breeding calls of the Western Chorus Frog. After the first round of surveys it was determined that stations placed within LMSF Option #3 and #4 sites did not have appropriate conditions to support breeding for this species, therefore moving forward, only LMSF Option #2 site were visited during rounds two (2) and three (3). The timing of each set of surveys was dependent on air temperature, as this species can be heard calling in temperatures as low as 5°C.

During all three site visits to the LMSF Option #2 site, a full chorus of Western Chorus Frogs was heard calling less than 280 m from the northern extent of the site. They are breeding in a cattail marsh at the corner of Moodie Dr. and Carling Ave. (Figure 6-1).

City of Ottawa (unpublished) investigations in the area identified Blanding's Turtles (*Emydoidea blandingii)* in the vicinity of the wetlands to the south of the Carling Campus. This area is in excess of 700m away from the LRT and LMSF and will not be directly impacted. The use of Stillwater Creek by individuals as a migratory route is already impacted by existing infrastructure and the long culvert under 417 represents a barrier

AVIFAUNA – No SAR birds were observed within the study area during 2017 field investigations.

Background sources contain recent records of Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark (*Sturnella magna)* within 1 km of the study area. Both species are designated as provincially threatened and recently identified as threatened federally. The meadow to the north of Corkstown Road (adjacent to Wesley Clover Parks), within the LMSF Option #3 site may provide habitat for these SAR grassland specialists depending on the type of crop planted in any given year. Due to the proximity of the project, surveys to determine SAR presence are recommended prior to construction within the area.

MAMMALS – Four (4) species of bats – Eastern Small-footed Bat (Myotis leibii), Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) – comprise the suite of SAR mammals

that are likely to occur within the project area. Surveys completed were common to all species, and consisted of searches for bat roost trees in order to ascertain availability of potential maternity roosting habitat. In order to identify potential maternity roosting habitat for SAR bats, thorough searches of all wooded areas within the study area were undertaken. According to the Ministry of Natural Resources and Forestry (MNRF) 2011 document called *Bats and Bat Habitats: Guidelines for Wind Power Projects*, any tree that is equal to or greater than 25 cm in Diameter at Breast Height (DBH), and has a cavity deep enough to accommodate a roosting bat could serve as a roost tree. All trees that met these basic criteria were recorded, and mapped using a GPS, as trees with the potential to provide roosting sites for bats (both maternity roosts as well as day roosts for male and non-breeding female bats). A total of seven (7) suitable bat roost trees were found within the woodlot at the LMSF Option #2 site (Figure 6-1).

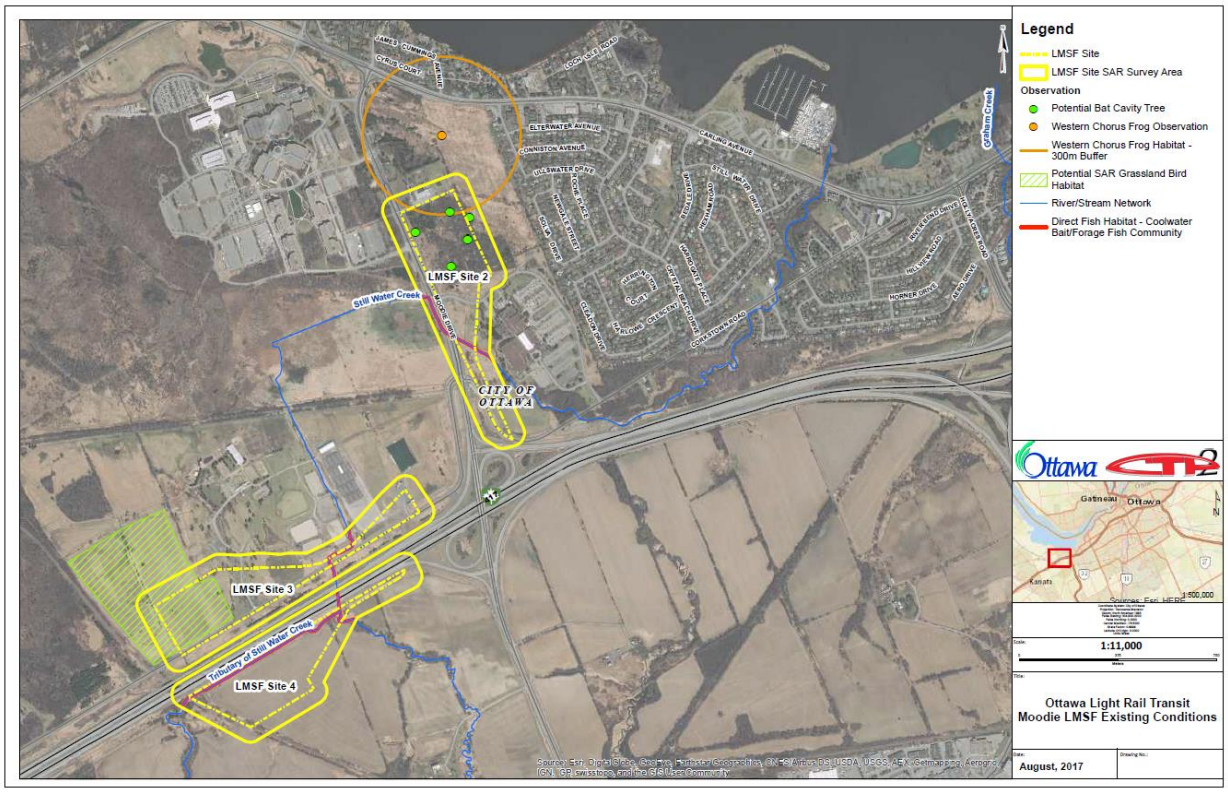


Figure 6-1: Biophysical Features

6.2.2 Air Quality

A comparison to the Bayshore Station predicted air quality (CPT2, 2017), was undertaken. The air quality impacts from the implementation of the Moodie LRT Extension would be expected to be similar or lower. There would be fewer busses expecting to operate at the Moodie station and the nearest sensitive receptor is three times the distance from any bus idling/layby locations. The air

quality impacts from the Bayshore Station and Bus Layby Air Quality Assessment found that of all air pollutants, only particulate matter and benzene exceeded their respective air quality thresholds, and a large contributor to these exceedances was existing background air quality concentrations.

Since the ambient concentration of benzene exceeds the AAQC annual limit, and the ambient concentration of PM2.5 is already 87% of the 2020 CAAQS annual limit, effects of mitigation for the project would not improve ambient conditions for either of these two contaminants. Total project contribution for the Future Build-Out condition (2031) is 7% of the existing ambient concentration of benzene and 32% of the existing annual background concentration of PM2.5. The existing impacts of PM10 including background concentrations is already 149% of the 24-hour averaging period AAQC limit. Project contribution of PM10 for the Future Build-Out condition compared with Existing condition is less than 2 µg/m3.

6.2.3 Noise

Updated noise assessments were undertaken, and presented in a Noise and Vibration Study report (Appendix C), including representing the worst case (End of Service) noise impact for each MSF option. Ambient sound levels were established based on MOECC exclusionary limits, adjusted based on traffic data. The assessed points of reception (POR's) are presented in **Figure 6-2**, **Figure 6-3** and **Figure 6-4**. The residential POR's identified as POR01, POR02, POR03, POR04 and school as POR07 are considered to be in an acoustical environment which can be classified as Class 2 area, while the residences in farm land (POR05 and POR06) are in a Class 3 area. Noise barrier locations and heights were determined, in addition quiet rooftop ventilation units and closed bay doors are required for Option 2 and Option 4. The noise predictions without mitigation are presented in Table 6-1.

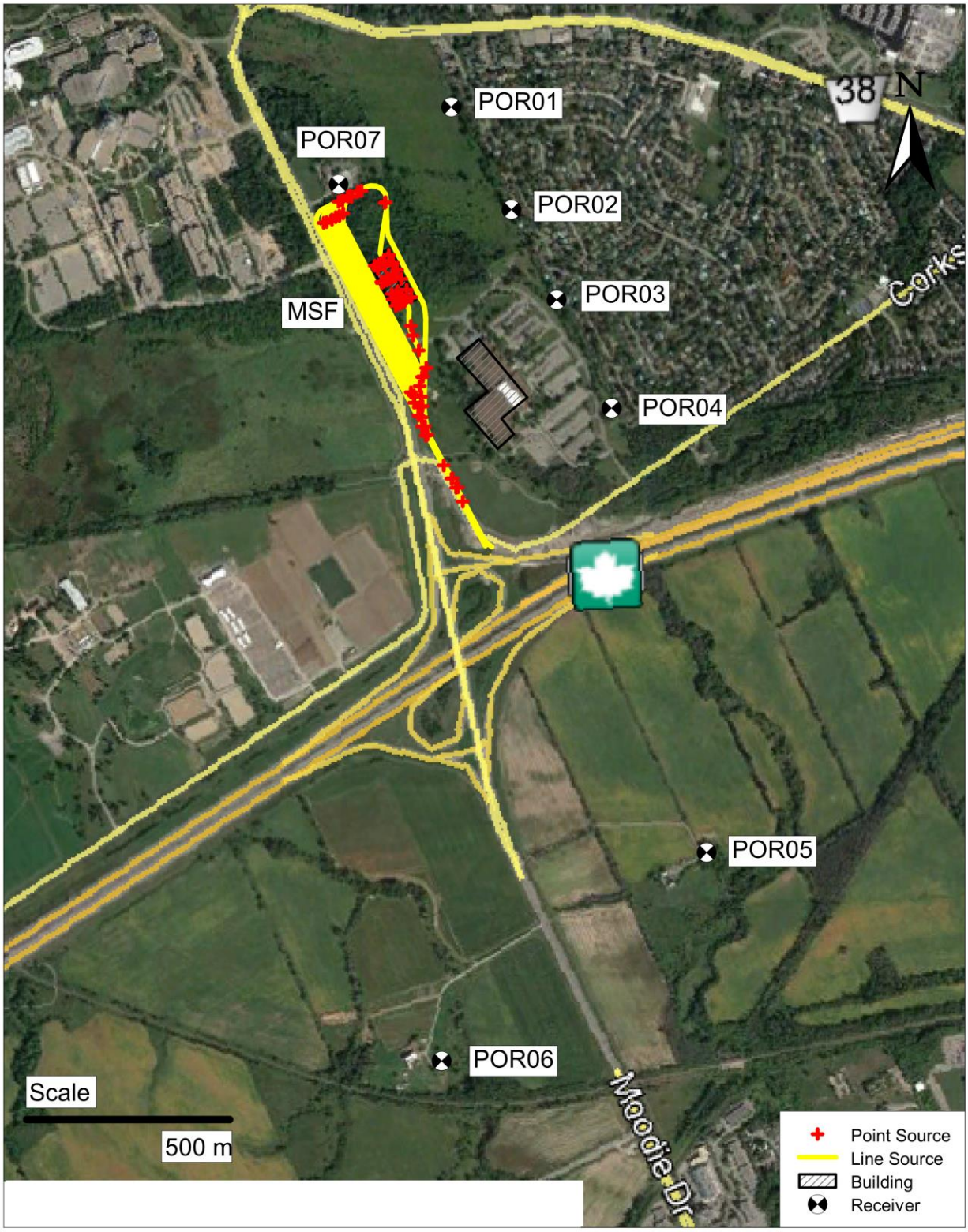


Figure 6-2: Option 2 Site Location and Assessed Points of Reception

Figure 6-3: Option 3 Site Location and Assessed Points of Reception

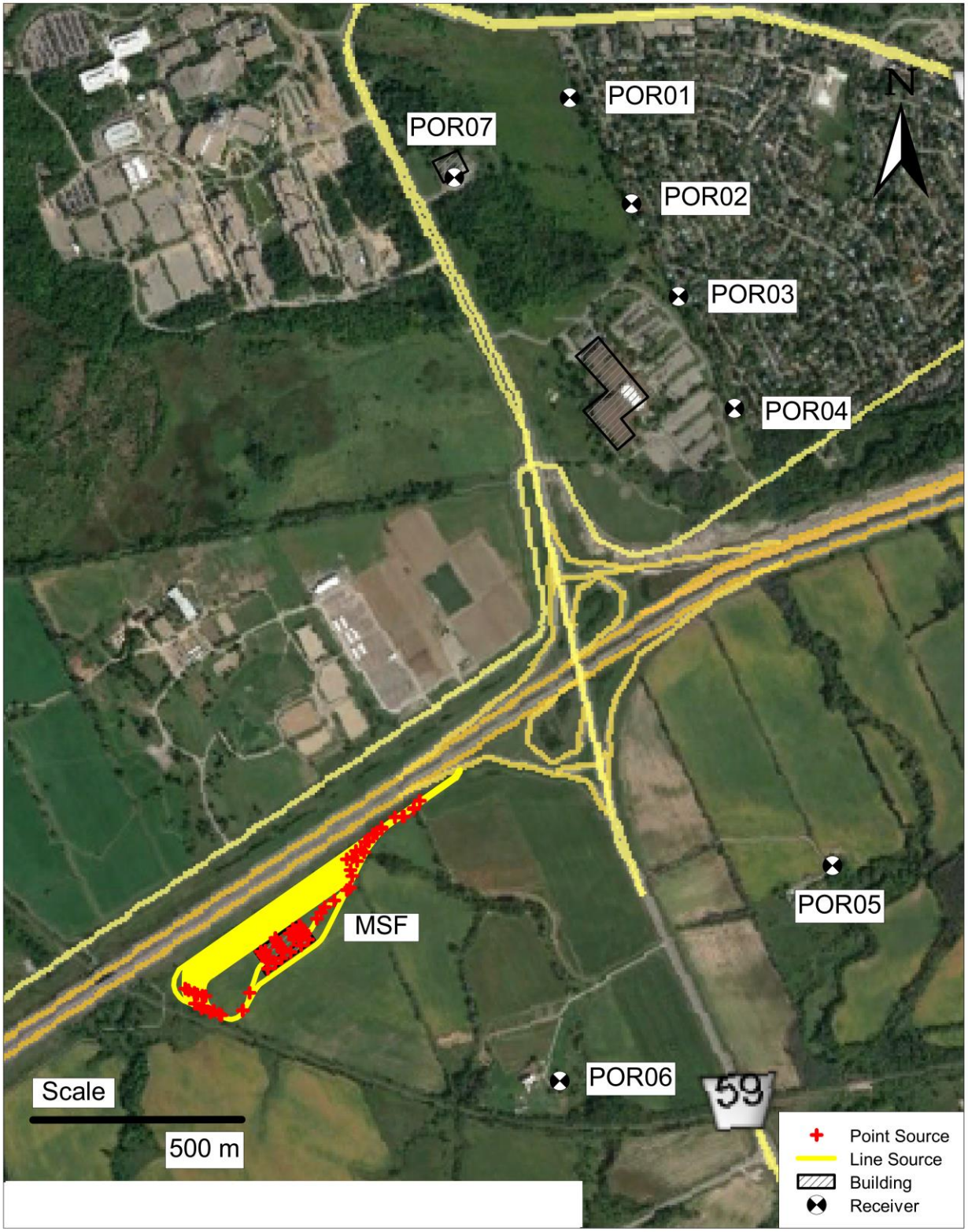


Figure 6-4: Option 4 Site Location and Assessed Points of Reception

Table 6-1: Noise Predictions Option 2

POR ID	Predicted MSF Noise Level (Leq, dBA)	MOECC Noise Criteria	Compliance with MOECC Limits	Mitigation Required
POR01	59	45	No	Yes
POR02	58	45	No	Yes
POR03	55	45	No	Yes
POR04	50	46	No	Yes
POR05	37	42	Yes	No
POR06	31	42	Yes	No
POR 07*	67	56	No	Yes

Note: Results for POR 07 are for maintenance scenario operations during daytime, which is the worst-case scenario for the School, as it is not occupied during the night-time.

Table 6-2: Noise Predictions Option 3

POR ID	Predicted MSF Noise Level (Leq, dBA)	MOECC Noise Criteria	Compliance with MOECC Limits	Mitigation Required
POR01	30	45	Yes	No
POR02	32	45	Yes	No
POR03	36	45	Yes	No
POR04	35	46	Yes	No
POR05	34	42	Yes	No
POR06	41	42	Yes	No
POR 07*	33	56	Yes	No

Note: Results for POR 07 are for maintenance scenario operations during daytime, which is the worst-case scenario for the School, as it is not occupied during the night-time.

Table 6-3: Noise Predictions Option 4

POR ID	Predicted MSF Noise Level (Leq, dBA)	MOECC Noise Criteria	Compliance with MOECC Limits	Mitigation Required
POR01	26	45	Yes	No
POR02	29	45	Yes	No
POR03	33	45	Yes	No
POR04	35	46	Yes	No
POR05	40	42	Yes	No
POR06	49	42	No	Yes
POR07*	20	56	Yes	No

Note: Results for POR 07 are for maintenance scenario operations during daytime, which is the worst-case scenario for the School, as it is not occupied during the night-time.

Table 6-4: Minimum Acoustic Barrier Requirements

Option		Barrier Height	Total Barrier Length	Requirement
Option 2	on ground	6 m – 10 m	1,000 m	1. A surface density of at least 20kg/m2; 2. Must be free of any gaps or cracks; 3. Must extend continuously from ground level (or roof level in the case of a rooftop barrier) to its design height.
	on roof	3 m	140 m	
Option 4	on ground	9 m	840 m	
	on roof	4 m	140 m	

Table 6-5: Noise Predictions Option 2 – With Noise Mitigation

POR ID	Predicted MSF Noise Level (Leq, dBA)	MOECC Noise Criteria	Compliance with MOECC Limits	Mitigation Required
POR01	45	45	Yes	No
POR02	45	45	Yes	No
POR03	45	45	Yes	No
POR04	46	46	Yes	No
POR05	35	42	Yes	No
POR06	31	42	Yes	No
POR07*	48	56	Yes	No

Note: Results for POR 07 are for maintenance scenario operations during daytime, which is the worst-case scenario for the School, as it is not occupied during the night-time.

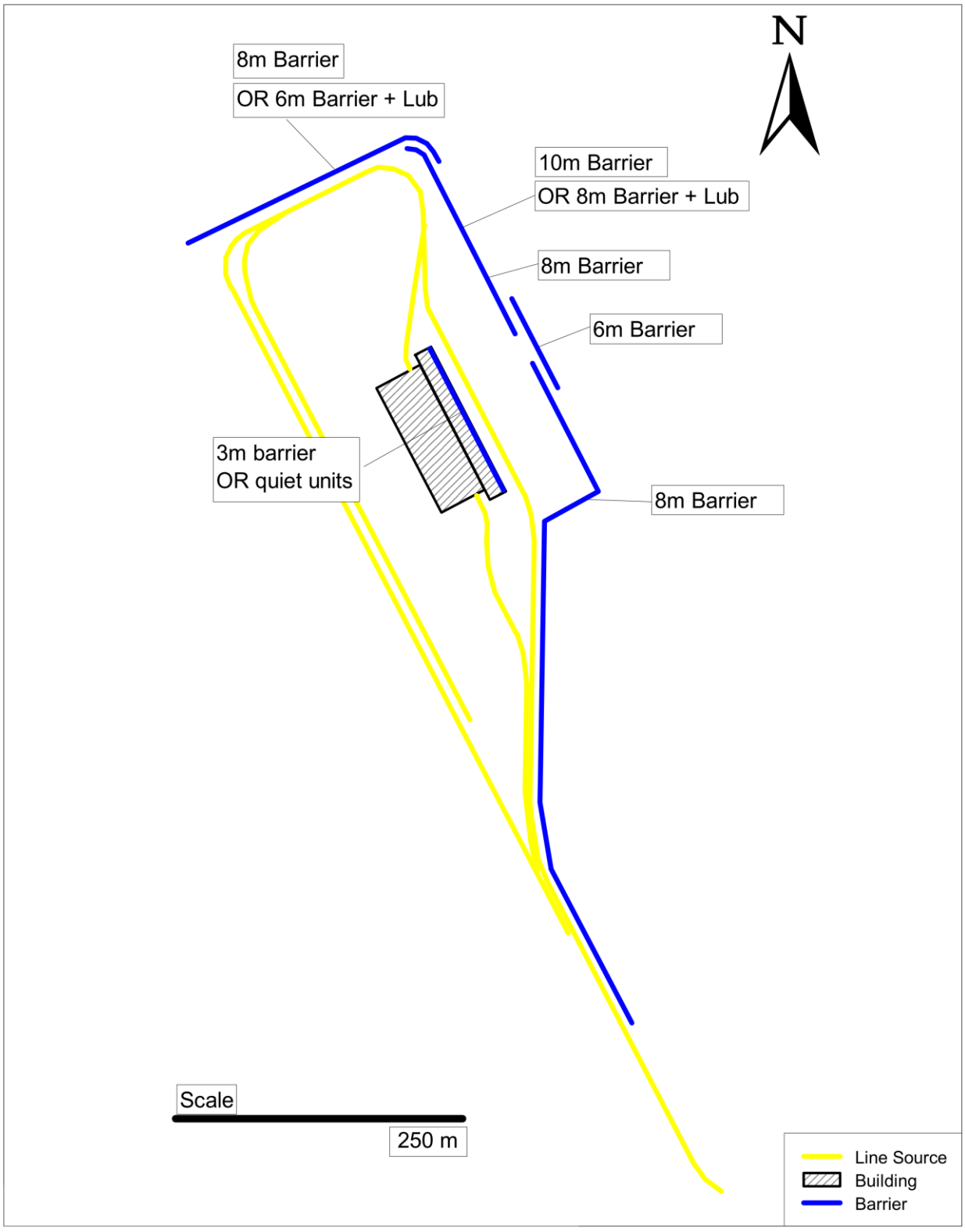


Figure 6-5: Option 2 – Acoustic Barrier (and Rail Lubrication) Locations

Table 6-6: Noise Predictions Option 4 – With Noise Mitigation

POR ID	Predicted MSF Noise Level (Leq, dBA)	MOECC Noise Criteria	Compliance with MOECC Limits	Mitigation Required
POR01	26	45	Yes	No
POR02	29	45	Yes	No
POR03	33	45	Yes	No
POR04	35	46	Yes	No
POR05	36	42	Yes	No
POR06	42	42	Yes	No
POR07*	27	56	Yes	No

Note: Results for POR 07 are for maintenance scenario operations during daytime, which is the worst-case scenario for the School, as it is not occupied during the night-time.

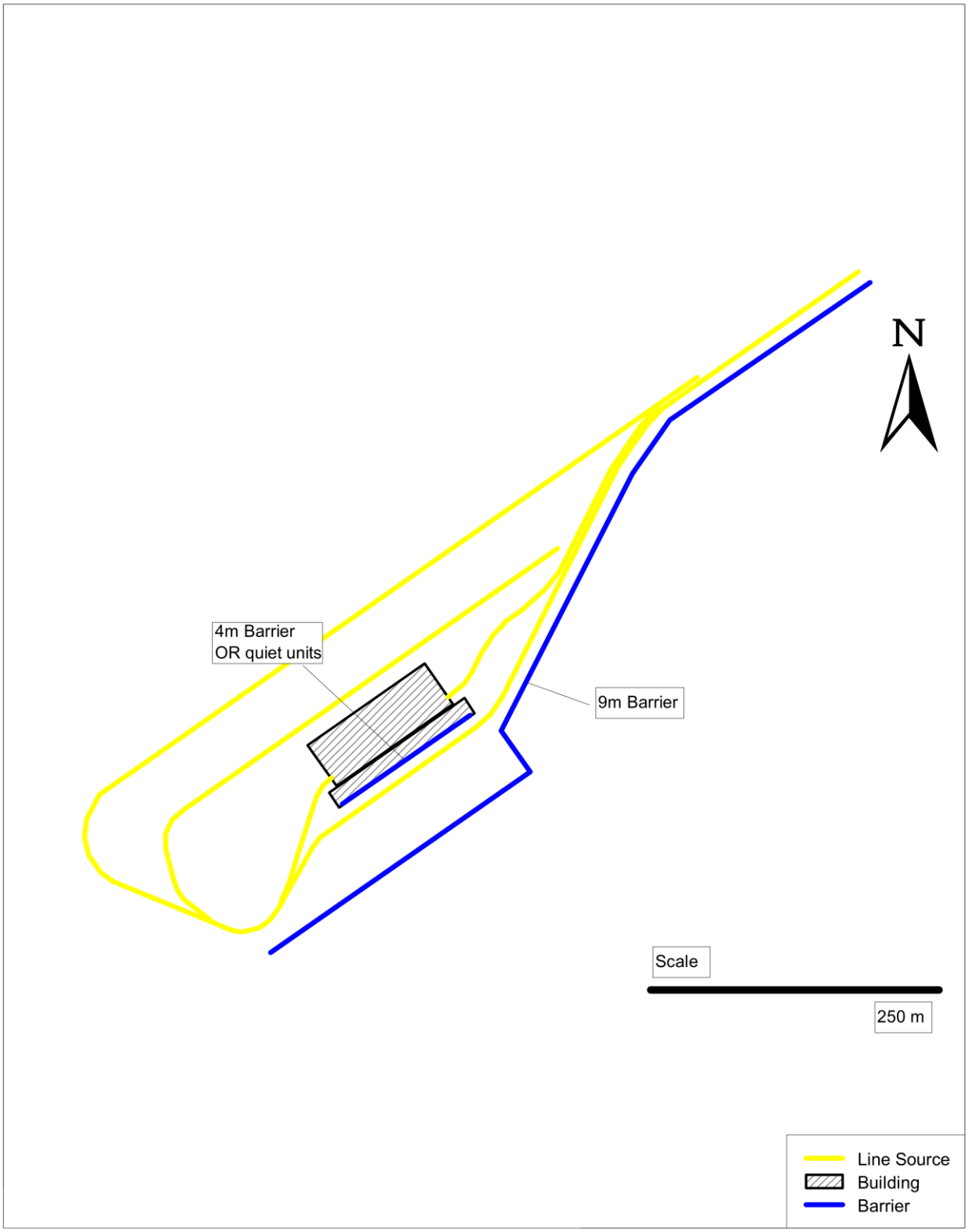


Figure 6-6: Option 4 – Acoustic Barrier Locations

As part of the WTE, a section of transitway near Holly Acres Road in Ottawa is planned to be constructed as bridge over the existing Holly Acres Road. The planned west transitway will be located approximately 30 m north and parallel to existing Highway 417. The Noise Barrier Retrofit Study[1] report from the MTO describes the construction of a noise barrier in the vicinity of Holly Acres Road on the north side of Highway 417 to reduce the noise of road traffic from Highway 417. During the transit project, it is considered to relocate the proposed noise barrier on the north side of Highway 417 to the north side of the transitway. This memo summarizes the performance change of a noise barrier due to the relocation.

6.2.1 Performance of Holly Acres Bridge Noise Barrier

The noise impact of light rail transit (LRT) traffic on the planned west transitway was examined and summarized in Table 6-7. As described in the table, the noise impact due to the LRT traffic on the transitway is 21 dB lower than the highway road traffic, which implies the contribution of the LRT system is negligible.

