LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Metric Scale
25m 0 50m
Horizontal

135-0
9.3 ha

140-0
28.0 ha

ENHANCED GRASSED SWALES AND BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

ENHANCED GRASSED SWALES AND BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

See Trafalgar Road Class EA Study (Section 1)
Steeles Avenue to North of 10 Side Road

5+900 6+000 6+100 6+200 C8 6+300 6+400 6+500 6+600 6+700 6+800 C9 6+900 7+000

TRAFALGAR ROAD

OGS

135-1
2.9 ha

140-1
1.30 ha

10 SIDE ROAD

POND – 8S
GRASSED LINEAR DRY SWM FACILITY
FOR QUANTITY AND QUALITY CONTROL
100–YEAR STORAGE VOLUME = 630 m^3

POND– 9S
GRASSED LINEAR DRY SWM FACILITY
FOR QUANTITY AND QUALITY CONTROL
100–YEAR STORAGE VOLUME = 455 m^3

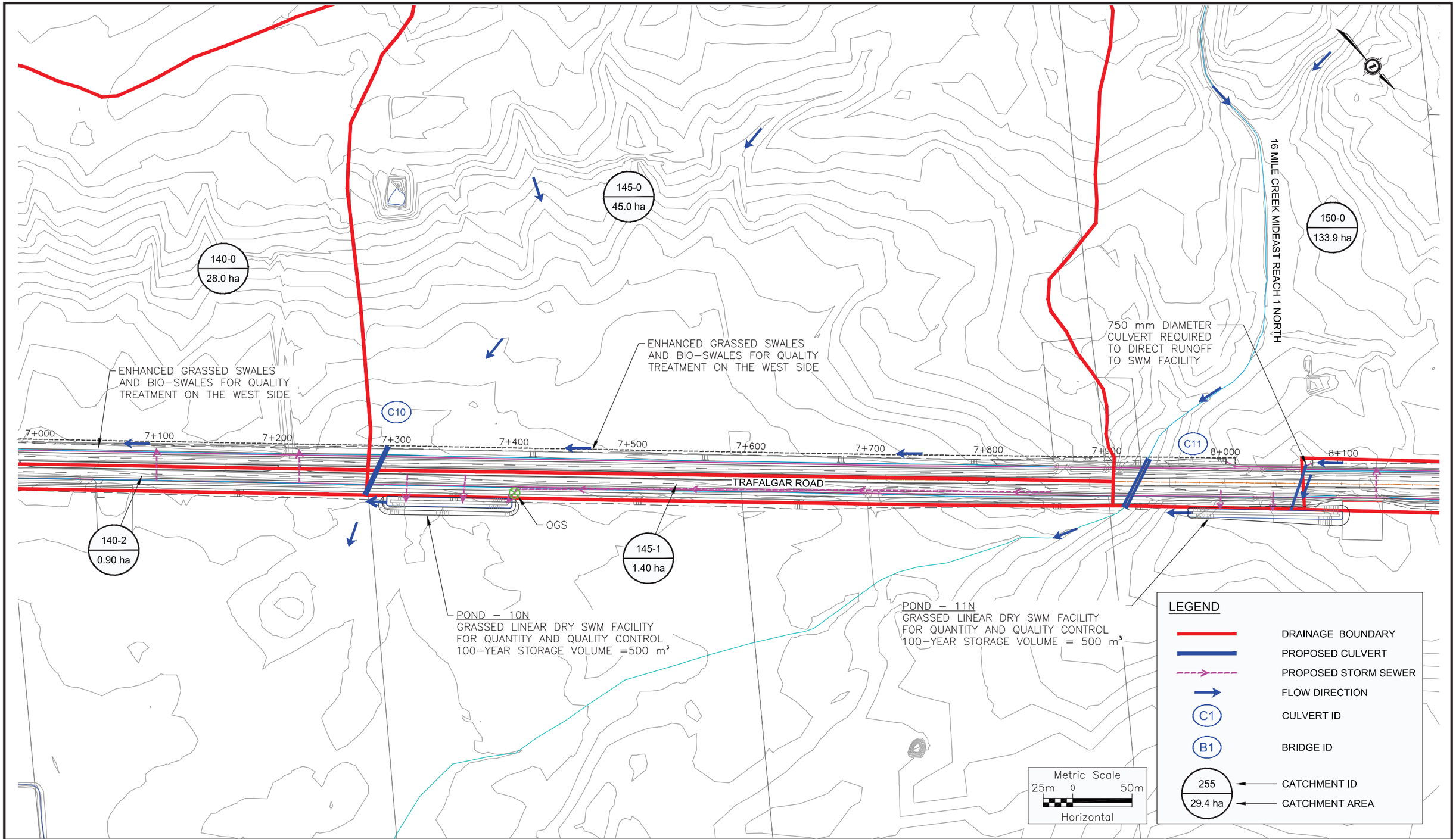
Halton REGION

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit
7-10



Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit

7-11

150-0
133.9 ha

155-0
37.4 ha

150-1
2.1 ha

155-1
1.90 ha

ENHANCED GRASSED SWALES
AND BIO–SWALES FOR QUALITY
TREATMENT ON THE WEST SIDE

ENHANCED GRASSED SWALES
AND BIO–SWALES FOR QUALITY
TREATMENT ON THE WEST SIDE

8+200 8+300 8+400 8+500 8+600 C12 8+700 8+800 8+900 9+000 9+100 9+200 9+300

TRAFALGAR ROAD

OGS

POND– 12N
GRASSED LINEAR DRY SWM FACILITY
FOR QUANTITY AND QUALITY CONTROL
100–YEAR STORAGE VOLUME = 580 m³

Metric Scale
25m 0 50m
Horizontal

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit
7-12

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Metric Scale
100m 0 200m
Horizontal

SIXTH LINE

150-0
133.9 ha

145-0
45.0 ha

155-0
37.4 ha

140-0
28.0 ha

200-0
8.9 ha

C9 C10 C11 C12

TRAFALGAR ROAD

BLACK CREEK

CNR

10 SIDE ROAD

15 SIDE ROAD

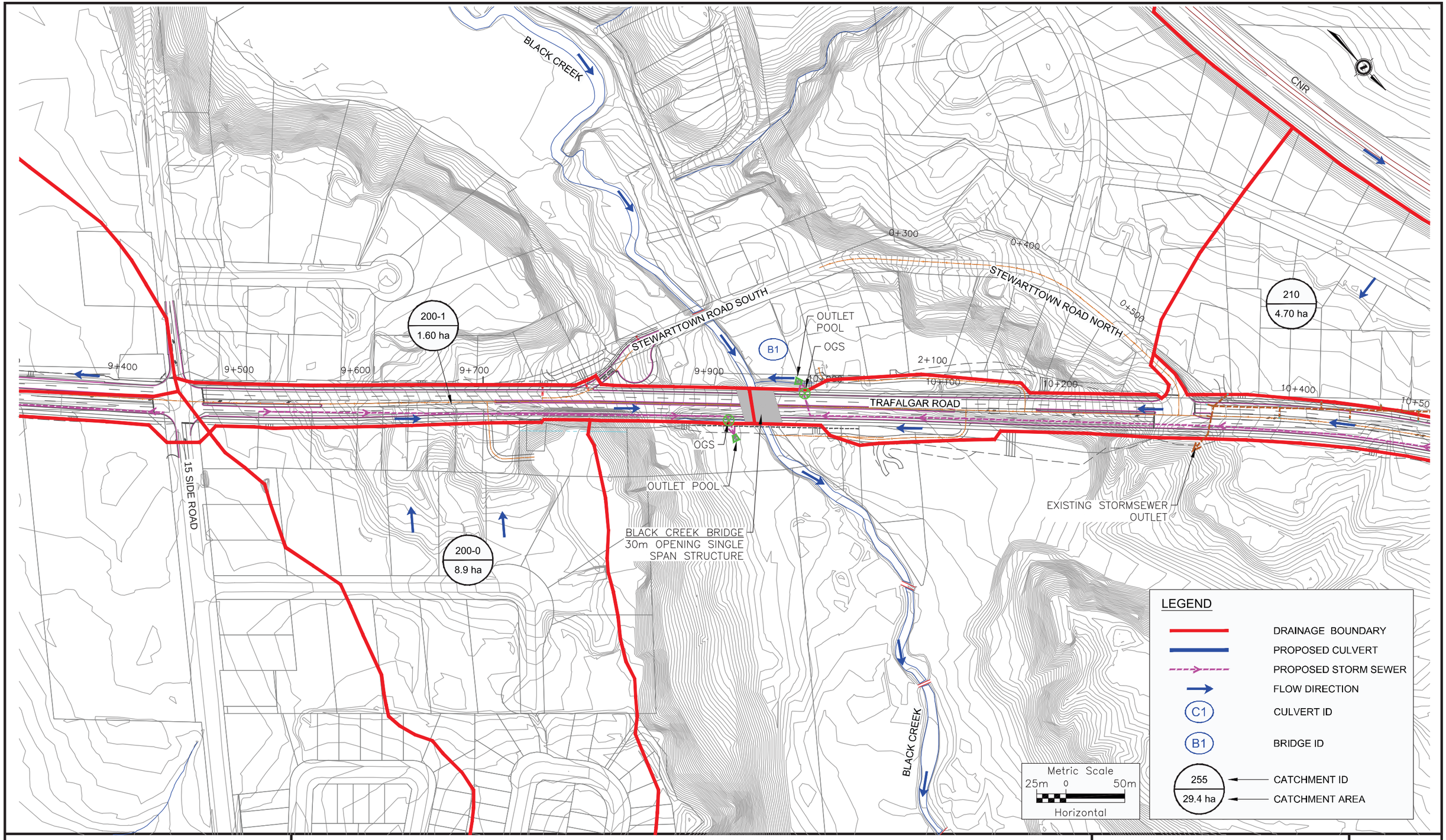
Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit
7-13



Halton Region

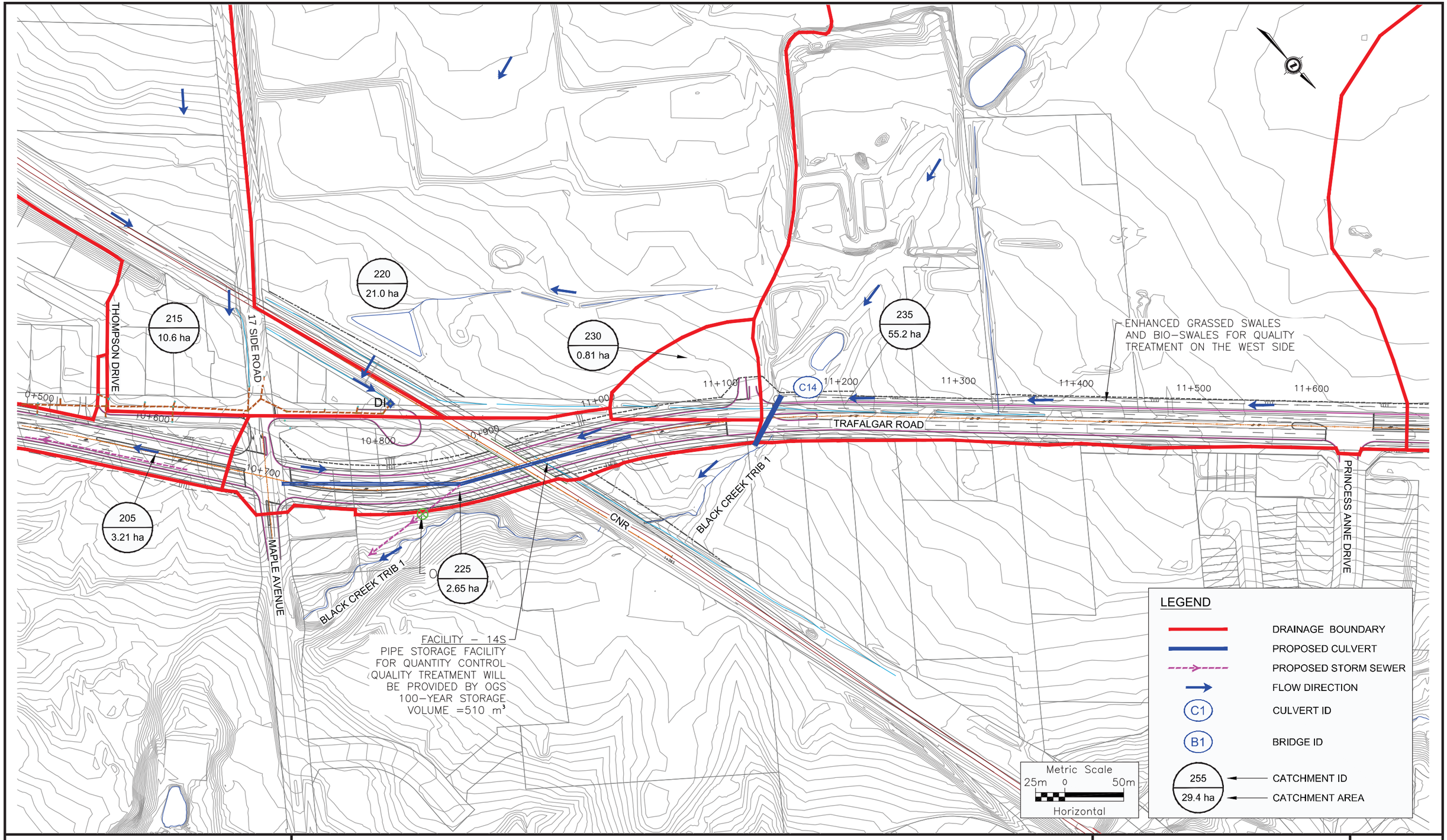
MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit

7-14



Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit

7-15

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

240 / 40.3 ha

245 / 9.0 ha

255 / 29.4 ha

250 / 1.12 ha

260 / 71.5 ha

270 / 18.3 ha

275 / 0.40 ha

251 / 0.56 ha

265 / 1.50 ha

ENHANCED GRASSED SWALES AND BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

ENHANCED GRASSED SWALES AND BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

TRAFALGAR ROAD

20 SIDE ROAD

C15 C16 C17 C18 S1

11+800 11+900 12+000 12+100 12+200 12+300 12+400 12+500 12+600 12+700

20+000 20+100

0+100 0+200 0+300 0+400 0+500 0+600 0+700 0+800 0+900 0+100 0+200

OGS

TO EXISTING STORM SEWER

BERTON BOULEVARD

BLACK CREEK TRIBUTARY 2

METROLINX (GO TRANSIT KITCHENER LINE)

LINDSAY COURT

HIGHWAY 7

Metric Scale
25m 0 50m
Horizontal

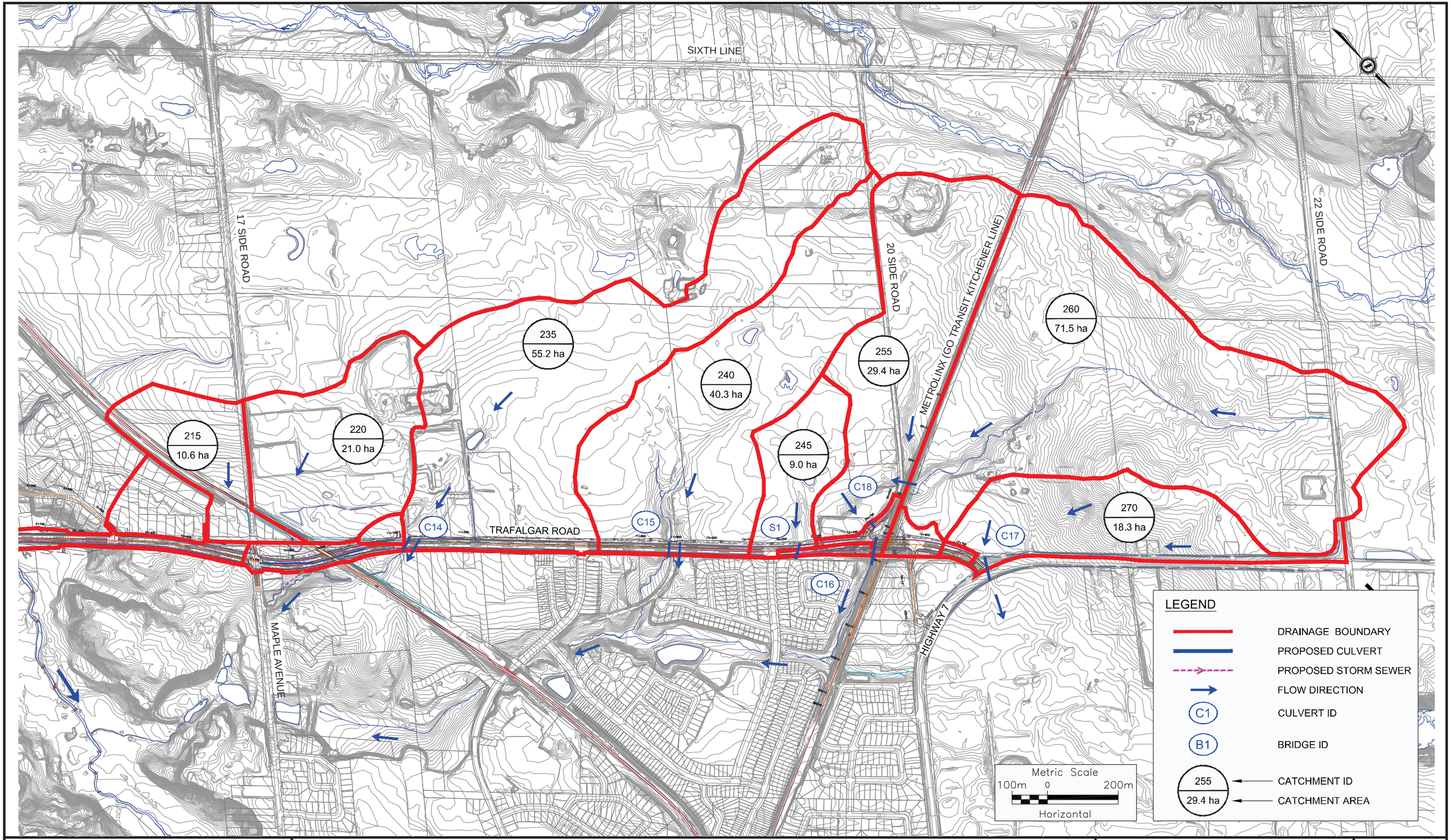
Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit
7-16



Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 2)
North of 10 Side Road to Highway 7

Proposed Conditions
Drainage Mosaic

Exhibit

7-17

From 15 Side Road to Highway 7– Credit Valley Conservation Jurisdiction

Catchment areas north of 15 Side Road are located within the jurisdiction of Credit Valley Conservation (CVC); part of the Black Creek Subwatershed.

Catchment 200 was further separated into two (2) sub-catchments. Minor system flows (assumed as 5-year) from Catchment 200-0 drain to the existing storm sewers within the residential subdivision. Major system flows drain overland to Trafalgar Road, combine with flows from Catchment 200-1 and discharge to Black Creek. The minor system flows from Catchment 200-1 will be conveyed by separate storm sewers to discharge to Black Creek on the east side at approximately Station 9+920. An OGS is proposed to provide quality treatment and an outlet pool will be provided at the storm sewer outlet for the erosion control. Quantity control of the runoff is not feasible in this section of Trafalgar Road due to the steep grade and land constraints. It would not be feasible to construct pipe storage facilities due to significant cut. The surrounding lands on both sides of Trafalgar Road are located within the Regional Storm flood plain and therefore are not suitable locations for proposed SWM facilities.

Minor system flows from Catchment 220, 215 and 210 are conveyed by the existing storm sewers to discharge to Black Creek. Minor system flows from Catchment 205 will be conveyed by a separate storm sewer system and will be discharged to a ditch on the west side of Trafalgar Road at approximately Station 10+000. This approximately 40 m long ditch ultimately conveys the storm runoff to the Black Creek. An OGS is proposed to provide quality treatment and an outlet pool will be provided at the storm sewer outlet for the erosion control. As mentioned above quantity control of the runoff is not feasible in this section of Trafalgar Road due to the steep grade (significant cut for pipe storage facility) and land constraints (lands located within the Regional Storm flood plain). Major system flows from Catchments 215, 210, and 205, drain overland to Black Creek.

Flows from Catchments 225 (an underpass at CN) and 230 are conveyed to a pipe storage facility, Facility 14S, which will provide quantity control. An OGS is proposed to provide quality treatment. Outflows discharge to a tributary of Black Creek.

