Eglinton East Transit Project Assessment Process (TPAP)

10% Design Phase

Drainage and Stormwater Management Report

City of Toronto
February 27, 2024

Client Project Team

Project Manager	David Brutto

HDR Project Team

Project Manager	Karim Nahed, P.Eng.
Technical Team	Aaron Farrell, M.Eng., P.Eng., CPM Aliaksei Maksachou, M.Eng., EIT Mark Tan, EIT Janice Look, P.Eng.
Quality Control	Douglas Nuttall, P.Eng.

Disclaimer

The material in this report reflects HDR's professional judgment considering the scope, schedule and other limitations stated in the document and in the contract between HDR and the client. The opinions in the document are based on conditions and information existing at the time the document was published and do not consider any subsequent changes.

In preparing this report, HDR relied, in whole or in part, on data and information provided by the Client and third parties that was current at the time of such usage, which information has not been independently verified by HDR and which HDR has assumed to be accurate, complete, reliable, and current. Therefore, while HDR has utilized its best efforts in preparing this report, HDR does not warrant or guarantee the conclusions set forth in this report which are dependent or based upon data, information or statements supplied by third parties or the client, or that the data and information have not changed since being provided in the report. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that HDR shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party resulting from decisions made or actions taken based on this document.

Contents

Tables

Figures

Appendices

This page is intentionally left blank.

1 Introduction

The proposed EELRT project is an 18 km long light rail transit line through Scarborough. The transit line is proposed to travel along Eglinton Avenue East, Kingston Road, Morningside Avenue, and Sheppard Avenue East, through the University of Toronto Scarborough Campus and to Malvern Town Centre via Neilson Road. The proposed works include the LRT tracks within the existing rights-of-way, 27 proposed stops, 15 traction power substations (TPSS), and a Maintenance Storage Facility (MSF) at Conlins Road and Sheppard Avenue East.

The subject corridors of Eglinton Avenue East, Kingston Road, Morningside Avenue, and Sheppard Avenue East are currently major urban arterial roads, with two to three-lanes in each direction; for the existing corridors along Neilson Road and through the University of Toronto Scarborough Campus, are minor arterial roads. The subject corridor for the EELRT intersects with multiple existing local roads, highways and interchanges, railways, and entrance driveways within the project limits. The existing right-of-way and adjacent land use vary throughout the corridor.

Figure 1-1 depicts the alignment of the proposed EELRT works in conjunction with existing and proposed transit facilities.

