Function and Design Review of Heart Lake Road Corridor

City of Brampton

Final Report - February 2019

Stantec

Sign-off Sheet

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Prepared by 

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François Tomeo, P.Eng.

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Irene Hauzar, MCIP, RPP, AICP

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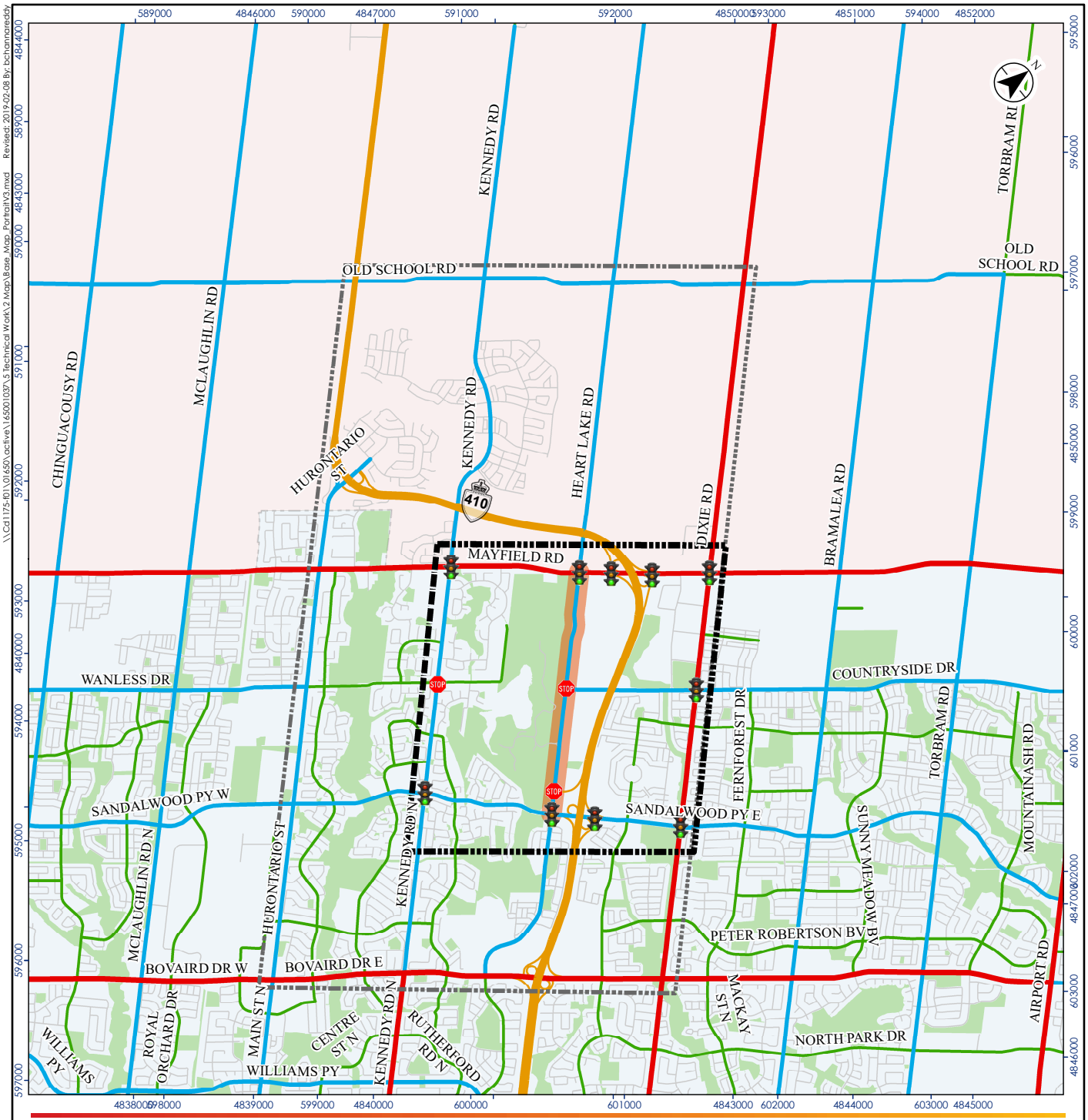
1.0 INTRODUCTION

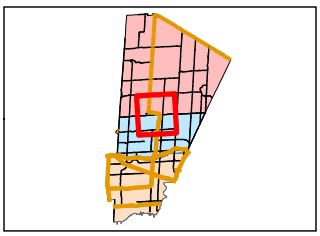
In response to concerns regarding wildlife mortality and traffic operations, the City of Brampton commissioned Stantec to undertake a function and design review of the Heart Lake Road corridor within the City of Brampton.

The focus of this study is the Heart Lake Road corridor between Sandalwood Parkway to a point just north of Mayfield Road, however, the assessment of the transportation network and recommendations from this study extend beyond this focus area. **Figure 1** shows the study corridor and area.

The Heart Lake Road Transportation Study will deliver on the following objectives:

- Assess the feasibility of preserving the existing rural/cultural landscape character of Heart Lake Road given its Official Plan designation and function as a Minor Arterial Road and relevant Secondary Plan policies.
- Assess the current roadway structure and long-term function of Heart Lake Road with the intent of identifying opportunities to safely accommodate active transportation, while meeting other transportation demands.
- Review the roadway operational mitigating measures that have already been implemented with the intent to preserve and enhance the unique cultural heritage landscape and existing wildlife habitat along Heart Lake Road (i.e. naturalization, natural area /wildlife signage, road closures for seasonal migration periods and monitoring) and recommend improvements/enhancements.
- Review the road infrastructure improvements planned along Heart Lake Road which are intended to deter wildlife from crossing the road (i.e. wildlife eco-passage culvert and wildlife fencing) and recommend additional measures to enhance the proposed works.
- Examine the implications on land use, development, and transportation of listing Heart Lake Road under the Ontario Heritage Act as a Cultural Heritage Landscape and make appropriate recommendations in this regard.





Legend

- Extended Study Area
- Study Area
- Study Corridor
- Parks

Municipality

- Caledon
- Brampton

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Collector Road
- Local Road
- Ramp

Study Intersections

- 1-way Stop
- Signalized

0 200 400 metres

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Project Location
Brampton, ON

165001037 REVA
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Client/Project
FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
1

Title
Focus Study Area

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
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2.0 CONTEXT AND STUDY PROCESS

2.1 CONTEXT

Historical evidence suggests that Heart Lake Road was a "corduroy log road" built in early to mid-1800s, traversing the Brampton Esker through wetlands, woodlands and wildlife habitat. In comparison to the majority of Brampton, very little active agriculture occurred along Heart Lake Road due to the significant natural constraints and unsuitable soil.

The largest land holding along the Heart Lake Road today is the Heart Lake Conservation Area (HLCA) owned by the Toronto and Region Conservation Authority (TRCA). Other development has been minimal, and comprises primarily older residential lots, a garden centre and a community organization headquarters. Between Heart Lake Road and Highway 410, previous agricultural lands are under application for development including employment, residential and institutional uses.

The primary concerns regarding Heart Lake Road relate to:

- Protection of the natural area adjacent to Heart Lake Road;
- Conservation of the cultural heritage landscape;
- Long range transportation planning;
- Land use planning.

2.2 STUDY PROCESS

Figure 2 shows the process followed for this study, which includes two technical advisory committee (TAC) and public information centres (PIC), each at the following milestones:

- After the background review, integrating components related to ecology & environment as well as cultural heritage;
- After the evaluation of alternatives and selection of preferred alternative.

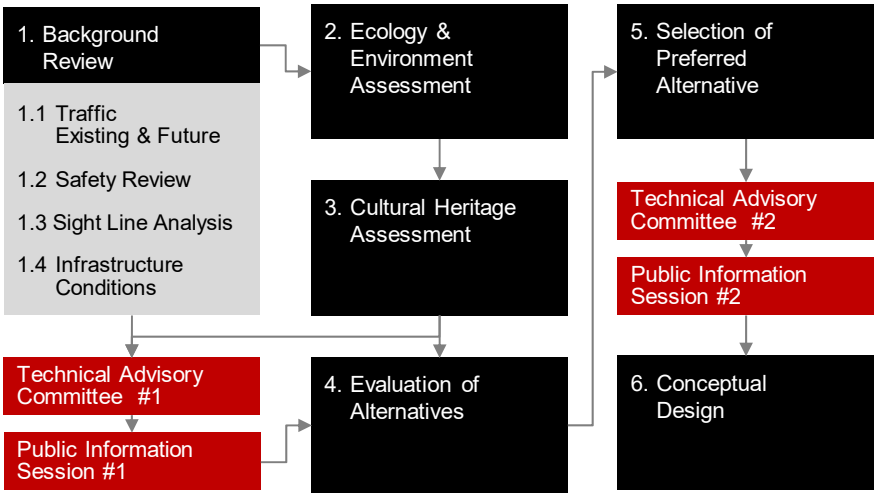


Figure 2 Study Process

3.0 TRANSPORTATION

3.1 TRAFFIC

3.1.1 Existing Conditions

3.1.1.1 Land Use

Figure 3 shows the current land use along the Heart Lake Road Corridor under study and the extended study area.

It should be noted that the Heart Lake Conservation Area (HLCA), under the jurisdiction of the Toronto and Region Conservation Authority (TRCA), is located on the west side of Heart Lake Road. HLCA occupies 169 hectares and contains two kettle lakes, the headwaters for Spring Creek, a Provincially Significant Wetland Complex and one of the largest individual blocks of forest in the Etobicoke Creek watershed.

3.1.1.2 Transportation Network

The existing transportation network consists of various multimodal facilities to provide local and regional travel options. The following section details: the road network, transit network, active transportation routes, and commercial vehicle routes.

Road Network

The road network around the Heart Lake Road corridor includes several major roadways that fall under Provincial, Regional, and municipal jurisdiction as summarized in **Table 1**. Highway 410, which is parallel and directly east of Heart Lake Road, provides regional connections as far north as the Bruce Peninsula, and the rest of the Greater Toronto and Hamilton Area to the south. Bovaird Drive and Sandalwood Parkway are 6-lane arterials providing local cross-town connections, as well as further regional connections to Halton Region and York Region. For a map of roadway hierarchy in relation to the study area see **Figure 4**.

Transit Services

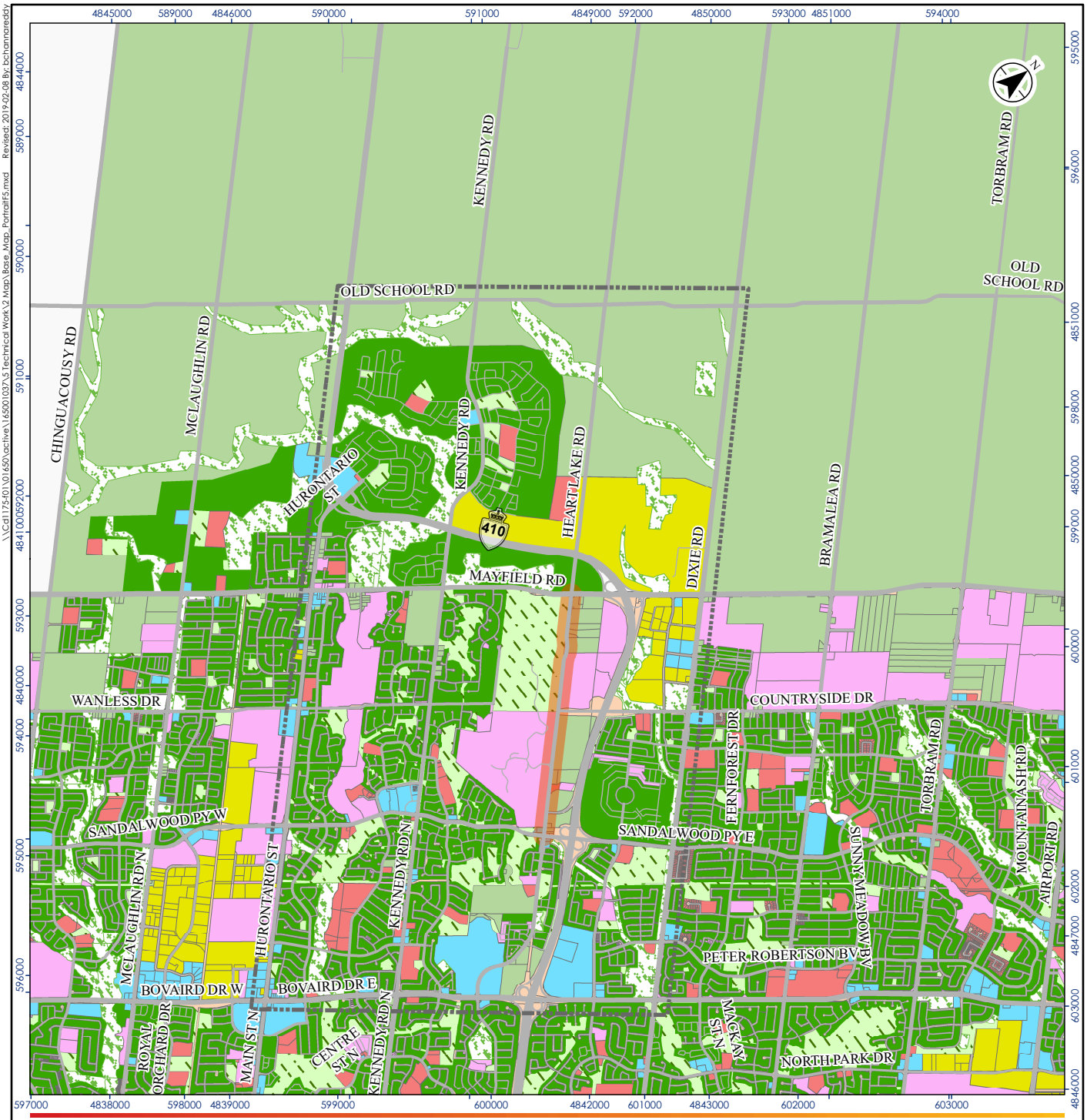
The Heart Lake Road corridor study area is served by a mixture of local and regional bus services, primarily centred along Hurontario Street and Bovaird Drive. Heart Lake Road is not directly serviced by transit between Mayfield Road and Bovaird Drive. In general, most routes in the study area offer service all week with headways of 30 minutes or better during the peak periods with a few routes that operate at larger headways (50 minutes) and only provide weekday service (see **Table 2**). For a map of existing services in the study are see **Figure 5**.

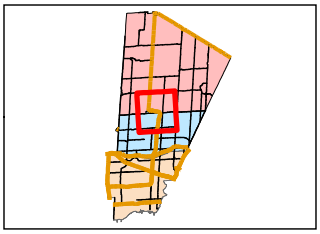
Table 1 Existing | Major Roadways in Study Area

Roadway	# of Lanes	Type	Jurisdiction
Hurontario St.	4	Arterial	Brampton
Kennedy Rd.	4	Arterial	Brampton
Heart Lake Rd. (HLR)	4	Arterial	Brampton
Dixie Rd.	4	Regional Arterial	Peel
Bovaird Dr.	6	Regional Arterial	Peel
Sandalwood Pkwy	East of HLR: 6 West of HLR: 4	Arterial	Brampton
Conservation Dr.	2	Arterial	Brampton
Mayfield Rd.	4	Regional Arterial	Peel
Old School Rd.	2	Arterial	Caledon
Hwy 410	4	Highway	MTO

Table 2 Existing | Transit Routes

Route	Type	Days of Operation	Frequency (min)			
			AM	Mid-Day	PM	Off-Peak
2 – Main	Local	Mon-Sun	20	20	20	30
3 - McLaughlin	Local	Mon-Sun	15	30	10	25
5 - Bovaird	Local	Mon-Sun	10	20	15	30
7 - Kennedy	Local	Mon-Sun	7	15	7	20
17 – Howden	Local	Mon-Sun	20	40	20	40
18 - Dixie	Local	Mon-Sun	10	16	10	20
19 - Fernforest	Local	Mon-Sun	20	30	20	30
21 – Heart Lake	Local	Mon-Fri	50	N/A	50	50
23 - Sandalwood	Local	Mon-Sun	15	30	15	30
24 – Van Kirk	Local	Mon-Sun	30	30	30	60
32 – Father Tobin	Local	Mon-Sun	30	40	30	40
33 – Peter Robertson	Local	Mon-Sat	30	40	30	40
502 – Zum Main	BRT	Mon-Sun	8	10	8	20
505 – Zum Bovaird	BRT	Mon-Sun	14	20	15	20
37 – Orangeville/Brampton (GO)	Regional	Mon-Fri	50	N/A	50	N/A





Legend

- Extended Study Area
- Study Corridor

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Collector Road
- Local Road
- Ramp

ZONING

- Other
- Agricultural
- Commercial
- Floodplain
- Industrial
- Institutional
- Open Space
- Public Ownership/Utilities
- Residential

0 200 400 metres

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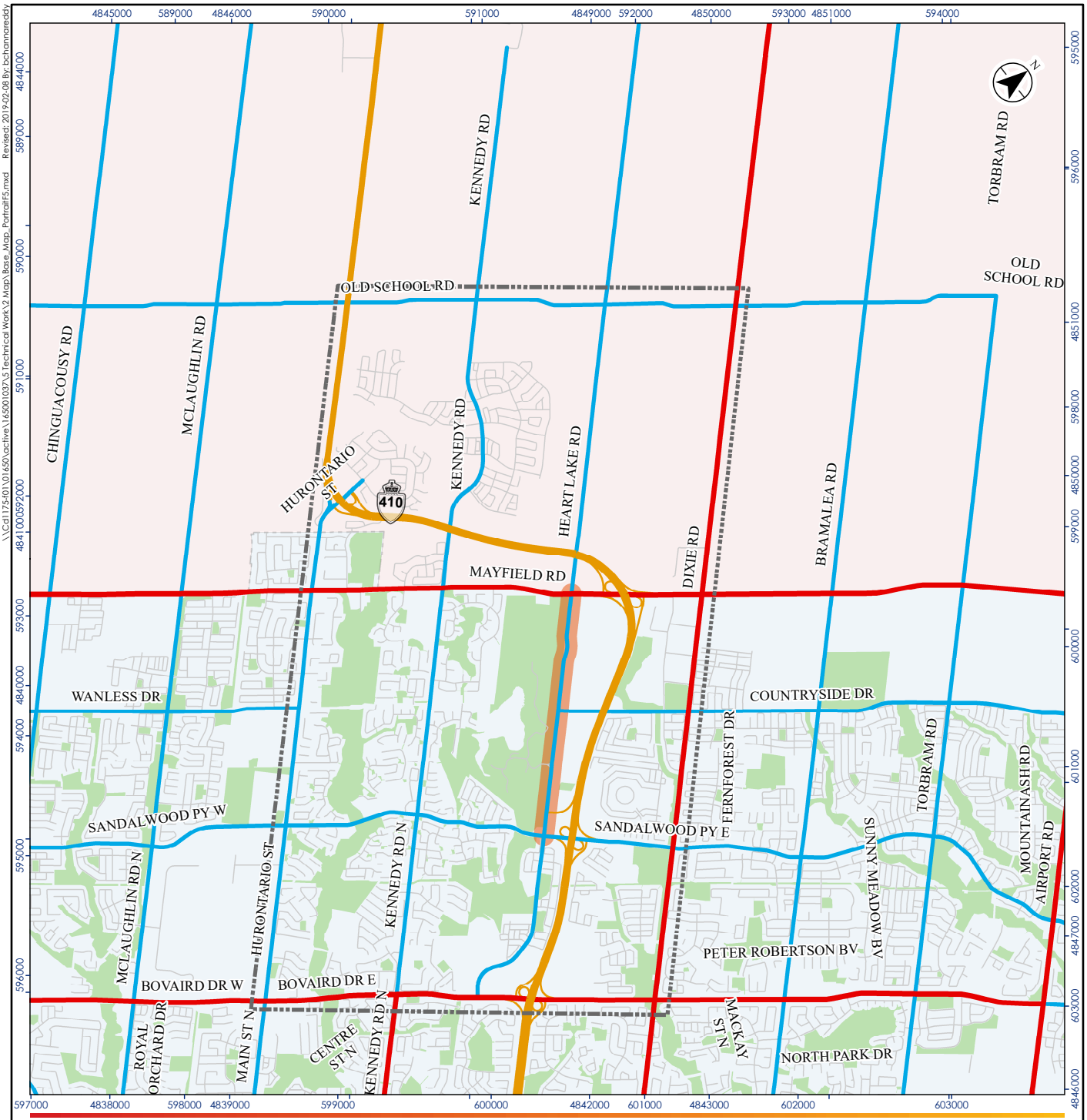
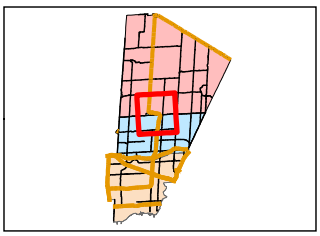
FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
3

Title
Existing Land Use





Legend

- Extended Study Area
- Study Corridor
- Parks

Municipality

- Caledon
- Brampton

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Local Road
- Ramp

0 200 400 metres

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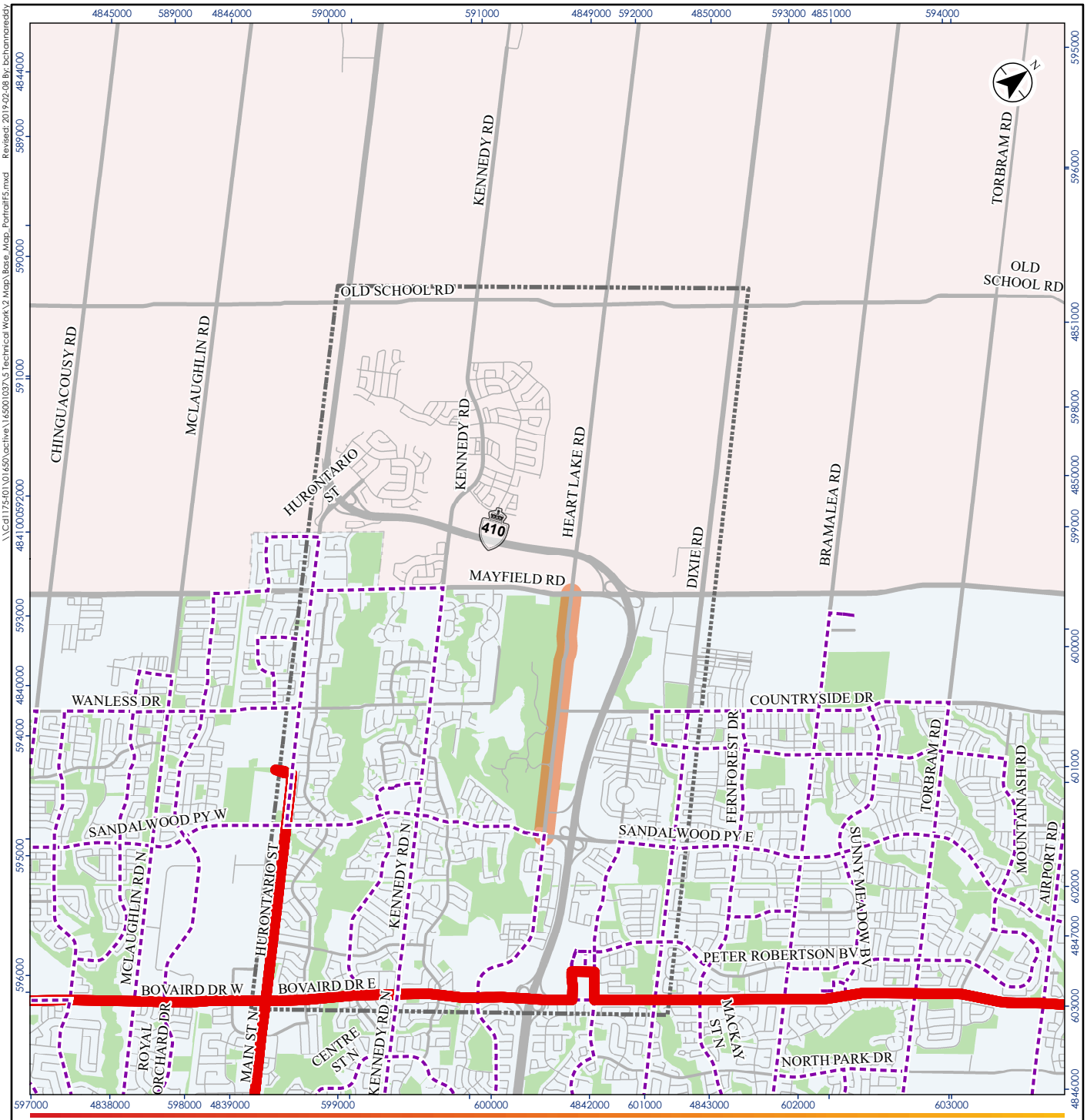
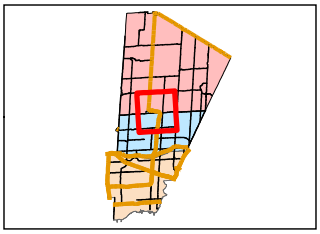
FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
4

Title
Existing Road Network





Legend

- Extended Study Area
- Study Corridor
- Parks

Municipality

- Caledon
- Brampton

Transit

- Local
- Zum BRT

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Collector Road
- Local Road
- Ramp

0 200 400 metres

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FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
5

Title
Existing Transit Network

Active Transportation

The study area includes numerous off-road cycling paths providing connections throughout the City of Brampton. The Heart Lake Conservation Area, which is adjacent to Heart Lake Road, is connected via the Esker Lake Trail which extends from the conservation area at its northern terminus to Copperfield Road in the south. There are limited connections from Heart Lake Road to other active transportation trails for cross-town or regional connections, however several other trails and cycling paths are in proximity to the corridor such as the boulevard paths on Countryside Drive and Sandalwood Parkway east of Highway 410 (summarized in **Table 3**). **Figure 6** shows a map of existing active transportation facilities in the study area.

Table 3 Existing | Active Transportation Facilities

Name	Type
Esker Lake Recreational Trail	Off-Road Trail (City)
Etobicoke Creek Recreational Trail	Off-Road Trail (City)
Chingacousy Recreational Trail	Off-Road Trail (City)
Flower City Recreational Trail	Off-Road Trail (City)
Kennedy Rd.	Boulevard Path (City)
Countryside Dr.	Boulevard Path (City)
Sandalwood Pkwy	Boulevard Path (City)
Bovaird Dr.	Boulevard Path (Region)

Commercial Vehicles

Goods movement in the area is provided via Highway 410 as well as regional roadways as summarized in **Table 4**. Most collector roads in the area have truck restrictions as well as several arterial roads such as Kennedy Road (North of Bovaird Drive), Heart Lake Road, Bramalea Road, Torbram Road, and Sandalwood Parkway (see **Figure 7**).

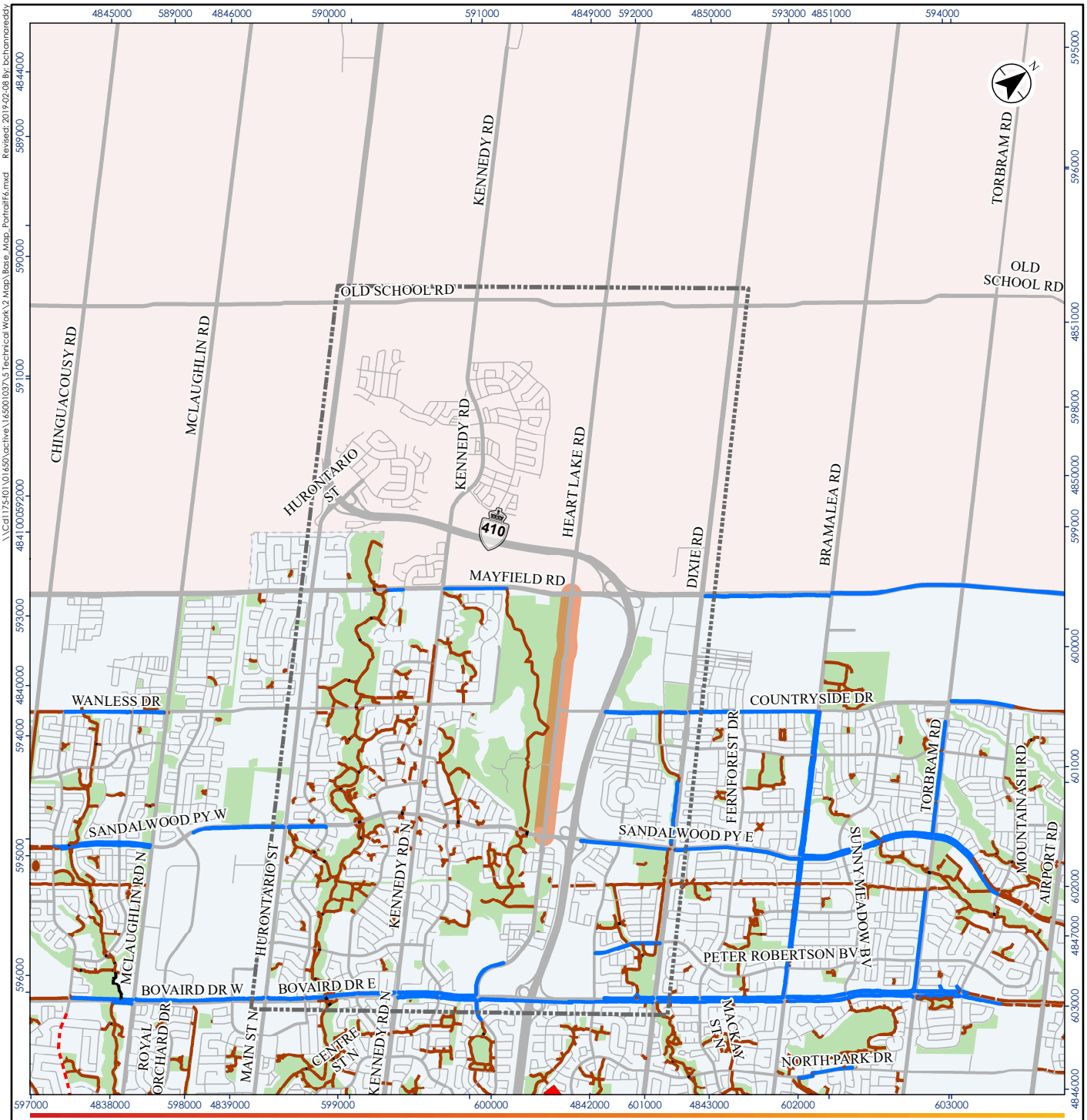
Table 4 Existing | Goods Movement Network Corridors

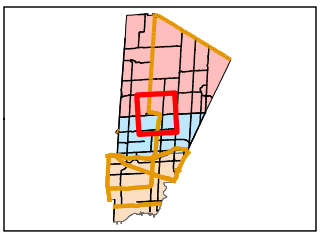
Corridor	Description	Type
Mayfield Rd.	Across the entire City	Primary Truck Route (Regional)
Dixie Rd.	Mayfield Rd. to south of Hwy 407	Primary Truck Route (Regional)
Bovaird Dr.	Across the entire City	Primary Truck Route (Regional)
Kennedy Rd.	Bovaird Dr. to south of Hwy 407	Primary Truck Route (City)
Hurontario St.	Mayfield Rd. to Bovaird Dr.	Potential City Truck Route

One important thing to note on **Figure 7** is that truck traffic is prohibited on Heart Lake Road between Mayfield Road and Bovaird Drive. However, we note the following three issues which makes that prohibition difficult to apply:

- Truck traffic is not prohibited on Countryside Drive between Dixie Road and Heart Lake Road;
- Countryside Drive connects to industrial areas east of Highway 410, prompting truck drivers to use Countryside Drive and Heart Lake Road to access Highway 410 South; and
- The Lakeside Garden Gallery is a generator of truck traffic because of delivery needs. It should be noted that there is a traffic by-law provision which allows trucks on delivery to travel within a prohibited area provided that the route taken is the most direct.

