



Stormwater Management Report

Wyecroft Road Improvements Environmental Assessment from Bronte Road to Kerr Street



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1 Introduction

1.1 Background

The Town of Oakville retained IBI Group to complete a Schedule 'C' Municipal Class Environmental Assessment (EA) study for the proposed improvements to Wyecroft Road between Bronte Road and Kerr Street in the Town of Oakville. This Stormwater Management (SWM) Report is a supporting document to the Class EA for the proposed improvements to Wyecroft Road between Bronte Road and Kerr Street.

Wyecroft Road is a Multi-Purpose Arterial roadway under the jurisdiction of the Town of Oakville. Wyecroft Road becomes South Service Road West for a section of the corridor between Third Line and Fourth Line. Within the study limits, Wyecroft Road connects Oakville's employment area to local, regional and provincial highways. The study corridor extends for a distance of approximately 6.4 km from Bronte Road to Kerr Street. The project limits for this study are delineated in Figure 1 presented in APPENDIX.

The purpose of this SWM Report is to support the Class EA, summarize the existing drainage and stormwater management conditions within the study limits, and develop a SWM Plan to convey external and internal runoff across the widened Wyecroft Road in order to mitigate the potential impacts of the proposed roadway improvements on receiving drainage systems.

1.2 Existing Drainage Infrastructure

As part of the Wyecroft Road EA, the following drainage components were identified:

- There are seven (7) transverse culverts within the study limits that convey external and roadside ditching flows across Wyecroft Road/South Service Road West. Of the seven existing culverts, two (2) are twin cell concrete boxes, one (1) is open footing, two (2) are concrete boxes, one (1) is a corrugated steel pipe arch (CSPA), and one (1) is a twin cell CSPA.
- The existing V-shaped road side ditches along Wyecroft Road provide water quality/quantity control for runoff prior to discharge into receiving systems.
- Storm runoff from Bronte Road to Third Line is collected by storm sewers and conveyed to Fourteen Mile Creek. Storm sewers are also used to convey roadway runoff from approximately 350 m west of Weller Court to just west of Weller Court.
- Most of the watercourses convey flow through rural and urban areas. A significant amount of estate/commercial/residential land use areas are also located adjacent to Wyecroft Road.
- There are no stormwater management facilities within or adjacent to the project corridor. However, there is an existing SWM facility located upstream

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of where Taplow Creek crosses Fourth Line, south of South Service Road West.

1.3 Proposed Roadway Improvements

As part of the Wyecroft Road EA study, the following preferred roadway improvements were investigated:

Preferred Roadway Improvements

- Widening of Wyecroft Road from 2 lanes to 4 lanes from Bronte Road to just east of Third Line.
- Proposed eastbound/westbound centre left turn lane from just east of Bronte Road to just west of Third Line.
- Proposed eastbound/westbound centre left turn lane between Cranberry Court and Equestrian Court.
- Extension of the eastbound/westbound centre left turn lane located east of Fourth Line to Weller Court to include roadway segment up to the Fourth Line/Wyecroft Road intersection, as well as roadway segment just east of Weller Court.
- Proposed eastbound/westbound centre left turn lane from just east of Sinclair Road to just west of Kerr Street.
- Improvements at the Bronte GO Station Bus Layby
 Driveway/Wyecroft Road intersection by incorporating traffic signals.
- Improvements at the South Service Road West/Wyecroft Road intersection, just west of Third Line, by incorporating centre islands and left-turn lanes.
- Improvements at Third Line/Wyecroft Road intersection with additional east west lanes.
- Realignment of South Service Road West just east of Third Line, from Station 12+200 to 12+600.
- Improvements at the Progress Court/South Service Road West intersection by incorporating a flush centre island (west side of intersection), a westbound centre left turn lane, and traffic signals.
- Improvements at the Sinclair Road/Wyecroft Road intersection by incorporating eastbound and westbound left turn lanes.
- Improvements at the Kerr Street/Wyecroft Road intersection by incorporating eastbound left and right turn lanes and traffic signals.
- Multi-Use Trail (MUT) proposed on the south side of Wyecroft Road from Bronte Road to Third Line.

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- Buffered bike lanes on both sides of Wyecroft Road within the roadway allowance between Bronte Road and Kerr Street.
- Sidewalks on the north side of Wyecroft Road from Bronte Road to Third Line, South Service Road West on the south side of Wyecroft Road from Third Line to 470 m east of Progress Court, and on both sides of South Service Road West/Wyecroft Road from 470 m east of Progress Court to Kerr Street.
- Permeable pavement (permeable asphalt or porous concrete) for MUT and sidewalks, to be considered during detail design.
- Localized changes to the roadway profile.

Typical rural and urban cross sections for the proposed roadway are presented on Figures 3-7 in APPENDIX.

2 Site Description

2.1 Study Area

Wyecroft Road from Bronte Road to Kerr Street generally features a two lane paved road with wide gravel shoulders and grassy ditches on both sides of the right-of-way (ROW). Existing urban sections with curb and gutter exist at the following locations:

- Bronte Road to Third Line;
- Approximately 100 metres west of the intersection serving the Town Central Operations Depot to Cranberry Court;
- Equestrian Court to just east of Fourth Line;
- Along the Oakville Transit property (south side only); and
- Approximately 100 metres west of Dorval Drive to Sinclair Road.

The landscape on either side of Wyecroft Road is generally characterized by fully developed commercial and industrial parks with a few open spaces. From approximately 150 m east of Third Line to approximately 1350 m east of Third Line, South Service Road West runs parallel to and just south of the Queen Elizabeth Way (QEW) roadway corridor.

The Wyecroft Road corridor spans multiple watersheds including Bronte Creek, Fourteen Mile Creek, McCraney Creek, and Sixteen Mile Creek, all under the jurisdiction of Conservation Halton (CH) and the Ministry of Natural Resources and Forestry (MNRF), Aurora District Office. The watershed headwaters originate on the Peel Plain and then flow towards Lake Ontario. Within the Fourteen Mile Creek watershed, a 160 m stretch of South Service Road West beginning just east of Third Line and a 60 m stretch beginning 250 m east of Progress Court fall within CH's Regulation limit. Within the McCraney Creek

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watershed, a segment of South Service Road West from Redwood Square to Fourth Line and a 350 m stretch of Wyecroft Road beginning 90 m east of Fourth Line fall within CH's Regulation limit. As such, any proposed development, interference or alteration along these segments of Wyecroft Road will require a permit from CH. Refer to APPENDIX for CH floodplain mapping.

2.2 Existing Drainage Conditions

Based upon a review of CH subwatershed mapping and the existing survey data, a total of seven drainage features cross the Wyecroft Road ROW within the study area. These drainage features were characterized as either watercourses or intermittent drainage features which convey roadside ditch and adjacent area flows across the ROW. The location of the crossings is shown on Figure 2 in APPENDIX, with Crossings 1, 3, 6, and 7 situated along watercourses and Crossings 2, 4, and 5 situated along intermittent drainage features.

The Bronte Creek watershed extends across multiple cities and towns, with much of the watershed remaining undeveloped. The main branch of Bronte Creek is approximately 48 km long, with settlement concentrating near the mouth of the creek before discharging into Lake Ontario. Bronte Creek flows west of the Wyecroft Road/Bronte Road intersection, just outside of the project limits.

The main branch of Fourteen Mile Creek crosses under South Service Road West, just east of Third Line. The Fourteen Mile Creek watershed includes natural, enclosed and altered channels of Fourteen Mile Creek, with many headwater tributaries of both the east and west branches originating on the Trafalgar Moraine. The eastern branch of Fourteen Mile Creek used to form part of the McCraney Creek watershed until it was diverted to discharge into Fourteen Mile Creek in order to alleviate downstream flooding. Fourteen Mile Creek headwater tributaries are intermittent while the downstream main channel conveys permanent flow in a well-defined valley. The study area is located within the lower reach of the creek which outlets to Lake Ontario 3.4 km downstream of the Wyecroft Road crossing. Fourteen Mile Creek supports a warmwater thermal regime, as well as some coldwater (i.e. Redside Dace) and migratory coldwater species.

McCraney Creek's headwater tributaries drain the southern edge of the Trafalgar Moraine. Each branch of McCraney Creek is intermittent upstream, flowing in natural channels and swales, but enclosed and altered throughout urban areas. All branches flow south of the QEW. Upper McCraney Creek flows parallel to and west of Taplow Creek and Glen Oak Creek, ultimately discharging into Fourteen Mile Creek. At the Canadian National Railway tracks, Taplow Creek and Glen Oak Creek combine to flow through the urban development downstream and discharge into Lower McCraney Creek. Urban storm sewers discharge into the tributaries and support the perennial flow in the

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downstream reach. Lower McCraney Creek flows through a defined valley and discharges to Lake Ontario.

The Sixteen Mile Creek watershed spans across portions of Milton, Halton Hills, Oakville and Mississauga, and drains an area of approximately 371 km2, discharging into Lake Ontario. Sixteen Mile Creek flows just east of Kerr Street and does not cross Wyecroft Road within the project limits.

Within the project limits, Wyecroft Road is primarily a two-lane, rural roadway, approximately 7.1 m wide with gravel shoulders varying in width from 2.2 m to 3.0 m. In general, Wyecroft Road has a rural cross-section for the majority of the corridor, with the exception of an urban stretch between Bronte Road and Third Line located at the west end of the study area. Within the rural section, stormwater resulting from both minor and major storm events is managed through roadside ditches/swales on both sides of Wyecroft Road, rather than through storm sewers, and there are no curbs or pedestrian sidewalks with the exception of intersections. Longitudinal corrugated steel pipe (CSP) culverts of varying diameter and length convey stormwater beneath driveways and street entrances on both sides of Wyecroft Road and ultimately discharge into receiving watercourses. Within the urban section (from just east of Bronte Road to just west of Third Line), Wyecroft Road features curbs, gutters, and pedestrian sidewalks on both sides of the roadway, and stormwater resulting from minor storm events is conveyed by storm sewers and discharged into the receiving watercourse (Fourteen Mile Creek). Major system flows within the urban section of the corridor are conveyed to existing watercourse crossings as roadway overland flow.

The location of the seven crossings and associated external drainage areas within the Wyecroft Road corridor are illustrated on Figure 2 in APPENDIX. These crossings convey external and roadside ditching flows across Wyecroft Road. The transverse drainage culverts associated with each crossing are labelled C1 through C7 (numbered from west to east along Wyecroft Road) on Figure 2 in APPENDIX. The following Table 1 lists all seven (7) transverse drainage culverts and provides details on their respective hydrologic and physical conditions.

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Table 1: Summary of Existing Transverse Drainage Culverts

| ID | LOCATI ON | TYPE | EXISTING SIZE | EXISTI NG LENGT H | SURFACE DRAINAGE CHARACTERIS TICS |
|--------|---|--|---|----------------------------|--|
| C1 (1) | Just east of Third Line | Twin Cell Concrete Box | (2x) 6000 x 3000 mm | 23.5 m | Fourteen Mile Creek |
| C2 | 175 m west of Progress Court | North Side: Twin Cell CSPA South Side: CSP | North Side: (2x) 1400 x 1000 mm South Side: 1000 mm | 80.2 m | Roadside Ditch/Swale |
| C3 (2) | 270 m east of Progress Court | Concrete Box | Centre & North | 97.3 m | Upper McCraney Creek |
| C4 | 160 m west of Cranberr y Court | Concrete Box | 2440 x 1830 mm | 42.7 m | Roadside Ditch/Swale |
| C5 | Just east of Cranberr y Court | CSPA | 1030 x 740 mm | 26.0 m | Roadside Ditch/Swale |
| C6 | Just west of Fourth Line | Twin Cell Concrete Box | (2x) 3000 x 1800 mm | 59.0 m | Taplow Creek |
| C7 (3) | 310 m east of Fourth Line | Open Footing | 6100 x 1470 mm | 16.9 m | Glen Oak Creek |

Note:

- (1) HEC-RAS model received from the Town of Oakville indicated this as an 11.0 m span and 2.0 m rise bridge.
- (2) HEC-RAS model received from the Town of Oakville indicated this as $4.27 \text{ m} \times 2.0 \text{ m}$ box culvert. The size identified in the field visit is $3.05 \text{ m} \times 2.0 \text{ m}$.
- (3) HEC-RAS model received from the Town of Oakville indicated this as $6.1 \text{ m} \times 0.95 \text{ m}$ box culvert. The size identified in the field visit is $6.1 \text{ m} \times 1.1 \text{ m}$.
- (4) Source of all culvert/crossing information is Record/As-Built Drawing.
- (5) Refer to Figure 2 in APPENDIX for culvert location.

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2.3 Existing Drainage Areas

A review of available topographic maps, floodplain maps, and Ontario Base Maps was undertaken to establish drainage boundaries and associated external drainage areas within the project limits. As part of the report titled, "Fourteen Mile Creek/McCraney Creek, Supplemental Alternative Assessment, Town of Oakville", dated December 7, 2016, AMEC Foster Wheeler prepared a Drainage Area Map which encompasses the project area. Based on AMEC's Drainage Area Map and information provided by the Town of Oakville, external drainage areas were delineated to establish drainage boundaries for the study area. Subcatchments and associated drainage areas for the seven crossings are illustrated on Figure 2 in APPENDIX. Roadside ditching has been used at most locations along Wyecroft Road to direct runoff to the nearest receiving watercourse.

2.4 Existing Drainage Elements

2.4.1 Transverse Culverts

Currently, there are seven (7) transverse drainage culverts within the study area. Based on the field investigation that was conducted, the hydrologic and physical conditions of the culverts were assessed and summarized in the preceding Table 1. Site photographs at the culverts are presented in APPENDIX M. The following paragraphs describe the three non-structural culverts:

Twin Cell CSPA Culvert (C2)

This culvert is located on South Service Road West approximately 175 m west of Progress Court. At the upstream end, C2 is a twin cell CSPA. At the downstream end, C2 is a CSP which connects to a swale. The culvert runs under the South Service Road West, QEW, and North Service Road West corridor for a length of approximately 80.2 m. C2 is within the Fourteen Mile watershed.

Concrete Box Culvert (C4)

This existing structure is located on South Service Road West approximately 160 m west of Cranberry Court. The culvert is a single cell concrete box with a clear span of 2.44 m and a vertical opening of 1.83 m. C4 has a length of 42.7 m with a roadway width of 17.5 m which accommodates three lanes of vehicular traffic. The culvert was constructed on a skew angle of 35° perpendicular to the roadway alignment. C4 is within the Fourteen Mile watershed.

CSPA Culvert (C5)

This culvert is located on South Service Road West just east of Cranberry Court. C5 is a 1.03 m x 0.74 m CSPA culvert which conveys flow from the roadside ditches located north of South Service Road West and connects to a swale at the downstream end. The culvert has an existing length of 26.0 m. C5 is within the Fourteen Mile watershed.

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Structural Culverts

Fourteen Mile Creek Culvert (C1)

The structure has a North-South orientation and is located on South Service Road West just east of Third Line. This culvert is a twin cell concrete box with a cell clear span of 6.0 m and a vertical opening of 3.0 m which carries two lanes of vehicular traffic across Fourteen Mile Creek. The culvert has a length of 23.5 m with a roadway width of 7.3 m. This structure was constructed on a skew angle of 25° perpendicular to the roadway alignment. C1 is within the Fourteen Mile Creek watershed and is a regulated watercourse crossing.

Upper McCraney Creek Culvert (C3)

This structure has a North-South orientation, conveys Upper McCraney Creek across the QEW and service roads, and is comprised of three sections: Centre (original), North Extension, and South Extension. The south extension culvert is located on South Service Road West approximately 270 m east of Progress Court and carries two lanes of vehicular traffic. The clear span of the south extension culvert is 3.06 m, with a vertical opening of 2.6 m. The centre and north extension culverts have a clear span of 3.06 m and a vertical opening of 1.7 m. The centre section of the structure is a single cell concrete box culvert while the south and north extensions are open footing. C3 is enclosed under the South Service Road West, QEW, and North Service Road West corridor for a length of approximately 97.3 m, and was constructed perpendicular to the roadway alignment. C3 is within the Fourteen Mile Creek watershed and is a regulated watercourse crossing.