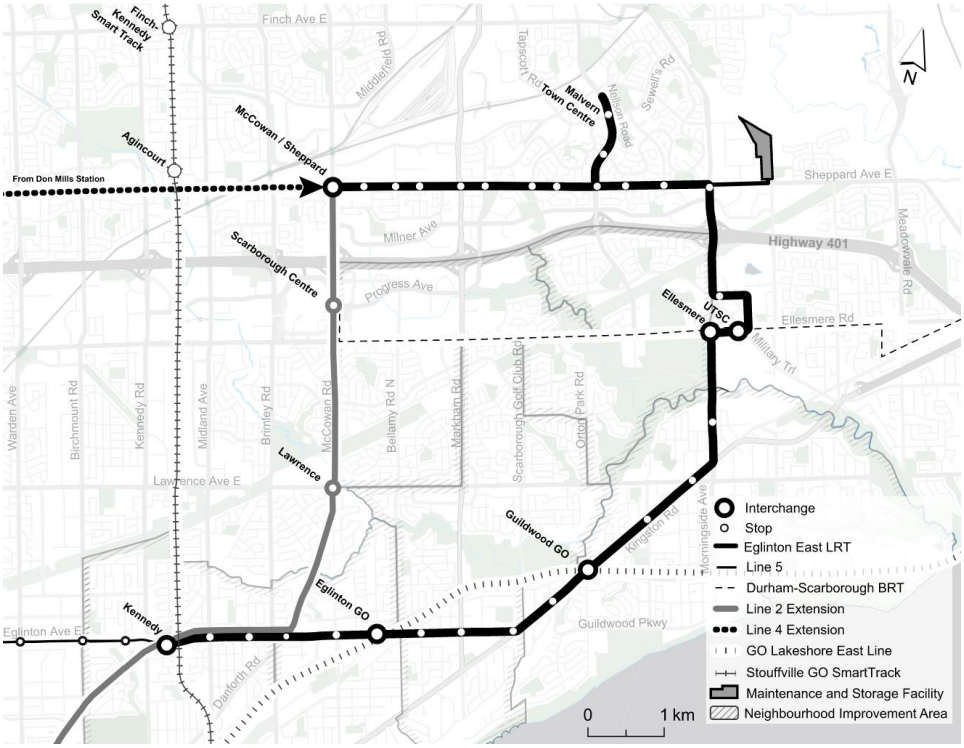

Figure 1-1: Study Corridor

This Drainage and Stormwater Management Report has been prepared in support of the Transit Project Assessment Process (TPAP) and complies with the Ministry of the Environment, Conservation and Parks (MECP), The Ministry of Transportation (MTO), Toronto and Region Conservation Authority (TRCA), the City of Toronto policies, regulations, and standards. This 10% design phase includes an assessment of the drainage and stormwater management systems for both existing and proposed conditions.

The objective of the Drainage and Stormwater Management Report is to develop a strategic approach to the development of the proposed project that will:

- Review available drainage information for existing conditions, including storm drainage area plans, reports, drawings, and hydraulic models;
- Identify and evaluate existing drainage patterns and hydraulic structures;
- Identify and evaluate the existing stormwater and drainage conditions in the study area, including sensitive areas and potential issues;
- Establish design criteria for stormwater management to meet the requirements of the various authoritative bodies; and
- Identify potential stormwater runoff quality and quantity impacts to the receiving watercourses/ storm sewer systems resulting from changes to the roadway cross-section (i.e. increased pavement area) and develop a mitigation strategy.

The EELRT project also includes a maintenance and storage facility (MSF) within the northeast limit of the study area. The drainage and stormwater management requirements for the MSF site are addressed under separate cover.

1.1 Background Information

In preparation of the EELRT Drainage and Stormwater Management Report, the following documents were reviewed to determine the applicable stormwater management criteria:

- Design Criteria for Sewers and Watermains, City of Toronto, 2021;
- Wet Weather Flow Management Guidelines (WWFMG), City of Toronto, 2006;
- Toronto and Region Conservation Authority (TRCA) Stormwater Management Criteria, August 2012;
- Sustainable Technologies Evaluation Program (STEP) Low Impact Development Stormwater Management (LID SWM) Planning and Design Guide, 2020;
- Toronto and Region Conservation Authority (TRCA) Erosion and Sediment Control Guide for Urban Construction, 2019;
- Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Practices Planning and Design Manual, March 2003; and
- Ministry of Transportation Highway Drainage Design Standards, January 2008.

Subsections bellow summarize the additional background materials that were received and reviewed to characterize the existing drainage conditions and assist in determining anticipated impacts from the proposed works and associated requirements for drainage and stormwater management.

1.1.1 Reports

- Highland Creek Watershed Greening Strategy, Toronto and Region Conservation Authority (TRCA), 2020;
- Highland Creek Watershed Report Card 2018, Toronto and Region Conservation Authority (TRCA), 2018;

- Rogue River Watershed Plan, Toronto and Region Conservation Authority (TRCA), 2007; and
- Natural Heritage Report, Eglinton East Light Rail Transit Project Assessment Process, LGL Limited, August 2023.

1.1.2 Maps Data

- CUMAP Digital Water and Sewer Network, Eglinton Ave E and Kingston Rd, DWG/DGN, City of Toronto, 2014;
- CUMAP Digital Water and Sewer Network, Kingston Rd, Morningside Ave and Sheppard Ave E, DWG/DGN, City of Toronto, 2014;
- CUMAP Digital Water and Sewer Network, Sheppard Ave E (McCowan Rd - Neilson Rd except north part) west of Morningside Ave, DWG/DGN, City of Toronto, 2014;
- CUMAP Digital Water and Sewer Network, Sheppard Ave E (Conlines Rd - Dean Park Rd) east of Morningside Ave, DWG/DGN, City of Toronto, 2014;
- City of Toronto Digital Terrain Models (DTM), 2020;
- Toronto Maps Webpage; and
- Available Satellite Imagery.

1.1.3 Hydrologic and Hydraulic Models

The following hydrologic and hydraulic models were received from TRCA for use and reference in this assessment:

- Highland Creek PCSWMM Hydrologic Model, Version 5.1, 2020;
- Rouge River PCSWMM Hydrologic Model, Version 5.0, 2018;
- Highland Creek HEC-RAS 1D Hydraulic Model, 2020; and
- Rouge River HEC-RAS 1D Hydraulic Model, 2019.