This implies that despite the restrictions on Heart Lake Road, trucks are observed.





Legend

- Extended Study Area
- Study Corridor
- Parks

Municipality

- Caledon
- Brampton

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Collector Road
- Local Road
- Ramp

Pathways

- Recreational Trail
- Multi-Use Boulevard Pathway
- On-Street Bike Lane
- Bridge or Underpass

0 200 400 metres

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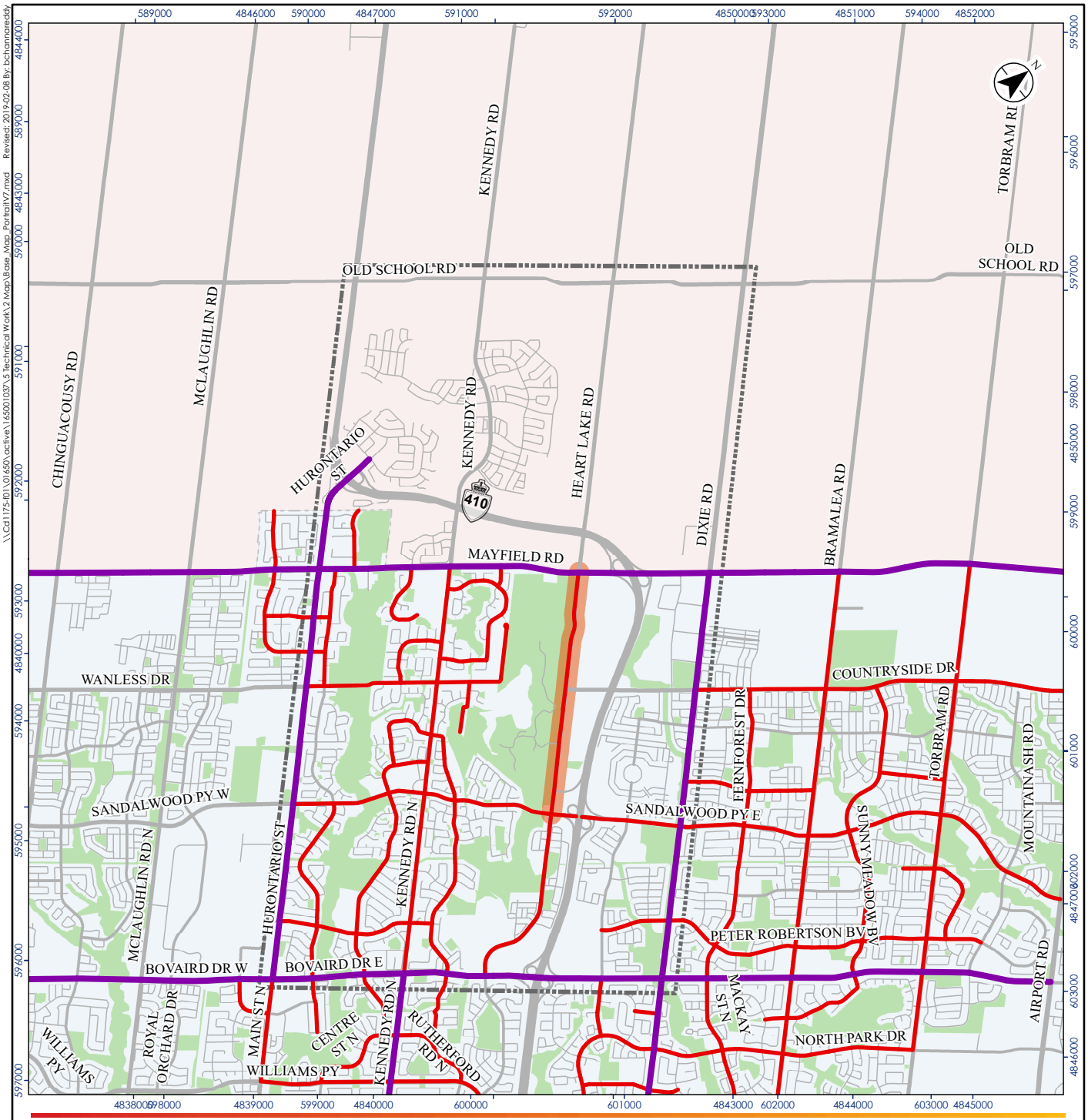
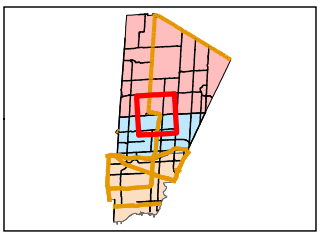
FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
6

Title
Existing Active Transportation Network





Legend

- Extended Study Area
- Study Corridor
- Parks

Municipality

- Caledon
- Brampton

- Truck Routes
- Truck Restrictions

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Collector Road
- Local Road
- Ramp

0 200 400 metres

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FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
7

Title
Existing Commercial Vehicle Routes

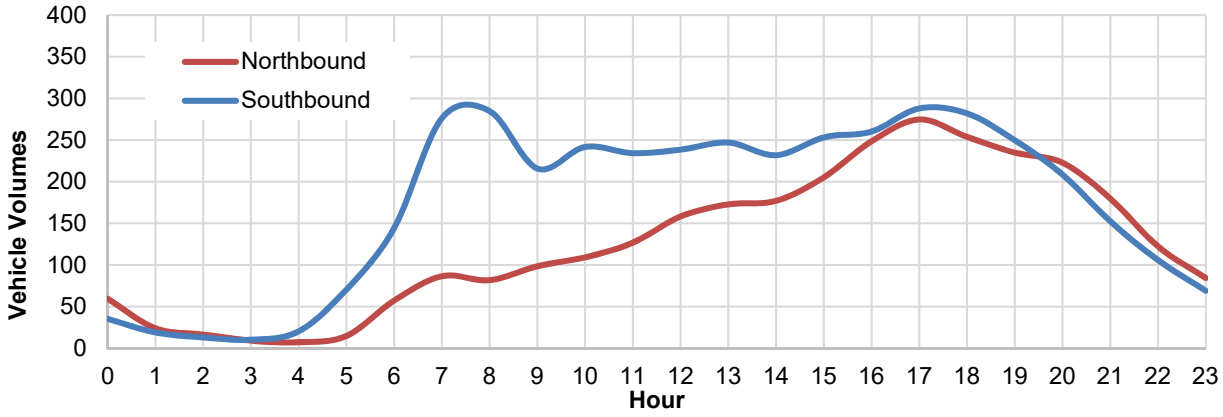
3.1.1.3 Travel Demand

Figure 9 and **Figure 10** show the path of drivers are using Heart Lake Road destined to/from a location south of Countryside Drive during the morning and afternoon weekday peak periods according to the regional travel demand model of the City of Brampton. It clearly shows that the travel demand on Heart Lake Road is in relation to trips from/to Countryside Drive. It also shows that people driving along Heart Lake Road travel up to King Street to the north (in Caledon) and beyond Highway 401 to the south.

3.1.1.4 Vehicular Traffic Conditions

Traffic Volumes

Figure 8 show the hourly volume profile during a typical (24-hour) weekday between the Highway 410 off-ramp and Countryside Drive.



Note: Based on traffic counts conducted between July 27 and 29 + August 1, 2016

Figure 8 Existing | Weekday Traffic Volume Profile on Heart Lake Road

What emerges from **Figure 8** are the followings:

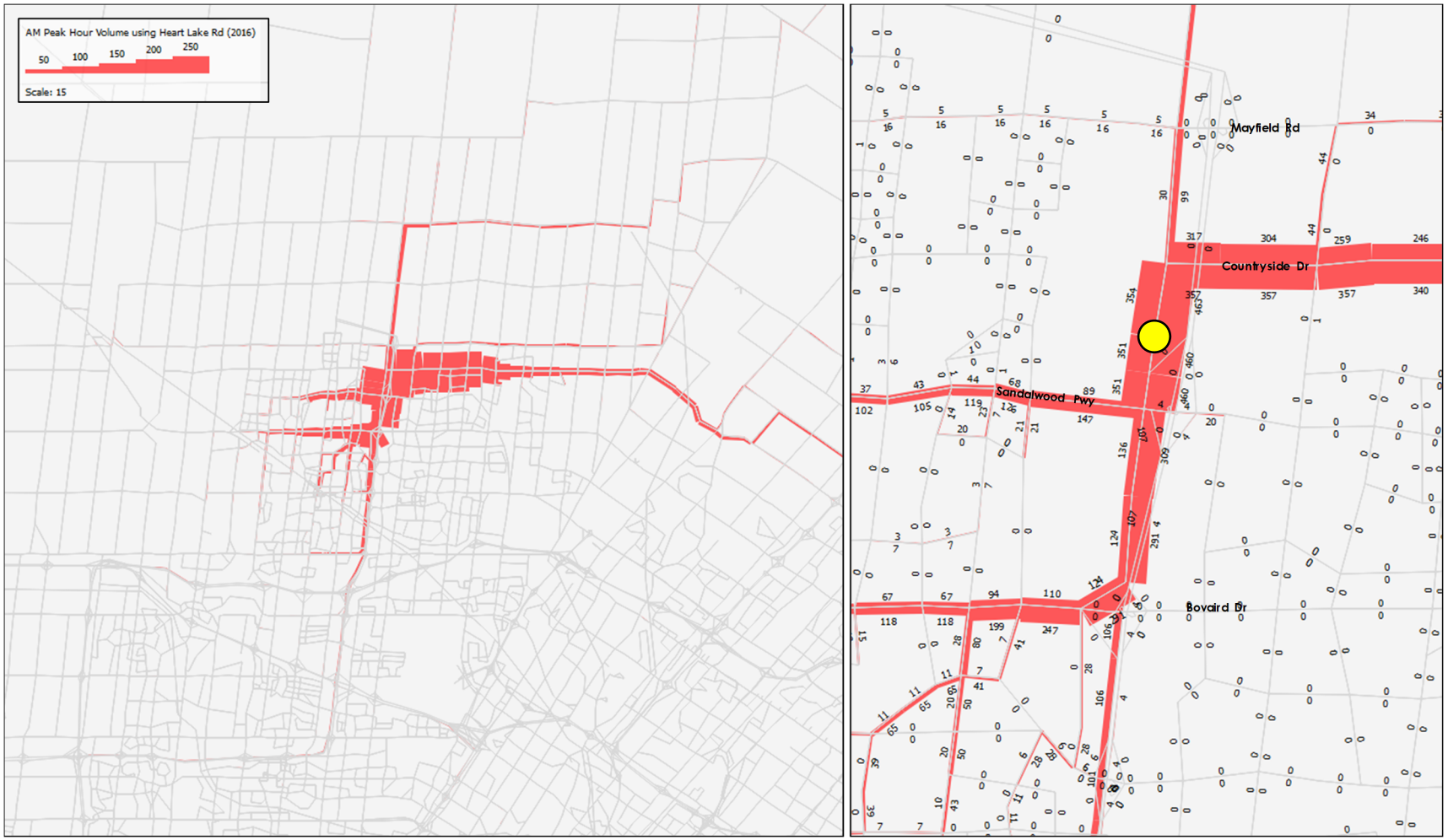
- Although peaks are observed in the morning and in the afternoon, southbound traffic is relatively stable between 6:00 am and 7:00 pm, with volumes between 200 and 300 veh/hr;
- Northbound traffic peaks in the afternoon with volume exceeding 250 veh/h;
- Maximum total volumes on Heart Lake Road are just over 500 veh/h (pm peak hour); and
- Daily traffic is about 3,000 and 4,000 veh/day southbound and northbound respectively for a total of 7,000 veh/day.

In addition to what is shown in **Figure 8**, it is noted that 2% of vehicles travelling on Heart Lake Road are trucks. Despite this not being a large proportion, it remains problematic as heavy vehicles are currently prohibited on Heart Lake Road.

Figure 11 and **Figure 12** show the turning movement volumes at the intersections within the study area. On the Heart Lake Road Corridor, the peak directional traffic flows (southbound in the morning and more proportionate equivalently in the afternoon), are usually around 300 – 350 veh/h north of the Highway 410 off-ramp that connects to Sandalwood Parkway. Between this ramp and Sandalwood Parkway, southbound traffic flows are above 700 veh/h in the morning while in the afternoon they are in the range of 400 and 300 veh/h going southbound and northbound respectively.

Source: Brampton Emme Regional Model 2017

Figure 9 Existing | Select Link Analysis @ Heart Lake Rd south of Countryside Dr - Demand 2016 / Network 2016 AM Peak



Source: Brampton Emme Regional Model 2017

Figure 10 Existing | Select Link Analysis @ Heart Lake Rd south of Countryside Dr - Demand 2016 / Network 2016 PM Peak

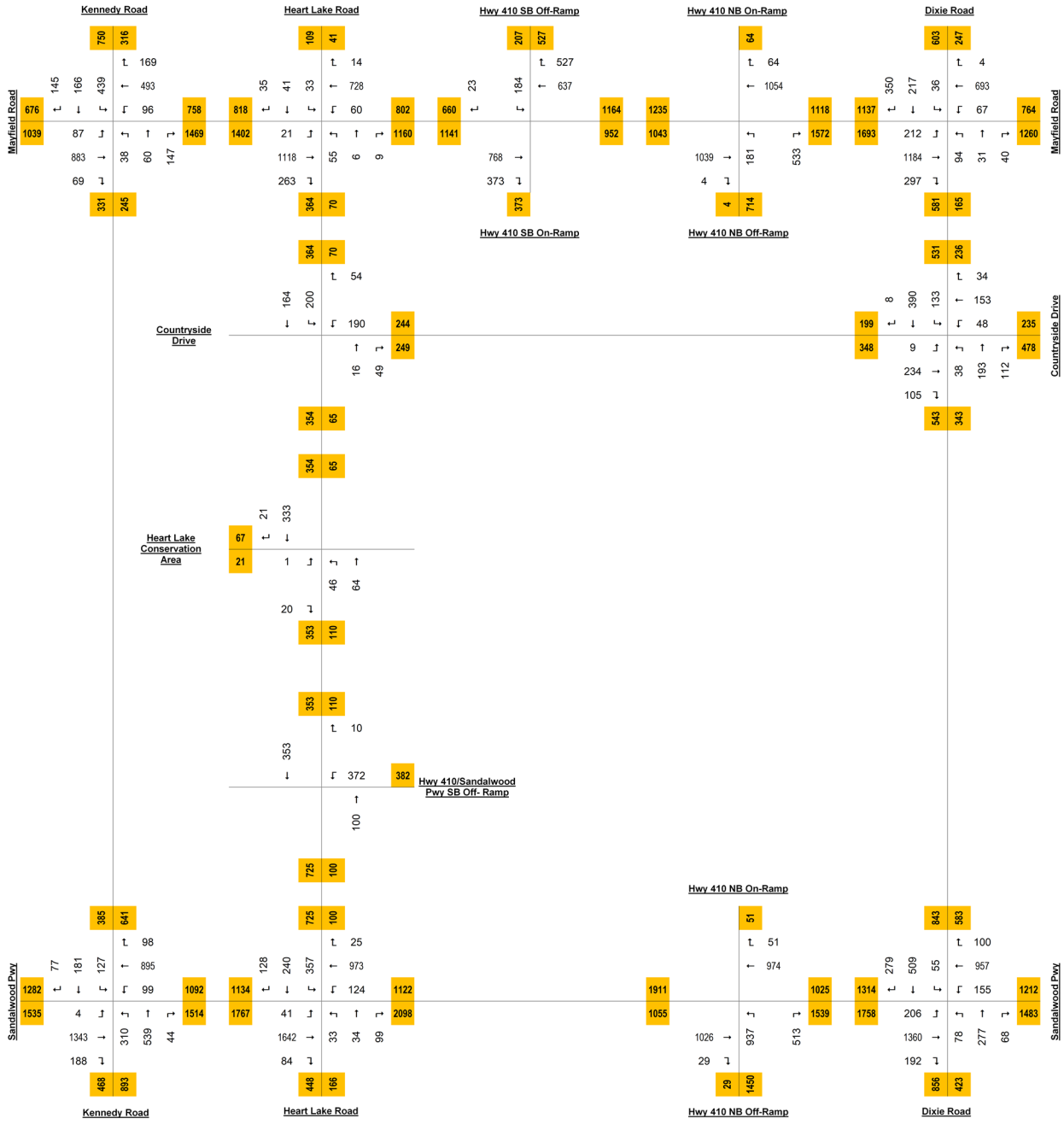


Figure 11 Existing | Turning Movement Volumes – Weekday AM Peak Hour

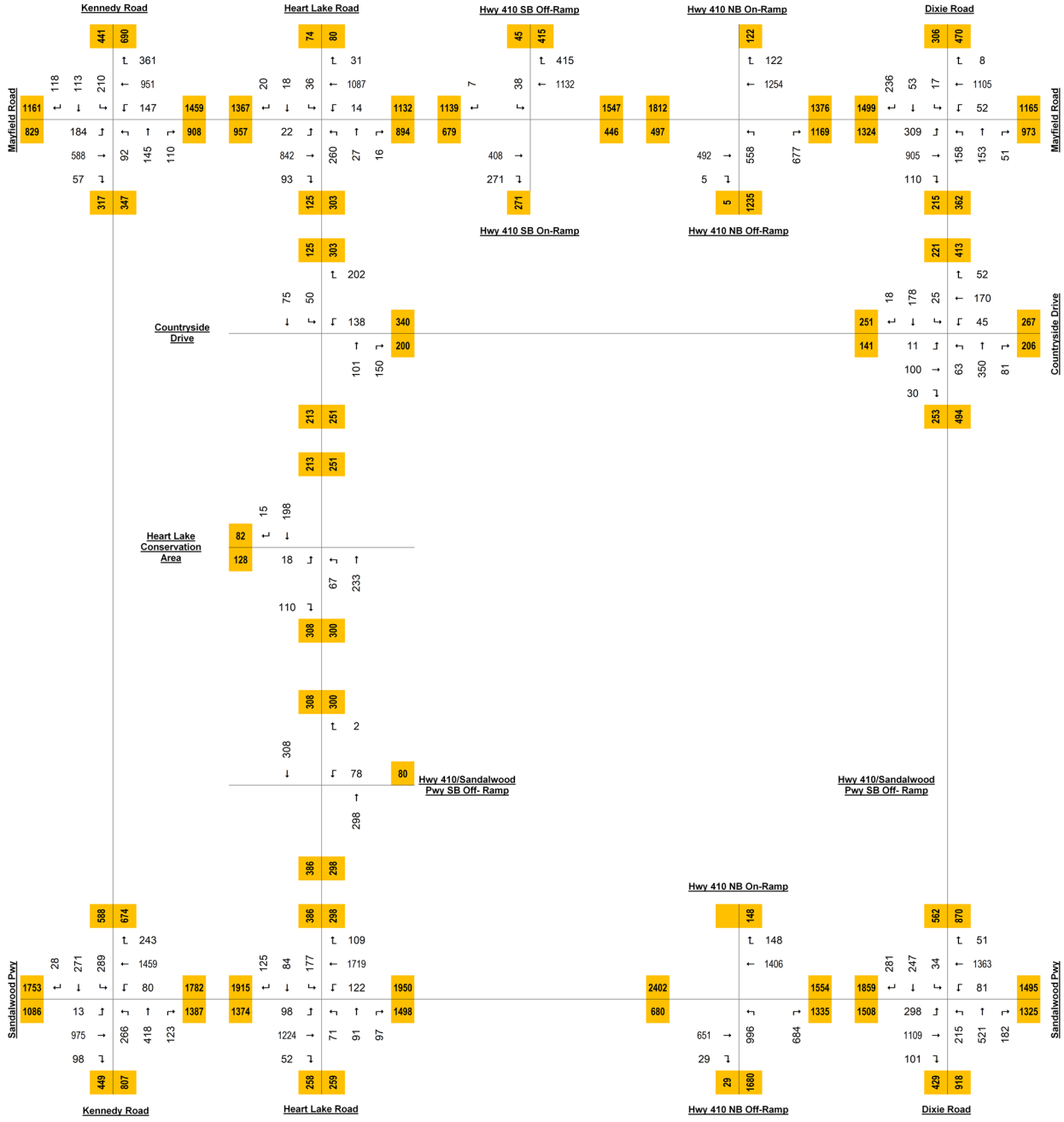


Figure 12 Existing | Turning Movement Volumes – Weekday PM Peak Hour

Traffic Operations

The quality of intersection operations at signalized and unsignalized intersections is evaluated in terms of level of service (LOS) and volume to capacity (v/c) as defined by the Highway Capacity Manual (HCM). LOS is evaluated on the basis of average control delay per vehicle and includes deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Capacity is evaluated in terms of ratio of demand flow to capacity with an at-capacity condition represented by a v/c ratio of 1.00 (i.e. volume demand equals capacity). For signalized intersections LOS ranges from LOS A for 10 seconds or less average delay to LOS F for average delay greater than 80 seconds. For unsignalized intersections, the LOS ranges from LOS A for 10 seconds or less average delay to LOS F for average delay greater than 50 seconds.

To assess the existing peak hour traffic conditions, a level of service analysis was undertaken for the study area intersections using Trafficware Synchro Software, which implements the methods of the 2000/2010 Highway Capacity Manual. The key parameters used in the analysis include:

- Existing lane configurations;
- Heavy vehicle percentages as derived from collected traffic count data;
- Calculated peak hour factors (PHFs). It is noted that this factor adjusts the hourly volumes to better represent conditions during the peak 15 minutes of intersection operations; and
- Synchro default values for all other inputs.

Figure 13 and **Figure 14** show the traffic conditions which are good on the Heart Lake Road Corridor, with the exception of the intersection with Sandalwood Parkway whose capacity is limited during weekday peak periods.

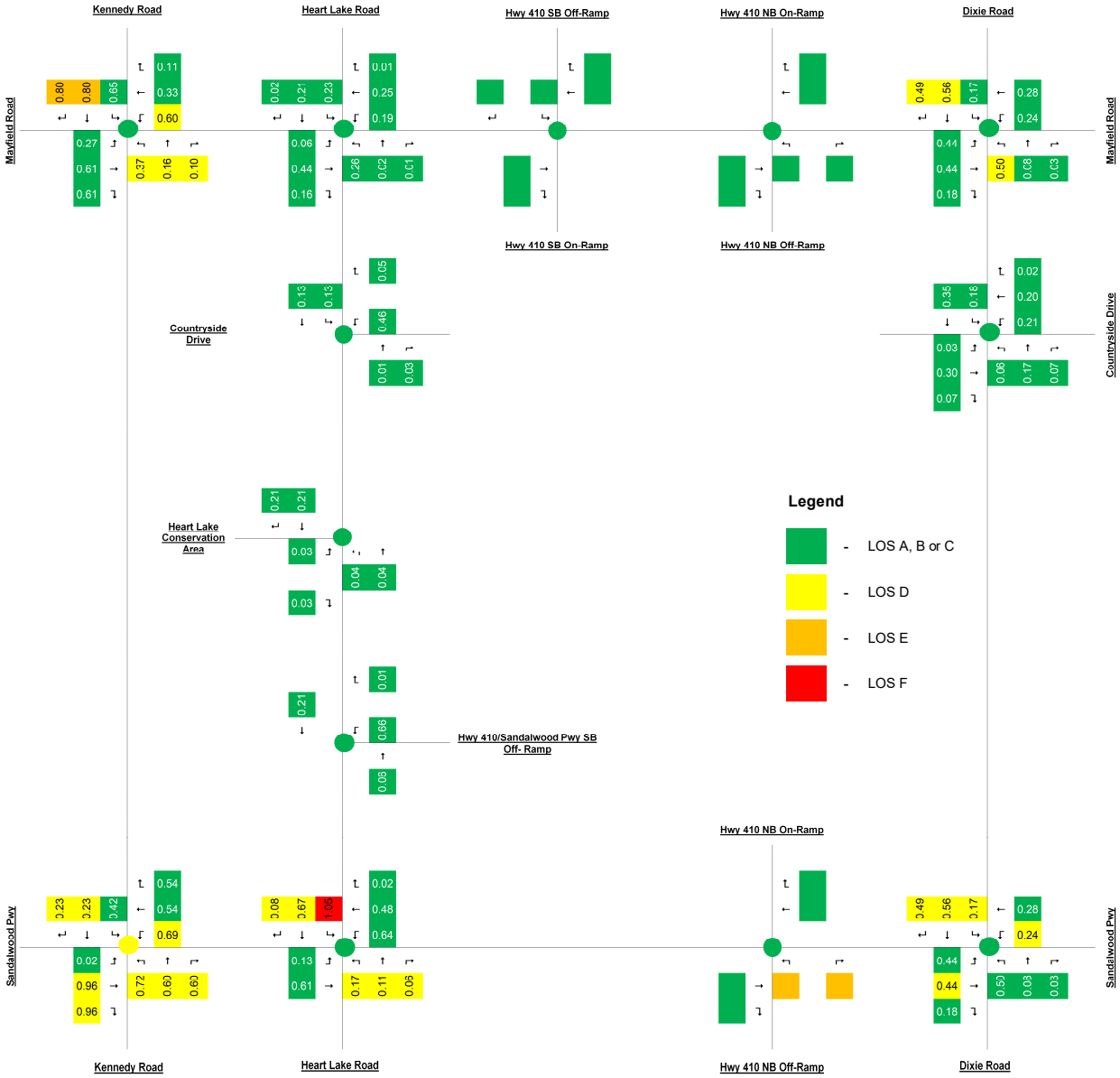


Figure 13 Existing | LoS and V/C Ratios – Weekday AM Peak Hour

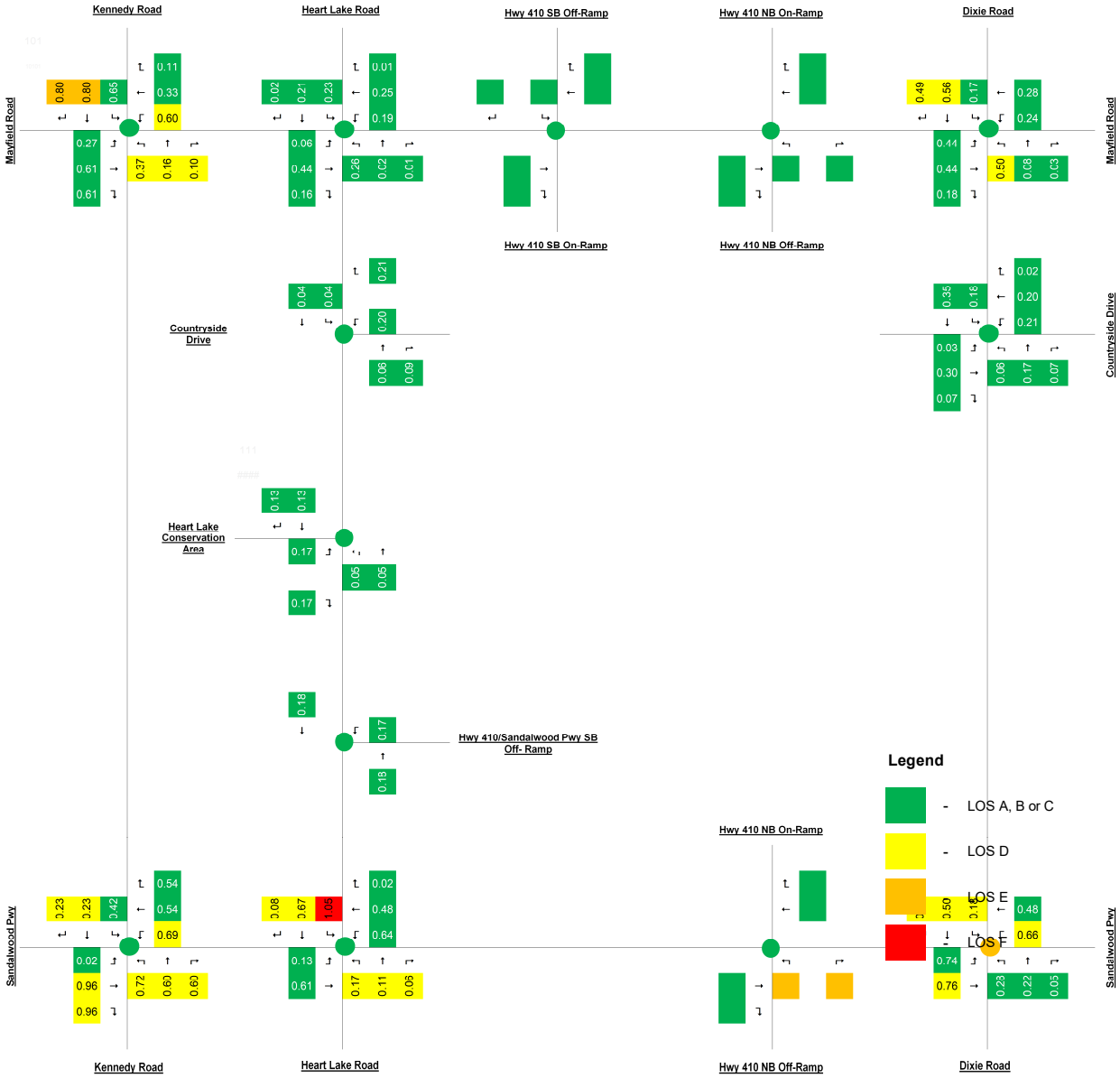
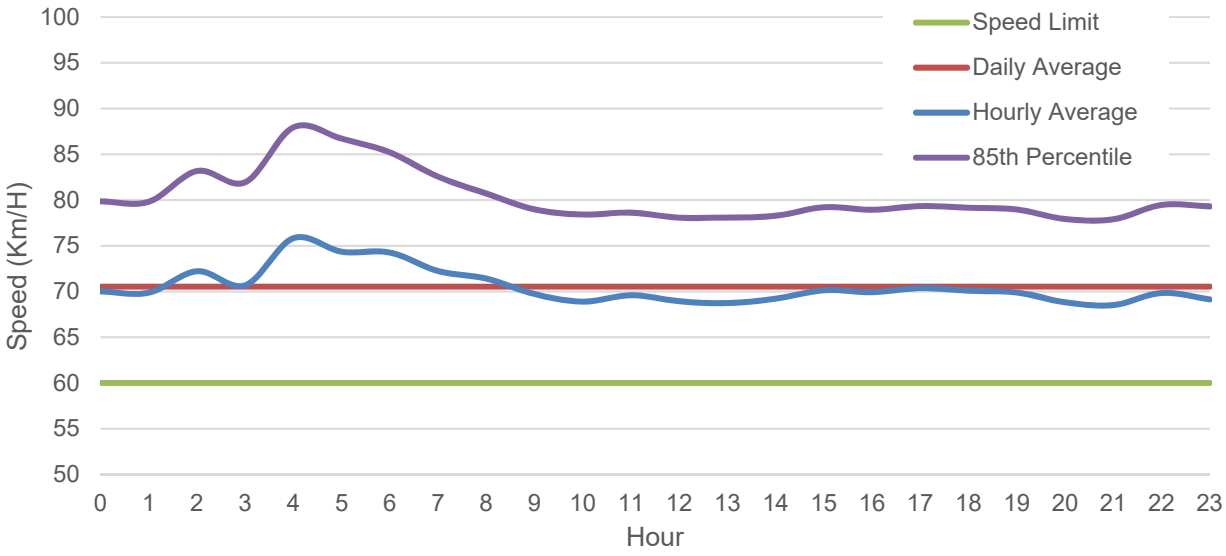


Figure 14 Existing | LoS and V/C Ratios – Weekday PM Peak Hour

3.1.1.5 Speed

Figure 15 summarizes the speeds observed on Heart Lake Road in front of the Garden Gallery in comparison to the posted speed (60 km/hr).