Table 6-7: Hwy 417 and LRT Noise

Noise Source	Noise Impact at POR131
Highway Traffic	65 dBA
LRT Traffic*	44 dBA

Note:

*1. Assumptions: Total number of vehicles within 24 hours is 126; Train speed is 80 km/h; and passby train noise level (sound power) is 87 dBA.
**2. POR131 is same point of reception (POR) identified in the MTO report, which is located approximately 200 m north from Highway 417 west bound lane.

The change in performance of the noise barrier due to the proposed barrier relocation has been examined and is summarized in Table 6-8. The noise impact predictions from both models from MTO and AECOM are similar as shown in the table: AECOM predicted 0.2 dB higher without barrier while same results with barrier. The noise barrier on the north side of Highway 417 is predicted to provide approximately 4 dB noise reduction. The relocation of the noise barrier to the north side of the transitway was predicted to decrease the performance of the noise barrier by 0.5 dB, so the predicted noise impact at the receptor increased from 60.6 dBA to 61.1 dBA.

For the equivalent performance of the noise barrier on the transitway as on the highway, the height of the noise barrier would need to be increased by 4 m (9 m barrier on the transitway).

Table 6-8: Noise Impact at POR131 (Leq-24hr)

Source	Without Barrier dBA, (1)	Barrier on Hwy 417 dBA, (2)	Barrier on Transitway dBA, (3)	(1) – (2) dB	(1) –(3) dB
MTO Report*	64.4	60.6	n/a	3.8	n/a
AECOM Model**	64.6	60.6	61.1	4.0	3.5

Note:
*1. MTO results are based on STAMINA model, which is not available for commercial.
**2. AECOM results are based on STAMSON model. All road traffic was assumed to be on the west bound lane of Hwy 417.
3. Highway traffic data used for both models are same as in the MTO report.

SADT (2010)	Speed	Automobile	Medium Truck	Heavy Truck
133,600	100 km/h	91.4%	1.5%	7.1%

Since the noise impact due to the transitway is negligible compared to the highway noise, the relocation of the noise barrier will not provide any benefit in terms of noise reduction. Also, a 9 m noise barrier on transitway is not practically achievable.

6.2.2 Existing Land Uses and Availability

All of the property for the sites is owned by the NCC. Consultation with the NCC indicated their preference was to utilize a site which was already impacted with built features or designated as an existing facility.

6.3 Evaluation of Short-listed Sites

The updated existing conditions provided additional information regarding the short-listed sites. These conditions, along with a detailed review of operations and costs were considered in the evaluation of the short-listed sites.

Evaluation criteria included:

- Transportation and Connectivity
  - Connectivity (pedestrians and cyclists); Local traffic
- Social
  - Views and vistas; Noise/Air Quality/Vibration; Existing land use; Land Availability
- Biophysical
  - Groundwater; Water quality/Drainage; Fish habitat; Species at Risk; Significant Wildlife Habitat
- Operations
  - Operational flexibility; Station Options; Deadhead time
- Costs
  - Affordability (capital and operating)

Table 6-9: Short-list Evaluation

	Criteria	Option 2	Option 3	Option 4
Transportation and Connectivity	Connectivity (pedestrians and cyclists)		✓	✓
	Local traffic			✓
Preferred				✓
Social	Views and vistas	✓	✓	
	Noise/Air Quality/Vibration		✓	
	Existing land use	✓		
	Land Availability	✓		
Preferred		✓		
Biophysical	Groundwater	✓	✓	✓
	Water quality/Drainage			✓
	Fish habitat	✓	✓	✓
	Species at Risk		✓	✓
	Significant Wildlife Habitat		✓	✓
Preferred				✓
Operations	Operational flexibility		✓	
	Station Options	✓	✓	
	Deadhead time	✓		
Preferred		✓		
Costs	Affordability (capital and operating)	✓		
Preferred		✓		
Overall Preferred		✓		

6.3.1 Consultation

The second public meeting was held on June 13, 2017 and was attended by approximately 195 people (*Consultation Report*). General comments heard at the meeting included:

- Support and opposition to LRT station locations on both the East and West side of Moodie Drive;
- Traffic impacts on Corkstown Road;
- Unexpected conversion to LRT; and
- Health impacts associated with the location of transformers and associated air, noise, vibration impacts.

Based on the initial assessment, LMSF "Option 2" was identified as the preferred option given the advantages it provided from both a capital and operative perspective.

The LMSF "Option 2" was presented as the preferred option to the study's PAC, TAC, and subsequently at the June 13, 2017 public consultation, but was met by substantial opposition from the community, with a preference expressed for "Option 3".

While LMSF "Option 3" scored slightly lower from a capital and operating perspective, it was preferred over "Option 2" from an environmental and social perspective. LMSF "Option 3" was also preferred over "Option 2" in terms of connectivity, noise/vibration/air quality, species at risk, avoiding significant wildlife habitat and operational flexibility.

In response to community feedback, LMSF "Option 3" was carried forward as the preferred alternative solution for further assessment.

Much of the work the City performed to further assess the potential merits of Option 3 was in response to the NCC, who are the adjacent landowner as well as Wesley Clover Parks, who are the NCC's tenants at this location.

The City and the NCC developed an informal working group with a mandate to further assess the feasibility of "Option 3" as well as other alternatives from both Capital Criteria and Stage 2 operational requirements perspectives, and to confirm an engagement and approvals process.

6.3.2 Refinements to the Preferred LMSF Alternative

Discussion with the NCC, Wesley Clover and the Stage 2 office consisted of the exploration of refinements to Option 3 to reduce the potential impacts (Figure 6-7).

These discussions identified design refinements for the LMSF location and further analysis was undertaken to determine if the storage and maintenance requirements for 2023 (opening day) could be contained within the area between the 417 and Corkstown Road, with a future expansion limited to the southwest corner of these federal lands in order to mitigate impacts to the current and future operations of Wesley Clover Parks. Discussions were also undertaken with the MTO to further assess this option.

As result of these efforts, the Moodie Light Maintenance and Storage Facility (LMSF) is now proposed to be located between Corkstown Road and Highway 417, west of both Moodie Drive and the proposed LRT Station. The entrance to the yard is approximately 660m west of the proposed Moodie Station platform, and the track connection from the Moodie Station to the yard entrance passes through the existing Moodie Drive/Highway 417 interchange with new structures required at both westbound on-ramps and Moodie Drive itself. A structure to allow the LRT to cross under the westbound off-ramp is currently under construction as part of the West Transitway construction, and will be re-used for LRT.

While this 660 metre westerly extension to the LMSF will initially operate as a non-revenue service line to provide vehicle access to the facility, it will become a revenue service line with the implementation of a future Kanata West Extension. Design features of this Moodie LMSF include a special events platform that could provide LRT access for large scale events at Wesley Clover Parks. To support this, there will be consideration of a special events platform

Other facilities to be located on the Moodie LMSF site in 2023 could include an administration building, staff parking, a maintenance shed, and covered storage for 16 trains (or 32 LRVs). In total, this site requires approximately 5.5 hectares of mostly MTO lands that are north of the Highway 417 corridor to house a facility capable of supporting opening day operations. This site is also capable of housing interim capacity if necessary of up to 40 additional LRVs without causing any impacts to adjacent federal lands.

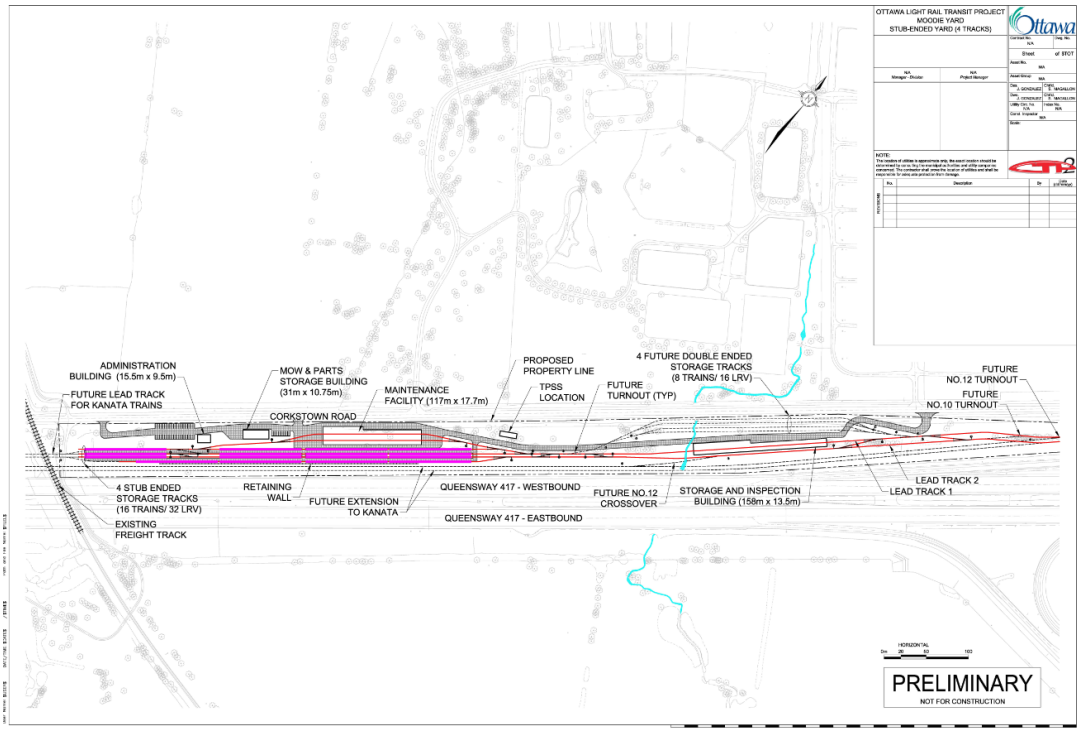


Figure 6-7: Refined LMSF

When the Kanata LRT is implemented, an expansion of this facility will be required to accommodate additional maintenance and storage needs as well as ridership growth. In total, the ultimate LMSF will require approximately 2.5 hectares of additional land which is enough space for the facility to accommodate a total of 90 LRVs. This expansion would provide storage for the 29 additional trains (or 58 LRVs) as well as a westerly turnout track to connect to the future lead track to Kanata near the western limits of the site. It will also require the slight realignment of Corkstown Road as well as the existing entrance to Wesley Clover Parks.

As an alternative to expansion, the currently underway Kanata LRT EPR is evaluating the potential for an additional facility to meet the needs of an extended LRT system to the west in Ottawa.

6.3.3 Refinements to the Preferred Holly Acres Grade Separation

The proposed design (MRC 2012) of the Holly Acres Road structure will be changed from a BRT to an LRT bridge. The alignment and profile of Holly Acres Road will remain unchanged from the existing conditions. The following are the key design changes that are recommended for the conversion:

- As the structure now needs to only accommodate the LRT system and not consideration for conversion from BRT to LRT, the width of the bridge can be reduced. LRT tracks are spaced 4500mm apart, and an additional 2600mm could be provided on either side of tracks to allow for an emergency walkway.

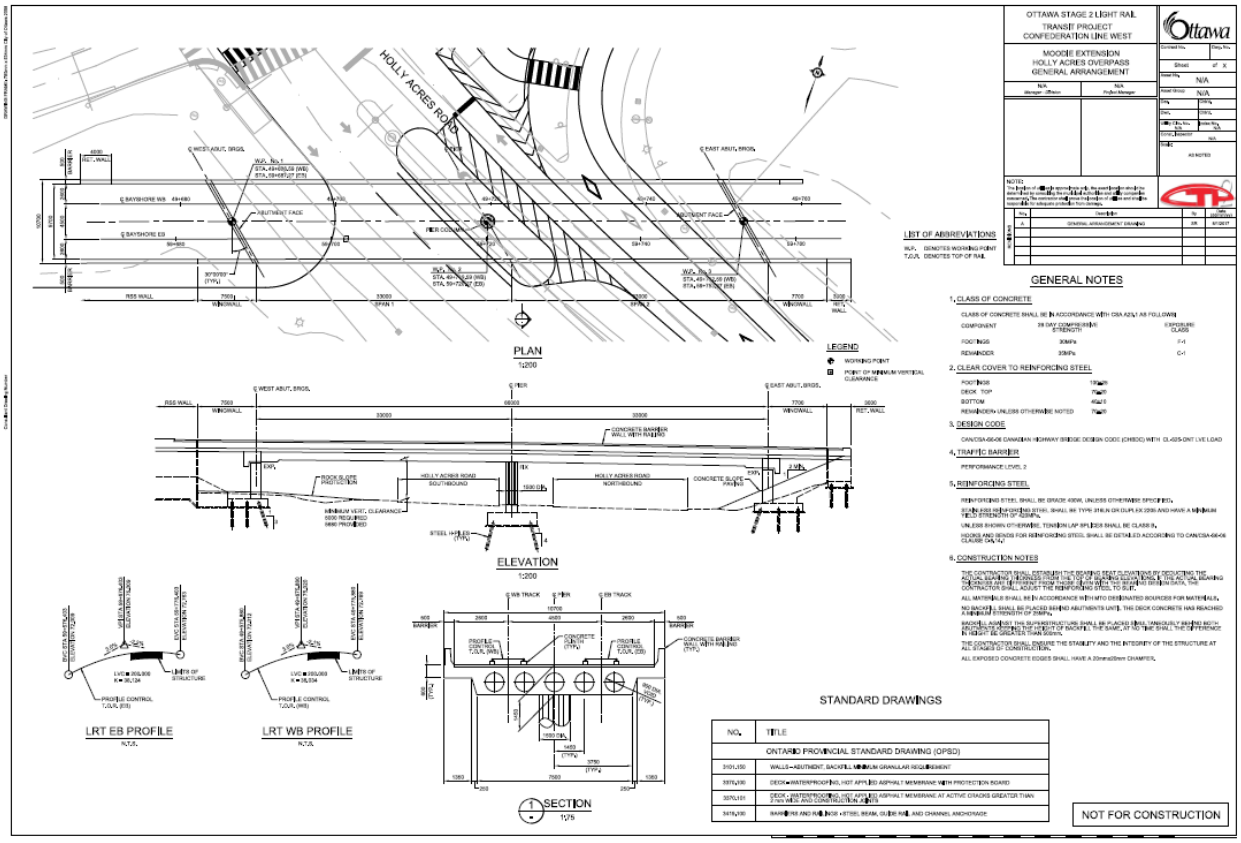
Bridge width can be reduced from 12000mm to 10700mm, which still includes a 500mm barrier on both sides.

- Substructure units are assumed to be in the same locations as the BRT design, and thus the span lengths will not change.

- The proposed LRT profile is different than the original BRT profile, so an investigation into the minimum vertical clearance was done to ensure that the structure type and depth proposed for the BRT design can still be used for the LRT bridge. Utilizing the same structure type and depth as the BRT design, and including a direct-fixation track system on the bridge, the minimum vertical clearance over Holly Acres Road is 5680mm, which exceeds the 5000mm minimum.

Aside from the reduction of bridge width that may be made, no major changes from the BRT design are expected. LRT bridge will have an unchanged span configuration from the BRT design, and current minimum vertical under clearance requirements are met by the BRT structure type, no major changes from the BRT bridge to a proposed LRT bridge are required (Figure 6-8).

Figure 6-8: Holly Acres LRT Bridge



7. PREFERRED ALTERNATIVE

As part of the Stage 2 LRT project, the planned BRT alignment between Bayshore Station and Moodie Drive will be converted to a fully grade separated LRT facility. The LRT will follow the same general alignment as the BRT along the north side of Highway 417 between Holly Acres Road and across Moodie Drive. Due to the grade separation of the LRT track, east-west Transitway buses that would previously access Bayshore Station at the intersection of Holly Acres Road and Bayshore Station / Highway 417 WB on-ramp will be removed from the intersection. The only buses entering Bayshore Station will be buses that travel on Holly Acres Road.

The Moodie LMSF is located on the western side of the intersection of Moodie Drive and Highway 417. The ultimate buildout (Phase 3) consists of the following:

- Traction Power Sub Station (TPSS)
- Maintenance Yard
- Service and Inspection Bay
- Administration and Welfare Building
- Special Event Platform for the Wesley Clover Farms Park
- Hand-Off Platform
- Employee Parking Lot
- 13 Storage Tracks for 45 Trains and 90 Light Rail Vehicles (LRVs)

The Ultimate LMSF will be situated between the Highway 417 Westbound lanes and the Realigned Corkstown Road. The facility will be serviced by two (2) lead tracks with provisions for a future lead track for Kanata trains. The layout provides sufficient right-of-way for a potential future additional travel lane by MTO on the northern edge including the shoulder. At the request of MTO, the City of Ottawa confirms the Stage 2 LRT would change any design to reduce the LMSF footprint in order to not preclude the future Highway 417 widening.

The LMSF has been sized to accommodate opening day storage requirements with 4 tracks and storage for 32 LRVs. If in the future, additional tracks and / or storage are necessary at this site, and the site can be phased to accommodate additional tracks and storage of up to 90 LRVs. There is however, no project approved or funding available to expand the LRT system that would necessitate this up to the 2031 TMP horizon.

The Moodie Station is located on the eastern side of the intersection of Moodie Drive and Highway 417. The facility will consist of the following:

- Relocated LRT Station
- Transit Operator Building
- Bus Parking Lot

The LRT west of the station will be tunneled under the S-W Ramp, the S-E Ramp, Moodie Drive, and the N-W Ramp to connect the Moodie Station with the LMSF. The Moodie Drive Stormwater Pumping Station (MDSPS) has been designed, as part of the previous Moodie BRT EA, to convey the stormwater runoff from the lowest point on the expanded transitway to an adjacent stormwater stilling basin, where it will be conveyed via gravity through a stormwater management pond and eventually out to Stillwater Creek.

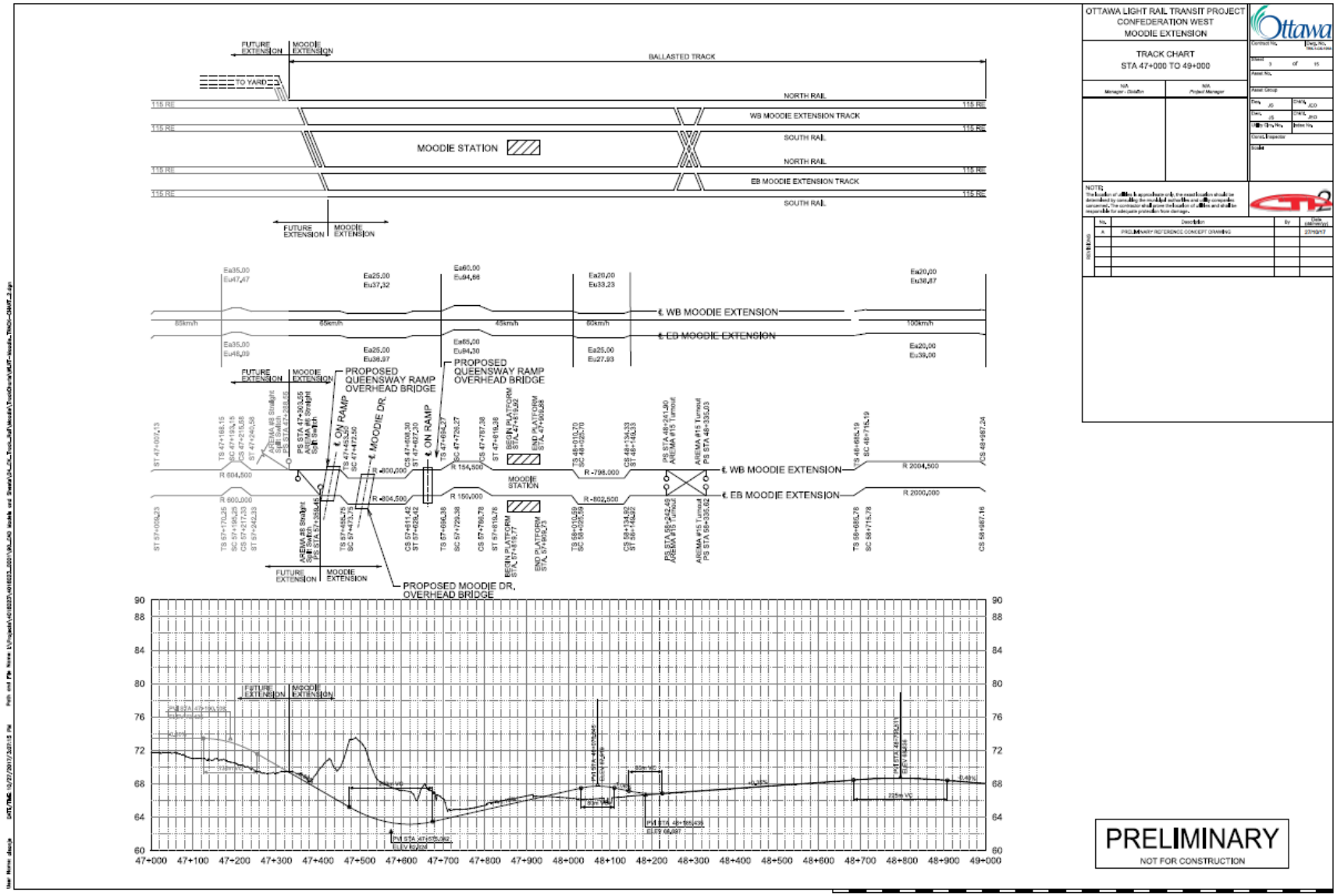
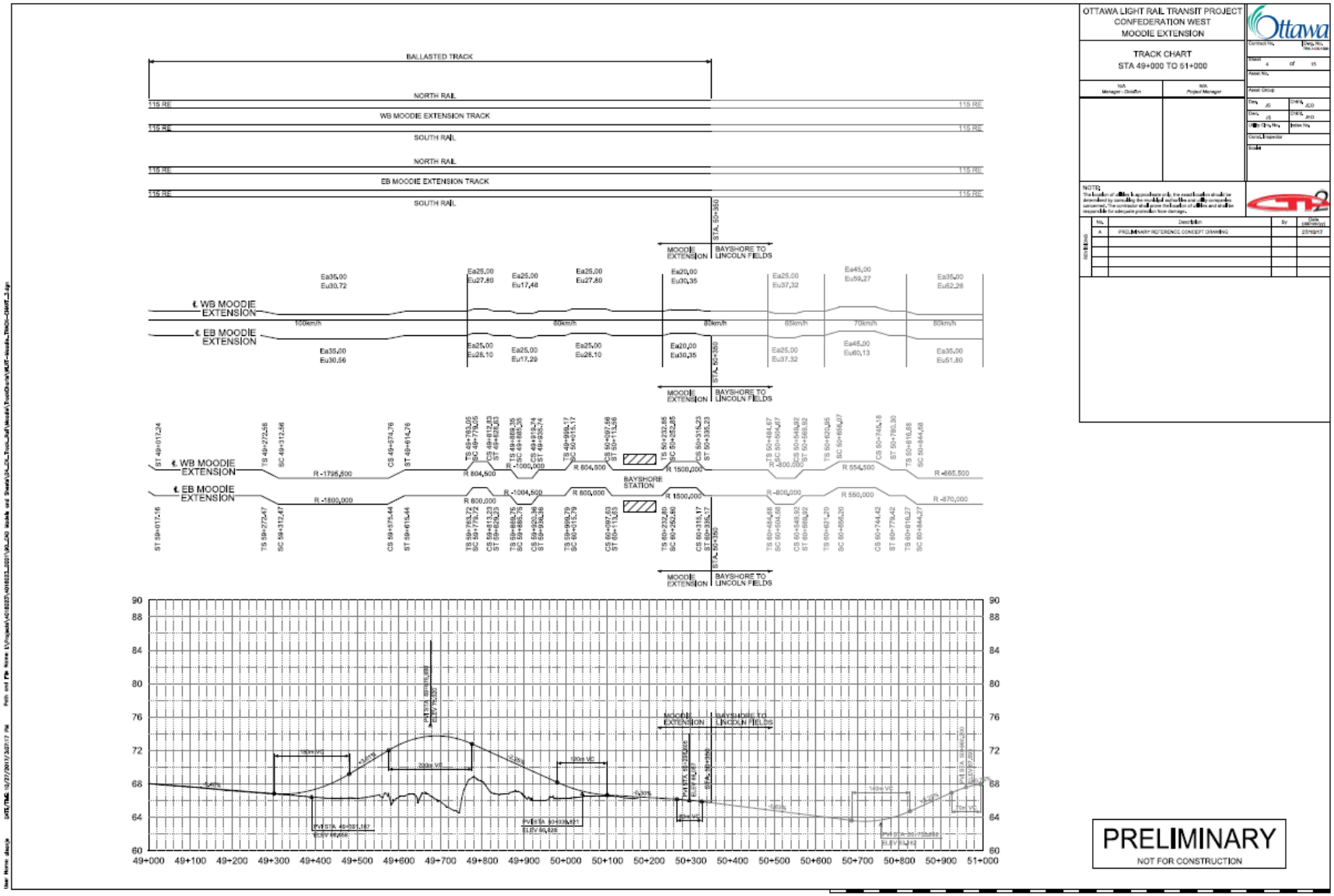
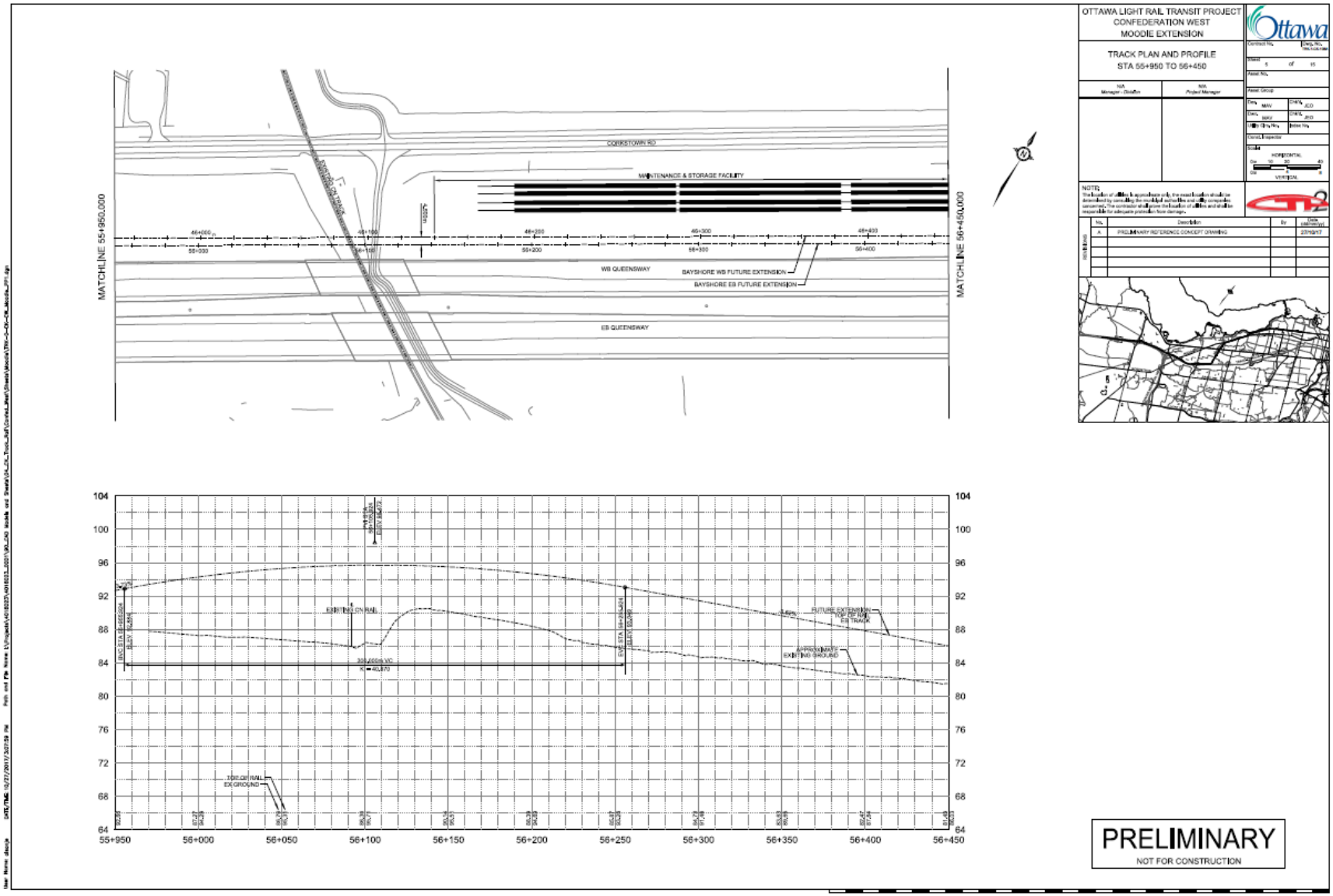