2 Baseline Characterization

A drainage mosaic for the subject corridor of EELRT has been compiled based on the desktop review of the background information provided. After reviewing the background materials, discrepancies were noted among the various datasets, as well as gaps in the information provided. Various assumptions were made to address these information gaps and discrepancies, and to thereby complete the drainage mosaic, based upon available information and the general understanding of the drainage and stormwater management systems within the area. A copy of the drainage mosaic is provided in **Appendix A**. Key components of the drainage mosaic and overall water resources system are summarized in the sections below.

2.1 Watersheds

The EELRT study corridor spans across two watersheds that are regulated by the TRCA. The highly urbanized Highland Creek watershed encompasses most of the study corridor, while the northwest portion of the study area along Sheppard Avenue and Morningside Avenue, which includes the MSF site, lies within the Morningside Creek Subwatershed of the Rouge River watershed.

The Highland Creek watershed is a 102 km^2 highly urbanized watershed, located primarily within the City of Toronto. According to the TRCA Highland Creek Watershed Report Card 2018, natural cover (i.e. forest, meadow) represents only 11% of the total watershed area. Existing land use along the study corridor includes a variety of urban land uses including residential, commercial, mixed-use, and park space. Drainage from the existing urban ROWs is mostly managed through a series of underground storm sewers as is typical for urban drainage systems. These storm systems discharge to the Highland Creek and its tributaries, which ultimately discharge to Lake Ontario.

The Rouge River Watershed is a 336 km^2 size watershed spanning the Regions of York and Durham, and encompassing the Cities of Toronto, Markham and Pickering, and the Towns of Richmond Hill and Whitchurch Stouffville. The study corridor within the Rouge River watershed comprises of the area around the intersection of Sheppard Ave E and Morningside Ave. Existing land use along the study corridor includes a variety of types including residential, commercial, mixed-use, and park space. Drainage from the existing urban ROWs is collected and conveyed through underground storm sewers into Rouge River or its tributaries, and ultimately into Lake Ontario.

2.2 Land Use

Available satellite imagery was reviewed to characterize the land use adjacent to the subject segments of EELRT. Based on review, it is understood that the existing land use along the study corridor is highly urbanized, and includes residential lots, commercial areas, park space, as well as watercourse valley lands encompassing the main branch of the Highland Creek.

2.3 Natural Heritage

A Natural Heritage Report was completed for the EELRT by LGL Limited in August, 2023. As part of this investigation, fish and fish habitat were assessed. No aquatic species at risk have been found within or adjacent to the study area.

Based on the summary of designated natural areas, an environmentally significant area with a provincially significant wetland was identified at the Highland Creek valley in proximity to the

Morningside Avenue. Therefore, water quality measures will be required at this location. The water budget for key features is to be managed per the recommendations of ecologists.

Valley lands and wetlands associated with Bendale Branch, Milliken Branch, and Highland Creek are regulated areas, and a permit will be required from TRCA.

2.4 Existing Drainage System

Available CUMAP Digital Water and Sewer Network DWG/DGN files and City of Toronto DTM were reviewed to establish the existing drainage system for the drainage mosaic. During this review, the following data gaps have been identified in the CUMAP Digital Water and Sewer Network DWG/DGN files:

- No data was provided north of Nielson Road; and
- Storm sewer pipe slopes are missing for the entire storm sewer network.

Based upon the background information reviewed, it is understood that EELRT corridor is an urbanized roadway. Storm runoff within the urban cross-section is conveyed by a traditional urban major and minor system (i.e. storm sewers and overland within the right-of-way).

The approximate location, catchment areas, and discharge locations for each drainage area under existing conditions are summarized in **Table 2-1**. Refer to the drainage mosaic in **Appendix A** for additional details.