Source: City of Brampton, 2017

Figure 15 Heart Lake Road, in front of Garden Gallery

What emerges from **Figure 15** as well as the analysis of observed speeds are the followings:

- The average observed speed is 70 km/h;
- The 85th percentage speed is 79 km/h; and
- The speed limit compliance is only 11%.

The reasons for the low rate of compliances are:

- The corridor is relatively straight which makes it easy to drive at high speed;
- There are not many intersections (or interferences) on the corridor which could reduce speeds;
- The traffic lanes are wide, which makes it comfortable to drive at high speeds.

3.1.2 Future Conditions

3.1.2.1 Developments

Population and employment forecasts were prepared in February 2017 for the area surrounding the Heart Lake Road Corridor. The forecasts were distributed into Small Geographic Units (SGUs), the most disaggregated geography available (see **Figure 16**). Although the magnitude of the development is significant, the anticipated transportation impacts are mostly along Hurontario Street, McLaughlin Road and Highway 410, and are not significant on the Heart Lake Road Corridor.

Population and employment are expected to increase in the future, particularly in areas adjacent to Highway 410 and Heart Lake Road. The projected population and employment figures are summarized in **Table 5.**

Table 5 Growth Areas along the Heart Lake Road Corridor

SGU	Population (2011-2041)	Employment (2011-2041)
0327	1,342	175
0109	21	1,602
0326	0	46
0108	0	0
0208	5	0
1766	7,182	1,894
1769	106	1,937

Source: Hemson Consulting Ltd. 2017 & Brampton Emme Regional Model 2017

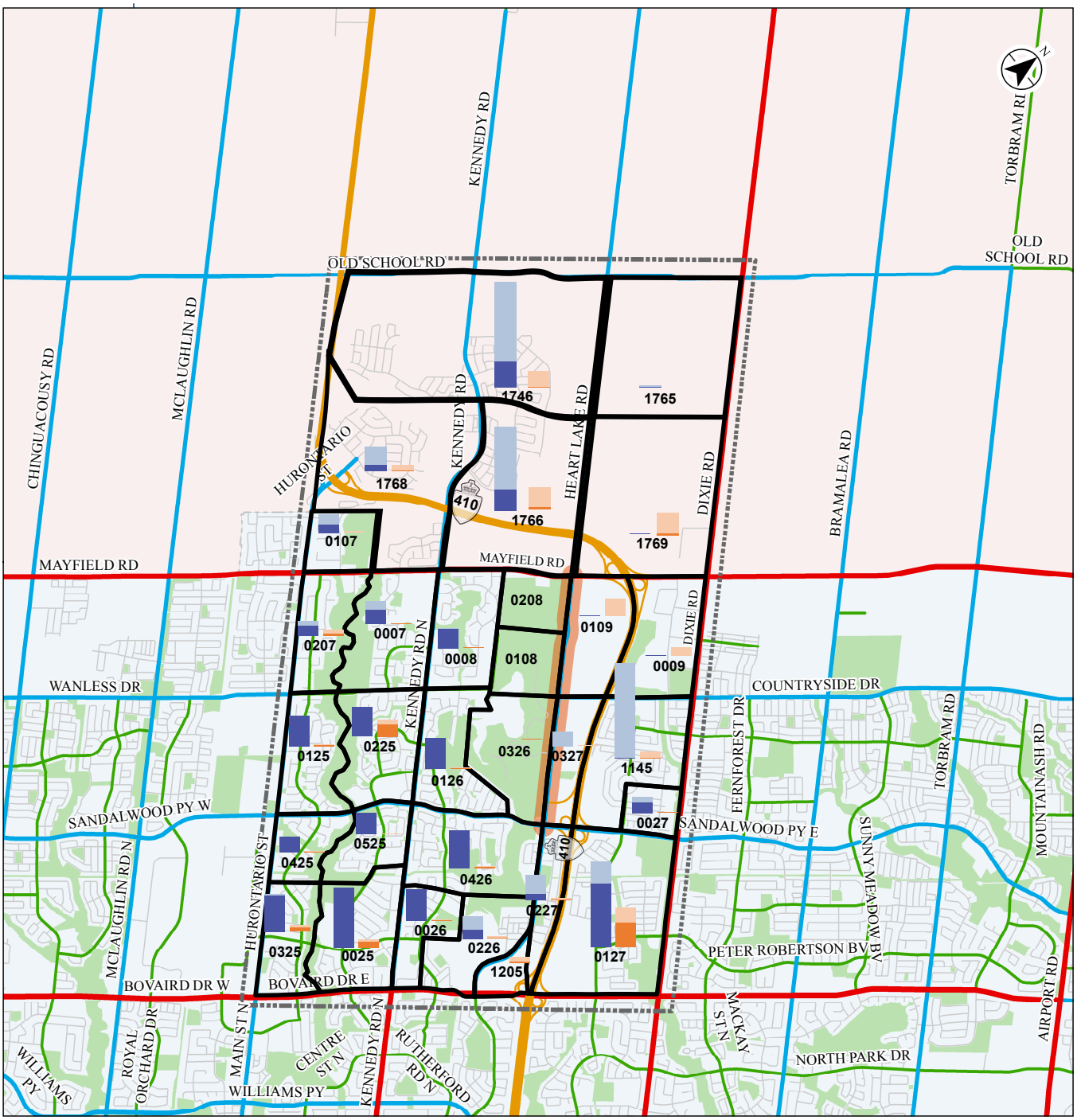
Table 6 shows traffic volumes forecasted by the City of Brampton's Regional Model for future horizon years on Heart Lake Road between Countryside Drive and Sandalwood Parkway. The focus is on the morning peak period as it is the period when we find mostly recurrent trips (work or study). This takes into consideration the population and employment growths shown previously.

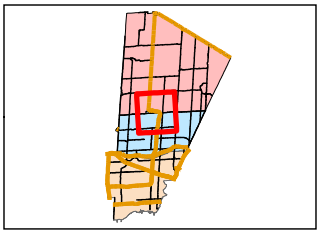
Table 6 Brampton Regional Model - Travel Demand Forecast at Future Horizons on Heart Lake Road – AM Peak

Link / AM Peak Hour Volumes	Horizon		
	2016	2031	2041
Heart Lake Rd, between Countryside Dr. and Sandalwood Pwy | Southboud	401	415	430
Heart Lake Rd, between Sandalwood Pwy and Countryside Dr | Northbound	263	429	472

Source: Brampton Emme Regional Model 2017

What emerges from **Table 6** is that the anticipated growth between 2016 and 2041 is not significant for trips travelling southbound, which is the direction of the peak in the morning. The growth is mostly in the opposite direction of the peak (northbound), where it grows more significantly. Since the anticipated growth is not significant for a road with an already relatively low traffic flow, it is assumed that traffic conditions will remain similar to the existing conditions in the future.





Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2016.
3. Orthoimagery © First Base Solutions, 2016. Imagery Date, 20XX.

Legend
- Study Area
- Small Geographic Unit (SGU)
- Study Corridor
- Parks

Municipality
- Caledon
- Brampton

Transportation
- Provincial Highway
- Regional Road
- Arterial Road
- Local Road
- Ramp

Population / Employment
- 3,000
- Future Population (2041)
- Existing Population (2011)
- 3,000
- Future Employment (2041)
- Existing Employment (2011)

0 200 400 metres

1:61,607 (at original document size of 8.5x11)

Stantec

Project Location
Brampton, ON

165001037 REVA
Prepared by Brandon Orr on 2019-02-08

Client/Project
FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
16

Title
Population & Employment Projections

Figure 17 and **Figure 18** show the path of drivers who pass by Heart Lake Road just south of Countryside Drive during the morning and afternoon weekday peak periods according to the City of Brampton's Regional Model. It clearly shows that the travel demand on Heart Lake Road is in relation to trips from/to Countryside Drive. It also shows that people driving along Heart Lake Road travel up to King Street to the north (in Caledon) and beyond Highway 401 to the south.

3.1.2.2 Planned Improvements

Based on the traffic demand forecast prepared for the 2015 Brampton Transportation Master Plan, several transportation improvements were identified for the area. These include a mixture of road widening, transit upgrades and active transportation routes. The list of improvements can be seen below in **Table 7**.

Table 7 Planned Infrastructure Improvements

Type	Corridor	Description	Timeframe
Road	Dixie Rd.	• Widening to 6-lanes • Mayfield Rd to Countryside Dr	As development warrants by 2041
Road	Sandalwood Pkwy	• Widening to 6-lanes • McLaughlin Rd to Heart Lake Rd	2026
Road	Kennedy Rd.	• Widening to 6-lanes • Bovaird Dr. to Williams Pkwy	As development warrants by 2041
Transit	Zum – Bramalea Rd.	• BRT route along Bramalea Rd. between Bramalea GO station and Sandalwood Pkwy	2031
Transit	Higher Order Transit - Hurontario Street/Main Street	• Higher-Order transit to be determined along Hurontario St between Mayfield Rd. and Brampton GO station	2031
Transit	Zum – Sandalwood Pkwy	• BRT route along Sandalwood Pkwy with terminals at Bovaird/Airport Rd, and Bovaird/Chingacousy Rd	2031-2041
Transit	Zum – Kennedy Rd.	• BRT route along Kennedy Rd. between Steeles Ave and Sandalwood Pkwy	2031-2041
Active Transportation	Various Trails	• Various Off-Road and On-road cycling facilities connecting to the existing network of trails and boulevard paths	Phasing to be determined until 2041

The expansion of Sandalwood Parkway and the addition of Zum will increase the capacity of the surrounding road network while simultaneously bringing high-quality transit to the footsteps of the study area. There will also be several active transportation connections between these improvements, connecting to the existing active transportation network and providing connections where there currently are missing links. Heart Lake Road is identified as a bicycle facility candidate for bicycle lane in the City of Brampton Transportation Master Plan.

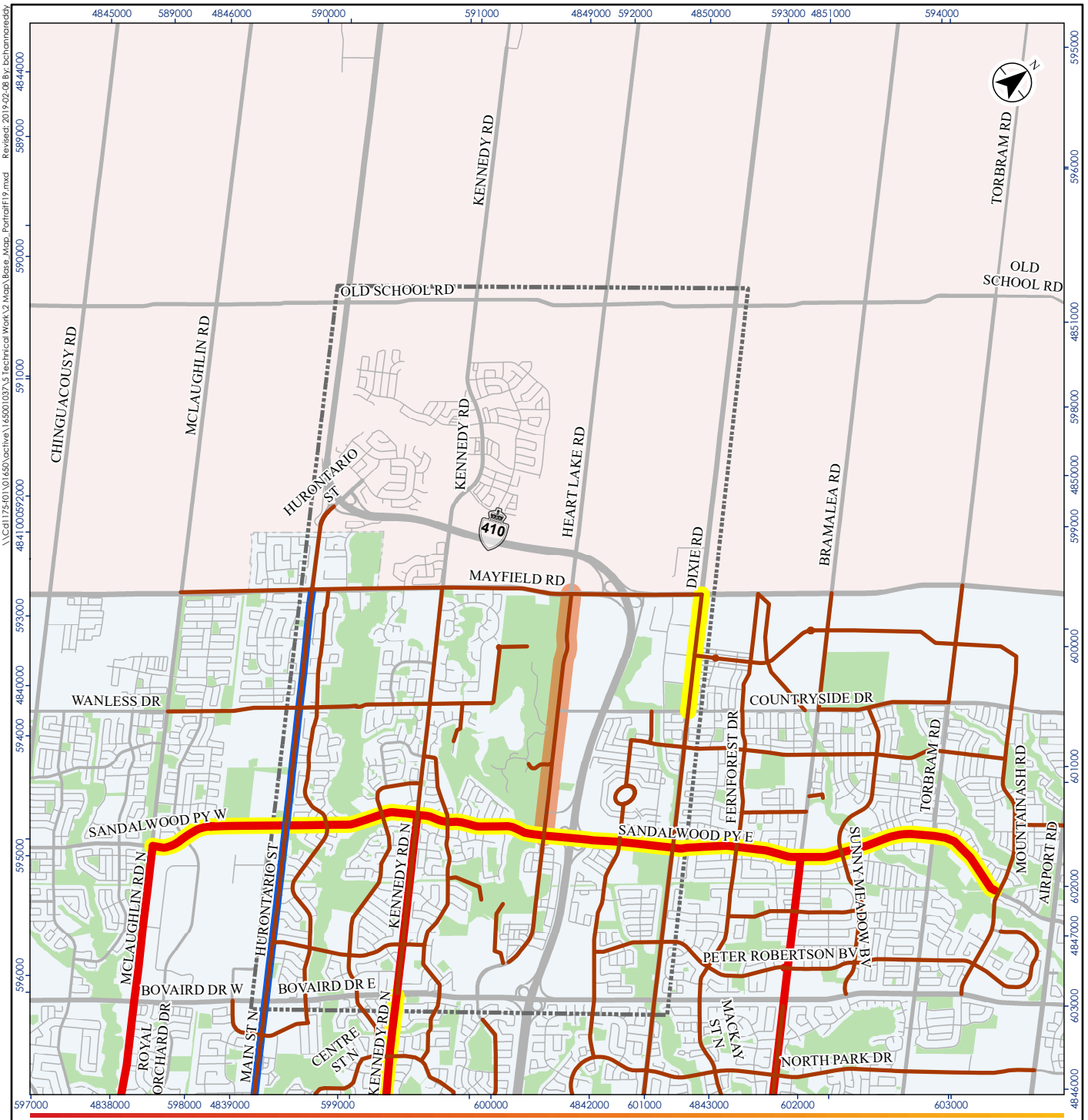
Figure 19 shows a map of the improvements discussed above.

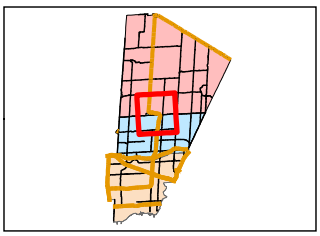
Source: Brampton Emme Regional Model 2017

Figure 17 Future Situation – Select Link Analysis @ Heart Lake Rd south of Countryside Dr | 2041 AM Peak

Source: Brampton Emme Regional Model 2017

Figure 18 Future Situation – Select Link Analysis @ Heart Lake Rd south of Countryside Dr | 2041 PM Peak





Legend

- Extended Study Area
- Study Corridor
- Parks

Municipality

- Caledon
- Brampton

Future Improvements

- Future Road Widening
- Zum BRT
- Higher Order Transit
- Future Cycling Improvement

Transportation

- Provincial Highway
- Regional Road
- Arterial Road
- Collector Road
- Local Road
- Ramp

0 200 400 metres

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Stantec

Project Location
Brampton, ON

165001037 REVA
Prepared by Brandon Orr on 2019-02-08

Client/Project
FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.
19

Title
Planned Infrastructure Improvements

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2016.
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3.2 SAFETY

This section presents the road safety assessment along the Heart Lake Road Corridor, between Mayfield Road and Sandalwood Parkway, consisting of a collision analysis along the corridor and at several midblock locations.

Collision data from 2011 to 2016 was provided by the City of Brampton. The data presents all reported collisions involving motorized vehicles, pedestrians and small vehicles like bicycles, in terms of collision type, severity and environmental state. The locations and total collision occurrences are illustrated in **Figure 20**.

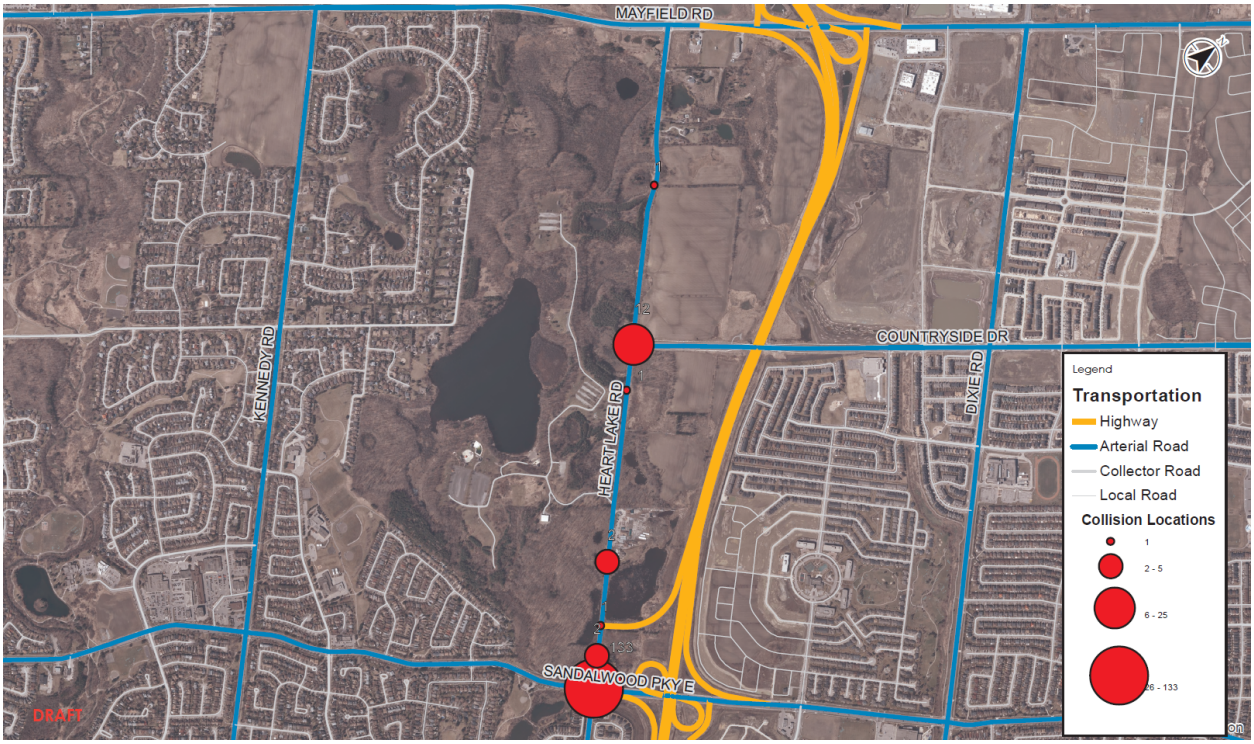


Figure 20 Total Number of Collisions by Location

3.2.1 Collision Frequency

Historical collision data for the study area, collected between 2012 and 2016, identified a total of 152 collisions over the five years, with an average 30 collisions per year (see **Table 8**).

As expected, the overwhelming majority of collisions occurred on the Heart Lake Road and Sandalwood Parkway intersection (133). A few collisions occurred at the Countryside Road intersection (12).

The breakdown of collision by year reveals generally consistent patterns, with 2013 representing the peak year with a total of 35 collisions. A very slight downward trend has been observed since.

Table 8 Total Yearly Collisions by Location

Intersection	2012	2013	2014	2015	2016	Total
Heart Lake Rd. – Countryside Dr.	4			2	6	**12**
Heart Lake Rd. - Hwy 410 off-ramp			1			**1**
Heart Lake Rd. – Sandalwood Pkwy	22	34	29	28	20	**133**
Heart Lake Rd. between Hwy 410 off-ramp and private access			1		1	**2**
Heart Lake Rd. between Hwy 410 off-ramp and Sandalwood Pkwy	1	1				**2**
Heart Lake Rd. between Countryside Dr. and Mayfield Rd.				1		**1**
Heart Lake Rd. between Countryside Dr. and private access			1			**1**
Total	**27**	**35**	**32**	**31**	**27**	**152**

Since these intersections experience traffic demand at different scales, the collision reports must be compared on a common Collision Rate (CR). The most often metric for CRs is the number of collisions per million vehicles entered (MVE), which is defined as:

$$CR = \frac{C_{AV}}{\left(\frac{365 * V_{max} * 10}{1{,}000{,}000}\right)}$$

Where, C_{AV} = Average yearly collisions, and V_{max} = Peak hourly volume

A CR less than or equal to 1.0 is generally considered to reflect a normal propensity to collisions and represents an intersection with no significant issues aside from basic human error.

MVE analysis of Heart Lake Road (see **Table 9**) suggests that the intersection of Heart Lake Road and Sandalwood Parkway experienced over the last 5 years an unusually high number of collisions on average.

Table 9 Average Collision Rate by Survey Location

Intersection	Total Collisions	Average Yearly Collisions	Peak Hour Volume	Collision Rate (C / MVE)
Heart Lake Rd. – Countryside Dr.	12	2.4	716	0.92
Heart Lake Rd.- Hwy 410 off-ramp	1	0.2	835	0.07
Heart Lake Rd. – Sandalwood Pkwy	133	26.6	3,969	1.84
Heart Lake Rd. between Hwy 410 off-ramp and private access	2	0.4	608	0.18
Heart Lake Rd. between Hwy 410 off-ramp and Sandalwood Pkwy	2	0.4	825	0.13
Heart Lake Rd. between Countryside Dr. and Mayfield Rd.	1	0.2	434	0.13
Heart Lake Rd. between Countryside Dr. and private access	1	0.2	464	0.12

3.2.2 Collision Classification

A review of the breakdown of collisions by type of impact observed at the surveyed locations (see **Table 10**) highlights that the majority of collisions were classified as either property damage (74%) or non-reportable (9%) (i.e. a minor collision resulting in damages worth less than $2,000) while only 16% of collisions resulted in injuries. No fatalities were reported during this period. Considering that only 16% of collisions over the past 5 years resulted in an injury, the area does not appear to present any abnormally high safety concerns. The following analysis nonetheless seeks to clarify the propensity for collisions, as illustrated by report collision types and geometric and environmental factors that might explain them.

Table 10 Collision Classification by intersection of Interest

Intersection	Non-fatal injury	P.D. only	Non-Reportable	Total
Heart Lake Rd. – Countryside Dr.		12		12
Heart Lake Rd. - Hwy 410 off-ramp		1		1
Heart Lake Rd.– Sandalwood Pkwy	25	94	14	133
Heart Lake Rd. between Hwy 410 off-ramp and private access		2		2
Heart Lake Rd. between Hwy 410 off-ramp and Sandalwood Pkwy		2		2
Heart Lake Rd. between Countryside Dr. and Mayfield Rd.		1		1
Heart Lake Rd. between Countryside Dr. and private access		1		1
Total	**25**	**113**	**14**	**152**
% of Collisions	**16%**	**74%**	**9%**	**100%**

3.2.3 Collision Type

Analysis of collisions by type and movement suggests that close to 70% of collisions were either rear-end, turning, or sideswipe related (see **Table 11**). These impact types are typically less dangerous than Angle or Approaching collisions which are usually accompanied by higher speeds and more direct physical impacts to vehicle occupants.

Table 11 Collision Type by Manoeuvre Type

Intersection	Angle	Approaching	Other	Rear end	Sideswipe	SMV other	Turning movement
Changing lanes			1	1	5	1	
Going ahead	6	4	1	23	6	9	4
Making "U" turn							2
Other						1	
Overtaking							1
Pulling onto shoulder or toward curb			1				
Reversing	1		1				
Slowing or stopping	2			11		1	
Stopped		2		5	1		2
Turning left	5			1	2	2	40
Total	**17**	**6**	**4**	**43**	**15**	**15**	**52**
% of Collisions	**11%**	**4%**	**3%**	**28%**	**10%**	**10%**	**34%**

Rear-end collisions mostly occurred when drivers followed too closely and were unable to react to deceleration quickly enough. Left-turn collisions occurred against oncoming vehicles, with turning drivers executing improper turns. Typically, rear-end collisions occur when there is more congestion and higher volumes of traffic. This falls in line with our observations at the Heart Lake Road and Sandalwood Parkway intersection, where some of the southbound movements are approaching capacity.

We do note a relatively high occurrence of collisions when turning left. A review of turning collisions by movement reveals a very high proportion of westbound-left turning vehicles colliding with eastbound-through movements (see **Table 12**). All 26 of these collisions occurred at the Heart Lake Road and Sandalwood Parkway intersection.

Table 12 Total Collisions by Movements

Movements	EBT	EBU	EBL	NBT	NBR	SBT	SB-STOPPED	SBL	WBT	WBL	WBR
EBT										1	
EBL									1		1
EBR											
NBT					1						
NBU				1							
NBL				1		1					
NBR									1		
SB-OVERTAKING								1			
SB-STOPPED							1				
SBL	6			2							
SBR						1					
WBT		1	1								
WBU	1										
WB-STOPPED										1	
WBL	26							1			

Left turns generally occur in conflict with oncoming through movement in permissive traffic signal operations. The number of such collisions itself at this intersection is relatively small when compared to the high volume of vehicles (close to 1,766 during the AM peak hour) executing the two movements involved. As noted subsequently, a report was prepared for recommending improvements to increase safety at the intersection of Heart Lake Road and Sandalwood Parkway.

3.2.4 Heart Lake Road and Sandalwood Parkway Intersection

Appendix D presents the safety review prepared in 2014 at the intersection of Heart Lake Road and Sandalwood Parkway. **Table 13** shows the recommended improvements at this intersection.

Table 13 Recommended Improvements at the Heart Lake Rd and Sandalwood Pwy Intersection

Intersection	Recommended Improvement	Rationale	Time Frame
Heart Lake Road/Sandalwood Parkway	Revised pedestrian curb ramp and orientation channels on the southeast corner to direct pedestrians to available east-west crosswalk	Improve guidance for visually impaired users	Short Term
	Provide tooled orientation channels on the northwest corner for north-south crossing	Improve guidance for visually impaired users	Long Term
	Review single point ramp on the northeast corner of the intersection to incorporate tooled orientation channels for east-west crossing	Improve guidance for visually impaired users	Long Term
	Replace CHEVRON ALIGNMENT (Wa-9) signs with white post mounted delineators as described in Section 4.3 of OTM Book 11	Improved motorist comprehension of the road alignment (shift). Ensure substantial compliance with the Ontario Traffic Manual.	Short Term
	Implementation of stop bar detection for westbound left turn movements.	Reduce collision potential between westbound left and eastbound through vehicles	Medium Term
	Request enforcement of eastbound operating speeds approaching the intersection	Reduce potential for eastbound rear end collision potential	Short Term

Source: Giffin Koerth, 2014

3.3 SIGHT LINES

A sight distance evaluation was undertaken along the Heart Lake Road corridor from Mayfield Road to Sandalwood Parkway. The evaluation of available and required sight distance is in conformance with the *Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDG)*, September 1999. To assure that adequate sight distances are available to drivers approaching potential conflict locations along the Heart Lake Road corridor, and to drivers departing from the stopped position turning on to the corridor, both stopping sight distances and turning sight distances must be assessed.