Taplow Creek Culvert (C6)

The existing structure is located on South Service Road West just west of Fourth Line and conveys Taplow Creek beneath the roadway. The culvert is a twin cell concrete box with a cell clear span of 3.0 m and a vertical opening of 1.8 m. The culvert has a length of 59.0 m and supports a roadway width of 19.1 m which accommodates four lanes of vehicular traffic. The existing structure was constructed on a skew angle of 40° perpendicular to the roadway alignment. C6 is within the McCraney Creek watershed and is a regulated watercourse crossing.

Glen Oak Creek Bridge (C7)

The existing structure is located on Wyecroft Road approximately 310 m east of Fourth Line and conveys Glen Oak creek beneath the roadway. This structure is rigid frame open footing with a clear span of 6.1 m and a vertical opening of 1.47 m. The structure has a length of 16.9 m and supports a roadway width of 7.3 m which accommodates two lanes of vehicular traffic. The existing structure was constructed perpendicular to the roadway alignment. C7 is within the McCraney Creek watershed and is a regulated watercourse crossing.

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2.4.2 Storm Sewers

Under existing conditions, Wyecroft Road runoff from Bronte Road to Third Line is primarily collected by catchbasins, conveyed by storm sewers, and discharged into Fourteen Mile Creek and the Bronte Road sewer system. The storm sewer system along Wyecroft Road is located between Station 10+000 and 12+100, with sewers ranging in size from 675 mm to 1800 mm in diameter. There is also a network of storm sewers located from approximately 350 m west of Weller Court to just west of Weller Court which conveys roadway runoff and discharges into the existing channel south of Wyecroft Road, approximately 175 m west of Weller Court. The storm sewers near Weller Court range in size from 750 mm to 1050 mm in diameter. Existing storm sewers and outlet points within the study area are illustrated on Figure 8 in APPENDIX.

2.4.3 Drainage Ditches

V-shaped roadside ditches currently exist within the rural sections of the study area, generally from Third Line to Kerr Street, and ultimately drain into receiving watercourses at crossing locations.

2.5 Existing Land use, Soils and Physiography

The majority of lands adjacent to the study area on either side of Wyecroft Road are generally characterized by fully developed commercial and industrial parks with a few open spaces. Within the Fourteen Mile Creek watershed, areas north of Highway 5 (Dundas Street) have agricultural land uses and areas south of Highway 7 comprise a mixture of urban land uses. Within the McCraney Creek watershed, land use is predominantly commercial from south of the QEW to Speers Road and predominantly residential from south of Speers Road towards Lake Ontario.

The study area is located within the Iroquois Plain physiographic region in southern Ontario, a lowland region bordering Lake Ontario. The area is relatively flat and formed by lacustrine deposits, a result of the inundation from Lake Iroquois during the Pleistocene period. This region extends around the western part of Lake Ontario, from the Niagara River to the Trent River (Chapman and Putnam 1984). The old shorelines of Lake Iroquois include cliffs, bars, beaches and boulder pavements.

3 Drainage and Stormwater Management Issues

Wyecroft Road has a rural cross-section throughout the majority of the corridor, meaning that stormwater runoff resulting from both minor and major storm events is largely managed through roadside ditches. The Town of Oakville is proposing localized roadway improvements within the study area. Typical rural and urban cross sections for the proposed roadway are presented on Figures 3-7 in APPENDIX.

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Under proposed conditions at urban sections along Wyecroft Road, runoff resulting from major storm events will continue to be conveyed to existing watercourse crossings as roadway overland flow, while runoff from minor storm events will be conveyed by the proposed condition storm sewer system (comprising a combination of existing sewers, replacement sewers, and new sewers). At rural sections, both minor and major system flows will be conveyed by proposed flat bottom roadside ditches towards receiving watercourses.

The proposed improvements to Wyecroft Road will result in a slight increase in pavement area. A pavement area analysis was conducted for the Wyecroft Road corridor to determine the impervious surface area in the existing and proposed condition within the fourteen (14) internal roadway drainage areas defined for the site. Peak flow rates were also determined and compared for various design storms using the Rational Method for flow calculation and the Town of Oakville IDF curves for determination of rainfall intensity. The results of the analysis are presented in the following Table 2. The existing and proposed internal roadway drainage areas are delineated in Figure 8 and Figure 9 presented in APPENDIX and APPENDIX, respectively.

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Table 2: Pavement Area Analysis

| ADEA | TOTAL | DAVEMENT | PERCENT | DUNOFF | | FLO | OW (m³/s) | |
|------------|--------------|-----------------------|----------------|------------------|------------|-------|-------------|--------------|
| AREA ID | AREA (ha) | PAVEMENT AREA (ha) | IMPERV. (%) | RUNOFF COEFF. | 2- VEAD | 5- | 10- YEAR | 100- YEAR |
| | (/ | | | CONDITIO | YEAR | YEAR | IEAR | IEAR |
| C1 | 2.67 | 1.54 | 57.68 | 0.60 | 0.368 | 0.511 | 0.604 | 0.899 |
| C2 | 0.97 | 0.55 | 56.70 | 0.60 | 0.132 | 0.184 | 0.217 | 0.323 |
| C3 | 2.54 | 1.61 | 63.39 | 0.64 | 0.373 | 0.519 | 0.612 | 0.912 |
| C4 | 2.00 | 0.86 | 43.00 | 0.50 | 0.229 | 0.318 | 0.375 | 0.559 |
| C5 | 1.14 | 0.63 | 55.26 | 0.59 | 0.153 | 0.212 | 0.250 | 0.373 |
| C6 | 1.33 | 0.69 | 51.88 | 0.56 | 0.171 | 0.238 | 0.280 | 0.418 |
| C7 | 0.78 | 0.42 | 53.46 | 0.57 | 0.102 | 0.142 | 0.168 | 0.250 |
| C8 | 1.44 | 0.80 | 55.76 | 0.59 | 0.194 | 0.270 | 0.318 | 0.474 |
| C9 | 0.91 | 0.69 | 75.82 | 0.73 | 0.152 | 0.211 | 0.249 | 0.371 |
| C10 | 1.05 | 0.56 | 53.33 | 0.57 | 0.137 | 0.191 | 0.225 | 0.336 |
| C11 | 1.98 | 1.25 | 63.13 | 0.64 | 0.290 | 0.403 | 0.476 | 0.709 |
| C12 | 1.26 | 0.79 | 62.70 | 0.64 | 0.184 | 0.255 | 0.301 | 0.449 |
| C13 | 0.61 | 0.34 | 55.74 | 0.59 | 0.082 | 0.114 | 0.135 | 0.201 |
| C14 | 1.54 | 0.81 | 52.60 | 0.57 | 0.200 | 0.278 | 0.328 | 0.488 |
| TOTAL | 20.22 | 11.54 | 57.07 | 0.60 | 2.767 | 3.846 | 4.539 | 6.761 |
| | | | | D CONDITIO | | | | 001 |
| C1 | 3.30 | 2.10 | 63.73 | 0.65 | 0.487 | 0.677 | 0.798 | 1.189 |
| C2 | 1.36 | 0.82 | 60.36 | 0.62 | 0.194 | 0.269 | 0.318 | 0.474 |
| C3 | 3.17 | 2.11 | 66.55 | 0.67 | 0.483 | 0.671 | 0.791 | 1.179 |
| C4 | 2.16 | 0.99 | 45.97 | 0.52 | 0.257 | 0.358 | 0.422 | 0.629 |
| C5 | 1.03 | 0.50 | 48.59 | 0.54 | 0.128 | 0.177 | 0.209 | 0.312 |
| C6 | 1.26 | 0.52 | 41.34 | 0.49 | 0.141 | 0.196 | 0.231 | 0.344 |
| C7 | 0.81 | 0.34 | 41.67 | 0.49 | 0.091 | 0.126 | 0.149 | 0.222 |
| C8 | 1.52 | 0.82 | 53.70 | 0.58 | 0.200 | 0.278 | 0.328 | 0.488 |
| С9 | 0.99 | 0.64 | 64.54 | 0.65 | 0.147 | 0.205 | 0.242 | 0.360 |
| C10 | 0.97 | 0.54 | 55.22 | 0.59 | 0.130 | 0.180 | 0.213 | 0.317 |
| C11 | 2.06 | 1.12 | 54.38 | 0.58 | 0.273 | 0.379 | 0.447 | 0.667 |
| C12 | 1.34 | 0.71 | 52.83 | 0.57 | 0.174 | 0.242 | 0.285 | 0.425 |
| C13 | 0.50 | 0.29 | 56.85 | 0.60 | 0.069 | 0.095 | 0.112 | 0.168 |
| C14 | 1.61 | 0.71 | 44.31 | 0.51 | 0.188 | 0.261 | 0.308 | 0.458 |
| TOTAL | 22.09 | 12.21 | 55.27 | 0.59 | 2.960 | 4.113 | 4.854 | 7.231 |

The results of the pavement area analysis revealed that the proposed improvements to Wyecroft Road will slightly increase peak flows within internal roadway areas C1, C2, C3, C4, and C8. Post to pre-development quantity control is required to reduce peak flows within these five internal roadway areas.

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Based on the quantity control criteria, storage is required to temporarily retain runoff at these five outlet locations and discharge it at the existing flow rates. For the five roadway areas requiring storage, a total storage volume of 709 m3 is required. In C1, C2, C3, and C4, the required storage volume will be provided either by underground infiltration chambers beneath the proposed MUT or by superpipes within the storm sewer system before discharging to the receiving watercourses. In C8, the required storage volume will be provided either by an underground infiltration chamber beneath the proposed sidewalk or by superpipes within the storm sewer system before discharging to the receiving watercourse. Refer to APPENDIX for the full pavement area analysis and determination of peak flow rates for the existing and proposed internal roadway drainage areas. Required storage volumes for the five outlet locations that experience an increase in peak flow in the proposed condition are indicated on Figure 9 in APPENDIX.

Under proposed conditions, water quality control for the Wyecroft Road corridor will be provided within the proposed flat bottom roadside ditches through vegetation runoff velocity reduction and infiltration, as well by Oil/Grit Separator (OGS) units proposed upstream of the culverts. In total, there are twelve (12) OGS units proposed within the project limits. During detail design, it is recommended that permeable pavement be considered for sidewalks and the MUT to provide water quality control through infiltration. Water balance control can be achieved through infiltration of permeable pavement and vegetative areas.

4 Design Criteria

In compliance with the Ministry of Transportation of Ontario (MTO) Highway Drainage Design Standards (HDDS, 2008) and the Town of Oakville current policies and guidelines, the following design criteria have been adopted in the development of drainage and stormwater management strategies for the Wyecroft Road improvements project between Bronte Road and Kerr Street.

Culverts

Design Storm Event

According to MTO HDDS WC-1, the design return period for urban structures with a span less than or equal to 6.0 m is 50-year. A structure with a span exceeding 6.0 m on an Urban Arterial road should be designed to convey the 100-year design storm at the required freeboard and soffit clearance. The following criteria were applied to evaluate the hydraulic performance of the existing and proposed culverts within the project limits.

Freeboard

Clause 1-10.8.2 of the Canadian Highway Bridge and Design Code (CHBDC) recommends a freeboard of 1.0 metre "....from the edge of through traffic lanes

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to the design high-water level" for the design storm. This freeboard is a recommended value although it is recognized that, due to site-specific considerations, it is not always feasible to provide this value.

Vertical Clearance to Soffit

The provision of vertical clearance is typically related to scour and debris. For low vulnerability bridges (rigid frame, internal abutment and slab) and for culverts with a span less than or equal to 6.0 m in general, the requirement is a minimum of 0.30 m vertical clearance from the design flood to the soffit. For structures exceeding 6.0 m in span, the vertical clearance shall not be less than 1.0 m.

Headwater / Depth (HW/D) Ratio

MTO HDDS WC-7 stipulates a design standard for flood depth at the upstream face of a culvert which is expressed as a ratio of flood depth at the upstream face of the culvert to the diameter or rise of the culvert (HW/D). The following criteria apply for the Wyecroft Road culverts:

| Culverts with diameter or rise < 3.0 | HW/D ≤ |
|---|--------|
| meters | 1.5 |
| Culverts with diameter or rise 3.0 to 4.5 | HW/D ≤ |
| meters | 4.5 |
| Culverts with diameter or rise > 4.5 | HW/D ≤ |
| meters | 1.0 |

Changes in Upstream Water Levels

In accordance with good design practice, any increase in the upstream flood elevation resulting from the construction of a new structure should be kept to a minimum. The design target for upstream water level increases is zero. Minor increases may be accepted if:

- i. They are contained within the lands owned by the proponent;
- ii. The increase is in a valley system in which the flood line does not change appreciably in a horizontal direction;
- iii. No structures are impacted by the flood level change;
- iv. The increase is contained within municipally owned land or easement;
- v. The increase is at the face of the existing structure and does not impact upstream/downstream lands;
- vi. Written approval is obtained from the affected landowner.

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Storm Sewer System

In accordance with the Town of Oakville Development Engineering Procedures and Guidelines, the minor drainage system has been sized to convey runoff from a 5-year storm event.

Major System Drainage

In accordance with the Town of Oakville Development Engineering Procedures and Guidelines, major system flows (i.e. storms in excess of a 5-year event) will be conveyed overland to receiving drainage watercourses.

IDF Curves

In accordance with the Town of Oakville Development Engineering Procedures and Guidelines, the current Town of Oakville IDF curves have been used for all hydrological analyses.

Water Quantity Control

In accordance with the Town of Oakville Development Engineering Procedures and Guidelines, post-development peak runoff has been controlled to predevelopment levels in locations where the proposed roadway improvements result in an increase in peak flows.

Water Quality Control

- Proposed flat bottom roadside ditches will provide the 'Enhanced' Level of Protection (i.e. long-term average removal of 80% of total suspended solids (TSS)) as outlined by the Ministry of the Environment, Conservation and Parks (MECP) and stipulated in the Town of Oakville Development Engineering Procedures and Guidelines.
- OGS units have been proposed upstream of culverts to treat runoff and provide the 'Enhanced' Level of Protection as outlined by the MECP (80% TSS removal).

Water Balance Control

In accordance with the MECP Stormwater Management Planning and Design Manual (March 2003), the proposed design for the Wyecroft Road corridor will provide, at a minimum, on-site retention of all run-off from the first 5 mm of each rainfall event through infiltration and/or evapotranspiration.

5 Hydrotechnical Assessments

5.1 General

Hydrologic analyses were undertaken to determine peak flow rates for the Wyecroft Road storm sewers under existing and proposed roadway conditions, as well as peak flow rates at the seven drainage features which cross the Wyecroft Road ROW. The drainage features within the study limit are part of the

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Fourteen Mile Creek and McCraney Creek watersheds. Watercourses which cross Wyecroft Road within the study corridor include Fourteen Mile Creek, Upper McCraney Creek, Taplow Creek, and Glen Oak Creek. The three remaining crossings convey roadside ditch and adjacent area flows across Wyecroft Road. Hydraulic analyses were conducted to evaluate the performance of existing culverts and to determine appropriate sizing for culvert replacements, where required, to convey external runoff across Wyecroft Road according to current design standards. Hydraulic analyses were also conducted to evaluate the performance of the existing and proposed condition storm sewer systems under existing and proposed design flows, respectively.

5.2 Hydrologic Assessment

5.2.1 Culverts

All surface drainage features contributing flows to Wyecroft Road are located within the jurisdiction of CH. As part of the "Fourteen Mile Creek/McCraney Creek, Supplemental Alternative Assessment, Town of Oakville" report dated December 7, 2016, AMEC Foster Wheeler conducted a hydrologic assessment and model re-validation for the watercourses located within and adjacent to the project site. The hydrologic assessment was conducted in PCSWMM for the Fourteen Mile Creek and McCraney Creek systems. The Drainage Area Map prepared by AMEC and used for the PCSWMM hydrologic model is presented as Figure 2 in APPENDIX. The results of AMEC's peak flow calculations at/adjacent to the Wyecroft Road study corridor are presented in Table 3, and the flow nodes are shown on Figure 2 in APPENDIX. Peak flows for Fourteen Mile Creek (C1), Upper McCraney Creek (C3), Taplow Creek (C6), and Glen Oak Creek (C7) were taken from AMEC's hydrologic assessment for use in this EA study.