Table 2-1: Summary of Existing Preliminary Drainage Areas

Drainage Area Segment No.	Description	Drainage Area (ha)	Discharge Location
1	Sheppard Avenue East, from Brimley Road to Highland Creek Milliken Branch	4.24	Highland Creek Milliken Branch
2	Sheppard Avenue East, from Highland Creek Milliken Branch to 300 m west of Markham Road	4.04	Highland Creek Milliken Branch
3	Sheppard Avenue East, from 300 m west of Markham Road to Highland Creek Malvern Branch	4.05	Highland Creek Malvern Branch
4	Sheppard Avenue East (south side), from 240 m east of Malvern Street to 40 m west of Highland Creek Malvern Branch	0.16	Existing storm sewer system on Purvis Crescent, nearby outlet to Highland Creek Malvern Branch
5	Sheppard Avenue East from Highland Creek Malvern Branch to 80 m east of Murison Boulevard, including Neilson Road from Sheppard Avenue to Berner Trail/Wickson Trail	6.40	Highland Creek Malvern Branch
6	Neilson Road from Berner Trail/Wickson Trail to McLevin Avenue	3.36	Existing storm sewer system on Sheppard Avenue
7	Sheppard Avenue East (south side), from 140 m east of Neilson Road to 80 m east of Murison Boulevard	3.94	Existing storm sewer system on Coltman Crescent
8	Sheppard Avenue East, from 80 m east of Murison Boulevard to 270 m west of Brenyon Way	0.58	Existing storm sewer system on United Square
9	Sheppard Avenue East, from 270 m west of Brenyon Way to 300 m east of Morningside Avenue, including Morningside Avenue from Sheppard Avenue to Highway 401	6.54	Existing storm sewer system on Morningside Avenue
10	Sheppard Avenue East, from 300 m east of Morningside Avenue to Conlins Road	2.02	Existing storm sewer system on Conlins Road, nearby outlet to Tributary of Morningside Creek
11	Morningside Avenue, from Highway 401 to Military Trail	2.74	Existing storm sewer system on Morningside Avenue, nearby outlet to Highland Creek
12	Ellesmere Road, from Military Trail to 110 m east of Military Trail	0.29	Existing storm sewer system on Ellesmere Road

Drainage Area Segment No.	Description	Drainage Area (ha)	Discharge Location
13	Ellesmere Road, from 40 m east of Morningside Avenue to Military Trail	1.73	Highland Creek
14	Ellesmere Road, from 20 m west of Morningside Avenue to 40 m east of Morningside Avenue	0.28	Highland Creek
15	Morningside Avenue, from Ellesmere Road to 160 m south of Ellesmere Road	0.32	Highland Creek
16	Morningside Avenue, from 160 m south of Ellesmere Road to 230 m south of Ellesmere Road	0.15	Highland Creek
17	Morningside Avenue, from 230 m south of Ellesmere Road to 300 m south of Ellesmere Road	0.15	Highland Creek
18	Morningside Avenue, from 300 m south of Ellesmere Road to 370 m south of Ellesmere Road	0.15	Highland Creek
19	Morningside Avenue, from 370 m south of Ellesmere Road to 440 m south of Ellesmere Road	0.15	Highland Creek
20	Morningside Avenue, from 440 m south of Ellesmere Road to 510 m south of Ellesmere Road	0.13	Highland Creek
21	Morningside Avenue, from 510 m south of Ellesmere Road to 590 m south of Ellesmere Road	0.16	Highland Creek
22	Morningside Avenue, from 590 m south of Ellesmere Road to 670 m south of Ellesmere Road	0.14	Highland Creek
23	Morningside Avenue, from 670 m south of Ellesmere Road to 770 m south of Ellesmere Road	0.21	Highland Creek
24	Morningside Avenue, from 470 m north of Beath Street to Warnsworth Street	1.20	Highland Creek
25	Morningside Avenue, from Warnsworth Street to Kingston Road, and Kingston Road from Morningside Avenue to Lawrence Avenue East	2.53	Existing storm sewer system on Morningside Avenue
26	Kingston Road (north side), from Lawrence Avenue East to 180 m east of Galloway Road	1.11	Existing storm sewer system on Lawrence Avenue East
27	Kingston Road (south side), from Lawrence Avenue East to Poplar Road	0.45	Existing storm sewer system on Kitchener Road
28	Kingston Road (south side), from Poplar Road to 230 m west of Poplar Road	0.45	Existing storm sewer system on Poplar Road
29	Kingston Road, from 180 m east of Galloway Road to Payzac Avenue	2.43	Existing storm sewer system on Galloway Road
30	Kingston Road, from Payzac Avenue to Metrolinx rail crossing	3.22	Existing storm sewer system on Payzac Avenue (partial outlet to storm sewer system on Celeste Avenue)
31	Kingston Road, from Metrolinx rail crossing to Guildwood Parkway	3.45	Existing storm sewer system on Livingston Road
32	Kingston Road, from Guildwood Parkway to Scarborough Golf Club Road	1.83	Existing storm sewer system on Guildwood Parkway
33	Kingston Road, from Scarborough Golf Club Road to Eglinton Avenue East	1.45	Existing storm sewer system on Kingston Road, connects to storm sewer system on Cedar Drive
34	Eglinton Avenue East, from Kingston Road to Markham Road	3.92	Existing storm sewer system on Cedar Drive
35	Eglinton Avenue East, from Markham Road to Mason Road	1.31	Existing storm sewer system on Markham Road
36	Eglinton Avenue East, from Beachell Street to 90 m west of Mason Road	0.85	Existing storm sewer system on Beachell Street
37	Eglinton Avenue East, from 90 m west of Mason Road to Torrance Road	3.09	Existing storm sewer system on Bellamy Road North
38	Eglinton Avenue East, from Torrance Road to 30 m west of Brimley Road	3.93	Existing storm sewer system discharging to open channel on Barbados Boulevard (partial outlet to storm sewer system on Danforth Road)
39	Eglinton Avenue East, from 20 m east of Brimley Road to 30 m west of Brimley Road	0.21	Existing storm sewer on Brimley Road
40	Eglinton Avenue East, from 30 m west of Brimley Road to Glider Drive	1.43	Existing storm sewer system on Bimbrook Road
41	Eglinton Avenue East, from Glider Drive to Metrolinx rail crossing	2.88	Existing storm sewer system on Glider Drive
42	Eglinton Avenue East, from Metrolinx rail crossing to 190 m east of Kennedy Road	0.69	Existing storm sewer system on Eglinton Avenue