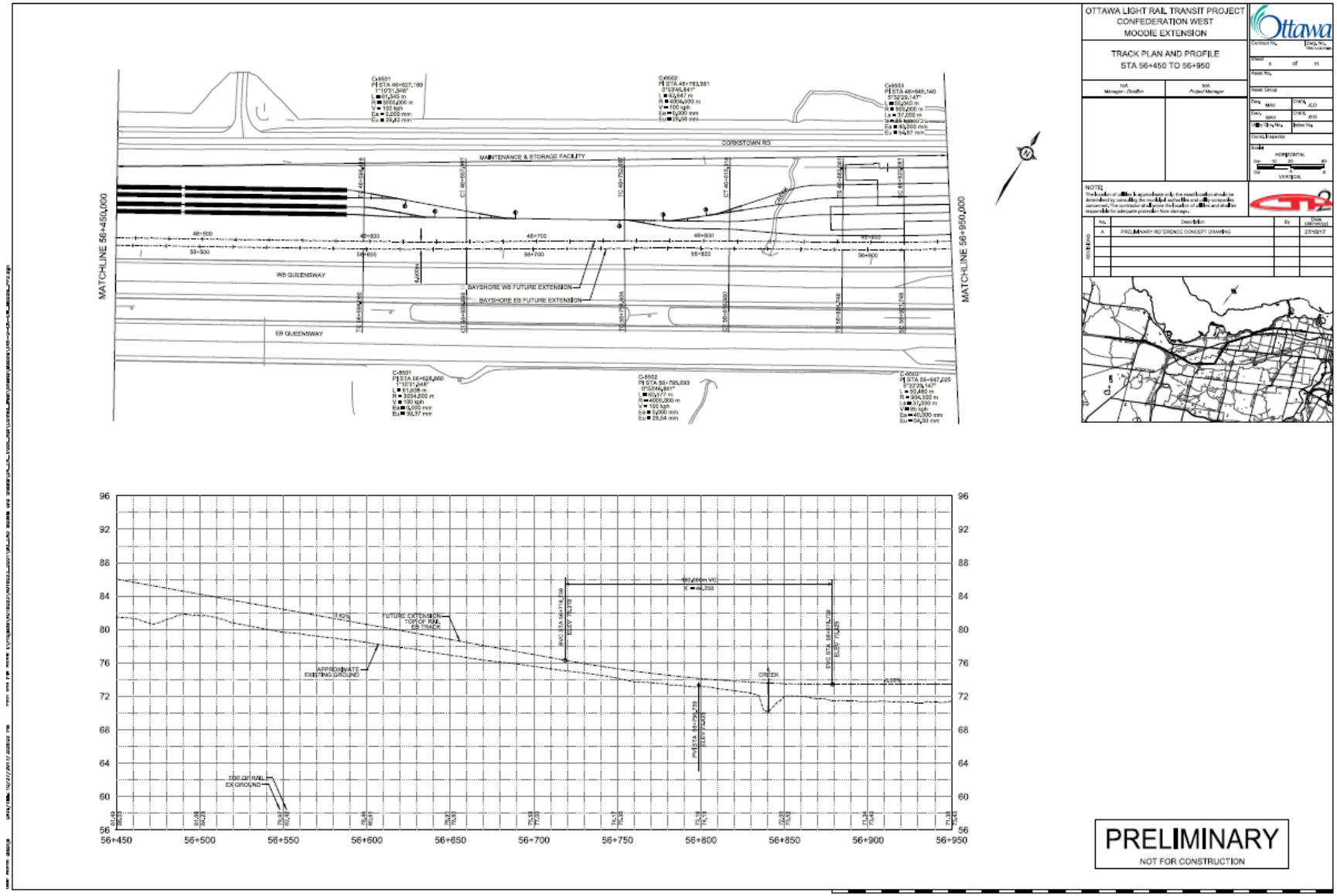
Figure 7-1: LRT Track (1 of 13)



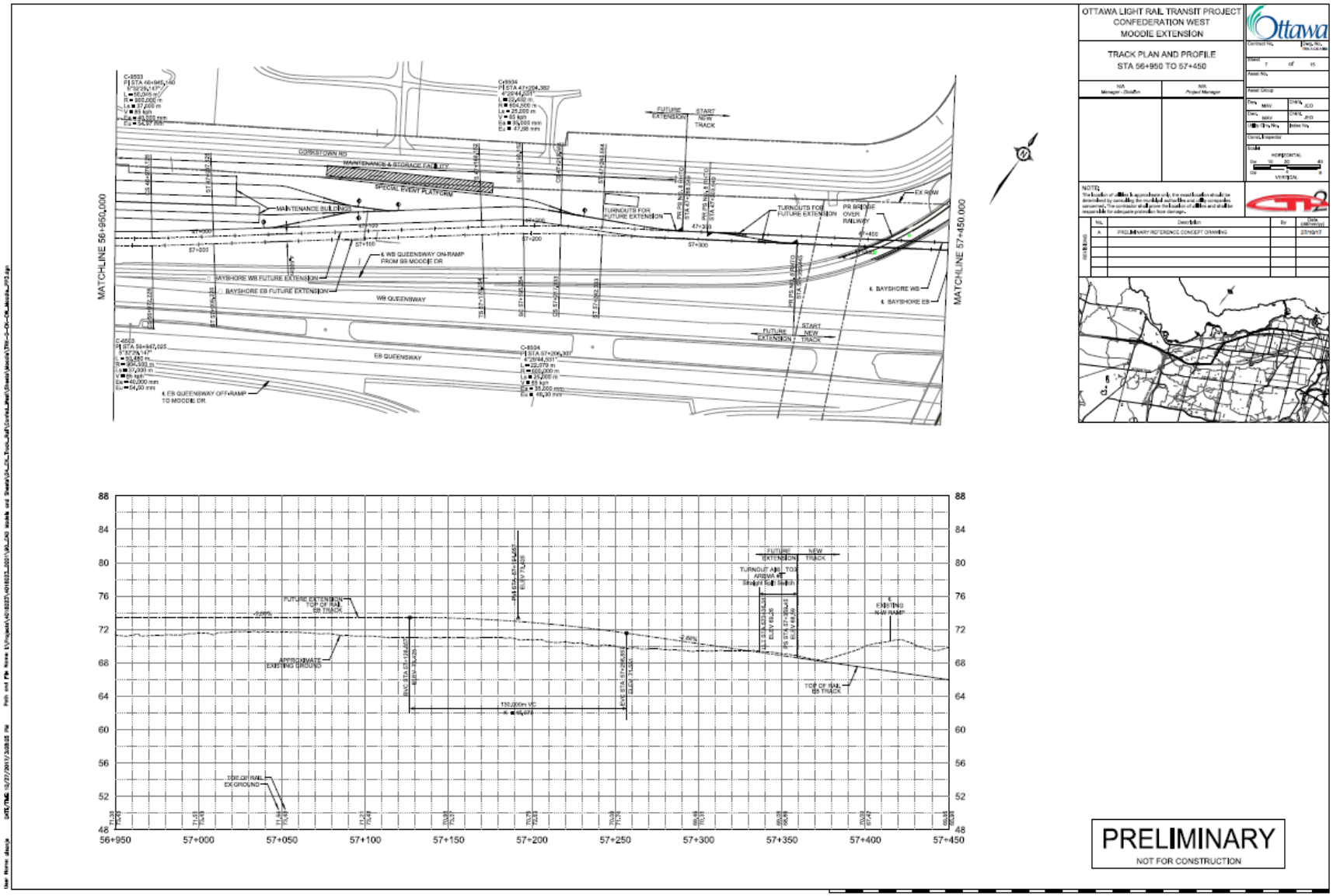
LRT Track (2 of 13)



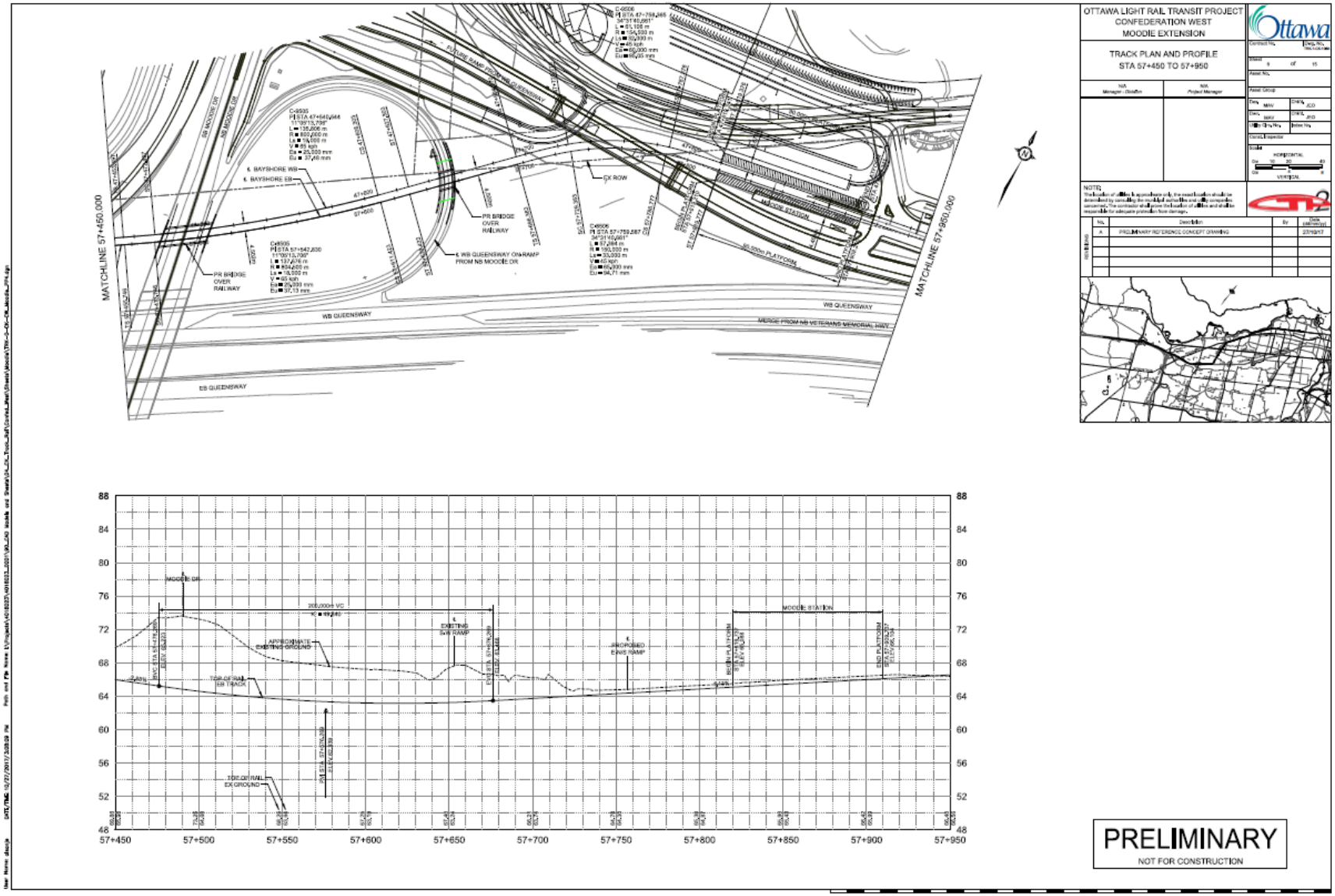
LRT Track (3 of 13)



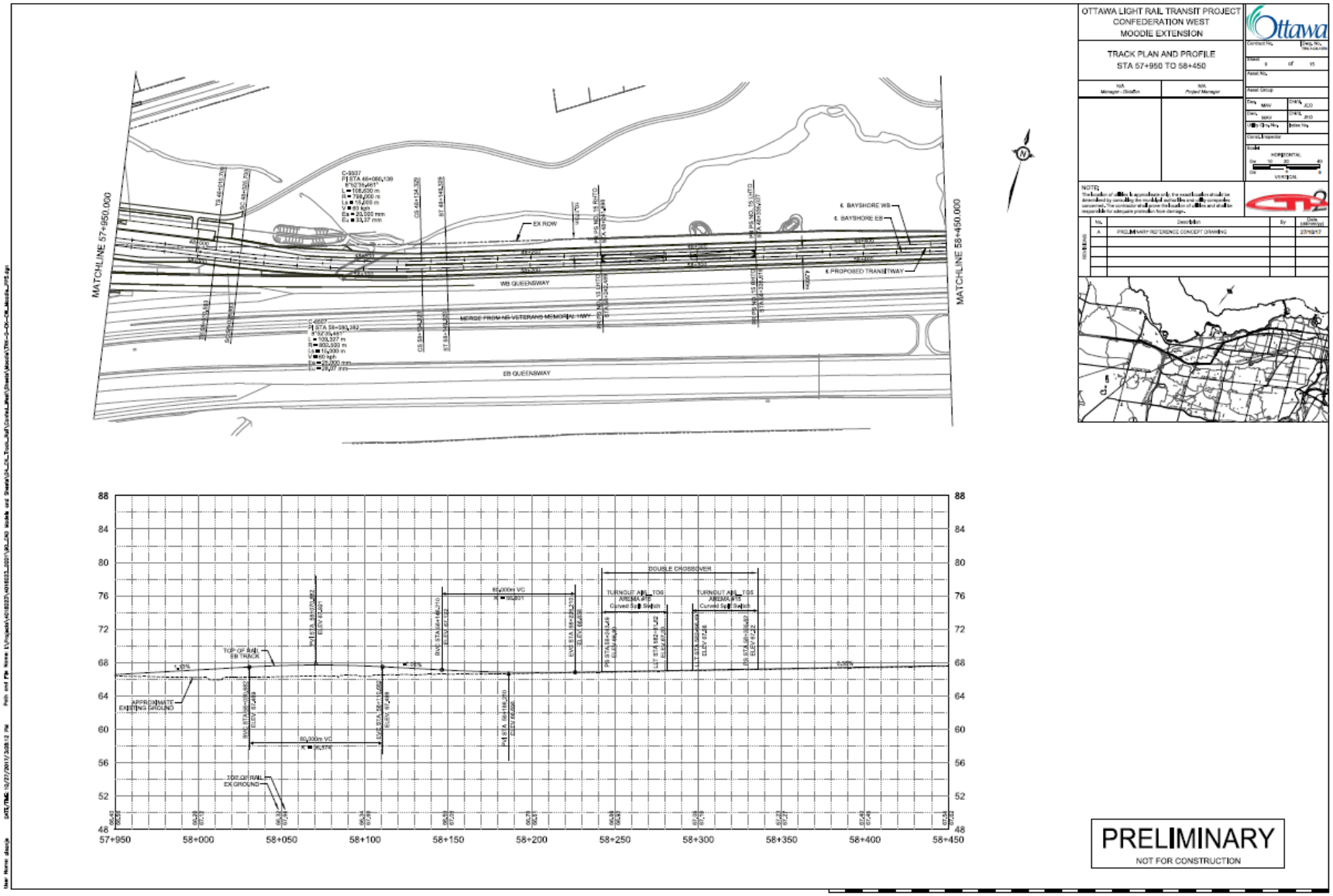
LRT Track (4 of 13)



LRT Track (5 of 13)



LRT Track (6 of 13)



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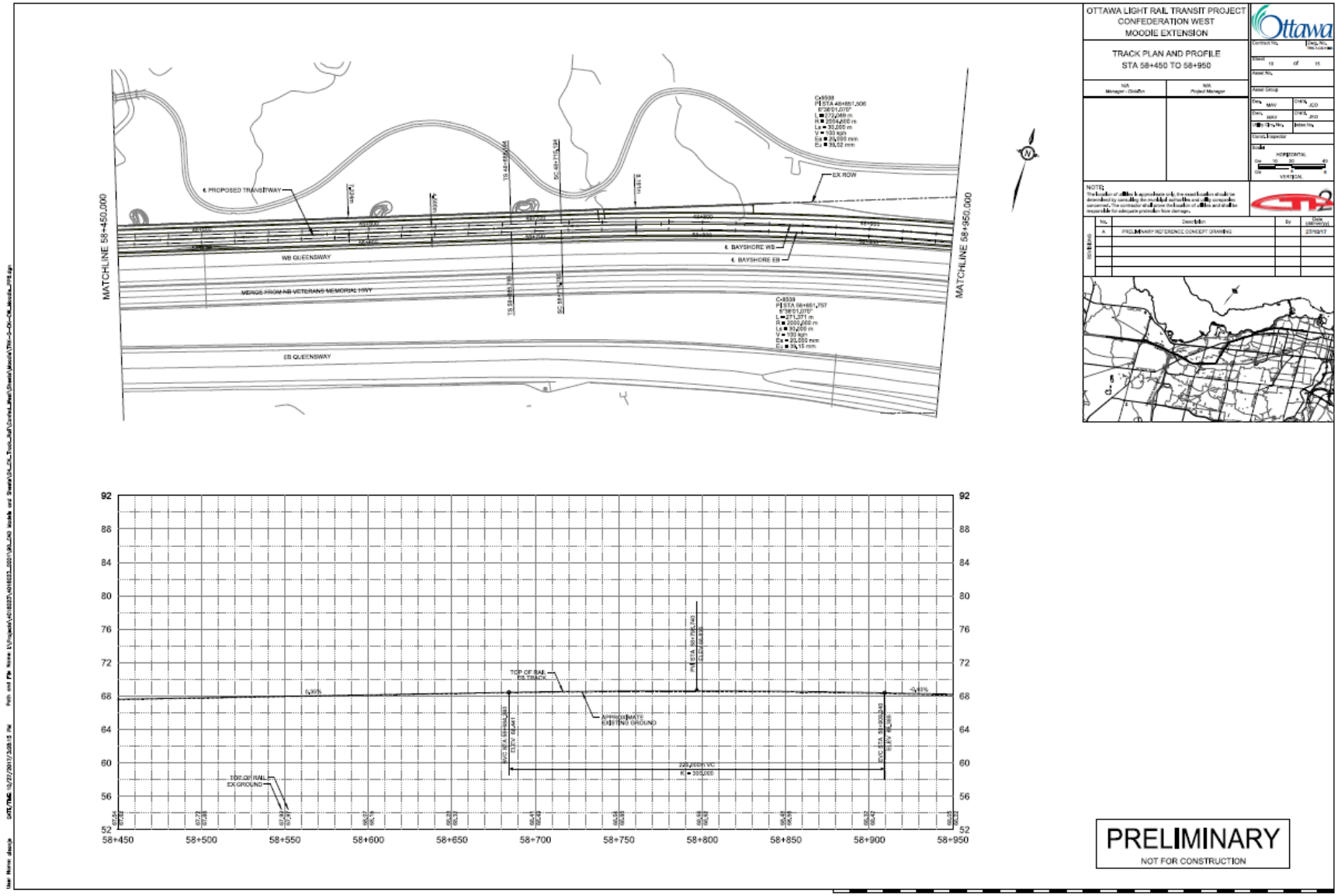
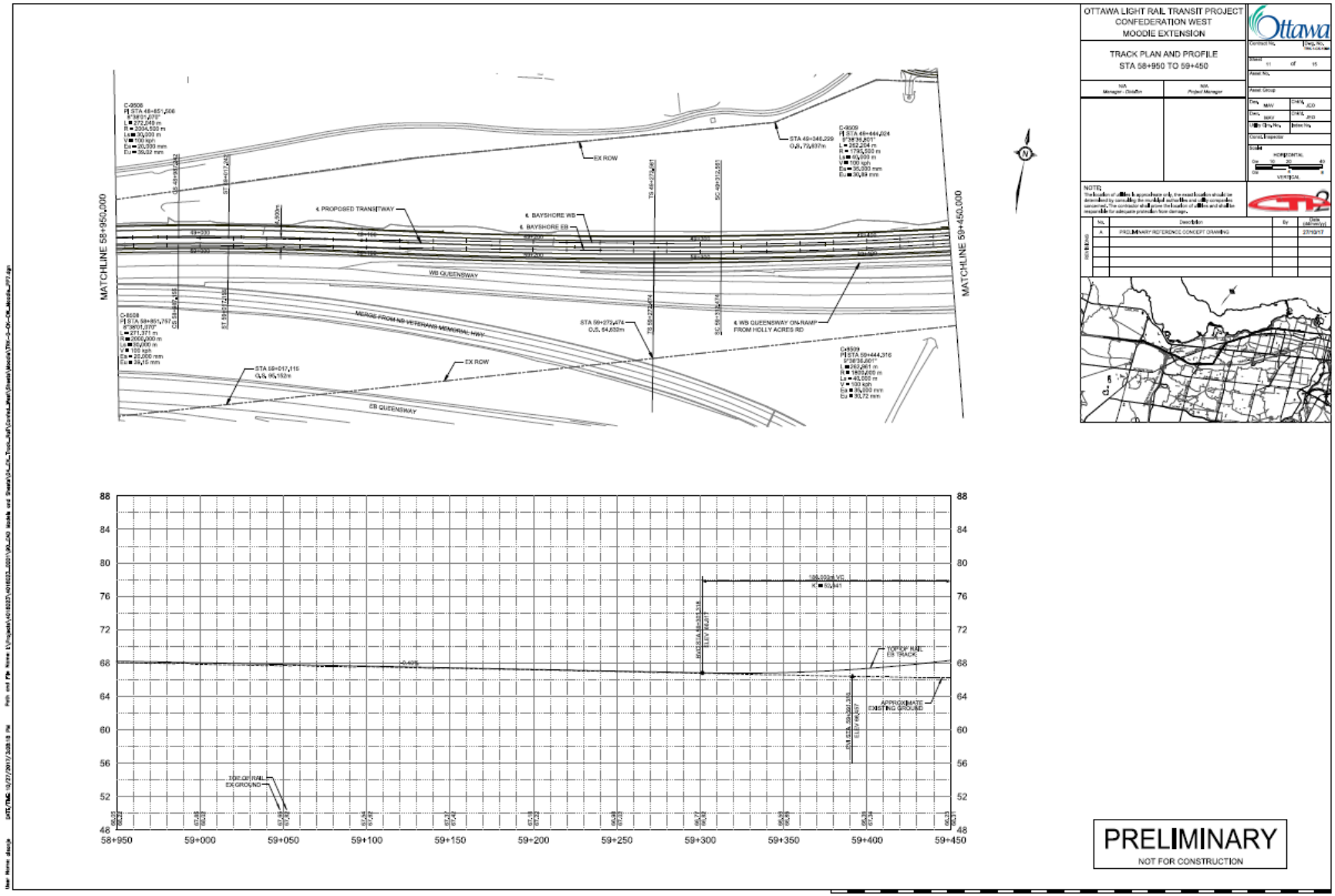


LRT Track (8 of 13)