Roadway runoff from Catchment 235 drains to Enhanced grassed swales and bio-swales on the west side via storm laterals to provide quality treatment. There is an increase in flow due to increase in drainage area. Quantity control of flows from Catchment 235 will not be provided. The flow from CNR underpass and this catchment drains to a tributary (Tributary 1) of Black Creek. An over-control of flows is provided by Facility 14S to balance the flows draining to Tributary 1 of Black Creek.

Roadway runoff from Catchment 240 drains to Enhanced grassed swales and bio-swales on the west side via storm laterals to provide quality treatment. Quantity control of flows from Catchment 240 is not required because a part of the roadway area is directed towards Culvert C14.

Flows from Catchment 245 drain to an open storm inlet. This storm inlet is connected to the existing storm sewer system within the residential subdivision. Drainage area under proposed conditions is less than under existing conditions; as such, quantity control of flows from Catchment 245 is not required. Enhanced grassed swale is provided on the west side for additional quality treatment.

Flows from Catchments 255 and 260 drain to Culvert C18 located under 20 Side Road. Flows from Catchments 265, 275 and 250 combine with flows from Culvert C18 to discharge to Culvert C16, which is located on the Metrolinx underpass (Trafalgar Road realignment). Flows from Catchment 251 are conveyed by storm sewers to an OGS to provide quality treatment before discharging to Culvert C16. Culvert C16 drains to Tributary 2 of Black Creek. A Bio-swale is provided on the west side of the roadway for quality treatment. Quantity control of runoff from Catchment 251 is not required due to different times to peak of the hydrographs.

Within the roadway corridor, SWM facilities are provided in different locations, as required, to control the runoff from post-development to pre-development conditions. Enhanced grassed swales, bio-swales and oil-grit separators (OGSs) provided in different locations will facilitate the quality treatment of runoff.

7.1.10.2 Proposed Conditions Hydrologic Modelling

The proposed conditions drainage mosaics (**Exhibits 7-10 to 7-17**) vary slightly compared to the existing conditions drainage mosaics. A SWMHYMO hydrologic model was developed to estimate runoff from the roadway and external areas under proposed conditions, based on the 24-hour SCS storm distribution. The results of the hydrologic modelling are summarized in **Table 7-4 and Table 7-5**, which provide the proposed condition flows at each culvert.

The proposed hydrologic modelling schematics, hydrologic modelling parameters, and SWMHYMO summary output files are included in Appendix B of **Appendix J: Drainage and Stormwater Management Report**.

7.1.10.3 Comparison of Flows

As presented in **Table 7-4** and **Table 7-5**, the comparison of peaks flows in CH and CVC jurisdiction, respectively, are summarized as follows:

From North of 10 Side Road to 15 Side Road – CH Jurisdiction:

- Controlled flows through Culverts C9 and C11 decrease for all storm events.
- Controlled flows through Culvert C10 increase for the 2-year event by 0.7%.
- Controlled flows through Culvert C12 increase for the 2-year and 5-year storm events by approximately 1% and 0.4%, respectively, but decrease for all other storm events.

From 15 Side Road to Highway 7 – CVC Jurisdiction:

- Quantity control of runoff discharging into Black Creek is not feasible due to the steep grade of Trafalgar Road and land constraints. The increases in flows in Black Creek are 0.272 m^3/s for the 2 year to 0.582 m^3/s for the 100 year and 0.053 m^3/s for the Regional Storm events. Comparing these flow increases with the flows of Black Creek, the increases will be only 4.5% for the 2-year to 1.6% for the 100-year and 0.04% for the Regional Storm events.

- Peak flow control for CNR underpass area will be provided by pipe storage facility. Except for the 2 year flow, peak flows for other storm events decrease from 0.3% to 10%. This pipe storage facility will provide over control of flows to balance the uncontrolled flows from Culvert C14. Flows from both Culvert C14 and underpass area drain to Tributary 1 of Black Creek. At Tributary 1, there are no increases in flows for the 25 year, 50 year and 100 year; however, there are minor increases in flows for the 2-year, 5-year and 10-year of 3.3%, 1.7% and 0.9%, respectively. This can be further reviewed in detailed design phase to balance the flows by adjusting the control features.
- There are no increases in flows at Culvert C15, storm inlet S1, Culvert C16, Culvert C17 and Culvert C18. As such, peak flow controls at these locations are not required.

7.1.10.4 Hydraulic Assessment

A hydraulic assessment was performed for the culverts between north of 10 Side Road and Highway 7.

Hydraulic assessments of Culvert C11 and the Black Creek Bridge B1 were analyzed using the Hydraulic Engineering Center's River Analysis System modelling software (HEC-RAS). Bentley's CulvertMaster hydraulic model was used to analyze the hydraulic performance of the other culverts.

The design standards for the hydraulic assessment of culverts are based on the "MTO Highway Drainage Design Standards (HDDS) (February 2008)", discussed in **Appendix J Drainage and Stormwater Management Report**. The CulvertMaster hydraulic model was used to estimate headwater depth elevation and assess the hydraulic performance of each culvert within the study area. The CulvertMaster model was selected for the following reasons:

- Evaluates inlet and outlet controlled headwater depths;
- Simulates the hydraulic performance of culverts based on user-specified flows;
- Considers variable 7-43ailwater depths based on either outlet channel geometry or user specified depth discharge rating curves; and
- Incorporates an extensive database of standard culvert sizes, shapes and materials, and allows for the addition of custom culvert types and sizes.

Under existing conditions, there are ten (10) crossing culverts and one (1) bridge between north of 10 Side Road and Highway 7. Nine (9) culverts are proposed to be replaced, one (1) culvert is proposed to be removed, and one (1) bridge is proposed to be replaced. These proposed changes are summarized in **Table 7-6**.

Table 7-4: Peak Flow Comparison – CH Jurisdiction

Culvert ID / Node	Hydro ID	Drainage Area (ha)	Condition	24-hour SCS Storm Distribution Flows (m3/s)						Regional (Hazel)	Comments
				2-year	5-year	10-year	25-year	50-year	100-year		
C9	140 / 525	30.2	Existing	0.735	1.129	1.448	1.864	2.208	2.471	3.523	Peak flow control is provided by interim linear facility Pond 9S.
			Proposed (Uncontrolled)	0.830	1.254	1.593	2.031	2.391	2.665	3.569	
			Difference (Pr. Un. – Ex)	0.095	0.125	0.145	0.167	0.183	0.194	0.046	
			Proposed (Controlled)	0.716	1.083	1.381	1.768	2.088	2.333	3.446	
			Difference (Pr. Con .- Ex)	-0.019	-0.046	-0.067	-0.096	-0.120	-0.138	-0.077	
			%	-2.59%	-4.07%	-4.63%	-5.15%	-5.43%	-5.58%	-2.19%	
C10	145 / 530	46.4	Existing	0.869	1.317	1.680	2.155	2.548	2.849	4.934	Peak flow control is provided by interim linear facility Pond 10N.
			Proposed (Uncontrolled)	0.869	1.320	1.680	2.160	2.550	2.850	4.930	
			Difference (Pr. Un. – Ex)	0.000	0.003	0.000	0.005	0.002	0.001	-0.004	
			Proposed (Controlled)	0.875	1.314	1.669	2.132	2.521	2.816	4.930	
			Difference (Pr. Con. – Ex)	0.006	-0.003	-0.011	-0.023	-0.027	-0.033	-0.004	
			%	0.69%	-0.23%	-0.65%	-1.07%	-1.06%	-1.16%	-0.08%	
C11	150 / 535	136	Existing	1.402	2.154	2.769	3.579	4.255	4.774	11.005	Peak flow control is provided by interim linear facility Pond 11N.
			Proposed (Uncontrolled)	1.454	2.225	2.854	3.678	4.365	4.891	11.081	
			Difference (Pr. Un. – Ex)	0.052	0.071	0.085	0.099	0.110	0.117	0.076	
			Proposed (Controlled)	1.398	2.142	2.751	3.552	4.220	4.733	10.982	
			Difference (Pr. Con. – Ex)	-0.004	-0.012	-0.018	-0.027	-0.035	-0.041	-0.023	
			%	-0.29%	-0.56%	-0.65%	-0.75%	-0.82%	-0.86%	-0.21%	
C12	155 / 540	39.3	Existing	0.633	0.975	1.255	1.624	1.931	2.167	4.047	Peak flow control is provided by interim linear facility Pond 12N.
			Proposed (Uncontrolled)	0.711	1.082	1.383	1.776	2.102	2.351	4.142	
			Difference (Pr. Un .- Ex)	0.078	0.107	0.128	0.152	0.171	0.184	0.095	
			Proposed (Controlled)	0.639	0.979	1.252	1.604	1.898	2.124	4.040	
			Difference (Pr. Con .- Ex)	0.006	0.004	-0.003	-0.020	-0.033	-0.043	-0.007	
			%	0.95%	0.41%	-0.24%	-1.23%	-1.71%	-1.98%	-0.17%	

Table 7-5: Peak Flow Comparison – CVC Jurisdiction

Culvert ID / Node	Hydro ID	Drainage Area (ha)	Condition	24-hour SCS Storm Distribution Flows (m3/s)						Regional (Hazel)	Comments
				2-year	5-year	10-year	25-year	50-year	100-year		
C13	No culvert in proposed conditions, a storm sewer is proposed for the railway underpass										
Existing STM Outlet	520	36.3	Existing	0.639	1.019	1.146	1.388	1.584	1.695	2.288	Existing storm sewer will be maintained to drain the runoff from Catchments 210, 215 and 220. No increase in flow.
			Proposed (Uncontrolled)	0.639	1.019	1.146	1.388	1.584	1.695	2.288	
			Difference (Pr. Un. – Ex)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
			%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
B1 Black Creek	525	50.01	Existing	0.763	1.203	1.596	2.322	2.886	3.268	3.156	Sum of flows from North and South of the bridge. Peakflow control cannot be provided due to steep road grade and land constraints.
			Proposed (Uncontrolled)	1.035	1.498	2.033	2.808	3.434	3.850	3.209	
			Difference (Pr. .Un – Ex)	0.272	0.295	0.437	0.486	0.548	0.582	0.053	
			%	35.6%	24.5%	27.4%	20.9%	18.9%	17.8%	1.7%	
			Flow in Black Creek	6.10	12.10	16.70	25.20	31.40	37.10	117.9	
			% increase with respect to Black Creek Flow	4.5%	2.4%	2.6%	1.9%	1.7%	1.6%	0.04%	
CNR Under-pass	530 / 805	3.46	Existing	0.240	0.336	0.417	0.531	0.630	0.698	0.465	Peak flow control is provided by pipe storage facility 14S.
			Proposed (Uncontrolled)	0.397	0.529	0.636	0.777	0.897	0.982	0.484	
			Difference (Pr. Un – Ex)	0.157	0.193	0.219	0.246	0.267	0.284	0.019	
			Proposed (Controlled)	0.250	0.335	0.403	0.494	0.567	0.652	0.466	
			Difference (Pr. Con – Ex)	0.010	-0.001	-0.014	-0.037	-0.063	-0.046	0.001	
			%	4.2%	-0.30%	-3.4%	-7.0%	-10.0%	-6.6%	0.22%	
C14	235	55.2	Existing	0.481	0.759	0.991	1.300	1.562	1.765	4.421	Flow increased due to increase in drainage area. Pipe storage facility 14S will provide over-control to balance the flows.
			Proposed (Uncontrolled)	0.495	0.779	1.017	1.334	1.602	1.810	4.529	
			Difference (Pr. Un – Ex)	0.014	0.020	0.026	0.034	0.040	0.045	0.108	
			%	2.9%	2.6%	2.6%	2.6%	2.5%	2.5%	2.4%	
Tributary 1 of Black Creek	235+530 / 235+805	58.66	Existing	0.721	1.095	1.408	1.831	2.192	2.463	4.886	Peak flow control is provided by pipe storage facility 14S.
			Proposed (Uncontrolled)	0.880	1.290	1.629	2.079	2.461	2.749	4.906	
			Difference (Pr. Un – Ex)	0.159	0.195	0.221	0.248	0.269	0.286	0.020	
			Proposed (Controlled)	0.745	1.114	1.420	1.828	2.169	2.462	4.995	
			Difference (Pr. Con – Ex)	0.024	0.019	0.012	-0.003	-0.023	-0.001	0.109	
			%	3.3%	1.7%	0.85%	-0.16%	-1.1%	-0.04%	2.2%	
C15	240	40.3	Existing	0.583	0.912	1.183	1.543	1.845	2.078	4.143	Part of roadway area is directed to C14. No increase in flows due to decrease in drainage area.
			Proposed (Uncontrolled)	0.573	0.896	1.163	1.517	1.814	2.042	4.072	
			Difference (Pr. Un – Ex)	0.002	0.002	0.003	0.003	0.002	0.002	0.000	
			%	-1.72%	-1.75%	-1.70%	-1.70%	-1.68%	-1.73%	-1.71%	

Culvert ID / Node	Hydro ID	Drainage Area (ha)	Condition	24-hour SCS Storm Distribution Flows (m3/s)						Regional (Hazel)	Comments
				2-year	5-year	10-year	25-year	50-year	100-year		
S1	245	9.0	Existing	0.236	0.373	0.487	0.638	0.765	0.864	1.239	No increase in flows due to reduction in drainage area.
			Proposed (Uncontrolled)	0.224	0.352	0.459	0.600	0.718	0.809	1.121	
			Difference (Pr. Un – Ex)	-0.012	-0.021	-0.028	-0.038	-0.047	-0.055	-0.118	
			%	-5.08%	-5.63%	-5.75%	-5.96%	-6.14%	-6.37%	-9.52%	
C18	535	100.9	Existing	1.149	1.842	2.429	3.220	3.894	4.419	9.982	No increase in flows.
			Proposed (Uncontrolled)	1.149	1.842	2.429	3.220	3.894	4.419	9.982	
			Difference (Pr. Un. – Ex)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
			%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
C16	540 / 545	104.5	Existing	1.172	1.878	2.474	3.276	3.959	4.491	10.232	No increase in flows.
			Proposed (Uncontrolled)	1.178	1.880	2.474	3.274	3.955	4.486	10.202	
			Difference (Pr. Un – Ex)	0.006	0.002	0.000	-0.002	-0.004	-0.005	-0.030	
			%	0.51%	0.11%	0.00%	-0.06%	-0.10%	-0.11%	-0.29%	
C17	545 / 270	18.3	Existing	0.338	0.538	0.706	0.932	1.124	1.274	2.153	Drainage area decreased from 18.7 ha to 18.3 ha. No increase in flows.
			Proposed (Uncontrolled)	0.333	0.531	0.698	0.922	1.113	1.261	2.148	
			Difference (Pr. Un – Ex)	-0.005	-0.007	-0.008	-0.010	-0.011	-0.013	-0.005	
			%	-1.48%	-1.30%	-1.13%	-1.07%	-0.98%	-1.02%	-0.23%	

Table 7-6: Status of Crossing Structures from Existing to Proposed Conditions

Sixteen Mile Creek Watershed		Black Creek Watershed	
Culvert ID	**Status**	**Culvert ID**	**Status**
C9	Replace	B1	Replace
C10	Replace	C13	Remove
C11	Replace	C14	Replace
C12	Replace	C15	Replace
		C16	Replace
		C17	Replace
		C18	Replace

In addition to the ten crossing structures mentioned above, one (1) 750 mm diameter pipe culvert is required to direct the roadway runoff to Pond 11N on the east side of Trafalgar Road approximately midblock between 10 Side Road and 15 Side Road.

7.1.10.5 Road Classification and Design Flow

Trafalgar Road will become a semi-urban road through some sections and fully urban in the remaining areas. According to the MTO HDDS for an urban arterial road, for structures with spans less than or equal to 6.0 m, the design flow is the 50-year storm flow; and for spans greater than 6.0 m, the design flow is the 100-year storm flow.

- All culverts located on Trafalgar Road have spans of less than 6.0 m; therefore, the design flow for the culverts is the 50-year flow
- The Black Creek Bridge has a span greater than 6.0 m. The design flow for the Black Creek Bridge is the 100-year flow
- 20 Side Road is classified as a local road; therefore the design flow is the 10-year flow
- Highway 7 is classified as a rural arterial road. The design flow for the culvert crossing Highway 7 is the 25-year flow

It should be noted that while the Regional Storm is not the design storm being applied, Trafalgar Road is considered to be a critical transportation corridor within the Halton Region and it is the Region's policy that all regional arterial roads be designed as an emergency route such that it is flood free under Regional Storm conditions and can be relied upon by emergency services.

7.1.10.6 Hydraulic Modelling and Impact Assessments

The hydraulic performance of the existing structures was analyzed using HEC-RAS for Culvert C11 and for Bridge B1. These are regulated watercourses and HEC-RAS models were available and provided by CH and CVC, respectively. For the remaining culvert crossings where HEC-RAS model are not available, CulvertMaster hydraulic model was used.

Culvert C11

Culvert C11 at Trafalgar Road Station 7+927 (south of 15 Side Road) is located on Sixteen Mile Creek Mideast Reach 1 North tributary. The HEC-RAS model for this reach was provided by Conservation Halton. Four Sections 4199.265, 4178, 4140 and 4105.245 were updated based on current survey. In addition, the culvert size, culvert inverts, road profile and flows were updated in the model.

Under existing conditions, Culvert C11 is a 25.5 m long CSP with HDPE pipe lining. The HDPE pipe has a 750 mm diameter. The road low point elevation at this crossing is 257.38 m. Only the 2-year flow passes through the culvert, while Trafalgar Road is overtopped from the 5-year to the Regional Storm flows.

Under proposed conditions, Culvert C11 will be replaced with a 44.0 m long concrete open footing culvert with an opening of 3.05 m x 1.53 m. A low flow channel is recommended at the culvert. The road low point elevation at this crossing is 257.45 m. The available freeboard for the proposed culvert is 1.29 m for the 50-year design flow, which meets the minimum requirement of 1.0 m. The 100-year and the Regional Storm flows do not overtop Trafalgar Road. Upstream water levels are lowered by 1.24 m for the 2-year flow to 0.68 m for the Regional Storm flow.

Table 7-7 provides the comparison of the existing and proposed conditions HEC-RAS hydraulic modelling for Culvert C11.

Table 7-7: Comparison of HEC-RAS Modelling Results for Culvert C11

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
4105.25	Regional	11.01	255.08	0.64	255.08	0.0	0.64
4105.25	100-year	4.77	254.93	0.49	254.93	0.0	0.49
4105.25	50-year	4.26	254.92	0.47	254.92	0.0	0.47
4105.25	25-year	3.58	254.90	0.44	254.9	0.0	0.44
4105.25	10-year	2.77	254.87	0.4	254.87	0.0	0.4
4105.25	5-year	2.15	254.85	0.37	254.85	0.0	0.37
4105.25	2-year	1.40	254.81	0.32	254.81	0.0	0.32
4140.00	Regional	8.44	256.13	3.11	255.82	-0.31	2.54
4140.00	100-year	3.66	255.71	2.36	255.54	-0.17	1.93
4140.00	50-year	3.26	255.67	2.27	255.51	-0.16	1.86
4140.00	25-year	2.74	255.61	2.13	255.47	-0.14	1.75
4140.00	10-year	2.12	255.54	1.96	255.42	-0.12	1.61
4140.00	5-year	1.65	255.48	1.81	255.38	-0.10	1.47
4140.00	2-year	1.08	255.40	1.58	255.33	-0.07	1.28
4158.16		**Culvert C11**					
4178.00	Regional	8.44	257.52	1.30	256.89	-0.63	0.98
4178.00	100-year	3.66	257.58	0.55	256.23	-1.35	0.69
4178.00	50-year	3.26	257.59	0.49	256.16	-1.43	0.66

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
4178.00	25-year	2.74	257.59	0.41	256.07	-1.52	0.61
4178.00	10-year	2.12	257.59	0.32	255.95	-1.64	0.54
4178.00	5-year	1.65	257.60	0.25	255.86	-1.74	0.48
4178.00	2-year	1.08	256.97	0.22	255.73	-1.24	0.39
4199.27	Regional	8.44	257.65	0.10	256.97	-0.68	0.16
4199.27	100-year	3.66	257.61	0.04	256.26	-1.35	0.18
4199.27	50-year	3.26	257.61	0.04	256.19	-1.42	0.18
4199.27	25-year	2.74	257.61	0.03	256.1	-1.51	0.18
4199.27	10-year	2.12	257.60	0.03	255.98	-1.62	0.19
4199.27	5-year	1.65	257.60	0.02	255.88	-1.72	0.19
4199.27	2-year	1.08	256.98	0.02	255.74	-1.24	0.21
4300.00	Regional	8.44	257.65	0.52	257.12	-0.53	1.80
4300.00	100-year	3.66	257.61	0.25	256.96	-0.65	1.46
4300.00	50-year	3.26	257.61	0.23	256.94	-0.67	1.43
4300.00	25-year	2.74	257.60	0.19	256.91	-0.69	1.38
4300.00	10-year	2.12	257.60	0.15	256.87	-0.73	1.31
4300.00	5-year	1.65	257.60	0.12	256.84	-0.76	1.25
4300.00	2-year	1.08	256.97	0.40	256.79	-0.18	1.15
4400.00	Regional	8.44	257.68	0.71	257.55	-0.13	0.88
4400.00	100-year	3.66	257.62	0.34	257.33	-0.29	0.62
4400.00	50-year	3.26	257.61	0.31	257.31	-0.3	0.59
4400.00	25-year	2.74	257.61	0.26	257.27	-0.34	0.55
4400.00	10-year	2.12	257.61	0.20	257.22	-0.39	0.50
4400.00	5-year	1.65	257.6	0.16	257.18	-0.42	0.45
4400.00	2-year	1.08	257.09	0.43	257.11	0.02	0.39
4500.00	Regional	8.44	258.22	1.55	258.22	0.0	1.55
4500.00	100-year	3.66	258.07	1.39	258.07	0.0	1.39
4500.00	50-year	3.26	258.06	1.34	258.06	0.0	1.34
4500.00	25-year	2.74	258.03	1.28	258.03	0.0	1.28
4500.00	10-year	2.12	258.00	1.22	258	0.0	1.22
4500.00	5-year	1.65	257.98	1.14	257.98	0.0	1.14
4500.00	2-year	1.08	257.94	1.04	257.94	0.0	1.04

Black Creek (Bridge B1)

Bridge B1 at Trafalgar Road Station 9+940 crosses over Black Creek, north of 15 Side Road. The HEC-RAS model for Black Creek was provided by CVC. The existing

conditions model had outdated flows. As advised by CVC, the flows for the HEC-RAS model were therefore updated. The updated flows were based on the GAWSER model and were extracted from Table 3.23 of the Black Creek Hydrology Study Report. The road profile was also updated in the existing conditions model.