The background information provided for use and reference in this study was insufficient to confirm final catchment boundaries and discharge locations. Consequently, existing conditions are to be confirmed based on additional as-built and roadway profile information at the detailed design stage.

2.4.1 External Drainage Areas

External drainage areas which contribute runoff to the EELRT corridor right-of-way were identified based on the review of CUMAP Digital Water and Sewer Network DWG/DGN files. No Stormwater Management Reports have been provided for external areas, hence these findings are to be confirmed as part of future works and analyses.

Based upon the background information reviewed, it is understood, there are multiple storm sewer connections from areas outside the right-of-way to the storm sewer system along the corridor, as shown in the drainage mosaic in **Appendix A**.

Although the locations where runoff from external lands have been identified, insufficient information has been provided to determine the size and impervious coverage of the external drainage areas which discharge to the EELRT corridor right-of-way. Further, it is unknown whether stormwater infrastructure is currently provided within the external drainage areas, or if the external connections rely on the major system or minor system for conveyance.

2.5 Hydraulic Structures

A hydraulic structure inventory has been compiled based upon the background information review. Three bridge crossings were identified along the study corridor based on review of Toronto Maps and EELRT corridor Available Satellite Imagery. All three structures are within the Highland Creek Watershed. Two bridge crossings, 265 and 211, are located along Sheppard Ave East, while 357 is along Morningside Avenue, adjacent to the University of Toronto Scarborough (UTSC) lands. Refer to the Drainage Mosaic in **Appendix A** for the location of the crossings.

A summary of the size and location of the existing bridge structures can be found in **Table 2-2.**

Table 2-2: Summary of Roadway Crossing Structures

Structure ID (City of Toronto)	Crossing (Watercourse)	Crossing Location	Crossing Dimensions (Span x Rise x Length)
265	Bendale Branch	Sheppard Ave E, between McCowan Rd and Shorting Rd	10.2 m x 3.03 m x 26.8 m
211	Milliken Branch	Sheppard Ave E, between Gateforth Dr and Washburn Way	12.2 m x 6.07 m x 29.6 m
357	Highland Creek	Morningside Ave, between Ellesmere Rd and Beath St	130 m x 13.54 m x 19.5 m

The hydraulic structure sizes were summarized based on the available background data. TRCA HEC-RAS models were utilized to ensure the accuracy in our findings.

Based upon a high level review of the area, it is anticipated that other hydraulic structures (i.e. culverts) possibly located within the study area. Inventory to be updated at the detailed design stage based upon review of the additional background information.

2.5.1 Drainage System Design Criteria

Preliminary assessments for the conveyance capacity of hydraulic structures spanning the regulated watercourses within the project limits have been completed to identify any existing potential capacity constraints within the existing drainage system. The capacity assessment for the hydraulic structures has been completed based upon the criteria provided in the Highway Drainage Design Standards (MTO, January 2008).

2.5.2 Hydraulic Structures Preliminary Capacity Assessment

The design peak flows for the hydraulic structures spanning regulated watercourses were obtained from the currently approved hydraulic models provided by TRCA for use in this study. During detailed design, the design flows should be reviewed and verified using hydrologic modelling to confirm any changes to the land-use, channel geometry and associated hydrologic information that may affect the peak flows presented in this study.