Table 3: Peak Flows at Watercourse Crossing Locations

| | | | PE | AK FLO | W (m³/s |) | |
|---|----------------|----------------|-----------------|-------------|-------------|--------------|--------------|
| FLOW NODE / LOCATION | 2- YEA R | 5- YEA R | 10- YEA R | 25- YEAR | 50- YEAR | 100- YEAR | REGION AL |
| FM2 – Fourteen Mile Main Branch @ QEW | 20.0 | 38.3 2 | 51.7 1 | 70.61 | 84.53 | 99.1 | 221.6 |
| FM4 – Former McCraney Creek @ QEW | 4.66 | 7.55 | 9.47 | 12.03 | 13.87 | 15.62 | 31.86 |
| MC2 – Taplow Creek @ QEW | 1.97 | 4.58 | 6.43 | 9.23 | 11.22 | 13.12 | 37.57 |
| MC4 – Glen Oak Creek @ QEW | 6.54 | 9.83 | 12.0 5 | 16.06 | 18.54 | 22.71 | 37.93 |

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The hydrological analysis undertaken for C2, C4, and C5 was based on the Rational Method using the Town of Oakville IDF curves for determination of rainfall intensity and the external drainage areas for each crossing identified on Figure 2 in APPENDIX. The hydrologic input parameters, including pervious and impervious drainage area, runoff coefficient, and catchment length were calculated based on the available topographic and drainage area mapping. The time of concentration for the external drainage catchments was determined for flow computations using the Bransby-Williams Equation. Regional storm flows for C2, C4, and C5 were calculated through transposition and interpolation of adjacent Regional discharge values using the MTO's Transposition of Flood Discharge method. Hydrologic input parameters are presented in APPENDIX. The results of the hydrologic assessment for all seven Wyecroft Road culverts are presented in the following Table 4.

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Table 4: Hydrologic Assessment of Wyecroft Road Culverts

| Drainage | Station | Drainage Catchment Watershed Watershed Length US Elev. DS Elev | | | | Slope | | Time of Runoff coefficient | | Rainfall Intensity (mm/hr) | | | | | Flow (m ³ /s) | | | | | | | |
|-------------------|---------|--|--------|--------|--------|-------|-------|----------------------------|------|----------------------------|-------|-------|-------|---|--------------------------|----------------|-------|-----------------|-----------------|------------------------|------------------|-----------------------|
| Outlet | | Α | L | m | m | S | T | T _C | | C la | | le ko | | I ₂₅ I ₅₀ I ₁₀ | | Q ₂ | Q_5 | Q ₁₀ | Q ₂₅ | Q ₅₀ | Q ₁₀₀ | Q _{REGIONAL} |
| | | ha | m | | | % | min | hr | | -2 | -5 | -10 | -25 | -50 | -100 | | 75 | ~10 | 25 | ~30 | ~100 | REGIONAL |
| C1 ⁽¹⁾ | 12+221 | 2380.90 | - | - | ı | - | - | - | - | - | - | - | - | - | - | 20.01 | 38.32 | 51.71 | 70.61 | 84.53 | 99.10 | 221.60 |
| C2 ⁽²⁾ | 12+932 | 25.32 | 490.00 | 113.90 | 108.60 | 1.08 | 19.90 | 0.33 | 0.52 | 54.3 | 75.8 | 89.2 | 106.7 | 119.7 | 131.8 | 2.00 | 2.79 | 3.29 | 3.93 | 4.41 | 4.86 | 5.01 |
| C3 ⁽¹⁾ | 13+380 | 298.00 | - | - | ı | - | - | ı | - | - | - | • | - | - | - | 4.66 | 7.55 | 9.47 | 12.03 | 13.87 | 15.62 | 31.86 |
| C4 ⁽²⁾ | 13+846 | 5.62 | 240.00 | 108.50 | 106.00 | 1.04 | 11.42 | 0.19 | 0.56 | 76.3 | 106.2 | 125.3 | 150.6 | 169.1 | 186.4 | 0.67 | 0.94 | 1.10 | 1.33 | 1.49 | 1.64 | 1.81 |
| C5 ⁽²⁾ | 14+047 | 4.71 | 250.00 | 109.00 | 105.50 | 1.40 | 11.41 | 0.19 | 0.65 | 76.4 | 106.3 | 125.4 | 150.7 | 169.1 | 186.5 | 0.65 | 0.91 | 1.07 | 1.29 | 1.45 | 1.60 | 1.58 |
| C6 ⁽¹⁾ | 14+416 | 321.60 | - | - | ı | - | - | 1 | - | - | - | - | - | - | - | 1.97 | 4.58 | 6.43 | 9.23 | 11.22 | 13.12 | 37.57 |
| C7 ⁽¹⁾ | 14+776 | 298.10 | - | - | - | - | - | - | - | - | - | - | - | - | - | 6.54 | 9.83 | 12.05 | 16.06 | 18.54 | 22.71 | 37.93 |

Notes

$$Q = 0.0028 \times A \times C \times I$$

$$I = \frac{A}{(T_C + B)^C}$$

| (3) Town of Oakville IDF Curve Parameters | | | | | | | | | | | |
|---|------|-----|-------|--|--|--|--|--|--|--|--|
| Return Period | A | В | С | | | | | | | | |
| 2-Year | 725 | 4.8 | 0.808 | | | | | | | | |
| 5-Year | 1170 | 5.8 | 0.843 | | | | | | | | |
| 10-Year | 1400 | 5.8 | 0.848 | | | | | | | | |
| 25-Year | 1680 | 5.6 | 0.851 | | | | | | | | |
| 50-Year | 1960 | 5.8 | 0.861 | | | | | | | | |
| 100-Year | 2150 | 5.7 | 0.861 | | | | | | | | |

| Use Airport Equation to calculate time of concentration (T_C) for C < 0.4, and Bransby-Williams Equation for C > 0.4 | | | | | | | | | | | |
|--|---|--|--|--|--|--|--|--|--|--|--|
| Airport Equation: | Bransby-Williams Equation: | | | | | | | | | | |
| $T_C = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_W^{0.33}}$ | $T_C = \frac{0.057 \times L}{S_W^{0.2} \times A^{0.1}}$ | | | | | | | | | | |
| Where: | Where: | | | | | | | | | | |
| T_C = time of concentration (min) | T_C = time of concentration (min) | | | | | | | | | | |
| C = rational method runoff coefficient | A = catchment area (ha) | | | | | | | | | | |
| L = length of overland flow (m) | L = length of overland flow (m) | | | | | | | | | | |
| S _W = surface slope (%) | S _W = surface slope (%) | | | | | | | | | | |

 A_2 = unknown basin area

⁽¹⁾ All flows at C1, C3, C6, and C7 are obtained from "Fourteen Mile Creek/McCraney Creek, Supplemental Alternative Assessment, Town of Oakville" report dated December 7, 2016, prepared by AMEC Foster Wheeler.

⁽²⁾ Regional storm flows are calculated based on transposition and interpolation of adjacent Regional flow values using MTO Method.

⁽³⁾ All other flow rates calculated using Rational Method and Town of Oakville IDF curve parameters outlined in Town of Oakville Development Engineering Procedures and Guidelines.

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5.2.2 Storm Sewers

The Rational Method and Town of Oakville IDF curves were used to compute existing and proposed peak flows for the storm sewer network along Wyecroft Road. Peak flow calculations for the storm sewer system are provided in the storm sewer design sheets presented in APPENDIX.

5.3 Hydraulic Assessment

5.3.1 Culverts

Existing Condition

In order to assess the hydraulic capacity of the existing culverts, the peak flows established in the hydrologic assessment were used in conjunction with hydraulic modelling software. The HEC-RAS model provided by the Town of Oakville was used to model the existing C1, C3, C6, and C7 watercourse crossings. Since there were discrepancies in culvert size between the HEC-RAS model and the Record/As-Built Drawings, the HEC-RAS model was revised to reflect actual culvert sizes. The revised existing condition HEC-RAS model was run to obtain water surface elevations (WSEs) at the cross sections upstream of the culverts. C2, C4, and C5 were modelled in CulvertMaster using the Town of Oakville IDF curve data, and corresponding headwater elevations were extracted from the outputs. Using the computed headwater elevations and surveyed road data, freeboard was calculated at all existing crossings. HW/D ratios were also calculated for all culverts.

Evaluation of the culverts was based on a 50-year or 100-year design storm event in accordance with MTO HDDS WC-1, depending on if culvert spans exceeded 6.0 m. All existing culverts are concrete with the exception of C2 and C5 which are CSPA. The results of the hydraulic assessment for the existing Wyecroft Road culverts are presented in the following Table 5. As evident from Table 5, C1, C2, C5, and C7 do not meet the minimum 1.0 m freeboard requirement, with C7 overtopping the roadway for the design flow. C5 also exceeds the maximum HW/D ratio of 1.5. All other culverts meet hydraulic criteria in the existing condition. As a result of hydraulic deficiency, C1, C5, and C7 will be replaced and upsized in the proposed condition. Although hydraulically deficient, C2 upgrading will be determined by the MTO. C2, C3, and C4 will be extended in the proposed condition to accommodate the roadway widening. Since C6 currently meets all hydraulic criteria and will not be impacted by roadway widening, it will be maintained in the proposed condition. CulvertMaster and HEC-RAS outputs for the existing Wyecroft Road culverts are presented in APPENDIX and APPENDIX, respectively.

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Table 5: Hydraulic Assessment of Existing Wyecroft Road Culverts

| | | Size (mm) | | | | D/S Invert | Length | Roadway Elevation | | Design Storm | | | | |
|-------------------------|---------------|-----------|------|------------------------|------------|------------|--------|----------------------|-------------------------|--------------|------------------------|-----------|------------|--|
| Crossing / Structure | Drainage Area | | | Туре | U/S Invert | | | | Design Return Period | Flow | Headwater Elevation | Freeboard | HW/D Ratio | |
| | ha | Span | Rise | | m | m | m | m | 1 | m³/s | m | m | | |
| C1 ⁽¹⁾ | 2380.90 | (2x) 6000 | 3000 | Twin Cell Concrete Box | 98.65 | 98.60 | 23.50 | 102.50 | 100 Year | 99.10 | 102.02 | 0.48 | 1.12 | |
| C2 ⁽⁵⁾ | 25.32 | (2x) 1400 | 1000 | Twin Cell CSPA | 108.00 | 105.90 | 80.20 | 109.38 | 50 Year | 4.41 | 109.18 | 0.20 | 1.22 | |
| C3 ⁽²⁾ | 298.00 | 3060 | 1700 | Concrete Box | 108.00 | 105.99 | 97.30 | 111.20 | 50 Year | 13.87 | 110.13 | 1.07 | 1.25 | |
| C4 ⁽⁵⁾ | 5.62 | 2440 | 1830 | Concrete Box | 105.40 | 105.28 | 42.70 | 107.39 | 50 Year | 1.49 | 106.25 | 1.14 | 0.47 | |
| C5 ⁽⁵⁾ | 4.71 | 1030 | 740 | CSPA | 104.75 | 104.03 | 26.00 | 106.17 | 50 Year | 1.45 | 105.96 | 0.21 | 1.65 | |
| C6 (3) | 321.60 | (2x) 3000 | 1800 | Twin Cell Concrete Box | 103.90 | 103.74 | 59.00 | 107.32 | 100 Year | 13.12 | 105.28 | 2.04 | 0.77 | |
| C7 ⁽⁴⁾ | 298.10 | 6100 | 1470 | Open Footing | 104.87 | 104.78 | 16.90 | 106.76 | 100 Year | 22.71 | 106.96 | -0.20 | 1.42 | |

Notes

⁽¹⁾ Design headwater elevation obtained from Town of Oakville Fourteen Mile Creek Main Branch HEC-RAS model.

⁽²⁾ Design headwater elevation obtained from Town of Oakville Upper McCraney Creek HEC-RAS model.

⁽³⁾ Design headwater elevation obtained from Town of Oakville Taplow Creek HEC-RAS model.

⁽⁴⁾ Design headwater elevation obtained from Town of Oakville Glen Oak Creek HEC-RAS model.

⁽⁵⁾ Design headwater elevation obtained from CulvertMaster.

⁽⁶⁾ Roadway elevations used for hydraulic analysis of C2 and C3 based on QEW profile.

⁽⁷⁾ C2 and C3 are MTO culverts.

⁽⁸⁾ Insufficient hydraulic capacity at C1, C2, C5 & C7, with C7 overtopping the road during the 100-year design storm event.

⁽⁹⁾ C1, C5 & C7 will be upsized and replaced in proposed condition to meet hydraulic criteria.

⁽¹⁰⁾ Upsizing of C2 will be determined by the MTO.

⁽¹¹⁾ C2, C3 & C4 will be extended in proposed condition to accommodate roadway widening.

⁽¹²⁾ C6 will be maintained in proposed condition.

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Fourteen Mile Creek, Upper McCraney Creek, Taplow Creek, and Glen Oak Creek Culverts

For C1, C3, C6, and C7, the existing condition flood elevations for all storm events at the cross sections upstream of the culverts were taken from the revised existing condition HEC-RAS model and are summarized in the following Table 6. The location of the HEC-RAS cross sections is illustrated on the Regional Floodplain Map in APPENDIX.

Table 6: Existing Condition WSEs Upstream of Watercourse Crossing Locations

| 27.22.00 | HEC-RAS | WATER SURFACE ELEVATION (m) | | | | | | | | | | |
|----------|----------------------------|-----------------------------|------------|-------------|-------------|-------------|--------------|----------|--|--|--|--|
| CROSSING | STATION U/S OF CROSSING | 2- YEAR | 5- YEAR | 10- YEAR | 25- YEAR | 50- YEAR | 100- YEAR | REGIONAL | | | | |
| C1 | 3597.283 | 100.91 | 101.24 | 101.43 | 101.58 | 101.80 | 102.02 | 103.42 | | | | |
| C3 | 657.1833 | 109.02 | 109.41 | 109.65 | 109.94 | 110.13 | 110.34 | 111.45 | | | | |
| C6 | 488.6925 | 104.23 | 104.49 | 104.64 | 105.00 | 105.15 | 105.28 | 107.18 | | | | |
| C7 | 2888.56 | 106.68 | 106.85 | 106.87 | 106.91 | 106.94 | 106.96 | 107.05 | | | | |

Proposed Condition

As a result of inadequate hydraulic capacity, C1, C5, and C7 will be replaced and upsized in the proposed condition. C2, C3, and C4 will be extended to accommodate the widening of Wyecroft Road, and C6 will be maintained. A comparison of existing and proposed culvert sizes is presented in the following Table 7. Refer to APPENDIX L for the Preliminary General Arrangement Drawing for the proposed C1 structure.

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Table 7: Comparison of Existing and Proposed Culvert Sizes

| | E | XISTING | | PROPOSED | | | |
|-------------|---------------------|------------------------------|----------------------------|---------------------|----------------------|-------------------|--|
| CULV ERT | SIZE (mm) | TYPE | LENG TH (m) | SIZE (mm) | TYPE | LENG TH (m) | |
| C1 | (2x) 6000 x 3000 | Twin Cell Concrete Box | 23.50 | 20000 x 5070 | Clear Span Bridge | 24.78 | |
| C2 | (2x) 1400 x 1000 | Twin Cell CSPA | 80.20 | (2x) 1400 x 1000 | Twin Cell CSPA | 87.70 | |
| СЗ | 3060 x 1700 | Concrete Box | 97.30 | 3060 x 1700 | Concrete Box | 109.7 5 | |
| C4 | 2440 x 1830 | Concrete Box | 42.70 | 2440 x 1830 | Concrete Box | 48.00 | |
| C5 | 1030 x 740 | CSPA | 26.00 | 3660 x 1220 | Concrete Box | 35.70 | |
| C6 | (2x) 3000 x 1800 | Twin Cell Concrete Box | 59.00 Culvert To Be Mainta | | Го Ве Maintai | ned | |
| C7 | 6100 x 1470 | Open Footing | 16.90 | 6100 x 1500 | Open Footing | 29.5 | |

In order to assess the capacity of the culverts in the proposed condition, the peak flows established in the hydrologic assessment were used. The proposed condition culverts were then modelled in either HEC-RAS or CulvertMaster, and headwater elevations were extracted from the outputs. Using the proposed headwater elevations and proposed roadway data, freeboard was calculated at all proposed crossings. HW/D ratios were also calculated at all proposed crossings with the exception of C1 since the structure is a bridge in the proposed condition. Although maintained, C6 was modelled in the proposed condition using proposed roadway elevations to assess the impact of the proposed roadway design on the existing culvert.