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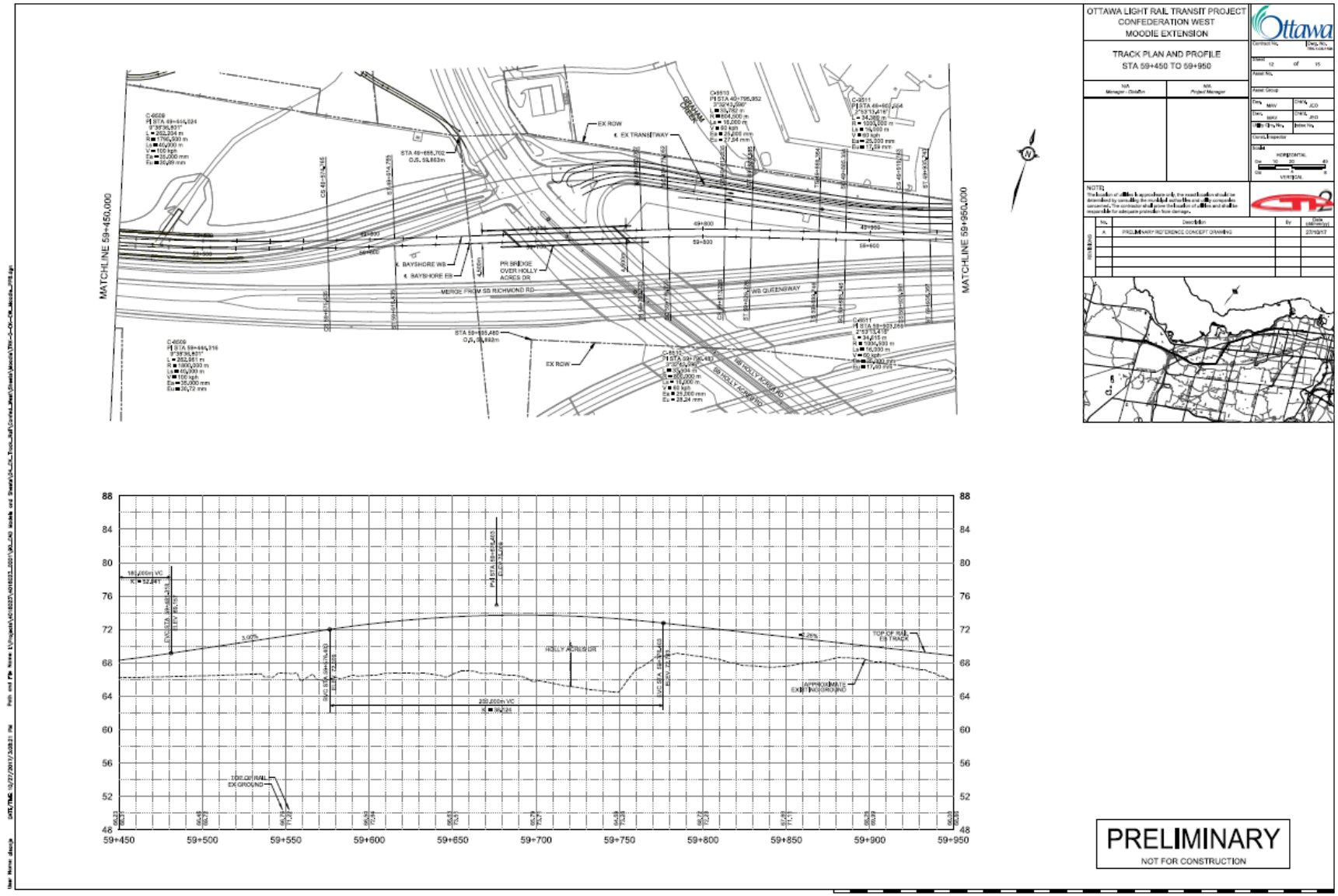
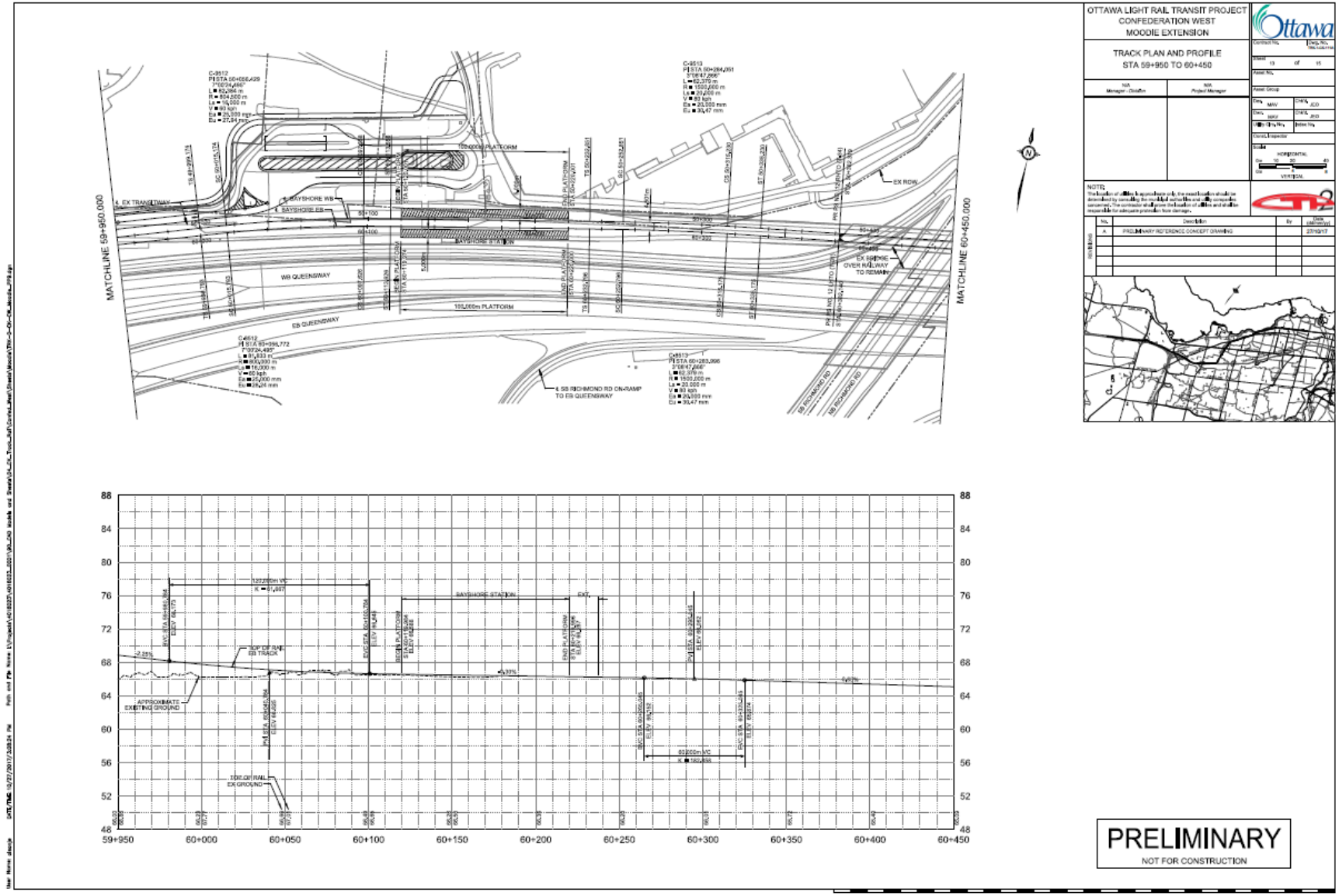
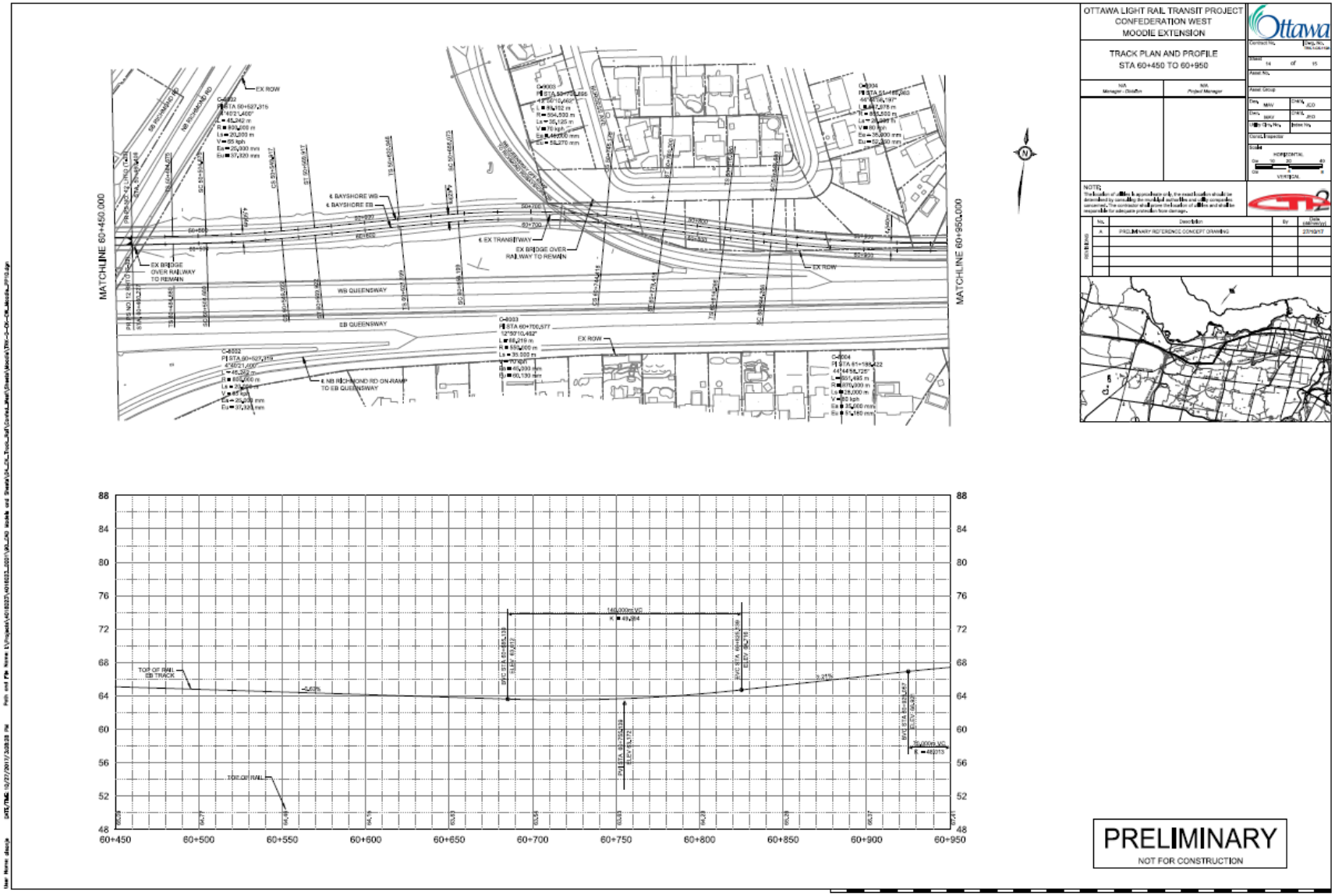


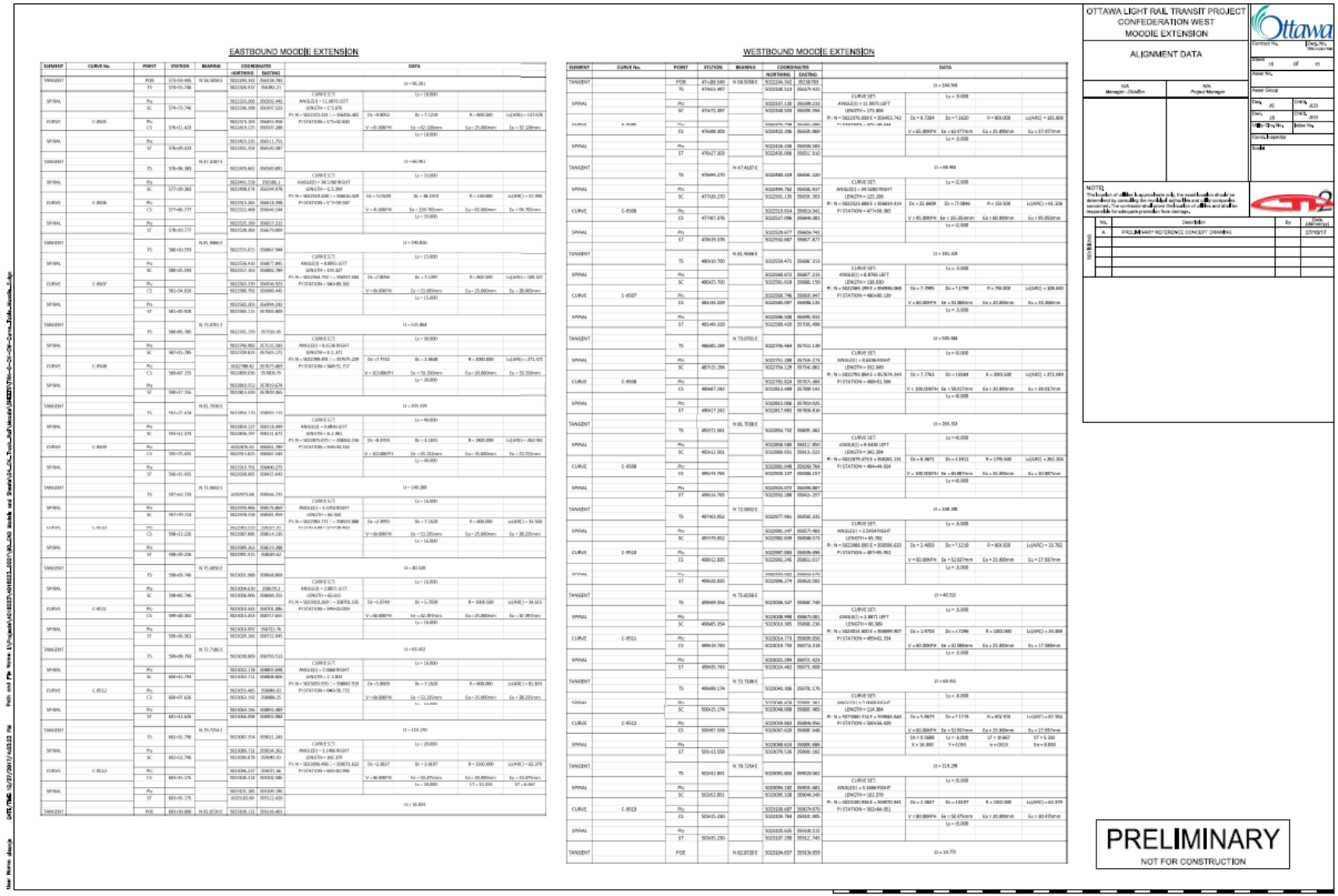
LRT Track (10 of 13)



LRT Track (11 of 13)



LRT Track (12 of 13)



LRT Track (13 of 13)

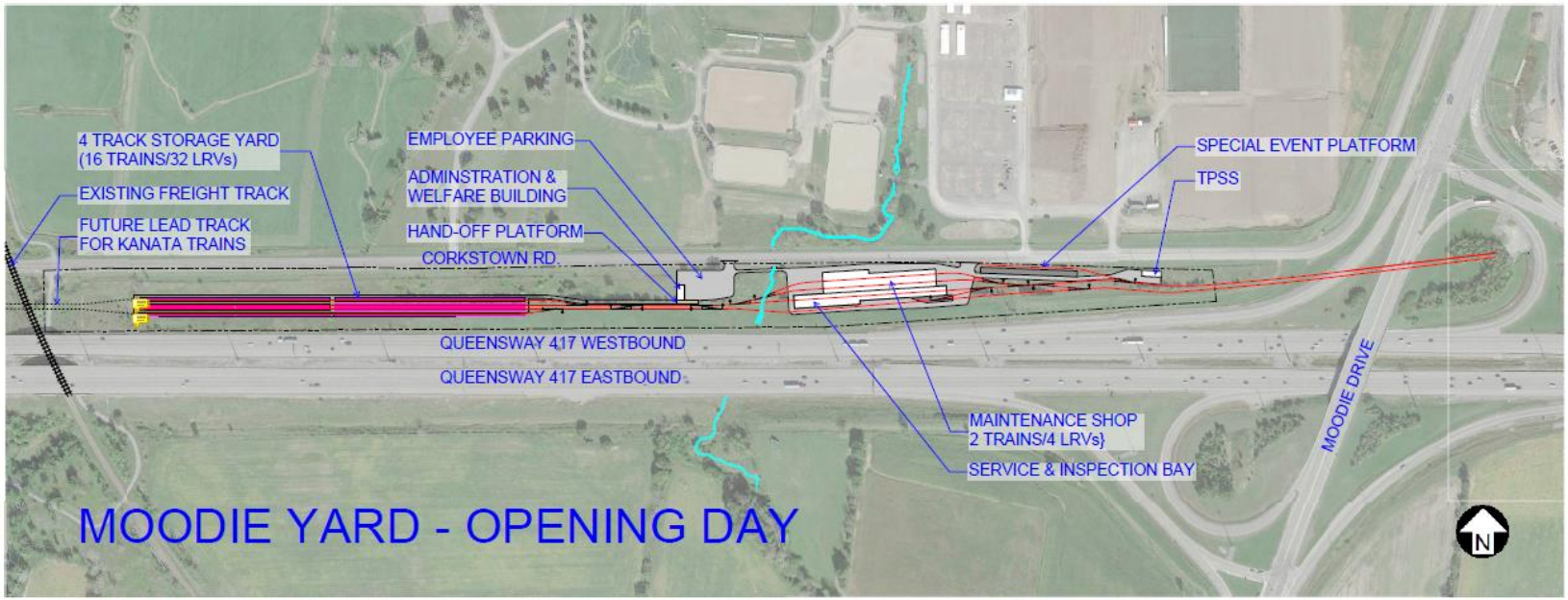


Figure 7-2: Moodie LRT and LMSF 2021

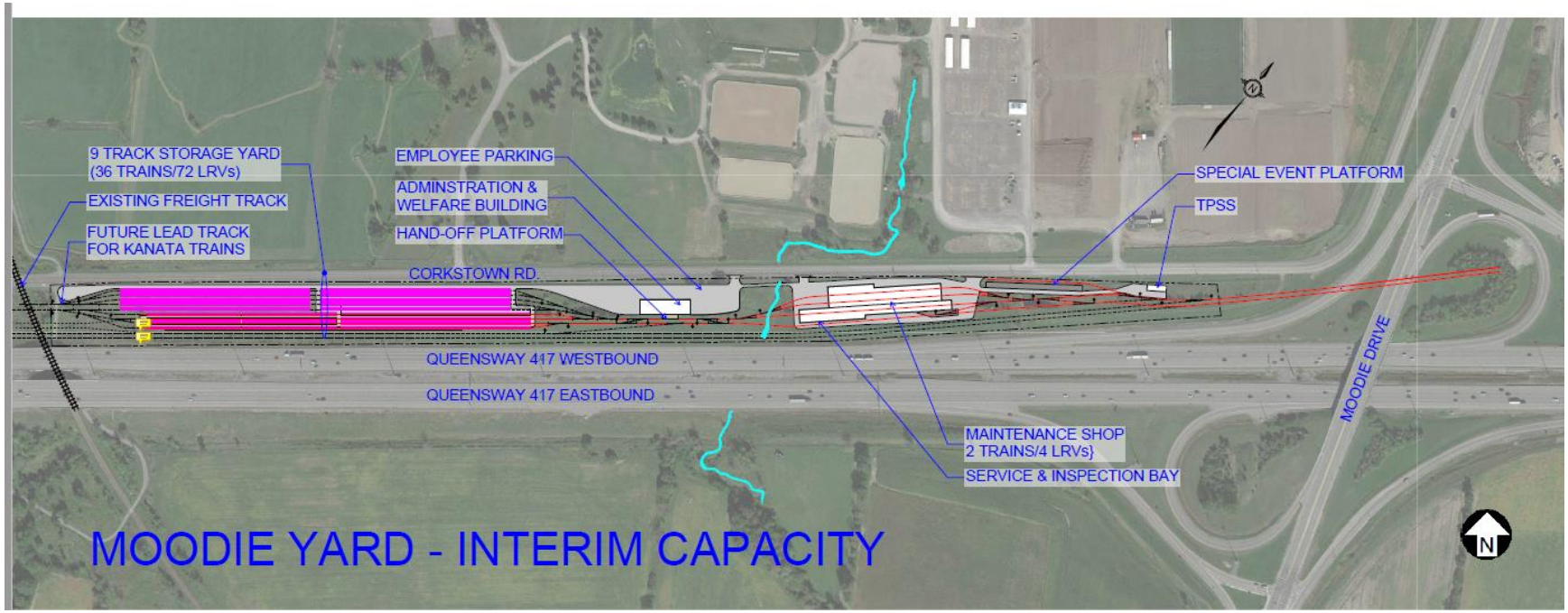


Figure 7-3: Moodie LRT with LMSF Interim Capacity

Figure 7-4: Moodie LRT and LMSF Ultimate Capacity

7.1 Additional Community Consultation

Moodie Station Connectivity Study: Integrating the Stage 2 LRT alignment and stations with local pedestrian and cyclist networks is one of the key principles of the project. Recognizing this, connectivity studies were carried out for each of the stations for the Stage 2 LRT project.

For Moodie Station, a connectivity study was also carried out as part of the BRT extension for Moodie to Bayshore. This resulted in new future cycling/pedestrian connections (e.g. sidewalk along Corkstown Road to Crystal Beach) that are already under construction. The current connectivity study for the Moodie extension will build on this work, and also identify additional connections for the LRT project to implement (e.g. Moodie/Corkstown crossings).

The Moodie LRT Station Connectivity consultation took place on August 21, 2017 as a workshop with 87 interested members of the community, and this public feedback is currently being assessed and incorporated into a final study that will help inform the ultimate station design at Moodie (*Consultation Report*). A similar event was held with PSPC and DND representatives to accommodate multi-modal transportation access to the new DND National Headquarters on Moodie Drive at Carling Avenue.

Overall, the Moodie LRT Station Connectivity Workshop provided a platform for the community to engage and discuss opportunities for connectivity with the Moodie LRT Station. The community provided feedback on topics the Stage 2 team had set out to discuss, including: existing pedestrian and cycling infrastructure, work to be completed by the BRT, what previous connectivity assessments had identified to date, cycling connections between Kanata and Crystal Beach, and any additional features that would benefit the community.

Based on the input received at the workshops a landscaping and connectivity plan around the station has been developed. The plan includes the following:

- Sidewalk connection between the PPUDO and the Station entry. With the relocation of the PPUDO from the south side of Corkstown, and the site modifications to integrate the LRT Station adjacent to the BRT Station, there is a requirement for a new sidewalk connection from Corkstown Road, at the PPUDO intersection to the Station Entry Plaza.
- Corkstown Road: In addition to the relocation of the PPUDO from the south side of Corkstown to the north side, there is also a shift to the west, to accommodate the bus turning movements, and access to the LRT/BRT station. Through the BRT, a sidewalk was built on the north side of Corkstown Road, from Crystal Beach Drive, westerly towards 185 Corkstown Road. As there are no street lights through this newly constructed sidewalk, additional street lights, to current City standards will be installed through the work of the Moodie Station.

- Trans Canada Trail: The existing Trail, along the west embankment of Stillwater Creek will be maintained. It is anticipated that there will be some adjustments to the alignment to accommodate the BRT requirements and the realignment of Corkstown Road. It will be continuous from the Moodie/Corkstown intersection east to Holly Acres Drive, in approximately the same location, and with the roadway crossing installed through the BRT construction. We have also identified a review of the Moodie/Corkstown intersection to enhance the pedestrian and cycling crossing including crosswalks and crossrides. Further enhancements include a direct connection to the MUP from the PPUDO on the north side of Corkstown. This MUP will extend to the LRT Station Plaza, allowing passengers exiting the station to easily access the Trail system. Enhancement of the visual aesthetic along the corridor will be undertaken with additional planting to balance the LRT/BRT station within the naturalized landscape. The proposed planting will provide the both visual buffer from Corkstown Road and Highway 417.

  There will be a new connection from the PPUDO north to the existing Trail along Stillwater Creek. This MUP connection will provide a direct segregated connection from the Trail to the Station, coming from the westerly direction.

- Corkstown/Moodie Intersection: There is a high level of use of the Trans Canada Trail, as it connects Kanata to the downtown core. Currently the intersection has a crosswalk. This will be modified to include a crosswalk/crossride on the north and west side of the intersection.
- Moodie Overpass. Under the BRT extension, there was the sidewalk and MUP identified. Discussions with MTO have led to consideration of the following proposed changes to the Moodie Overpass:
  - 2.0m sidewalk north and south of the structure
    - A sidewalk on the structure, demonstrated to be achievable through detailed design with no structural compromise to existing bridge
    - Extra width for bike lane
    - Extra width for two travel lanes, split evenly
    - Extra shoulder space between west edge of bike lane and raised sidewalk, or between east edge of median travel lane and median
    - Hatched out space on the roadway, on either side of the travel lanes
    - Extend sidewalk from Station to Moodie Drive
    - Revise existing guardrail and crash barrier

  All designs would be subject to MTO approval and must be done to current MTO standards any modifications to existing ramps found to be deficient must be brought up to standard.

- Transportation Master Plan: The other works continue to be beyond the Moodie EA, and are addressed within the future City plans.