A hydraulic assessment of the bridge crossings spanning regulated watercourses was conducted to determine the performance of the hydraulic structures under the existing conditions. For hydraulic structures which are represented in the currently approved hydraulic models provided by TRCA, the simulated water surface elevations generated by the model have been extracted and used for the assessment. The culvert capacities were assessed based on the 100 year and Regional storm events for freeboard and clearance, and the Regional storm assessment also considered depth of overtopping to confirm safe vehicle passage for an emergency access route. As per the MTO standards, the minimum design flow for the bridges on regulated watercourses is 100 year storm event.

Table 2-3 summarizes the hydraulic analyses of the existing hydraulic structures spanning regulated watercourses.

Table 2-3: Hydraulic Structures Preliminary Capacity Assessment Results

Structure ID (City of Toronto)	Reach	Station	Existing Design Flow, m^3/s		Approximate Freeboard, m		Approximate Clearance, m		Approximate Overtopping Depth at the Upstream Cross Section, m	
			100 Year	Regional	100 Year	Regional	100 Year	Regional	100 Year	Regional
265	Bendale Branch Reach 3	6785.84	87.43	158.67	0.00	0.00	0.00	0.00	0.21	1.92
211	Milliken Branch Reach 2	4161.41	97.81	153.57	3.30	2.02	2.72	1.44	0.00	0.00
357	Highland Creek Reach 2	5691.523	340.44	784.91	12.43	10.78	10.07	8.42	0.00	0.00

The results presented in **Table 2-3** indicate that the 100 year and Regional Storm events overtop the road at Bendale Branch crossing (structure 265).

3 Proposed Drainage Conditions

3.1 Roadway Drainage System

A proposed conditions scenario was developed and assessed for the 18 km long LRT corridor. The proposed scenario consists of three segments:

- Segment 1. Eglinton Avenue and Kingston Road;
- Segment 2. Morningside Avenue and University of Toronto Scarborough Campus (UTSC) Area; and
- Segment 3. Sheppard Avenue and Neilson Road.

All segments will incorporate one center lane LRT in each direction. From a stormwater standpoint, it is expected that there will be an increase in impervious areas within the right-of-way under proposed scenario. Proposed changes along the study corridor are summarized in **Table 3-1**.

Table 3-1: Summary of Proposed Changes

Segment Number	Road Section	Roadway Design	Description of changes
1	Eglinton Ave-Kingston Rd	Two general purpose travel lanes per direction.	Minor widening into existing parking lots and frontages. No to minimal impervious surfaces increase.
2	Morningside Ave	- One general purpose travel lane per direction between Kingston Rd and Ellesmere Rd. - Two general purpose travel lanes per direction between New Military Trail and Sheppard Ave.	- South of Highland Creek, widening to the west with property acquisition. - North of the Highland Creek bridge to Ellesmere, widening into the valley and adding retaining walls. - North of Military Trail and south of Highway 401, widening and landscaping reduction. - North of Highway 401, minor widening into existing parking lots and frontages. Impervious surfaces increase.
	Ellesmere Rd	Two general purpose travel lanes per direction between Morningside Ave and New Military Trail.	Widening on both sides with tall retaining walls. Impervious surfaces increase.
	New Military Trail	One general purpose travel lane per direction between Ellesmere Rd and Morningside Ave.	Creation of a new road. New impervious surfaces.
3	Sheppard Ave	Two general purpose travel lanes per direction.	Limiting widening into residential properties. Reduce landscaping. Impervious surfaces increase.
	Neilson Rd	Two general purpose travel lanes per direction.	Limiting widening into residential properties. Eliminating median and boulevard landscaping. Impervious surfaces increase.

All segments propose widened boulevards with mix of cycle, pedestrian, and landscaping elements. The total width of the transportation corridor is anticipated to vary due to localized constraints at certain locations.

3.1.1 Minor Drainage System

The overall drainage pattern is anticipated to remain consistent with the existing conditions, under the proposed expansion to accommodate the LRT. To accommodate the proposed roadway widening, storm sewer upsizing and catchbasin relocations are anticipated. The proposed works may also warrant additional storm infrastructure to capture and convey flows.

The drainage within University of Toronto Scarborough Campus newly proposed roadway (i.e. New Military Trail) is to be provided through the proposed underground storm sewer system and an outlet. Those to be designed at the detailed design stage.