Evaluation of the proposed condition culverts was based on a 50-year or 100-year design storm event in accordance with MTO HDDS WC-1, depending on if culvert spans exceed 6.0 m. In the proposed condition, all culverts are concrete with the exception of C2 which is CSPA. The results of the hydraulic assessment for the proposed condition Wyecroft Road culverts are presented in the following Table 8. As evident from Table 8, all crossings meet hydraulic criteria in the proposed condition with the exception of C2 and C7 which do not meet the minimum 1.0 m freeboard requirement. C7 also overtops the roadway for the design flow. Since C2 was hydraulically deficient in the existing condition and upgrading the culvert will be determined by the MTO, C2 continues to be deficient in the proposed condition. However, the proposed HW/D ratio at C2 meets the MTO HDDS WC-7 design standard. For C7, when maintaining the

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proposed rise of 1.5 m, increasing the bridge span beyond 6.1 m did not result in any change to the water surface elevation. At the size of 6.1 m x 1.5 m, C7 will continue to be hydraulically deficient in the proposed condition, as road profile restrictions prevent the rise from being increased beyond 1.5 m and increasing the span has no effect on the proposed hydraulics. However, the proposed HW/D ratio at C7 meets the MTO HDDS WC-7 design standard. It should also be noted that for C5, the proposed culvert must be embedded by 0.42 m in order to provide sufficient cover and freeboard for the structure.

CulvertMaster and HEC-RAS outputs for the proposed condition Wyecroft Road culverts are presented in APPENDIX and APPENDIX, respectively. Refer to Table 9 for a comparison of existing and proposed Regional water surface elevations at the culvert locations. All culverts in the proposed condition will reduce the existing Regional storm water surface elevations with the exception of C3 and C4 which experience no change in Regional WSE.

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Table 8: Hydraulic Assessment of Proposed Wyecroft Road Culverts

| | | | | | Design Storm | | | | | | | | |
|-------------------------|---------------|-----------|------|------------------------|--------------|------------|--------|----------------------|-------------------------|-------|------------------------|-----------|------------|
| Crossing / Structure | Drainage Area | Size (| mm) | Туре | U/S Invert | D/S Invert | Length | Roadway Elevation | Design Return Period | Flow | Headwater Elevation | Freeboard | HW/D Ratio |
| | ha | Span | Rise | | m | m | m | m | | m³/s | m | m | |
| C1 ⁽¹⁾ | 2380.90 | 20000 | 5070 | Clear Span Bridge | 98.65 | 98.60 | 24.78 | 105.03 | 100 Year | 99.10 | 101.91 | 3.12 | - |
| C2 ⁽⁵⁾ | 25.32 | (2x) 1400 | 1000 | Twin Cell CSPA | 108.00 | 105.63 | 87.70 | 109.38 | 50 Year | 4.41 | 109.18 | 0.20 | 1.22 |
| C3 ⁽²⁾ | 298.00 | 3060 | 1700 | Concrete Box | 108.00 | 105.99 | 109.75 | 111.20 | 50 Year | 13.87 | 110.13 | 1.07 | 1.25 |
| C4 ⁽⁵⁾ | 5.62 | 2440 | 1830 | Concrete Box | 105.41 | 105.28 | 48.00 | 107.65 | 50 Year | 1.49 | 106.25 | 1.40 | 0.46 |
| C5 ⁽⁵⁾ | 4.71 | 3660 | 1220 | Concrete Box | 104.75 | 104.03 | 35.70 | 106.18 | 50 Year | 1.45 | 105.15 | 1.03 | 0.5 |
| C6 ⁽³⁾ | 321.60 | (2x) 3000 | 1800 | Twin Cell Concrete Box | 103.90 | 103.74 | 59.00 | 107.21 | 100 Year | 13.12 | 105.28 | 1.93 | 0.77 |
| C7 ⁽⁴⁾ | 298.10 | 6100 | 1500 | Open Footing | 104.92 | 104.73 | 29.50 | 106.74 | 100 Year | 22.71 | 106.85 | -0.11 | 1.29 |

Notes

⁽¹⁾ Design headwater elevation obtained from Town of Oakville Fourteen Mile Creek Main Branch HEC-RAS model.

⁽²⁾ Design headwater elevation obtained from Town of Oakville Upper McCraney Creek HEC-RAS model.

⁽³⁾ Design headwater elevation obtained from Town of Oakville Taplow Creek HEC-RAS model.

⁽⁴⁾ Design headwater elevation obtained from Town of Oakville Glen Oak Creek HEC-RAS model.

⁽⁵⁾ Design headwater elevation obtained from CulvertMaster.

⁽⁶⁾ Roadway elevations used for hydraulic analysis of C2 and C3 based on QEW profile.

⁽⁷⁾ C2 and C3 are MTO culverts.

⁽⁸⁾ Since C2 was hydraulically deficient in existing condition and upsizing of the culvert will be determined by the MTO, C2 continues to be hydraulically deficient in proposed condition. However, proposed HW/D ratio meets MTO HDDS WC-7 design standard.

⁽⁹⁾ C5 must be embedded by 0.42 m to provide sufficient cover and freeboard for culvert.

⁽¹⁰⁾ For C7, when maintaining a rise of 1.5 m, increasing the bridge span beyond 6.1 m does not result in any change to the water surface elevation. At the size of 6.1 m x 1.5 m, C7 will continue to be hydraulically deficient in the proposed condition, overtopping the road during the 100-year design storm event. However, proposed HW/D ratio meets MTO HDDS WC-7 design standard.

⁽¹¹⁾ HW/D ratio not calculated for C1 because the structure is a bridge in the proposed condition.

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Table 9: Comparison of Existing and Proposed Regional WSEs

| CULVE RT ID | EXISTING CONDITION REGIONAL STORM WSE (m) | PROPOSED CONDITION REGIONAL STORM WSE (m) | DIFFERENCE (m) |
|----------------|--|--|-------------------|
| C1 | 103.42 | 103.01 | -0.41 |
| C2 | 109.33 | 109.32 | -0.01 |
| C3 | 111.45 | 111.45 | 0.00 |
| C4 | 106.28 | 106.28 | 0.00 |
| C5 | 106.10 | 105.18 | -0.92 |
| C6 | 107.18 | 107.17 | -0.01 |
| C7 | 107.05 | 106.99 | -0.06 |

Note: Negative value indicates reduction in flood elevation.

The following Table 10 summarizes the deficient culverts in the proposed condition and the constraints and justification for the hydraulic deficiency.

Table 10: Summary of Hydraulically Deficient Culverts in Proposed Condition

| CULVER T ID | TYPE OF DEFICIENCY IN PROPOSED CONDITION | CONSTRAINT/JUSTIFICATION |
|----------------|--|--|
| C2 | Freeboard | This is an MTO culvert. Upgrading will be determined by the MTO. |
| C7 | Freeboard | Road profile cannot be increased. Culvert cannot be upsized to meet hydraulic criteria without significantly impacting the road profile. Increasing the culvert span has no effect on the proposed hydraulics. |

Fourteen Mile Creek, Upper McCraney Creek, Taplow Creek, and Glen Oak Creek Culverts

A preliminary hydraulic analysis of the proposed condition culverts conveying watercourses across the widened Wyecroft Road was undertaken by modifying the revised existing condition HEC-RAS model (original model provided by the Town of Oakville). Proposed culvert dimensions and roadway data were programmed into the model (where applicable), and the proposed condition flood elevations upstream of the culverts were recorded for all storm events. The results of the hydraulic analyses are presented in the following Table 11.

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Table 11: Proposed Condition WSEs Upstream of Watercourse Crossing Locations

| | HEC-RAS | WATER SURFACE ELEVATION (m) | | | | | | |
|------------------------|----------|-----------------------------|----------------|-----------------|-----------------|-----------------|--------------|--------------|
| CROSS U/S OF CROSSIN G | | 2- YEA R | 5- YEA R | 10- YEA R | 25- YEA R | 50- YEA R | 100- YEAR | REGION AL |
| C1 | 3597.283 | 100. 92 | 101. 27 | 101. 47 | 101. 63 | 101. 77 | 101.9 1 | 103.01 |
| C3 | 657.1833 | 109. 02 | 109. 41 | 109. 65 | 109. 94 | 110. 13 | 110.3 4 | 111.45 |
| C6 | 488.6925 | 104. 23 | 104. 49 | 104. 64 | 105. 00 | 105. 15 | 105.2 8 | 107.17 |
| C7 | 2897.894 | 106. 47 | 106. 79 | 106. 78 | 106. 63 | 106. 87 | 106.8 5 | 106.99 |

5.3.2 Storm Sewers

A storm sewer assessment was conducted to determine the hydraulic performance of the existing Wyecroft Road sewers under existing design flows. Storm sewer capacity was calculated using Manning's Equation as detailed in the storm sewer design sheets presented in APPENDIX. The results of the hydraulic assessment for the existing storm sewers along Wyecroft Road indicate that based on a 5-year design return period, seven (7) sewer legs are deficient in capacity and require replacement and upsizing. Refer to Table 12 for a summary of the deficient storm sewer legs. The storm sewers requiring replacement are indicated on Figure 8 in APPENDIX.

Table 12: Summary of Deficient Storm Sewers

| EXISTING | S STORM SEWE | TYPE OF | | |
|------------|------------------------|-----------------|------------|------------|
| FROM MH | то мн | FROM STATION | TO STATION | DEFICIENCY |
| 42259 | 41804 | 11+655 | 11+788 | Hydraulic |
| 41804 | 41401 | 11+788 | 11+900 | Hydraulic |
| 41401 | 44260 | 11+900 | 12+050 | Hydraulic |
| 44260 | 44239 | 12+050 | 12+060 | Hydraulic |
| 44239 | Outlet 3 Third Line | 12+060 | 12+100 | Hydraulic |
| 6663 | 6952 | 15+100 | 15+170 | Hydraulic |
| 7875 | 7375 | 14+930 | 15+050 | Hydraulic |

In addition to existing storm sewer replacements, new storm sewers have been proposed along Wyecroft Road in locations where the rural corridor has been

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converted to an urban roadway. As such, the storm sewer system in the proposed condition is comprised of a combination of existing sewers, replacement sewers, and new sewers. New storm sewers range from Third Line to east of Glen Oak Creek (Station 12+100 to 14+800) and from Dorval Drive to west of Kerr Street (Station 15+600 to 16+225). A storm sewer assessment was conducted to determine the hydraulic performance of the Wyecroft Road storm sewer system in the proposed condition under proposed design flows. Details are provided in the storm sewer design sheets presented in APPENDIX. The results of the hydraulic assessment for the proposed condition Wyecroft Road storm sewers indicate that based on a 5-year design return period, all legs of the storm sewer system have been designed to sufficiently convey minor flows. The proposed condition storm sewer system is illustrated in Figure 9 in APPENDIX.

6 Design Features of Proposed SWM System

6.1 Minor and Major System Drainage

Under proposed conditions at urban sections along Wyecroft Road, runoff resulting from major storm events will continue to be conveyed to existing watercourse crossings as roadway overland flow, while runoff from minor storm events will be conveyed by the proposed condition storm sewer system (comprising a combination of existing sewers, replacement sewers, and new sewers). At rural sections, both minor and major system flows will be conveyed by proposed flat bottom roadside ditches towards receiving watercourses.

6.2 Low Impact Development (LID) Measures

As an LID measure to promote water balance and peak flow reduction through infiltration, 2.05 ha of permeable pavement could be considered in detail design along the Wyecroft Road corridor for MUT and sidewalks. Table 13 provides the total potential permeable pavement areas. Refer to Figure 9 in APPENDIX for details on the potential LID measures that could be implemented along the Wyecroft Road corridor.

Table 13: Permeable Pavement Area Summary

| PERMEABLE PAVEMENT AREA | | | | | | |
|-------------------------|---------|--|--|--|--|--|
| Multi-Use Trail (MUT) | 0.51 ha | | | | | |
| Sidewalk | 1.54 ha | | | | | |
| TOTAL | 2.05 ha | | | | | |

Other examples of LID measures that could be implemented within the study area include:

Rain gardens;

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- Infiltration chambers underneath Multi-use Trail or sidewalks; and
- Stormwater Bioretention System.

6.3 Water Quantity Control

As outlined in Section 3, the results of the pavement area analysis revealed that the proposed improvements to Wyecroft Road will slightly increase peak flows within internal roadway areas C1, C2, C3, C4, and C8. Post to pre-development quantity control is required to reduce peak flows within these five internal roadway areas. Based on the quantity control criteria, storage is required to temporarily retain runoff at these five outlet locations and discharge it at the existing flow rates. For the five roadway areas requiring storage, a total storage volume of 709 m3 is required. Refer to Table 14 for a summary of the quantity control requirements proposed for the Wyecroft Road corridor.

| Table 14: Water Quantity Control Requirements |
|--|
| |

| LOCATI | FLOW (| FLOW (m ³ /s) | | | | |
|--------|-----------------------|----------------------------|------------------------|--|--|--|
| ON | PROPOSED 100- YEAR | CONTROLLED RELEASE RATE | STORAGE VOLUME (m³) | | | |
| C1 | 1.189 | 0.899 | 227.88 | | | |
| C2 | 0.474 | 0.323 | 103.43 | | | |
| C3 | 1.179 | 0.912 | 218.45 | | | |
| C4 | 0.629 | 0.559 | 94.83 | | | |
| C5 | 0.312 | Not Required | - | | | |
| C6 | 0.344 | Not Required | - | | | |
| C7 | 0.222 | Not Required | - | | | |
| C8 | 0.488 | 0.474 | 63.58 | | | |
| C9 | 0.360 | Not Required | - | | | |
| C10 | 0.317 | Not Required | - | | | |
| C11 | 0.667 | Not Required | - | | | |
| C12 | 0.425 | Not Required | - | | | |
| C13 | 0.168 | Not Required | - | | | |
| C14 | 0.458 | Not Required | - | | | |
| | TOTAL | | | | | |

In C1, C2, C3, and C4, the required storage volume will be provided either by underground infiltration chambers beneath the proposed MUT or by superpipes within the storm sewer system before discharging to the receiving watercourses. In C8, the required storage volume will be provided either by an underground infiltration chamber beneath the proposed sidewalk or by superpipes within the storm sewer system before discharging to the receiving watercourse. Refer to APPENDIX for the full pavement area analysis and determination of peak flow rates for the existing and proposed internal roadway drainage areas. Required

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storage volumes for the five outlet locations that experience an increase in peak flow in the proposed condition are indicated on Figure 9 in APPENDIX.

6.4 Water Quality Control

Under proposed conditions, the proposed flat bottom roadside ditches will provide water quality treatment through vegetation runoff velocity reduction and infiltration as outlined by the MECP and stipulated in the Town of Oakville Development Engineering Procedures and Guidelines. OGS units proposed upstream of the culverts will also treat runoff prior to discharge into receiving watercourses. In total, there are twelve (12) OGS units proposed within the project limits. The permeable pavement proposed within the Wyecroft Road corridor will provide water quality control through infiltration. Refer to Table 15 for a summary of the OGS units proposed within the Wyecroft Road corridor.

| OGS# | DOWNSTREAM CULVERT | OUTLET |
|---------|-----------------------|-----------|
| OGS4-1 | C1 | OUTLET 4 |
| OGS4-2 | C1 | OUTLET 4 |
| OGS5A-1 | C2 | OUTLET 5 |
| OGS5-1 | C2 | OUTLET 5 |
| OGS6-1 | C3 | OUTLET 6 |
| OGS6-2 | C3 | OUTLET 6 |
| OGS7-1 | C4 | OUTLET 7 |
| OGS8-1 | C5 | OUTLET 8 |
| OGS8-2 | C5 | OUTLET 8 |
| OGS9-1 | C6 | OUTLET 9 |
| OGS10-1 | C7 | OUTLET 10 |
| OGS10-2 | C7 | OUTLET 10 |

Table 15: Summary of Proposed OGS Units

6.5 Water Balance Control

Based on the water balance control criteria outlined by the MECP, the proposed design for the Wyecroft Road corridor must provide, at a minimum, on-site retention of all run-off from the first 5 mm of each rainfall event through infiltration and/or evapotranspiration. For the proposed corridor, water balance control is achieved through infiltration of the proposed permeable pavement and vegetative areas. Water balance calculations yielded a required infiltration volume of 1104.58 m3 for the proposed site. Based on the permeable pavement and vegetative infiltration areas, the infiltration rate of the underlying soil, and a 24-hour detention time, the proposed Wyecroft Road corridor will be capable of infiltrating 11,446.37 m3 of runoff which exceeds the MECP requirements. Calculations for water balance control are provided in APPENDIX.