Under existing conditions, Bridge B1 has a 9.25 m span skew opening structure which provides an 8.80 m of clear perpendicular opening. The existing bridge length is 13 m. The road low point elevation is 240.31 m and the lowest point of the soffit has an elevation of 240.65 m. The available freeboard for the 100-year design flow is 0.52 m and the soffit vertical clearance for the design flow is 0.86 m. The existing bridge does not meet the minimum freeboard and soffit (vertical) clearance requirements. The roadway overtops by 0.93 m under the Regional Storm flow, approximately 133 m of roadway length would be flooded.

Under proposed conditions, Bridge B1 will be replaced by a 33.0 m span skew opening structure which provides a 30.0 m clear perpendicular opening. The new bridge length is approximately 30 m. Reach lengths were adjusted based on the new bridge length. The new road profile was also raised and was updated for the proposed conditions modelling. The channel section on the north side will be re-graded above the 2-year water level to span the bridge and to provide more capacity for higher storm flows. The proposed road low point is 243.14 m and the lowest soffit elevation is 241.08 m. The hydraulic modelling results provided in Table 7-8 shows that the proposed bridge meets all hydraulic requirements. The structure has a freeboard of 3.42 m and a soffit vertical clearance of 1.36 m for the 100-year design flow. The roadway will not be overtopped and will be free from flooding during the Regional Storm flow. Immediately upstream of the bridge, the Regional Storm water level decreases by 0.27 m.

The HEC-RAS cross section locations and the Regional Storm flood lines for the Black Creek for both existing and proposed conditions is provided in Exhibit 32 of **Appendix J Drainage and Stormwater Management Report**. **Table 7-8** provides a comparison of the existing and proposed conditions HEC-RAS hydraulic modelling for Bridge B1.

Table 7-8: Comparison of HEC-RAS Modelling Results for Black Creek Bridge B1

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
2197.6	Regional	117.9	239.96	3.61	239.7	0.00	3.61
2197.6	100-year	37.1	239.35	3.11	239.35	0.00	3.11
2197.6	50-year	31.4	239.27	2.87	239.27	0.00	2.87
2197.6	25-year	25.2	239.16	2.63	239.16	0.00	2.63
2197.6	10-year	16.7	238.95	2.27	238.95	0.00	2.27
2197.6	5-year	12.1	238.78	2.08	238.78	0.00	2.08
2197.6	2-year	6.1	238.54	1.52	238.54	0.00	1.52
2230.6	Regional	117.9	240.47	3.15	240.51	-0.16	3.23
2230.6	100-year	37.1	239.49	2.74	239.57	0.08	2.16
2230.6	50-year	31.4	239.41	2.43	239.48	0.07	1.95

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
2230.6	25-year	25.2	239.32	2.07	239.36	0.04	1.71
2230.6	10-year	16.7	239.14	1.57	239.14	0.00	1.36
2230.6	5-year	12.1	238.98	1.29	238.97	-0.01	1.15
2230.6	2-year	6.1	238.68	0.87	238.66	-0.02	0.8
2231	**Bridge at Trafalgar Road**						
2250.1	Regional	117.9	241.24	1.93	241.05	-0.27	3.04
2250.1	100-year	37.1	239.79	2.79	239.72	-0.07	2.18
2250.1	50-year	31.4	239.62	2.60	239.6	-0.02	2.03
2250.1	25-year	25.2	239.51	2.24	239.45	-0.06	1.85
2250.1	10-year	16.7	239.20	1.86	239.2	0.00	1.56
2250.1	5-year	12.1	239.04	1.55	239.02	-0.02	1.38
2250.1	2-year	6.1	238.74	1.08	238.7	-0.04	1.08
2293.3	Regional	117.9	241.45	3.94	241.45	0.00	3.94
2293.3	100-year	37.1	240.30	3.34	240.30	0.00	3.34
2293.3	50-year	31.4	240.18	3.23	240.18	0.00	3.23
2293.3	25-year	25.2	240.04	3.03	240.04	0.00	3.03
2293.3	10-year	16.7	239.79	2.77	239.79	0.00	2.77
2293.3	5-year	12.1	239.61	2.61	239.61	0.00	2.61
2293.3	2-year	6.1	239.36	2.09	239.36	0.00	2.09
2317.1	Regional	117.9	242.27	3.76	242.27	0.00	3.76
2317.1	100-year	37.1	240.91	4.04	240.91	0.00	4.04
2317.1	50-year	31.4	240.77	3.80	240.77	0.00	3.8
2317.1	25-year	25.2	240.59	3.53	240.59	0.00	3.53
2317.1	10-year	16.7	240.32	3.11	240.32	0.00	3.11
2317.1	5-year	12.1	240.15	2.80	240.15	0.00	2.8
2317.1	2-year	6.1	239.88	2.25	239.88	0.00	2.25
2317.5	**Bridge at Stewarttown Road**						
2337.3	Regional	117.9	242.39	3.30	242.39	0.00	3.30
2337.3	100-year	37.1	241.61	2.37	241.61	0.00	2.37
2337.3	50-year	31.4	241.41	2.58	241.41	0.00	2.58
2337.3	25-year	25.2	241.24	2.27	241.24	0.00	2.27
2337.3	10-year	16.7	240.69	2.20	240.69	0.00	2.2
2337.3	5-year	12.1	240.48	1.93	240.48	0.00	1.93
2337.3	2-year	6.1	240.14	1.44	240.14	0.00	1.44

Other Culverts

The CulvertMaster hydraulic model was used to determine the upstream headwater elevations (HWL) for Culverts C9, C10, C12, and C14 to C18. The input characteristics of the culverts include size, length, type, material and invert elevations. Culverts C9 to C12 are located within the Sixteen Mile Creek watershed (i.e. south of 15 Side Road and within CH jurisdiction) and Culverts C14 to C18 are located within the Black Creek watershed (i.e. north of 15 Side Road and within CVC jurisdiction).

Peak flows obtained from the 24-hour SCS storm distribution were used for the assessments. The hydraulic assessment was carried out for flows of the design storm, 100-year storm and Regional Storm (Hurricane Hazel). Tailwater elevations (TWL) were determined based on the downstream channel geometry of each culvert where a channel was present. Otherwise, a constant 7-52ailwater was used. The computed headwater elevations were compared to the road low point elevation to determine if freeboard was available.

The CulvertMaster output files for both existing and proposed conditions assessments are included in Appendix D of **Appendix J Drainage and Stormwater Management Report**.

Existing Conditions Assessment

Although Trafalgar Road is a rural arterial road under existing conditions, it will become an urban road and a semi-urban arterial road under proposed conditions where the design storm flow is the 50-year flow. Therefore, the 50-year storm flow was considered as the design flow for the existing culverts, so that upstream water levels can be compared with the proposed conditions.

Table 7-9 provides the results of the existing conditions hydraulic assessments of the culverts located within the Sixteen Mile Creek watershed. The results show that:

- Culvert C9 does not meet the freeboard criterion. The roadway is overtopped during the design, 100-year, and Regional Storm flows by 0.06 m, 0.06 m and 0.09 m respectively.
- Culvert C10 does not meet the freeboard requirement. The 50-year to the Regional Storm flows spill from the driveway toward Culvert C9.
- Culvert C12 does not meet the freeboard requirement. The roadway is overtopped during the design, 100-year, and Regional Storm flows by 0.11 m, 0.15 m, and 0.26 m, respectively.

Table 7-10 provides the results of the existing conditions hydraulic assessments of the culverts located within the Black Creek watershed. The results show that:

- Culvert C13 will be eliminated under proposed conditions due to CN underpass. No assessment was carried out.
- Culvert C14 does not meet the freeboard requirement. The roadway is overtopped during the design, 100 year, and Regional Storm flows by 0.17 m, 0.19 m and 0.35 m respectively.
- Culvert C15 does not meet the freeboard criterion. The roadway is overtopped during the design, 100-year, and Regional Storm flows by 0.05 m, 0.11 m and 0.26 m respectively.

- Culvert C16 meets the freeboard criterion for the 50-year design flow. The roadway is overtopped during the Regional Storm flow by 0.10 m.
- Culvert C17 does not meet the freeboard requirement for the 25-year design flow. The roadway is overtopped during the Regional Storm flow by 0.20 m.
- Culvert C18 meets the freeboard requirement for the 10-year design flow. The roadway is overtopped during the Regional Storm flows by 0.38 m.

Proposed Conditions Assessment

While undertaking the assessments to determine the sizes of the culverts under proposed conditions, the following guidelines were taken into consideration:

- No increase of upstream headwater elevations compared to the existing conditions;
- No overtopping of the roadway during the 100-year and the Regional Storm flows; and
- Consideration of geomorphic interest.

Table 7-11 provides the results of the proposed conditions hydraulic assessments of the culverts located within the Sixteen Mile Creek watershed. The results show that:

- Culvert C9 will be replaced by an 1830 mm x 1220 mm concrete culvert. This structure will be an open footing structure due to geomorphic interest. The culvert meets the freeboard requirement for the 50-year design flow and the Regional Storm flow does not overtop the roadway.
- Culvert C10 will be replaced by a 2130 mm x 1220 mm concrete box culvert which includes a 300 mm embedment. The culvert meets the freeboard requirement for the 50-year design flow and Trafalgar Road does not overtop during the Regional Storm flow.
- Culvert 12 will be replaced by a 2130 mm x 1220 mm concrete culvert. This structure will be an open footing structure due to geomorphic interest. The culvert meets the freeboard requirement for the 50-year design flow. Trafalgar Road does not overtop during the Regional Storm flow.

Table 7-12 provides the results of the proposed conditions hydraulic assessments of the culverts located within the Black Creek watershed. The results show that:

- Culvert 14 will be replaced by a 2130 mm x 1220 mm concrete culvert. This structure will be an open footing structure due to geomorphic interest. The culvert meets the freeboard requirement for the 50-year design flow and the Regional Storm flow does not overtop the roadway.
- Culvert 15 will be replaced by a 1520 mm x 910 mm concrete culvert. This structure will be an open footing structure due to geomorphic interest. The culvert meets the freeboard requirement for the 50-year design flow and the roadway does not overtop during the Regional Storm flow.
- Culvert 16 will be replaced by a 3050 mm x 1520 mm concrete culvert. This structure will be an open footing structure due to geomorphic interest. The culvert meets the freeboard requirement for the 50-year design flow and the Regional Storm flow does not overtop Trafalgar Road.

- Culvert 17, located on Highway 7, will be replaced by a 975 mm diameter concrete culvert. The culvert meets the freeboard requirement for the 25-year design flow and the Regional Storm flow does not overtop Highway 7.
- Culvert 18, located in 20 Side Road, will be replaced by a 3050 mm x 1520 mm concrete culvert. This structure will be an open footing structure due to geomorphic interest. The culvert meets the freeboard requirement for the 10-year design flow and the Regional Storm flow overtops 20 Side Road by 0.14 m which is less than 0.30 m, hence, acceptable since this is a Town road and not a Regional road. The Regional Storm does not overtop Trafalgar Road.

The CulvertMaster output files for both existing and proposed conditions assessments are included in Appendix D of **Appendix J Drainage and Stormwater Management Report**.

7.1.10.7 Stormwater Management

The preferred alignment of Trafalgar Road is located inside the watershed of Sixteen Mile Creek north of 10 Side Road to 15 Side Road, and inside the watershed of Black Creek between 15 Side Road and Highway 7. A list of stormwater best management practices (BMPs) was screened, with consideration of the general advantages and disadvantages, experience, and practical feasibility for the site specific conditions.

It was determined at the start of the study that the “do nothing” alternative is not an acceptable course of action. The increase in pavement areas and the associated potential increase in pollutant loading to the receiving watercourses would result in negative effects such as reduced stream water quality, degraded aquatic habitat, flooding, and in-stream erosion, which necessitate provision of appropriate mitigation measures.

The MOECC has identified a broad range of stormwater management practices (SWMPs) that may be considered for the proposed roadway corridor. The recommended practices that can be implemented as part of this project are:

- Wet ponds providing quality treatment, quantity control and erosion control;
- Vegetative, dry linear facilities providing quantity control and a measure of quality treatment;
- Storage pipe systems providing quantity control;
- Enhanced vegetated grassed swales providing quality treatment;
- Special SWMPs such as oil and grit separators (OGSs) to provide quality treatment;
- LID measures such as bio-retention areas (bio-swales), tree pits, and infiltration galleries/trenches

Table 7-9: Hydraulic Assessments of Existing Culverts located within Sixteen Mile Creek Watershed

Culvert ID	Size (mm)	Length (m)	Drainage Area (ha)	Type / Material	U/S Invert (m)	D/S Invert (m)	Road Low Point Elevation (m)	Ditch Spill Elevation (m)	Events	Flow (m3/s)	TWL (m)	Computed HWL (m)	HW/D	Freeboard (m)	Meets Requirements?		
															Freeboard	HW/D	Overtopping?
C9	900 mm diameter	22.9	30.2	Circular, CSP	251.000	250.830	253.020	n/a	50-year	3.950*	251.24	253.08	2.27	-0.06	No	No	Overtopping
									100-year	4.508*	251.24	253.08	n/a	-0.06	n/a	n/a	Overtopping
									Regional	7.633*	251.24	253.11	n/a	-0.09	n/a	n/a	Overtopping
C10	700 mm diameter	26.5	46.4	Circular, CSP	252.320	252.240	254.360	253.920	50-year	2.548	252.56	254.00	2.40	0.36	No	No	No
									100-year	2.849	252.56	254.01	n/a	0.35	n/a	n/a	No
									Regional	4.934	252.56	254.05	n/a	0.31	n/a	n/a	No
C12	900 mm diameter	26.4	39.3	Circular, CSP	260.740	260.420	262.470	n/a	50-year	1.931	245.52	262.58	2.02	-0.11	No	No	Overtopping
									100-year	2.167	245.53	262.62	n/a	-0.15	n/a	n/a	Overtopping
									Regional	4.047	245.60	262.73	n/a	-0.26	n/a	n/a	Overtopping

Note: Regional flows from C10 spill into C9. Spilled flows from C10 were added to C9 flows for the hydraulic analysis.
U/S = Upstream D/S = Downstream TWL = Tailwater elevation HWL = Headwater elevation HW/D = Headwater to depth ratio

Table 7-10: Hydraulic Assessments of Existing Culverts located within Black Creek Watershed

Culvert ID	Size (mm)	Length (m)	Drainage Area (ha)	Type / Material	U/S Invert (m)	D/S Invert (m)	Road Low Point Elevation (m)	Ditch Spill Elevation (m)	Events	Flow (m3/s)	TWL (m)	Computed HWL (m)	HW/D	Freeboard (m)	Meets Requirements?		
															Freeboard	HW/D	Overtopping?
C13	525 mm diameter	24.1	53.9	Circular, HDPE	238.41	238.25	n/a	n/a	This culvert will be eliminated under proposed conditions.								
C14	900 mm diameter	24.1	53.9	Circular, CSP with HDPE Liner	267.920	267.640	268.790	n/a	50-year	1.562	267.76	268.96	1.14	-0.17	No	Yes	Overtopping
									100-year	1.765	267.78	268.98	n/a	-0.19	n/a	n/a	Overtopping
									Regional	4.420	267.92	269.14	n/a	-0.35	n/a	n/a	Overtopping
C15	600 mm diameter	28.3	41.0	Circular, CSP with HDPE Liner	269.670	268.680	274.040	n/a	50-year	1.845	268.90	274.09	7.26	-0.05	No	No	Overtopping
									100-year	2.078	268.92	274.15	n/a	-0.11	n/a	n/a	Overtopping
									Regional	4.140	269.05	274.30	n/a	-0.26	n/a	n/a	Overtopping
C16	1800 mm diameter	50.2	104.0	Circular, CSP	269.480	269.290	273.000	n/a	50-year	3.959	269.92	271.16	0.92	1.84	Yes	Yes	No
									100-year	4.491	269.96	271.30	n/a	1.70	n/a	n/a	No
									Regional	10.230	270.26	273.10	n/a	-0.10	n/a	n/a	Overtopping
C17 (Highway 7)	900 mm diameter	65.5	18.7	Circular, CSP	274.460	273.500	276.240	n/a	25-year	0.932	273.93	275.47	1.10	0.96	No	Yes	No
									100-year	1.274	273.95	275.68	n/a	0.75	n/a	n/a	No
									Regional	2.150	274.08	276.63	n/a	-0.20	n/a	n/a	Overtopping
C18 (20 Side Road)	1800 mm diameter	49.2	100.9	Circular, CSP	270.500	270.000	272.750	n/a	25-year	3.220	270.98	272.00	0.82	0.75	No	Yes	No
									100-year	4.419	271.30	272.29	n/a	0.46	n/a	n/a	No
									Regional	9.980	273.10	273.13	n/a	-0.38	n/a	n/a	Overtopping

Note: Regional flows from C10 spill into C9. Spilled flows from C10 were added to C9 flows for the hydraulic analysis.
U/S = Upstream D/S = Downstream TWL = Tailwater elevation HWL = Headwater elevation HW/D = Headwater to depth ratio

Table 7-11: Hydraulic Assessments of Proposed Culverts located within Sixteen Mile Creek Watershed

Culvert ID	Size (mm)	Length (m)	Drainage Area (ha)	Type / Material	U/S Invert (m)	D/S Invert (m)	Road Low Point Elevation (m)	Ditch Spill Elevation (m)	Events	Flow (m3/s)	TWL (m)	Computed HWL (m)	HW/D	Freeboard (m)	Meets Requirements?		
															Freeboard	HW/D	Overtopping?
C9	1830 x 910 mm	39.0	30.2	Open Footing, Concrete	251.000	250.830	253.090	n/a	50-year	2.088	251.24	251.92	1.08	1.17	Yes	Yes	No
									100-year	2.333	251.24	251.99	n/a	1.10	n/a	n/a	No
									Regional	4.270*	251.24	253.00	n/a	0.09	n/a	n/a	No
C10	2130 mm x 1220 mm 300 mm embedded	43.3	46.4	Box, Concrete	252.320	252.240	254.460	253.920	50-year	2.521	252.56	253.30	1.07	1.16	Yes	Yes	No
									100-year	2.816	252.56	253.37	n/a	1.09	n/a	n/a	No
									Regional	4.930	252.56	253.97	n/a	0.49	n/a	n/a	No
C12	2130 x 910 mm	43.5	39.3	Open Footing, Concrete	260.740	260.420	262.570	n/a	50-year	1.898	245.53	261.48	0.81	1.09	Yes	Yes	No
									100-year	2.124	245.53	261.54	n/a	1.03	n/a	n/a	No
									Regional	4.040	245.60	262.33	n/a	0.24	n/a	n/a	No