The major system of the proposed urban arterial road will be designed to convey the 100 year flow within the right-of-way. The maximum allowable flow spread for a two lane New Military Trail roadway should provide 3.5 metres of open roadway.

The storm sewer system for the ultimate roadway configuration is to be established at the detailed design stage for a 5-year storm event as per the City of Toronto Storm Drainage Design Requirements. Roadway drainage will be collected by a series of catchbasins and will be conveyed by storm sewers to the existing storm outlet locations.

3.1.2 Hydraulic Structures

The requirements to replace or extend hydraulic structures spanning regulated watercourses were determined based on the review of the proposed conditions (e.g. road widening) and the results of the existing hydraulic structures capacity assessment conducted in section 2.4.2. The requirements for hydraulic structure extension or replacement are summarized in **Table 3-2** for each of the scenarios evaluated.

Table 3-2: Proposed Scenario Existing Hydraulic Structures Assessment

Structure ID (City of Toronto)	Proposed Scenario Recommendation
265	Replace
211	Extend
357	Extend

The hydraulic structures for the ultimate roadway configuration are to be designed at the detailed design stage, including review of the existing structures conditions, fluvial geomorphological considerations, and associated aquatic habitats.

4 Stormwater Management Strategy

4.1 Stormwater Management Criteria

The stormwater management plan for the study area shall be developed to comply with the policies, regulations, and standards of Toronto and Region Conservation Authority (TRCA), Ministry of Environment, Conservation and Parks (MECP), and City of Toronto.

4.1.1 Water Quality Control Requirements

Watercourses within the TRCA's jurisdiction are classified as requiring an "Enhanced" level of protection, which equates to 80% Total Suspended Solids (TSS) removal.

Water quality management measures within the study limits will be designed at the detailed stage to provide "Enhanced" water quality treatment for the increased pavement area as a result of roadway widening.

4.1.2 Water Quantity Control Requirements

Storm Sewer Systems

Within the project limits, the stormwater runoff from EELRT corridor discharges either into the existing storm sewer systems or outlets at the watercourse crossings. For locations where the runoff discharges into an existing system, the minor system design storm peak flows must be controlled to the existing peak flows, for which the receiving system was designed.

Watercourse Crossings

TRCA has established quantity control targets for the watersheds under their jurisdiction. Details in this regard are summarized in **Table 4-1**.

Table 4-1: Summary of Water Quantity Control Criteria

Watershed	Water Quantity Control Criteria
Highland Creek	Control post development peak flows to pre-development levels for all storms up to and including the 100 year storm (I.e. 2, 5, 10, 25, 50 and 100 year storms)
Rouge River	Control post-development peak flows to pre-development levels for all storms up to and including the 100 year storm (i.e. 2, 5, 10, 25, 50, and 100 year storms) Note: Further study is required to determine the appropriate level of control for lands draining to contributing tributaries of the above noted watercourses.

4.1.3 Water Balance and Erosion Control Requirements

The TRCA criteria for water balance and erosion control requires retention of 5 mm of rainfall. This criterion is applicable to increased pavement area as a result of roadway widening/improvements.

4.2 Stormwater Management Requirements and Options

Stormwater management requirements and alternatives have been evaluated for proposed scenario. This assessment has been completed based upon the change in impervious coverage as determined from the capacity assessment. Where the scenario has been identified as resulting in an increase in impervious coverage to the drainage outlet, it has been anticipated that this would correspondingly

require stormwater management practices be implemented to mitigate the impacts of the additional impervious coverage, primarily with respect to quantity (i.e. flooding) impacts.

The stormwater management requirements have been assigned constraint rankings of “high”, “medium”, and “low” to each road segment and corresponding outlet, based upon the type of receiving system. A “high” constraint ranking represent red drainage area segments, where roadway storm sewer system connects to an existing storm sewer downstream, and no existing quantity controls (e.g. ponds, etc.) were identified adjacent to the right-of-way; under these conditions, it is anticipated that opportunities to provide post-to-pre control to the receiving municipal right-of-way would be highly constrained. A ”medium” constraint ranking represent yellow drainage area segments, which outlets to minor and medium watercourses. In these areas, it is anticipated that stormwater quantity controls would be required, however the type of receivers (i.e. regulated watercourses) would accommodate the application of source controls within the right-of-way. A “low” constraint ranking includes green drainage area segments, where roadway drainage discharges into a major watercourse (e.g. Highland Creek); in these areas, it is anticipated that quantity controls would not be required, due to the size of the road right-of-way relative to the total contributing drainage area of the receiving watercourse. Refer to the drainage mosaic in **Appendix A** for additional details.