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7 Mitigation Measures

Mitigation measures will be required due to culvert replacements at crossing locations within the study area. The following mitigation measures are recommended to offset negative impacts of the project on the terrestrial and aquatic features in the vicinity of the crossings.

- Detailed staging drawings, to minimize temporary effects to the watercourse during construction, will be provided in the detailed design stage;
- Water management plans will be developed to facilitate completion of works "in the dry" through the use of by-pass pumping, dam and flume, partial coffer dams or timing of the works during dry conditions in the ephemeral channels;
- An in-water construction timing restriction must be implemented;
 based on the recommendations provided by CH;
- A detailed restoration plan will be prepared for channel and bank areas associated with the culvert replacements. The restoration plans will include erosion and sediment control, vegetation strategies, and permanent stabilization measures;
- All culvert replacements will maintain or improve the current hydraulics of the crossings and will be designed to maintain the current watercourse gradient with appropriate embedding to promote fish passage;
- Incorporate habitat diversity into the final structure design (i.e., bank diversity and substrate placement associated with any scour protection requirements);
- All materials and equipment used shall be operated and stored in such a manner that prevents any deleterious substance from entering watercourses, wetlands or other sensitive area;
- Work areas should be delineated with construction fencing to minimize the area of disturbance;
- Where cofferdams are to be employed, dewatering effluent should be treated prior to discharge to receiving watercourse. Dewatering must be discharged in a vegetated area 30 metres from the creek;
- Cofferdams should be constructed using pea gravel bags to isolate the work area and maintain flow;
- Fish isolated by construction activities should be captured and safely released to the watercourse. Fish capture and release to be conducted by fisheries professionals;

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- Apply standard sediment and erosion control measures (e.g., silt fence, flow checks, silt curtain, sedimentation basins) consistent with Ontario Provincial Standards and Specifications (OPSS) to ensure no effects to the surface waters. The control measures shall be implemented prior to construction of the work and be maintained during construction and until disturbed areas have been effectively stabilized with permanent vegetation cover;
- All disturbed areas of the work site shall be stabilized and revegetated promptly, and/or treated with appropriate erosion protection materials. In riparian and aquatic habitats, all temporarily disturbed areas will be reinstated to original condition upon completion of works:
- Any stockpiled materials shall be stored and stabilized away from the water; and
- Crossings which are within CH's regulated areas will require CH permits.

8 Erosion and Sediment Control

If uncontrolled, the construction activities associated with the Wyecroft Road improvements could result in increased rates of erosion and sedimentation within and adjacent to the study area and the CH watersheds. Erosion, for the purposes of this discussion, is described as the process whereby soil particles are detached from an exposed surface and transported by water, wind or some other agent. Sedimentation is defined as the deposition of (eroded) particles at a "downstream" point, typically a watercourse. The potential environmental impacts from increased erosion and sedimentation include: degradation of water quality; destruction of fisheries habitat; and, increased flooding potential.

Erosion and sedimentation processes are typically accelerated due to construction activities. Literature indicates that construction activities can increase erosion and sedimentation rates by 2 to 3 orders of magnitude over that expected from a natural forested area. Erosion and sedimentation control are therefore an integral and important component in the design and construction of any project.

8.1 Erosion and Sediment Control Measures

To minimize the potential environmental impacts, the following erosion and sedimentation control practices will serve to guide the design and implementation phase of the Erosion and Sedimentation Control Plan:

- limit size of disturbed area,
- limit duration of soil exposure,

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- retain existing vegetation where feasible,
- limit slope length and gradient of disturbed areas,
- preserve overland sheet flow and micro-drainage (avoid concentrated channel flows),
- break and redirect flows to lower gradients,
- design and implement staged stripping,
- prevent disturbance of previously stripped and stabilized parcels, and
- stabilize stripped parcels with temporary vegetative controls.

Appropriate permanent/temporary erosion control measures to be considered in the design and implementation of the Erosion and Sedimentation Control Plan are:

- Hydroseeding One step application of seed and hydraulic slurry with adhesive binder (provides permanent stabilization for moderate to steep slopes).
- Seed and Straw Mulch Alternative two step application that will be applied to provide permanent/temporary vegetative stabilization of disturbed areas.
- Mulch (straw, wood etc.) Used to provide temporary erosion protection of exposed slopes during over-wintering and for disturbed areas inactive for greater than 45 days.
- Sod Utilized to provide quick permanent stabilization of disturbed areas. Applications include lateral ditches with gradients < 5% and slopes with steep to moderate grades (i.e. 3% to 5%).
- Erosion Control Blanket Applied as temporary/permanent erosion protection for slopes greater than 2:1 or as a ditch liner. For permanent applications, seed will be applied prior to installation.
- Aggregate Stone Appropriate material, such as rip rap will be used to provide immediate permanent erosion protection of lateral ditches > 5% gradient; and along chute/spillways. Geotextile fabric will be applied prior to placement of any aggregate material.

8.2 Sediment Control

The following elements should be included in the sediment control plan:

- provision of a series of temporary interceptor/conveyor ditches to direct runoff to the siltation/watercourses;
- provision of rock or straw bale within drainage swales/ditches; and
- placement of a series of silt control fencing for the interception of sheet flow drainage.

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All sediment control measures should not be removed until final stabilization of the site. In addition, any accumulated sediment shall be removed, as part of a maintenance program, from all control measures when accumulation reaches 50% of the height or volume of the control structure.

<u>Environmental Inspection Process</u> - As a component of erosion and sedimentation control, environmental inspections of the construction site will be conducted. Environmental inspections will be conducted to assess the performance of erosion and sedimentation control measures and identify any required maintenance. The frequent inspections will also permit the identification of localized erosion and sedimentation control issues that require site specific attention.

<u>Implementation and Recommendation</u> - A 200 m standby supply of prefabricated silt fence barrier, in addition to silt fence requirements, shall be maintained at the construction site prior to commencement of grading operations and throughout the duration of the contract.

- Where interceptor ditches and/or subsurface drains are specified, they shall be constructed prior to commencement of any related cut or fill activities.
- Cut and fill earth slopes and ditches, shall be treated with the specified cover material (seed and mulch, seed and erosion control blanket, seed and sod, rip rap, etc.) within 45 days from the commencement of the cut, fill or ditching operation. Commencement of a cut, fill or ditching operation shall be considered to have occurred when the original stabilizing cover has been removed, including grubbing, or has been covered with fill material.
- Run-off from the site and stockpiles shall be controlled to the extent possible to minimize sediment entry to the adjacent watercourses.
- Where dewatering is required, and where culverts are cleaned by hydraulic means, the effluent shall be discharged in a manner that prevents the entry of sediments to watercourses, or scouring and erosion at the outlet.
- All erosion and sediment control measures will be clearly stated in the contract drawings and documents.
- Erosion and sediment control plan for the project must adhere to Erosion and Sediment Control (ESC) Guidelines for Urban Construction, December 2006, Greater Golden Horseshoe Area Conservation Authorities.

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9 Conclusion

This report documents the SWM aspects associated with the improvements to Wyecroft Road and a portion of South Service Road West between Bronte Road and Kerr Street. It describes the existing and proposed drainage conditions within the study limits and outlines the proposed SWM Plan for conveying external and internal runoff across the widened Wyecroft Road in order to mitigate the potential impacts of the proposed roadway improvements on receiving drainage systems. The findings of this SWM study completed in support of the Wyecroft Road EA from Bronte Road to Kerr Street are summarized as follows:

- There are seven (7) transverse culverts within the study limits that
 convey external and roadside ditching flows across Wyecroft
 Road/South Service Road West. Of the seven existing culverts, two
 (2) are twin cell concrete boxes, one (1) is open footing, two (2) are
 concrete boxes, one (1) is a CSPA, and one (1) is a twin cell CSPA.
- Culverts C1, C5, and C7 will be replaced due to inadequate hydraulic capacity. C2, C3, and C4 will be extended to accommodate the widening of Wyecroft Road, and C6 will be maintained. In the proposed condition, all culverts are concrete, with the exception of C2 which is CSPA and under MTO jurisdiction.
- All culverts meet the MTO HDDS hydraulic criteria in the proposed condition, with the exception of C2 and C7 which do not meet the required freeboard. Since C2 was hydraulically deficient in the existing condition and upgrading the culvert will be determined by the MTO, C2 continues to be deficient in the proposed condition. For C7, road profile restrictions prevent the rise from being increased beyond 1.5 m, and increasing the span has no effect on the proposed hydraulics. C7 continues to overtop the roadway for the design flow in the proposed condition.
- In the proposed condition, C5 must be embedded by 0.42 m in order to provide sufficient cover and freeboard for the structure.
- All culverts in the proposed condition will reduce the existing Regional storm water surface elevations with the exception of C3 and C4 which experience no change in Regional WSE.
- Within the urban sections of the Wyecroft Road corridor, runoff is collected and conveyed by storm sewers. The existing Wyecroft Road storm sewer system is located between Station 10+000 and 12+100, with sewers ranging in size from 675 mm to 1800 mm in diameter. There is also a network of storm sewers located from approximately 350 m west of Weller Court to just west of Weller Court which conveys roadway runoff and discharges into the existing channel south of Wyecroft Road, approximately 175 m west of Weller Court.

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The storm sewers near Weller Court range in size from 750 mm to 1050 mm in diameter.

- Based on the results of the storm sewer assessment, seven (7)
 existing sewer legs are deficient in capacity and require replacement
 and upsizing.
- In addition to storm sewer replacements, new storm sewers have been proposed along Wyecroft Road in locations where the rural corridor has been converted to an urban roadway. As such, the storm sewer system in the proposed condition is comprised of a combination of existing sewers, replacement sewers, and new sewers.
- In the proposed condition, all legs of the storm sewer system have been designed to convey minor flows.
- Porous paving/permeable pavement is recommended for consideration for MUT and sidewalks in detail design. These LID measures will promote water balance and peak flow reduction through infiltration.
- Proposed flat bottom roadside ditches and OGS units will provide water quality control to Wyecroft Road runoff in the proposed condition. Permeable pavement will also provide water quality control through infiltration.
- The results of the pavement area analysis indicated that the proposed improvements to Wyecroft Road will slightly increase peak flows within five internal roadway areas. Post to pre-development quantity control is required to reduce peak flows within these five areas. Based on the quantity control criteria, 709 m3 of storage is required to temporarily retain runoff at these five outlet locations and discharge it at the existing flow rates. The required storage volume will be provided either by underground infiltration chambers or by superpipes within the storm sewer system before discharging to the receiving watercourses.
- Water balance control for the proposed Wyecroft Road corridor can be achieved through infiltration of the permeable pavement and vegetative areas within the study limit.
- The existing pavement area is 11.54 ha while the proposed pavement area is 12.21ha. The net increase in pavement area is 0.67ha or 5.8%.

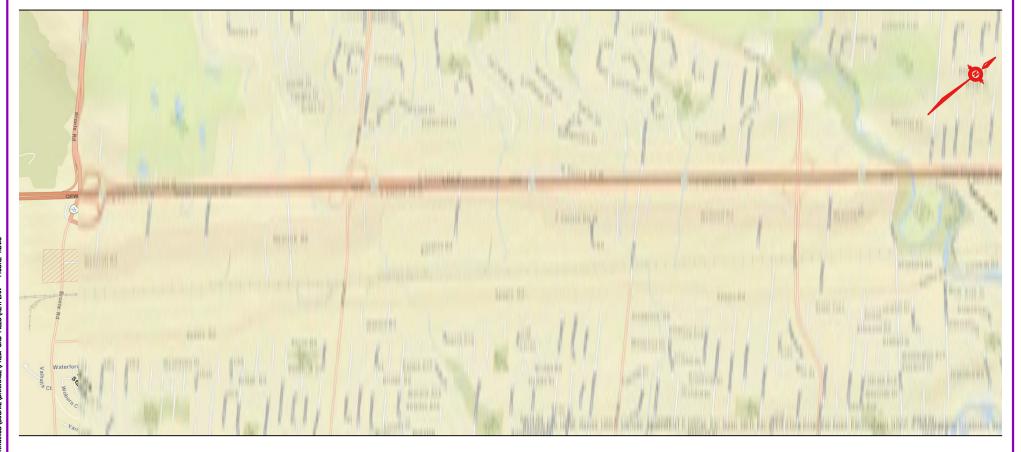
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Respectfully Submitted, IBI Group

Rakesh Pandey, Ph.D., P.Eng. Sr. Water Resources Engineer

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APPENDIX A: KEY PLAN





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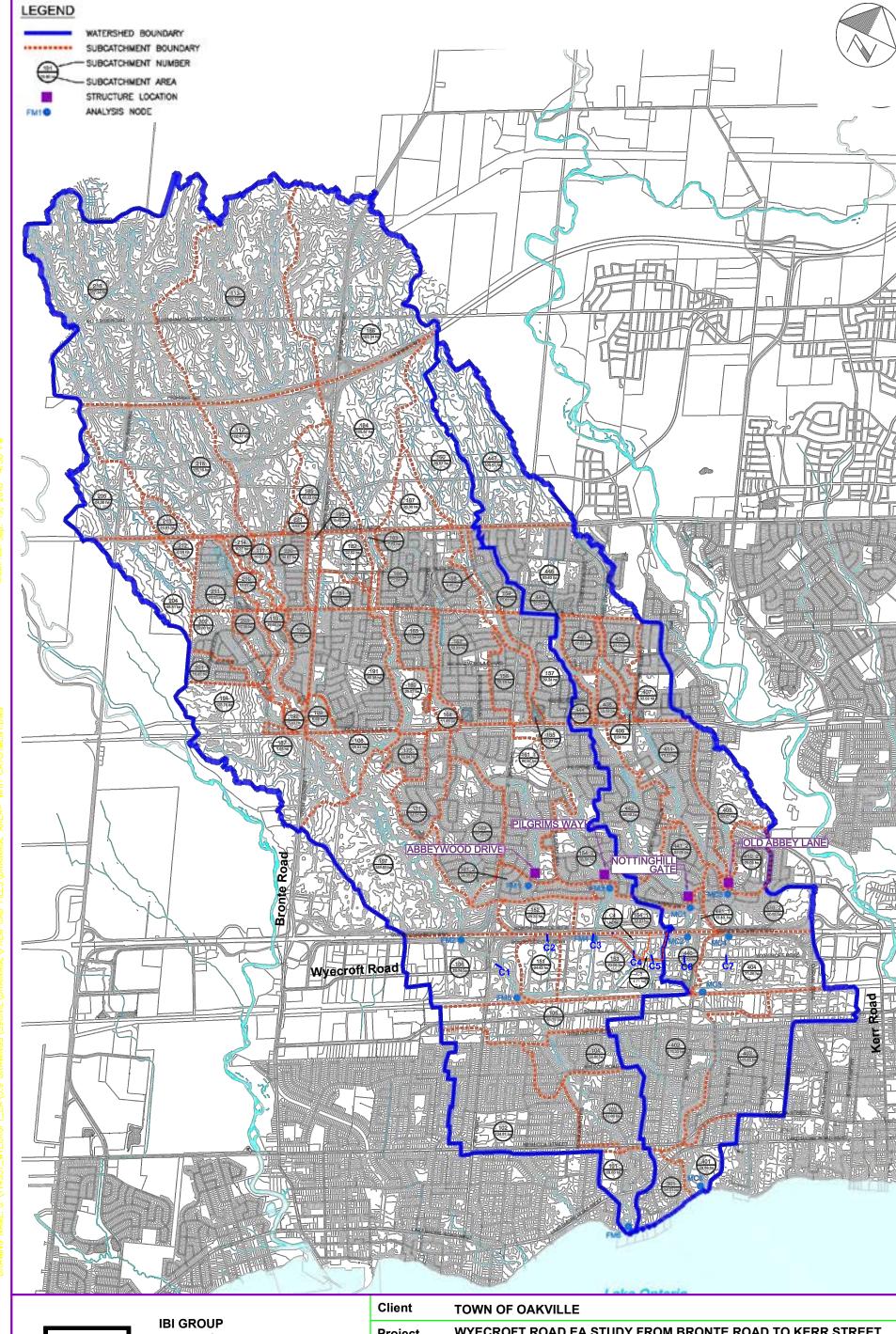
| Client | TOWN OF OAKVILLE | | | | |
|---------------|--|-------------|----------|--|--|
| Project | NYECROFT ROAD EA STUDY FROM BRONTE ROAD TO KERR STREET | | | | |
| Drawing Title | | Project No. | 114331 | | |
| | KEYPLAN | Drawing No. | FIGURE-1 | | |