Note: Regional flows from C10 spill into C9. Spilled flows from C10 were added to C9 flows for the hydraulic analysis.
U/S = Upstream D/S = Downstream TWL = Tailwater elevation HWL = Headwater elevation HW/D = Headwater to depth ratio

Table 7-12: Hydraulic Assessments of Proposed Culverts located within Black Creek Watershed

Culvert ID	Size (mm)	Length (m)	Drainage Area (ha)	Type / Material	U/S Invert (m)	D/S Invert (m)	Road Low Point Elevation (m)	Ditch Spill Elevation (m)	Events	Flow (m3/s)	TWL (m)	Computed HWL (m)	HW/D	Freeboard (m)	Meets Requirements?		
															Freeboard	HW/D	Overtopping?
C14	2130 mm x 1220 mm	46.0	55.2	Open Footing Concrete	267.450	267.200	269.410	n/a	50-year	1.602	267.77	268.13	0.56	1.28	Yes	Yes	No
									100-year	1.810	267.78	268.19	n/a	1.22	n/a	n/a	No
									Regional	4.529	267.92	268.81	n/a	0.60	n/a	n/a	No
C15	1520 mm x 910 mm	43.5	40.3	Open Footing Concrete	269.670	268.680	272.180	n/a	50-year	1.814	268.89	270.89	1.00	1.29	Yes	Yes	No
									100-year	2.042	268.91	270.96	n/a	1.22	n/a	n/a	No
									Regional	4.072	269.05	271.48	n/a	0.70	n/a	n/a	No
C16	3050 mm x 1520 mm	78.0	104.5	Open Footing Concrete	269.400	269.200	271.860	n/a	50-year	3.955	269.92	270.43	0.68	1.43	Yes	Yes	No
									100-year	4.486	270.52	270.52	n/a	1.34	n/a	n/a	No
									Regional	10.200	270.26	271.43	n/a	0.43	n/a	n/a	No
C17 (Highway 7)	975 mm diameter	65.5	18.3	Circular, Concrete	274.460	273.500	276.430	n/a	25-year	0.922	273.93	275.35	0.92	1.08	Yes	Yes	No
									100-year	1.261	273.95	275.54	n/a	0.89	n/a	n/a	No
									Regional	2.148	274.08	276.19	n/a	0.24	n/a	n/a	No
C18 (20 Side Road)	3050 mm x 1520 mm	22.0	100.9	Open Footing Concrete	270.000	269.800	271.700	n/a	10-year	2.429	270.16	270.69	0.56	1.01	Yes	Yes	No
									100-year	4.419	270.52	271.03	n/a	0.67	n/a	n/a	No
									Regional	9.982	271.43	271.84	n/a	-0.14	n/a	n/a	Overtopping (20 Side Road under Town of Halton Hills jurisdiction)

Note: Regional flows from C10 spill into C9. Spilled flows from C10 were added to C9 flows for the hydraulic analysis.
U/S = Upstream D/S = Downstream TWL = Tailwater elevation HWL = Headwater elevation HW/D = Headwater to depth ratio

Storage SWMP such as wet ponds, dry ponds, and linear SWM facilities, can be effective in providing combined quality treatment and/or quantity control where drainage areas are sufficient and land is available. Storage pipe systems can be effective for small drainage areas and in the case where land is not available. Vegetative SWMPs such as Enhanced grassed swales, bio-swales, etc. provide water quality treatment primarily by filtering out fine sediments and promoting infiltration, but can also be used to provide erosion control. Filtering of roadway pavement runoff can also be accomplished with vegetative embankments. Enhanced grassed swales are primarily designed to provide water quality control by limiting flow velocities and increasing the wetted perimeter, and can include grassed berms to detain water during small events and/or wider flat bottoms to increase storage and flow contact. Vegetative SWMPs can be readily applied to roads and highways, and are relatively inexpensive and particularly effective for small catchment areas. Infiltration measures such as bio-retention areas (bio-swales), tree pits, and infiltration galleries/trenches are effective for water balance and low impact development (LID) measures.

Within the study area, runoff from the proposed roadway will ultimately discharge to permanent watercourses via ditches and storm sewers. The roadway areas result in an increase in impervious area which eventually may result in an increase potential for erosion, flood risk, and water quality degradation along the receiving watercourses. Therefore, road runoff needs to be treated as far as possible both in terms of quantity and quality treatment before discharging into the receiving watercourses. Where appropriate, extension detention will be provided to reduce/mitigate the erosion impacts to the receiving watercourses during the detail design phase. Planting of native, non-rare species around the proposed SWM facilities will be reviewed during detailed design.

7.1.10.8 Impact of Proposed Improvement of Road Corridor

The proposed improvements to Trafalgar Road include the widening from a 2 to 4 lane roadway with the provision of active transportation facilities with a combination of urban section and semi-urban sections. Two grade separations will also be provided – one at the CN crossing north of 17 Side Road and one at the Metrolinx crossing north of 20 Side Road. The roadway section with a semi-urban section will have an urban cross section on the east side and a rural cross section on the west side. The proposed roadway improvement will lead to an increase in impervious areas thereby increasing the peak flow rates. Several SWM facilities are proposed to address flows from the increased impervious areas.

Table 7-13 provides a comparison of impervious areas under existing and proposed conditions at each Node or point of interest due to the proposed road alignment. The table also shows the uncontrolled 100 year peak flow increases due to increase in impervious areas.

Table 7-13: Comparison of Impervious Areas

Node / Outlet	Existing Conditions			Proposed Conditions			Increase from Existing	
	Drainage Area (ha)	Impervious Area		Drainage Area (ha)	Impervious Area			
		Ha.	%		Ha.	%	Impervious Area	100-year Flow
Sixteen Mile Creek Watershed								
C9	30.2	2.54	8.4%	30.2	3.50	11.6%	3.2%	7.90%
C10	46.4	0.78	1.7%	46.4	1.73	3.7%	2.0%	3.30%
C11	136	1.10	0.8%	136	2.11	1.6%	0.7%	2.50%
C12	39.3	1.80	4.6%	39.3	2.83	7.2%	2.6%	8.50%
Black Creek Watershed								
Existing Storm Outlet	36.3	3.02	8.3%	36.3	3.02	8.3%	0.0%	0.0%
B1	50.1	4.90	9.8%	50.1	7.21	14.4%	4.6%	17.8%
Underpass Area	3.46	1.09	31.4%	3.46	1.97	56.9%	25.5%	40.7%
C14	53.9	5.20	9.6%	55.2	5.85	10.6%	1.0%	2.5%
Tributary 1	57.4	6.29	11.0%	58.7	7.82	13.3%	2.4%	13.4%
C15	41.0	1.39	3.4%	40.3	1.60	4.0%	0.6%	-1.73%
S1	10.0	0.57	5.7%	9.00	0.50	5.6%	-0.1%	-6.4%
C16	104.0	2.34	2.3%	104.5	3.69	3.5%	1.3%	-0.1%
C17	18.7	1.42	7.6%	18.3	1.37	7.5%	-0.1%	-1.0%

C – Culvert, B- Bridge, S- Storm Inlet

The table illustrates that there is significant increase in flows at Culverts C9, C10, C11, B1, CNR Underpass area, and Tributary 1. Therefore, to reduce the impacts of sediment loading as well as increased peak flows to the receiving watercourses, storm water management measures are required for runoff quality and quantity control.

7.1.10.9 Proposed Stormwater Management Strategy

The stormwater management strategy for the Trafalgar Road corridor involves a two stage approach which consists of interim SWM facilities and ultimate SWM facilities.

- **Interim SWM Approach:** A suitable temporary SWM approach will be proposed in the area of the future Vision Georgetown Subdivision development site (i.e. between 10 Side Road and 15 Side Road, on the east side of Trafalgar Road). Through the development of the Subdivision in the area, the interim SWM facilities can be integrated into the Subdivision's SWM plan. The Region, Town and the developer should have an agreement for the ultimate condition SWM plan, for the development will be subject to further review by the Region, Town through the development process.
- **Ultimate SWM Approach:** In the areas where there are no future development plans, ultimate SWM approach is proposed.

Under this approach, a total of five (5) SWM facilities are proposed for the runoff quality and quantity control. There will be four (4) grassed linear, dry SWM facilities and one (1) pipe storage facility. In addition, there will be Enhanced grassed swales and bio-swales to provide quality treatment as well as water balance. Oil and grit separators (OGSs) will be provided at five (5) locations where the roadway runoff is conveyed by storm sewers. The treatment goals for different SWM facilities are:

- SWM wet pond will provide quality treatment, quantity control and erosion control.
- Vegetative dry linear facility will provide peak flow control and a measure of quality control.
- Enhanced grassed swales, bio-swales and other grassed swales/ditch will provide quality treatment and water balance.
- OGSs will provide quality treatment.

Where feasible, a treatment train approach has been provided as per the MOECC guidelines.

Table 7-14 and **Table 7-15** summarize the details of the SWM component proposed for the Trafalgar Road corridor within the Sixteen Mile Creek watershed and Black Creek watershed, respectively.

Where appropriate, extension detention /erosion control measures will be provided during the detailed design phase. The possibility of other LID measures such as bio-retention areas (bio-swales), tree pits, infiltration galleries/trenches, etc. will be reviewed during the detail design phase. Consultation with Landscape Architect will be carried out to refine the LID options

Table 7-16 summarizes the characteristics and overall performance of each SWM facility.

Table 7-14: Proposed SWM Components within Sixteen Mile Creek Watershed (CH Jurisdiction)

Station		Length (m)	SWM Component	Purpose
From	To			
6+300	6+500	200	Storm sewer on northbound lane toward Pond 9S Grassed ditch on west side	Quality control
6+500	6+700	200	Storm sewer on northbound lane toward Pond 9S (Interim) on east side Enhanced grassed swale on west side	Quality control
6+700	6+850	150	Storm sewer, OGS and grassed linear facility Pond 9S Bio-swale on west side	Quality control, quantity control and water balance
6+850	7+000	150	Bio-swale on west side	Quality control and water balance
7+000	7+200	6500	Enhanced grassed swale on west side	Quality control
7+300	7+450	150	OGS and grassed linear facility 10N (interim)on east side Bio-swale on west side	Quality control, quantity control and water balance
7+450	7+900	450	Storm sewer on northbound lane toward Pond 10N Enhanced grassed swale on west side	Quality control

Station		Length (m)	SWM Component	Purpose
From	To			
7+975	8+100	125	Grassed linear facility Pond 11N (interim) on the east side	Quality and control
8+060	8+300	240	Bio-swale on west side	Quality control and water balance
8+300	8+500	200	Enhanced grassed swale on west side	Quality control
8+500	8+650	150	Grassed ditch	Limited water quality control
8+650	8+800	150	OGS and grassed linear facility Pond 12N (interim) on east side Bio-swale on west side	Quality control, quantity control and water balance
8+800	9+300	500	Enhanced grassed swale on west side	Quality control
9+300	9+450	150	Grassed ditch on west side	Limited water quality control

Table 7-15: Proposed SWM Components within Black Creek Watershed (CVC Jurisdiction)

Station		Length (m)	SWM Component	Purpose
From	To			
9+450	9+920	470	Storm sewer, OGS and outlet pool	OGS for quality treatment and outlet pool for erosion control
9+980	10+680	700	Storm sewer, OGS , outlet pool and grassed swale	OGS and grassed swale for quality treatment and outlet pool for erosion control
10+700	11+125	425	Storage pipe facility 14S and OGS	Quality and quantity control
11+125	11+400	275	Bio-swales on west side	Quality control and water balance
11+400	11+750	350	Enhanced grassed swale on west side	Quality control
11+750	11+850	100	Bio-swales on west side	Quality Control and water balance
11+850	11+950	100	Ditch with rip-rap	Riprap for erosion control
11+950	12+100	150	Bio-swales on west side	Quality control and water balance
12+100	12+300	200	Enhanced grassed swale on west side	Quality control
12+300	12+420	120	Storm sewer and OGS on the east side Bio-swales on west side	Quality control and water balance
12+500	12+720	220	Grassed ditch on west side	Limited water quality control

Table 7-16: Characteristics of Proposed SWM Facilities

Facility ID.	Type	Design Stage	Drainage Area	Permanent Pool [1]	Active Storage [2]	100-yr Peak Inflow	100-yr Peak Outflow	% Reduction in 100-yr Peak Flow
			(ha)	(m^3)	(m^3)	(m^3/s)	(m^3/s)	
9S	Grassed linear dry SWM facility	Interim	1.30	--	455	0.390	0.088	77%
10N	Grassed linear dry SWM facility	Interim	1.40	--	500	0.406	0.169	58%
11N	Grassed linear dry SWM facility	Interim	2.10	--	505	0.595	0.239	60%
12N	Grassed linear dry SWM facility	Interim	1.90	--	580	0.481	0.266	45%
14S	Pipe storage facility	Ultimate	3.46	--	510	0.982	0.652	34%

1) Permanent Pool is based on Table 3.2 of the MOECC Stormwater Planning and Design Manual.
2) Active Storage refers to the maximum volume used during the 100-year 24-hr SCS Storm.

The location of Enhanced grassed swales, bio-swales and other stormwater management BMPs are shown in **Exhibit 7-10** to **Exhibit 7-17**. The stage-discharge-storage information for each stormwater management facility is provided in Appendix F or **Appendix J Drainage and Stormwater Management Report**. Additional details for each SWM facility are provided in the following text.

Pond 9S:

- It is a grassed linear SWM facility located at Station 6+800 on the east side of Trafalgar Road.
- This facility is considered an interim facility until such time when the future SWM facility of 'Vision Georgetown" is constructed.
- The facility will service 1.3 ha of the roadway corridor (Catchment 140-1) from approximately Station 6+300 to 6+820. The layout plan of this facility is shown in **Exhibit 7-10**.
- The pond will have 3:1 side slopes and a bottom elevation of 251.0 m. At the bottom of the facility, the dimension will be approximately 100 m long and 3 m wide. The 100-year storage volume for this pond will be approximately 455 m3.
- Roadway runoff will be conveyed by storm sewers and an OGS is provided for quality treatment before discharging to the grassed linear facility. Outflows from the SWM facility will discharge to the downstream side of Culvert C9.
- The OGS and vegetative linear facility together will provide quality treatment of the runoff and maintaining a treatment train approach.

Pond 10N:

- It is a grassed linear SWM facility located at Station 7+350 on the east side of Trafalgar Road.

- This facility is considered as an interim facility until such time when the future SWM facility of 'Vision Georgetown" is constructed.
- The facility will service 1.4 ha of the roadway corridor (Catchment 145-1) from approximately Station 7+300 to 7+900. The layout plan of this facility is shown in **Exhibit 7-11**.
- The pond will have 3:1 side slopes and a bottom elevation of 252.6 m. At the bottom of the facility, the dimension will be approximately 100 m long and 2.5 m wide. The 100-year storage volume for this pond will be approximately 500 m^3.
- Roadway runoff will be conveyed by storm sewers and an OGS is provided for quality treatment before discharging to the grassed linear facility. Outflows from the SWM facility will discharge to the downstream side of Culvert C10.
- The OGS and vegetative linear facility together will provide quality treatment of the runoff and maintaining a treatment train approach.

Pond 11N:

- It is a grassed linear SWM facility located at Station 8+150 on the east side of Trafalgar Road.
- This facility is considered as an interim facility until such time when the future SWM facility of 'Vision Georgetown" is constructed.
- The facility will service 2.1 ha of the roadway corridor (Catchment 150-1) from approximately Station 8+080 to 8+560. The layout plan of this facility is shown in **Exhibit 7-11**.
- The pond will have 3:1 side slopes and a bottom elevation of 256.3 m. At the bottom of the facility, the dimension will be approximately 125 m long and 2 m wide. The 100-year storage volume for this pond will be approximately 500 m^3.
- Before discharging into this SWM facility, roadway runoff will be conveyed by grassed ditch, Enhanced grassed swale and bio-swale on the west side of the roadway and through a 750 mm diameter culvert, the storm runoff is directed to the SWM facility on the east side. Outflows from the SWM facility will be conveyed by approximately 50 m long ditch to Culvert C11.
- The grassed ditch, Enhanced grassed swale, bio-swale, vegetative linear facility and grassed ditch together in series will provide quality treatment of the runoff and maintaining a treatment train approach.

Pond 12N:

- It is a grassed linear SWM facility located at Station 8+750 on the east side of Trafalgar Road.
- This facility is considered as an interim facility until such time when the future SWM facility of 'Vision Georgetown" is constructed.
- The facility will service 1.9 ha of the roadway corridor (Catchment 155-1) from approximately Station 8+680 to 9+450. The layout plan of this facility is shown in **Exhibit 7-12**.
- The pond will have 3:1 side slopes and a bottom elevation of 261.50 m. At the bottom of the facility, the dimension will be approximately 125 m long and 2 m wide. The 100-year storage volume for this pond will be approximately 580 m^3.
- Before discharging into this SWM facility, roadway runoff will be conveyed by storm sewers and an OGS is provided for quality treatment before discharging to the

grassed linear facility. Outflows from the SWM facility will discharge to the downstream side of Culvert C12.
- The OGS and vegetative linear facility together will provide quality treatment of the runoff and maintaining a treatment train approach.

SWM Facility 14S:

- It is a Super Pipe (pipe storage system) design located within the CN underpass area.
- The facility will service the runoff of a 3.46 ha area of Catchments 225 and 230 from approximately Station 10+680 to 11+120. The layout plan of this facility is shown in **Exhibit 7-15**.
- Outflows from the SWM facility will discharge to Tributary 1 of Black Creek via storm sewers and an OGS will be provided for quality treatment before discharging the runoff into the watercourse.
- The Super Pipe system will be used to provide over control of the peak flows to balance the uncontrolled flows from Catchment 235 discharging to Tributary 1 of Black Creek.
- The storage pipe system will be extended 150 m long on each side of the sag, thus providing a total length of 300 m. The storage pipe system consists of 1830 mm x 910 mm concrete box at a slope of 0.65% from one end to the sag point. The invert elevation of the storage pipe facility at its outlet is 256.8 m. The 100-year storage volume for this facility is approximately 510 m^3.

7.1.10.10 Water Balance and Low Impact Development Measures

For the water balance and low impact development (LID) measures the following steps were considered:

- Maximum exposure of roadway runoff into the pervious areas;
- Implementation of Enhanced grassed swales; and
- Implementation of bio-swales.

This will allow both quality treatment of the roadway runoff and infiltration into the ground to provide water balance requirement. **Table 7-15** and **Table 7-16** list the locations where Enhanced grassed swales and bio-swales are proposed along the Trafalgar Road corridor. A comprehensive review of these water balance and LID measure will be carried out during the detailed design phase.

7.1.10.11 Erosion and Sediment Control

At each watercourse crossing structure, erosion and sediment control best practices will be applied during construction to prevent sediment-laden runoff from entering the water course.

Two outlet pools will be provided at the proposed storm sewer outlets on the south side and north side of the Black Creek Bridge for erosion control.

The detailed design of outlet pools and other erosion and sediment control measures will be carried out during the detailed design phase.

7.1.11 Fluvial Geomorphology

A fluvial geomorphic assessment was conducted to describe the existing conditions of the various watercourses within the study area, to assess the possible impacts of the proposed works on the watercourses and to provide preliminary design recommendations for the proposed watercourse crossings. A brief overview of the assessment is provided in this section.

Relevant background information was reviewed to provide context and fill any data gaps. This included available topographic data, drainage and hydraulic data from the drainage and stormwater management review completed as part of the Trafalgar Road EA Study, surficial geology mapping, project correspondence with technical agencies, relevant guidelines and relevant background reports.

Site visits were conducted on December 2 and 3, 2015 as well as on February 3, 2016. Existing reach characteristics are summarized in **Table 7-17**. Most of the watercourse crossings (e.g. Culverts C14, C15, C16 and C18) are headwater features with small drainage areas on the order of 1km^2 or less. These are typically swales or ditches with minimal ongoing geomorphic processes.

Within the study area between north of 10 Side Road and Highway 7, Black Creek is the only regulated watercourse and is the largest watercourse which has a drainage area of 73.2km^2. The watercourse is a permanent and within the study reach the channel appears to have been straightened and locally stabilized.