A design speed of 80 km/h, 20 km/h above the posted speed limit along Heart Lake Road was used.

3.3.1 Stopping Sight Distance

Apart from the intersections with Mayfield Road and Sandalwood Parkway, no traffic control or yield exists along the north-south directions of Heart Lake Road, therefore, the required approaching sight distance along this section is evaluated using stopping sight distance. Stopping sight distance is the sum of the distance travelled during the perception and reaction time and the braking distance. To determine the minimum stopping sight distance relative to the design speed, *TAC Table 1.2.5.3 – Stopping Sight Distance for Automobiles and Trucks with Antilock Braking Systems* is used. With a design speed of 80 km/h, it is found that the minimum stopping sight distance is 115 m to 140 m.

The majority of the Heart Lake Road Corridor horizontal alignment is very straight and provides excellent sight distances. Minimum stopping sight distances are met for most approaches to intersecting roads and driveways. An exception is noted at the northbound approach to the south Lakeside Garden Gallery access which has thick vegetation adjacent to it.

In both directions prior to the horizontal curve between Countryside Drive and Mayfield Road, signage is posted which warns drivers that the road curves ahead and that drivers should navigate the curve at a maximum of 60 km/h. The minimum stopping sight distance of 115 m would not be met around the curve due to the vegetation and road curvature which may result in hazardous conditions where drivers would not be given sufficient time to brake were an animal or object to be located along the curve. In addition, the recommended maximum speed of 60 km/h does not vary from the regular posted speed limit along Heart Lake Road and may not motivate drivers to reduce their speed while navigating around the curve.

The required stopping sight distance with a design speed of 70 km/h is 95 to 110 metres. It is recommended to trim the vegetation along the west side of Heart Lake Road around the curve such that sufficient stopping sight distance can be provided.

3.3.2 Departure Sight Distance Triangles

In this section, sight distance triangles are evaluated for crossing, left-turning, and right-turning movements at the intersections within the Study area to assure that they meet the minimum requirements as outlined in *TAC Figure 2.3.3.2 – Departure Sight Triangles*. Evaluation of required sight triangles at stop-controlled and signalized intersections is conducted in the same manner. Departure sight distance requirements are not as stringent for signalized intersections because the movements are being controlled with traffic signals. The minimum sight distance

required for stop-control intersections is recommended to be provided for signalized intersections in the event of a signal malfunction or if a driver on an opposing approach runs through a red light.

The intersections of Heart Lake Road with Mayfield Road and Sandalwood Parkway exceed two-lane cross sections, therefore, the departure sight triangles for these intersections are determined using *TAC Equation 2.3.1* which incorporates design speed, perception reaction time, and time to traverse the intersection. Left-turning and right-turning departure sight triangles are determined using TAC Figure 2.3.3.4a and Figure 2.3.3.4b.

$$Equation\ 2.3.1 \quad D_1, D_2 = \frac{V(J+t)}{3.6}$$

A design speed (V) of 80 km/h is used in *TAC Equation 2.3.1*, with a perception reaction time (J) of 2 seconds. Variable t is the time in seconds to cross the intersecting roadway and is determined from *TAC Figure 2.3.3.3 – Assumed Acceleration Curves (Acceleration From Stop Control on Minor Road)*. The crossing distance includes the distance from the stop bar to the edge of the intersecting roadway, the width of the intersecting roadway, and the length of the crossing vehicle. A passenger car vehicle with a length of 5.6 m as shown in *TAC Table 1.2.4.1 – Design Dimensions for Passenger Cars* is used in the estimation of crossing distance.

Table 14 Crossing Sight Distance

Location on Heart Lake Road	Approach	Crossing Distance	Time (t)	Required Sight Distance	Requirement Met
Mayfield Rd.	North	48 m	8.25 s	228 m	Yes
	South	48 m	8.25 s	228 m	Yes
	East	43 m	7.5 s	211 m	No
	West	43 m	7.5 s	211 m	Yes
Sandalwood Pkwy	North	43 m	7.5 s	211 m	Yes
	South	46 m	8 s	222 m	Yes
	East	37 m	7.25 s	206 m	No
	West	37 m	7.25 s	206 m	Yes

Due to the embankments along Heart Lake Road north of Mayfield Road, sight distance for the east approach is not fully provided. It is noted, however, that departure sight distance requirements at signalized intersections are not as stringent as stop-control intersections and that drivers on the east approach would be able to slowly move forward to have a better sightline. Trees and other vegetation along Heart Lake Road north and south of Sandalwood Parkway obstruct sightlines from the stop bar of the east approach to Sandalwood Parkway/Heart Lake Road.

Sight distance at signalized intersections is assessed only for vehicles turning right on red phases and looking to the left for opposing vehicles. This is done because vehicles turning left and right at signalized intersections on protected phases can move freely and do not require gaps to accommodate acceleration time. The signalized intersections of Heart Lake Road with Mayfield Road and Sandalwood Parkway are not two-lane roadways, therefore, *TAC Table 2.3.3.4a* and *2.3.3.4b* are not applicable and *TAC Equation 2.3.3* is used to determine the required intersection sight distance (ISD).

$$Equation\ 2.3.3 \quad ISD = \frac{V_{major}\ x\ t_g}{3.6}$$

The time gap (t_g) is found from *TAC Table 2.3.3.2a* to be 6.5 seconds for a passenger car turning right. Adjustments are not required for the right turn on red movements since the additional width of the roadway does not affect the travelled distance to complete the right turn movement. Using a design speed (V_{major}) of 80 km/h, the required sight distance looking left for all right-turning movements is 144 m.

The required intersection sight distance for right-turning movements is provided at all road except for the east approach to Heart Lake Road/Highway 410 southbound off-ramp. Due to the alignment of the Heart Lake Road approach to the intersection at Sandalwood Parkway, sightlines looking left from the Highway 410 southbound off-ramp may be obstructed by vegetation requiring drivers to advance closer to Heart Lake Road for better sightlines. It is recommended to manage the vegetation along the south-east section of Heart Lake Road/Highway 410 southbound off-ramp such that the minimum 144 m sight distance can be provided.

Table 15 Left-Turning Departure Sight Triangles

Location on Heart Lake Road	Approach	Looking Towards	Required Distance	Meets Requirement
Countryside Dr.	East	Left	155 m	Yes
		Right	170 m – 250 m	Yes
HLCA Access	West	Left	155 m	Yes
		Right	170 m – 250 m	Yes
Highway 410 southbound off-ramp	East	Left	155 m	No
		Right	170 m – 250 m	Yes

Left-turning departure sight triangles are provided along all approaches with the exception of the previously identified deficient sightline to the left of the east approach of Heart Lake Road/Highway 410 southbound Off-Ramp.

3.3.3 Recommendations to improve Sightlines

There are several opportunities to improve sightlines along the Heart Lake Road corridor from Mayfield Road to Sandalwood Parkway. These opportunities include:

1. Trim vegetation along the south of the south access to Lakeside Garden Gallery to provide adequate approaching and departing sight distance of 155 m
2. Trim vegetation and reduce the posted speed limit to 50 km/h along the curve of Heart Lake Road between Mayfield Road and Countryside Drive to provide adequate stopping sight distance of 95 m
3. Trim vegetation along the south-east section of Heart Lake Road/Highway 410 SB Off-Ramp to provide adequate turning sight distance of 155 m for vehicles departing from the stopped position from the Highway 410 southbound off-ramp.

3.4 GEOMETRY

Figure 21 shows a typical cross-section on Heart Lake Road just south of Countryside Drive where the existing eco-passage is located. This figure shows that currently traffic lanes have a width of 3.7 metres, with very large shoulders, which is comparable to what is observed on highways. This geometry would explain why many vehicles travel at speeds higher than posted (60 km/hr) since wide traffic lanes encourage high speeds.

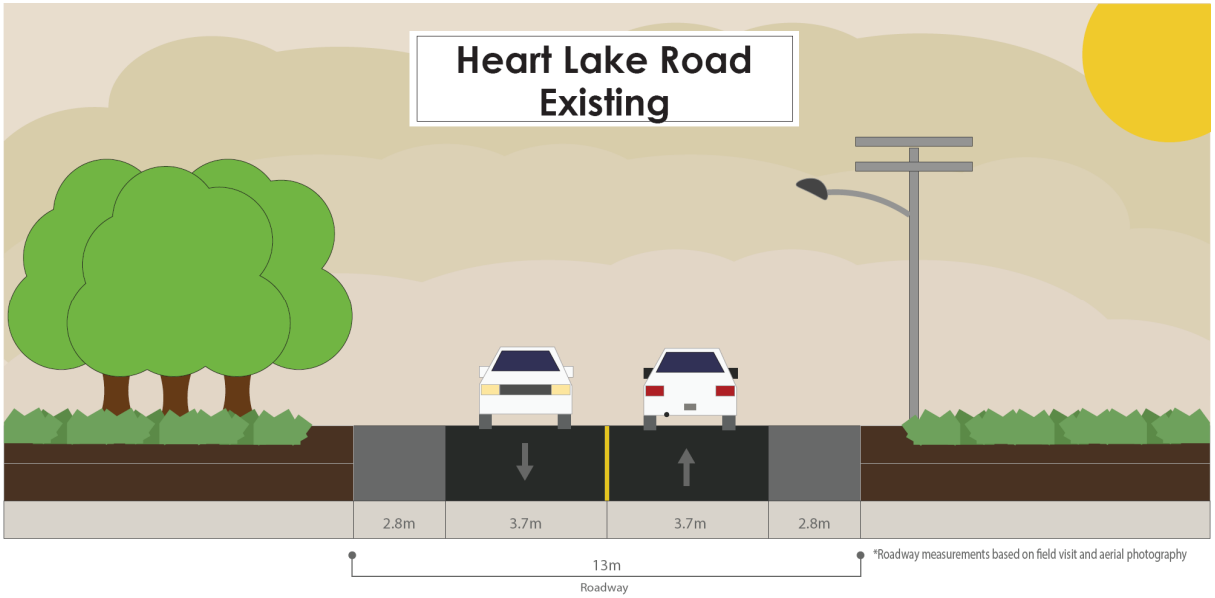


Figure 21 Existing Conditions | Typical Cross-Section

3.5 INFRASTRUCTURE CONDITIONS

Two geotechnical reports are used as reference for the assessment of existing infrastructure conditions: one prepared by Engtec Consulting Inc. (Engtec) in 2015 and the other one prepared by Stantec as part of this study (see **Appendix E**). The reports take into consideration the possible addition of bicycle lanes on both sides of Heart Lake Road, potential intersection improvements and the addition of wild life crossings.

Regarding the soils under the proposed crossing at station 0+800 (just North of the access to the HLCA), two boreholes (BH101 and BH102) were conducted at this location. These boreholes were advanced through the existing pavement structure to obtain the information on the thickness of the pavement structure of the existing road (240mm and 245mm), the thickness of the granular base/subbase (500mm), and through the shoulders of the existing road. Below the granular base/subbase were encountered fill materials consisting of sandy silt to silty sand, extended to depths ranging from about 1.1m to 4.7m below the existing ground surface. Below the fill materials, peat deposits were encountered, extended to depths ranging from about 1.9m to 5.6m below the existing ground surface. According to boreholes logs, the peat layer, which thickness varies from 1,1 m to 0,4 m, is at a depth starting on the South side on 3,3 m under the ground level, and on the North side, on 2,6 m. The peat layer is generally highly compressible and will be subject to long term settlement and potentially to differential settlement, should additional

loading be applied. Below the peat, silty sand deposits were encountered, extended to the termination depths of the boreholes.

For the second location at stationing 0+300 (closer to Sandalwood Parkway) one borehole (BH01-17) was conducted. According to the borehole log, buried peat was encountered below the embankment fill. However, this is a shallow layer, 1.3 m under the ground level and its thickness is less than a meter. Consolidation settlement of the peat should be expected because of the road widened to accommodate the new bike lanes. The amount of consolidation settlement will be dependent on the load produced by the new road embankment fill and the thickness of the compressible deposits. The anticipated road embankment will range in height from 1 m to 4 m.

Regarding the turtle crossings, for alternatives with concrete box culverts which would increase the existing load of the road on the underlying soils below, the peat layers would have to be removed on both locations and replace with class B controlled backfill. This would require an excavation starting from a depth of 4,4 m for the South side and going up to a depth of 3 m for the North side. It is considered that the excavation required for the removal of the peat layers, especially the shallow one, would not be difficult to perform.

Regarding the StormTech chambers, the removal of the peat layers is not required, because they will substantially decrease the existing load of the road on the underlying soils below. However, as mentioned above, as the removal of the peat layers doesn't appear to be complicated, we recommend the peat layer removal in order to eliminate any consolidation settlement later if road widening is required for the new bicycle lanes.

3.6 SUMMARY

The followings summarize the transportation issues and challenges noted on the Heart Lake Road corridor:

- Daily traffic on Heart Lake Road, between Countryside Drive and the Highway 410 off-ramp, is currently around 7,000 vehicles per day, 4,000 southbound and 3,000 northbound;
- The existing and forecasted traffic volumes do not justify widening of Heart Lake Road (additional traffic lanes), given that the theoretical capacity per lane for a typical two-lane rural roadway is 800 veh/h;
- Vehicles travelling on Heart Lake Road currently exceed the speed limit, which reduces safety on the corridor, given that higher speeds increase the probability and severity of collisions;
- Heart Lake Road is identified as a candidate for bicycle lane in the City of Brampton Transportation Master Plan;
- Improvements are required at the intersection with Sandalwood Parkway to improve safety conditions (see **Table 13**);
- Heavy trucks are observed on Heart Lake Road despite being prohibited; and
- Road infrastructure conditions constrain the type of measures that can be put in place along the corridor.

4.0 ECOLOGY AND ENVIRONMENT

4.1 BACKGROUND REVIEW

The analyzes of this study were conducted in consultation with Toronto and Region Conservation Authority (TRCA) and the following documents were consulted:

- 2015 Heart Lake Road Ecology Report,
- 2016 (Draft) Post Eco-Passage Installation Road Ecology Monitoring Report, and
- Detailed Design package for the eco-passage.

In addition, a variety of background documents and information sources were reviewed and include the following:

- Natural Heritage Information Centre (NHIC) database (retrieved March 16, 2017);
- Species at Risk in Ontario (SARO) List (updated October 1, 2015);
- MNRF Land Information Ontario (LIO) digital mapping of natural heritage features;
- Various wildlife atlases (birds, mammals, herpetofauna);
- Toronto and Region Conservation Authority flora and fauna data for Heart Lake Road Conservation Area;
- Ecological Land Classification data from Toronto and Region Conservation Authority;
- Ecological Land Classification data from Toronto and Region Conservation Authority;
- Heart Lake Volunteer Road Ecology Monitoring Project, Phase I (2011);
- Heart Lake Road Volunteer Road Ecology Monitoring Project - Phase II (2013);
- Heart Lake Road Volunteer Road Ecology Monitoring Project – (August 2014);
- Brampton Grow Green – Environmental Master Plan (2014);
- Staff Report – SUPPLEMENTARY REPORT: Heart Lake Mitigation Strategy, Brampton City Council April 22, 2015 (includes Appendix RECOMMENDATION REPORT: Heart Lake Mitigation Strategy P&IS April 13, 2015);
- 2015 Road Ecology and Turtle Population Study;
- Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (MNRF 2016);
- HLCA Master Plan (HLCA Master Plan Advisory Committee, n.d).

A search of NHIC database revealed two recent records of Species at Risk in the area; Butternut and Eastern Meadowlark. **Table 16** shows a list of species of conservation concern that may also be present in the study area based on a review off the background documents, wildlife atlases, TRCA flora and fauna data.

Table 16 NHIC and Background Review of Species of Conservation Concern that may be Present within the Heart Lake Road Study Area

Species Common Name	Species Scientific Name	Provincial Rank	Federal Rank
Snapping Turtle	Chelydra serpentina	Special Concern	Special Concern
Eastern Milksnake	Lampropeltis triangulum	None	Special Concern
Common Nighthawk	Chordeiles minor	Special Concern	Threatened
Chimney Swift	Chaetura pelagica	Threatened	Threatened
Eastern Wood-Pewee	Contopus virens	Special Concern	No status, COSEWIC THR
Olive-sided Flycatcher	Contopus cooperi	Special Concern	Threatened
Barn Swallow	Hirundo rustica	Threatened	Threatened
Wood Thrush	Hylocichla mustelina	Special Concern	No Status, COSEWIC THR
Bobolink	Dolichonyx oryzivorus	Threatened	No Status, Threatened
Eastern Meadowlark	Sturnella magna	Threatened	No Status, Threatened
Little Brown Myotis	Myotis lucifugus	Endangered	Endangered
Northern Myotis	Myotis septentrionalis	Endangered	Endangered
Butternut	Juglans cinerea	Endangered	Endangered

4.2 NATURAL HERITAGE FEATURES

This section of Heart Lake Road is one of the largest and most diverse natural areas within the City of Brampton. Heart Lake Conservation Area (HLCA) which is owned by TRCA, is located on the west side of the road. HLCA is a diverse, 169-hectare ecosystem that includes; two kettle lakes, the headwaters for Spring Creek and a wetland complex. HLCA has one of the largest blocks of forest in the Etobicoke Creek watershed, and contains provincially significant wetlands, and Environmentally Significant Woodland area and a bog of Natural and Scientific Interest. At least seventy-five species of birds' nest within the HLCA, including a regionally significant heronry. There are also many herpetofauna and mammal species and more than 115 plant species, of which more than 50 species that are classified as species of regional conservation concern (L1-L3; HLCA Master Plan, u.d).

Heart Lake Conservation Area is an Environmentally Significant Area (ESA), Provincially Significant Wetland (PSW), and Area of Natural and Scientific Interest (ANSI). Heart Lake Conservation contains six provincially rare vegetation community types, the remaining portions of Brampton Buried Esker, and 26 species of threatened bird species, including the Barn Swallow and Trumpeter Swans. The Eastern Snapping Turtle and Eastern Milksnake are found at the Heart Lake Conservation Area, both are provincially and nationally designed species of Special Concern. Over 40% of the conservation area is covered in forest, which is rare since most forests within Peel Region were cleared for agricultural purposes during the 19the century (City of Brampton 2014:11).

4.3 WILDLIFE ROAD MORTALITY

4.3.1 Background Review

Heart Lake Road, between Sandalwood Parkway and Countryside Drive, is known as a "hotspot" for wildlife mortality. To address the issue of wildlife mortality on Heart Lake Road, TRCA collaborated with Ontario Road Ecology Group and the City of Brampton to create the Heart Lake Road Ecology Volunteer Monitoring Project (HLREMP) in 2011. In the first year of the project, volunteers monitored over a 25-week period from May to October with the goal of determining the species that were being impacted, and to record the number of wildfire-vehicle interactions (HLREMP

2011). In 2011, 1,239 wildlife road fatalities were documented, confirming that this stretch of road is experiencing high levels of wildlife mortality.

The HLREMP continued to conduct intensive surveys along Heart Lake Road in 2013 (HLREMP 2013), 2015 (HLREMP 2015) and 2016 (HLREMP 2016) with modifications to the study design and updated objectives as their knowledge of the road ecology in the area increased. Supplemental research projects were also conducted, including a mock culvert and wildlife directional fencing study in 2013 (HLREMP 2013), and a turtle population study in 2014 (HLREMP 2014) and 2015 (HLREMP 2015).

Results from these studies have documented thousands of wildlife-vehicle collisions each year. More than 80% of the wildlife/vehicle collisions consisted of frogs/toads, and turtles comprised 5-8% of the mortality. Frogs and toads typically have limited movements; most remain within 1 km. In early spring, Wood Frogs and Spring Peepers emerge and move in masse from upland overwintering areas to breeding wetlands. Similar movements occur in late summer when young of the year move from wetlands to uplands areas. When a road bisects their seasonal habitat, high levels of road mortality can result, as it is occurring along Heart Lake Road.

In 2013 alone, more than 100 turtles were documented killed on the road (HLREMP 2013), including Snapping Turtle, which is a species of Special Concern both federally and provincially. Snapping Turtles are a long-lived species with delayed sexual maturity. The loss of even a few individuals can have population-level impacts. Vehicle collisions with turtles are a well-documented threat to turtle populations in Ontario (Ashley and Robinson 1996, Gibbs and Shriver 2002, COSEWIC 2008). Gibbs and Shriver (2002) recommend that roads with more than 100 to 200 vehicles/land/day can have substantial limitations on land turtles such as the Snapping Turtle.

The frog and turtle populations within the study area are of regional significance because they represent the most southerly location for several species in the Etobicoke Creek watershed including Wood Frog, Spring Peeper, Leopard Frog and Midland Painted Turtle. Furthermore, Snapping Turtle is only found at one other more southerly location within the watershed.

4.3.2 Road Mortality Hotspots

Identifying spatial hotspots of wildlife-vehicle collisions and understanding the factors that influence the occurrence of hotspots are essential for designing appropriate road mitigation (Gunson and Teixeira 2015). In 2013, the HLREMP focused on mapping the locations of wildlife fatalities to identify 'hotspots' or sections of the road where the largest number of fatalities were occurring (HLREMP 2013). When a wildlife vehicle collision was noted in the field, it was mapped to the nearest fixed location (which were flagged along the road at 25-1 metre increments). A figure was then created, which showed locations of all fatalities along the road and the frequency of occurrence. Each fixed location was placed into one of the following categories, representing the number of fatalities associated with the point:

- Category 1: 1 WVC;
- Category 2: 2-42 WVC;
- Category 3: 43-54 WVC;
- Category 4: 55-71 WVC;
- Category 5: 72-114 WVC.

Sections of road where the highest number of mortalities were recorded (i.e. areas with clustering if category 4 and 5 points) are identified visually and grouped into three sections ("hotspots"), as shown on **Figure 22**. The identification of these sections of road will assist with the design and implementation of mitigation, noting that an eco-passage is already installed at the "hotspot" just south of Countryside Drive.

596000 597000 598000

4845000 4844000 4843000

N

DRAFT

Stantec

Legend

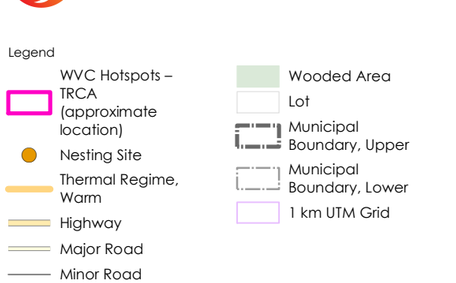
- WVC Hotspots – TRCA (approximate location)
- Nesting Site
- Thermal Regime, Warm
- Highway
- Major Road
- Minor Road
- Watercourse (Permanent)
- Candidate ANSI, Earth Science
- Candidate ANSI, Life Science
- Conservation Area Administrative Boundary
- Thermal Regime, Warm
- Waterbody
- Wetland, Provincially Significant
- Wetland, Not evaluated per OWES
- Wooded Area
- Lot
- Municipal Boundary, Upper
- Municipal Boundary, Lower
- 1 km UTM Grid

0 0.5 Kilometres

1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2016.
3. Orthoimagery © First Base Solutions, 2016. Imagery Date, 20XX.



Project Location
City of Brampton

165001037 REVA
Prepared by AMW on 2017-04-25
Technical Review by ABC on yyyy-mm-dd
Independent Review by ABC on yyyy-mm-dd

Client/Project

FUNCTION AND DESIGN REVIEW OF THE HEART LAKE ROAD CORRIDOR

Figure No.

22

Title

Ecological & Environmental Characteristics

\\Cd1125-f01\work_group\01650\active\165001037\3 Technical Work\2 Mxds\Drawing\Figures\Terrestrial\Intermd\mxds\165001037_EcoBackgroundDataReview_20170425.mxd Revised: 2017-04-25 By: cwhite

4.4 MITIGATION MEASURES

There are many different mitigation measures to reduce wildlife vehicle mortality, which vary in cost, permanence, and effectiveness (Gunson and Schueler 2012). These include structures such as underpasses and fencing, wildlife crossing signs, and measures to reduce traffic volume and speed. Using the data that have been collected since 2011, many mitigation measures have been recommended by the HLREMP and the TRCA to reduce the incidence of wildlife road mortality. The City of Brampton has also developed a Heart Lake Road Mitigation Strategy in 2015 and has subsequently implemented some of the proposed mitigation.

4.4.1 Traffic Calming

One of the mitigation measures suggested by the HLREMP to reduce road mortality was to install a three-way stop at the intersection of Countryside Drive and Heart Lake Road. In response to this suggestion, the City of Brampton assessed vehicle volume and speed data and determined that this intersection and the Heart Lake Road/southbound Highway 410 off ramp intersection did not warrant a three-way stop.

Seasonal road closures were also recommended to allow safe passage of wildlife during seasonal dispersal periods. This strategy has been used effectively by the City of Burlington to accommodate the dispersal of Jefferson Salamander. A road closure was a recommended option in the Heart Lake Road Mitigation Strategy. The strategy recommended a three-week closure in both spring and fall. The stretch of the road north of Sandalwood Parkway would remain open to local traffic, including commercial businesses, whereas a 'hard' closure would be used between the HLCA entrance and Countryside Drive.

The road closures were not implemented because local business owners expressed concern that the road closures would have a detrimental effect on their business revenue. It was also decided that nighttime closures were not a viable option. The installation of 'speed cushions' or other vertical deflections to slow down traffic were only recently endorsed for use in the City of Brampton because of concerns from emergency service providers.

Pavement markings (optical speed bars) and wildlife warning signs are mitigation measures that have been approved and implemented with the goal of reducing the average speed of vehicles along Heart Lake Road.

4.4.2 Wildlife Signage

Wildlife signs are advantageous because they are relatively inexpensive and are easily deployed, however their effectiveness varies, and it is important to consider timing and placement of signs prior to deployment (Gunson and Schuler 2012). Wildlife signage is best used in combination with other mitigation measures such as traffic calming, fencing and crossing structures.

A variety of signs have been installed on Heart Lake Road to notify motorists of the dangers of WVC and to slow down traffic. Types of signs included "significant natural areas" signage, wildlife crossing signs and solar operated flashing "seasonal wildlife crossing – reduce speed when flashing" signage. The efficacy of wildlife crossing signs is unknown, as studies have shown mixed results and most research has focused on deer crossing signs (Premo and Premo 1995, Hedlund et al. 2004, Found and Boyce 2011).

4.4.3 Wildlife Crossing Structures and Fencing

4.4.3.1 Crossing Structure

The use of crossing structures combined with fencing is currently the most effective mitigation measure to reduce road impact for amphibians and reptiles (OMNRF 2016). Crossing structures enhance connectivity by connecting fragmented habitats and reduce mortality by keeping animals off the road (OMNRF 2016). The recently published "Best Management Practices for Mitigating Effects of Roads on Amphibian and Reptile Species at Risk in Ontario" (OMNRF 2016) provides recommendations on the use of different type of structures, including design, location, spacing, retrofitting of existing culverts and installation and placement of fencing.

The placement of the structure, the construction material, dimensions, substrate, thermodynamics, and amount of natural light will influence the probability of the target species using the eco-passage.

A concrete box culvert was installed by City of Brampton in April 2016, approximately 100 m south of Countryside Drive, in one of the wildlife mortality hotspots. To encourage use of the culvert by amphibians and turtles, the bottom of the culvert was filled with a 10 cm layer of natural soil (HLREMP 2016 draft).

4.4.3.2 Fencing

Fencing should be used in conjunction with crossing structures to direct animals towards structure entrances and to prevent animals from gaining access to the road. Fencing can also be used as a standalone mitigation measure to prevent road mortality, but only if habitat connectivity is not a concern (i.e., areas where habitat is not bisected by the road) (OMNRF 2016). The most important objective of fence design is to minimize the likelihood of animals breaching the fence (HLREMP 2016 draft). Fencing should be designed so that animals cannot get under or over the fence, and regularly monitored and maintained so that there are no holes or access points. Fencing design must also consider the target species. For example, Snapping Turtles are good climbers, so an overhanging lip that extends away from the road is recommended for this species (OMNRF 2016).

Animex one-way exclusionary fencing was installed onto 45 cm high galvanized steel farm fencing with round posts. The Animex attaches to the farm fence and the section facing the wetland has a smooth interior and a 15 cm lip angled back to the wetland to discourage climbing. The opposite side of the fence has a textured grid to facilitate the return of animals to the wetland if they are trapped on the roadway. Fencing was installed on both the east and west sides of Heart Lake Road, south of Countryside Drive for approximately 190 m on the east and 140 m on the west. The ends of the fencing were curled back to the wetland to re-direct animals that may have missed the eco-passage.

Road mortality monitoring in 2016 continued to record high mortality for amphibians and reptiles, but the mortality was concentrated in areas where mitigation has not been implemented. Preliminary data suggest that the installation of the eco-passage and installation of fencing was successful at reducing mortality in the area where mitigation was applied. Further efforts will be needed to reduce mortality on other sections of the road.

Temporary wildlife fencing was installed in the spring of 2018, and was effective in reducing the amount of wildlife mortality along Heart Lake Road. Areas that were not planned for fencing, or where fencing stopped short, did continue to have turtle mortality. These areas are recommended to have an extension of the wildlife fencing in the future.

4.4.4 Turtle Nesting Mounds

One of the mechanisms behind turtle road mortality is that roads are bisecting the turtles' seasonal habitat and so they are crossing the road to gain access to nesting sites. Furthermore, turtles may use gravel shoulders as nesting sites. Creating alternative nesting habitat away from the road can be used as a mitigation tool to reduce mortality of nesting females and hatchlings. This method has been proven to be an effective conservation tool for Midland Painted Turtles and Snapping Turtles (Paterson et al. 2013).

To encourage nesting within the wetlands and discourage turtles from accessing Heart Lake Road, TRCA created artificial turtle nesting mounds in May 2016. Mounds were places on both sides of the mitigated section of road, inside the exclusionary fencing. The nesting mounds were not used in 2016, however, drought conditions experienced in that year may have rendered the wetlands that were adjacent to the mounds to be unsuitable for turtles, causing them to disperse elsewhere. Further monitoring will determine whether the artificial nesting mounds are an effective road mitigation tool.