LEGEND

STUDY AREA

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APPENDIX B: EXISTING CATCHMENT AREA MAP



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WYECROFT ROAD EA STUDY FROM BRONTE ROAD TO KERR STREET **Project**

Drawing Title

EXISTING CATCHMENT AREA MAP

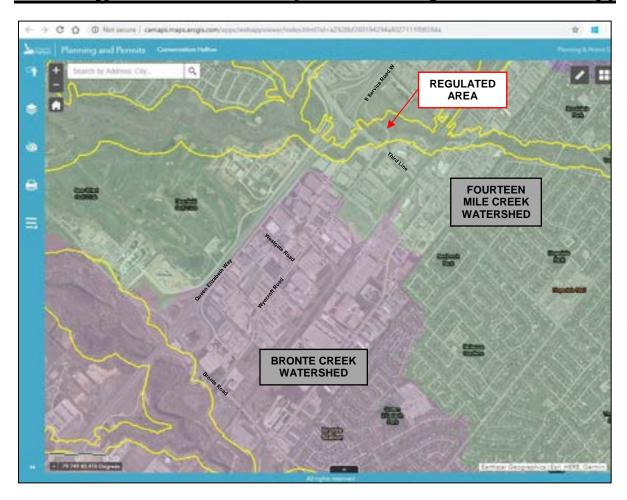
Project No. 114331

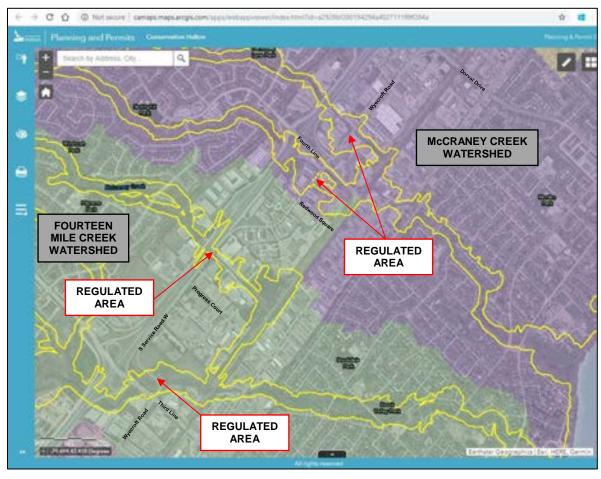
FIGURE No. 2

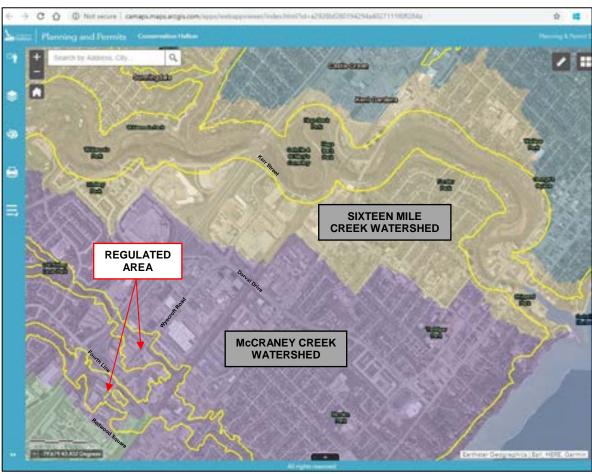
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APPENDIX C: CH FLOODPLAIN MAPPING

CH Regulation Limits (within Project Boundary)

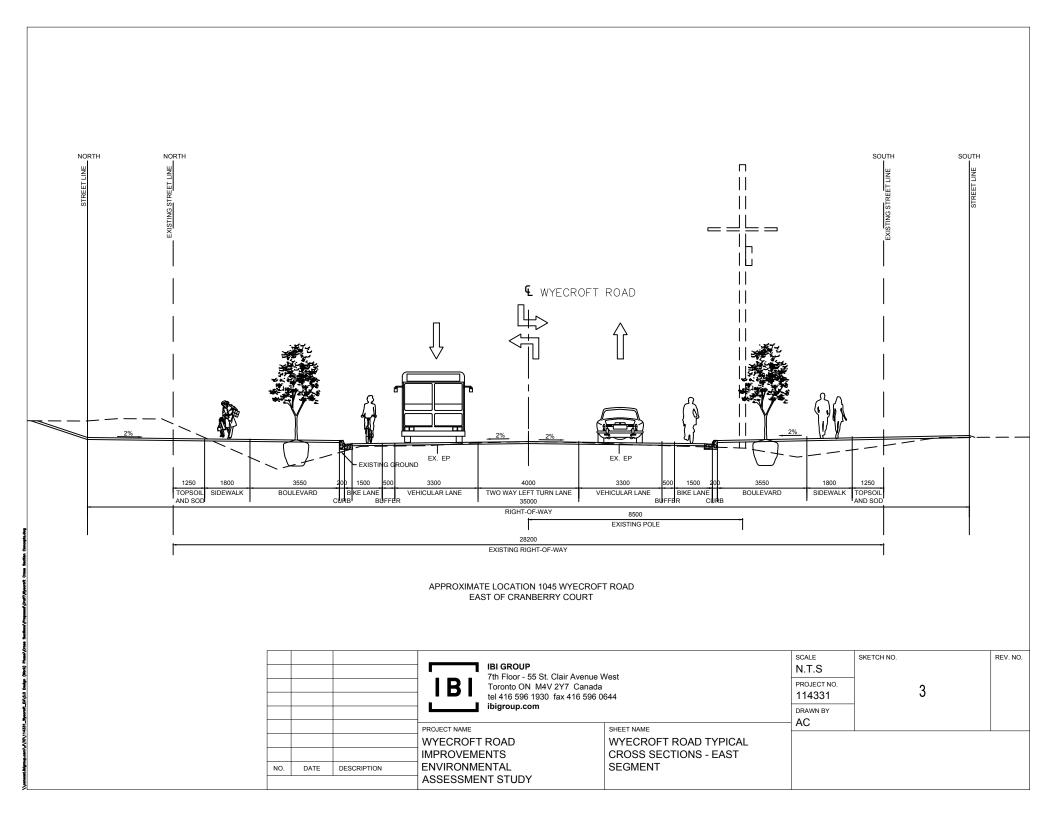


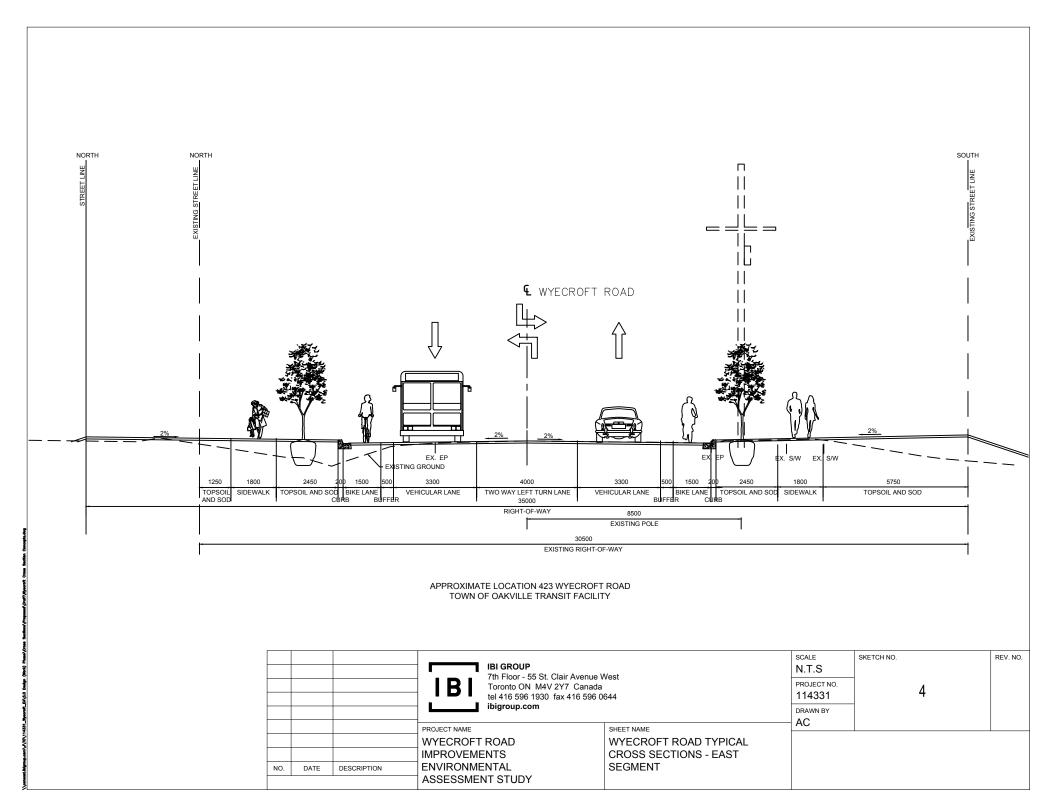


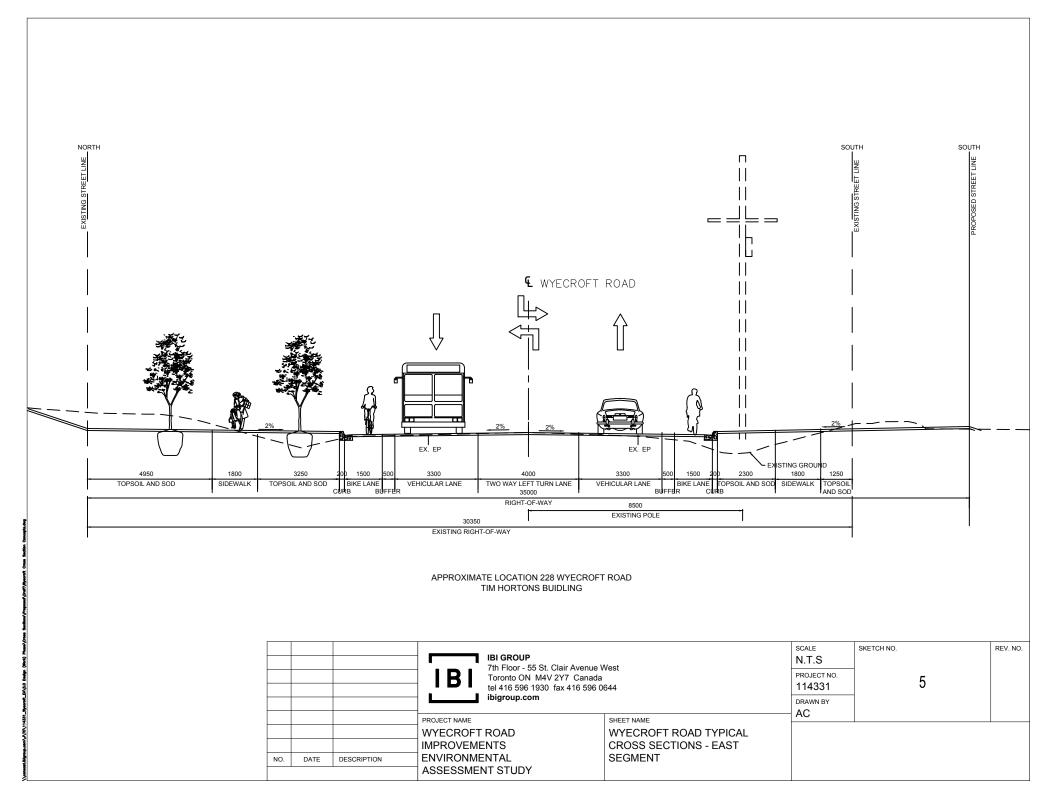


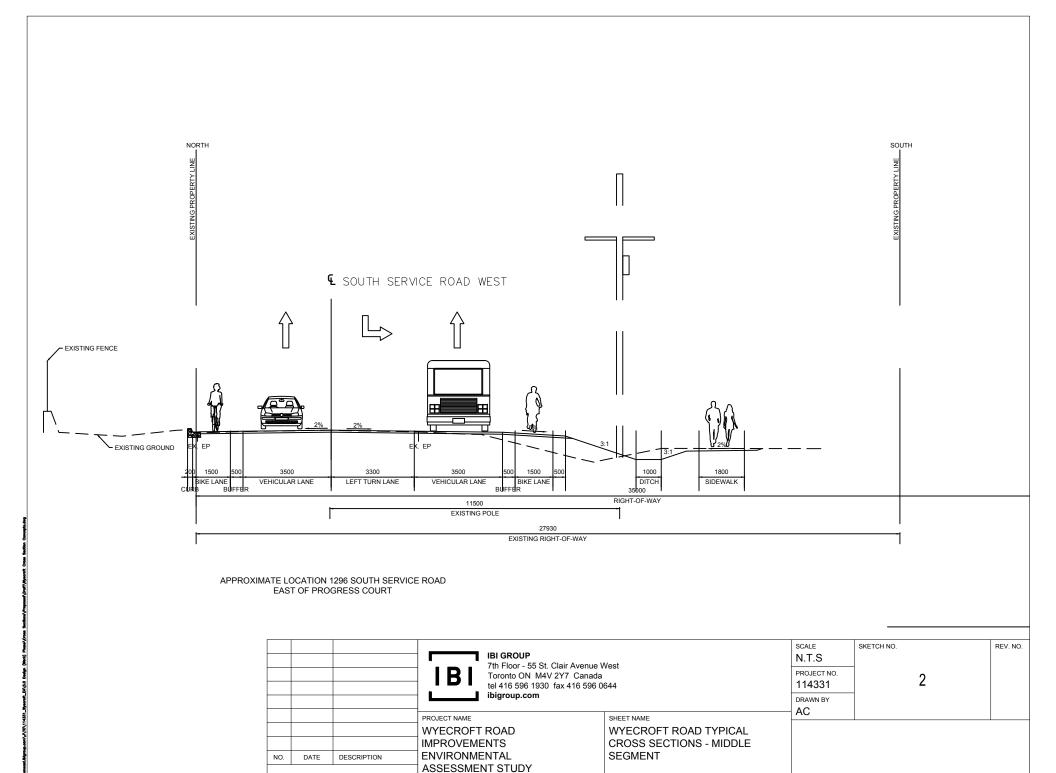
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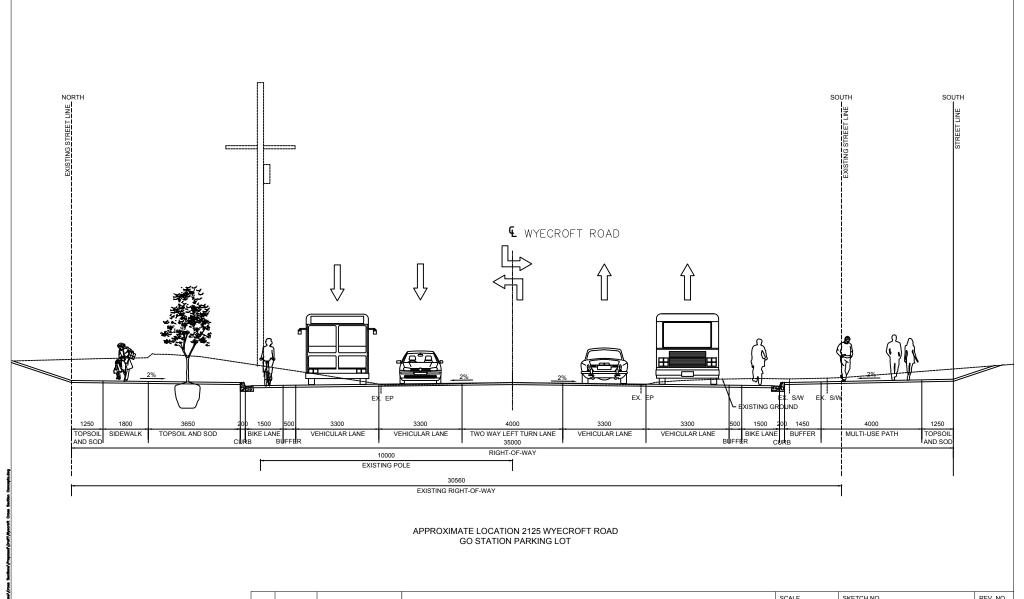
APPENDIX D: TYPICAL PROPOSED ROAD CROSS SECTIONS