The study reach on the Tributary to Black Creek downstream of Culvert C14 was also assessed in detail because the future road alignment will be shifted toward the creek valley as part of the CN rail grade separation. This is classified as a permanent watercourse. It has defined channel and is undergoing incision and lateral adjustment within a narrow forested valley.

The proposed works include replacement of all watercourse crossings included in the geomorphology assessment. All replacement crossings with fluvial interest will be open-foot structures to allow sediment transport processes to occur unimpeded. Replacement structures will also be widened to meet hydraulic criteria.

Table 7-17: Summary of Reach Characteristics

	Culvert No.	Drainage Area (km^2)	Bankfull Width (m)	Planform Geometry	Description
Sixteen Mile Creek Watershed (Conservation Halton	**C9**	0.30	N/A	Straight	No defined channel downstream of roadside ditch.
	C11	1.36	N/A	Straight	Ditch is 2.5m wide, no natural bankfull indicators. Erosion present at outlet due to undersized culvert.
	C12	0.39	N/A	Straight	No defined channel outside of roadside ditches.

	Culvert No.	Drainage Area (km^2)	Bankfull Width (m)	Planform Geometry	Description
Black Creek Subwatershed / Silver Creek Watershed (Credit Valley Conservation)	**B1**	73.20	6-9	Straightened reach in meandering system	Black Creek has been straightened near Trafalgar Road. Partial bank protection present, limited bank erosion. Cobble-gravel bed with riffle-run morphology. Reach is located downstream of Stewarttown Road Bridge.
	C14	0.54	1.3	Straight	Upstream is a wetland with no defined channel. Downstream channel is modified.
	Downstream of C14	Unknown	1.7-2.5	Meandering	CN rail culvert outlet is perched. Downstream, channel is sinuous within confined valley. Active erosion on banks. Ongoing lateral adjustment and incision. Cobble-gravel bed.
	C15	0.41	N/A	Straight	Swale flowing on forest floor. No defined channel in Trafalgar Road right-of-way.
	C16	1.00	2	Straight	No defined channel upstream. Straightened channel downstream. Vegetated, fine gravel substrate.
	C18	1.00	N/A	Straight	No defined channel.

The detailed geomorphology assessment is provided in a separate report in **Appendix J Drainage and Stormwater Management Report**.

Culvert crossings C9, C11 and C12 which are within CH jurisdiction will be replaced with open foot culverts. This will allow sediment transport to occur unimpeded through the crossings. These replacement structures will be widen than the existing culverts. The proposed spans are considered sufficient to maintain ongoing geomorphic processes and will not increase erosion risk. At C9 and C12, there is no defined channel present and span criteria based on multiples of bankfull width are not applicable. At C11, the wider span will be an improvement over existing conditions and will help to address downstream bank scour.

At C9, realignment of the upstream roadside ditch will be required as the existing ditch will be removed. Minor tie in works will be required to connect the culvert to the downstream swale.

At C11, realignment of the upstream and downstream roadside ditches will be required as existing ditches will be removed. At the culvert outlet, a stable scour pool may be created to allow dissipation of energy. The skew angle of the culvert may be considered to be reduced to improve the angle between the ditch planform upstream and downstream.

At C12, realignment of the upstream and downstream roadside ditches will be required as existing ditches will be removed.

Within CVC jurisdiction, culvert crossings C14, C15, C16 and C18 will be replaced. At C15 and C18, there is no defined channel present, and span criteria based on multiples of bankfull width are not applicable.

The proposed span of C14 will be approximately 1.5 times the channel width downstream. The channel width is modified; the upstream feature consists of a swale, and the downstream reach is hardened and confined by residential landscaping. The wider culvert is an improvement over existing conditions. Tie in works will be required at the culvert inlet.

Culvert C15 will be replaced, no tie in work will be required.

The proposed span of C16 will be approximately 1.5 times the channel width downstream. The upstream feature consists of a swale, and the downstream reach is straight and confined by the railway embankment. The widen span will be an improvement over existing conditions. As the proposed road alignment of Trafalgar Road will be shifted to the west, inverts and substrate should be designed to tie in smoothly with the channel downstream. Minor tie in works may be required to connect to the swale upstream. A scour pool may be considered at the culvert outlet.

Culvert C18 will be replaced. Minor tie in works may be required to connect the swale downstream. A scour pool may be considered at the culvert outlet.

Black Creek Crossing

The surficial geology of Black Creek near Trafalgar Road consists of alluvium within the Black Creek channel, glaciofluvial gravel on adjacent floodplain, and silt to clay till in the wider valley. The reach is classified as coldwater.

Within the study reach the geomorphic form and function of the channel has been heavily impacted by historical and contemporary infrastructure. This includes the Stewarttown Dam, the bridge on Stewarttown Road, the bridge on Trafalgar Road, several pedestrian bridges within the golf course property, a stormwater outfall downstream of the Stewarttown Road bridge and several road side ditch outfalls. The Stewarttown Dam controls the grade and channel planform at the upstream extent of the reach and also alters sediment transport processes downstream. Between the dam and Stewarttown Road, the channel may have been historically impacted by a millrace. The Stewarttown Road and Trafalgar Road bridges also impose local limits on lateral channel migration. Embankment and grading works associated with the adjacent properties appear to contribute to the partial confinement of the channel, particularly upstream of Trafalgar Road.

The planform within the study reach appears to have been straightened. The historic aerial photographs reviewed indicate the creek has occupied the same planform since the earliest aerial photograph date of 1954. Given the close proximity to urban land use, it is likely the existing planform has been maintained by property management activities throughout the period of the photographic record and will continue to be maintained under future conditions.

The straightened channel planform, lack of historic pre-disturbance planform information and the likelihood that the existing planform will be maintained precludes the

measurement of bank migration from the aerial photographs. Due to the urbanized conditions, the calculation of a meander belt from empirical model is not considered applicable to this reach. Instead, it is recommended that the replacement of Trafalgar Road bridge meet other geomorphic considerations for crossing design as outlined in the CVC Fluvial Geomorphic Guidelines (2015).

The existing 8.8m wide bridge at Black Creek will be replaced with an over 30 m wide clear span structure. The bridge will be placed well outside of the bankfull channel. The creek on both sides of the bridge has been straightened and the channel has been prevented from migrating laterally by the installation of local bank protection. The additional span will not increase erosion hazards within the creek. The proposed span is anticipated to provide ample room to allow existing geomorphic processes to continue unimpeded.

Tributary to Black Creek

A grade separation is proposed between the CN railway and Trafalgar Road north of 17 Side Road / Maple Avenue (road under rail). The profile will be lowered at the grade separation and will encroach toward a Tributary to Black Creek.

A preliminary assessment of the erosion hazard limit of the creek was completed within this reach with guidance from CVC's Slope Stability Definition & Determination Guideline (2014), following procedure for confined valleys.

The preliminary erosion hazard assessment is for general purpose only and was based on coarse topographic data and standard offsets. A detailed erosion hazard limit may be delineated during detailed design based on a slope stability study by a geotechnical engineer and detailed topographic survey data.

The preliminary assessment indicates that parts of the proposed road alignment will fall within the preliminary erosion hazard limit of the creek between CN railway and Maple Avenue where the road is nearest to the valley. The standard 8 m erosion setback alone is nearly equivalent to the minimum distance between the retaining wall and the creek centerline. As there is limited opportunity to realign the Tributary due to valley confinement, opportunities for local bank and valley slope protection and post-construction monitoring should be explored at detailed design.

7.1.12 Hydrogeology

A hydrogeology assessment was conducted as part of the EA Study to broadly characterize the hydrogeological conditions in the overall study area between Steeles Avenue and Highway 7. A copy of the Hydrogeology Report can be found in **Appendix N**. The discussion in this section will focus on the section between 10 Side Road and Highway 7.

The Ontario Water Resources Act states that the diversion of surface water or the extraction of groundwater in excess of 50,000 L/day requires a Permit to Take Water (PTTW) to be obtained from the MOECC. A Category 3 PTTW is expected to be required for this project for the construction of the grade separations at CN and Metrolinx, as well as at the Black Creek Bridge. The dewatering of excavations shall be

conducted to ensure that all discharges meet the Provincial Water Quality Objectives and comply with the Ontario Water Resources Act thresholds for water quality.

Since the works are located within the Wellhead Protection Areas (WHPA)-A and WHPA-B of the Lindsay Court Wellfield, a monitoring and mitigation plan will have to be developed with Halton Region Water Services to mitigate against potential construction period issues and/or operational constraints that relate to Lindsay Court Well 9 (LC9).

The findings from the ongoing Lindsay Court Wellfield Expansion EA (by others) will have to be incorporated with the findings from the Trafalgar Road EA during the designed detail phase.

The water takings related to active PTTWs will need to be evaluated and considered as part of any construction period dewatering in support of the Trafalgar Road grade separation work.

A door to door well survey within the study limits between 10 Side Road and Highway 7 will have to be performed. Groundwater monitoring points will have to be established near the municipal wells fields and near the proposed grade separations, to monitor the effects of construction on the municipal and domestic water wells. Documentation of other permitted water takings will need to be evaluated and the effects considered as part of this door to door survey.

A suitable drinking water monitoring plan will need to be established, involving pre-construction baseline groundwater quantity and quality details at private wells and municipal wells. Monitoring of groundwater levels and water quality will be performed at the municipal and domestic wells during the construction period. The data will be analyzed to determine if any adverse trends regarding groundwater level and quality are observed.

Construction related impacts to domestic wells will be mitigated by notification (private well owner, Halton Region Water Services, Halton Region Health Unit, etc.), identifying the source/cause of the well issue, providing temporary water supplies to impacted well owners, and providing a solution to the well issue (e.g. drilling a new well, providing municipal water servicing, etc.)

The potential for soil and groundwater contamination near major intersections and adjacent to commercial properties should be evaluated. Dewatering discharge may need to be managed and/or treated during construction dewatering**.** A soil management plan may have to be developed to manage any potentially contaminated soil identified during construction, especially within Wellhead Protection Areas.

Contamination migration flow paths may potentially be modified during groundwater pumping in the shallow aquifer. Dewatering discharge may need to be managed and/or treated during construction dewatering**.**

During construction, the quality of surface water and groundwater between 10 Side Road and Highway 7 needs to be protected from loading of suspended solids into watercourses, potential fuel leaks or falling construction debris caused from construction activities. Protection may be achieved through implementation of best management

practices and the development of robust erosion and sediment control plans and monitoring and mitigation programs.

There is a requirement that there be permanent stormwater outlets at both grade separations (CN and Metrolinx), to preclude precipitation event flooding. This is especially important at the Metrolinx grade separation, as static groundwater levels reflect LC9 pumping conditions. While it is anticipated that LC9 will continue to function at its current capacity in the foreseeable future, if LC9 were to be turned off, the groundwater level may rise to approximately 270 metres above sea level (masl), which is just below the proposed grade separation sub-drain.

The impacts on the hydrology and geomorphology of the surface watercourses that receives discharge from the permanent stormwater outlets at the grade separations will have to be evaluated by a qualified hydrologist and geomorphologist, respectively at detailed design.

The hydraulic connectivity between groundwater, surface watercourses and wetlands that are within the study limits will have to be determined during field investigations, to identify the effects of the road construction and dewatering on these sensitive features.

The depth to the groundwater table during wellfield pumping and non-pumping conditions will have to be confirmed to determine the need for temporary dewatering, and whether permanent dewatering is required in the distant future, should there be a change in the pumping conditions of the wellfields in the immediate area. Opportunities for minor adjustment at the grade separations should be explored during detailed design where feasible (e.g. minor profile adjustment or consideration of different structure types), to allow greater separation between the road elevation and the natural groundwater table.

Wellhead Protection Area Policy and Monitoring Frameworks as identified need to be considered in the design and construction of the project within Wellhead Protection Areas.

The construction and/or decommissioning of wells will be carried out by a qualified and licensed well contractor, in accordance with Ontario Regulation 903, under the Ontario Water Resources Act, 1990, which governs well construction, maintenance and decommissioning.

7.1.13 Landscaping

A landscape can be defined as the aggregate of all of the visual elements found within a region or area. Each of these elements contributes to the over-arching character of a place, and can define it as distinctive or unique within a neighbourhood or region.

Currently, Trafalgar Road is a 2-lane rural roadway which functions as a major arterial road that supports the movement of goods and people. The character of Trafalgar Road between 10 Side Road and 15 Side Road is largely rural with intermittent residential properties and farming operations; this area is designated for future development east of Trafalgar Road as part of Vision Georgetown. North of 15 Side Road, the character of Trafalgar Road transition to a more urban setting with residential properties on both sides as part of Stewarttown and Georgetown. As Trafalgar Road is widened from 2 to 4

lanes, active transportation facilities such as multi-use path and bike lanes / paved shoulder and illumination will be provided to support all modes of transportation. The future landscaping should also be provided accordingly to complement these changes.

Conceptual landscape plans are shown in **Exhibit 7-18** to **Exhibit 7-20** at the Black Creek crossing, the CN underpass and the Metrolinx underpass. These conceptual landscape plans reflect the integration of landscape and road elements, including active transportation facilities.

A detailed landscape plan will be developed based on the defining elements during subsequent detailed design.

Protection of Existing Vegetation

There are some natural environmental features along Trafalgar Road between 10 Side Road and Highway 7. Important natural environment features adjacent to Trafalgar Road in the study area include the Black Creek valley, various ESAs and the Niagara Escarpment as described in **Section 3.3**. The Trafalgar Sports Park is also a local destination for the community. Conservation Halton's Landscaping Guidelines should be applied to the extent possible inside regulated areas. Relevant policies in the Greenbelt Plan and the Niagara Escarpment Plan should also be referenced.

Opportunities for Enhancements to Corridor Vegetation

In areas where enhanced vegetation will be provided, all enhancement plantings should be native, hardy, drought-tolerant species, salt resistant, and shall be restricted to the road right-of-way. Vegetation impacted in the easement areas should also be replaced. Planting layout will consider denser, more ornamental screenings at locations where residences are near the roadway.

A series of streetscape design techniques will be employed to balance the needs of motorized and non-motorized users.

Shape the driving experience:

- Add clear and consistent signage to assist navigation and caution about cyclists and use by farm equipment

Create comfortable non-motorized zones:

- Incorporate the multi-use path or sidewalk to serve as part of the transportation circulation system and support multiple recreation opportunities

Landscape Plantings:

- Add street trees and ornamental grasses along the boulevard where space permits to provide a landscaped buffer and increase the year-round visual interest.
- Plant selection for enhancement and infill planting should provide seasonal interest (i.e. spring flowering, interesting bark for winter appeal, attractive fall colours). Street trees within the urban cross section should be planted with

regularity along the length of the corridor where context permits. Particular attention should be paid to the growing conditions of these urban trees, giving consideration to continuous planting trenches and the use of structural soil technologies to improve tree health and survivability.

- Selection of proposed plantings should reflect changing climate conditions and therefore should consider resistance to drought, road salt and winter ice storms as these are becoming potentially more common. Plant materials currently at the southern limit of their natural range should be avoided.

Boulevard / Green Space:

Boulevards and green space areas within both the rural and urban cross sections of the corridor also play an important role in defining the streetscape. The boulevards / green space provide an element of continuity to the streetscape and also offer an area for street trees and other vegetation to grow, further enhancing the street, providing shading and separation of facilities. Maintaining street trees and other ornamental plantings within the boulevard / green space is a continuous challenge. Street trees within the boulevard / green space should also be planted with regularity along the length of the corridor where context permits. Within the boulevard / green space, it is imperative that particular attention be paid to the growing conditions of the trees, again giving consideration to continuous planting trenches and the use of structural soil technologies to improve tree health and survivability.

Signage for recreational purposes (e.g. connections to trail system, Trafalgar Sports Complex, etc.) should be considered for cyclists and pedestrians during the detailed design phase.

Exhibit 7-18: Conceptual Landscape Plan – Black Creek Crossing

Exhibit 7-19: Conceptual Landscape Plan – CN Crossing

Exhibit 7-20: Conceptual Landscape Plan – Metrolinx Crossing

7.1.14 Utilities

There are a number of existing buried and aerial utilities located on either side along the corridor (varies), including watermain, sanitary sewer, gas main, hydro, and telecom. Existing hydro poles along the corridor will have to be relocated as a result of the

proposed widening of Trafalgar Road. This will be pursued during detailed design in consultation with Halton Hills Hydro Inc., and Hydro One Networks Inc. Other utilities such as Bell, Cogeco, and Enbridge Gas may also be impacted as a result of the widening of Trafalgar Road. These utilities will be contacted during detailed design to confirm the conflicts and the extent of relocation required.

For any adjacent properties planned for development, provisions shall be made to install ducts or liners as part of the road reconstruction to facilitate future utility crossings of the Regional Road. Consultation with all utilities shall be undertaken during detailed design in order to coordinate this provision.

7.1.15 Illumination

It is proposed that Trafalgar Road be illuminated in accordance with Halton Region standards. A defining feature of any street is its illumination. This is not only because the quality of light provided can significantly enhance the night environment, but also because the form of the light standard can affect the character of a street during the day.

7.1.16 Property Requirements

The nominal proposed right-of-way for Trafalgar Road is 42 m between 10 Side Road and Highway 7 in accordance with the approved 2011 Halton Region Transportation Master Plan except in localized areas where there are existing constraints. The Region will be acquiring property to accommodate improvements on the corridor. Additional property may be required at intersections to accommodate turning lanes, as well as for grading. The proposed property line is shown on **Plates 1 to 38**.

Property requirements, as shown in the red dash line on **Plates 1 to 38**, are preliminary only and subject to further review and confirmation during detailed design. The approximate property requirements for privately owned or publicly owned (provincial or municipal) properties are summarized in **Table 7-18** (properties are listed from south to north). A nominal 5 m temporary easement is shown beyond the proposed property line for construction purposes. The exact limit of the temporary easement will be confirmed during detailed design.

Table 7-18: Preliminary Property Requirements

Location	Preliminary Property Requirement (ha)	Location	Preliminary Property Requirement (ha)
10114 Eighth Line	0.08	Property located between 620 m and 920 m north of 10 Side Road on the east side of Trafalgar Road	0.09
10229 Trafalgar Road	0.01	10284 Trafalgar Road	0.27
10332 Eighth Line	0.09	10445 Trafalgar Road	0.06
10498 Trafalgar Road	0.02	10512 Trafalgar Road	0.01
10579 Trafalgar Road*	0.003	10552 Trafalgar Road	0.13
10676 Trafalgar Road	0.02	10666 Trafalgar Road	0.12

Location	Preliminary Property Requirement (ha)	Location	Preliminary Property Requirement (ha)
10690 Trafalgar Road	0.02	Property located between 620 m and 950 m south of 15 Side Road on the east side of Trafalgar Road	0.05
10704 Trafalgar Road	0.02	10720 Trafalgar Road	0.02
10730 Trafalgar Road	0.02	10742 Trafalgar Road	0.02
10746 Trafalgar Road	0.06	12268 15 Side Road	0.11
10857 Trafalgar Road	0.05	Property located in south east quadrant of Trafalgar Road / 15 Side Road intersection, adjacent to Stewarttown Public School	0.10
10996 Trafalgar Road	0.00	13068 15 Side Road	0.10
13011 15 Side Road	0.07	11033 Trafalgar Road	0.22
11045 Trafalgar Road	0.19	11051 Trafalgar Road	0.12
11061 Trafalgar Road	0.12	11065 Trafalgar Road	0.09
11069 Trafalgar Road	0.13	11079 Trafalgar Road	0.13
11087 Trafalgar Road (note: property in floodplain)	0.16	11091 Trafalgar Road	0.001
11129 Trafalgar Road (note: property in floodplain)	0.01	11177 Trafalgar Road	0.004
11177 Trafalgar Road	0.01	11193 Trafalgar Road	0.06
19 Stewarttown Road	0.01	17 Stewarttown Road	0.02
15 Stewarttown Road	0.01	363 Maple Avenue	0.03
363 Maple Avenue	1.11	11280 Trafalgar Road	0.002
11409 Trafalgar Road	0.21	408 Maple Avenue	0.13
404 Maple Avenue	0.16	404 Maple Avenue	0.04
11421 Trafalgar Road	0.14	11431 17 Side Road	0.63
11509 Trafalgar Road (note: property in floodplain)	0.39	11494 Trafalgar Road*	0.16
11541 Trafalgar Road	0.02	11551 Trafalgar Road	0.01
11571 Trafalgar Road	0.01	11582 Trafalgar Road	0.05
11582 Trafalgar Road	0.05	11618 Trafalgar Road*	0.15
11672 Trafalgar Road	0.53	12794 20 Side Road	0.41
12944 20 Side Road	0.24	12942 20 Side Road	0.37
12940 20 Side Road	0.18	9 Lindsay Court	0.01
13678 Highway 7	0.68		

*Note: * Properties under the ownership of the Town of Halton Hills.*

7.1.17 Preliminary Cost Estimate

A preliminary cost estimate (for construction) was prepared as part of this Class EA Study. The estimated roadway construction cost (excluding property cost) for Section 2 was estimated at approximately $100 M, including 25% engineering and 10% contingency costs, and is the sum the following three components:

- Trafalgar Road: 10 Side Road to Highway 7 – $ 53.5 M
- CN Structure and Rail Diversion – $ 28.3 M
- Metrolinx Structure and Rail Diversion – $ 17.9 M

Breakdowns of these cost estimates are shown in **Table 7-19** to **Table 7-21**. The costs are preliminary; a detailed cost estimate will be prepared during detailed design.