4.4.5 Effectiveness of Mitigation Measures

Table 17 shows average and 85th percentile speeds observed on Heart Lake Road while the mitigation measures were in place. In general, it can be concluded that the effect is not significant.

Table 17 Effectiveness of Mitigation Measures on Speed observed on Heart Lake Road

Year	Speed	
	Average	85th Percentile
2013	64	77
2015	71	82
2016	70	80
2018	67	81

Source: City of Brampton, 2018

5.0 CULTURAL HERITAGE

The study area is currently not listed on the City of Brampton *Municipal Register of Cultural Heritage Resources* (2016) or designated under the *Ontario Heritage Act* (OHA). However, in 2014, the Brampton Heritage Board received a delegation from the public seeking the possible recognition of Heart Lake Road as a cultural heritage landscape. This recognition was not defined at the time and the City of Brampton is seeking additional clarification regarding what recognition options are available.

5.1 SITE HISTORY

5.1.1 Introduction

The study area is located in the former Township of Chinguacousy, now the City of Brampton, within the Regional Municipality of Peel. Heart Lake Road was originally a 19th century corduroy road and was constructed between the late 1820s to the mid-19th century. The following sections outline the historical development of the study area from the time of Euro-Canadian settlement to the 20th century.

5.1.2 Physiography

Heart Lake Road is located in the Peel Plain physiographic region of southern Ontario (Chapman and Putnam 1984: 113). The region is a level to undulating tract of clay soils, stretching across the Regional Municipalities of York, Peel and Halton. The general elevation of the region is 500 to 750 feet above sea level. The underlying geological material is till containing large amounts of shale and limestone. The water supply in the region has historically been a constraint to settlement, due to the density of the till, and the lack of thick beds of sand to serve as aquifers. This is combined with a high degree evaporated water from the deforested clay surface (Chapman and Putnam 1984: 174-175). The major watercourses that traverses the City, include the Credit River, Humber River, the Etobicoke Creek, Fletchers Creek, and Mimico Creek (City of Brampton 2013: 2.3).

The study area crosses one of the most Provincially and Regionally significant natural areas within the City of Brampton (City of Brampton 2015: 11). The Brampton Esker is a geologic formation and is designated a Regional Earth Science ANSI, that supports provincially significant wetlands and approximately eight lakes, including Heart Lake and Teapot Lake within the Heart Lake Conservation Area (HLCA) (City of Brampton 2015: 4). The esker extends 8 kilometers in a southeasterly direction from Heart Lake Road south to Bovaird Drive (City of Brampton 2013: 2.3). The sands and gravels of the Brampton Esker hold and purify water as it percolates downward, making the esker an aquifer and a groundwater resource. (Laing et al. 2014: 14). Within the exception of the study area and HLCA, most of the Brampton Esker had disappeared due to aggregate extraction (Laing et al. 2014: 57).

The HLCA, the largest greenspace within the City of Brampton is situated adjacent to the study area, occupies 169 hectares (417 acres) within the Etobicoke Creek watershed. The Etobicoke Creek watershed drains a total area of 211 square kilometers and has three distinct branches, the Main Branch, Little Etobicoke Creek watershed, and surficial geology of glacial till and river deposits. In addition, sections of Heart Lake Provincially Significant Wetland Complex, the Heart Lake Woodlands Environmentally Significant Area, and the Heart Lake Forest and Bog Area of Natural and Scientific Interest are found in the HLCA (HLCA Master Plan Advisory Committee; online). The main hydrological feature in the HLCA is the 16.5 ha kettle lake. It was formed 10,000 years ago when an ice block trapped under a melting glacier left a natural steep-sided depression (Laing et al. 2014: 13).

5.1.3 Historical Development

5.1.3.1 19th Century

The Township of Chinguacousy was surveyed in 1819 by land surveyor Richard Bristol (Laing et al. 2014: 19). The township was surveyed using the double-front system, with concessions running north-south. The system utilized 200 acre lots that were broken into 100-acre parcels, each fronting a concession road. Between every five lots an allowance was surveyed for a side road. Concessions were numbered east and west of Hurontario Street, which runs through the centre of the township (PAMA, Property Research in Peel; online). Hurontario Street was surveyed in 1818 and received its name from the points located at the ends of the route; Lake Huron and Lake Ontario (Heritage Mississauga, History Bytes; online). The route increased accessibility to the township and provided a connection to Dundas Street to the south.

Heart Lake Road is situated on Lots 14 to 17, in Concession 2 East and 3 East. When Heart Lake Road, originally Concession Road 2 East, was laid out by Bristol in 1819, he noted on the survey swamp areas located along the concession road (Laing et al. 2014: 5). The area surrounding Heart Lake Road, at the time of survey, was composed of swamp land and forested land that included species of cedar, hemlock, black ash, beech, maple, basswood, tamarack, and elm (Laing et al. 2014: 26).

Settlements in the township initially developed along Hurontario Street and waterways that provided the water power for mills. The study area, located with the Etobicoke Creek watershed, was the location of a few mills, but given the lack of reliable stream flow, as well as periodic flooding, mills did not thrive on the creek. This was particularly notable when compared to the rivers in the township (TRCA 1998: 21). As a result, the closest settlements near the study area, developed at road intersections, including Edmonton, Mayfield, and Brampton.

Business in the township was initially conveyed at the settlement of Salisbury in the inn operated by Martin Salisbury (Loverseed 1987: 39). The settlement of Brampton developed two kilometers from Salisbury southwest of the study area. In 1834, William Buffy built the first tavern, followed by Judge Scott who built the first store, as well as a pot ashery, distillery, and mill. In 1834, John Elliott laid out the settlement into village lots with the name of Brampton (Pope 1877: 87). The population of Brampton in 1837 was 18 (Loverseed 1987: 40).

The township grew steadily as settlers were attracted to farmland close to the growing markets of the Town of York (now the City of Toronto). In 1841, the population of the Township of Chinguacousy reached 3,721 (Pope 1877: 84). By 1846, the township included 74,977 acres of land, with 26,266 under cultivation. The township is noted in *Smith's Canadian Gazetteer*, as being one of the best settled townships in the Home District by 1846, with excellent land and many good farms (Smith 1846: 32). Heart Lake Road would have been opened as settlement increased on the adjacent lots and settlers completed their settlement duties which included clearing the portion of the road which fronted each property.

The earliest settler to clear the road in the study area was Richard Stinson in 1827 on the east half of Lot 16, Concession 2 East (Laing et al. 2014: 22). Due to the swampy areas, it is likely that once the rest of clearing was completed a corduroy road was constructed to pass over the soft wet ground. The construction of the corduroy roads during this period involved laying tree trunks side by side with earth dug from the side of the road and laid over top of the logs securing the logs and creating a ditch (Laing et al. 2014: 29).

Growth and increased accessibility to settlement came to township with the opening of Grand Trunk Railway (G.T.R.) line. This was furthered with construction of a station at Brampton in 1856. Brampton had been incorporated as a village three years prior and had a central location within the township. That same year, Hurontario Street had been planked from Port Credit through Brampton to Edmonton. Through the railway line farmers could distribute their agricultural goods to a larger market and access to the City of Toronto increased (Loverseed 1987: 43). This economic boom in Brampton brought entrepreneurs and industries to the village in the 1850s and 1860s. In 1860, Edward Dale started a flower nursery in the village, and became the largest employer in Brampton (City of Brampton; online). Market gardening developed as a large industry in Brampton and by the end of the 19th century it became known as the "Flower town of Canada" (City of Brampton; online).

In 1867, the County of Peel separated from York, becoming its own governing entity with Brampton as the county town (Loverseed 1987: 24). Brampton was officially incorporated as town in 1873, with John Haggert as the first mayor (City of Brampton; online). The Credit Valley Railway, was constructed from 1877 to 1879, connecting Toronto and Orangeville with a station in Brampton (Heritage Mississauga Railways in Mississauga; online). The line furthered development in Brampton but took away people and business from smaller communities in the township that witnessed a decline. The closest settlement to the study area was Mayfield, which was considered a small community when compared to Brampton. By 1877, it had a population of 50 including a schoolhouse, general store, post office, blacksmith shop, and hotel (Pope 1877: 91). The population of the township remained stable in the late 19th century, slightly decreasing from population of 6,397 in 1861, to 6,129 in 1871 (Pope 1877: 84).

5.1.3.2 20th Century

At the turn of the century the Township of Chinguacousy witnessed a change in settlement patterns as retired farmers began to move into the City and surrounding villages. This occurred along a shift in the specialization of agriculture and industries. It also characterized the greatest period of growth for Brampton during the 20th century occurred after the Second World War. With the construction of several major highways, and Brampton's proximity to the City of Toronto, the development of subdivisions and increased ownership of automobiles changed the landscape Brampton (City of Brampton; online).

Adjacent to the study area, Heart Lake Conservation Area (HLCA) was established in 1956 when the Metropolitan Toronto and Region Conservation Authority (MTRCA) purchased roughly150 acres of land from Allan Taylor (HCLA Master Plan Advisory Committee; online). The HCLA was formed to protect, conserve, and restore the valuable ecological features and functions of the site, while guiding the current and potential future public uses of the area (HCLA Master Plan Advisory Committee; online). The HCLA opened to the public in 1957 (Laing et al. 2014: 38). By 1982, nine additional tracts of land were purchased, for a total of nearly 425 acres, from T.B. Ingoldsby, H.C. Parkinson, M.J. Hunter, G. Rayner, the Township of Chingaucousy, Agrob. Investments Ltd., City of Brampton, the Regional Municipality of Peel, and the Ministry of the Environment (HLCA Master Plan Advisory Committee; online).

The City was incorporated in 1974 with the amalgamation of the former Town of Brampton, parts of the former Town of Mississauga, and the former Townships of Toronto Gore and Chinguacousy (City of Brampton 2013: 2.1). In the 1980s and 1990s subdivisions developed on farmlands surrounding the City, converting rural lands into an urban landscape. Adjacent to the study area, in the 1970s, the Village of Heart Lake was formed between Hurontario Road and Heart Lake Road (Laing et al. 2014: 39). The population of the City continued to grow into the 21st century, increasing from 433,806 in 2006, to 523,911 in 2011 (Statistics Canada; online).

5.1.4 Site Description

The study area is comprised of Heart Lake Road from Sandalwood Parkway East to Mayfield Road, including areas captured by current development proposals on the east side of the road, environmentally sensitive areas, and relevant portions of the adjacent transportation network. This area is broadly bordered by Highway 410 and recent residential development on the east, Sandalwood Parkway and residential development on the south, residential development on the west, including Toronto and Region Conservation Authority (TRCA) lands to the west, and Mayfield Road and agricultural land on the north. This section of Heart Lake Road is visually distinct from the surrounding lands since it is mostly bordered by natural areas that have not been used for residential development.

The study area is generally bordered by naturalized lands that exhibit a wide variety of ecology including wet lands, kettle lakes, treed ridges, forested areas, and rolling agricultural fields. The south end of the study area features wet lands on both sides of the road (**Figure 23**). In general, the west wide of the road (TRCA lands) feature higher ground with treed ridges and forested areas while the east side is mainly comprised of wet land (**Figure 24**). A church and a garden centre are located on the east side of the road (**Figure 25** and **Figure 26**). Both developments appear to be relatively recent and are not related to historical land use along Heart Lake Road.

The entrance to the Heart Lake Conservation area is located on the west side of the road, just north of the garden centre (Figure 27). The entrance features a triangular shaped driveway that is bordered by split rail fences (**Figure 28**). Split rail fencing is used intermittently along the west side of the road on the border of the TRCA lands (**Figure 29**).

The lands included in the Metrus Developments (residential) parcel are located north of the garden centre. These lands consist of wet land and higher ground that appears to have once been used as agricultural fields (**Figure 30**, **Figure 31** and **Figure 32**). This parcel of land contains a remnant tree lined driveway that once led to a farmstead on the east side of Heart Lake Road (see **Figure 31**).

North of Countryside Road, the landscape changes to be predominantly rolling agricultural fields on the east side of the road and undulating forested land on the west side (**Figure 33** and **Figure 34**). The lands within the Emery Developments (residential) parcel consist mainly of former agricultural land with rolling topography (**Figure 35** and **Figure 36**).

The Khalsa School parcel is located north of the Emery Developments parcel and south of an existing residential property. The Khalsa School parcel is mainly comprised of rolling agricultural land (**Figure 37** and **Figure 39**). The Starbright Developments (Employment) parcel is visible through the Khalsa School parcel. These lands appear to consist mainly of rolling agricultural fields divided by a water course and associated wet lands that cross the middle of the property parcel in a general southeast-northwest direction.

The north section of the study area is bordered by a forested area on the west side of the road and residential development on the east side (**Figure 38**). The residential development on the east side appears to date to the mid-20th century. A mid-century modern residence is located on the northwest corner of Heart Lake Road and Mayfield Road. This section of the study area also features numerous kettle lakes, which are located between the residential properties.

Figure 23 View looking SE along Heart Lake Rd towards Sandalwood Pwy E

Figure 24 View looking NW along Heart Lake Rd showing wetland (right) and treed ridge (left)

Figure 25 View NW of Heart Lake Rd showing the Heart Lake Seventh Day Adventist Church (right) and treed ridge (left)

Figure 26 NW View of Heart Lake Rd showing the Lakeside Garden Gallery (right)

Figure 27 NW View of Heart Lake Rd showing wetland (right) and entrance to the Heart Lake Conservation Area (left)

Figure 28 Entrance to the Heart Lake

Figure 29 Example of split rail fences located along Conservation Area

Figure 30 NW View of Heart Lake Rd showing the lands within Metrus Developments (Residential) parcel on the right

Figure 31 SE View of Heart Lake Rd showing the lands within Metrus Developments (Residential) parcel on the left. Note the remnant tree lines and driveway.

Figure 32 NW View towards Countryside Dr showing the lands within Metrus Developments (Residential) parcel on the right

Figure 33 Example of Tree Ridge/High Ground in the Heart Lake Conservation Area on the west side of Heart Lake Road

Figure 34 NE View of Rolling Agricultural

Figure 35 NW View of Heart Lake Road showing Lands included in the Emery Developments (Residential) Parcel (right)

Figure 36 NW View of Heart Lake Rd showing Lands included in the Emery Developments (Residential) Parcel (right) and Khalsa School (far right)

Figure 37 East View from Heart Lake Rd showing Lands included in the Khalsa School Parcel

Figure 39 East View of the Khalsa School Parcel

Figure 38 NW View of Heart Lake Rd

5.1.5 Heritage Evaluation

5.1.5.1 Ontario Regulation 9/06

The criteria for determining Cultural Heritage Value or Interest (CHVI) are defined by *Ontario Regulation 9/06* (O. Reg. 9/06) (Government of Ontario 2006b). If a property meets one or more of the below criteria than it merits designation under Part IV of the *Ontario Heritage Act*.

In order to identify CHVI at least one of the following criteria must be met:

1. The property has design value or physical value because it:
   - i. is a rare, unique, representative or early example of a style, type, expression, material or construction method;
   - ii. displays a high degree of craftsmanship or artistic merit; and
   - iii. demonstrates a high degree of technical or scientific achievement.
2. The property has historical value or associative value because it:
   - i. has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community;
   - ii. yields, or has the potential to yield, information that contributes to an understanding of a community or culture; and
   - iii. demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community.
3. The property has contextual value because it:
   - i. is important in defining, maintaining or supporting the character of an area;
   - ii. is physically, functionally, visually or historically linked to its surroundings; and
   - iii. is a landmark.

5.1.5.2 Evaluation According to *Ontario Regulation 9/06*

Table 18 identifies which criteria of *Ontario Regulation 9/06* are met (Government of Ontario 2006b).

Table 18 Criteria of Ontario Regulation 9/06 Compliance

Criteria of Ontario Reg. 9/06	Y/N
Is a rare, unique, representative or early example of a style, type, expression, material or construction method	N
Displays a high degree of craftsmanship or artistic merit	N
Demonstrates a high degree of technical or scientific achievement	N
Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	Y
Yields, or has the potential to yield, information that contributes to an understanding of a community or culture	Y
Demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community	N
Is important in defining, maintaining or supporting the character of an area	Y
Is physically, functionally, visually or historically linked to its surroundings	Y
Is a landmark	Y

5.1.5.3 Design or Physical Value

Heart Lake Road does not illustrate or exemplify a style, type, expression, material or construction method. It is highly likely that this road was once a corduroy road. However, road improvements completed in the mid-20th century and in 1987 have removed evidence of this early road construction technique. The present physical conditions of Heart Lake Road, including two lanes of traffic, gravel shoulder, and ditching, are typical of other rural roads in the City of Brampton. Therefore, Heart Lake Road does not meet criterion 1.i of O. Reg. 9/06.

Heart Lake Road does not display a high degree of craftsmanship or artistic merit. The road has standard paving and shoulders and does not have details that are greater than normal quality or are that are implemented at an intensity above an industry standard. Therefore, Heart Lake Road does not meet criterion 1.ii of O. Reg. 9/06.

Heart Lake Road does not display a high degree of technical or scientific achievement. The existing conditions of the road evolved through time from an unimproved concession road in the 19th and early-mid 20th century to an improved road in the mid-20th century. It is likely that road improvements to Heart Lake Road were completed in response to the opening of the Heart Lake Road Conservation Area in 1957 since increased traffic along this section of the road was anticipated. The existing conditions of Heart Lake Road reflect the road improvements carried out in the mid-20thcentury. The construction methods used to improve the road do not display a high degree of technical expertise, adaptation of materials, forms, or spatial arrangements, or a breakthrough in design or construction techniques. Therefore, Heart Lake Road does not meet criterion 1.iii of O. Reg. 9/06.

5.1.5.4 Historic or Associative Value

Heart Lake Road is historically associated with the theme of early road building in the Town of Chinguacousy and has direct associations with the Heart Lake Conservation Area and the TRCA.

Regarding Euro-Canadian history, there were three successive attempts to settle the Heart Lake Road area. The first attempts were made by John Pettit Jr, George Coon, and Thomas Graham in 1819. All three landowners were unable to settle the land and returned their grants since the land was too swampy to settle, which made farming difficult if not impossible (City of Brampton 2014: 7-8). Richard Stinson successfully settled Concession 2E, east quarter of Lot 16 between 1823 and 1827. King's College (subsequently the University of Toronto) was granted a Crown patent for 200 acres in 1828. King's College subsequently subdivided the lot and sold it off during the mid-19th century. The swampy nature of Heart Lake Road, and the difficulties experienced by early settlers, support the claim that Heart Lake Road was originally constructed as a corduroy road. 19th century corduroy roads consisted of laying young trees (cut in similar size) side by side across a road to create a passable surface. This construction technique was reserved for areas with soft, swampy ground that could not be drained. While no direct evidence (i.e. archival photos, maps, or travelers accounts) exists to definitively prove that Heart Lake Road was a corduroy road, it is highly likely that this road construction technique was used here due to the undulating topography and historically documented swampy conditions.

In addition to the historical theme of early road building, Heart Lake Road is directly associated with the Toronto and Region Conservation Area (TRCA). The Heart Lake Conservation Area was formed in 1956 and was opened to the public in 1957. Mid-century improvements to Heart Lake Road were likely complete in response to the opening of the conservation area. Presently, Heart Lake Conservation Area is one of the largest natural green space areas in the City of Brampton. In relation to the Study Area, the entire west side of the Heart Lake Road between Sandalwood Parkway and Mayfield Road is owned and operated by the TRCA. Therefore, Heart Lake Road meets criterion 2.i of O. Reg. 9/06 due to the likelihood that Heart Lake Road is historically associated with the theme of early road construction, specifically corduroy roads, in the Township of Chinguacousy and the direct historical association with the TRCA.

Heart Lake Road has the potential to yield, information that contributes to an understanding of a community or culture. As identified in the draft listing report prepared by the City of Brampton, Heart Lake Road and its surrounding lands have archaeological potential and known archaeological sites related to the Paleo-Indian Period (10000-7000 BC), Archaic Period (7000-1000 BC), Initial Woodland Period (1000 BC to AD 700), and Late Woodland Period (AD 700-1651) are well documented in the area. Specifically, a high number of Indigenous campsites from the Archaic Period were discovered in the area by the TRCA during 2007 excavations of the Heart Lake Road Conservation Area, which has resulted in the area being dubbed "The Stopover Site" (2014). Therefore, Heart Lake Road meets criterion 2.ii of O. Reg. 9/06 due to the potential to yield archaeological information that will contribute to an understanding of Indigenous history in the area.

Heart Lake Road was an unimproved concession road until the mid-20th century when it was improved, likely in response to the opening of the Heart Lake Road Conservation Area in 1957. The road was subsequently rebuilt and paved in 1987 (City of Brampton 2014:11). Heart Lake Road evolved through time and does not reflect the work or ideas of a builder or theorist. Therefore, Heart Lake Road does not meet criterion 2.iii of O. Reg. 9/06.

5.1.5.5 Contextual Value

Heart Lake Road, between Sandalwood Parkway and Mayfield Road is important in maintaining and supporting the character of the surrounding landscape. Although improved and updated, Heart Lake Road still maintains its rural road cross section with two lanes of traffic, gravel shoulders, and ditches. As a rural road, Heart Lake Road supports and maintains the significant natural areas on the east and west sides of the road, which are now rare in the City of Brampton. Specifically, the Heart Lake Road Conservation Area, located on the west side of Heart Lake Road, is an Environmentally Significant Area (ESA), Provincially Significant Wetland (PSW), and Area of Natural and Scientific Interest (ANSI). Heart Lake Conservation Area contains six provincially rare vegetative community types, the remaining portions of Brampton Buried Esker, and 26 species of threatened bird species, including the Barn Swallow and Trumpeter Swans. The Eastern Snapping Turtle and Eastern Milksnake are found at the Heart Lake Conservation Area; both are provincially and nationally designated species of Special Concern. Over 48% of the conservation area is covered with forest, which is rare since most forests within Peel Region were cleared for agricultural purposes during the 19th century (City of Brampton 2014:11). The rural setting of Heart Lake Road, including the TRCA lands on the west side of the road and mix of agricultural lands and forested kettle lakes on the east side of the road support and maintain the significant natural heritage value present along the road between Sandalwood Parkway and Mayfield Road. The continuing rural and relatively undeveloped setting of the road is unique in the City of Brampton, which has become increasingly urbanized. Accordingly, Heart Lake Road meets criterion 3.i of O. Reg. 9/06.

Heart Lake Road is functionally, visually, and historically linked to its surroundings. The road is functionally and historically linked to its surrounding context since it has been used as a rural road since the road was opened in 1819. With the exception of the physical condition of the road, which was improved in the mid-20th century and again in 1987, the surrounding context of Heart Lake Road has remained remarkably intact. Specifically, the forested lands on the west side of the road and the agricultural lands, kettle lakes, and wetlands on the east side of the road are rare within the City of Brampton. In addition, Heart Lake Road is visually linked to its surroundings. The rural character of the road, the conservation area on the west, and open rural/agricultural land on the east together create a unique roadscape that is primarily defined by its naturalized, undeveloped character. Accordingly, Heart Lake Road meets criterion 3.ii of O. Reg. 9/06.

Heart Lake Road acts as a landmark within the City of Brampton. The section of Heart Lake Road between Sandalwood Parkway and Mayfield is visually distinctive from surrounding roads. Heart Lake Road is bordered by development to the east, south, and west. Highway 410 borders Heart Lake Road to the north. Despite the surrounding development, Heart Lake Road retains its rural cross section and offers views to the adjacent natural heritage resources, including forests, kettle lakes, wetlands, and agricultural fields. The natural setting of Heart Lake Road is distinctive and is notable to those travelling along this section of the road. Heart Lake Road is a popular route for cyclists and the conservation area is a popular destination with more than five million visitors since it opened in 1957 (City of Brampton 2018). Therefore, Heart Lake Road meets criterion 3.iii of O. Reg. 9/06.

5.2 SUMMARY OF EVALUATION

Heart Lake Road, between Sandalwood Parkway and Mayfield Road met five criteria (2.i, 2.ii, 3.i, 3.ii, and 3.iii) of O. Reg. 9/06. Therefore, Heart Lake Road has CHVI for historical/associative and contextual reasons and warrants designation under Part IV of the *Ontario Heritage Act*.

5.3 STATEMENT OF CULTURAL HERITAGE SIGNIFICANCE

Heart Lake Road is a two-lane, rural road set in a significant natural setting that has strong historical associative value and contextual heritage value. Its historical value is related to its associations with early road building techniques in the City of Brampton and the TRCA through its connection to the Heart Lake Road Conservation Area. Heart Lake Road and its surrounding land has also yielded, and has potential to further yield, information regarding Indigenous land use and culture due to the archaeological potential of the area and high number of archaeological sites dating to the Archaic period.

Historically, there were three successive attempts to settle the Heart Lake Road area. The first attempts were made by John Pettit Jr, George Coon, and Thomas Graham in 1819. All three landowners were unable to settle the land and returned their grants since the land was too swampy to settle, which made farming difficult if not impossible (City of Brampton 2014: 7-8). Richard Stinson successfully settled Concession 2E, east quarter of Lot 16 between 1823 and 1827. King's College (subsequently the University of Toronto) was granted a Crown patent for 200 acres in 1828. King's College subsequently subdivided the lot and sold it off during the mid-19th century. The swampy nature of Heart Lake Road, and the difficulties experienced by early settlers, support the claim that Heart Lake Road was originally constructed as a corduroy road. 19th century corduroy roads consisted of laying young trees (cut in similar size) side by side across a road to create a passable surface. This construction technique was reserved for areas with soft, swampy ground that could not be drained. While no direct evidence (i.e. archival photos, maps, or travelers accounts) exists to definitively prove that Heart Lake Road was a corduroy road, it is highly likely that this road construction technique was used here due to the undulating topography and historically documented swampy conditions.

Heart Lake Road has direct, historical associations with the Toronto and Region Conservation Area (TRCA). The Heart Lake Conservation Area was formed in 1956 and was opened to the public in 1957. Mid-century improvements to Heart Lake Road were likely completed in response to the opening of the conservation area. Presently, Heart Lake Conservation Area is one of the largest natural green space areas in the City of Brampton. The entire west side of the Heart Lake Road between Sandalwood Parkway and Mayfield Road is owned and operated by the TRCA.

Heart Lake Road has the potential to yield information that contributes to an understanding of a community or culture. As identified in the draft listing report prepared by the City of Brampton, Heart Lake Road and its surrounding lands have archaeological potential and known archaeological sites related to the Paleo-Indian Period (10000-7000 BC), Archaic Period (7000-1000 BC), Initial Woodland Period (1000 BC to AD 700), and Late Woodland Period (AD 700-1651) are well documented in the area. Specifically, a high number of Indigenous campsites from the Archaic Period were discovered in the area by the TRCA during 2007 excavations of the Heart Lake Road Conservation Area, which has resulted in the area being dubbed "The Stopover Site" (City of Brampton 2014).

Heart Lake Road has contextual value since it maintains and supports the surrounding natural character of the area, is functionally, visually, and historically linked to its surroundings, and acts as a landmark. Heart Lake Road retains its rural cross section and is surrounded by significant natural land, including forested land on the west and agricultural land, kettle lakes, and wetland on the east. When considered together with its rare surroundings, Heart Lake Road is a unique roadscape within the City of Brampton.

Heart Lake Road, between Sandalwood Parkway and Mayfield Road is important in maintaining and supporting the character of the surrounding landscape. Although improved and updated, Heart Lake Road still maintains its rural road cross section with two lanes of traffic, gravel shoulders, and ditches. As a rural road, Heart Lake Road supports and maintains the significant natural areas on the east and west sides of the road, which are now rare in the City of Brampton. Specifically, the Heart Lake Road Conservation Area, located on the west side of Heart Lake Road, is an Environmentally Significant Area (ESA), Provincially Significant Wetland (PSW), and Area of Natural and Scientific Interest (ANSI). Heart Lake Conservation Area contains six provincially rare vegetative community types, the remaining portions of Brampton Buried Esker, and 26 species of threatened bird species, including the Barn Swallow and Trumpeter Swans. The Eastern Snapping Turtle and Eastern Milksnake are found at the Heart Lake Conservation Area; both are provincially and nationally designated species of Special Concern. Over 48% of the conservation area is covered with forest, which is rare since most forests within Peel Region were cleared for agricultural purposes during the 19th century (City of Brampton 2014:11). The rural setting of Heart Lake Road, including the TRCA lands on the west side of the road and mix of agricultural lands and forested land, and kettle lakes on the east side of the road support and maintain the significant natural heritage value present along the road between Sandalwood Parkway and Mayfield Road. The continuing rural and relatively undeveloped setting of the road is unique in the City of Brampton, which has become increasingly urbanized.

Heart Lake Road is functionally, visually, and historically linked to its surroundings. The road is functionally and historically linked to its surrounding context since it has been used as a rural road since the road was opened in 1819. With the exception of the physical condition of the road, which was improved in the mid-20th century and again in 1987, the surrounding context of Heart Lake Road has remained remarkably intact. Specifically, the forested lands on the west side of the road and the agricultural lands, kettle lakes, and wetlands on the east side of the road are rare within the City of Brampton. In addition, Heart Lake Road is visually linked to its surroundings. The rural character of the road, the conservation area on the west, and open rural/agricultural land on the east together create a unique roadscape that is primarily defined by its naturalized, undeveloped character.

Heart Lake Road acts as a landmark within the City of Brampton. The section of Heart Lake Road between Sandalwood Parkway and Mayfield is visually distinctive from surrounding roads. Heart Lake Road is bordered by development to the east, south, and west. Highway 410 borders Heart Lake Road to the north. Despite the surrounding development, Heart Lake Road retains its rural cross section and offers views to the adjacent natural heritage resources, including forests, kettle lakes, wetlands, and agricultural fields. The natural setting of Heart Lake Road is distinctive and is notable to those travelling along this section of the road. Heart Lake Road is a popular route for cyclists and the conservation area is a popular destination with more than five million visitors since it opened in 1957 (City of Brampton 2018).