The preliminary assessment of the stormwater management constraints of the proposed scenario is summarized in **Table 4-2**.

Table 4-2: Proposed Scenario Stormwater Management Assessment

Drainage Area Segment No.	Impervious Area Increase	High, Medium and Low Rankings
1	Yes	Medium
2	Yes	Medium
3	Yes	Medium
4	Yes	Medium
5	Yes	Medium
6	Yes	High
7	Yes	High
8	Yes	High
9	Yes	High
10	Yes	High
11	Yes	High
12	Yes	High
13	Yes	Low
14	Yes	Low
15	Yes	Low
16	Yes	Low
17	Yes	Low
18	Yes	Low
19	Yes	Low
20	Yes	Low
21	Yes	Low
22	Yes	Low
23	Yes	Low
24	Yes	Low
25	Yes	High
26	Minimal	High
27	Minimal	High
28	Minimal	High
29	Minimal	High
30	Minimal	High
31	Minimal	High
32	Minimal	High
33	Minimal	High
34	Minimal	High

Drainage Area Segment No.	Impervious Area Increase	High, Medium and Low Rankings
35	Minimal	High
36	Minimal	High
37	Minimal	High
38	Minimal	High
39	Minimal	High
40	Minimal	High
41	Minimal	High
42	Minimal	High

The results presented in **Table 4-2** indicate that proposed scenario includes areas which are highly constrained from a stormwater management perspective. At detailed design, other stormwater management alternatives (i.e. drainage area diversions) should be investigated, to mitigate potential increases in peak flow to major and minor drainage systems representing the receivers from the right-of-way. Various Best Management Practices (BMPs) alternatives are available to provide stormwater management for the additional impervious coverage resulting from the implementation of the EELRT. The BMPs alternatives for the road segments with impervious area increase are summarized in **Table 4-3**. These alternatives will be reviewed and assessed for their applicability during the detailed design stage.

Table 4-3: BMPs Alternatives

Rankings	Water Quality Control	Water Quantity Control
High	OGS Units; Bioretention Cells; Infiltration Trenches; Vegetated Filter Strips	Online Storage Pipes with Increased Sewer Conveyance and Catchbasin Inlet Capacity; Underground Chambers with Increased Sewer Conveyance and Catchbasin Inlet Capacity
Medium	OGS Units; Bioretention Cells; Infiltration Trenches; Vegetated Filter Strips	Online Storage Pipes; Underground Chambers
Low	OGS Units; Bioretention Cells; Infiltration Trenches; Vegetated Filter Strips	None Anticipated to Be Required

Due to the nature of the development area (i.e. linear transportation corridor) and the limited space within the roadway right-of-way, an available pervious area space will be assessed at the detailed design stage for the final preferred scenario. Low Impact Development Best Management Practices (LID BMPs) will be incorporated to provide resilience for the municipal drainage system.

5 Conclusions

The 18 km long corridor through Scarborough along Eglinton Avenue East, Kingston Road, Morningside Avenue, and Sheppard Avenue East, through the University of Toronto Scarborough Campus and to Malvern Town Centre via Neilson Road is proposed to be improved to incorporate Light Rail Transit.

To accommodate the proposed roadway widening, storm sewer upsizing and catchbasin relocations are anticipated. The drainage within the New Military Trail right-of-way is to be provided through the proposed underground storm sewer system and an outlet. Those are to be designed at the detailed design stage. The storm sewer system for the ultimate roadway configuration is to be established at the detailed design stage for a 5-year storm event as per the City of Toronto Storm Drainage Design Requirements.

The anticipated requirements for hydraulic structures replacement and extension were determined based on the review of the proposed road widening and existing hydraulic structures capacity assessment. Preliminary assessment indicated that bridge replacement is to be proposed for Bendale Branch crossing, as well as bridges extensions are to be proposed for Milliken Branch and Highland Creek crossings. The proposed hydraulic structures for the ultimate roadway configuration are to be designed at the detailed design stage. Supplementary hydraulic structures assessment should be conducted at the detailed design stage.

The preliminary assessment of the proposed scenario regarding the stormwater management alternatives was conducted, and BMPs alternatives were provided. Various BMPs alternatives will be reviewed and assessed for their applicability during the detailed design stage following TRCA policies and standards.