Property cost is not included in the preliminary cost estimate. Affected property owners (**Section 7.1.16**) will be consulted individually during detailed design through property negotiation to address property requirement, mitigation measures and to discuss project details. Property will be acquired at fair market value.

7.2 Potential Environmental Effects, Mitigation Measures, and Commitments to Future Work

7.2.1 Natural Environment

The analysis of potential impacts arising from the planned improvements to Trafalgar Road was undertaken by assessing the details of the preferred road alignment (Alternative 1A) in relation to the known natural heritage features, functions, and species present within the study area.

Potential impacts are discussed in two categories:

- Direct Impacts – associated with the direct removal of natural features/habitats, caused by the actual "footprint" of the undertaking (e.g., clearing and grading, direct alteration of surface water features); and
- Indirect Impacts – associated with: 1) site alteration (e.g., alterations to surface water and groundwater quality/quantity, flow patterns); and 2) temporary disruption of features/habitats or displacement of species from active construction activities (e.g., impact to water quantity/quality, temporary physical disturbance, erosion, etc.).

The analysis of potential impacts (**Sections 7.2.1.1 to 7.2.1.3)**, recommended mitigation measures and the overall residual effect after mitigation **(Sections 7.2.1.4 to 7.2.1.6)** has been applied. The full report can be found in **Appendix E Natural Heritage Report**.

As the impact assessment was based on preliminary conceptual design details, potential impacts and recommended mitigation measures should be revisited at the detailed design phase of the project when detailed design is developed.

Table 7-19: Preliminary Cost Estimate – Trafalgar Road (10 Side Road to Highway 7)

#	Item Description	Quantity	Unit	Estimated Price	Total
1.	Earth Excavation	210,000	m³	$12.00	$ 2,520,000.00
2.	Hot Mix HL1 (40mm depth)	15,000	t	$90.00	$ 1,350,000.00
3.	Hot Mix HDBC (120mm depth)	38,000	t	$85.00	$ 3,230,000.00
4.	19mm Crusher Run Limestone (150mm)	56,000	t	$22.00	$ 1,232,000.00
5.	50mm Crusher Run Limestone (550mm)	260,000	t	$21.00	$ 5,460,000.00
6.	Concrete Curb and Gutter	18,000	m	$50.00	$ 900,000.00
7.	Concrete Sidewalk / Median	6,000	m²	$50.00	$ 300,000.00
8.	Concrete Strip	6,000	m²	$55.00	$ 330,000.00
9.	Asphalt Pathway	18,600	m²	$30.00	$ 558,000.00
10.	Storm Sewer		L.S.		$ 3,000,000.00
11.	SWM Facilities / Oil Grit Separator		L.S.		$ 800,000.00
12.	Concrete Culverts				
	• Sta. 6+852	40	m	$3,800.00	$ 152,000.00
	• Sta. 7+285	44	m	$4,000.00	$ 176,000.00
	• Sta. 7+927	42	m	$6,000.00	$ 252,000.00
	• Sta. 8+635	44	m	$4,000.00	$ 176,000.00
	• Sta. 11+145	46	m	$4,200.00	$ 193,200.00
	• Sta. 11+880	44	m	$3,000.00	$ 132,000.00
	• Sta. 12+245	20	m	$400.00	$ 8,000.00
	• Sta. 12+460	40	m	$6,500.00	$ 260,000.00
	• Sta. 20+100	22	m	$6,500.00	$ 143,000.00
13.	Driveway Culverts	300	m	$150.00	$ 45,000.00
14.	Black Creek Structure		L.S.		$ 3,500,000.00
15.	Retaining Walls				
	• 10m Uphill Wall S. of Black Creek	750	m²	$3,000.00	$ 2,250,000.00
	• RSS Walls at Black Creek	650	m²	$700.00	$ 455,000.00
	• Concrete Walls at CN Structure	350	m²	$900.00	$ 315,000.00
16.	Steel Beam Guide Rail	500	m	$150.00	$ 75,000.00
17.	Topsoil and Sod	50,000	m²	$7.00	$ 350,000.00
18.	Cold Plane Existing Pavement	20,000	m²	$3.00	$ 60,000.00
19.	Removal of Existing Pavement	40,000	m²	$3.00	$ 120,000.00
20.	Removal of Curb and Gutter	4,000	m	$15.00	$ 60,000.00
21.	Clearing and Grubbing		L.S.		$ 150,000.00
22.	Removal of Existing Black Creek Structure		L.S.		$ 150,000.00
23.	Removal of Existing Retaining Walls		L.S.		$ 100,000.00
24.	Landscaping		L.S.		$ 1,000,000.00
25.	Illumination				
	• Permanent		L.S.		$ 1,300,000.00
	• Temporary		L.S.		$ 200,000.00
26.	Traffic Signals				
	• Permanent	9	each	$200,000.00	$ 1,800,000.00
	• Temporary	3	each	$110,000.00	$ 330,000.00
27.	Maintenance of Traffic				
	• Traffic Control		L.S.		$ 200,000.00
	• Temporary Widening/Staging		L.S.		$ 200,000.00
28.	Miscellaneous (~15%)		L.S.		$ 5,077,800.00
	Subtotal (Construction)				**$ 38,910,000.00**
	Utility Relocation (est. by Consultant)				$ 1,000,000.00
	Contingency (10%)				$ 3,891,000.00
	Engineering (EA, Detailed Design & CA) (25%)				$ 9,727,500.00
	TOTAL (excluding HST)				**$ 53,528,500.00**
	*Rail structures in other tables				

Table 7-20: Preliminary Cost Estimate – CN Structure and Rail Diversion

#	Item Description	Quantity	Unit	Estimated Price	Total
1.	Earth Excavation	40,000	m^3	$15.00	$ 600,000.00
2.	Clearing and Grubbing		L.S.		$ 5,000.00
3.	Storm Sewer Outlet incl. Superpipe & OGS		L.S.		$ 700,000.00
4.	Temporary Culvert Extension	16	m	$1,500.00	$ 24,000.00
5.	Subway Structure		L.S.		$ 9,000,000.00
6.	Temporary Shoring		L.S.		$ 1,500,000.00
7.	Retaining Walls		L.S.		$ 200,000.00
8.	Restoration		L.S.		$ 100,000.00
9.	Rail Diversion Grading and Sub-ballast		L.S.		$ 500,000.00
10.	CN Rail Costs				
	• Trackwork	2	tracks	$1,500,000.00	$ 3,000,000.00
	• Signals / Gates	2	crosssings	$600,000.00	$ 1,200,000.00
	• Flagging		L.S.		$ 300,000.00
	• CN Design / Review		L.S.		$ 100,000.00
11.	Maintenance of Traffic				
	• Traffic Control		L.S.		$ 10,000.00
	• Temporary Widening/Staging		L.S.		$ 50,000.00
12.	Miscellaneous (~20%)		L.S.		$ 3,461,000.00
	Subtotal (Construction)				**$ 20,750,000.00**
	Utility Relocation (est. by Consultant)				$ 300,000.00
	Contingency (10%)				$ 2,075,000.00
	Engineering (EA, Detailed Design & CA) (25%)				$ 5,187,500.00
	TOTAL (excluding HST)				**$ 28,312,500.00**

Table 7-21: Preliminary Cost Estimate – Metrolinx Structure and Rail Diversion

#	Item Description	Quantity	Unit	Estimated Price	Total
1.	Earth Excavation	10,000	m^3	$15.00	$ 150,000.00
2.	Earth Borrrow	20,000	m	$10.00	$ 200,000.00
2.	Clearing and Grubbing		L.S.		$ 10,000.00
3.	Storm Sewer Outlet		L.S.		$ 100,000.00
4.	Temporary Culvert Extension	12	m	$1,500.00	$ 18,000.00
5.	Subway Structure		L.S.		$ 5,000,000.00
6.	Temporary Shoring		L.S.		$ 2,000,000.00
7.	Retaining Walls		L.S.		$ 200,000.00
8.	Restoration		L.S.		$ 100,000.00
9.	Rail Diversion Grading and Sub-ballast		L.S.		$ 500,000.00
10.	Metrolinx Rail Costs				
	• Trackwork	1	tracks	$1,500,000.00	$ 1,500,000.00
	• Signals / Gates	1	crosssings	$600,000.00	$ 600,000.00
	• Flagging		L.S.		$ 300,000.00
	• Metrolinx Design / Review		L.S.		$ 100,000.00
9.	Maintenance of Traffic				
	• Traffic Control		L.S.		$ 10,000.00
	• Temporary Widening/Staging		L.S.		$ 50,000.00
10.	Miscellaneous (~20%)		L.S.		$ 2,162,000.00
	Subtotal (Construction)				**$ 13,000,000.00**
	Utility Relocation (est. by Consultant)				$ 300,000.00
	Contingency (10%)				$ 1,300,000.00
	Engineering (EA, Detailed Design & CA) (25%)				$ 3,250,000.00
	TOTAL (excluding HST)				**$ 17,850,000.00**

7.2.1.1 Vegetation – Impacts

Existing vegetation conditions within the Study Area are described in **Section 3.3.2.5**. The proposed works will occur within and immediately adjacent to the existing Trafalgar Road right-of-way, extending either to the edge of the right-of-way, or to the grading limits, as shown on **Plates 1 to 38**. The grading limits vary from being inside the right-of-way to extending slightly beyond it. Potential direct and indirect impacts to vegetation are summarized below.

7.2.1.1.1 Potential Direct Impacts

Minor vegetation removals are required to accommodate the proposed road widening and intersection improvements.

Individual Street/Urban Tree Removal

Individual tree removal is required to accommodate the widened roadway. No provincially or regionally significant species are anticipated to be impacted – this should be confirmed during detailed design.

Vegetation / Habitat Removals – Non-Natural Vegetated Areas

Minor removals of vegetation are required within the existing right-of-way. Vegetation affected is predominantly common, disturbance tolerant species and altered community types such as CUM1-1 (dry-moist old field meadow). Limited impact on wildlife and wildlife habitats anticipated as follows:

- BOBO and EAME Habitat. Agricultural fields (hay crop) located north and south of the Metrolinx railway are crossed by the new alignment, resulting in the removal of ~ 0.65 ha of potential habitat.

- A small area of CUM1-1 (~0.14 ha) requires removal on the south side of the Metrolinx railway (west of Trafalgar Road). Low sensitivity feature.

- Feature # 21 (cultural meadow) at Trafalgar Sports Park. A small narrow strip (~10m width) along the existing right-of-way (~650 m^2 of CUM1-1 and ~280 m^2 of MAMM 1-12), 0.09 ha, would be removed. Feature is highly altered as it is being removed to accommodate development. Low sensitivity, no known sensitive wildlife habitats are anticipated to be affected.

Vegetation / Habitat Removals – Naturally Vegetated Areas

Overall, there will be limited removal of vegetation/habitat within the existing right-of-way and removals within existing adjacent natural communities/features. Minor encroachment into natural features is not anticipated to affect the form or function of the wetland and woodland features. The majority of each feature area is retained outside the alignment. Minor vegetation removals are not anticipated to affect significant flora or fauna species if recommended mitigation is implemented; however, mitigation measures would require confirmation during detailed design. Wildlife using the existing right-of-way

will be displaced to adjacent natural habitats. Potential disturbance during construction is discussed under 'Wildlife Disturbance'. Key features with potential for direct impacts between 10 Side Road and Highway 7 include the following (see Feature # reference in **Exhibit 3-1**):

- Feature #15 (woodland) FOD5-1. A small narrow strip (ranging from ~6m to 15 m in width) along the existing right-of-way (about 0.15 ha) would be removed. This Feature has moderate sensitivity, although likely low sensitivity in the area of encroachment (northeast exposure). Several Species of Conservation Concern (SCC) have been recorded within this feature. However, no known sensitive wildlife habitat is anticipated to be affected. Wildlife will continue to move between this feature and Feature #19 which have been identified as a candidate wildlife corridor.

- Feature #19 (woodland) FOD5-8. A very small narrow strip (~6m width) along the existing right-of-way (~ 0.04 ha) would be removed. Feature has moderate sensitivity, although likely low sensitivity in the area of encroachment. Several SCC have been recorded within this feature. However, no known sensitive wildlife habitat is anticipated to be affected. Wildlife will continue to move between this feature and Feature #15 which have been identified as a candidate wildlife corridor.

- Feature #25 (watercourse/small woodlot). The shift in the alignment of Trafalgar Road to the east due to the CN grade separation will not encroach within the feature, but would be located in close proximity adjacent to this feature. This feature is of moderate sensitivity. There is potential for indirect effects to the vegetation within the feature from salt spray. Potential for indirect effects to wildlife within the feature are anticipated to be negligible as the feature is already impacted (e.g. noise, light from the existing Trafalgar Road).

7.2.1.1.2 Potential Indirect Impacts

Vegetation Disturbance

Vegetation clearing and other construction activities have the potential to inadvertently destroy, damage, and degrade adjacent vegetation through: use of construction equipment outside of the work zone; sedimentation; soil compaction; and spills.

Temporary drawdown of shallow groundwater levels from localized dewatering which is required at three locations within the study area; at the Black Creek Crossing, Metrolinx Grade Separation, at the CN Rail Grade Separation, and may be required at additional locations where groundwater levels are near the surface and excavation is required (e.g. works adjacent to wetland areas). This has potential to impact water levels in wetland areas supporting wetland vegetation if the drawdown is prolonged and recovery is slow. Any decrease in water levels is anticipated to be temporary and minor in nature, resulting in no permanent impacts to adjacent wetland vegetation.

Soil Compaction

Soil compaction also has potential to occur as a result of heavy machinery and the stockpiling of heavy materials and stripped soils. Soil compaction can greatly reduce the

permeability of soils and affect their ability to retain water during rain/snow melt events. This may result in an increase in surface water run-off which will ultimately increase the erosion potential and the amount of sediment being transported into adjacent features. Soil compaction can prohibit roots from establishing in soil, preventing vegetation growth.

Construction Materials/Debris

Construction materials or vegetative debris from clearing that is stockpiled near a natural feature have potential to enter the feature if not properly contained.

Debris entering wetlands or woodlands has potential to smother and/or damage vegetation and impact water quality.

Erosion and Sedimentation

Vegetation clearing, grading, use of heavy machinery, and soil stockpiling all have the potential to increase erosion and sedimentation. Sediment-laden runoff has the potential to enter into adjacent natural features. Impacts include impaired surface water quality and the potential for vegetation dieback.

An Erosion and Sedimentation Control (ESC) plan will need to be prepared by qualified professionals. Construction inspectors should be trained and certified in ESC construction practices. ESC risk management should also include the phasing of stabilization efforts so that the establishment of groundcover is not left until the end of the project. These items should be incorporated into the construction contracts as special provisions.

7.2.1.2 Wildlife – Impacts

Existing wildlife habitats within the Study Area are described in **Section 3.3.2.6**. The proposed works will occur within and immediately adjacent to the existing Trafalgar Road right-of-way, extending either to the edge of the right-of-way, or to the grading limits, as shown on **Plates 1 to 38**. Potential direct and indirect impacts to wildlife are summarized below.

7.2.1.2.1 Potential Direct Impacts

Wildlife Passage

Candidate wildlife movement corridors have been identified at two locations between 10 Side Road and Highway 7:

- Black Creek Corridor (Feature 12) – the existing box culvert will be removed and replaced with a large bridge span structure, significantly improving potential for wildlife (including large mammals) to move across Trafalgar Road within the Black Creek river valley.
- Within woodland Feature 15 – a small CSP structure at this location will be replaced with a larger box culvert (1.5 x 0.9 x 43.5 m) with an Openness Ratio (OR) of 0.03. The structure replacement is an improvement upon existing

conditions and maintains any existing function, passage by tolerant amphibian and mammal species.

7.2.1.2.2 Potential Indirect Impacts

Wildlife Disturbance during Construction

Increased disturbance caused by excessive noise, dust, vibrations, and proximity of human presence during construction may cause certain wildlife to abandon or avoid the area. Additionally, these disturbances may disrupt or discourage breeding birds from nesting within the vicinity.

However, these impacts are anticipated to be minimal and localized given the existing degree of anthropogenic disturbance, tolerance of species expected to use these habitats and small areas of proposed grading / works.

7.2.1.3 Watercourses and Fish Habitat – Impacts

Existing watercourse and fish habitat conditions within the Study Area are described in **Section 3.3.2.9**. This section summarizes the preliminary proposed works and associated implications at the various watercourses that support fish habitat (direct or indirect) along the Trafalgar Road study area between 10 Side Road and Highway 7 and their implications on fish and aquatic habitat. As noted, this impact assessment is preliminary and will be refined as required based on the detailed design. The proposed works and their associated impacts to fish and aquatic habitat are highlighted below.

7.2.1.3.1 Potential Direct Impacts

Fish Habitat Alteration and Serious Harm to Fish

The preferred alternative has the potential to impact eight (8) aquatic features crossing Trafalgar Road between 10 Side Road and Highway 7. Impacts to aquatic features by the proposed works at watercourse crossings are limited to minor additional enclosure of features and minor removals of riparian vegetation associated with proposed culvert replacements with longer culverts, and extensions to two existing culverts. There are seven (7) intermittent watercourses with proposed culvert replacements, and one permanent watercourse (Black Creek) with a proposed bridge replacement.

All intermittent watercourses with proposed culvert replacements are indirect fish habitat only, and have low sensitivity. The one permanent watercourse with a proposed extension to the existing culvert is moderately sensitive supporting a coolwater fish community and contributing to Redside Dace habitat downstream. Black Creek, with the proposed bridge replacement, is a highly sensitive coldwater salmonid habitat. Black Creek and all intermittent watercourses north of Black Creek (Features #14, 16, and 19) have evidence of groundwater inputs.

Longer culvert lengths may impact watercourses by reducing allochthonous and solar inputs to contributing fish habitat and potentially interfering with groundwater input to the watercourses. All of the culvert replacements will result in larger openings than the existing structures. The proposed alignment also shifts a segment of Trafalgar Road

(due to the CN grade separation) to be adjacent to a moderately sensitive groundwater-fed watercourse (Feature #25), with potential impacts to the bank.

Details of potential direct impacts to each aquatic feature are as follows:

- Feature #8 (Intermittent watercourse). Enclosure of approximately an additional 20 m of watercourse resulting in reduced solar and allochthonous inputs. The larger culvert opening and inset of the culvert by 0.3 m into the substrate will ensure maintenance of natural flows contributing to fish habitat downstream and no new barriers to potential fish passage.

- Feature #9 (Intermittent watercourse). Enclosure of approximately an additional 23 m of watercourse resulting in reduced solar and allochthonous inputs. The larger culvert opening and inset of the culvert by 0.3 m into the substrate will ensure maintenance of natural flows contributing to fish habitat downstream and no new barriers to potential fish passage.

- Feature #10 (Intermittent watercourse). Enclosure of approximately an additional 22 m of watercourse resulting in reduced solar and allochthonous inputs. The larger culvert opening and inset of the culvert by 0.3 m into the substrate will ensure maintenance of natural flows contributing to fish habitat downstream and no new barriers to potential fish passage.