5.4 HERITAGE ATTRIBUTES

Based on the evaluation of CHVI, the following heritage attributes were identified for Heart Lake Road between Sandalwood Parkway and Mayfield Road:

- Rural cross section of the road, including the width of the road, two lanes of traffic, and ditching (where present);
- Bend in the road to avoid TRCA wetland, approximately 500 metres southeast of Mayfield Road;
- Intermittent presence of split rail and post-and-rail fencing along the road side;
- Wood utility poles along the road side;
- Natural topography of adjacent lands, including the remaining sections of the Brampton Buried Esker;
- Potential, and known, archaeological sites;
- Likely historical association with corduroy road construction techniques;
- Historical association with the Heart Lake Conservation Area and TRCA;
- Linear corridor views along Heart Lake Road, bordered by significant natural areas; and
- Natural setting of the roadscape, including forests, wetlands, and kettle lakes on the west side of the road and wetlands, agricultural fields, and kettle lakes on the east side of the road.

6.0 EVALUATION OF ALTERNATIVES

6.1 ROAD CLASSIFICATION

Table 19 presents the characteristics of roads in relation to their classification. Currently, Heart Lake Road is classified as an arterial road. According to **Table 19**, the main characteristics associated to minor arterials are the followings:

- Typical daily motor vehicle traffic volume (both directions) is between 8,000 and 20,000 vehicles per day;
- The minimum number of peak period lanes (excluding bicycle lanes) is two lanes;
- Flow is uninterrupted except at signals and crosswalks;
- The legal speed limit is between 40 and 60 km/h;
- There are generally no restrictions for heavy trucks;
- Wide curb lane or special facilities are desirable for cyclists.

Based on analysis presented in the previous chapters, the following issues and challenges are noted on Heart Lake Road:

- Heart Lake Road has CHVI for historical/associative and contextual reasons and warrants designation under Part IV of the Ontario Heritage Act;
- Heart Lake Road, between Sandalwood Parkway and Countryside Drive, is known as a “hotspot” for wildlife mortality;
- Daily traffic (both directions) is about of 7,000 veh/day and is not expected to grow significantly;
- Vehicles travelling on Heart Lake Road currently exceed the speed limit, which reduces safety on the corridor;
- Heart Lake Road is identified as a candidate for bicycle lane in the latest City of Brampton Transportation Master Plan; and
- Heavy trucks are prohibited on Heart Lake Road.

Because of the above, it is recommended that Heart Lake Road, between Sandalwood Parkway and Mayfield Road, be classified as a collector road instead of an arterial road. The section on Heart Lake Road between Sandalwood Parkway and Bovaird Drive should also be classified as a collector road. An amendment should be made to Schedule B of the Official Plan to identify this recommended roadway classification.

The proposed road classification of Heart Lake Road makes it possible to develop alternatives capable of responding to issues and challenges listed above while being in line with road classification criteria shown in **Table 19**. A posted speed of 50 km/hr is then recommended along the corridor.

Table 19 Road Classification Criteria

Characteristic	Locals	Collectors	Minor Arterials	Major Arterials	Expressways
Traffic movement versus property access	Property access primary function	Traffic movement and property access of equal importance	Traffic movement primary consideration; some property access control	Traffic movement primary consideration; subject to property access control	Traffic movement primary consideration; no property access
Typical daily motor vehicle traffic volume (both directions)	<2,500	2,500 -8,000	8,000 - 20,000	> 20,000	> 40,000
Minimum number of peak period lanes (excluding bicycle lanes)	One (One-way streets) or two	One (one-way streets) or two	Two	Four	Four
Desirable connections	Locals, collectors	Locals, collectors, arterials	Collectors, arterials	Collectors, arterials, expressways	Major arterials, expressways
Flow characteristics	Interrupted flow	Interrupted flow	Uninterrupted except at signals and crosswalks	Uninterrupted except at signals and crosswalks	Free-flow (grade separated)
Legal speed limit, km/h	40 - 50	40 - 50	40 - 60	50 -60[2]	80 - 100
Accommodation of pedestrians	Sidewalks on one or both sides	Sidewalks on both sides	Sidewalks on both sides	Sidewalks on both sides	Pedestrians prohibited
Accommodation of cyclists	Special facilities as required		Wide curb lane or special facilities desirable	Cyclists prohibited	
Surface transit	Generally not provided	Permitted	Preferred	Preferred	Express pical buses only
Surface transit daily passengers	Not applicable	<1,500	1,500 - 5,000	> 5,000	Not applicable
Heavy truck restrictions (e.g. seasonal or night time)	Restrictions preferred	Restrictions permitted	Generally no restrictions	Generally no restrictions	No restrictions
Typical spacing between traffic control devices[2], m	0 - 150	215 - 400	215 - 400	215 - 400	Not applicable
Typical right-of-way width, m	15- 22	20 - 27	204 -305	204 -455	> 455

Notes:
1. Private roads and lanes (public or private) are not part of this classification system.
2. A number of major arterial roads have speed limits which fall outside this range, as noted in Table 2: Speed Limit.
3. Traffic control devices refer to traffic control signals, pedestrian crossovers and 'Stop' signs.
4. 20 m rights-of-way exist on many downtown or older arterial roads. New arterial roads should have wider rights-of-way.
5. Wider rights-of-way (within the ranges given) are sometimes required to accommodate other facilities such as utilities, noise mitigation installations, bicycle facilities, and landscaping. For new streets, wider rights-of-way (upper end of ranges given) should be considered to accommodate such facilities.

Source: City of Toronto, Road Classification System, Summary Document, August 2013

6.2 CATEGORIES OF ALTERNATIVES

Based on findings made in Chapters 3, 4 and 5, the alternatives were divided into three (3) categories:

- Active transportation to increase the mobility of people with alternative modes to motorized vehicle;
- Traffic calming to increase safety on the corridor; and
- Wildlife treatment to reduce wildlife mortality.

All these alternatives should maintain the cultural heritage attributes described in Section 5.4.

6.3 LIST OF ALTERNATIVES

6.3.1 Development of Alternatives

The following alternatives were developed for each category:

1. Active transportation:
   A. Do nothing;
   B. Two Lanes with Paved Shoulders and Rumble Strips (**Figure 40**);
   C. Two Lanes with Separated Bike Lanes (**Figure 41**);
   D. Two Lanes with Separated Bi-directional Multi-Use Path on one side (**Figure 42**);
   E. Narrow Roadway with Shared Bike Lanes (**Figure 43**);
   F. Hybrid Multi-Use Trail in Heart Lake Conservation Area (**Figure 44**); and
   G. One-way operation with Separated Bike Lanes (**Figure 45** and **Figure 46**).

2. Traffic calming:
   A. Do nothing;
   B. Stop control or mini roundabouts at intersections (Heart Lake Conservation Area/Access to new residential development) (see mini roundabout proposed at access to HLCA access in **Figure 47**);
   C. Speed cushions/lane narrowing with rumble strips;
   D. Traffic deflection at Countryside Drive/One-way operation with separated bike lanes;
   E. Roundabout at Countryside Option 1 (with encroachment on TRCA lands) (**Figure 48**); and
   F. Roundabout at Countryside Option 2 (without encroachment on TRCA lands) (**Figure 49**).

3. Wildlife treatment:
   A. Do nothing;
   B. Maintain solar powered flashing amber lights;
   C. Maintain pavement markings (optical speed bars);
   D. Additional eco-passage tunnel(s);
   E. Wildlife directional fencing; and
   F. Turtle nesting mounts.

6.3.2 Screening of Alternatives

A screening evaluation process is used to identify feasible alternatives to be carried forward to the more detailed phase. The screening evaluation is generally based on the multi-modal transportation opportunities, social and cultural environment, and natural environment, and potential impacts to significant environmental features based on available secondary source information. The purpose of the screening evaluation is to identify alternatives that have potential “fatal flaws” and to remove them from further consideration.

Three sets of assessments were conducted to examine potential preferred solutions for each of the study objectives including enhancing active transportation, traffic calming and reducing wildlife mortality. **Table 20**, **Table 21** and **Table 22** present a description of each of the alternatives as well as results of screening evaluation.

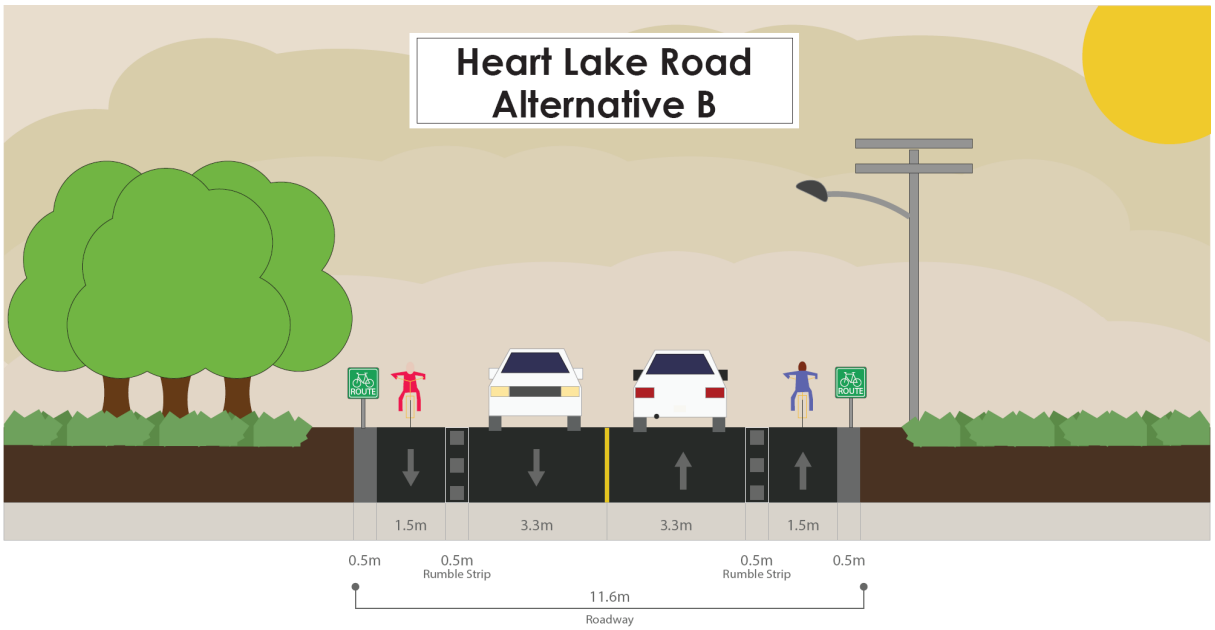


Figure 40 Alternative 1.B | Two Lanes with Paved Shoulders and Rumble Strips

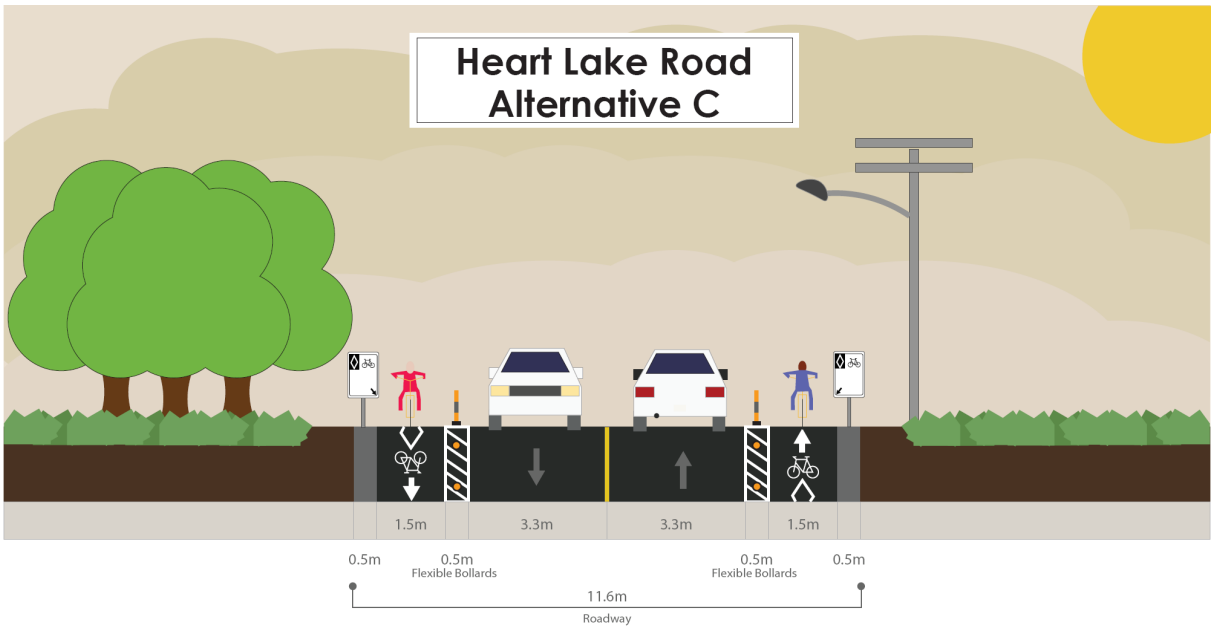


Figure 41 Alternative 1.C | Two Lanes with Separated Bike Lanes

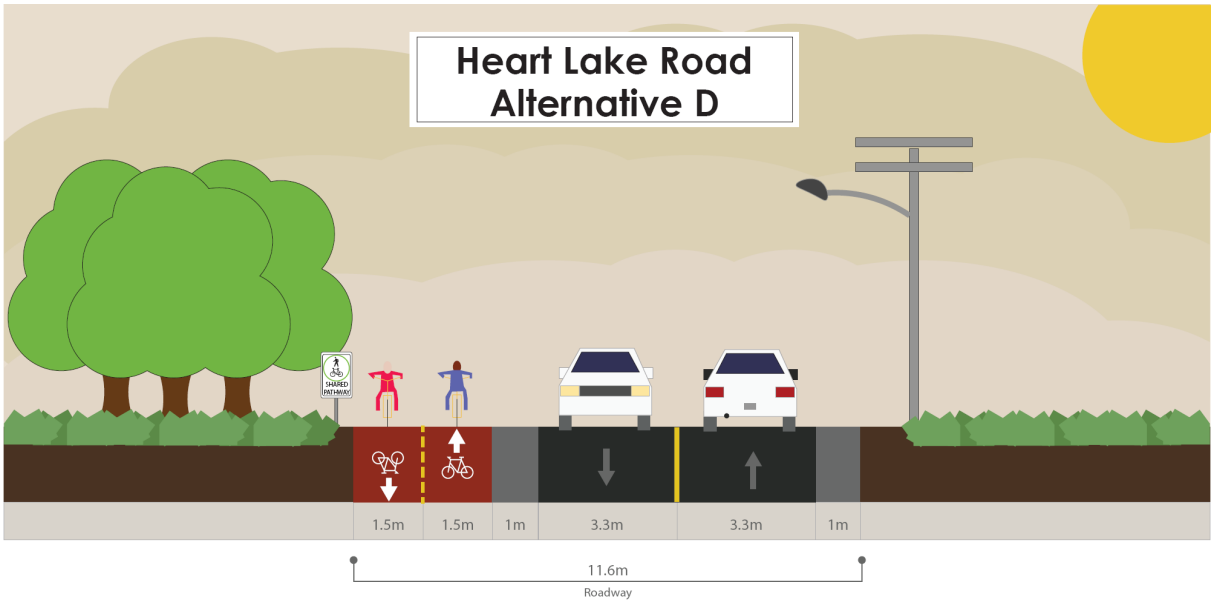


Figure 42 Alternative 1.D | Two Lanes with Separated Bi-directional Multi-Use Path on one side

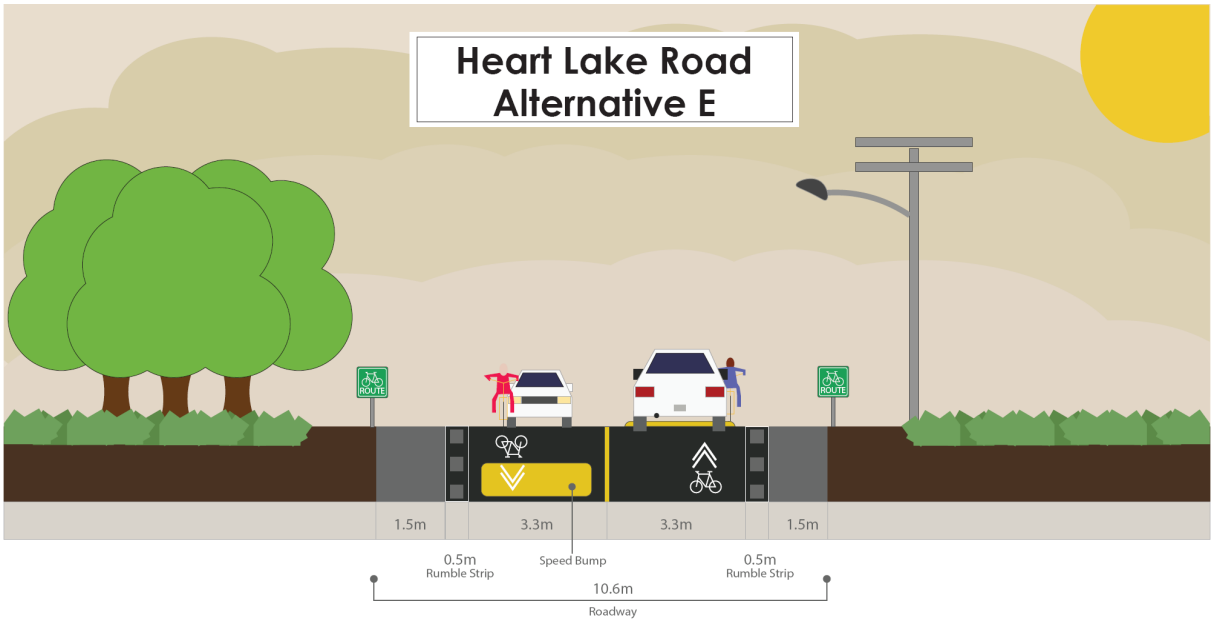


Figure 43 Alternative 1.E | Narrow Roadway with Shared Bike Lanes

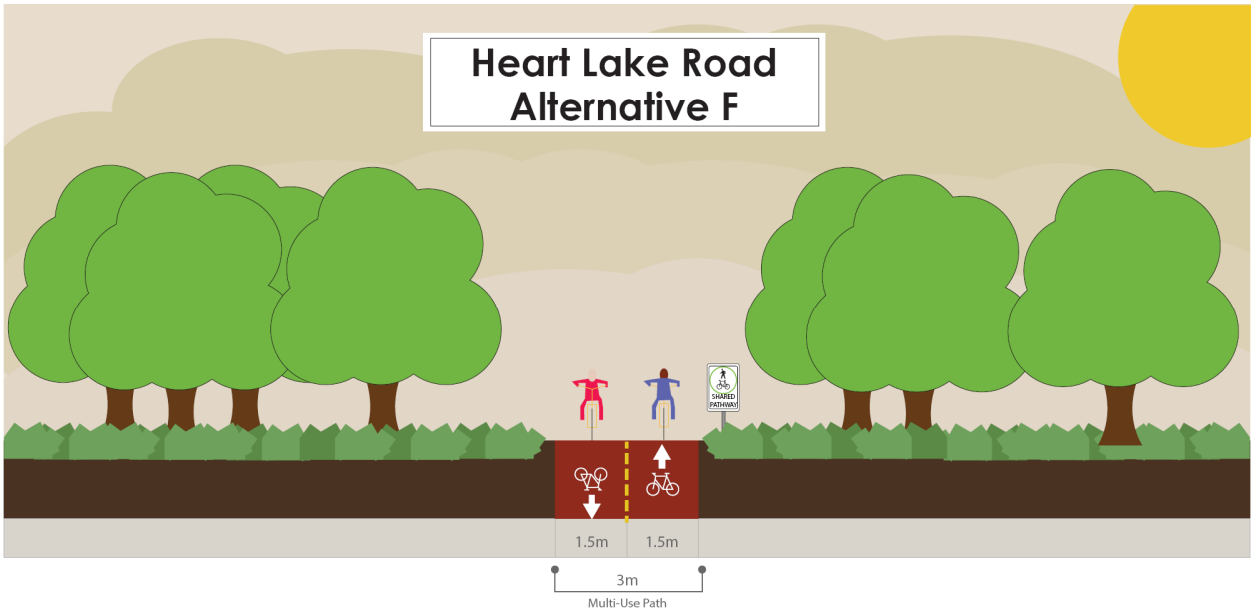


Figure 44 Alternative 1.F | Hybrid Multi-Use Trail in Heart Lake Conservation Area

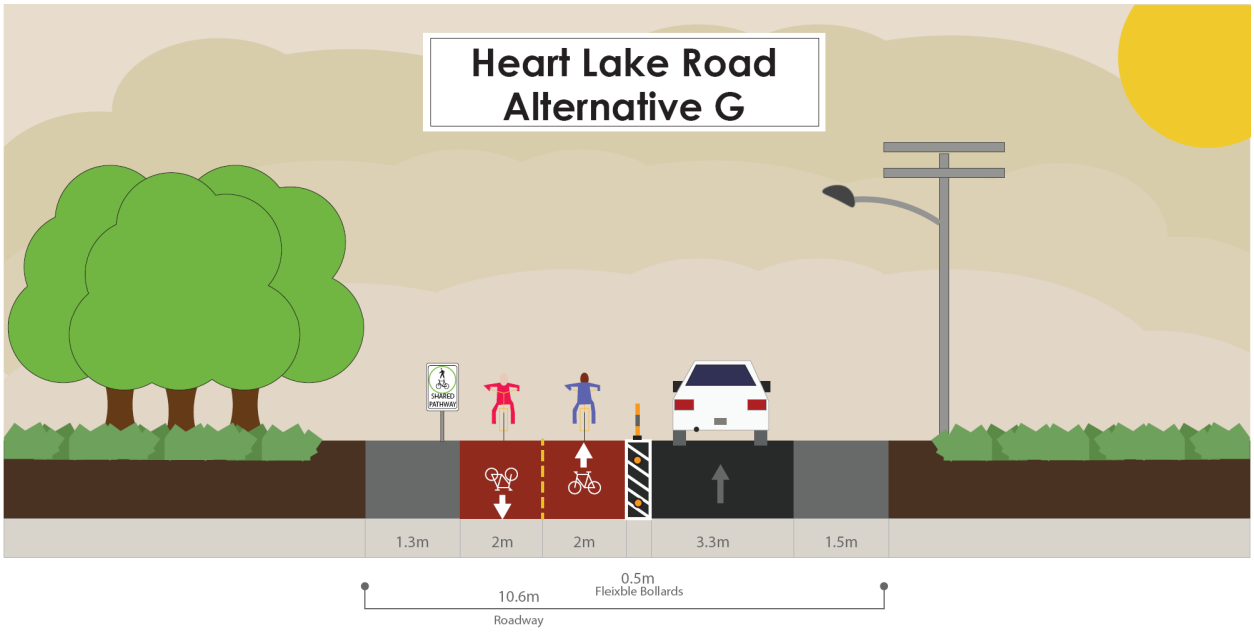


Figure 45 Alternative 1.G | One-way operation with Separated Bike Lanes

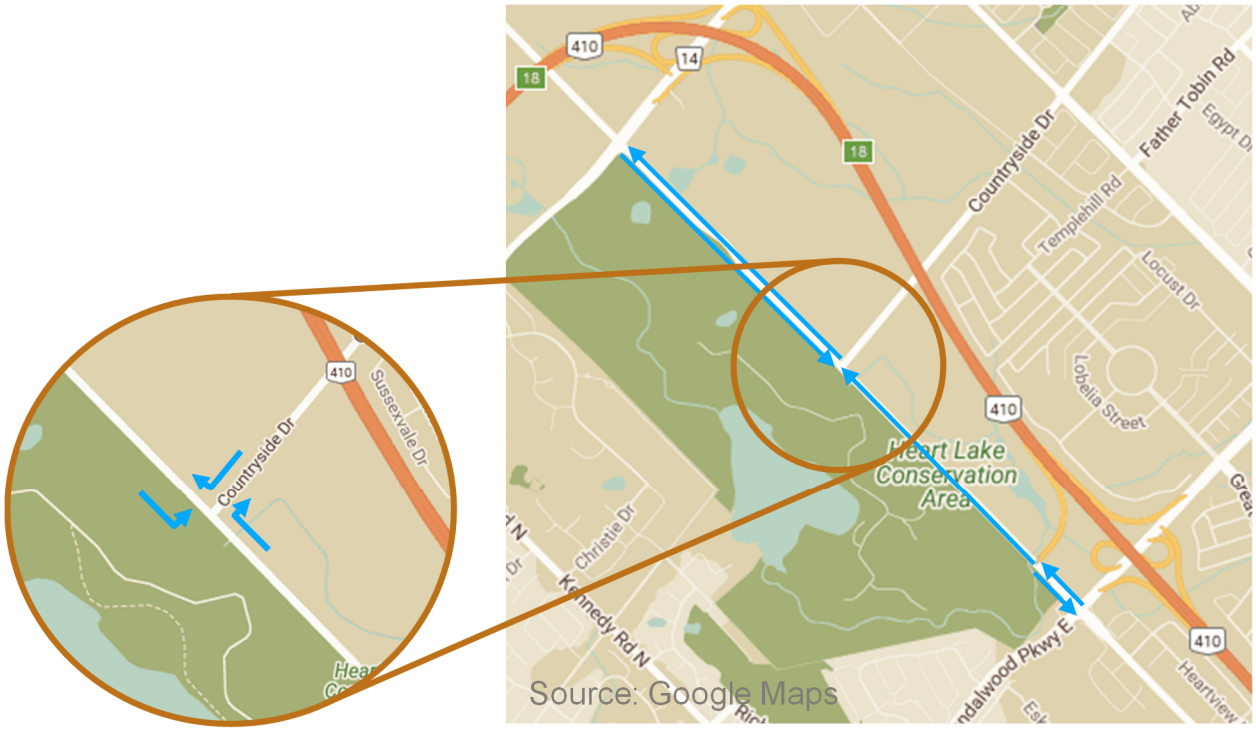


Figure 46 Alternative 1.G | Proposed Road Network

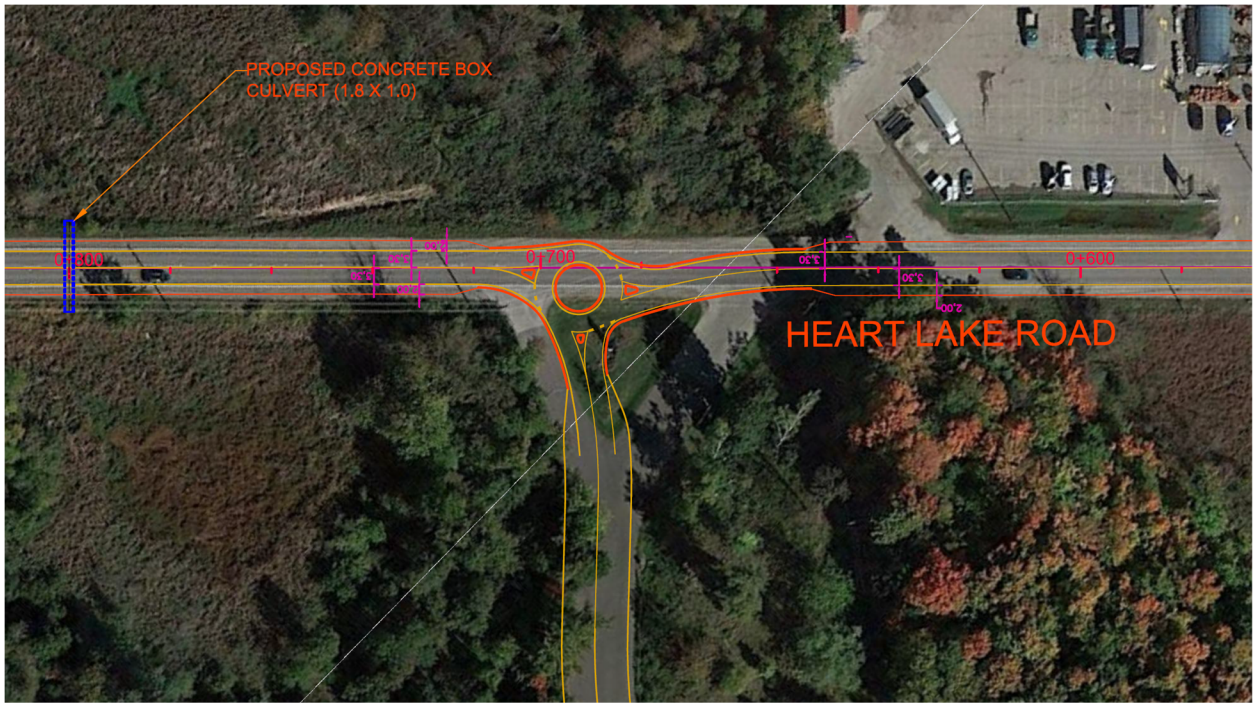


Figure 47 Mini Roundabout proposed at Access to HLCA

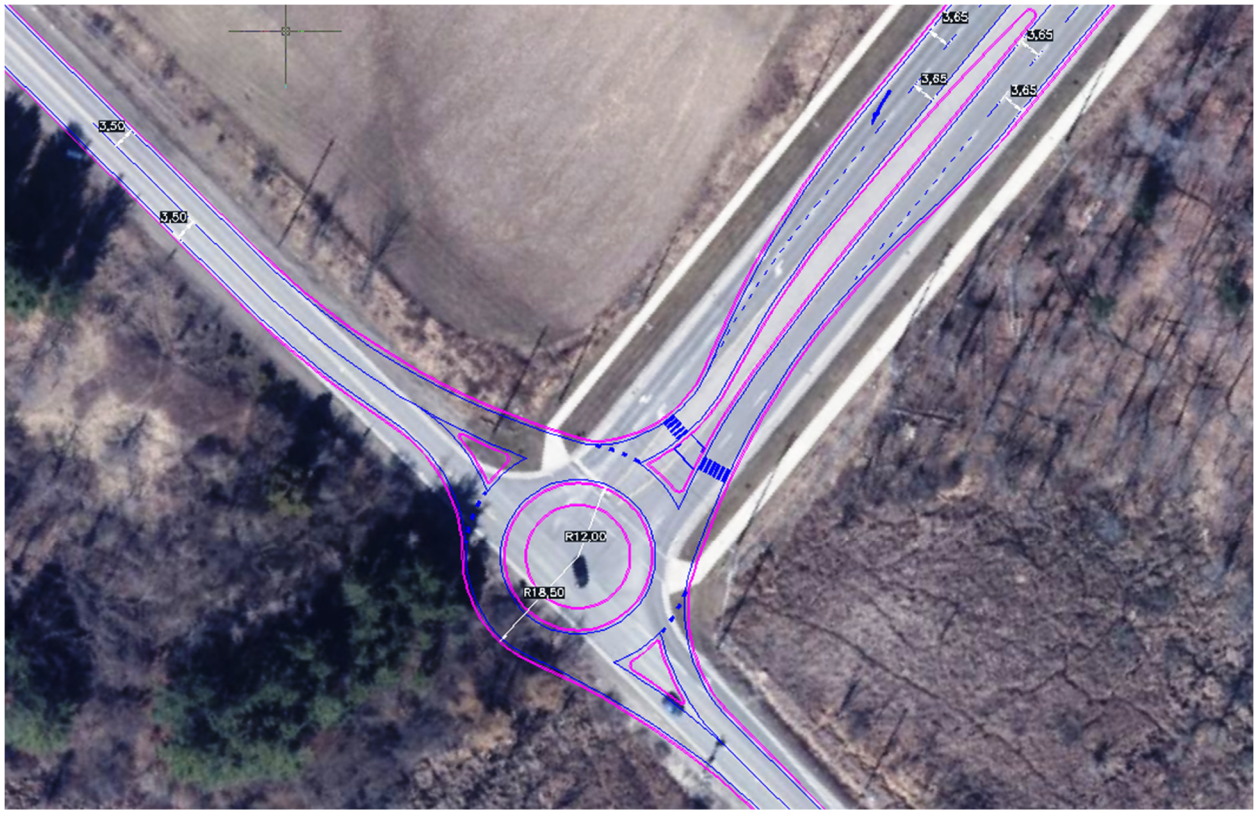


Figure 48 Roundabout at Countryside Option 1 (with encroachment on TRCA lands)