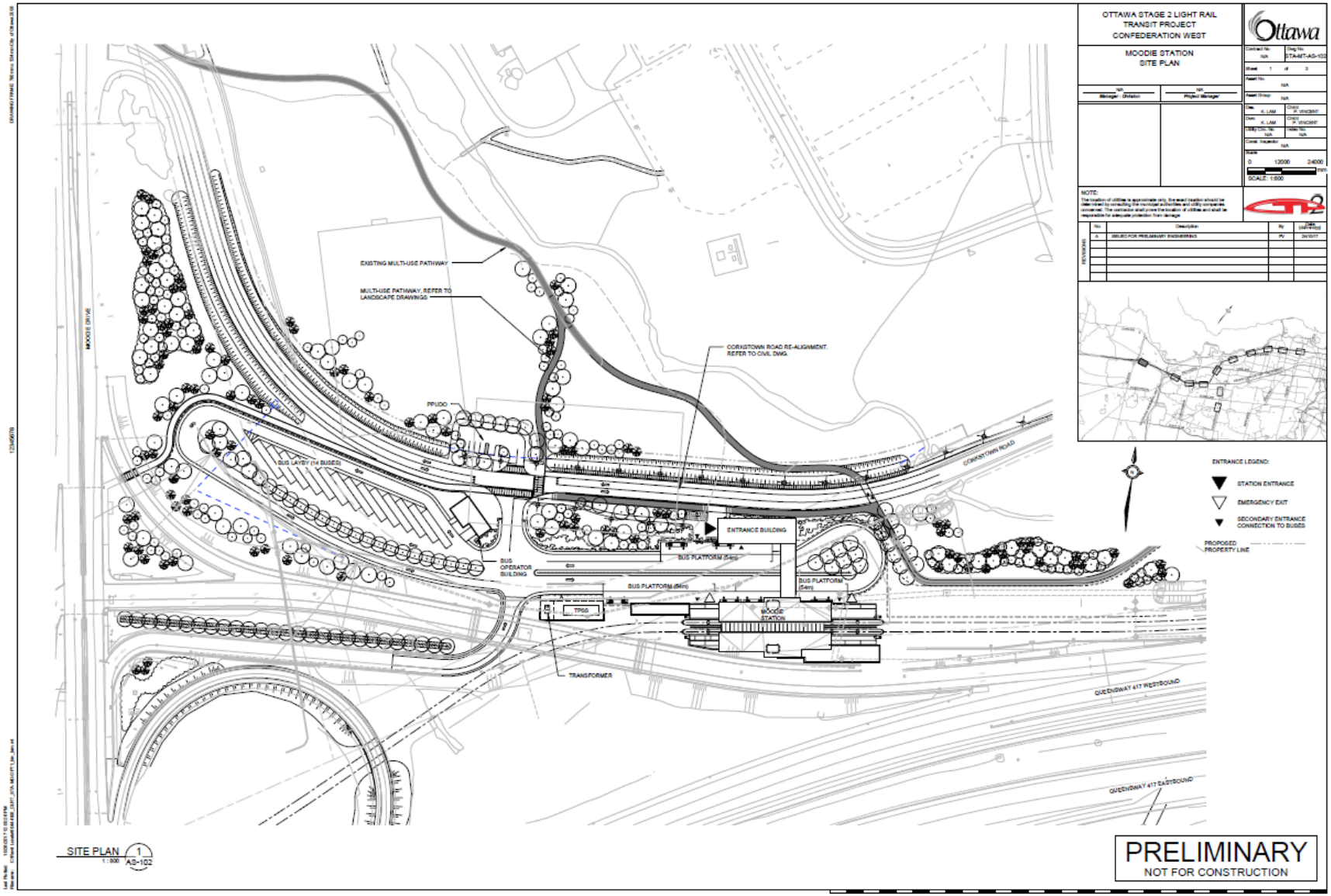


Figure 7-5: Moodie Station: Landscaping and Pathways

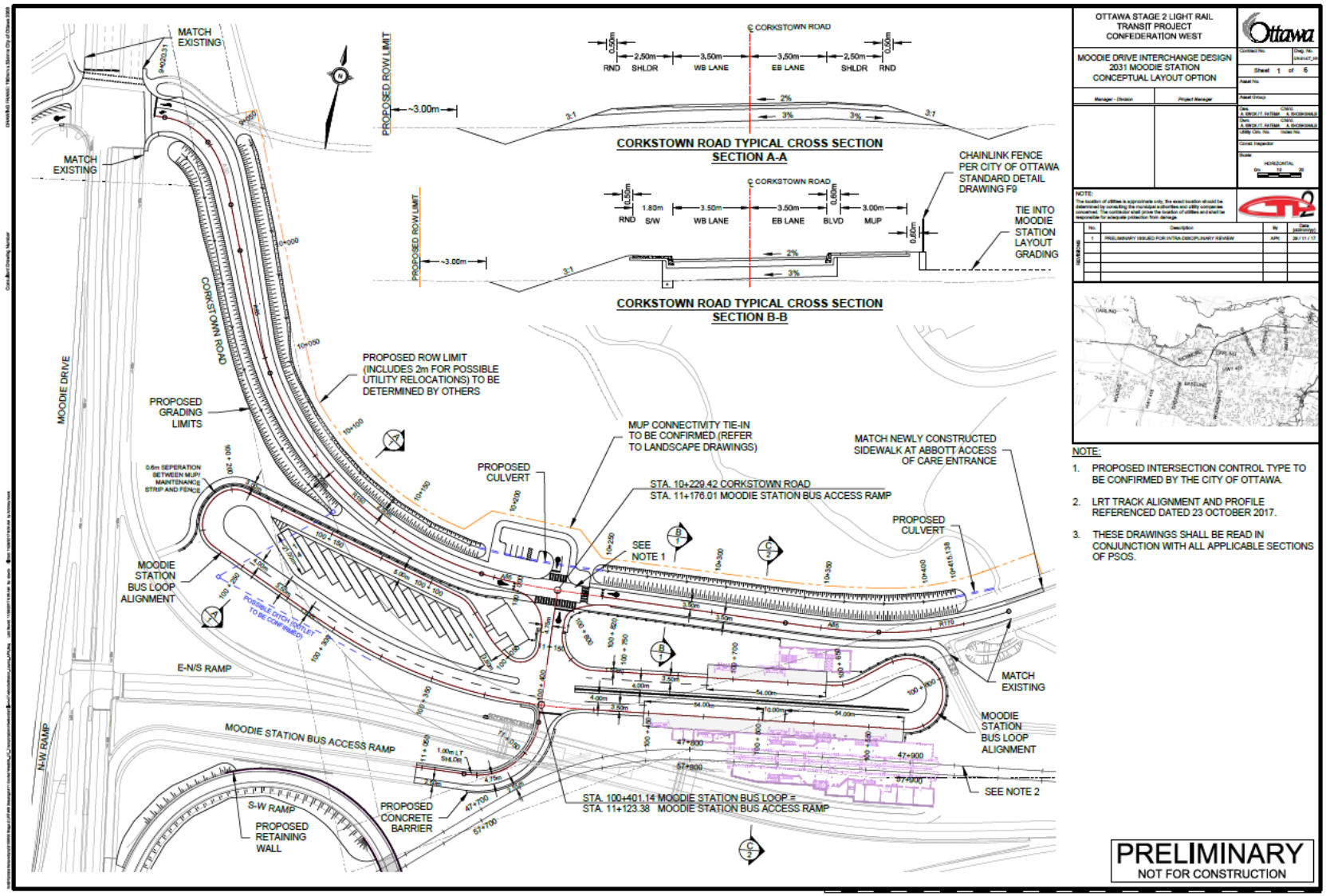


Figure 7-6: Moodie / Corkstown Intersection

Table 7-1: Project Phases and Descriptions

Project Phase	Description
Pre-Construction and Site Preparation Prior to the start of construction, more detailed planning and design needs to be completed. Preliminary and detailed engineering design of the entire project, including design review, peer review and additional filed 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 required easements will be reviewed.	
Site Preparation	Works will include utility and infrastructure relocations. 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.
Bus Detours	Buses currently run in the far right lane on HWY 417 from Bayshore to Moodie. When the BRT is completed in of 2017, they will move to the BRT corridor. In preparation for construction, the will return to service similar to existing conditions. Modifications will be made to Moodie Drive ramps to accommodate transfer to DND campus and modifications to Holly Acres Rd ramps will be made to accommodate transfer to Bayshore Station.
Construction Construction of the Moodie BRT Conversion to LRT is likely to follow the same process as the current Stage 1 Confederation Line project, with a private sector partner responsible for the final design, and construction of the project, with OC Transpo operating the service. The contractor selected by the City will be responsible for developing construction plans and designs that meet contractual requirements, including defining the means and methods of construction.	
Construction of new at-grade LRT segments and station modifications	At-grade runningway segments will have ballast track, except in the station areas where the track will be fixed to a concrete slab to assist with maintenance. New 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.
Conversion of existing	Construction of the project includes the conversion of existing Transitway from BRT to LRT technology. Asphalt will be

Transitway and station	removed and it is proposed that tracks for the LRT be laid over top of 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. 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. At the Transitway station which will be remaining largely in the current configuration, existing platforms will be lengthened and widened as necessary 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. 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 the 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. The sanitary trunk sewer transecting below the LMSF will be reinforced for reliability prior to the construction of the facility

Pathways/Connections	The LRT extension project will realign a section of the current MUP on the north side of Corkstown to have it avoid the ditching planned along the realigned section of Corkstown Road. The grading of the MUP at the Corkstown intersection will be confirmed to ensure positive drainage, however, as indicated above, the MUP on the west side of Stillwater Creek, north of Corkstown Road, is within the floodplain, and this is not anticipated to be changed as we are proposing to raise this MUP to prevent flooding.
General site 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 LMSF and Station areas have been identified for TPSS: 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 The Moodie LRT is likely to follow the same process as the current Stage 1 Confederation Line project, with a private sector partner responsible for maintenance of the project, with OC Transpo operating the service.	

Decommissioning

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.

7.2 Construction Staging

A general construction staging plan for the key project components is outlined below. Note that the detailed construction staging plans will have to be approved by both the City and the MTO.

- Extend the LRT tracks west from Moodie Station to the Moodie LMSF, requiring grade separation structures at the following locations:
  - Moodie/417 S-W ramp
  - Moodie Drive
  - Moodie/417 N-W ramp

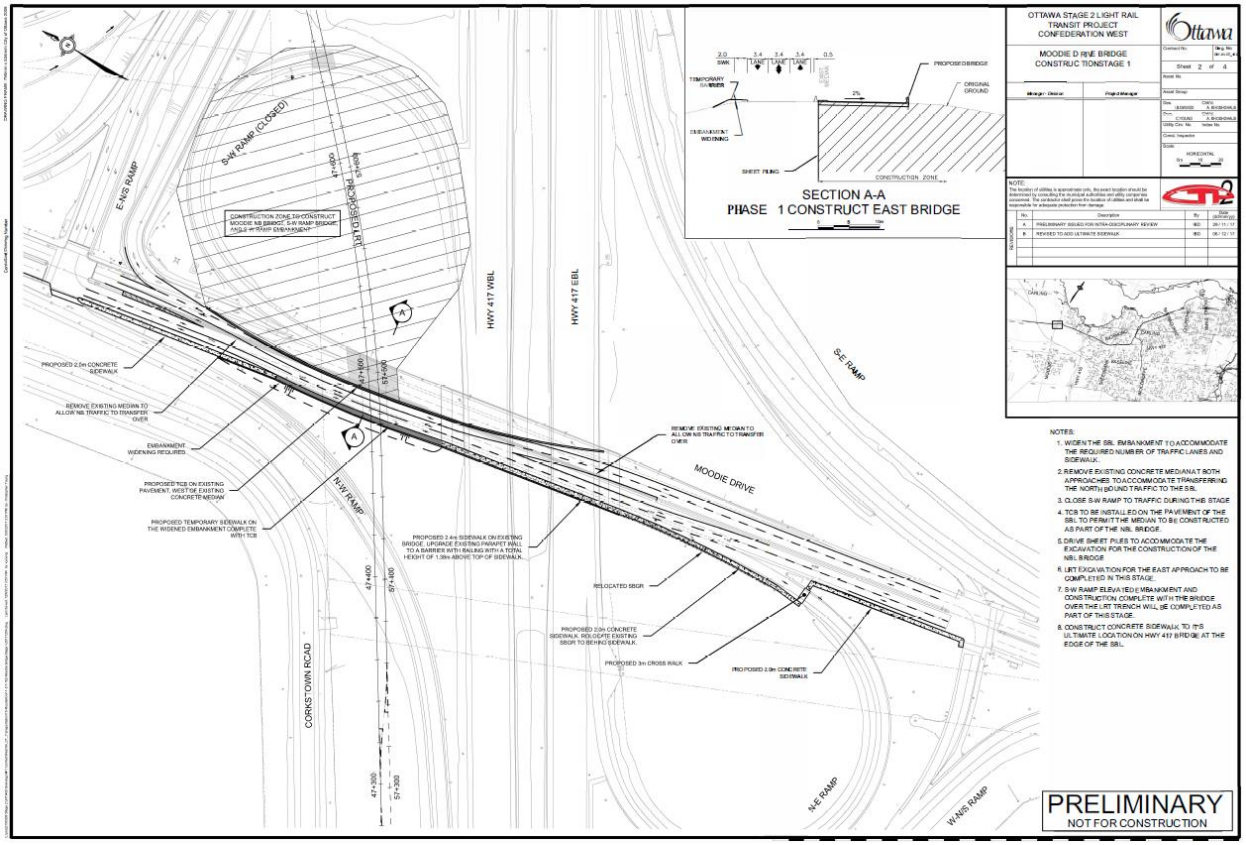


Figure 7-7: Phase 1 LRT Track Extension

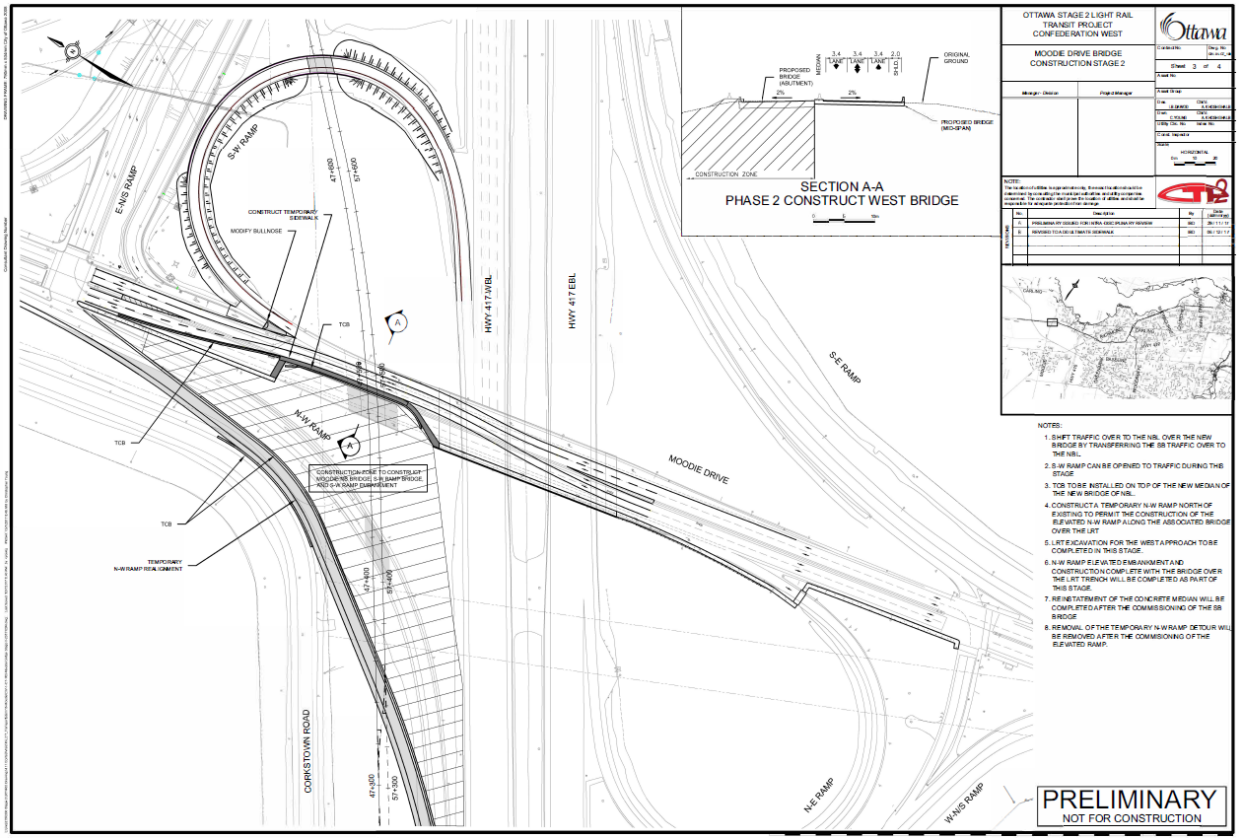


Figure 7-8: Phase 2 LRT Track Extension

The drawings also indicate the addition of a sidewalk to the west side of Moodie Drive, connecting the north and south ramp terminal signalized intersections. While the final details of this are still pending, the intention is to do the following:

- North of the 417 overpass, construct a 2m sidewalk from the north ramp terminal to the north side of the 417 overpass, west of the existing roadway
- Over the 417 overpass, construct a minimum 2m sidewalk (2.4m desirable, however structural considerations may prevent this) utilizing the space currently used by the auxiliary storage lane for the N-E ramp; this will enable the addition of a sidewalk without widening the structure
- South of the 417 overpass, construct a 2m sidewalk from the south side of the 417 overpass to the south ramp terminal, west of the existing roadway

In order to accomplish the above-noted objectives, the following staging plan will be required:

- Phase 1:
  - Shift traffic to the west side of the overpass (remove median as needed)
  - Reduce the 4 existing through travel lanes to 3 lanes

        - Roadway to operate as 2 lanes in the peak direction of travel, 1 lane in the off peak direction of travel
        - This is to say, 2 lanes northbound will remain open in morning rush hour, and 2 lanes southbound will remain open in the afternoon rush hour
    - Close the S-W loop ramp (northbound to westbound traffic) in order to construct the necessary grade separation
    - Construct a temporary realignment for the N-W (southbound to westbound) ramp, to be utilized in Stage 2
- Phase 2:
    - Shift traffic to the east side of the overpass (removed median as needed)
    - Reduce the 4 existing through travel lanes to 3 lanes
        - Roadway to operate as 2 lanes in the peak direction of travel, 1 lane in the off peak direction of travel
        - This is to say, 2 lanes northbound will remain open in morning rush hour, and 2 lanes southbound will remain open in the afternoon rush hour
    - Re-open the S-W loop ramp, as construction will now be complete there
    - Use the temporarily realigned N-W ramp in order to construct the grade separation for the N-W ramp in its permanent (existing) location
- Phase 3:
    - Return traffic to ultimate lane alignments
    - Reinstate median on Moodie Drive
    - Remove temporary N-W ramp that was used in Stage 2

Duration for each of these stages is likely to be in the order of 3-6 months with every effort made to work with the contractor to reduce the time and impacts. 2015 maximum volumes for the S-W ramp are 197 from 5pm-6pm and the lowest was 74 vehicles from 7am-8am. These limited movements can be readily absorbed in the existing network with traffic dispersal amongst existing arterial routes (Timm Drive, Robertson Road, Corkstown Road and Carling Avenue). Public notification, in advance of the closures, and a Detour Plan must be prepared.

The phased construction for Moodie Station and the realignment of Corkstown Road is outlined below.

- Phase 1:
    - Construct new alignment of Corkstown Road north of the existing alignment
    - Construct new PPUDO
    - Traffic remains on existing Corkstown alignment

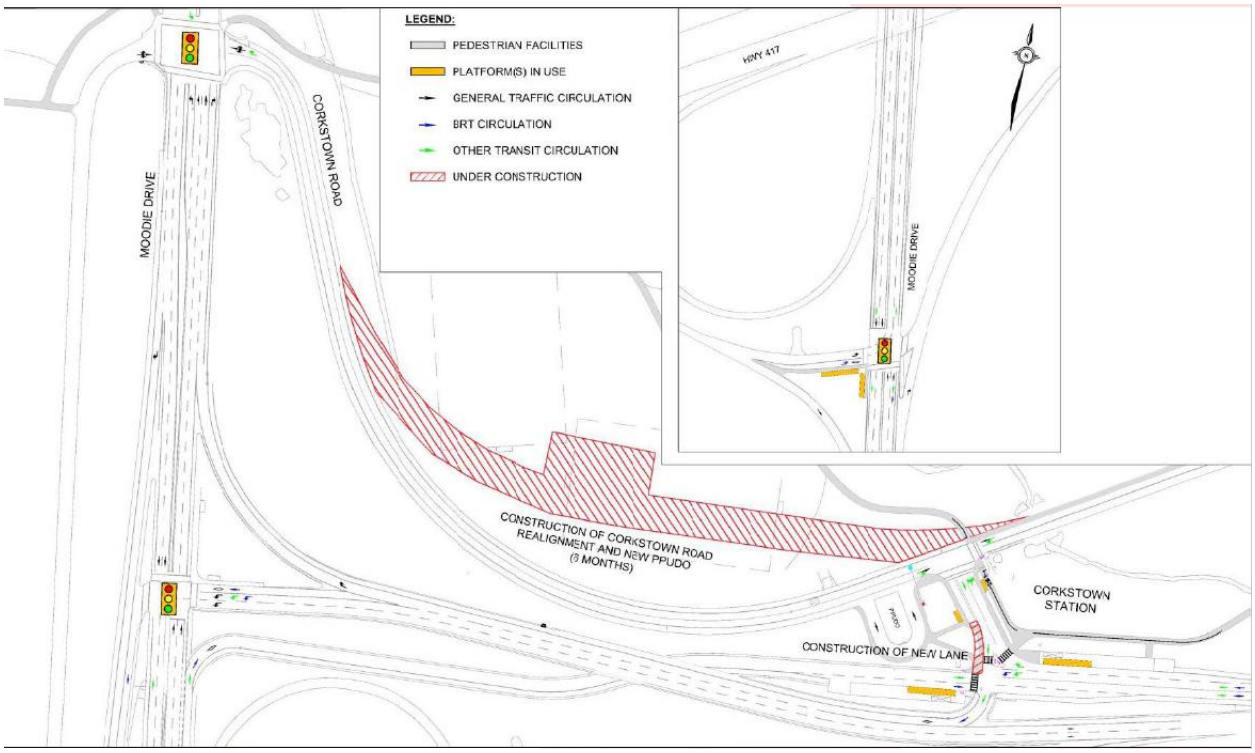


Figure 7-9: Phase 1 Moodie Station Staging

- Phase 2:
  - Shift traffic to realigned Corkstown Road
  - Construct new BRT station

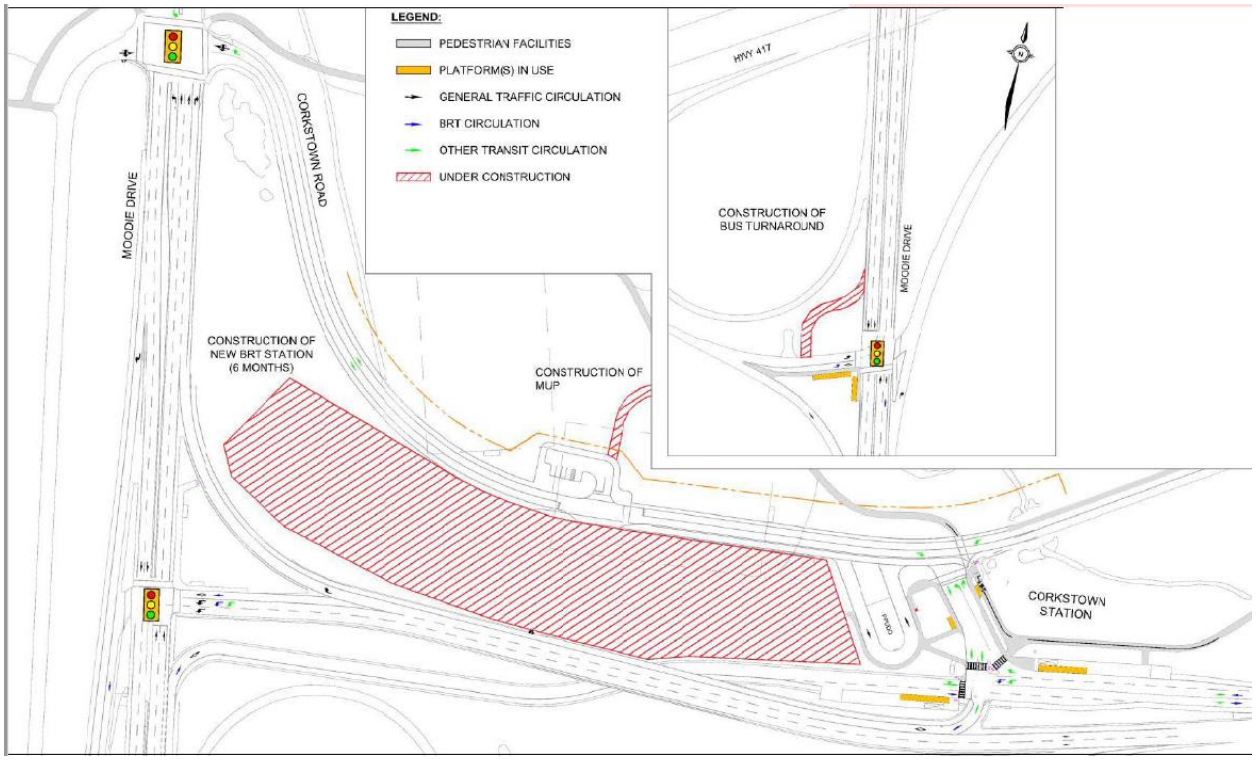


Figure 7-10: Phase 2 Moodie Station Staging

- Phase 3:
  - Shift BRT operations to new BRT station
  - Temporarily close the ramp from Moodie Drive NB into the BRT station (buses use Moodie/Corkstown to access the station)
  - Remove “old” BRT station, and construct new LRT station

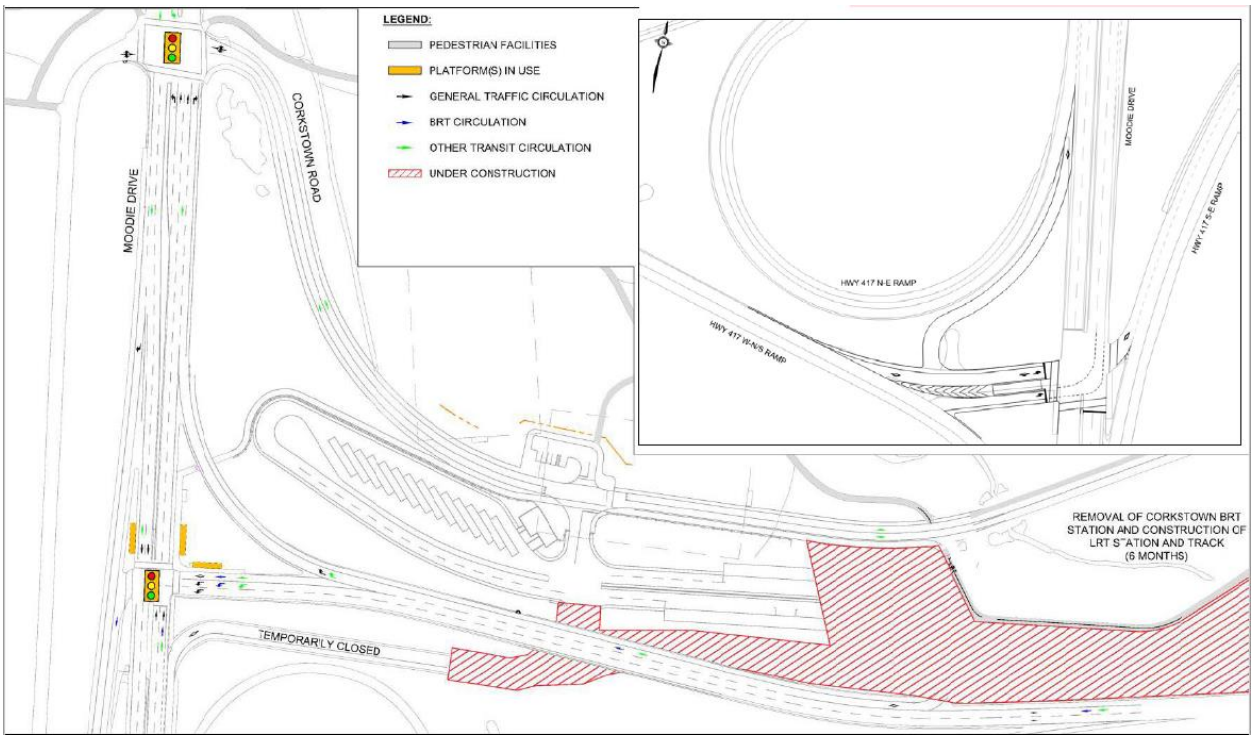


Figure 7-11: Phase 3 Moodie Station Staging

8. ASSESSMENT AND EVALUATION OF IMPACTS

8.1 Assessment and Evaluation Approach

The values and conditions identified in the documentation of existing conditions were used as the basis for assessing the effects of the preferred alternative on the natural, physical, social, economic, and transportation environments. The impact analysis involved applying the following steps, as presented in Table 7-1.

Table 8-1: Assessment

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 *mitigation of residual effects*, if possible/practical.
Step 5	Determine the *significance of the residual* environmental effects, after further mitigation.

Professional judgment and experience formed the basis for identifying environmental effects and mitigation measures. The analysis was based primarily on comparing changes to the existing environment, prior to, during, and after construction. To understand the interactions between the project and the environment it is necessary to consider all phases of the project: pre-construction/design, construction, and operation.

8.2 Built in Mitigation Measures

In this assessment, “built-in mitigation” is defined as actions or design features incorporated into the pre-construction, construction, and operational phases that have the specific objective of lessening the significance or severity of environmental effects that may be caused by the project. These can manifest as monitoring plans prepared before construction commences, design elements, or general site recommendations.