- Feature 12 – Black Creek (Permanent watercourse). The proposed bridge replacement will be up to 30 m wider than the existing bridge, shading an additional length of the watercourse, removing riparian vegetation and potentially reducing allochthonous and solar inputs. However, the bridge replacement will increase the span from the existing 8.8 m span, to a 30 m clear span, which will increase the natural bank area allowing more natural flows and morphology in the fish habitat under the bridge and upstream and downstream, as well as increase the potential allochthonous and solar inputs from the sides of the bridge. The bridge widening would potentially impact two specific sensitive features of the watercourse: Widened bridge abutments could interfere with a groundwater seepage channel ~8 m west of the bridge on the north bank; and sensitive fish habitat in the form of a nursery pool with YOY salmonids observed ~6 m east of the bridge on the south bank. Impacts on sensitive fish habitat would need to be assessed at detailed design.

- Feature 14 (Intermittent watercourse). Enclosure of approximately an additional 19 m of watercourse resulting in reduced solar and allochthonous inputs. The larger culvert opening and inset of the culvert by 0.3 m into the substrate will ensure maintenance of natural flows contributing to fish habitat downstream and will not introduce barriers to potential fish passage. The proposed open footing culvert would not interfere with groundwater inputs feeding the watercourse that were observed immediately upstream of the existing culvert.

- Feature 15 (Intermittent watercourse). Enclosure of approximately an additional 13 m of watercourse resulting in reduced solar and allochthonous inputs. The larger culvert opening and inset of the culvert by 0.3 m into the substrate will ensure maintenance of natural flows contributing to fish habitat downstream and

no new barriers to potential fish passage. The proposed open footing culvert would not interfere with groundwater inputs feeding the watercourse that were observed immediately downstream of the existing culvert.

- Feature 16 (Intermittent watercourse). The proposed alignment will require replacing both culverts under Trafalgar Road and 20th Side Road. This will result in enclosure of approximately an additional 30 m of the watercourse resulting in reduced solar and allochthonous inputs. The larger culvert openings and inset of the culverts by 0.3 m into the substrate will ensure maintenance of natural flows contributing to fish habitat downstream and no new barriers to potential fish passage. The proposed open footing culvert would not interfere with groundwater inputs suspected to be feeding the watercourse in the vicinity of the existing culverts.

- Feature #25 (intermittent watercourse) – The proposed alignment would not encroach within the feature, but is located closely adjacent to this feature. Grading requirements may interfere with the bank slopes on the west side of the watercourse and associated ravine. Potential for indirect effects to aquatic habitat from road salt application and stormwater runoff. This Feature is moderately sensitive due to noted groundwater seepages and indirect fish habitat with Brook Trout known to occur downstream in close vicinity.

Alteration of Existing Surface Water Drainage Patterns

No alterations of existing surface water drainage patterns are anticipated. All existing water crossing structures and drainage features and functions will be retained (except for Culvert 13 as explained in **Section 7.1.10**). The increased opening size of all proposed culvert replacements will ensure maintenance of natural flows contributing to watercourses downstream.

7.2.1.3.2 Potential Indirect Impacts

Surface Water Quality Impairment

Potential indirect impacts to surface water quality are associated with all surface water drainage features, including fish habitat.

Sedimentation of a watercourse or wetland from construction activities (e.g., sediment laden runoff, dewatering discharge) can negatively impact surface water quality with increased turbidity and Total Suspended Solids (TSS) levels. Dewatering is required at three locations within the study area; 1) at the Black Creek Crossing; 2) Metrolinx Grade Separation and: 3) at the CN Rail Grade Separation. Dewatering may also be required at additional locations where groundwater levels are near surface and excavation is required (e.g. works adjacent to wetland areas). Dewatering requirements will be identified at detailed design.

Contaminant spills will result in the degradation of water quality. The degree and type of impact is dependent on the type and volume of contaminant released and how promptly and effectively the Spill Response Plan is initiated. Ultimately, a release of contaminant or ‘spill’ into a water body is considered a release of a ‘deleterious substance’.

Alterations of surface water quality have potential to impact aquatic organisms. Under prolonged conditions where water quality remains at levels unacceptable for aquatic life, death of aquatic organisms may result.

Disruption to Fish and Fish Habitat

Potential indirect effects on fish and fish habitat include the following temporary impacts during construction:

- Temporary disturbance to bed and banks of watercourses by workers or equipment during construction
- Temporary disruption of fish passage during works
- Direct harm to fish caught within the work area of in-water works.
- Release of sediment into the watercourse from construction areas
- Potential spills of deleterious materials from machinery during construction
- Temporary disturbance to riparian vegetation during construction
- Temporary interruption of stream flow from localized dewatering which is required at three locations within the study area; 1) at the Black Creek Crossing; 2) at the Metrolinx Grade Separation; and 3) at the CN Rail Grade Separation. Temporary interruption may also be required at additional locations where groundwater levels are near surface and excavation is required (e.g. works adjacent to wetland areas).

Indirect effects may also occur during future operation / maintenance of the road way, including increased input of salt to watercourses during winter maintenance.

Soil Compaction

Soil compaction also has potential to occur as a result of heavy machinery and the stockpiling of heavy materials and stripped soils. Soil compaction can greatly reduce the permeability of soils and affect their ability to retain water during rain/snow melt events. This may result in an increase in surface water run-off which will ultimately increase the erosion potential and the amount of sediment being transported into adjacent features.

Construction Materials/Debris

Construction materials or vegetative debris from clearing that is stockpiled near a natural feature have potential to enter the feature if not properly contained.

Debris entering a water body has potential to: destroy or disturb fish habitat; disrupt flow patterns increasing risk for flooding or erosion and sedimentation; and impair water quality. The degree of impact on the water body is dependent on the type and amount of material entering the watercourse.

Erosion and sedimentation

Vegetation clearing, grading, use of heavy machinery, and soil stockpiling all have the potential to increase erosion and sedimentation. Sediment-laden runoff has the potential to enter into adjacent natural features. Impacts include impaired surface water quality and the potential for vegetation dieback.

Discharges to watercourses from temporary dewatering have potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly. Dewatering is required at three locations within the study area; 1) at the Black Creek Crossing; 2) at the Metrolinx Grade Separation; and 3) at the CN Rail Grade Separation. Dewatering may also be required at additional locations where groundwater levels are near surface and excavation is required (e.g. works adjacent to wetland areas). Dewatering requirements will be identified at detailed design. A PTTW from MOECC may be required. A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

7.2.1.4 Vegetation – Mitigation Measures

The following section outlines recommended mitigation measures to avoid or minimize effects to the local vegetation communities and their associated habitat functions.

7.2.1.4.1 Potential Direct Impacts

Vegetation/Habitat Removal

- Woodland trees and wetland areas are to be retained and protected, if feasible. Re-establish vegetation in the newly cleared/graded areas that are not to be paved as soon as possible after disturbance. Native species are recommended for planting.
- Tree and vegetation protection is recommended for all trees and vegetation being retained. Tree protection should be outlined in a Tree Protection Plan (TPP) prepared at detailed design. Vegetation protection should be outlined on specification drawings in detailed design. Protection should be implemented to ensure encroachment within the adjacent natural features is restricted to the identified construction footprint. Vegetation clearing and road improvement construction activities should be minimized or avoided during the general nesting period for Zone C25 to avoid direct impacts to wildlife anticipated to use these areas. This timing window also covers off the breeding period of amphibians.
- Additional recommended mitigation measures to address indirect impacts that may occur during the construction phase are discussed under 'indirect impacts'.
- Any trees identified for removal as part of the detailed design should be surveyed for potential suitable bat habitat (i.e. cavity) prior to removal.
- Additional targeted BOBO and EAME surveys would be required prior to the completion of detailed design. Compensation of the removed area in terms of habitat removal may be required depending on the findings of those surveys.

Net effects of these measures include the removal of disturbed vegetation within the existing right-of-way, the maintenance of the form and function of adjacent natural features, and the displacements of wildlife in the right-of-way to adjacent available habitats.

[5] http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1

7.2.1.4.2 Potential Indirect Impacts

Vegetation Disturbance

- Install ESC silt fencing prior to any site grading to delineate the work zone and prevent direct damage to adjacent retained vegetation (i.e., mechanical damage, soil compaction). Leave fencing in place until construction is complete.
- Implement tree protection measures outlined in the Tree Protection Plan (TPP) (to be prepared at detailed design).
- A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Soil Compaction

- Control vehicle access routes and areas and limit equipment access
- Locate staging areas away from natural features (e.g., 30m)

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Construction Materials/Debris

- Stabilize construction debris (e.g., tarps) away from natural features
- Dispose of refuse and other material appropriately off-site
- Locate staging areas away from natural features (e.g., 30m)

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Erosion and sedimentation

- Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. Applicable measures include:
  - "Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear."
  - "Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practical, prune or top the vegetation instead of grubbing/uprooting."
  - "Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed."

- "Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site."
- "Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored."
- "If replacement rock reinforcement/armoring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment."
- "Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation."
- "Remove all construction materials from site upon project completion."
- "Minimize duration of in-water work."
- "Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows."

- Eliminate potential from erosion and sedimentation by restricting access of works to limit of grading—achieved through clearly demarcating the limit of works through use of ESC structures such as silt fencing.
- A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

7.2.1.5 Wildlife – Mitigation Measures

The following section outlines recommended mitigation measures to avoid or minimize effects to local wildlife.

7.2.1.5.1 Potential Direct Impacts

Wildlife Passage

- The modified structures will continue to maintain wildlife passage and, in the case of the new Black Creek bridge structure, it will significantly enhance potential for movement.
- It is recommended that new structures / replacement culverts be designed using most current wildlife passage design principles available at the time of detailed design.
- It is recommended that the structure at Feature 15 be designed to minimize the final length of the culvert in order to maximize suitability for continued wildlife passage. Final culvert dimensions (both length and height) should be reviewed at detailed design.

As a result of these mitigation measures, wildlife passage function will be maintained. In the case of the new bridge structure over Black Creek, wildlife passage opportunities will be significantly enhanced.

7.2.1.5.2 Potential Indirect Impacts

Wildlife Disturbance during Construction

- Ensure that timing constraints are applied to avoid vegetation clearing (including grubbing) during the breeding bird season for tree nesting (approximately **April 1 to August 31**). It should be noted that occasionally bird species will precede or exceed the approximate breeding bird season window.
- **Wildlife exclusion fencing** should be installed temporarily to keep wildlife out of the construction zone, particularly in areas adjacent to natural habitat features e.g. fencing to prevent movement of amphibians and reptiles into the construction zone in areas adjacent to wetlands.
- In the event that an animal encountered during construction does not move from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities will stop and the Contract Administrator will be notified.

In the event that a SAR or possible SAR is found in the construction area, all construction that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. The Contract Administrator will then contact the MNRF SAR Biologist for direction, as these animals are protected under the ESA (2007).

No net effects are anticipated with proper implementation of these recommended mitigation measures.

7.2.1.6 Watercourses and Fish Habitat – Mitigation Measures

The following standard and site specific mitigation measures will be implemented (where feasible) to protect fish and fish habitat at the watercourse crossings supporting fish habitat (directly or indirectly). These mitigation measures will be refined and augmented during detailed design once the details of the design and associated work requirements and potential impacts at each crossing are finalized.

7.2.1.6.1 Potential Direct Impacts

Fish Habitat Alteration and Serious Harm to Fish

- Adhere to standard coldwater timing window for in-water work of **October 1 to May 31** to protect the coldwater fishery in Black Creek, including works on contributing flows in tributaries. **No in-water work is to occur within this timeframe.**
- Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented.
- Eliminate potential for direct impacts to fish habitat by restricting access of works to limit of grading. This can be achieved through clearly demarcating the limit of works through use of ESC structures such as silt fencing. Implement standard best management practices when carrying out construction activities near water.
- All culvert extensions should ideally be replacements with open-bottom structures to minimize impacts to groundwater inputs, especially on Features 19 and 14 where groundwater evidence was observed. Through consultation with Conservation Halton during the EA Study, open-bottom culverts will be

considered at locations where existing culverts with fluvial interest are being replaced.

- Areas of groundwater input, such as the northeast bank of Black Creek, should be maintained with appropriate design and fill materials in the design of the bridge replacement.
- Culverts should be embedded into the existing invert of the watercourses by 10% to maintain natural flows and prevent barriers to potential seasonal movement of fish.
- Consider employing wingwalls to minimize required length extension of culverts and additional enclosure of watercourses.

Overall, potential impacts to sensitive fish habitat and groundwater input channels in Black Creek can be mitigated with appropriate design (i.e. clear-span bridge).

Following design mitigation on all culvert extensions and replacements, impacts of these route alternatives would be limited to minor losses of riparian vegetation, allochthonous input and solar inputs to channel sections enclosed or covered by structure extensions.

With proper design, groundwater inputs to watercourses can be retained – this will be a priority during detailed design.

Alteration of Existing Surface Water Drainage Patterns

Alteration of existing surface water drainage patterns are to be mitigated through design considerations. All existing drainage features and functions will be maintained.

Existing surface water drainage patterns are to be maintained through design.

7.2.1.6.2 Potential Indirect Impacts

Surface Water Quality Impairment

- Implement an Erosion and Sediment Control (ESC) Plan to minimize risk of potential impacts from sedimentation. See 'Erosion and Sedimentation' under **Section 7.2.1.4.2**
- Isolate in-water work areas, preventing sediment laden water or spills from entering the watercourse.
- Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. Applicable measures include[6]:
  - Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks.
  - Whenever possible, operate machinery on land above the high water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
  - Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.

[6] Note that these measures should be applied anywhere where surface water has potential to be impacted (i.e. wetlands).

  - Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
  - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
  - Plan activities near water to ensure that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse.
  - Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
  - Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish.
  - Manage water flowing onto the site, as well as water being pumped/diverted from the site such that sediment is filtered out prior to the water entering a waterbody.
- A Permit to Take Water (PTTW) from the Ministry of Environment and Climate Change (MOEE) may be required. A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Disruption to Fish and Fish Habitat

- Ensure DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. These include but are not limited to:
  - Time work in water to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.
  - Minimize duration of in-water work.
  - Conduct instream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
  - Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation
  - Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided.
  - Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.
  - Ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows.
  - Retain a qualified environmental professional to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the work site and safely relocate them to an

appropriate location in the same waters. Fish may need to be relocated again, should flooding occur on the site.

- Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish.
- Plan activities near water such that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse.
- Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
- Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish
- Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation of the waterbody during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear.
- Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practical, prune or top the vegetation instead of grubbing/uprooting.
- Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed.
- Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.
- Restore bed and banks of the waterbody to their original contour and gradient – if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored.
- If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
- Remove all construction materials from site upon project completion.
- Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds.
- Whenever possible, operate machinery on land above the high water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
- Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.
- Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a

temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
  - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
- A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

The potential for indirect negative effects on fish and fish habitat through construction activities occurring in close proximity will be mitigated through recommended best management practices.

Potential increase of salt input to watercourses may persist with future road maintenance; however, watercourses are already subject to salt inputs with winter maintenance of the existing roadway. Standards/requirements as per Halton Region's Salt Management Plan will be applied.

Soil Compaction

See 'Soil Compaction' under **Section 7.2.1.4.2**.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Construction Materials/Debris

See 'Construction Materials / Debris' under **Section 7.2.1.4.2**.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Erosion and sedimentation

Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. See 'Erosion and Sedimentation' under **Section 7.2.1.4.2**.

"No net effects are anticipated with proper implementation of these recommended mitigation measures.

7.2.2 Socio-Economic Environment

The proposed undertaking would:

- Maintain 2 through lanes of traffic during construction to minimize traffic delays;
- Provide for a future 4 lanes
- Accommodate pedestrians and cyclists through provision of a multi-use path and on-street bike lanes / paved shoulders;
- Meet the Region's corridor "vision" and objectives for Trafalgar Road (i.e. a major arterial road which accommodates all modes of transportation, including active transportation, inter-regional travel, agricultural vehicles, and goods movement);

- Support future growth (e.g. Vision Georgetown) and travel demands in Halton Region

The following is a description of the social environmental effects (**Section 7.2.2.1** Property Impacts, **Section 7.2.2.2** Access, **Section 7.2.2.3** Pedestrians / Cyclists, **Section 7.2.2.4** Noise Analysis, and **Section 7.2.2.5** Air Quality), the proposed mitigation measures, and commitments to further address those effects.

7.2.2.1 Property Impacts

Proposed property impacts are shown in **Plates 1 to 38**. All adjacent and potentially impacted property owners were notified of the Class EA Study and invited to attend the Public Information Centres. The existing right-of-way for Trafalgar Road between 10 Side Road and Highway 7 ranges between 26 and 36 m, and the right-of-way for the proposed 4-lane Trafalgar Road is nominally at 42 m (varies locally near intersections and areas of constraint).

As noted in **Section 7.1.2**, Trafalgar Road will be widened as follows:

- 10 Side Road and 15 Side Road: widening mainly along the centreline
- 15 Side Road and Stewarttown Road North: widening mainly to the east
- Stewarttown Road North to Trafalgar Sports Park entrance: alignment shifted to the east to cross under CN railway; reconnects with existing alignment at Trafalgar Sports Park entrance
- Trafalgar Sports park entrance to Berton Boulevard: widening generally to the west
- Berton Boulevard to Highway 7: alignment shifted to the west to cross under the Metrolinx corridor; ties into existing Highway 7 intersection

However, in areas where there are significant constraints, the widening will be shifted to the east or west or mitigated in constrained locations through modification to the typical cross section to minimize impact to adjacent properties / features.

Some properties will be directly impacted as a result of the widening of Trafalgar Road and meetings were held with the respective property owners to discuss the preliminary plan and associated property impacts. Affected property owners will be contacted again during detailed design to further address mitigation measures, property negotiation and to discuss project details and timing. Property required will be acquired at fair market value.

Property impacts are generally along the frontage of properties abutting Trafalgar Road and are listed in **Section 7.1.16**.

7.2.2.2 Access

As a major arterial road, Trafalgar Road will include left and right turn lanes at all signalized intersections as listed in **Section 7.1.8**.

As Trafalgar Road is widened from 2 to 4 lanes, a raised median will be provided to separate northbound and southbound traffic for operational and safety purposes. Median cuts and centre turn lanes will be provided for majority of existing commercial and

residential properties along Trafalgar Road that currently have full move access (i.e. can turn left and right). There are a few exceptions along the corridor where access will be restricted to right-in/right-out only; for example, three properties on the east side of Trafalgar Road between 10 Side Road and 15 Side Road which are expected to be redeveloped as part of Vision Georgetown, and three properties on the west side of Trafalgar Road immediately north of 15 Side Road (due to median island for left-turn lane storage).

Future access to Trafalgar Road will be subject to review and approval should any properties or currently vacant properties with no direct access to Trafalgar Road make applications for development / redevelopment.

7.2.2.3 Pedestrians / Cyclists

As noted in **Section 7.1.9**, Halton Region is implementing an active transportation network in the Region to support and encourage people to walk and bike around Halton as outlined in the Halton Region Active Transportation Master Plan (ATMP). Active transportation facilities within the Study Area are proposed as follows:

- From north of 10 Side Road to 15 Side Road: 3.0 m bi-directional multi-use path on the east side, 1.8 m exclusive bike lane on the east side, 1.5 m paved shoulder on the west side available for use by cyclists
- From 15 Side Road to Trafalgar Sports Park Entrance: 3.0 m bi-directional multi-use path on the east side, 2.0 m sidewalk on the west side, 1.8 m exclusive bike lane in each direction
- From Trafalgar Sports Park Entrance to Highway 7: 3.0 m bi-directional multi-use path on the east side, 1.8 m exclusive bike lane on east side, 1.5 m paved shoulder on west side available for use by cyclists

In constrained areas, the width of the multi-use path will be confirmed during detailed design in consultation with adjacent land owners, and the Town of Halton Hills.

It was also noted that between the completion of the EA Study and construction of improvements to the Trafalgar Road corridor between 10 Side Road and Highway 7, there may be new trends in active transportation and the facilities being implemented may be updated at that time. The right-of-way protected through the EA Study (nominally 42 m right-of-way) will be able to accommodate variations of active transportation facilities, as well as intersection treatments.

7.2.2.4 Noise Analysis

Based on the Ontario Ministry of Transportation (MTO)/Ministry of the Environment and Climate Change (MOECC) Noise Protocol, where an existing roadway is proposed to be modified / widened adjacent to a Noise Sensitive Area (NSA), MOECC requires that the future noise levels without the proposed improvements be compared to the future noise level with the proposed improvements. The assessment is completed at the Outdoor Living Area (typically backyards) of each NSA. The provision of noise mitigation is to be investigated should the future noise level with the proposed improvements result in a greater than 5 dBA increase over the future noise level without the proposed improvements. If noise mitigation is provided, the objective is a minimum 5 dBA

reduction. Mitigation will attempt to achieve levels as close to, or lower than, the objective level as is technically, economically and administratively feasible.