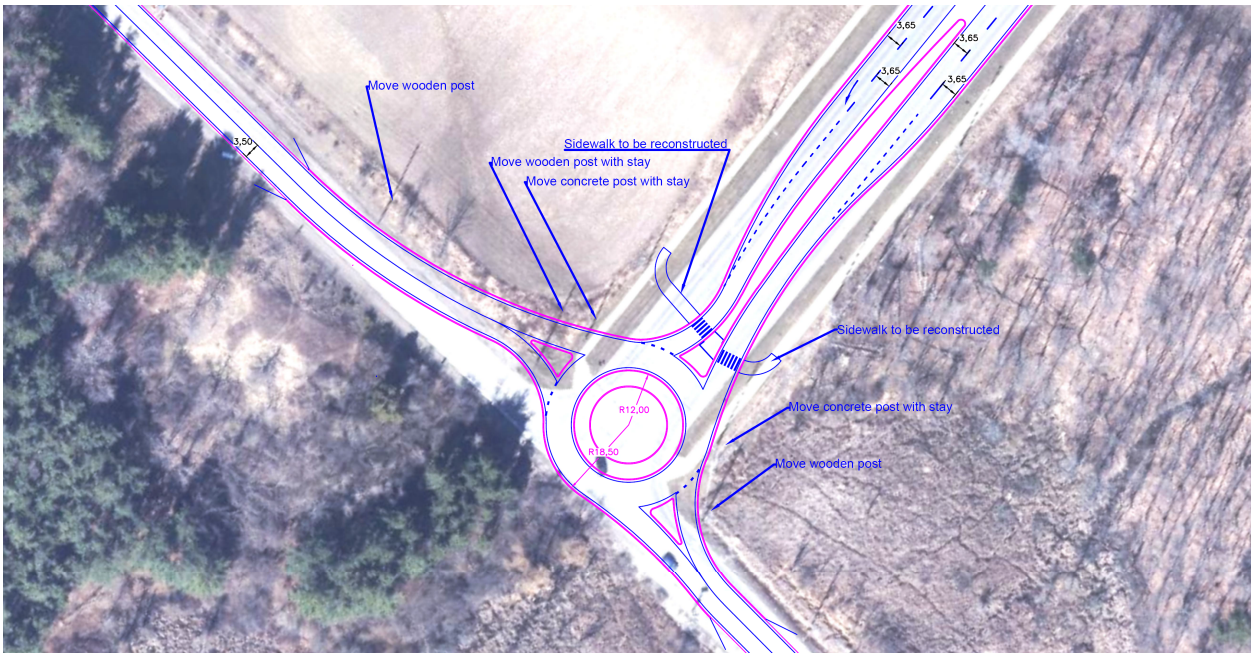


Figure 49 Roundabout at Countryside Option 2 (without encroachment on TRCA lands)

Table 20 Assessment of Active Transportation Alternatives Evaluation

Alternative	Description of Alternative	Results of Screening Evaluation	Alternative Carried Forward?
1.A Do Nothing	The Do Nothing alternative maintains existing operations along Heart Lake Road, with no provisions for cycling, walking, and does not conform to municipal transportation master plan vision.	This alternative is not being carried forward because it does not meet the study purpose or objective of reducing speed on Heart Lake Road or providing cycling infrastructure. No changes to the land use, natural or social environment adjacent to the study area.	• No
1.B Two Lanes with Paved Shoulders and Rumble Strips	Vehicular lane to be narrowed to 3.3 m with the introduction of a painted 0.5 m rumble strip buffer and 1.5 m paved shoulder for cycling with another 0.5 m of unpaved shoulder.	This alternative supports the study purpose of reducing speed on Heart Lake Road (by narrowing the vehicle lanes) and provides cycling infrastructure on the roadway to accommodate for future development needs. However, this solution only moderately addresses active transportation safety. No changes to the land use, natural or social environment adjacent to the study area.	• Yes; long term solution (dependent on future land development and cycling demand)
1.C Two Lanes with Separated Bike Lanes	Vehicular lane to be narrowed to 3.3 m and the addition of a 0.5 m buffer with flex bollards and 1.5 m paved dedicated bicycle lane and another 0.5 m of unpaved shoulder.	This alternative supports the study purpose of reducing speed on Heart Lake Road (through the use of flex bollards adjacent to the roadway) and provides cycling infrastructure on the roadway to support future development needs. This solution also provides enhanced improvements which addresses active transportation safety. No changes to the land use, natural or social environment adjacent to the study area.	• Yes; long term solution (dependent on future land development and cycling demand)
1.D Two Lanes with Separated Bi-directional Multi-Use Path on one side	Vehicular lane to be narrowed to 3.3 m and a 3.0 m bi-directional multi-use facility would be placed on either the east or west side of the roadway with a 0.5 m shoulder buffer. This would require the vehicular lanes to be shifted to the east of west side.	This alternative supports the study purpose of reducing speed on Heart Lake Road and provides cycling infrastructure on the roadway to provide for future development needs. This solution also provides enhanced improvements to active transportation safety. No changes to the land use, natural or social environment adjacent to the study area.	• Yes; long term solution (dependent on future land development and cycling demand)
1.E Narrow Roadway with Shared Bike Lanes	Vehicular lane to be narrowed to 3.3 m and the overall paved width of the roadway gets narrowed with traffic calming measures along the roadway including speed cushions and mini-roundabouts.	This alternative supports the study purpose of reducing speed on Heart Lake Road and provides minor cycling infrastructure on the roadway. However, this solution provides only minor improvements to active transportation safety with cyclists operating in mixed-traffic. It relies on the effectiveness of traffic calming measures. No changes to the land use, natural or social environment adjacent to the study area.	• Yes; long term solution (dependent on future land development and cycling demand)
1.F Hybrid Multi-Use Trail in Heart Lake Conservation Area	Multi-use trail connections between existing boulevard paths along Countryside Drive and Sandalwood Parkway to connect to the existing internal	This alternative would enhance active transportation connections to and from the corridor to the Heart Lake Conservation Area which is the primary trip generator along the corridor currently. In terms of the roadway	• Yes; short term solution

Alternative	Description of Alternative	Results of Screening Evaluation	Alternative Carried Forward?
	trail within Heart Lake Road Conservation Area.	cross-section, this alternative will result in Heart Lake Road being mostly unchanged beyond intersection improvements at Heart Lake Road and Countryside Drive. No changes to the land use, natural or social environment adjacent to the study area.	
1.G One-way operation with Separated Bike Lanes	Heart Lake Road operate as one-way going northbound between Sandalwood Parkway and Countryside Drive.	• Benefits – Provides a safer cycling environment along Heart Lake Road; – Prevents through traffic along Heart Lake Road between Sandalwood Parkway and Mayfield Road. • Inconvenient: – Vehicular accessibility to / from the Heart Lake Road Conservation Area is reduced: o Vehicles headed SB from the Conservation Area must head northbound and detour through Dixie Road, Kennedy Road, or Highway 410, causing significant delay; o Vehicles entering the Conservation Area from the north will need to use Highway 410 or detour through Sandalwood Parkway. – Detours will increase the distance travelled and vehicle emissions – Detours will exacerbate traffic operations at nearby intersections.	• No

Table 21 Assessment of Traffic Calming Alternatives

Alternative	Description of Alternative	Results of Screening Evaluation	Alternative Carried Forward?
A. Do Nothing	Existing vehicular lane width of 3.5 m make it comfortable for cars and promote faster speeds. No cycling infrastructure in place.	This alternative does not satisfy the study objective and does not provide any measures to reduce traffic speed along the corridor. Existing speed limit compliance is currently 11%.	• No
B. Stop control or mini roundabouts at intersections (Heart Lake Conservation Area/Access to New Residential Development)	Stop signs or traffic circle at Heart Lake Road and Conservation Area Entrance. Posted speed limit to 50 km/h.	This alternative could satisfy the study objectives if a traffic circle is the measure implemented at the intersections (and not a stop sign). A traffic circle would calm traffic at the Heart Lake Conservation Area entrance. A stop sign is not warranted here and would risk issues of non-compliance. Mini roundabouts should be considered for future major development accesses to Heart Lake Road.	• Yes • Sort-term: – Implement traffic circle at Heart Lake Conservation Entrance • Long-term: – Consider traffic circle at major development accesses to

Alternative	Description of Alternative	Results of Screening Evaluation	Alternative Carried Forward?
			Heart Lake Road
C. Speed cushions/lane narrowing with rumble strips	Raised sections of the roadway designed to discourage motor vehicle drivers from travelling at excessive speeds. Reduce speed limit to 50 km/h. Existing vehicular lane width would be narrowed to 3.3 m along with rumble strips to give physical and auditory cues to drivers. Posted speed limit to 50 km/h.	This alternative satisfies the study purpose of reducing the operating speed limit on the roadway and is a recognized measure. The roadway would need to be re-classified as a local collector road as speed cushions and lane narrowing are generally not recommended for rural arterial roadways.	• Yes; Short/Medium term solution • Short-term: – roadway would need to be re-classified as a local collector – Speed cushions implemented. • Medium-term: – Lane Narrowing
D. Traffic Deflection at Countryside Drive/One-way operation with separated bike lanes	Roadway would be closed to general traffic going south from Countryside Drive; would still allow local traffic and general traffic existing northbound. Change Heart Lake Road to one-way operation going northbound between Sandalwood Parkway and Countryside Drive	This alternative does not satisfy the study purpose in that it doesn't reduce traffic speed along the corridor. This alternative will effectively increase traffic volume on certain portions of the roadway and would have minimal impacts on travel speed, despite a potential reaction in the speed limit to 50 km/h.	• No
E. Roundabout at Countryside Option 1	Convert the existing non-signalized intersection at Countryside Drive to a roundabout. Extends into the existing TRCA lands on the west portion of the intersection.	This alternative satisfies the study purpose in that it will reduce traffic speed along the corridor and dissuade trucks of using Heart Lake Road, without preventing them from maneuvering if required. However, TRCA lands will be impacted. As a result, this alternative is considered non-acceptable.	• No
F. Roundabout at Countryside Option 2	Convert the existing non-signalized intersection at Countryside Drive to a roundabout. Does not impact TRCA lands.	This alternative satisfies the study purpose in that it will reduce traffic speed along the corridor and dissuade trucks of using Heart Lake Road, without preventing them from maneuvering if required. There are some property implications on the east side of Heart Lake Road and relocation of concrete electric poles This alternative does not impact TRCA lands and can be considered.	• Yes; long term solution

Table 22 Assessment of Wildlife Treatment Alternatives

Alternative	Description of Alternative	Results of Screening Evaluation	Alternative Carried Forward?
A. Do Nothing	Continue with the existing wildlife mitigation measures (including solar powered flashing amber lights, optical speed bars, eco-passage tunnels, wildlife directional fencing, and turtle nesting mounts) that have been implemented with little post-mitigation monitoring	This alternative does continue to implement wildlife mitigation measures however their effectiveness is yet to be determined	• No
B. Maintain Solar Powered Flashing Amber Lights	This alternative involves a solar operating flashing "seasonal wildlife crossing-reduce speed when flashing" signage	This alternative provides notification to drivers to reduce their speed due to the presence of wildlife crossing Heart Lake Road. Its effectiveness is yet to be determined. This option (alone) will continue to result in conflicts between wildlife and vehicles.	• Yes; short term solution
C. Maintain Pavement Markings (optical speed bars)	Painted lines on the roadway meant to reduce the average speed of vehicles along Heart Lake Road.	This alternative has been implemented however its effectiveness in decreasing speed along Heart Lake Road is yet to be determined. This option (alone) will continue to result in conflicts between wildlife and vehicles.	• Yes; short term solution
D. Additional Eco-Passage Tunnel(s)	Eco-passage tunnel or wildlife crossing are designed to provide a safe means for amphibians or reptiles to cross Heart Lake Road therefore avoiding traffic.	This alternative has been implemented adjacent to one of the identified wildlife fatality areas. Long term solution would include implementing additional eco-passage tunnels in adjacent identified hot spot locations.	• Yes; short term solution
E. Wildlife Directional Fencing	Designed to provide a barrier from turtles from crossing the road.	This alternative assists with preventing wildlife from accessing the roadway and directs them to the existing eco-passage tunnel.	• Yes; short term solution
F. Turtle Nesting Mounts	Man-made mound designed to create an alternative away from the road for both females and hatchlings.	This alternative assists with providing a save area for females and hatchlings to nest. There are minor impacts to vegetation during the construction of the nesting mound.	• Yes; short term solution

6.3.3 Results of Screening

That attached matrix provides a high level, reasoned argument approach to evaluating one alternative compared to another. After reviewing the preliminary evaluation of alternatives for all three types of problems encountered with Heart Lake Road (Assessment of Transportation Alternatives, Assessment of Traffic Calming Alternatives, and Assessment of Wildlife Treatment Alternatives), a few of the alternatives are recommended for further consideration.

6.4 EVALUATION CRITERIA

Evaluation criteria have been developed based on existing conditions and background data, meetings with City officials and the Toronto Regional Conservation Authority (TRCA). The evaluation criteria are independent variables, each of which may contribute a positive or negative influence on the overall suitability of an alternative.

The evaluation criteria for the assessment of transportation alternatives consist of three main categories:

- Multi-modal Transportation;
- Social and Cultural Environment;
- Natural environment.

Within each of these three main categories, a number of criteria and factors were considered when evaluating each of the seven transportation alternative options as detailed in **Table 23**.

Table 23 Evaluation Criteria and Factors Considered

Category	Criteria	Factors Considered
Multi-modal transportation	Roadway geometrics	Satisfies desirable design criteria
	Access	Proximity to Community Facilities
	Traffic engineering	Impacts to Traffic Operations
	Speed	Reduce Speed km/hr
	Cycling	Attract cyclists to promote bicycle connectivity
	Safety	Improve safety for all road users
Social and Cultural Environment *	Built cultural heritage features	Preserve Cultural Heritage Features
	Agricultural resources	Minimize impacts to agricultural lands
	Land use	Minimize impacts to existing residential/recreational properties
	Economic environment	Accommodate planned development and growth
Natural Environment*	Designated natural areas	Minimize Impacts to Designated Natural Areas
	Wildlife and terrestrial habitat	Minimize impacts to wildlife
	vegetation	Minimize impacts to vegetation
	Surface water and drainage	Minimize Impacts to Surface Water and Ground Water

6.5 EVALUATION MATRIX

Table 24, **Table 25** and **Table 26** present the detailed evaluation of alternatives. Each alternative was evaluated based on the following preference factors:

✓ Moderately preferred;
– Least preferred; and
X Fail.

Table 24 Evaluation of Transportation Alternatives

Category	Criteria	Factors	Transportation Alternatives						
			1.A Do Nothing	1.B Two Lanes with Paved Shoulders and Rumble Strips	1.C Two Lanes with Separated Bike Lanes	1.D Two Lanes with Separated Bi-directional Multi-Use Path on one side	1.E Narrow Roadway with Shared Bike Lanes	1.F Hybrid Multi-Use Trail in Heart Lake Conservation Area	1.G One-way operation with Separated Bike Lanes
Multi-Modal Transportation	Roadway Geometry	Satisfies Desirable Design Criteria	– The existing vehicular lane widths of ~3.5m make the roadway more comfortable for cars and promote faster speeds .	✓ Would require the vehicular lane to be narrowed to 3.3m and the addition of a painted 0.5m rumble strip buffer and 1.5m paved shoulder for cycling with and another 0.5m of unpaved shoulder. The existing un-paved shoulder would have to be partially paved. (MTO, 2013) A 0.5m painted buffer would be required.	✓ Would require the vehicular lane to be narrowed to 3.3m and the addition of a 0.5m buffer with flexible bollards and 1.5m paved dedicated bicycle lane and another 0.5m of unpaved shoulder. The existing un-paved shoulder would have to be partially paved and flexible bollards would have to be installed. (MTO, 2013) A 0.5m painted buffer would be required.	✓ Would require the vehicular lane to be narrowed to 3.3m and a 3.0m bi-directional multi-use facility would be placed on either the east or west side of the roadway with a 0.5m shoulder buffer. This would require the vehicular lanes to be shifted to the east or west side. (MTO, 2013). A controlled crossing is required at Countryside Drive and future access to residential development.	✓ Would require the vehicular lane to be narrowed to 3.3m and the overall paved width of the roadway gets narrowed with traffic calming measures along the roadway including speed cushions and mini roundabouts. The rationale is to make the roadway feel less like a high-speed route and more like a slower local route.	* Would require appropriate multi-use trail connections between existing boulevard paths along Countryside Drive and Sandalwood Parkway to connect to the existing internal trail within the Heart Lake Conservation Area. Pedestrians would also be accommodated on the multi-use trail. Refurbishment of the existing trail/old access road entrance opposite Countryside Drive is required.	× Change Heart Lake Road to one-way operation going northbound between Sandalwood Parkway and Countryside Drive. This alternative will increase the travel distance from Heart Lake Road (north) to the Conservation Area by 1.8km, and from the Conservation Area to Heart Lake Road (south) by 4.0km.
	Access	Proximity to Community Facilities	✓ Existing vehicular access to facilities maintained. × Currently requires cyclists to share the roadway (ride with traffic) along Heart Lake Road which provides a direct access to the main Heart Lake Conservation Area Entrance and other properties along the corridor.	✓ Existing vehicular access to facilities maintained. – Would provide direct access to the main Heart Lake Conservation Area entrance off of Heart Lake Road. A cyclist will have to ride with traffic along Heart Lake Road to access the Conservation Area entrance.	✓ Existing vehicular access to facilities maintained. ✓ Would provide direct access to the main Heart Lake Conservation Area entrance off of Heart Lake Road. A cyclist will have to ride with traffic along Heart Lake Road to access the Conservation Area entrance.	✓ Existing vehicular access to facilities maintained. ✓ Would provide a direct access into the Heart Lake Conservation Area and reduce conflict points for active transportation road users if the multi-use facility were to be placed on the west side of the roadway.	✓ Existing vehicular access to facilities maintained. ✓ Would provide direct access to the main Heart Lake Conservation Area entrance off of Heart Lake Road and would require cyclists exiting towards the north and entering from south to cross one vehicular lane of traffic.	* Would provide a direct access into the Heart Lake Conservation Area and reduce conflict points via protected crossings for entering and exiting. – Does not provide continual/direct access to all destinations along Heart Lake Road. * Trail could also accommodate pedestrians	× Vehicular access to destinations along Heart Lake Road will be limited to access from the south.
	Traffic	Impacts to Traffic Operations	× Maintain existing operations. Does not promote cycling or walking, does not conform with the municipal transportation master plan vision.	✓ Little to no impacts on traffic operations.	✓ Little to no impacts on traffic operations.	✓ Little to no impacts on traffic operations.	✓ May generate minor impacts on adjacent corridors by making the corridor less appealing for through vehicles.	✓ Little to no impacts on traffic operations. Conforms to municipal transportation master plan vision.	× Significant impacts to traffic operations, would require extra travel distance for vehicles to travel southbound from within the corridor. Would also generate impacts on adjacent corridors.
	Speed	Reduce Speed	– The roadway will maintain poor speed compliance with the existing compliance rate at 11%, indicating that only 11% of drivers travel at or below the posted speed limit. Heart Lake Road also includes advisory and warning signage which is meant to raise awareness/identify the wildlife crossing potential hazard.	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for 3.3m vehicular lane widths. The rumble strip buffer will further reinforce narrow roadway cues even if visually, the corridor looks wide and rural.	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for 3.3m vehicular lane widths. The physical flexible bollards will create a visual wall to make the roadway look more urban and less rural to promote slower speeds.	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for 3.3m vehicular lane widths. (Columbia Pike Street Space Planning Task Force, 2003) (MTO, 2006) (MTO, 2013)	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for 3.3m vehicular lane widths. The add. of traffic calming measures such as speed cushions and mini roundabouts are effective ways to reduce vehicular speed, volume and increase safety along roadways.	– The roadway will remain mostly unchanged beyond intersection improvements at Heart Lake Road and Countryside Drive that will have minor positive impacts on traffic speed.	– Increase in volume is forecasted on Countryside Drive eastbound due to forced right turns northbound at the intersection of Heart Lake Road and Countryside Drive. It also increases overall trip lengths for vehicles as it forces all vehicles to go northbound. – The option may increase speeding.
	Cycling	Attract Cyclists and Promote Bicycle Connectivity	– Currently no cycling infrastructure is in place.	– The signed route will connect with future and existing boulevard paths on Countryside Drive and Sandalwood Parkway. This facility type has a low attractiveness for cyclists.	* The separated bicycle lane will connect with existing boulevard paths on Countryside Drive and Sandalwood Parkway. This facility type has a high attractiveness for cyclists.	* The separated bi-directional multi-use trail will connect with existing boulevard paths on Countryside Drive and Sandalwood Parkway. This facility type has a high attractiveness for cyclists.	✓ The shared route will connect with existing boulevard paths on Countryside Drive and Sandalwood Parkway. This facility type will be attractive to cyclists based on the effectiveness of traffic calming measures.	* Direct internal connections to Heart Lake Conservation Area will be made to the existing boulevard paths on Countryside Drive and Sandalwood Parkway. A new section of the recreational trail through the Conservation Area lands will complete a gap in the Esker Lake Recreational Trail.	* The separated bi-directional multi-use trail will connect with existing boulevard paths on Countryside Drive and Sandalwood Parkway. This facility type has a high attractiveness for cyclists.
	Safety	Improve Safety for All Road Users	– The roadway will remain unchanged. Speed compliance will remain low and there are no traffic calming measures to help reduce the	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for the narrowed lanes. The lower	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for the narrowed lanes. The	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for the narrowed lanes. The	✓ The operating speeds will be reduced to 50km/h to adhere to appropriate design speed standards for narrowed lanes. Traffic calming	– The roadway will remain mostly unchanged beyond intersection improvements at Heart Lake Road and Countryside Drive that will have	✓ One-way operation would allow cyclists to use the southbound lane for travel along the corridor,

Category	Criteria	Factors	Transportation Alternatives: 1.A Do Nothing	1.B Two Lanes with Paved Shoulders and Rumble Strips	1.C Two Lanes with Separated Bike Lanes	1.D Two Lanes with Separated Bi-directional Multi-Use Path on one side	1.E Narrow Roadway with Shared Bike Lanes	1.F Hybrid Multi-Use Trail in Heart Lake Conservation Area	1.G One-way operation with Separated Bike Lanes
			severity of collisions with vehicles or cyclists beyond the existing speed optical bars.	speed limit will work towards reducing the severity of collisions and the paved shoulders will reduce conflicts between cyclists and vehicles.	dedicated bicycle lanes with flexible bollards will significantly reduce conflicts between cyclists and vehicles by providing physical and visual cues separating the two modes.	separated bi-directional multi-use path will significantly reduce conflicts between cyclists and vehicles by providing complete separation between the two modes.	measures such as speed cushions and mini roundabouts will further reinforce reduced vehicular speeds. There is no dedicated space for cyclists on the roadway and existing conflicts will still remain.	minor positive impacts on traffic speed and collisions.	separated from traffic which would enhance cyclist safety greatly.
Social and Cultural Environment	Built Cultural Heritage Resources and Landscapes	Preserve Cultural Heritage Features	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural characteristics adjacent to the roadway remain intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands
	Agricultural Resources	Minimize Impacts to Agricultural Lands	* No impacts to agricultural lands located north of Countryside Road/east side of Heart Lake Road	* No impacts to agricultural lands located north of Countryside Road/east side of Heart Lake Rd	* No impacts to agricultural lands located north of Countryside Road/east side of Heart Lake Rd	* No impacts to agricultural lands located north of Countryside Road/east side of Heart Lake Rd	* No impacts to agricultural lands located north of Countryside Road/east side of Heart Lake Rd	* No impacts to agricultural lands located north of Countryside Road/east side of Heart Lake Rd	* No impacts to agricultural lands located north of Countryside Road/east of Heart Lake Rd
	Land Use	Minimize Impacts to Existing Residential/ Recreational Properties	* No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * No impact to recreational facilities at Heart Lake Conservation Area	* No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * No impact to recreational facilities at Heart Lake Conservation Area	* No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * No impact to recreational facilities at Heart Lake Conservation Area	* No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * No impact to recreational facilities at Heart Lake Conservation Area	* No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * No impact to recreational facilities at Heart Lake Conservation Area	* No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * Enhanced connections to existing recreational facilities at Heart Lake Conservation Area	× Significant impacts to existing facilities. Would require vehicles leaving the properties along the roadway to travel further to go south. × Would increase the distance vehicles accessing the corridor would have to travel.
	Economic Environment	Accommodate Planned Development and Growth	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	× Would require vehicles leaving the properties along Heart Lake Road to travel much further to go southbound. Would increase the distance vehicles accessing the corridor would have to travel.
Natural Environment	Designated Natural Areas	Minimize Impacts to Designated Natural Areas	* No impacts.	* Work will not occur outside of the Right of Way therefore no impact to Designated Natural Areas	* Work will not occur outside of the Right of Way therefore no impact to Designated Natural Areas	* Work will not occur outside of the Right of Way therefore no impact to Designated Natural Areas	* Work will not occur outside of the Right of Way therefore no impact to Designated Natural Areas	✓ Minor impacts to vegetated areas inside Heart Lake Conservation Area.	* Work will not occur outside of the Right of Way therefore no impact to Designated Natural Areas
	Wildlife and Terrestrial Habitat	Minimize Impacts to Wildlife	* No impacts.	* Paved shoulders may deter turtle nesting sites that exist along gravel shoulders	* Paved shoulders may deter turtle nesting sites that exist along gravel shoulders	* Paved shoulder surface may deter turtle nesting sites that exist along gravel shoulders	* Continue to implement the wildlife signs, concrete box culvert (ecopassage), fencing, and artificial turtle nesting mounds	* Refurbishment to the existing trail/old access road entrance may remove some existing habitat within Heart Lake Conservation Area	* No impacts.
	Vegetation	Minimize Impacts to Vegetation	* No impacts to vegetation; no change to Right of Way	* No impacts to vegetation; no change to Right of Way	* No impacts to vegetation; no change to Right of Way	* No impacts to vegetation; no change to Right of Way	* No impacts to vegetation; no change to Right of Way	* Removal of old growth vegetation within the existing trail/old access road entrance	* No impacts to vegetation; no change to Right of Way
	Surface Water and Drainage	**Minimize Impacts to Surface Water and Ground Water**	– **Salt and/or sand from road winter operations can cause changes in the water quality to neighbouring wetlands and potentially impact surface and groundwater** * **No change to paved portion of shoulder**	– **Salt and/or sand from road winter operations can cause changes in the water quality to neighbouring wetlands** – **Paving a portion of the shoulder would create greater impervious cover**	– **Salt and/or sand from road winter operations can cause changes in the water quality to neighbouring wetlands** – **Paving a portion of the shoulder would create greater impervious cover**	– **Salt and/or sand from road winter operations can cause changes in the water quality to neighbouring wetlands** – **Paving a portion of the shoulder would create greater impervious cover**	– **Salt and/or sand from road winter operations can cause changes in the water quality to neighbouring wetlands** * **No pavement increase to existing shoulder**	– **No salt or fluids originating from vehicles and salt distributing vehicles affect the existing trail/old access road entrance**	– **Salt and/or sand from road winter operations can cause changes in the water quality to neighbouring wetlands** * **No pavement increase to existing shoulder**
Scoring	* Most Preferred		* 7	* 6	* 8	* 7	* 7	* 10	* 6
	✓ Moderately Preferred		✓ 3	✓ 7	✓ 6	✓ 8	✓ 9	✓ 4	✓ 2
	– Least Preferred		– 5	– 4	– 3	– 0	– 1	– 3	– 3
	× Fail		× 2	× 0	× 0	× 2	× 0	× 0	× 6