The Moodie LRT will be designed and implemented with the benefit of current planning, engineering, and environmental management practices with regard 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. Descriptions of the practices that should be employed, based on current standards, are described below. These measures can be considered “built into” the preferred design for the Moodie LRT. They will be updated and refined during the pre-construction, construction, and operation phases of the project.

Archaeology Risk Management Plan will outline:

- the actions required resulting from the recommendations of the Archaeological Reports including any archaeological monitoring requirements by a licenced archaeologist during the Construction Activities;

- a process for amending the Archaeological Risk Management Plan to incorporate any additional actions required resulting from subsequent archaeological assessment reports completed;

- a protocol to be followed if human remains are discovered which includes how it will be ensured that human remains are managed in compliance with Applicable Law and all requirements of Governmental Authorities with respect to such discovery, including the *Funeral, Burial and Cremations Services Act*, *2002* (Ontario), the *Standards & Guidelines for Conservation of Provincial Heritage Properties* issued under the *Ontario Heritage Act* (Ontario) and the *Standards and Guidelines for the Conservation of Historic Places in Canada*;

- the protocol addressing the discovery of human remains on federal lands to be developed in consultation with the archaeologist of the NCC heritage program to reflect the NCC's requirement for notification and their need to inform First Nations, in particular for human remains identified as pertaining to Indigenous individuals, in accordance with current protocols between the NCC and First Nations;

- a protocol to be followed if previously undocumented archaeological resources are discovered which comply with Applicable Law regarding management of previously undocumented archaeological resources;

- the protocol to be followed should the discovery of previously undocumented archaeological resources occur on NCC lands must include the notification of the NCC Heritage Program

Construction Waste Management Plan: During construction there may be excess materials that must be disposed of off the project site. These materials could include asphalt, waste steel/metal structural components, earth, and road right-of-way appurtenances such as signs, lighting and utility poles. A Construction Waste Management Plan will be developed to emphasize that surplus or scrap material is to be recycled whenever possible, and to describe the methods to be used by the contractor for disposal of non-recyclable surplus material in accordance with provincial and City of Ottawa practices and guidelines.

Dewatering Management Plan: address the management of excess water generated by the Project (the "**Dewatering Management Plan**"). The 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;
- procedures for addressing any complaints received related to groundwater control activities; and

- reporting procedures to document how all groundwater management activities and best practices have been implemented.

DFO Requirements for Culvert Extensions: The Fisheries Act requires that projects avoid causing serious harm to fish unless authorized by the Minister of Fisheries and Oceans Canada. A self-assessment should be undertaken and a request for review by DFO prepared and submitted to DFO before proceeding to construction. If, after project review, it is determined that the project will cause harm to fish that are part of or that support a commercial, recreational or Aboriginal fishery, an Authorization under Paragraph 35(2)(b) of the Fisheries Act will be required.

Dust Control Plan: The Dust Control Plan will be implemented during the Works to limit the generation and dispersion of, and mitigate potential effects of, air-borne particulate matter associated with the Works. The Dust Control Plan shall address air-borne particulate matter issues in the context of the potential environmental impacts, nuisance impacts and impacts on human health and safety in accordance with O. Reg 419/05.

Erosion and Sediment Control Plan: to document the degree of erosion and sedimentation that would occur under normally anticipated weather conditions during the life of the project, and to develop and describe mitigation strategies to control foreseen areas determined to be predisposed to the problem. This would include: identifying planting and slope rounding specifications within the contract; identifying and specifying seeding and sodding locations; identifying areas requiring slope benching or retaining structures in the detail design process; and post construction monitoring and mitigation practices.

Emergency Response Plan: The preparation of an Emergency Response Plan to be used by the construction 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 will include provisions for providing temporary services to end users in the event of a construction-related service outage or other service disruption.

Excavated and Imported Materials Management Plan: Plan that 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).

Excess Water Management Plan: will be developed by the contractor to manage excess water as a result of dewatering activities. The plan will minimize the potential for water

contamination, and prevent the release of polluted water into the environment. Additionally, surrounding surface and groundwater quality is monitored. Consideration of all of the above factors will inform the appropriate discharge method for the water will be selected.

Exclusionary Fencing: Exclusion fencing should be installed prior to working in or around natural areas, to prevent wildlife (especially turtles) 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.

Geotechnical Investigations: Preliminary geotechnical investigations have been completed for the preferred alignment, as well as the LMSF approach and site. Additional geotechnical investigations in the detailed design stage will be required to confirm groundwater and subsurface conditions and the potential impacts as the alignment design is developed further. Foundation investigation will be required for structural design of new structures and any possible extension of culverts

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 Treatment Plan, in accordance with municipal standards, will be prepared during the pre-construction phase. 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 confirm clear sight lines and appropriate illumination. City of Ottawa policy regarding lighting of connections to LRT stations will be followed. Consideration should also be given to the use of wavelengths safe for wildlife.

Noise and Vibration Control Plan: to identify and document the processes, required analyses and surveys, and any other supporting effort necessary to ensure that the Project Operations are carried out in compliance with the Applicable Noise and Vibration Requirements and include:

- identify major noise and vibration producing construction activities and identify a plan to minimize, monitor and mitigate noise and vibration levels to the extent reasonably possible;
- identify ground-borne and air-borne noise and vibration prediction and measurement procedures, and methods to evaluate ground-borne and air-borne noise and vibration from the Project Operations, the New City Infrastructure, and the operation of the light rail transit vehicles on the System Infrastructure in accordance with the LRT Rules and Standard Operating Procedures;
- identify possible mitigation measures to be applied when and where calculated ground- borne or air-borne noise or vibration levels exceed the Noise and Vibration Performance Limits;

- procedures for conducting compliance verification measurements, measurement processes, measurement equipment and analysis methods, during the Construction Period.

Management of Contaminated Materials: The MOECC 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 (MOE, 1994)) to ensure that it can be discharged without causing an environmental impact/impairment/adverse effect.

Landscape Plan: The landscape plan must consider the use of landscaping features to provide visual abatement of the Moodie LRT project from adjacent communities and uses, particularly in the vicinity of the Wesley Clover Facility and take into consideration views to and from the Capital Arrival perspective.

Public Communications Plan: The purpose of the Plan is to make residents and other stakeholders aware of scheduled road closures, transit service modifications and other disruptions to normal service ahead of time to help them plan their activities with minimum disruption. The public communications plan will detail how to communicate information about the work in progress to the public, what information should be disseminated, and at which project stage the communication should take place.

Spills Response and Action Plan: prepared and adhered to by the construction 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, refueling and maintenance of equipment with the use of toxic materials is 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, MOECC Spills Action Hotline shall be contacted (1-800-268-6060), as well as the NCC if the spill is within, adjacent to, or could potentially affect federal lands.

Species at Risk: The SARA and OESA are updated on a regular basis. 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, NCC and Environment Canada are to be contracted 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 impacts. This includes: Fisheries; Migratory Birds; Bats; Turtles; and Species at Risk.

Traffic and Transit Management Plan: to support the development of the transit detours. The objective is to document how traffic will be managed during construction. Each specific stage of the work will require its own specific plan to address local issues and identify how an acceptable level of service will be maintained. The document will use the City's multi-modal level of service approach, which considers pedestrian, cycling, bus and traffic impacts. Any temporary facilities built as part of the staging should consider impacts to the SWM and drainage as a result of their implementation.

Tree Conservation Report: to retain as much natural vegetation as possible, including mature trees, stands of trees, and hedgerows. The Report will identify and describe the vegetative cover on the site prior to construction, and will provide a professional opinion as to the priority that should be given to the conservation of the treed areas that are beyond the grading limit for the Moodie LRT. This report will also provide an assessment of trees identified for removal including health, and bat cavity suitability.

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, EC, MNFR, NCC

8.3 Site Specific Mitigation Measures

After potential effects were predicted, site specific mitigation measures were identified to reduce potential negative effects to an insignificant or negligible status. Mitigation includes specific design features, commitment to future studies and permitting processes triggered by the proposed works, and outlining appropriate approvals required prior to the start of construction. Monitoring is important to verify the accuracy of the prediction of environmental effects. Monitoring measures may be recommended to determine what effects actually occurred with project implementation, and may result in the modification of mitigation measures to improve their effectiveness. Identified monitoring measures included inspection and surveillance, and compliance monitoring. Should the description of the project be changed, additional site specific mitigation and monitoring may need to be considered.

Noise and Vibration: An environmental noise and vibration study for a proposed Light Maintenance and Storage Facility (LMSF) was undertaken.

The LMSF serves the LRT system for storage of Light Rail Vehicles (LRV's), minor maintenance, minor repairs and cleaning. The operations dispatch for daily LRT activity and house office spaces. The primary sound sources at the facility are on-site LRV movements; and other sound sources include several air handling units and exhaust fans on the MSF building roof. The facility operates twenty-four (24) hours per day, seven (7) days per week.

The sound power data of the proposed LRV was derived from a United State (US) Federal Transit Administration (FTA) guideline. The number of stationary sound sources was assumed in accordance with a similar physically sized maintenance facility and office building.

The residential dwellings in the residential zone to the east of Moodie Drive and the north of Highway 417, one (1) school building, and two (2) residences on the south of Highway 417 were identified as noise and vibration sensitive receptors. It was informed that there is no vacant lot within 1,000 metre range from the potential MSF sites since the entire area is designated as greenbelt area.

The ambient sound levels were established based on traffic data and MOECC exclusion limits, and used as noise criteria in this study. The assessment utilizes ground-borne vibration criteria established in the FTA guideline for vibration sensitive receptors near the LMSF.

Service movement is related to LRV's returning from transit service, leaving the facility for service, and maintenance. From the analysis it was determined that the preferred layout does not require any noise mitigation.

It was predicted that the vibration impact at the school building will be in compliance with FTA ground-borne vibration guideline, and will not require any vibration mitigation measures. Other vibration-sensitive receptors are further set back so no vibration mitigation is needed.

Bus/BRT routings

Bus/BRT routings have been organized to prevent community cut through. There will be no dead-end runs along Corkstown Road to the bus terminal. Operations will be focused on major routings (Figure 8-1).

Figure 8-1: BRT Routes

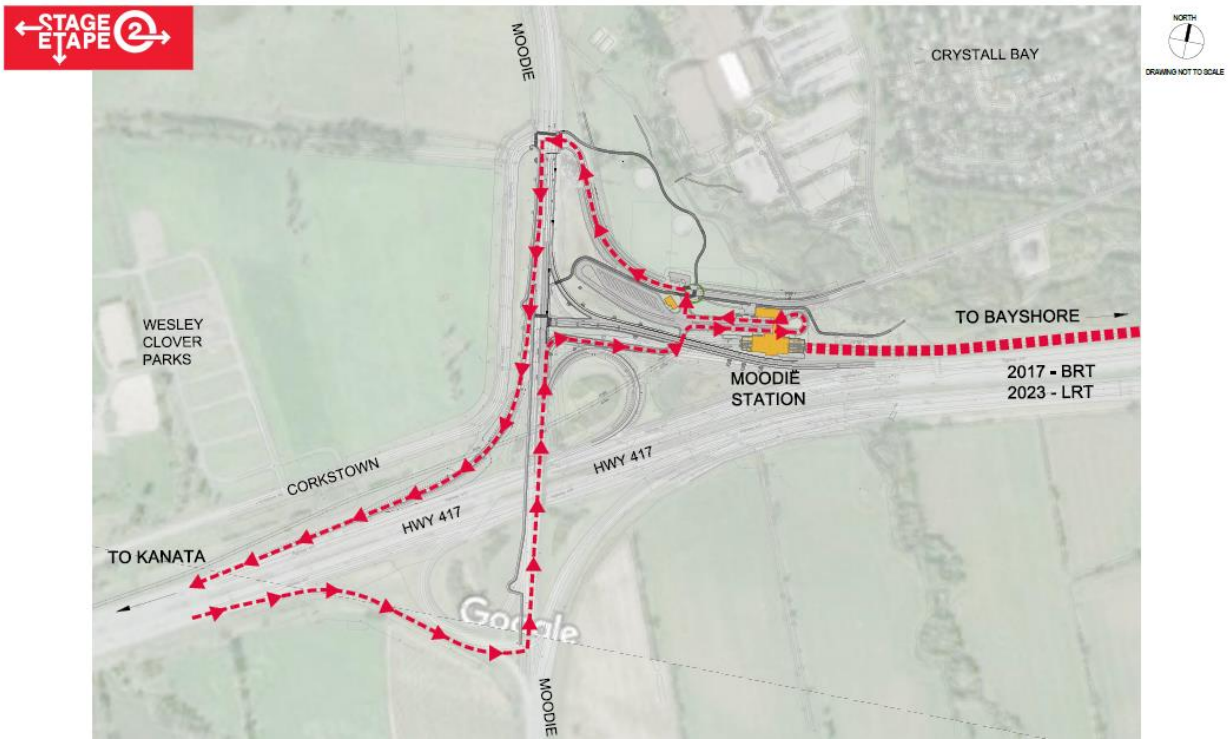
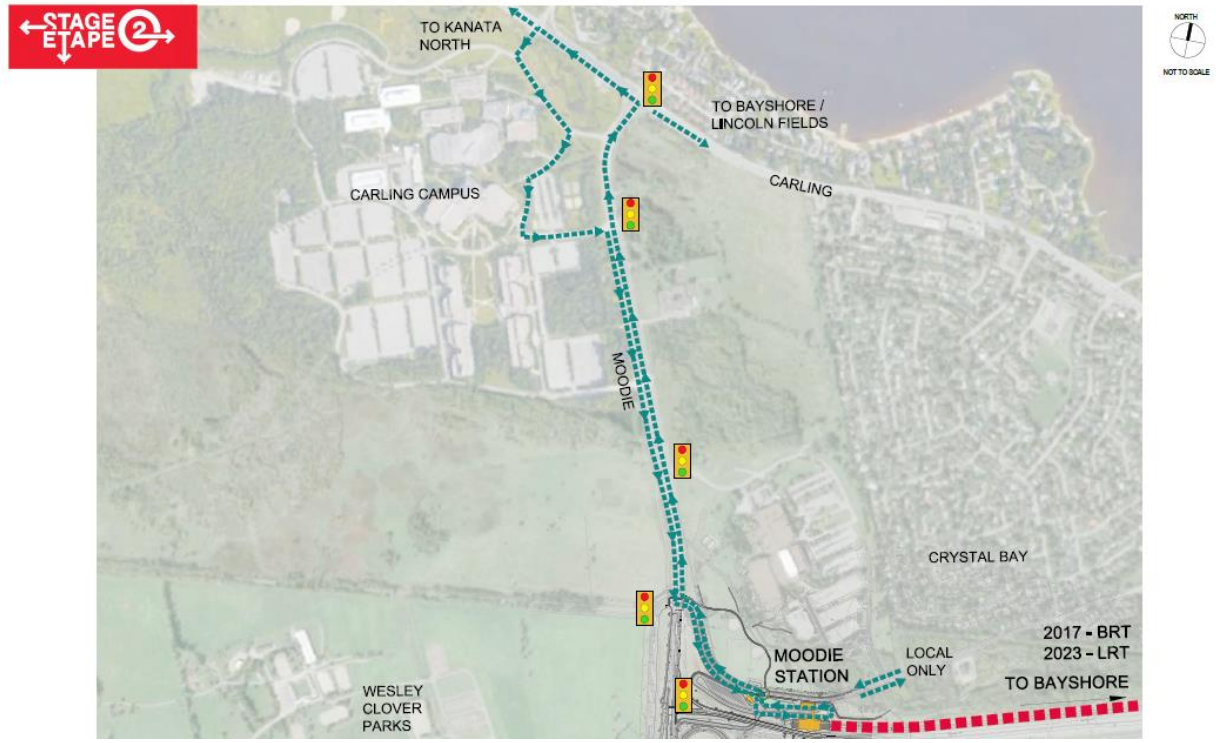
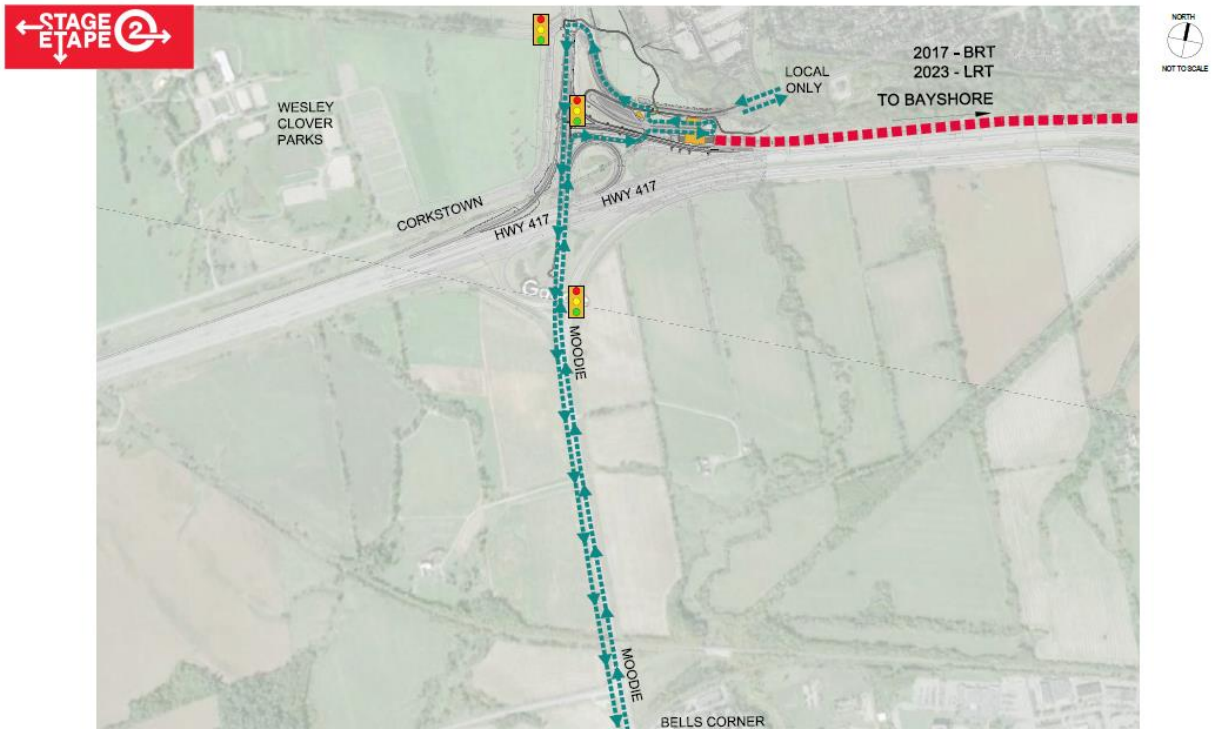


Figure 8-2: Local Transit Service





Utility Relocation

The LMSF crosses a major municipal Trunk Sewer. The easement passes diagonally through the adjacent farm fields and under Highway 417. Protection of this utility for repairs/emergency services is necessary to prevent the interruption in LRT services if repairs are required. Options include either increased resiliency or relocation. Potential relocation routes were assessed east and west of the LMSF and to the east of Moodie Drive adjacent to City watermain easements.

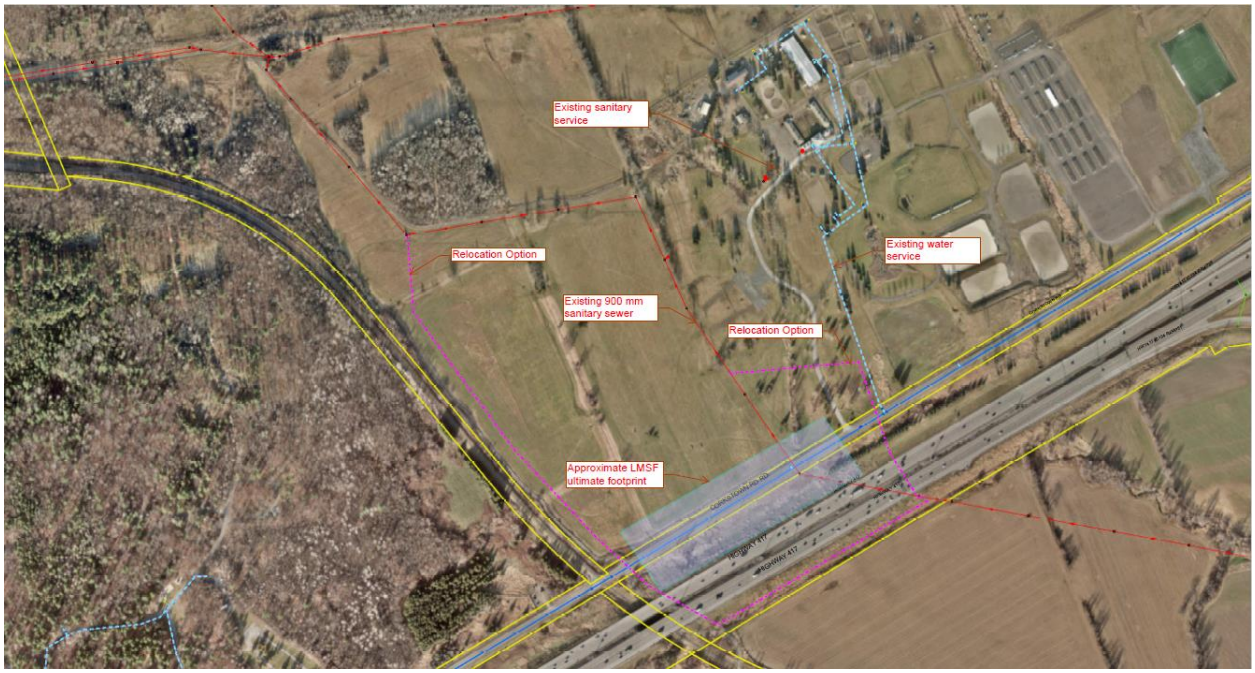


Figure 8-3: Relocation East or West of LMSF

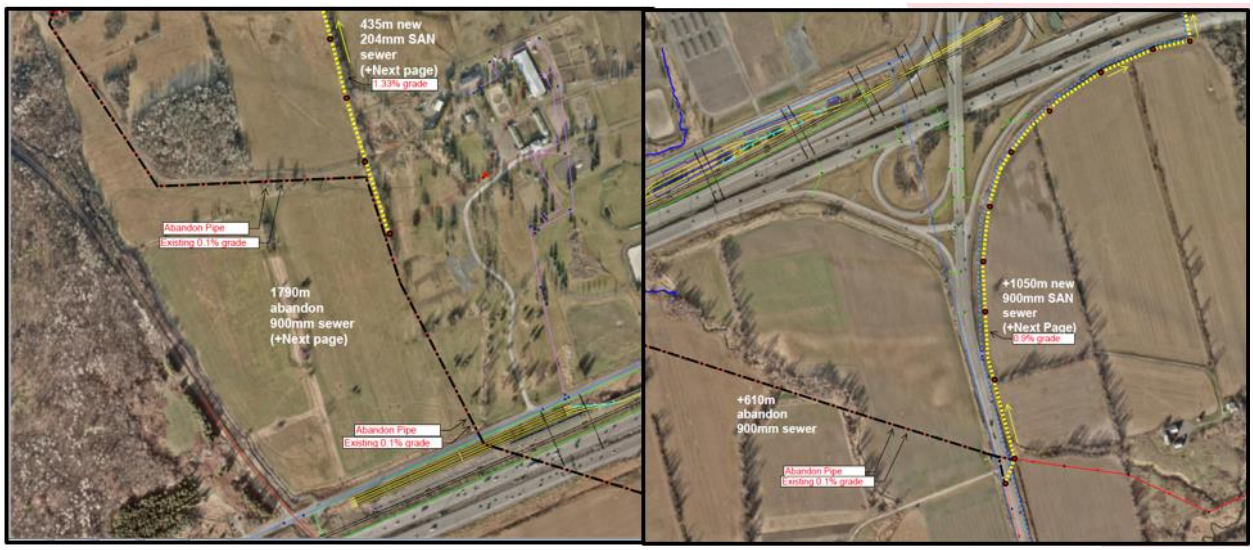


Figure 8-4: Relocation East of Moodie

The City of Ottawa has confirmed that improving resiliency is feasible. The portion of the sewer would be rebuilt along with the construction of the LMSF. This would reduce the likelihood of repairs being required beneath the LMSF. If, in the future, the sewer needs to be relocated, the routing east of Moodie is preferred.

Traffic Operations - 2031

Intersection operations were reviewed for the 2031 horizon year at all intersections in the study area. Two scenarios were analyzed for the 2031 horizon year: one with the LRT out to Bayshore Station and BRT to Moodie Drive, and one with the LRT all the way to Moodie Drive.

For both analyses it was assumed that the DND campus is fully built out to accommodate the projected 9,000 employees, as described in **Section 3.1**. All other background traffic growth in the study area was taken from the City of Ottawa's Regional Transportation Model.

Future 2031 intersection performance for all signalized intersections in the study area is shown in Table 8-2 and

Table 8-3. As in previous scenarios, the intersections were modelled using Synchro Version 9. Minor adjustments were made to the City's signal timing plans, where required, in order to maintain an acceptable intersection LOS.