The noise assessment was undertaken based on a selection of several private residential homes in the vicinity of the Trafalgar Road corridor between Steeles Avenue and Highway 7. In total, 34 receiver locations located adjacent to Trafalgar Road were selected to represent the potential noise impact to noise sensitive areas in proximity to Trafalgar Road between Steeles Avenue and Highway 7. The noise analysis is provided in **Appendix K**, including a table of the selected receiver locations. Of the 34 receiver locations, Receivers 1 to 12 are located between Steeles Avenue and north of 10 Side Road.

Noise modelling was carried out for the following two scenarios:

i) future noise levels without improvements to Trafalgar Road (Year 2031 – see *Note* below)
ii) future noise levels with 4 lanes (+turning lanes) on Trafalgar Road (Year 2031)

Note – It should be noted that existing (2015) traffic volumes on Trafalgar Road were used to represent the future (2031) "without widening of Trafalgar Road" scenario. This approach is acceptable and it would yield a more conservative comparison between the future "with" and "without" improvements conditions.

Based on analysis using approved simulation techniques and software, the potential change in noise levels are predicted to be less than 5 dBA for all receiver locations, except for receiver 33, between north of 10 Side Road and Highway 7 (i.e. receivers 13 to 34) as a result of the proposed improvements to Trafalgar Road when compared to the "future without roadway improvements" condition. **Therefore, the consideration of noise mitigation is not warranted based on MTO/MOECC Noise Protocol at these locations.**

At receiver 33 (12944 20 Side Road Road) the increase in noise level between the existing / future 2031 without and with improvements scenarios was calculated to be at 5.4 dBA (i.e. greater than 5 dBA) and therefore noise mitigation was considered under the MTO/MOECC Noise Protocol. Receiver 33 is a single house with one house adjacent to it (this adjacent house would be considered to be a second row receiver) and it is situated in an open area. In order to achieve a noise attenuation of 5 dBA under the future with improvements to Trafalgar Road scenario, a 3 m high by approximately 80 m long noise wall would be required (assuming the noise barrier would be constructed along the future Trafalgar Road right-of-way). The provision of an 80 m noise wall for a single receiver location would not be considered economically feasible. Therefore, noise mitigation is not proposed at this receiver location.

In addition to the MTO/MOECC Noise Protocol, the noise analysis took into consideration Halton Region Noise Abatement Noise Policy for Regional Roads.

Noise levels at receivers 3 to 15, 18 to 22 and 33 have predicted noise levels of greater than 60 dBA under future (2031) conditions with improvements to Trafalgar Road (see **Appendix K** Noise Analysis Report). Therefore, they have been reviewed in light of the Halton Region's "Noise Abatement Policy for Regional Roads" to confirm whether they

would qualify for mitigation under the Region's retrofit policy. Noise sensitive areas that qualify under the Region's retrofit policy must meet the following criteria:

- The residential area must be adjacent to a Regional Road.
- The residential areas must have reversed frontage lots or blocks including flanking units where their outdoor living areas are directly exposed to traffic noise. No barriers are considered under the policy for dwelling units that are of the direct frontage type.
- In addition, the minimum number of residences to be considered under this policy is 5 dwelling units and 50 linear meters of noise barrier.

Given the above, Receivers 3 to 11, 13 to 15, 18, 20 and 21 would not qualify for noise mitigation under the Region's policy as they all are direct frontage residences and have direct driveway access to Trafalgar Road; additionally, all of these receivers, as well as receivers 12, 14, 19 and 33 are rural dwellings with less than 5 dwelling units and thus would not qualify for noise mitigation under the Region's Retrofit policy.

Only Receiver 22 (9 Stewarttown Road North) would warrant the consideration for noise mitigation under the Region's retrofit policy; i.e. it is adjacent to Trafalgar Road (reversed frontage) and there are at least 5 dwelling units in a row and the length of property adjacent to Trafalgar Road is greater than 50 m at this location. The provision of an approximately 3 m high, 92 m long noise wall constructed along the right-of-way of Trafalgar Road would reduce the noise levels for the future configuration, by 4.7 dBA (i.e. from 62.8 dBA to 58.1 dBA under the future with improvements to Trafalgar Road scenario). Given that it would yield a noise reduction close to 5 dBA, a noise barrier of 3 to 3.5 m will be considered during detailed design.

Based on the foregoing, noise mitigation is not proposed as part of the Trafalgar Road Improvements Class EA Study.

It should be noted that any future new residential subdivision developments along the Trafalgar Road corridor will have to carry out noise analyses in accordance with MOECC requirements as part of the development application process under the Planning Act. These studies would recommend the provision of outdoor and indoor noise attenuation measures and the inclusion of noise warning clauses on title of affected properties; these are outside the scope of the EA Study.

7.2.2.5 Air Quality

An air quality assessment was carried out as part of the Trafalgar Road Class EA Study with reference to the following applicable contaminant guidelines:

- Ministry of the Environment and Climate Change Ambient Air Quality Criteria
- Health Canada / Environment Canada Ambient Air Quality Objectives
- Canadian Council of Ministers of the Environment Canada Wide Standards

The Air Quality Assessment Report can be found in **Appendix L**. The potential effects of the proposed project infrastructure on local air quality were assessed (summarized in **Appendix L** – Table 32) and resulted in the following conclusions and recommendations:

- The maximum combined concentrations for the future build scenario were all below their respective Ministry of Environment and Climate Change (MOECC) guidelines or Canada Wide Standards (CWS), with the exception of PM10, TSP, and annual benzene.
- Frequency Analysis determined that the project did not have additional exceedances of the PM10 guideline over the 5 year period. The TSP guideline was exceeded 2 additional days over the 5 year period. For TSP this equates to additional exceedances less than 1% of the time.
- Ambient annual benzene exceeded the relevant guideline without the roadway contribution. The contribution from the roadway was 1% of the maximum combined concentration.

Since there is a relatively small increase in the number of days above the MOECC guideline and CWS, mitigation measures are not warranted based on the air quality assessment.

7.2.3 Cultural Environment

7.2.3.1 Built Heritage Resources

A Cultural Heritage Impact Assessment was carried out and is included in **Appendix F**. A list of the Built Heritage Resources (BHR) and Cultural Heritage Landscape (CHL) features are listed in **Section 3.4**.

Based on the results of background data collection, field review, and a review of the preliminary plan, the proposed undertaking should not adversely affect cultural heritage resources. The following recommendations have been developed:

- Where limited encroachment on to BHRs and CHLs in the study corridor has been identified through grading and property acquisition, ensure that construction-related activities located in close proximity to identified heritage resources are suitably planned to conserve the resources and maintain appropriate vehicular access.
- The character and appearance of the Trafalgar Road corridor (CHL 3) will be changed permanently. As a record, during detailed design, a Photographic Documentation Report may be prepared for the cultural heritage landscape associated with Trafalgar Road and its context prior to any change in the study. The report should use historical mapping, 20th century and aerial photographs and current photographs to illustrate the development of the corridor.
- At BHR 31 (10229 Trafalgar Road), BHR 35 (10667 Trafalgar Road), remedial landscaping in the form of fencing and/or vegetation may be required (see **Section 7.1.13** Landscaping). Consultation with property owners will be conducted to determine the preferred approach. No further mitigation is anticipated.
- At CHL 34 (Mount Pleasant Wesleyan Methodist Cemetery) consideration may be given to the provision of a pull off area for maintenance and visitor vehicles. Ensure fencing around the property is retained.
- Confirm the school bell from year 1873 on the property at BHR 38 (Stewarttown Middle School) is protected. No further mitigation is anticipated.

- Permanent physical changes to the existing character of the Stewarttown settlement (CHL 47) are anticipated due to land acquisition, removal of buildings on the east side of Trafalgar Road, raising of the road profile 2-3 m in the vicinity of Black Creek and the replacement of the road bridge over Black Creek. While none of the buildings to be removed are included in the Town of Halton Hills Heritage Register, the owners at 11069 Trafalgar Road indicate there is a former ice house on the property. The Town of Halton Hills should, as a record, consider preparing a Photographic Documentation Report for the cultural heritage landscape associated with Trafalgar Road and its context prior to any change in the study corridor including the Stewarttown community. Particular attention should be paid to the east side of Trafalgar Road in Stewarttown where the buildings will be removed. If possible, the site history of 11069 Trafalgar Road should be confirmed.
- The existing retaining wall adjacent to CHL 48 (St. John's Anglican Cemetery) will be replaced as part of the road improvements. Protection of the cemetery including the headstones and landscaping may be required during this replacement. Consultation with the property owners will be conducted to determine the preferred approach.
- The Trafalgar Road Bridge over Black Creek (BHR 49) will be replaced. The existing structure was constructed c1975 and therefore, is of potential cultural heritage value or interest. The MCEA Municipal Heritage Bridges, Cultural, Heritage and Archaeological Resources Assessment Checklist should be completed. If required after completing the checklist, a Cultural Heritage Evaluation Report (CHER) should be prepared for the property that follows the evaluation criteria set out in Ontario Regulation 9/06 and includes mitigation recommendations.
- There will be some physical change to the existing character of the associated recreational land for The Club at North Halton (CHL 50) due to land acquisition. The Town of Halton Hills should, as a record, consider preparing a Photographic Documentation Report for the cultural heritage landscape associated with Trafalgar Road and its context prior to any change in the study corridor including the property to be acquired at the location of The Club at North Halton.
- Remedial landscaping in the form of fencing and/or vegetation may be required between Devereaux House (BHR 52) and the improved Trafalgar Road. Consultation with the property owner, the Town of Halton Hills, will be conducted to determine the preferred approach. Ensure appropriate access and signage is provided. No further mitigation is anticipated.

7.2.3.2 Archaeology Resources

As noted in **Section 3.6.2**, a Stage 1 archaeology assessment was carried out. The area within the right-of-way of Trafalgar Road between 10 Side Road and Highway 7 (east and west sides) has been completely disturbed by the existing roadway, gravel shoulders, and ditching associated with roadway construction. Therefore, since the study corridor within the right-of-way is completely disturbed, no further assessment is required for these areas.

The Stage 1 archaeological assessment identified areas of archaeological potential outside of the current right-of-way. Given this, it is recommended to the Ministry of Tourism, Culture and Sport that any land that is outside of the right-of-way that will be

impacted by future roadway construction will require Stage 2 archaeological assessment.

Details may be found in **Appendix G** – Stage 1 Archaeological Assessment.

7.2.4 Transportation

The proposed improvements on Trafalgar Road as described in **Chapter 7** support the transportation goals and objectives of Halton Region and Town of Halton Hills. All modes of transportation would be accommodated on Trafalgar Road as the roadway transforms into a multi-modal corridor. The proposed undertaking supports Halton Region's Transportation Master Plan and Active Transportation Master Plan.

7.2.5 Source Water Protection and Hydrogeology

Source water protection is discussed in **Section 3.5** of the ESR, and hydrogeology assessment as part of the Trafalgar Road improvements are discussed in **Section 7.1.12**.

It should be noted that recent changes to regulations governing dewatering activities outlined in *Ontario Regulation 63/16: Registrations Under Part II.2 of the Act* – Water Taking also place restrictions on where dewatering effluent may be discharged within WHPAs. The requirements of this regulation shall be considered during the dewatering planning and execution stages.

Some of the policies noted in Section 3.5 and above may require preparation of a Risk Management Plan (RMP) outlining risk management measures that must be implemented to address significant drinking water threat (SDWT) activities. Separate RMPs may be required to address SDWT activities during the construction and post construction phases of the project. RMPs are to be established between the organization engaged in the SWDT activity and Halton Region's Risk Management Official (RMO).

7.2.6 Design and Construction Considerations

The mitigation of construction impacts will follow the *Environmental Construction Guidelines for Municipal Road, Sewage and Water Projects*, issued by the Municipal Engineers Association.

7.2.6.1 Potential Impacts during Construction

The following sections describe the potential environmental impacts during construction and proposed mitigating measures. The following potential adverse effects are identified:

- disruption/removal of existing vegetation
- construction noise and air quality
- disruption to vehicle traffic
- mud and dust during construction
- impacts to quality of well-water
- vibration

The mitigation and monitoring conditions included in the following sections indicate a commitment on the part of the Region to mitigate potential environmental impacts and undertake a monitoring program during and after construction.

During the detailed design stage and prior to construction, Halton Region will be responsible for obtaining approval from the Ministry of the Environment and Climate Change, as well as the Ministry of Natural Resources and Forestry for stormwater management. Permit approval will be required from Conservation Halton for all culvert installations, watercourse realignments, structures, site alteration, etc. within areas regulated pursuant to Ontario Regulation 162/06.

A permit will likely be required from MNR under the Endangered Species Act and will be confirmed subject to MNR input to the Information Gathering Form.

A permit will be required from NEC for any work within Niagara Escarpment Lands and will be confirmed subject to NEC input to the Information Gathering Form.

It is intended that the works proposed are executed in such a manner, which to the fullest possible extent, minimizes any adverse effects on the natural environment of the project area. The Contractor will be responsible to ensure all his personnel are sufficiently instructed so that the work is carried out in a manner consistent with minimizing environmental impact. The Region will assign a qualified environmental inspector whose responsibility will be to ensure compliance with the environmental objectives.

7.2.6.2 Disposal of Excess Material

Surplus excavated material shall be removed to locations arranged by the Contractor. Prior to the disposal of any surplus excavated material, the Contractor will provide the Engineer with a sketch of the dumping site(s) showing access thereto. A written statement from the property owner(s) agreeing to allow the disposal of fill on the property must be approved by a Contract Administrator (CA). Furthermore, the placement of fill within any area associated with valleys, wetlands, shorelines and other hazardous lands that are regulated pursuant to Ontario Regulation 162/06 requires the written permission of Conservation Halton.

All approvals and permits will have to be obtained. Relevant MOECC policy frame work and best management practices should be referenced and applied where applicable.

Upon completion of the disposing, levelling and grading of surplus excavated material on any property, a written statement shall be obtained from the property owner(s) releasing the Contractor and Region from any claims and accepting the condition of the property as satisfactory.

7.2.6.3 Measures for Proper Tree Removal and Preservation of Residual Plant Communities

A Tree Protection Plan will be developed during detailed design. This plan will provide guidelines for protecting trees during construction, as well as minimizing soil compaction and making wise use of the removed timber resource. The plan should also include recommendations for during and post-construction maintenance including hazard tree monitoring, pruning, insect and disease control, aerating, watering and mulching.

7.2.6.4 Mud and Dust Control

The Contractor shall take such steps as may be required to prevent dust nuisance resulting from his operations. The Contractor shall be responsible for all dirt and mud that is tracked onto the roadways from vehicles entering or leaving the job site. The Contractor shall, upon request from the CA, immediately proceed with cleanup operations, or in the opinion of the CA, the Contractor has not or cannot sufficiently remove the mud from the road, the CA will proceed with the necessary clean up.

7.2.7 Monitoring and Maintenance

During construction, the Region will ensure that the environmental protection recommendations in the ESR and other subsequent agency approval conditions are complied with.

7.2.8 Detailed Design Commitments

Environmental concerns, anticipated impacts, and proposed mitigation measures as they relate to the project, have been described in **Chapter 7**. Many of the environmental concerns have been mitigated through the process by which the recommended design was selected, as described in the ESR. This section provides an additional list of standard commitments to be carried forward into Phase 5 of the Municipal Class EA process – Implementation Phase. These commitments have been developed through consultation with various agencies throughout the study process. It is recognized that certain decisions require specific agency input. Therefore, a key component of detailed design is refining and detailing the impact assessment and mitigation measures as the design is developed and refined, in consultation with the agency staff.

Conservation Halton, as well as the Ministry of Natural Resources and Forestry have been consulted throughout the Class EA process, and their comments and preliminary concerns have been integrated. For example, commitments to Conservation Halton may include but not limited to: Refinement and confirmation of drainage areas using latest DEM from CH and other sources (field survey), refinement of Hydrologic and Hydraulic model, if necessary, and submission to CH and refinement of LID options in consultation with Landscape Architect including the planting of native, non-rare species around the proposed SWM facilities.

Specific mitigation measures have been selected and committed to by Halton Region to address potential impacts as discussed throughout **Chapter 7**. It is recommended that these commitments, as presented in the ESR, become part of the contract package so that Contractors are aware of the requirements prior to tendering. Monitoring of construction activities must ensure that all environmental standards and commitments for construction are met. Halton Region will work with Conservation Halton, Credit Valley Conservation, and other authorities, during detailed design and prior to the start of construction to ensure that the proposed works are acceptable and to obtain required permits.

Environmental monitoring will be combined with construction supervision to include periodic site visits and inspections throughout the course of the work.

7.2.9 Permit Requirements

Permits and approvals that may be required for this project are identified in **Table 7-22**:

Table 7-22: Permit Requirements

Regulatory Agency	Legislation	Permit/Approval	Comments
Federal Government			
Department of Fisheries and Oceans	Fisheries Act	Approval under the Fisheries Act	The requirement for review by DFO under the Fisheries Act will be determined at detailed design.
Provincial Government			
Ministry of the Environment and Climate Change	Ontario Environmental Assessment Act	Schedule 'C' Class EA (Municipal Engineer's Association Class EA)	Satisfactory completion of EA requirements is a prerequisite for obtaining most other approvals
	Ontario Water Resources Act	Permit to Take Water[7]	Required if >50,000 L/d of surface or groundwater taken, includes temporary dewatering during construction
		Environmental Compliance Approval (ECA) for Industrial Sewage Works	Required if settling pond or other water treatment used during construction
	Environmental Protection Act	Environmental Compliance Approval	Storm water quality controls, including temporary facilities utilized during the project construction phase
		Environmental Compliance Approval	Construction and operation of water quality treatment facilities, including the proposed OGS And advanced filtration systems
Ministry of Natural Resources and Forestry	Endangered Species Act	Should a species or its habitat that is afforded protection under the ESA have potential to be negatively impacted, compliance under the Act must be demonstrated.	The requirement for completion of and IGF or activity registration will be determined at detailed design.
		A License to Collect Fish for Scientific Purposes	Removal of fish during installation of cofferdams for culvert extensions will also be determined at detailed design.
Ministry of Labour	Construction Projects Regulation (O.Reg. 213/91)	Notice of Project	Required before construction commences

[7] Source Water Protection and hydrogeology are discussed in Sections 3.5 and 7.1.12 of the ESR. The Region recognizes potential delays associated with satisfying Source Water Protection policy requirements, namely the potential requirements to establish Risk Management Plans (RMPs) for construction and post construction activities. Note that RMPs would need to be finalized with the Risk Management Official prior to engaging in significant drinking water threat activities.

Regulatory Agency	Legislation	Permit/Approval	Comments
Ministry of Transportation	Public Service Works on Highways Act	Encroachment Permit	Required prior to constructing any improvements to the Trafalgar Road / Highway 7 intersection
Conservation Halton and Credit Valley Conservation	Development, Interference with Wetlands & Alterations to Shorelines & Watercourses (O.Reg. 162/06)	Permit	Will be required for culvert extensions / replacements and widening of road
CN and Metrolinx	Per applicable Canadian Transportation Agency and Transport Canada Legislations	Grade Separation Construction Agreement	
Niagara Escarpment Commission	Niagara Escarpment Planning and Development Act	Development Permit	
Halton Region / Town of Halton Hills			
Halton Region	Tree Bylaw	Permit	Required to remove trees on region-owned property(i.e., within road right-of- way)
Town of Halton Hills	Noise Control By- law (2010-0030)	Exemption	Required to allow construction works outside of normal hours (7 pm to 7 am) and on weekends
Town of Halton Hills	Ontario Building Code	Building Permit	Required if temporary site trailers or other facilities are erected on-site

8 MONITORING

During construction, the on-site Contract Administrator will ensure that implementation of mitigating measures and key design features are consistent with the contract and external commitments (e.g., permit conditions/requirements and EA commitments). In addition, the effectiveness of the environmental mitigating measures established during detailed design will be assessed to ensure that:

- Individual mitigation measures are providing the expected control and / or protection;
- Additional mitigation measures are provided, as required, for any unanticipated environmental problems that may develop during construction.

On-site construction administration staff will ensure that the environmental measures outlined in this report (Chapter 7) and further developed during detailed design are carried out. In an event that problems arise, appropriate agencies will be contacted to provide further input.

If the impacts of construction are different than anticipated, or if the method of construction is such that there are greater than anticipated impacts, the Contractor's methods of operation will be changed or modified to reduce those impacts.