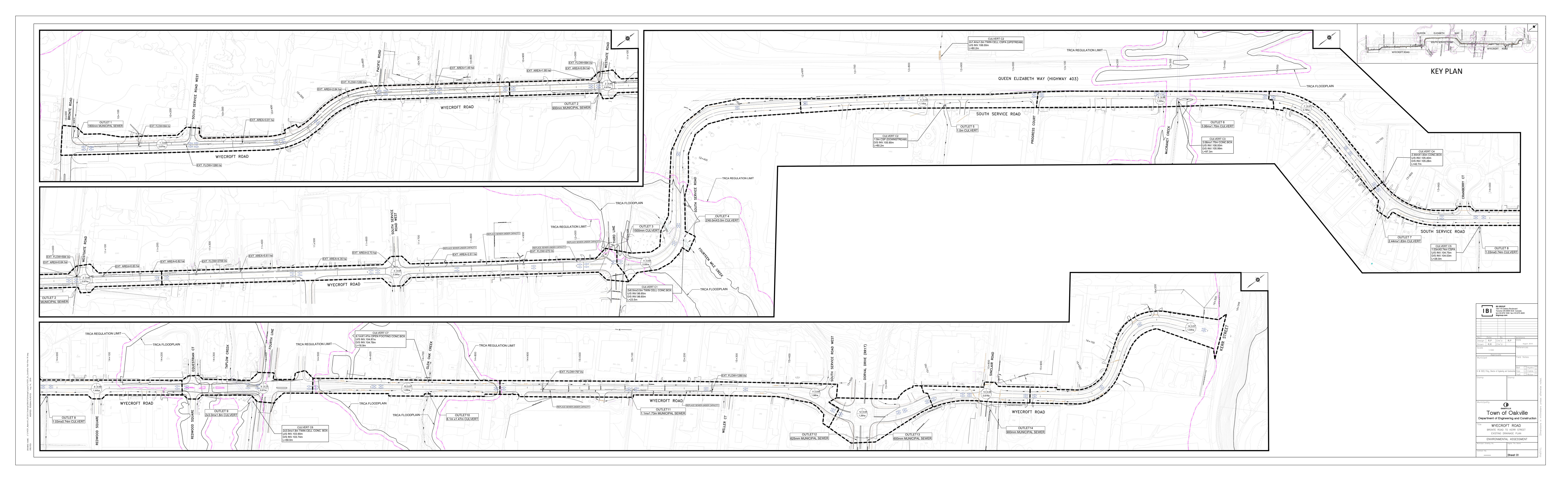




| | | | IBI GROUP 7th Floor - 55 St. Clair Avenue N Toronto ON M4V 2Y7 Canada tel 416 596 1930 fax 416 596 0 ibigroup.com | | SCALE N.T.S PROJECT NO. 114331 DRAWN BY AC | SKETCH NO. | REV. NO. |
|-----|------|-------------|---|---|--|------------|----------|
| NO. | DATE | DESCRIPTION | PROJECT NAME WYECROFT ROAD IMPROVEMENTS ENVIRONMENTAL ASSESSMENT STUDY | WYECROFT ROAD TYPICAL CROSS SECTIONS - WEST SEGMENT | AC | | |

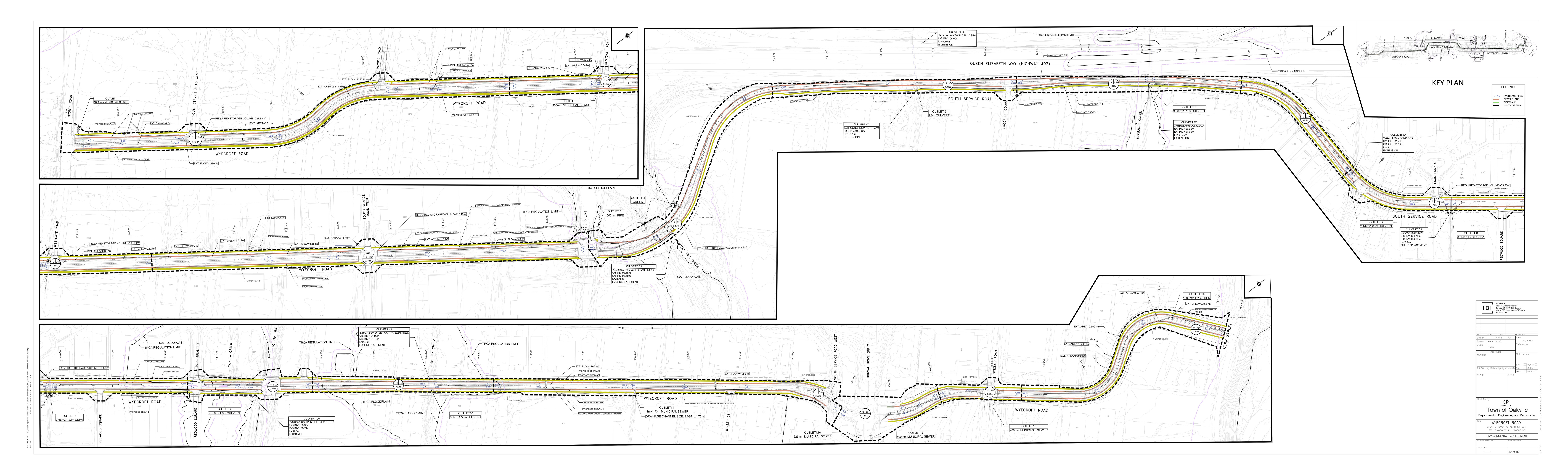
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APPENDIX E: EXISTING CONDITION ROLL PLAN



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APPENDIX F: PROPOSED CONDITION ROLL PLAN



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APPENDIX G: HYDROLOGIC INPUT PARAMETERS

Project Name: Wyecroft Road
Municipality: Town of Oakville

Project No.: 114331 **Date:** 23-Jul-18

Time of Concentration Estimate

Location Culvert C2

INPUT DATA

Catchment Length (m): 490

Catchment Slope (m/m): 0.0108

Watershed Area (ha): 25.32

Rational Method Runoff 0.52

RESULTS

Kirpich Formula

$$t_c = 0.0078 \times L^{0.77} \times S^{-0.38S}$$

Tc= **13.12** min

where:

L = length of channel/ditch from headwater to outlet, ft

S = average watershed slope, ft/ft

Federal Aviation Administration - Airport Method

$$t_c = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_w^{0.33}}$$

Tc= **40.81** min

where:

C = rational method runoff coefficient

L = length of overland flow, m

S = surface slope, %

C<0.40

Bransby Williams Formula

$$t_c = \frac{0.057 \times L}{S_w^{0.2} \times A^{0.1}}$$

Tc= **19.91** min

where:

 $L=\mbox{gross}$ length of main channel head of basin, m

S = net slope of main channel, %

A = watershed area, ha

C > 0.40

Tc (Average)= 25 min

Project Name: Wyecroft Road
Municipality: Town of Oakville

Project No.: 114331 **Date:** 23-Jul-18

Time of Concentration Estimate

Location Culvert C4

INPUT DATA

Catchment Length (m): 240

Catchment Slope (m/m): 0.0104

Watershed Area (ha): 5.62

Rational Method Runoff 0.56

RESULTS

Kirpich Formula

$$t_c = 0.0078 \times L^{0.77} \times S^{-0.38S}$$

Tc= **7.68** min

where:

L = length of channel/ditch from headwater to outlet, ft

S = average watershed slope, ft/ft

Federal Aviation Administration - Airport Method

$$t_c = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_w^{0.33}}$$

Tc= 26.92 min

where:

C = rational method runoff coefficient

L = length of overland flow, m

S = surface slope, %

C<0.40

Bransby Williams Formula

$$t_c = \frac{0.057 \times L}{S_w^{0.2} \times A^{0.1}}$$

Tc= **11.42** min

where:

 $L=\mbox{gross}$ length of main channel head of basin, m

S = net slope of main channel, %

A = watershed area, ha

C > 0.40

Tc (Average)= 15 min

Project Name: Wyecroft Road

Municipality: Town of Oakville

Project No.: 114331 **Date:** 23-Jul-18

Time of Concentration Estimate

Location Culvert C5

INPUT DATA

Catchment Length (m): 250

Catchment Slope (m/m 0.012

Watershed Area (ha): 4.71

Rational Method Runol 0.65

RESULTS

Kirpich Formula

$$t_c = 0.0078 \times L^{0.77} \times S^{-0.38S}$$

Tc=

7.50 min

where:

L = length of channel/ditch from headwater to outlet, ft

S = average watershed slope, ft/ft

Federal Aviation Administration - Airport Method

$$t_c = \frac{3.26 \times (1.1 - C) \times L^{0.5}}{S_w^{0.33}}$$

Tc= **21.84** min

where:

C = rational method runoff coefficient

L = length of overland flow, m

S = surface slope, %

C < 0.40

Bransby Williams Formula

$$t_{c} = \frac{0.057 \times L}{S_{w}^{0.2} \times A^{0.1}}$$

Tc=

11.77 min

where:

 $L = gross\ length\ of\ main\ channel\ head\ of\ basin,\ m$

S = net slope of main channel, %

A = watershed area, ha

C > 0.40

Tc (Average)=

14 min

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

APPENDIX H: CULVERTMASTER OUTPUTS

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

EXISTING CONDTION

Existing Culvert C2 (50-Year Flow)

| Culvert Summary | | | | | |
|---|---------------|-----|-----------------------|------------------|------|
| Computed Headwater Eleva | 109.18 | m | Discharge | 4.4100 | m³/s |
| Inlet Control HW Elev. | 109.15 | m | Tailwater Elevation | 106.40 | m |
| Outlet Control HW Elev. | 109.18 | m | Control Type | Entrance Control | |
| Headwater Depth/Height | 1.22 | | | | |
| Grades | | | | | |
| Upstream Invert | 108.00 | m | Downstream Invert | 105.90 | m |
| Length | 80.20 | m | Constructed Slope | 0.026185 | m/m |
| Hydraulic Profile | | | | | |
| Profile | S2 | | Depth, Downstream | 0.56 | m |
| Slope Type | Steep | | Normal Depth | 0.56 | m |
| Flow Regime S | Supercritical | | Critical Depth | 0.65 | m |
| Velocity Downstream | 3.04 | m/s | Critical Slope | 0.018187 | m/m |
| Section | | | | | |
| | A l- | | Manada a Carfficiant | 0.005 | |
| Section Shape Section Ma&minal and Alumin | Arch | | Mannings Coefficient | 0.025 1.45 | m |
| | 0 x 970 mm | | Span Rise | 0.97 | |
| Number Sections | 2 | | Nise | 0.51 | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 109.18 | m | Upstream Velocity Hea | ad 0.35 | m |
| Ke | 0.50 | | Entrance Loss | 0.18 | m |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 109.15 | | Flow Control | Transition | |
| | 0° headwall | 111 | Area Full | 1 ransition | m² |
| Inlet Type 96 | 0.00830 | | HDS 5 Chart | 34 | 111 |
| M | 2.00000 | | HDS 5 Chart | 1 | |
| | | | | - | |
| C | 0.03790 | | Equation Form | 1 | |

Existing Culvert C2 (Regional Flow)

| Culvert Summany | | | | | |
|---|----------------|-----|------------------------|----------------|-----|
| Culvert Summary | 400.05 | | Disabassa | 4 4000 | 3/- |
| Computed Headwater Eleva | 106.25 | | Discharge | 1.4900 | |
| Inlet Control HW Elev. | 106.20 | | Tailwater Elevation | 106.20 | m |
| Outlet Control HW Elev. Headwater Depth/Height | 106.25 0.47 | m | Control Type | Outlet Control | |
| Tleadwater Depth/Tleight | 0.47 | | | | |
| Grades | | | | | |
| Upstream Invert | 105.40 | m | Downstream Invert | 105.28 | m |
| Length | 42.70 | m | Constructed Slope | 0.002810 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M1 | | Depth, Downstream | 0.92 | m |
| Slope Type | Mild | | Normal Depth | 0.35 | |
| Flow Regime | Subcritical | | Critical Depth | 0.34 | m |
| Velocity Downstream | 0.66 | m/s | Critical Slope | 0.003298 | m/m |
| | | | | | |
| Section | | | | | |
| Section Shape | Box | | Mannings Coefficient | 0.013 | |
| Section Material | Concrete | | Span | 2.44 | m |
| | x 1830 mm | | Rise | 1.83 | m |
| Number Sections | 1 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 106.25 | m | Upstream Velocity Head | 0.03 | m |
| Ke | 0.70 | | Entrance Loss | 0.02 | m |
| | | | | | |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 106.20 | m | Flow Control | N/A | |
| Inlet Type 0° win | gwall flares | | Area Full | 4.5 | m² |
| K | 0.06100 | | HDS 5 Chart | 8 | |
| M | 0.75000 | | HDS 5 Scale | 3 | |
| С | 0.04230 | | Equation Form | 1 | |
| Υ | 0.82000 | | | | |

| Culvert Summary | | | | | |
|------------------------------|-------------|-----|------------------------|---------------|------|
| Computed Headwater Eleva | 105.96 | m | Discharge | 1.4500 | m³/s |
| Inlet Control HW Elev. | 105.96 | m | Tailwater Elevation | 104.40 | m |
| Outlet Control HW Elev. | 105.87 | m | Control Type | Inlet Control | |
| Headwater Depth/Height | 1.65 | | | | |
| Grades | | | | | |
| Upstream Invert | 104.75 | m | Downstream Invert | 104.03 | m |
| Length | 26.00 | m | Constructed Slope | 0.027692 | m/m |
| Hydraulic Profile | | | | | |
| Profile | S2 | | Depth, Downstream | 0.56 | |
| Slope Type | Steep | | Normal Depth | 0.56 | |
| | percritical | | Critical Depth | 0.58 | |
| Velocity Downstream | 2.72 | m/s | Critical Slope | 0.026212 | |
| Section | | | | | |
| Section Shape | Arch | | Mannings Coefficient | 0.025 | |
| Section Mathemal and Aluminu | m Var CR | | Span | 1.07 | m |
| Section Size 1030 | x 740 mm | | Rise | 0.74 | |
| Number Sections | 1 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 105.87 | m | Upstream Velocity Head | 0.36 | m |
| Ke | 0.50 | | Entrance Loss | 0.18 | m |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 105.96 | m | Flow Control | N/A | |
| | headwall | | Area Full | 0.6 | m² |
| K | 0.00830 | | HDS 5 Chart | 34 | |
| M | 2.00000 | | HDS 5 Scale | 1 | |
| C | 0.03790 | | Equation Form | 1 | |
| Υ | 0.69000 | | - | | |