Table 8-2: Future Intersection Operations: 2031 BRT

Intersection	Intersection Performance			Critical Movements			
	Delay (s)	v/c ratio	LOS	Movement	v/c ratio	LOS	95th% Queue
Holly Acres & Carling	8 (7)	0.30 (0.39)	A (A)	WBT (WBL)	0.33 (0.65)	A (B)	17 (#74)
Holly Acres / Nanaimo & Richmond	34 (32)	0.69 (0.77)	B (C)	EBL (EBL)	0.80 (0.80)	C (C)	#133 (#78)
Holly Acres & Hwy 417 WB / Bayshore	20 (23)	0.76 (0.59)	C (A)	NBTR (WBLTR)	0.78 (0.76)	C (C)	#209 (42)
Holly Acres & Hwy 416/417 EB	27 (14)	0.82 (0.65)	D (B)	EBR (NBR)	0.85 (0.66)	D (B)	151 (20)
Moodie / James Cummings & Carling	42 (22)	0.87 (0.93)	D (E)	NBLT (EBR)	**1.08** (0.97)	**F** (E)	#189 (#167)
Moodie & Network Access	9 (13)	0.28 (0.52)	A (A)	NBL (EBR)	0.51 (0.61)	A (A)	22 (22)
Moodie & South Ring	12 (27)	0.52 (0.65)	A (B)	NBL (EBR)	0.67 (0.82)	B (D)	115 (95)
Moodie & Abbott	5 (6)	0.66 (0.54)	B (A)	NBT (SBT)	0.67 (0.55)	B (A)	117 (96)
Moodie & Corkstown	14 (29)	0.79 (0.90)	C (D)	NBT (NBL)	0.81 (0.95)	D (E)	207 (#27)
Moodie & Hwy 417 WB	12 (14)	0.61 (0.76)	B (C)	WBL (WBL)	0.84 (0.78)	D (C)	#64 (50)
Moodie & Hwy 417 EB	19 (10)	0.64 (0.90)	B (D)	EBL (SBR)	0.83 (0.94)	D (E)	92 (#42)

Table 8-3: Future Intersection Operations: 2031 LRT

Intersection	Intersection Performance			Critical Movements			
	Delay (s)	v/c ratio	LOS	Movement	v/c ratio	LOS	95th% Queue
Holly Acres & Carling	8 (7)	0.30 (0.39)	A (A)	WBT (WBL)	0.33 (0.65)	A (B)	17 (#74)
Holly Acres / Nanaimo & Richmond	34 (32)	0.67 (0.76)	B (C)	EBL (EBL)	0.77 (0.78)	C (C)	#125 (#66)
Holly Acres & Hwy 417 WB / Bayshore	11 (13)	0.63 (0.39)	B (A)	NBTR (WBLTR)	0.65 (0.47)	B (A)	126 (19)
Holly Acres & Hwy 416/417 EB	27 (14)	0.82 (0.65)	D (B)	EBR (NBR)	0.85 (0.66)	D (B)	151 (20)
Moodie / James Cummings & Carling	42 (22)	0.87 (0.93)	D (E)	NBLT (EBR)	**1.08** (0.97)	**F** (E)	#189 (#167)
Moodie & Network Access	9 (13)	0.28 (0.52)	A (A)	NBL (EBR)	0.51 (0.62)	A (B)	22 (23)
Moodie & South Ring	12 (27)	0.52 (0.65)	A (B)	NBL (EBR)	0.67 (0.82)	B (D)	115 (95)
Moodie & Abbott	5 (6)	0.66 (0.54)	B (A)	NBT (SBT)	0.67 (0.55)	B (A)	115 (97)
Moodie & Corkstown	22 (43)	0.86 (0.98)	D (E)	NBT (SBT)	0.89 (**1.02**)	D (**F**)	#291 (#302)
Moodie & Hwy 417 WB	12 (13)	0.61 (0.76)	B (C)	WBL (WBL)	0.84 (0.78)	D (C)	#64 (50)
Moodie & Hwy 417 EB	18 (10)	0.61 (0.90)	B (D)	EBL (SBR)	0.81 (0.94)	D (E)	85 (#42)

There are no major changes in intersection operations from 2023 to 2031 for both the Moodie BRT and Moodie LRT scenarios. Intersections that operated well in the 2023 scenario continue to operate well in the 2031 scenario, and intersections that operated poorly in the 2023 scenario continue to operate poorly in the 2031 scenario.

Drainage and Stormwater Management RVCA dictates that the loss of floodplain storage volume within the 1:100-year floodplain (Figure 8-5) which will result from the placement of fill shall be fully compensated for by a balanced cut (or excavation) to be carried out in close proximity to and concurrent with the placement of the fill. A Stormwater Management Plan (Appendix B) was prepared to control post-development peak flows to pre-determined levels, and detain onsite stormwater up to and including the 100-year storm event without affecting adjacent lands, and to provide clean runoff to minimize pollution of the downstream receiving watercourse. The Plan took into account City's design criteria as outlined in the City of Ottawa *Sewer Design Guidelines.* Ministry of Transportation Ontario (MTO) *Highway Drainage Design Standards*, and the Rideau Valley Conservation Authority (RVCA) regulations.

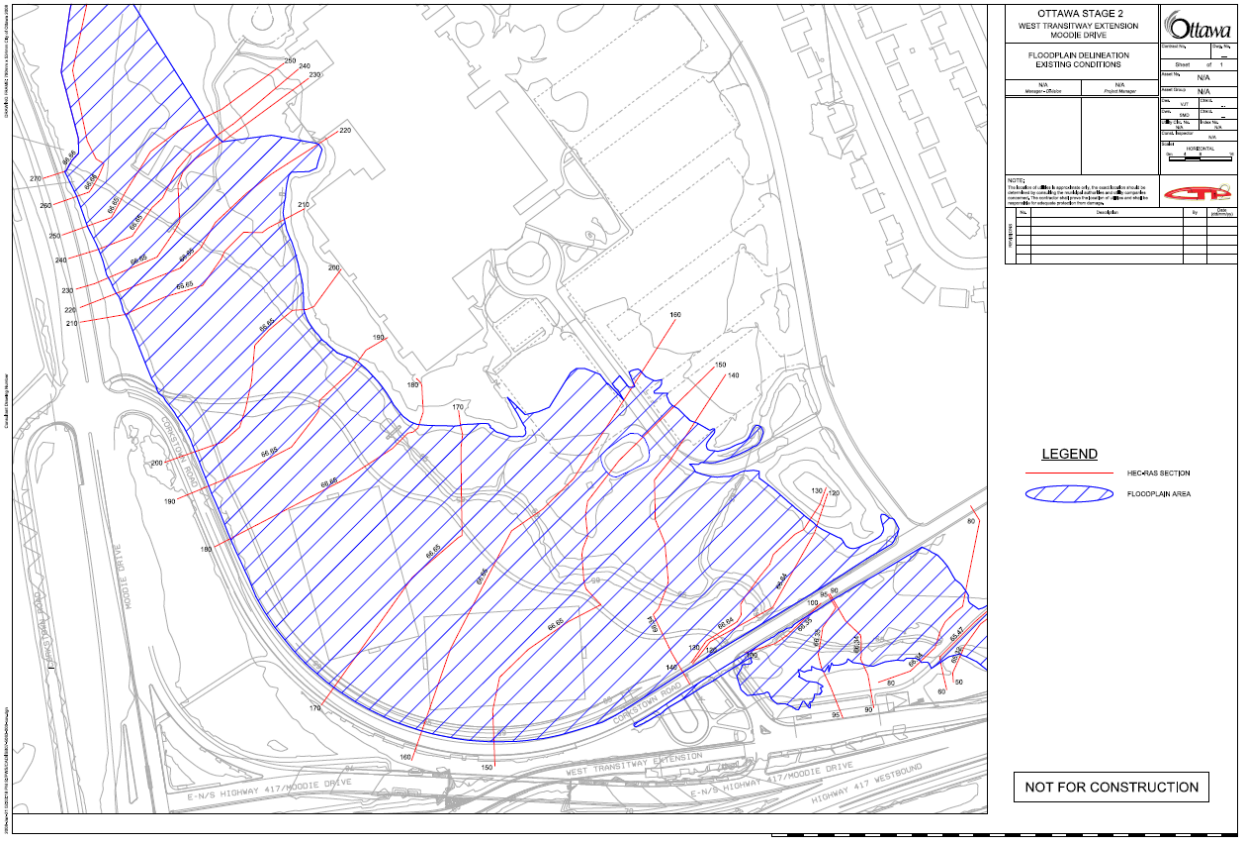


Figure 8-5: Stillwater Creek Floodplain (Station)

Stormwater Management measures identified include:

- Storm Drain Inlet and Sewers
- Underground Perforated Pipe Detention Basins
- Culverts
- Roadside Ditches
- Oil/Grit Separators (OGS)

In developing an effective stormwater management design, quantity control has been achieved to mitigate the effects of urbanization on the hydrologic cycle including increased runoff of rain and snowmelt.

In order to control surface water from the LMSF during increasingly intense and frequent rain events to prevent downstream degradation basins are sized to control the runoff up to the 100-year storm event and include perforated pipes. The basins will be located within the MTO/City right-of-way adjacent to Highway 417 and the City owned Corkstown Road.

The proposed site grading (cut and fill) must be designed to result in no increase in upstream water surface elevations and no increase in flow velocities in the affected river cross-sections under a full range of potential flood discharge conditions (1:2- year to 1:100-year return periods); compliance with this requirement shall be demonstrated by means of hydraulic computations. During the hydraulic analysis, it was found that by balancing the fill with an equal amount of cut reduced the proposed conditions water surface elevations below the existing. This, subsequently, led to an increase in channel velocities. An iterative process where the amount of cut was reduced resulted in a more balanced pre- and post-development elevations. It was found that proposing excavation at Cross-Section 150 of 0.20 meters and at Cross-Section 160 of 0.30 meters was the most ideal solution.

A storm sewer inlet and piping system was designed for the LMSF. The design adhered to the “Ottawa Sewer Design Guidelines”, as well as the “Standards Respecting Pipeline Crossings under Railways”, and the “Highway Drainage Design Standards”. Two (2) underground perforated pipe basins have been proposed to mitigate quantity of runoff for this watershed (Figure 8-6, Figure 8-7). There is one (1) Oil/Grit Separator (OGS) proposed for the outlet of each basin. In addition, an inline check valve (Tideflex Checkmate or approved equivalent) is required in each discharge pipe from the basins to Stillwater Creek (Figure 8-8, Figure 8-8).

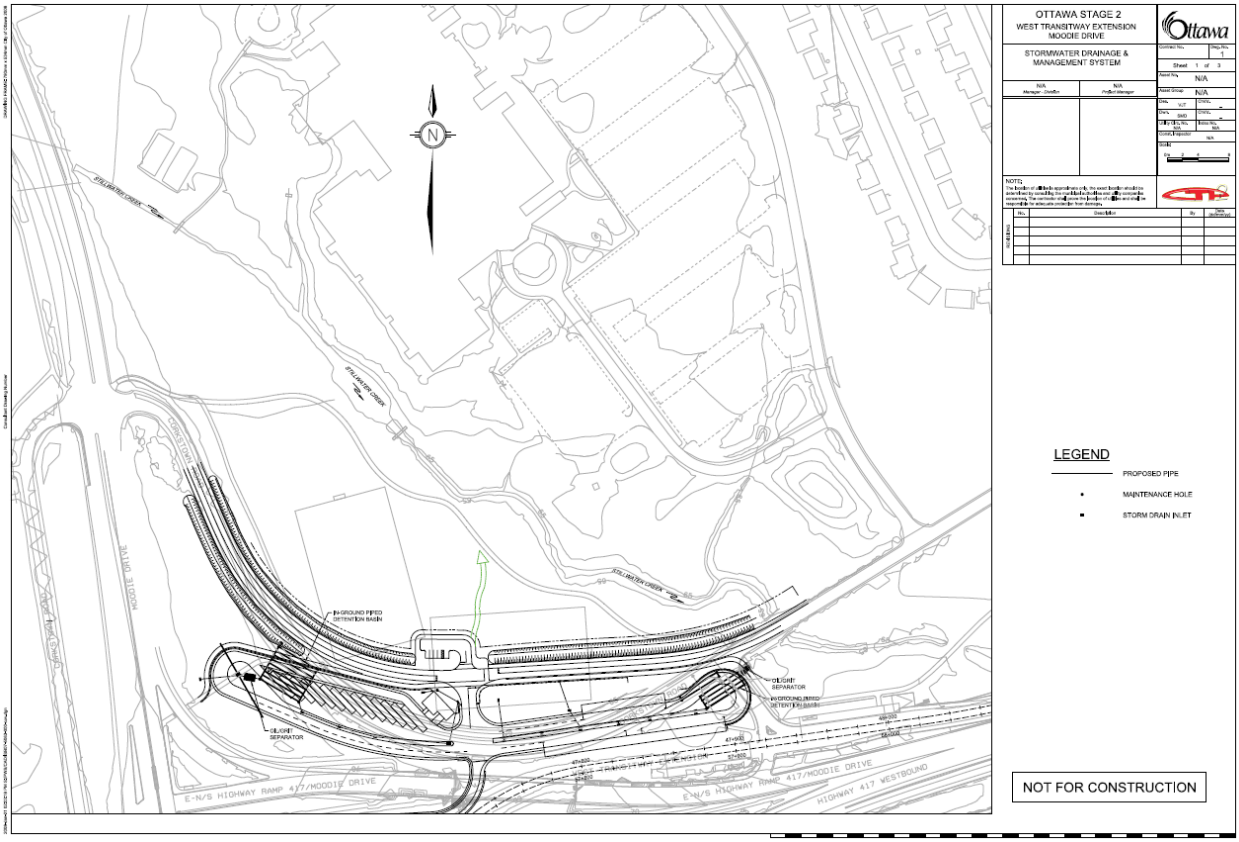


Figure 8-6: Moodie Station In-ground Piped Detention Basin

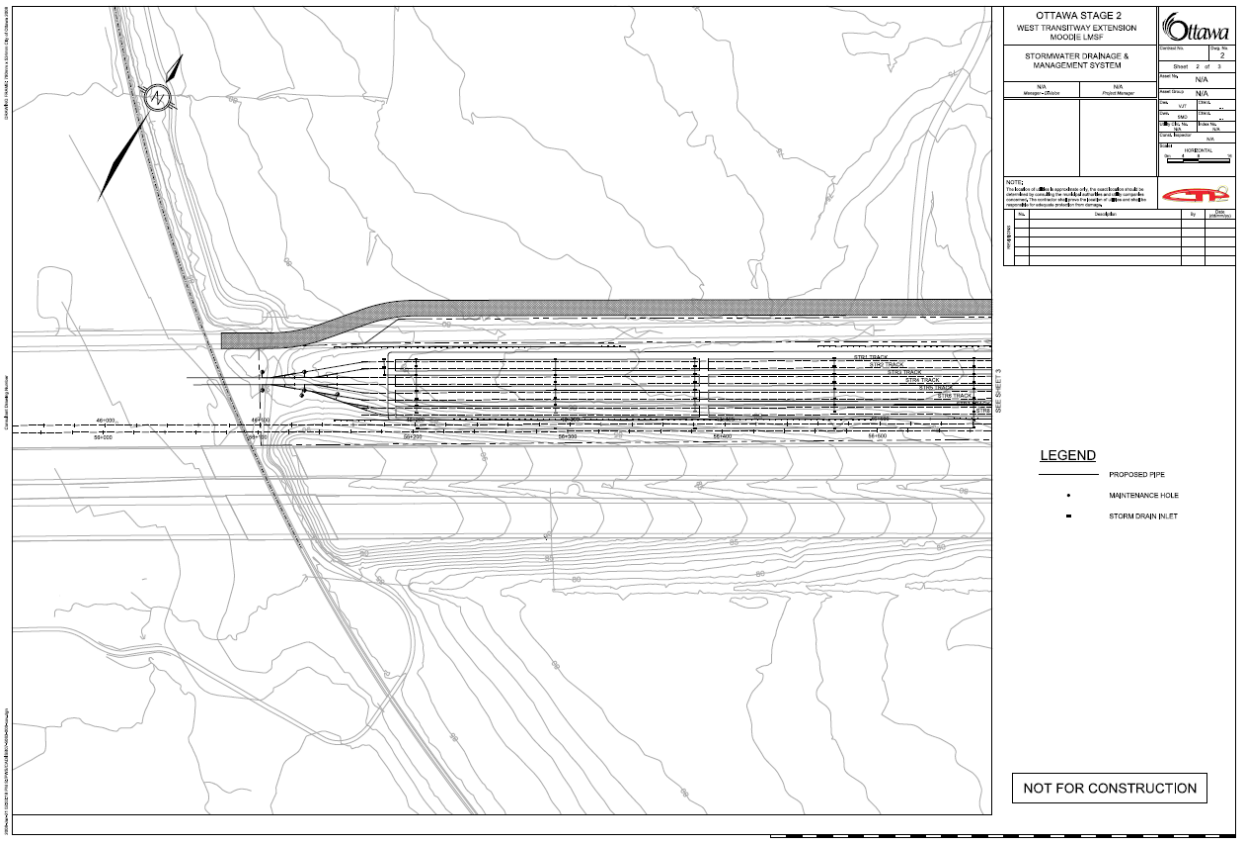


Figure 8-7: Stormwater Management LMSF (west)

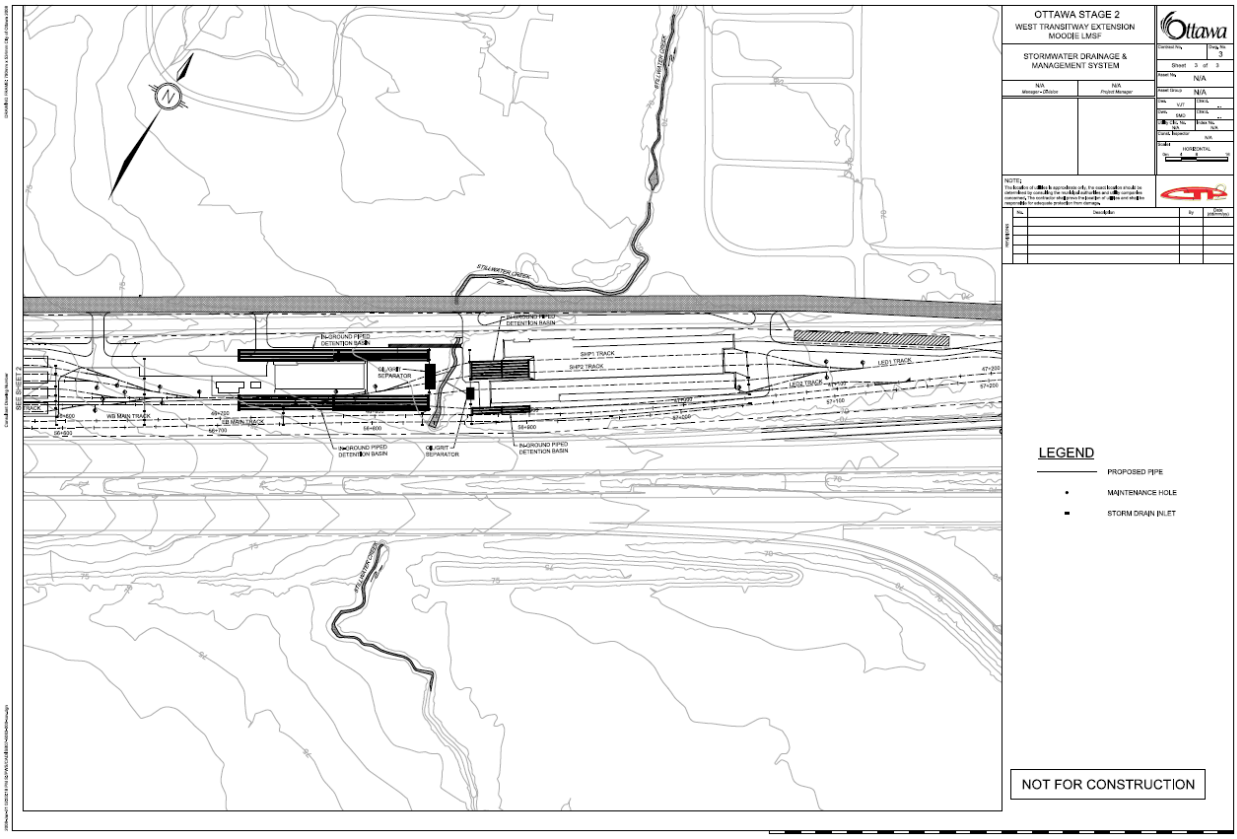


Figure 8-8: Stormwater Management (east)

Permeability tests should be performed to determine infiltration rates in an effort to mitigate the increased volume. However, all the underground perforated pipe detention basins have been designed as flat pipes with small orifices to increase the time of concentration and to store the increased runoff volume.

The proposed condition water surface in the vicinity of the LMSF is considered to be unchanged from the existing water surface during the 100-year event with the exception of two minor decreases in water surface elevation at the upstream faces of the Highway 417 and the Corkstown Road culvert extensions.

Stillwater Creek Culvert (West Branch)

The west branch of Stillwater Creek passes under Highway 417 in a culvert which opens up through the LMSF site.

Enclosing the channel of Stillwater Creek between the 417 and Corkstown Road is strongly discouraged. This is primarily due to the long section of box culvert that already exists under the 417. All efforts should be made to reduce expanding the in-water footprint. If an open structure can be adequately designed above the high water mark at this creek crossing to avoid the need for enclosing the creek entirely between the 417 and Corkstown, this would be preferred as:

- Potential fish passage disruption (due to an additional 40-50 m of channelized morphology)

- Erosion and scour within the short 6 m segment that would be confined between culverts with two different spans, especially since the larger culvert is upstream and smaller culvert is downstream (may create velocity issues through Corkstown Road culvert)

It would be important to design extensions as open bottom and there may be a need for velocity mitigation such as baffles to ensure fish passage is maintained at both culverts.

Each track crossing of Stillwater Creek should be a separate ballasted deck bridge as narrow as practical. Bridge drainage should be to the ballast on either side off the bridge and not directly into the creek. The creek bed should be left as natural under each bridge.

Hydraulic analysis may need to be completed to determine the impacts and appropriate mitigations required for these culvert extensions. A DFO Request for Review would be required based on the extent of in-water footprint.

Stillwater Creek Corridor (East Branch)

In order to maintain the corridor function of Stillwater Creek as a linkage within the Greenbelt and its continued use by a wide range of wildlife, the foot print of the station and LMSF have been minimized. The location of the bus layby has been shifted as far

west as possible, reducing the impact to the natural landscape of Stillwater Creek. The landscaping plan includes extensive plantings with natural species adjacent to the corridor. Closer to the station, landscaping has been designed to focus wildlife movements away from the LRT and station facilities. Encroachment within 30 m of Stillwater Creek is limited to the extent possible based on the geometric requirements of that station operation (Figure 8-9).

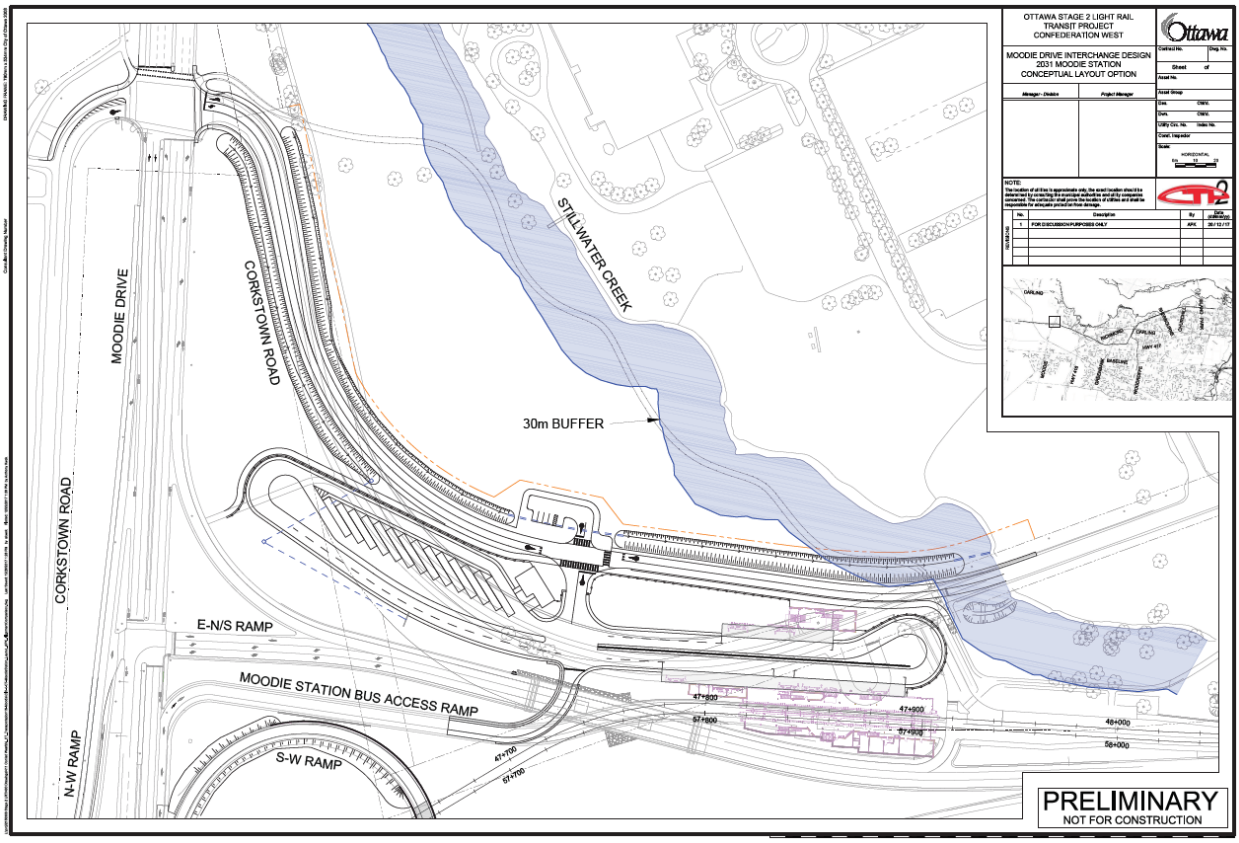


Figure 8-9: Stillwater Creek Buffer

The overall site design intent is to integrate the Station and infrastructure requirements within the NCC Greenbelt lands. Design review approval from the NCC will be required for the final design of the LRT station. In general, the Stage 1 design consists of the development of woodlots to frame the Station, with open meadows creating the transition between the woodlots and the Station.

Where pathways and sidewalks are proposed to be lit, full cut off lighting will be used and consideration will be given to the use of wavelengths safe for wildlife. These LED wavelengths safely illuminate areas while also protecting and minimizing the effect of light pollution on our wildlife.

First Nations Cultural Heritage Values and Interests

Potential effects on lands and resources used for traditional purposes by aboriginal persons have been examined by taking into account the City's knowledge of the study area, reviewing existing information from other sources including the AOO and Algonquins of Pikwàkanagàn and identifying potential effects. The City of Ottawa is not aware of any current use of lands and resources for traditional purposes by aboriginal persons within the study area boundaries. The urban and suburban nature of the study area limits many traditional land uses, including hunting, fishing and the gathering or harvesting of plants for traditional use. The City of Ottawa will continue consultation with the Indigenous groups that have expressed an interest in this project during the design and construction.

8.4 Assessment and Evaluation Results

Professional judgement 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.

Residual Environmental Effect

An environmental effect that remains, or is predicted to remain, following the implementation of mitigation measures. Professional judgement and expertise is used to determine significance as a function of these criteria.

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

Medium 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 Impact: Potential effect is small, localized, and limited to the construction phase of the project

Both Construction and Operation phases of the project were considered.

Table 8-4 describes the potential effects, mitigation, residual effects and their significance, and monitoring recommendations for the preferred alternative.