Table 25 Evaluation of Traffic Calming Alternatives

Criteria	Factors	Traffic Calming Alternatives					
		2.A Do Nothing	2.B Stop control or mini roundabouts at intersections (Heart Lake Conservation Area/New Residential Development)	2.C Speed Cushions Lane Narrowing with rumble strips	2.D Traffic Deflection at Countryside Drive One-way operation with Separated Bike Lanes	2.E Roundabout at Countryside Option 1	2.F Roundabout at Countryside Option 2
Roadway Geometrics	Satisfies Desirable Design Criteria	– The existing vehicular lane widths of 3.5m make the roadway more comfortable for cars and promote faster speeds.	✓ Added stop signs or traffic circle to the Heart Lake Road and Conservation Area Entrance. Traffic circles consist of a raised island located in the centre of an intersection which requires vehicles to travel through the intersection and around the island. Traffic speed would have to be reduced to 50km/h and the roadway would have to be re-classified as either a collector or local roadway.	* Speed cushions are raised sections of the roadway designed to discourage motor vehicle drivers from travelling at excessive speeds. These are an acceptable measure for roadways with low volumes (MTO, 2013). To implement this measure on Heart Lake Road, the traffic speed would have to be reduced to 50km/h and the roadway would have to be re-classified as either a collector or local roadway. * Vehicular lane would be narrowed to 3.3m along with rumble strips to give physical and auditory cues to drivers that they should not use the wider shoulder. (MTO, 2013). This would require a reduction in the speed limit as lane widths of 3m are recommended for roadways that operate at vehicular speeds of 50km/h or less.	– Roadway would be closed to general traffic going south from Countryside Drive but would still allow local traffic and general traffic exiting northbound. – Change Heart Lake Road to one-way operation going northbound between Sandalwood Parkway and Countryside Drive.	– Convert the existing non-signalized intersection at Countryside Drive to a roundabout. This would replace the existing free movement northbound and southbound approaches with yielding approaches going around a raised island. This option is less complex and extends onto the existing TRCA lands on the west portion of the intersection.	✓ Convert the existing non-signalized intersection at Countryside Drive to a roundabout. This would replace the existing free movement northbound and southbound approaches with yielding approaches going around a raised island. This option involves more complexity without impacting the TRCA lands but requires the relocation of hydro lines on the east side of the intersection.
Traffic Calming	Reduce Speed	– The roadway will maintain poor speed compliance with the existing compliance rate at 11% and 85th percentile speeds at 80km/h despite the posted speed limit of 60km/h.	✓ The speed limit will be reduced to 50km/h to adhere to appropriate design speed standards for mini roundabouts. Traffic circles are effective at promoting speed reduction and reducing vehicular volume. (Columbia Pike Street Space Planning Task Force, 2003) (MTO, 2006) (MTO, 2013)	✓ The speed limit will be reduced to 50km/h to adhere to appropriate design speed standards for speed cushions. Speed cushions are highly effective at reducing speed and reducing vehicular volume. ✓ Case studies have found a relationship between narrower road widths and slower vehicular speeds, although a narrow roadway is not the only determining factor and their effectiveness depend on other factors including roadway curvature, roadside development, type of traffic control, among others. The rumble strip buffer will further reinforce narrow roadway cues even if visually, the corridor looks wide and rural.	– This may initially reduce traffic volume, however, deflecting traffic away from the corridor will not help reduce traffic speed along the corridor and may even promote higher speeds as there are few obstacles and vehicular interactions along the roadway. – It would effectively increase volume on certain portions of the roadway and would have minimal impacts on travel speed, despite a potential reduction in the speed limit to 50km/h. It may also increase overall trip length for vehicles as it forces all vehicles to go northbound with the nearest southbound route located far away east of Highway 410.	✓ The roundabout will physically require all vehicles to reduce their speed in order to pass around the raised island. This is highly effective compared to the existing north-south movements that are unimpeded and free-flowing.	✓ The roundabout will physically require all vehicles to reduce their speed in order to pass around the raised island. This is highly effective compared to the existing north-south movements that are unimpeded and free-flowing.
Safety	Improve Safety for all Road Users	× Currently no cycling infrastructure is in place.	✓ A reduced speed limit and addition of a traffic circle will reduce speeds along the roadway and improve cyclist comfort.	✓ A reduced speed limit and addition of speed cushions will reduce speeds along the roadway and improve cyclist comfort. ✓ A narrower roadway will have some effect toward encouraging slower speeds with some minor improvement to cyclist comfort.	– Lower traffic volumes will improve cyclist comfort somewhat, but there would be little improvement to traffic speed. ✓ One-way operation would allow cyclists to use the southbound lane for travel along the corridor, separated from traffic which would enhance cyclist safety greatly.	✓ Slower vehicular operation through the Countryside Drive intersection along with a more direct line-of-sight for cyclists will greatly enhance safety.	✓ Slower vehicular operation through the Countryside Drive intersection along with a more direct line-of-sight for cyclists will greatly enhance safety.
Built Cultural Heritage Resources and Landscapes	Preserve Cultural Heritage Features	✓ Natural character of the roadway remains intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural character of the roadway remains intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural character of the roadway remains intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	✓ Natural character of the roadway remains intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands	× Requires vegetation adjacent to roadway to be removed to accommodate roundabout design × Encroaches on the TRCA lands	✓ Natural characteristics adjacent to the roadway remains intact; comprised of varied topography, wetlands, treed ridges, forested areas, and rolling agricultural lands

Criteria	Factors	Traffic Calming Alternatives					
		2.A Do Nothing	2.B Stop control or mini roundabouts at intersections (Heart Lake Conservation Area/New Residential Development)	2.C Speed Cushions Lane Narrowing with rumble strips	2.D Traffic Deflection at Countryside Drive One-way operation with Separated Bike Lanes	2.E Roundabout at Countryside Option 1	2.F Roundabout at Countryside Option 2
Land Use	Minimize Impacts to Existing Residential/ Recreational Properties	✓ No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre ✓ No impact to recreational facilities at Heart Lake Conservation Area	✓ No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre * Would enhance access to the recreational facilities at Heart Lake Conservation Area by slowing traffic down at the access	✓ No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre ✓ No impact to recreational facilities at Heart Lake Conservation Area	× Significant impacts to planned residential developments, and existing commercial and recreational facilities. Would prevent access to site along the roadway from the north. × One-way operation with separated bike lanes would result in large impacts to planned residential developments, and existing commercial and recreational facilities. Would require vehicles leaving the properties along the roadway to travel much further to go southbound.	✓ No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre ✓ No impact to recreational facilities at Heart Lake Conservation Area	✓ No impacts to residential developments planned in the Metrus Development north of Lakeside Garden Centre ✓ No impact to recreational facilities at Heart Lake Conservation Area
Economic Environment	Accommodate Planned Development and Growth	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ No impact to planned industrial/employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	× Significant impacts to planned residential developments, and existing commercial and recreational facilities. Would prevent access to site along the roadway from the north. Would increase the distance vehicles accessing the corridor would have to travel. × One-way operation with separated bike lanes would result in large impacts to planned residential developments, and existing commercial and recreational facilities. Would require vehicles leaving the properties along the roadway to travel much further to go southbound. Would increase the distance vehicles accessing the corridor would have to travel.	✓ Improved connections between the east and west sides of the roadway for planned industrial / employment development; Private School development; residential development within the Countryside Villages Secondary Plan area	✓ Improved connections between the east and west sides of the roadway for planned industrial / employment development; Private School development; residential development within the Countryside Villages Secondary Plan area
Designated Natural Areas	Minimize Impacts to Designated Natural Areas	✓ No impacts to designated natural areas.	✓ No impacts to designated natural areas.	✓ No impacts to designated natural areas.	✓ No impacts to designated natural areas.	× Impacts to lands associated with the Heart Lake Conservation Area	✓ Minor impact to lands adjacent to the intersection of Countryside Dr and Heart Lake Rd
Wildlife and Terrestrial Habitat	Minimize Impacts to Wildlife	✓ No impacts to wildlife.	✓ No impacts to wildlife.	✓ No impacts to wildlife.	✓ No impacts to wildlife.	✓ No impacts to wildlife anticipated.	✓ No impacts to wildlife anticipated.
Vegetation	Minimize Impacts to Vegetation	✓ No impacts to vegetation.	✓ No impacts to vegetation.	✓ No impacts to vegetation.	✓ No impacts to vegetation.	– Impacts to vegetation; change to Right of Way at Heart Lake Rd.	✓ No impacts to vegetation; moderate change to Right of Way off Countryside Dr and Heart Lake Road.

Table 26 Evaluation of Wildlife Treatment Alternatives

Criteria	Factors	Wildlife Treatment Alternatives					
		3.A Do Nothing	B Maintain Solar Powered Flashing Amber Lights	C Maintain Pavement Markings (optical speed bars)	D Additional Eco-Passage Tunnel(s)	E Wildlife Directional Fencing	F Turtle Nesting Mounds
							
Designated Natural Areas	Minimize Impacts to Designated Natural Areas	Existing wildlife mitigation measures have been recently implemented and there is little post-mitigation monitoring	No effect to minimize impacts to Designated Natural Areas	No effect to Designated Natural Areas	Provides connection to Designated Natural Areas and habitat	Provides protection for turtles from crossing the road	Provides a mitigation tool used to reduce mortality of nesting females and hatchlings
Terrestrial Habitat Design Factors	Minimize Impacts to Wildlife	Current mitigation measures used to minimize impacts to wildlife have not been determined if the effectiveness of the signage is working	Minimal impact on driver behaviour to slow down due to presence of wildlife habitat	No effect to minimize impacts to wildlife	Provides off road passage of turtles/frogs/snakes between vegetated areas	Provides protection to turtles wishing to cross the roadway	Proves a mitigation tool used to reduce mortality of nesting females and hatchlings
	Minimize Impacts to Vegetation	No impact to vegetation that exists along Heart Lake Road	No effect on Vegetation	No effect on Vegetation	✓ Minor impact to vegetation at the entrance and exit	✓ Minor impact to vegetation along the roadway edge of pavement	✓ Minor impacts to vegetation during the construction of the turtle nesting mounds

7.0 PREFERRED ALTERNATIVE

Three categories of solutions were screened and evaluated in Chapter 6:

- Active Transportation: Seven alternatives (including the do nothing alternative) focusing on accommodating active transportation activities.
- Traffic Calming: Six alternatives (including the do nothing alternative) were evaluated that focused on various traffic calming alternatives.
- Wildlife Mortality Mitigation: Six alternatives (including the do nothing alternative) were examined for the assessment of wildlife treatments along Heart Lake Road.

The following sections present the preferred alternatives following the analyzes performed.

7.1 SHORT TERM

The short-term alternatives recommended over a 2-year horizon include the following:

- Wildlife mortality mitigation:
  - Maintain existing solar powered flashing amber lights;
  - Maintain and re-paint optical speed bars;
  - Install (2) additional eco-passages tunnels at the two “hotspots” where passages are not already installed (**Figure 22**);
  - Permanently install wildlife directional fencing;
  - Implement turtle nesting mounds.

- Traffic calming measures
  - Re-classify the road as a collector road;
  - Lower speed limit to 50 km/h;
  - Implement speed cushions between Mayfield Road and the Highway 401 SB off-ramp;
  - Install a traffic circle at the Conservation Area entrance (**Figure 47**).

- Transportation Improvements:
  - Narrow roadway to include 3.3 m traffic lanes (**Figure 43**);
  - Consider implementing a hybrid multi-use trail through Heart Lake Conservation Area with connections to the existing boulevard path at Heart Lake Road / countryside Drive.

7.2 LONG TERM

The long-term alternatives recommended in the next 5 to 10 years, as development occurs and needs increase, include further study (Schedule C Class Environmental Assessment) of the following:

- Install a roundabout at the intersection of Countryside Drive (**Figure 49**);
- Implement alternative C with separated bike lanes on Heart Lake Road (**Figure 41**).

7.3 ECO-PASSAGES

Figure 51 shows the proposed locations of the two new eco-passages and the longitudinal profile of Heart Lake Road associated with these two new eco-passages.

Based on information provided from the geotechnical investigations on the corridor (see **Appendix E**), it is concluded that eco-passages with concrete boxes 1.8 x 1,5 m^2 (similar to the existing eco-passage south of Countryside Drive) are feasible but would require special measures to ensure a satisfactory lifespan. As a result, the solution recommended is to go with StormTech chambers (**Figure 50**).

Two boreholes were carried out close to station 0+800 (North of Heart Lake Conservation Area Access). According to boreholes logs, there is a peat layer, which thickness varies from 1,1 m to 0,4 m. The depth of the layer varies too, starting on the south side on 3,3 m under the ground level, and on the north side, on 2,6 m. The second location at stationing 0+300 (closer to Sandalwood Parkway) also has a peat layer. However, this is a shallow layer, 1.3 m under the ground level and its thickness is less than a meter.

For alternatives with concrete box culverts, the peat layers on both locations would have to be removed and replace it with class B controlled backfill. This would require an excavation starting from a depth of 4,4 m for the south side and going up to a depth of 3 m for the north side. Despite this not being mandatory with the StormTech chambers, the peat layer removal is recommended.

The concrete box culverts would slightly increase the existing load of the road on the underlying soils below, while the solution with the StormTech chambers substantially decreases it. It is unclear how the existing eco-passage was constructed, but the boreholes indicate that there is a peat layer under this culvert as well, which probably implies that the peat layer under the culvert was removed.

Figure 52 Figure 50 shows the cross sections of the two new eco-passages proposed using the StormTech Chambers.

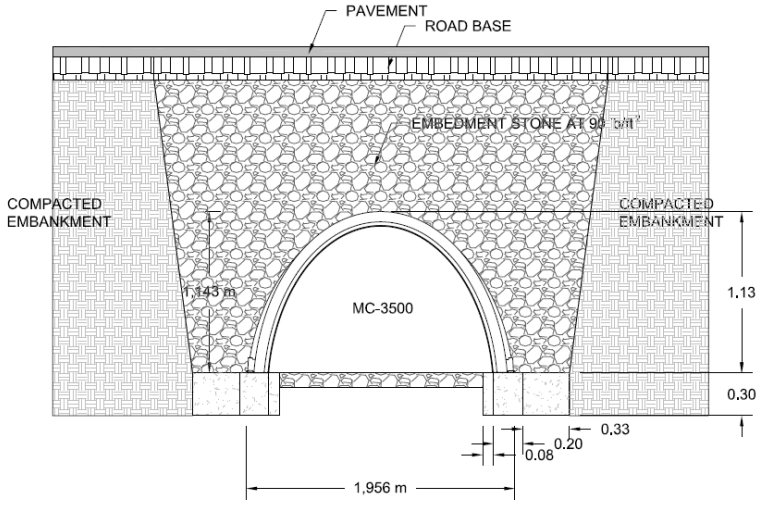


Figure 50 StormTech Chambers

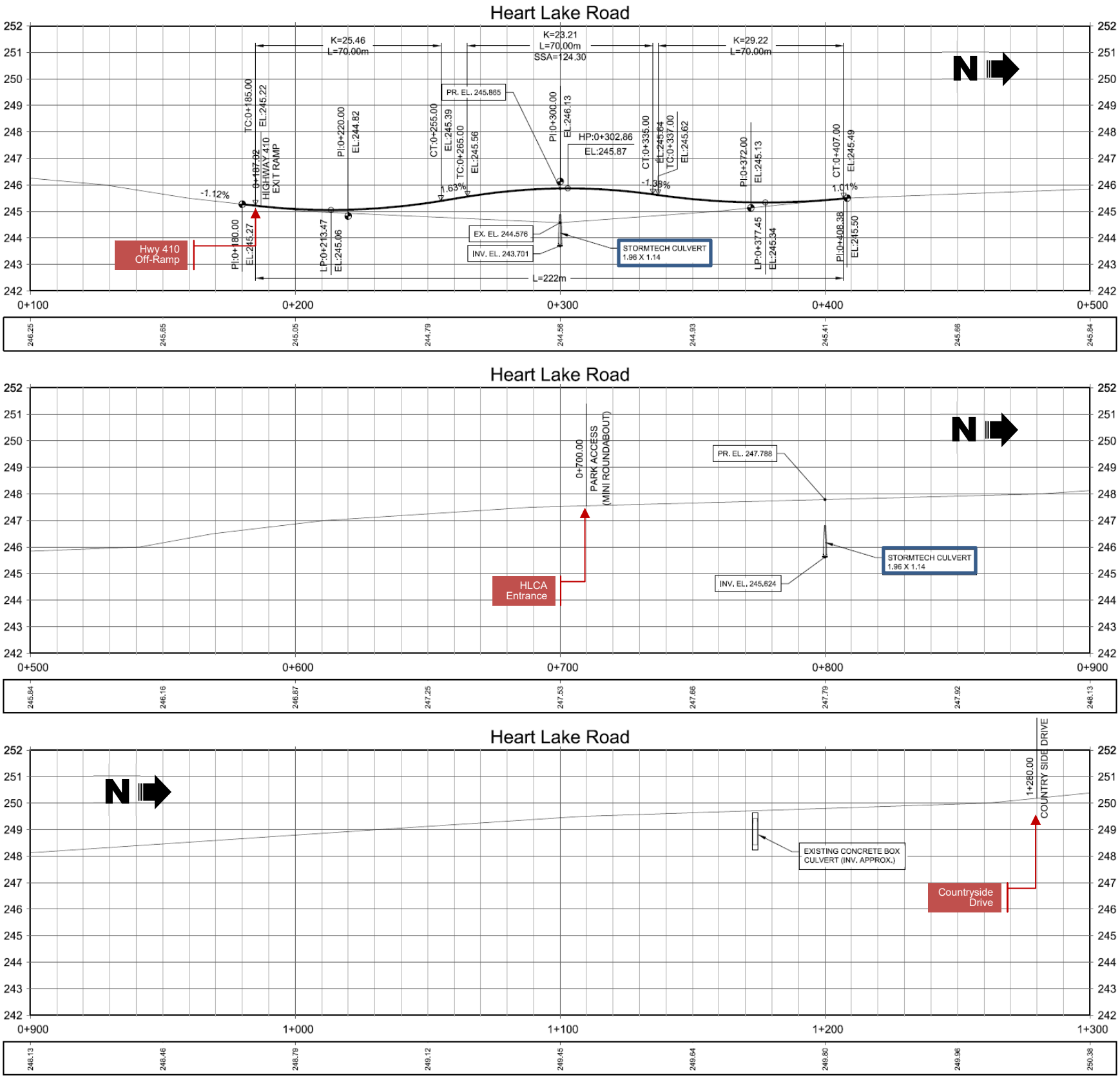


Figure 51 Heart Lake Road | Proposed Longitudinal Profile

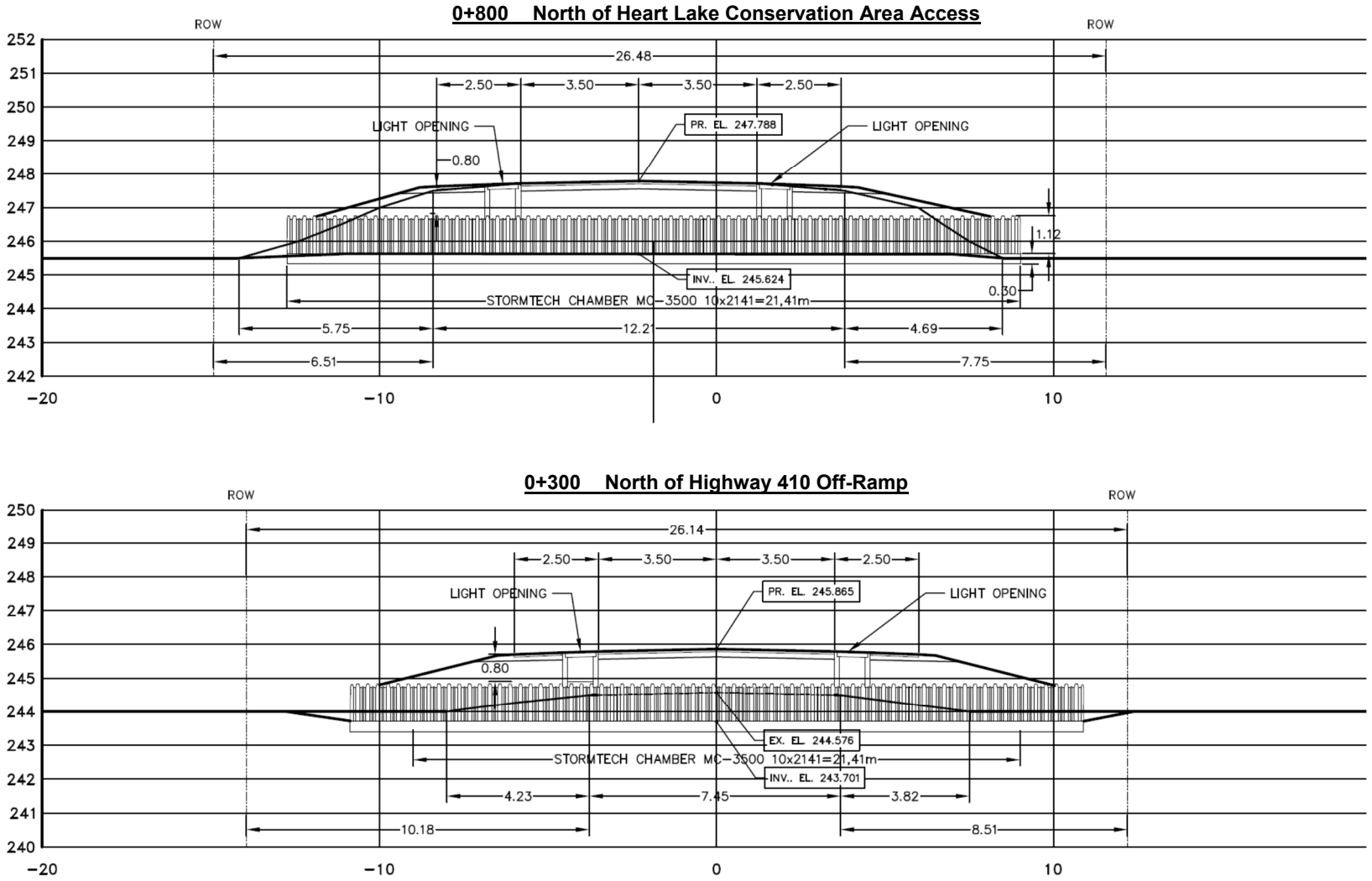


Figure 52 Cross-Sections of Proposed (2) Eco-Passages

7.4 BUDGETARY COST ESTIMATES

Appendix I provides the details associated to cost estimates, while the following sections summarize the costs per planning horizons with a 30% contingency.

7.4.1 Short Term

In the short term, the total cost for the recommended alternatives is $ 900,000, which can be divided as follow:

- Traffic lane narrowing with rumble strips, between Sandalwood and Mayfield: $ 20,000
- The mini roundabout at the intersection with the Conservation Area access: $ 525,000
- The eco-passage at station 0+300 (north of Highway off-ramp): $ 280,000
- The eco-passage at station 0+800 (north of Heart Lake Conservation Area): $ 75,000

The costs for the mini-roundabout include cost for lighting, while costs for the eco-passage include cost of fencing.

7.4.2 Long Term

In the long term, the total cost for the recommended alternatives is $ 1,750,000, which can be divided as follow:

- The roundabout at the intersection with Countryside Drive: $ 520,000
- Separated bicycle lanes between Sandalwood and Mayfield: $ 1,230,000

The costs for the roundabout include cost for lighting and relocation of concrete electric poles.

8.0 CONCLUSION

In response to concerns regarding wildlife mortality and traffic operations, the City of Brampton commissioned Stantec to undertake a function and design review of the Heart Lake Road corridor within the City of Brampton.

The focus of this study is the Heart Lake Road corridor between Sandalwood Parkway to a point just north of Mayfield Road, however, the assessment of the transportation network and recommendations from this study extend beyond this focus area.

The followings summarize the transportation issues and challenges noted on the Heart Lake Road corridor:

- Daily traffic on Heart Lake Road, between Countryside Drive and the Highway 410 off-ramp, is currently around 7,000 vehicles per day, 4,000 southbound and 3,000 northbound;
- The existing and forecasted traffic volumes do not justify widening of Heart Lake Road (additional traffic lanes), given that the theoretical capacity per lane for a typical two-lane rural roadway is 800 veh/h;
- Vehicles travelling on Heart Lake Road currently exceed the speed limit, which reduces safety on the corridor, given that higher speeds increase the probability and severity of collisions;
- Heart Lake Road is identified as a candidate for bicycle lane in the City of Brampton Transportation Master Plan;
- Improvements are required at the intersection with Sandalwood Parkway to improve safety conditions (see **Table 13**);
- Heavy trucks are observed on Heart Lake Road despite being prohibited; and
- Road infrastructure conditions constrain the type of measures that can be put in place along the corridor.

The section of Heart Lake Road under study is one of the largest and most diverse natural areas within the City of Brampton. Heart Lake Conservation Area (HLCA) which is owned by TRCA, is located on the west side of the road. HLCA is a diverse, 169-hectare ecosystem that contains provincially significant wetlands, and Environmentally Significant Woodland area and a bog of Natural and Scientific Interest. This section of Heart Lake Road, between Sandalwood Parkway and Countryside Drive, is known as a “hotspot” for wildlife mortality. Through the implementation of various mitigation measures such as traffic calming measures, wildlife signage, and wildlife fencing, the mortality rate of the wildlife (i.e. turtles, snakes, etc) will continue to decrease. Continued implementation of two future eco-passages will help mitigate wildlife mortality across Heart Lake Road.

Heart Lake Road was originally a 19th century corduroy road and was constructed between the late 1820s to the mid-19th century. Heart Lake Road, between Sandalwood Parkway and Mayfield Road is important in maintaining and supporting the character of the surrounding landscape. Although improved and updated, Heart Lake Road still maintains its rural road cross section with two lanes of traffic, gravel shoulders, and ditches. In 2014, the Brampton Heritage Board received a delegation from the public seeking the possible recognition of Heart Lake Road as a cultural heritage landscape. This recognition was not defined at the time, however it was evaluated as part of this study. The criteria for determining Cultural Heritage Value or Interest (CHVI) are defined by *Ontario Regulation 9/06* (O. Reg. 9/06) (Government of Ontario 2006b). If a property meets one or more of the prescribed criteria than it merits designation under Part IV of the *Ontario Heritage Act*. Heart Lake Road, between Sandalwood Parkway and Mayfield Road met five criteria (2.i, 2.ii, 3.i, 3.ii, and 3.iii) of O. Reg. 9/06. Therefore, Heart Lake Road has CHVI for historical/associative and contextual reasons and warrants designation under Part IV of the *Ontario Heritage Act*.

it is recommended that Heart Lake Road, between Sandalwood Parkway and Mayfield Road, be classified as a collector road instead of an arterial road. The section on Heart Lake Road between Sandalwood Parkway and Bovaird Drive should also be classified as a collector road. An amendment should be made to Schedule B of the Official Plan to identify this recommended roadway classification.

Three categories of solutions were screened and evaluated

- Active Transportation: Seven alternatives (including the do nothing alternative) focusing on accommodating active transportation activities.
- Traffic Calming: Six alternatives (including the do nothing alternative) were evaluated that focused on various traffic calming alternatives.
- Wildlife Mortality Mitigation: Six alternatives (including the do nothing alternative) were examined for the assessment of wildlife treatments along Heart Lake Road.

An evaluation process was conducted to help determine what feasible alternatives should be carried forward to the more detailed phase. The evaluation was based on the multi-modal transportation opportunities, social and cultural environment, and natural environment, and potential impacts to significant environmental features based on available secondary source information, meetings with City officials, and the Toronto and Regional Conservation Authority (TRCA). The evaluation matrix was developed that provided a high level, reasoned argument approach to evaluating one alternative compared to another, similar to what is undertaken for a Municipal Class Environmental Assessment (MCEA). All alternatives were presented to the public at a Public Consultation meeting, and the Technical Advisory Council (TAC), and the Toronto and Region Conservation Authority (TRCA) for input and comment. The project team took all comments into consideration as the evaluation of alternatives were further refined and finalized, and with both short-term, and long-term recommendations put forth.

Following the evaluation process, the short-term alternatives recommended over a 2-year horizon include the following:

- Wildlife mortality mitigation:
  - Maintain existing solar powered flashing amber lights;
  - Maintain and re-paint optical speed bars;
  - Install (2) additional eco-passages tunnels at the two “hotspots” where passages are not already installed;
  - Permanently install wildlife directional fencing;
  - Implement turtle nesting mounds.

- Traffic calming measures
  - Re-classify the road as a collector road;
  - Lower speed limit to 50 km/h;
  - Implement speed cushions between Mayfield Road and the Highway 401 SB off-ramp;
  - Install a traffic circle at the Conservation Area entrance.

- Transportation Improvements:
  - Narrow roadway to include 3.3 m traffic lanes;
  - Consider implementing a hybrid multi-use trail through Heart Lake Conservation Area with connections to the existing boulevard path at Heart Lake Road / countryside Drive.

The long-term alternatives recommended in the next 5 to 10 years, as development occurs and needs increase, include further study (Schedule C Class Environmental Assessment) of the following:

- Install a roundabout at the intersection of Countryside Drive;
- Implement alternative C with separated bike lanes on Heart Lake Road.

APPENDIX A

Turning Movement Counts

APPENDIX B

Synchro Reports

APPENDIX C

PIC #1 | Summary and Comments

APPENDIX D

Sandalwood Intersection | Safety Review

APPENDIX E

Geotechnical Reports

APPENDIX F

Heart Lake Volunteer Road Ecology Monitoring Project, Phases 1 and 2

APPENDIX G

TAC #2 | Meeting Notes

APPENDIX H

Response of TRCA To PIC #2 & TAC #2

APPENDIX I

Cost Estimates