Table 8-4: Impact and Mitigation

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
Views and Vistas	Construction and operation of LMSF	Removal of existing vegetation within the ROW will increase the views northerly towards the Greenbelt Additional lighting required for the operation	• Landscape plan to assist in screening the facility if required • Lighting design to minimize spill and glare onto highway	Permanent modification of views can be integrated into the landscape	Monitor health of new plantings	Not Significant (Minimal impact)
	General construction activities and equipment along the entire project length will be visible to the public	May impede the enjoyment of views and vistas along the Capital Arrival route and the general visual context for users of local roads and pathways on a temporary basis.	Public Communications Plan. Landscape plan	Temporary visual disruption	None required	Not Significant (Minimal impact)
Heritage and Archaeological Resources	Construction excavation	Disturbance of heritage and archaeological resources.	Stage 1-2 Archaeological Assessments have indicated there are no archaeological resources are present	Should any deeply buried archaeological remains be encountered, the MTCS / NCC will be notified immediately. If human remains are encountered during	None required	Not Significant (Minimal impact)

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
				construction activities, the MTCS/NCC and the Registrar of Cemeteries should be notified immediately.		
Water Quality	Operation of the LMSF will result in an increase in impervious area and runoff	Increased run off could increase flood levels, degrade water quality and/or increase erosion and sedimentation	Design LMSF and tracks at an elevation a minimum of 0.3 m above the 1:100 year flood elevation Stormwater conveyance and outlets have been designed to reduce TSS and control velocities (swales/OGS)	Potential increase in TSS and run off	Water quality monitoring in accordance with MOECC ECA	Not Significant (Minimal impact)
	Construction of the LMSF, stations and running way will expose soils subject erosion	Sedimentation from exposed soils could degrade water quality and/or increase erosion and sedimentation	Erosion and sediment Control Plan	Potential increase in TSS and run off	Construction monitoring	Not Significant (Minimal impact)
Fish and Fish Habitat	Construction of the LMSF and Corkstown Road within 30 m of Stillwater Creek	Indirect impacts to fish habitat in Stillwater Creek from increased sediment and erosion potential, and equipment / machinery leaks during adjacent construction	• Erosion and Sediment Control Plan • Stormwater Management Plan • Environmental Protection Plan • Spills Prevention and Response Plan • Operation of Machinery as per	None anticipated	Monitor installation and effectiveness of mitigation measures and Plan requirements	Not Significant (Minimal impact)

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
			DFO Measures to Avoid Harm • Exclusionary fencing			
	Construction of new watercourse crossings over Stillwater Creek (west branch) for LMSF	Direct loss of existing fish habitat due to new footprint below the high water mark	Implement open structure above the high water mark Utilize separate ballasted deck bridge as narrow as practical. Bridge drainage should be to the ballast on either side off the bridge and not directly into the creek. The creek bed should be left as natural under each bridge. Hydraulic analysis will need to be completed to determine the impacts and appropriate mitigations required for these culvert extensions. A DFO Request for Review may be required based on the extent of in-water footprint and mitigation/compensation measures as determined by DFO	Alteration of fish habitat	Monitor fish habitat/movement as per DFO recommendations	Not Significant (Medium impact)
	Operation and Maintenance of LMSF	Indirect impacts to fish habitat in Stillwater Creek from increased	Spills Prevention and Response Plan Design effective drainage plan for runoff management from parking	None anticipated	None required	Not Significant (Minimal Impact)

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
		potential for fluid leaks/pollution from LRT and new parking lots, and disturbance of Stillwater Creek during maintenance of new watercourse crossings.	lots. Design clear span structures over Stillwater Creek in a manner that prevent direct emission of fluid leaks etc. into watercourse. Proper maintenance of LRT trains.			
Habitat – Herpetofauna	Construction of LMSF	Potential Impacts to individuals entering construction area	Install temporary exclusion fencing prior to commencement of construction, to minimize turtle entry and nesting Add protocol if encountered	Incidental turtle entry into construction area	Inspect fences daily for breaches and/or gaps	Not significant (Minimal Impact)
SAR Habitat – Grassland Birds (Bobolink and Meadowlark)	Construction of LMSF	Potential disturbance to individuals	Avoid ANY work within adjacent meadow habitat north of Corkstown Road during the species' breeding season (15 Apr – 15 Aug) Field investigations prior to construction to confirm SAR presence/absence	Temporary avoidance of habitat adjacent to construction area due to noise	None required	Not significant (Minimal Impact)

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
SAR Habitat – Monarch	Construction and operation of LMSF	Impacts to individuals and Loss & Degradation of Habitat	Clear/mow vegetation, and maintain as clear during the breeding season (31 May – 30 September), in order to discourage monarch from laying eggs within the construction area. Avoid the use of open areas containing Milkweed as staging areas or for material storage Enhance foraging habitat by seeding adjacent meadows / ROWs a with native wildflowers	No net loss of foraging habitat	None required	Not Significant
General SAR – uplisted species	Future construction	Impacts to individuals and Loss & Degradation of Habitat	The SARA and OESA are updated regularly. Prior to construction, SARA and the OESA will be reviewed and an update of the potential species present and associated habitat will be completed.	None anticipated	SARA and OESA Updates	Not significant (Minimal Impact)

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
General wildlife habitat within the Stillwater Creek Valley	The LRT station has the potential to effect remnant natural vegetation communities north of Highway 417, between Moodie Drive and Holly Acres Road.	To the extent possible, the LRT and station footprint has been contained within the existing BRT right-of-way and avoids the main treed portion of the valley.	• Exclusionary fencing during construction • Landscaping plan • Rehabilitation of adjacent treed area to remove / prevent the spread of invasive species such as buckthorn can improve the quality of the habitat. Indigenous plants such as willows, nannyberry, maple and birch should be selected.	Improve the quality of remaining the habitat.	Monitor health of new plantings	Not significant (Minimal Impact)
Stillwater Creek Valley	Relocation of Corkstown Road	The Stillwater Creek Valley serves as a wildlife movement corridor that will be adjacent to the LRT. Wildlife entrance into the constrained corridor could result in conflicts	• Design pathways and entrances to reduce wildlife desire lines and funnel wildlife to the valley and prevent them from accessing the highway • Landscape with deterrent plants such as hawthorn to focus wildlife movements • Consider lighting hues/levels that are not detrimental to wildlife • Exclusionary fencing during construction • Landscaping Plan	Incidental encroachment of wildlife into the corridor Temporary avoidance during construction	Monitor health of new plantings Monitor wildlife collisions	Not significant (Minimal Impact)
Contaminated Materials	Dewatering during	Current and former land uses	• Analysis of excavated materials/groundwater to be analyzed in	None anticipated	Monitor discharge as required	Not significant

Environmental Condition	Project Activity	Environmental Effect	Mitigation Measure	Residual Effect	Monitoring	Significance
	construction	have or had the potential to cause contamination in the soil, groundwater or surface water. Therefore, potential to encounter impacted material is relatively high.	accordance with federal/provincial guidelines to ensure that it can be discharged/managed appropriately to avoid environmental impact / impairment/ adverse effects			(Minimal Impact)

8.5 Climate Change

A new MOECC Guide (*MOECC Draft Guidance for Considering Climate Change in Environmental Assessment*) advises project proponents on approaches for the consideration of:

- the effects of a project on climate change;
- the effects of climate change on a project; and
- various means of identifying and minimizing negative effects during project design

8.5.1 General Effects of the Project

The following represents the climate change considerations that have been made as an integral component of the Stage 2 LRT project by the City and were components in the Business case for project implementation.

Climate change refers to any significant change in the measures of climate lasting for an extended period of time. CO_2 emissions are a main producer of greenhouse gas, which contributes to global warming effects and associated climate change. With vehicle emissions being a major cause of global warming, the transportation sector is being targeted with efforts to reduce CO_2 emissions and prevent negative effects of climate change.[42]

A modal shift from fossil fuel powered single vehicle use to mass transit can be a key contributor to Canada's climate change strategy. Rising global temperatures and continued climate change could have numerous impacts on public health based on factors such as extreme weather events, heat waves, air quality deterioration, and or flooding.

Perhaps one of the most recognizable benefits of transit investment is the reduction in greenhouse gases (GHGs) and critical air contaminants (CACs), which have direct implications for the overall sustainability of urban growth and direct consequences on the health of residents. It is estimated that OLRT Stage 2 would result in nearly 50 million litres of savings in fuel consumption, and reduce GHG emissions by over 110 thousand tonnes and CACs by over three thousand tonnes by 2048 annually. The economic value of these reductions will total $438 million between 2023 and 2048.

Implementation of the light rail project is expected to reduce OC Transpo fleet emissions by approximately 94,000 tonnes per year by 2031 (Ottawa, 2014). As the City invests in light rail and vehicles to help promote transit use, the corporation will need to focus on ensuring the following:

- development occurs near transit;
- other incentives and disincentives are used to move people out of cars and onto transit; and

- fleet emissions continue to be managed by the corporation
- Going forward, the corporate GHG inventory will be completed annually and the community inventory once every four years.

8.5.2 Climate Change Projections

Transportation infrastructure in the Ottawa area is currently designed and operated to handle a broad range of climate impacts, based on experience under the 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 relevant, posing additional challenges for its sustainability, reliability, effectiveness, and costs for servicing.

In 2005, Engineers Canada created the Public Infrastructure Engineering Vulnerability Committee (PIEVC, “the Committee”) to conduct an engineering assessment of the vulnerability of Canada's public infrastructure to the impacts of climate change. Vulnerability of infrastructure is a function of its adaptive capacity and of climate change projections. The Committee developed the PIEVC Protocol (“the Protocol”) as a tool for the *systematic review* of historical climate data and projections of future climate events, and for the *evaluation* of the severity of potential climate change impacts on infrastructure components.

Intergovernmental Panel on Climate Change (IPCC). The IPCC was established by the United Nations and World Meteorological Organization in 1988 to review information on climate change. The IPCC has since been preparing Assessment Reports that, among other things, aggregate global climate models projection data. The latest such report, the Fifth Assessment Report (AR5), included projection information from forty Global Climate Models (GCMs). Additionally, AR5 included new Representative Concentration Pathways (RCPs) to denote various scenarios that depend on the extent to which climate change is mitigated or worsened. The scenario with the lowest projection change is represented by RCP 2.6, while the highest projection is represented by RCP 8.5.

The data from AR5 was accessed via the Climate Change Hazards Information Portal (CCHIP), a climate analysis tool developed by Risk Sciences International (RSI). CCHIP provides access to climate information and analysis based on historical data from Environment and Climate Change Canada and Natural Resources Canada. CCHIP computes the historical climate data and provides climate projections for individual meteorological stations. Climate projections are obtained using the climate models from AR5, and two future emissions

pathways, or RCPs, are presented: RCP 4.5 (moderate future emissions), and RCP 8.5 (highest future emissions). Although the future remains unknowable, RSI notes, “historically, the GHG emissions have followed the highest (8.5) pathway.”

Two time horizons were considered: 2080, a 60-year window to capture the full design life of most physical structures, and 2050, to capture any possible trends and to better inform the 2080 projection. Historical trends and climate projections were identified through the review of previous climate change studies in the Ottawa area, as well as through use of the Climate Change Hazards Information Portal (CCHIP).

CCHIP automatically selects the meteorological station nearest to the location of interest. However, the nearest station is not always the best choice as it may have incomplete records. Stations with at least 30 years of historical data are recommended for an accurate baseline, and stations with the longest periods of data are generally preferable. In the case of the Moodie LRT, the nearest meteorological stations (Figure 8-10) are the Carp and Ottawa Britannia stations, however these stations only have data for less than 15 years. The Ottawa Cda station, however, has over 100 years of data. The Ottawa Macdonald-Cartier International Airport station is another good option for projects in the City of Ottawa, however the Ottawa Cda station is closest to the study area.

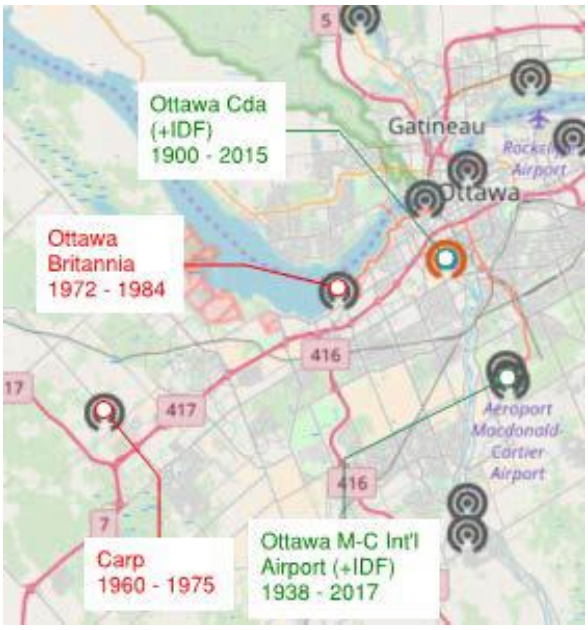


Figure 8-10: Meteorological Stations

Climate data from the Ottawa Cda station is presented in the following pages. Results from both the moderate (RCP4.5) and high (RCP8.5) climate change scenarios are included.

8.5.2.1 Temperature

As can be expected, temperatures in the Ottawa area are projected to increase in the future. Overall, annual daily average, maximum, and minimum temperatures will increase at similar rates. All three variables are projected to increase between 2.4 and 3.1 degrees by 2050, and between 3.3 and 5.8 degrees.

Table 8-5: Annual Daily Average, Maximum, and Minimum Temperature Projections

Annual Daily Average Temp (ºC)					
		RCP4.5		**RCP8.5**	
Data Source	**Historical Average 1980-2010**	**2050**	**2080**	**2050**	**2080**
Average Temperature	6.7	9.1	9.7	10	12.2
Difference	-	2.4	3	3.3	5.5
Annual Daily Max Temp (ºC)					
		RCP4.5		**RCP8.5**	
Data Source	**Historical Average**	**2050**	**2080**	**2050**	**2080**
Average Temperature	11.45	13.8	14.4	14.7	16.9
Difference	-	2.35	2.95	3.25	5.45
Annual Daily Min Temp (ºC)					
		RCP4.5		**RCP8.5**	
Data Source	**Historical Average**	**2050**	**2080**	**2050**	**2080**
Average Temperature	1.9	4.4	5	5.4	7.7
Difference	-	2.5	3.1	3.5	5.8

This increase in temperature will impact on the number of heating and cooling degree days. As shown in the following two tables, heating degree days are expected to decrease by 20% to 36%. Cooling degree days are expected to increase by 97% to 258%.

Table 8-6 - Heating Degree Days Projections

Heating Degree Days (ºC)		RCP4.5		RCP8.5	
Data Source	Historical Average	2050	2080	2050	2080
Annual Average	4625	3702	3557	3473	2963
Percent Change	-	-20.0	-23.1	-24.9	-35.9

Table 8-7 - Heating Degree Days Projection

Cooling Degree Days (ºC)		RCP4.5		RCP8.5	
Data Source	Historical Average	2050	2080	2050	2080
Annual Average	242	477	533	582	867
Percent Change	-	97.1	120.2	140.5	258.3

8.5.2.2 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, there is consensus on two key points:

- Total annual precipitation will increase; and
- Extreme precipitation will increase at a faster rate than total annual precipitation.

The following tables support both of the above. Whereas 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 data aggregated by CCHIP shows that the total precipitation from events in the 95th and 99th percentile (that is, events in the top 5% and 1% respectively when ranked by precipitation amounts) is set to increase by 51% and 92%, respectively. This indicates that, the 11% of total annual precipitation increase, will be disproportionately attributable to larger rain events.

Table 8-8 - Total Annual Precipitation Projections

Total Annual Precipitation		RCP4.5		RCP8.5	
Data Source	Historical Average	2050	2080	2050	2080
Annual Precipitation (mm)	925	983	991	997	1023
Percent Change (%)	-	6.3	7.2	7.8	10.6

Table 8-9 - Increase in Total Rainfall during Extreme Precipitation Events

Precipitation Extremes		RCP4.5		RCP8.5	
	Historical Average	2050	2080	2050	2080
1 Day Max Precipitation (mm)	42	47	46	47	49
Percent Change (%)	-	11.9	9.5	11.9	16.7
Total Precipitation of Events in 95th Percentile (mm)	240	301	306	321	362
Percent Change	-	25.4	27.5	33.8	50.8
Total Precipitation of Events in 99th Percentile (mm)	73	106	105	114	140
Percent Change	-	45.2	43.8	56.2	91.8

8.5.2.3 Snowfall

For this climate variable, the CCHIP tool could not provide the analysis required for projections. Below are 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 increase 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, as is shown in the table below.

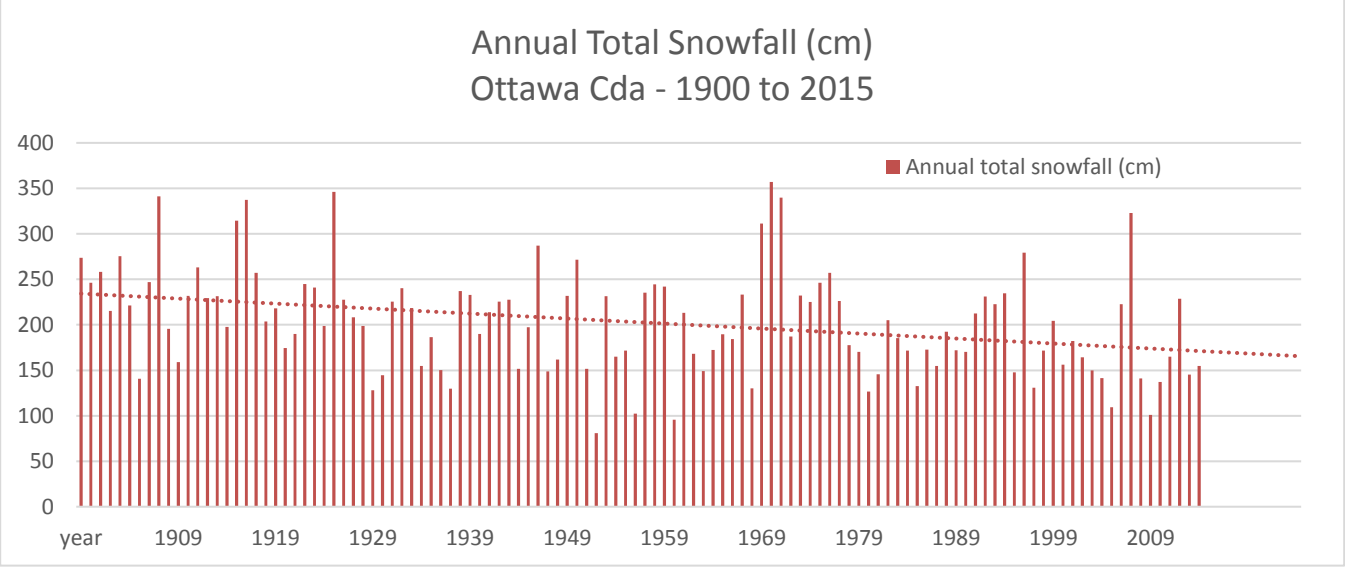


Table 8-10 - Seasonal Average Daily Temperature Increase Projections

Temperature Increase Compared to Historical Average (2010) (ºC)	RCP4.5		RCP8.5	
	2050	2080	2050	2080
Annual Daily Average	2.4	3	3.3	5.5
Winter (Dec, Jan, Feb) Daily Average	**2.9**	**3.6**	**3.9**	**6.3**
Spring (Mar, Apr, May) Daily Average	2.2	2.8	3	4.9
Summer (Jun, Jul, Aug) Daily Average	2.2	2.7	3.2	5.5
Fall (Sep, Oct, Nov) Daily Average	2.2	2.8	3.1	5.3

8.5.2.4 Freeze-thaw cycles

The ensemble of projections for both the moderate and high concentration pathways (RPC) show a noticeable decrease in the number of days with freeze-thaw cycles in 2050 and 2080. The months of April and October will see 62% to 95% fewer freeze-thaw cycles on average. December, January, and February will all see an increase in freeze-thaw cycles. The month of March will continue to see the most days with freeze-thaw cycles in 2080.

Table 8-11 - Freeze-Thaw Cycles Projections

Freeze-thaw cycles (days)		RCP4.5		RCP8.5	
	Historical Average	2050	2080	2050	2080
January	6.7	7.8	8.2	8	8.3
February	6.7	9.4	9.9	10.2	10.8
March	15.6	14.2	13.3	13.2	11.7
April	12.4	4.7	3.7	3.5	1.8
May	1.5	0.1	0	0	0
June	0	0	0	0	0
July	0	0	0	0	0
August	0	0	0	0	0
September	0.6	0	0	0	0
October	7.1	2.3	1.8	1.2	0.3
November	14	9.9	8.8	8.2	5.6
December	9	10.6	10.5	10	8.7
Total	73.6	59	56.4	54.3	47.3

8.5.2.5 Freezing Rain

Certain climate variables, such as freezing rain cannot be derived directly from temperature or precipitation and require regional modelling with higher resolution. This particular climate variable is not available with CCHIP. Although few studies have been conducted to look at the impacts of climate change on freezing rain, an Environment 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.

8.5.2.6 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 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 study analyzed projected climate data from eight GCMs under two climate change scenarios. Like RCPs but developed for the IPCC's fourth assessment report (AR4), different scenarios represent alternative future greenhouse gas emissions. A2 assumes higher GHG emissions, while scenario B1 assumes less.

The results of the 2012 study suggests modest increases in wind gusts are likely in the coming decades (Table #). Wind gusts over 70km/h will see the highest increase in frequency, occurring 23% to 46% more often than current conditions.

Table 8-12 - Daily and Hourly Wind Gust Projections (Cheng et. al., 2012)

Wind gust event	Daily wind gust (% increase in frequency)				Hourly wind gust (% increase in frequency)			
	2046-2065		2081-2100		2046-2065		2081-2100	
	A2	B1	A2	B1	A2	B1	A2	B1
≥28 km/h	3	2	4	2	7	6	9	6
≥40 km/h	5	4	6	4	7	6	9	7
≥70 km/h	10	10	13	9	47	33	23	35

8.5.3 Project Design for Climate Change

The Moodie LRT Extension has taken climate change into some of the basic planning tenets of the City of Ottawa including those contained in *Managing Risk Through Adaptation*. These include:

- Greater redundancy in the transportation system can be achieved by diversifying transportation modes;
- Improved track layout to maximize electrical regeneration and reduced brake wear; thereby making the electrical design more power efficient;
- Following a rigid power budget that incentivizes low power consumption and reduced running costs;
- Pedestrian and bicycle facilities to improve connectivity to key transportation hubs;
- LID principles for Stormwater Management; and
- 10 kilowatt rooftop solar project at the Transit Services Integrated Control Centre to reduce vulnerability to interruptions in power supply.

Additional modifications to the ultimate design/design solutions may be appropriate to consider to reduce vulnerability to changes in some of the identified climate/weather parameters. Potential adaptations to deal with changing climate conditions and LRT systems that have been utilized in other jurisdictions that may be considered including:

- High heat:
    - Transformers and electrical distribution system: Enhance capacity to deal with higher temperature conditions (in accordance with established Engineers Canada standards);and
    - Sagging wires: Utilizing a constant tension system for a broader temperature range.
- Extreme/intense rain and flooding:
    - Review/modify flood plain/storm frequency design criteria;
    - Elevate assets to keep from flooding, build flood protection structures;
    - Redirect storm runoff from track bed;
    - Slope stabilization to prevent washouts; and
    - Back-up power at key installations.
- Increased ice accumulation:

  - Provide structural reinforcement for overhead structures to protect against ice accumulation in accordance with the Canadian code; and
  - Utilization of trains that have scrapers fitted the pantograph to remove ice.

- Faster tree growth with potentially higher rates of disease and pest conditions:
  - Increased tree maintenance along the perimeter of corridors or affecting any project components.

9. FUTURE COMMITMENTS

The Moodie LRT EA is being undertaken under the Transit Project Assessment Process (TPAP). 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 EPR. This section outlines the future commitments that inform the development and implementation of the project.

9.1 Property Acquisition

The preferred alternative for the East LRT alignment is primarily within the right-of-way of the Moodie BRT owned by the City of Ottawa. Some additional lands are required from the NCC in the vicinity of the LRT station. The LMSF is within MTO lands which have previously been identified for a BRT facility.

The preferred alternative for the Moodie LRT is primarily within the right-of-way of the existing Moodie BRT owned by the City of Ottawa. Some additional lands are required from the NCC in the vicinity of the LRT station. The LMSF is within MTO lands which have previously been identified for a BRT facility. Full expansion of the LMSF will require land from the NCC.

Stage 2 LRT will be seeking an Encroachment Permit from MTO for the LMSF within their operating corridor. The MTO has been provided with preliminary plans of the Moodie LMSF and MTO are assessing the location of various elements to ensure spacing and safety requirements with respect to their proximity to Highway 417.

9.2 Gold Permit Park & Ride

Discussion to assess the feasibility of re-using the existing Abbott Point of Care surface lot if unused spaces are available as a Gold Permit park and ride will continue during the in market period. As part of the assessment for the feasibility of this, an assessment of air emissions (and controls) needs to be undertaken and considered. Traffic impacts on the access routes and community impacts must also be identified and mitigated.

9.3 Implementation / Staging Opportunity

The acquisition of temporary property needs, including temporary construction easements, will proceed as definitive property plans are developed.

9.4 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.

The project and its design will be implemented through the City of Ottawa Stage 2 Design / Build process currently underway. Refinements to the preferred alternative will be subject to the commitments and amending procedures outlined in this EPR.

9.5 Approvals

The EPR 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.

9.5.1 Federal

- Federal Land Use, Design and Transaction Approval (NCC);
- CEAA Section 67 (NCC); and
- *Species at Risk Act* permits (EC).

9.5.2 Provincial

- Environmental Compliance Approval for infrastructure (MOECC);
- Permit-to-Take-Water (MOECC);
- Ontario *Endangered Species Act*, 2007 (MNRF);
- Ontario Regulation 174/06 and 170/06 Development, Interference, with Wetlands and Alterations to Shorelines and Water Courses Regulation (Conservation Authority);
- 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, will be sought during the EA process. The amount of information required and effects on the project implementation will be assessed and the responsibility (City versus Project Co) will be identified. If prolonged approval schedules are identified, opportunities for the application/process requirements may be considered concurrently with the EA and harmonization (i.e., MTO Class EA) may be undertaken.

9.5.3 Municipal

- Temporary Encroachment Permits
- Road Modification Approval
- Noise By-Law Exemption

9.6 Statement of Completion

The Transit Project Assessment Process (TPAP) is completed when the proponent submits a Statement of Completion to the Director of the Environmental Assessment and Approvals Branch of the MOECC and the MOECC 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 EPR;
- The Minister gives a notice allowing the proponent to proceed with the project in accordance with the EPR, 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 EPR; 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:

- EPR;
- EPR subject to conditions set out by the Minister; or
- Revised EPR.

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.

9.7 Modifying the Recommended Plan

This EPR 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 EPR 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 EPR 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 EPR 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 MOECC. 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 Environmental 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 MOECC, 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.

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VII. MRC, 2012 West Transitway Extension Bayshore Station to Moodie Drive EPR

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IX. Ottawa, 2014 Air Quality & Climate Change Management Plan

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XI. Ottawa 2014, Noise Barrier Retrofit Study Highway 417 City of Ottawa: West of Holly Acres Drive – Site 1-B, East of Holly Acres Drive – Site 1-C, North Side (October 24, 2014) - MTO