Existing Culvert C4 (Regional Flow)

| Culvert Summary | | | | | |
|---|---------------|-----|------------------------|---------------|----------|
| Computed Headwater Eleva | 109.33 | m | Discharge | 5.0100 | m³/s |
| Inlet Control HW Elev. | 109.33 | m | Tailwater Elevation | 106.40 | m |
| Outlet Control HW Elev. | 109.30 | m | Control Type | Inlet Control | |
| Headwater Depth/Height | 1.37 | | | | |
| Grades | | | | | |
| Upstream Invert | 108.00 | m | Downstream Invert | 105.90 | m |
| Length | 80.20 | m | Constructed Slope | 0.026185 | m/m |
| Hydraulic Profile | | | | | |
| Profile | S2 | | Depth, Downstream | 0.62 | m |
| Slope Type | Steep | | Normal Depth | 0.62 | m |
| Flow Regime S | Supercritical | | Critical Depth | 0.70 | m |
| Velocity Downstream | 3.12 | m/s | Critical Slope | 0.020200 | m/m |
| Section | | | | | |
| | Anab | | Mannings Coefficient | 0.025 | |
| Section Shape Section Mathinal and Alumin | Arch | | Mannings Coefficient | 0.025 1.45 | m |
| | 0 x 970 mm | | Span Rise | 0.97 | |
| Number Sections | 2 | | Trise | 0.01 | "" |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 109.30 | m | Upstream Velocity Head | 0.40 | m |
| Ke | 0.50 | | Entrance Loss | 0.20 | m |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 109.33 | m | Flow Control | Cubmaras | |
| | 0° headwall | 111 | Area Full | Submerged 2.2 | m² |
| Inlet Type 9 K | 0.00830 | | HDS 5 Chart | 34 | 111 |
| M | 2.00000 | | HDS 5 Chart | 1 | |
| C | 0.03790 | | Equation Form | 1 | |
| ~ | 0.00.00 | | _95560111 01111 | | |

Existing Culvert C5 (50-Year Flow)

| Culvert Summary | | | | | |
|---------------------------|--------------|-----|------------------------|----------------|------|
| Computed Headwater Eleva | 106.28 | m | Discharge | 1.8100 | m³/s |
| Inlet Control HW Elev. | 106.20 | | Tailwater Elevation | 106.20 | m |
| Outlet Control HW Elev. | 106.28 | m | Control Type | Outlet Control | |
| Headwater Depth/Height | 0.48 | | | | |
| Grades | | | | | |
| Upstream Invert | 105.40 | m | Downstream Invert | 105.28 | m |
| Length | 42.70 | m | Constructed Slope | 0.002810 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M1 | | Depth, Downstream | 0.92 | m |
| Slope Type | Mild | | Normal Depth | 0.40 | |
| Flow Regime | Subcritical | | Critical Depth | 0.38 | |
| Velocity Downstream | 0.81 | m/s | Critical Slope | 0.003285 | m/m |
| Section | | | | | |
| Section Shape | Box | | Mannings Coefficient | 0.013 | |
| Section Material | Concrete | | Span | 2.44 | m |
| Section Size 2440 | x 1830 mm | | Rise | 1.83 | m |
| Number Sections | 1 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 106.28 | m | Upstream Velocity Head | 0.04 | m |
| Ke | 0.70 | | Entrance Loss | 0.03 | m |
| | | | | | |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 106.20 | m | Flow Control | Unsubmerged | |
| • • | gwall flares | | Area Full | 4.5 | m² |
| K | 0.06100 | | HDS 5 Chart | 8 | |
| M | 0.75000 | | HDS 5 Scale | 3 | |
| C | 0.04230 | | Equation Form | 1 | |
| Υ | 0.82000 | | | | |

Existing Culvert C5 (Regional Flow)

| Culvert Summary | | | | | |
|---|-------------|-----|------------------------|---------------|------|
| Computed Headwater Eleva | 106.10 | m | Discharge | 1.5800 | m³/s |
| Inlet Control HW Elev. | 106.10 | | Tailwater Elevation | 104.40 | |
| Outlet Control HW Elev. | 105.94 | m | Control Type | Inlet Control | |
| Headwater Depth/Height | 1.83 | | , | | |
| Grades | | | | | |
| | 404.75 | | Daving day and law and | 404.00 | |
| Upstream Invert | 104.75 | | Downstream Invert | 104.03 | |
| Length | 26.00 | m | Constructed Slope | 0.027692 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M2 | | Depth, Downstream | 0.61 | m |
| Slope Type | Mild | | Normal Depth | 0.63 | m |
| Flow Regime | Subcritical | | Critical Depth | 0.61 | m |
| Velocity Downstream | 2.80 | m/s | Critical Slope | 0.029222 | m/m |
| Section | | | | | |
| Section Shape | Arch | | Mannings Coefficient | 0.025 | |
| Section Snape Section Machinel and Alumir | | | Span | 1.07 | m |
| | 0 x 740 mm | | Rise | 0.74 | |
| Number Sections | 1 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 105.94 | | Upstream Velocity Head | 0.37 | m |
| Ke | 0.50 | | Entrance Loss | 0.19 | m |
| | | | | | |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 106.10 | m | Flow Control | Submerged | |
| 71 | 0° headwall | | Area Full | 0.6 | m² |
| K | 0.00830 | | HDS 5 Chart | 34 | |
| M | 2.00000 | | HDS 5 Scale | 1 | |
| C | 0.03790 | | Equation Form | 1 | |
| Υ | 0.69000 | | | | |

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

PROPOSED CONDITION

Proposed Culvert C2 (50-Year Flow)

| Culvert Summary | | | | | |
|---------------------------|---------------|-----|-----------------------|------------------|------|
| Computed Headwater Ele | eva 109.18 | m | Discharge | 4.4100 | m³/s |
| Inlet Control HW Elev. | 109.15 | m | Tailwater Elevation | 106.13 | m |
| Outlet Control HW Elev. | 109.18 | m | Control Type | Entrance Control | |
| Headwater Depth/Height | 1.22 | | | | |
| Grades | | | | | |
| Upstream Invert | 108.00 | m | Downstream Invert | 105.63 | m |
| Length | 87.70 | m | Constructed Slope | 0.027024 | m/m |
| Hydraulic Profile | | | | | |
| Profile | S2 | | Depth, Downstream | 0.56 | m |
| Slope Type | Steep | | Normal Depth | 0.56 | m |
| Flow Regime | Supercritical | | Critical Depth | 0.65 | m |
| Velocity Downstream | 3.07 | m/s | Critical Slope | 0.018187 | m/m |
| Section | | | | | |
| Section Shape | Arch | | Mannings Coefficient | 0.025 | |
| Section Matchiel and Alur | ninum Var CR | | Span | 1.45 | m |
| Section Size 13 | 390 x 970 mm | | Rise | 0.97 | m |
| Number Sections | 2 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 109.18 | m | Upstream Velocity Hea | ad 0.35 | m |
| Ke | 0.50 | | Entrance Loss | 0.18 | m |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 109.15 | m | Flow Control | Transition | |
| Inlet Type | 90° headwall | | Area Full | 2.2 | m² |
| K | 0.00830 | | HDS 5 Chart | 34 | |
| M | 2.00000 | | HDS 5 Scale | 1 | |
| С | 0.03790 | | Equation Form | 1 | |
| | | | | | |

Proposed Culvert C2 (Regional Flow)

| Culvert Summary | | | | | |
|---|----------------------|-----|---------------------------|---------------|------|
| Computed Headwater Eleva | 109.32 | m | Discharge | 5.0100 | m³/s |
| Inlet Control HW Elev. | 109.32 | m | Tailwater Elevation | 106.13 | m |
| Outlet Control HW Elev. | 109.30 | m | Control Type | Inlet Control | |
| Headwater Depth/Height | 1.37 | | | | |
| Grades | | | | | |
| Upstream Invert | 108.00 | m | Downstream Invert | 105.63 | m |
| Length | 87.70 | m | Constructed Slope | 0.027024 | m/m |
| Hydraulic Profile | | | | | |
| Profile | S2 | | Depth, Downstream | 0.62 | m |
| Slope Type | Steep | | Normal Depth | 0.62 | m |
| Flow Regime S | Supercritical | | Critical Depth | 0.70 | m |
| Velocity Downstream | 3.16 | m/s | Critical Slope | 0.020200 | m/m |
| Section | | | | | |
| | Arch | | Manninga Coefficient | 0.025 | |
| Section Shape Section Ma&minal and Alumin | | | Mannings Coefficient Span | 1.45 | m |
| | 0 x 970 mm | | Rise | 0.97 | |
| Number Sections | 2 | | 1100 | 0.01 | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 109.30 | m | Upstream Velocity Head | 0.40 | m |
| Ke | 0.50 | | Entrance Loss | 0.20 | m |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 109.32 | m | Flow Control | Submerged | |
| | 09.32 0° headwall | 111 | Area Full | 2.2 | m² |
| K | 0.00830 | | HDS 5 Chart | 34 | |
| M | 2.00000 | | HDS 5 Chart | 1 | |
| C | 0.03790 | | Equation Form | 1 | |
| Y | 0.69000 | | 4 | • | |

Proposed Culvert C4 (50-Year Flow)

| Culvert Summary | | | | | |
|---------------------------|--------------|-----|------------------------|----------------|------|
| Computed Headwater Eleva | 106.25 | m | Discharge | 1.4900 | m³/s |
| Inlet Control HW Elev. | 106.20 | m | Tailwater Elevation | 106.20 | m |
| Outlet Control HW Elev. | 106.25 | m | Control Type | Outlet Control | |
| Headwater Depth/Height | 0.46 | | | | |
| Grades | | | | | |
| Upstream Invert | 105.41 | m | Downstream Invert | 105.28 | m |
| Length | 48.00 | m | Constructed Slope | 0.002708 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M1 | | Depth, Downstream | 0.92 | m |
| Slope Type | Mild | | Normal Depth | 0.36 | |
| Flow Regime | Subcritical | | Critical Depth | 0.34 | |
| Velocity Downstream | 0.66 | m/s | Critical Slope | 0.003298 | m/m |
| Section | | | | | |
| Section Shape | Box | | Mannings Coefficient | 0.013 | |
| Section Material | Concrete | | Span | 2.44 | m |
| Section Size 2440 | x 1830 mm | | Rise | 1.83 | m |
| Number Sections | 1 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 106.25 | m | Upstream Velocity Head | 0.03 | m |
| Ke | 0.70 | | Entrance Loss | 0.02 | m |
| July Control Drop edice | | | | | |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 106.20 | m | Flow Control | Unsubmerged | _ |
| • • | gwall flares | | Area Full | 4.5 | m² |
| K | 0.06100 | | HDS 5 Chart | 8 | |
| M | 0.75000 | | HDS 5 Scale | 3 | |
| C | 0.04230 | | Equation Form | 1 | |
| Υ | 0.82000 | | | | |

Proposed Culvert C4 (Regional Flow)

| Culvert Summary | | | | | |
|------------------------------------|-----------------------|-----|---------------------------|----------------|------|
| Computed Headwater Eleva | 106.28 | m | Discharge | 1.8100 | m³/s |
| Inlet Control HW Elev. | 106.20 | m | Tailwater Elevation | 106.20 | m |
| Outlet Control HW Elev. | 106.28 | m | Control Type | Outlet Control | |
| Headwater Depth/Height | 0.48 | | | | |
| Grades | | | | | |
| Upstream Invert | 105.41 | m | Downstream Invert | 105.28 | m |
| Length | 48.00 | m | Constructed Slope | 0.002708 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M1 | | Depth, Downstream | 0.92 | m |
| Slope Type | Mild | | Normal Depth | 0.41 | m |
| Flow Regime | Subcritical | | Critical Depth | 0.38 | m |
| Velocity Downstream | 0.81 | m/s | Critical Slope | 0.003285 | m/m |
| O- dia | | | | | |
| Section | | | | 0.010 | |
| Section Shape | Box | | Mannings Coefficient | 0.013 | |
| Section Material Section Size 2440 | Concrete x 1830 mm | | Span Rise | 2.44 1.83 | |
| Number Sections | 1 | | Nise | 1.00 | "" |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 106.28 | m | Upstream Velocity Head | 0.04 | m |
| Ke | 0.70 | | Entrance Loss | 0.03 | m |
| Inlet Control Proportion | | | | | |
| Inlet Control Properties | 100.55 | | | | |
| Inlet Control HW Elev. | 106.20 | m | Flow Control | Unsubmerged | 2 |
| ,, | gwall flares | | Area Full | 4.5 | m- |
| K M | 0.06100 | | HDS 5 Chart | 8 | |
| C | 0.75000 0.04230 | | HDS 5 Scale Equation Form | 3 | |
| | U.U423U | | Lyualion Form | I I | |

Proposed Culvert C5 (50-Year Flow)

| Culvert Summary | | | | | |
|-----------------------------------|------------------------|-----|---------------------------|----------------|------|
| Computed Headwater Eleva | 105.15 | m | Discharge | 1.4500 | m³/s |
| Inlet Control HW Elev. | 105.15 | m | Tailwater Elevation | 104.43 | m |
| Outlet Control HW Elev. | 105.15 | m | Control Type | Outlet Control | |
| Headwater Depth/Height | 0.50 | | | | |
| Grades | | | | | |
| Upstream Invert | 104.75 | m | Downstream Invert | 104.03 | m |
| Length | 35.00 | m | Constructed Slope | 0.020571 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M1 | | Depth, Downstream | 0.40 | m |
| Slope Type | Mild | | Normal Depth | 0.40 | |
| Flow Regime | Subcritical | | Critical Depth | 0.25 | |
| Velocity Downstream | 0.99 | m/s | Critical Slope | 0.022589 | |
| Section | | | | | |
| | Box | | Manninga Coefficient | 0.035 | |
| Section Shape Section Material | Concrete | | Mannings Coefficient Span | 3.66 | m |
| | 00101616 0 x 800 mm | | Rise | 0.80 | |
| Number Sections | 1 | | ruse | 0.00 | ••• |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 105.15 | | Upstream Velocity Head | 0.12 | m |
| Ke | 0.20 | 111 | Entrance Loss | 0.12 | |
| 110 | 0.20 | | Entrance 2000 | 0.02 | |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 105.15 | m | Flow Control | Unsubmerged | |
| Inlet Type 90° headwall w | 45° bevels | | Area Full | 2.9 | m² |
| K | 0.49500 | | HDS 5 Chart | 10 | |
| M | 0.66700 | | HDS 5 Scale | 2 | |
| C | 0.03140 | | Equation Form | 2 | |
| Υ | 0.82000 | | | | |

Proposed Culvert C5 (Regional Flow)

| Culvert Summary | | | | | |
|---------------------------|--------------|-----|------------------------|----------------|------|
| Computed Headwater Eleva | 105.18 | m | Discharge | 1.5800 | m³/s |
| Inlet Control HW Elev. | 105.17 | m | Tailwater Elevation | 104.43 | m |
| Outlet Control HW Elev. | 105.18 | m | Control Type | Outlet Control | |
| Headwater Depth/Height | 0.53 | | | | |
| Grades | | | | | |
| Upstream Invert | 104.75 | m | Downstream Invert | 104.03 | m |
| Length | 35.00 | m | Constructed Slope | 0.020571 | m/m |
| Hydraulic Profile | | | | | |
| Profile | M1 | | Depth, Downstream | 0.40 | m |
| Slope Type | Mild | | Normal Depth | 0.27 | m |
| Flow Regime | Subcritical | | Critical Depth | 0.27 | m |
| Velocity Downstream | 1.08 | m/s | Critical Slope | 0.022373 | m/m |
| Section | | | | | |
| Section Shape | Box | | Mannings Coefficient | 0.035 | |
| Section Material | Concrete | | Span | 3.66 | m |
| Section Size 366 | 00 x 800 mm | | Rise | 0.80 | m |
| Number Sections | 1 | | | | |
| Outlet Control Properties | | | | | |
| Outlet Control HW Elev. | 105.18 | m | Upstream Velocity Head | 0.13 | m |
| Ke | 0.20 | | Entrance Loss | 0.03 | m |
| Inlet Control Properties | | | | | |
| Inlet Control HW Elev. | 105.17 | m | Flow Control | Unsubmerged | |
| Inlet Type 90° headwall v | v 45° bevels | | Area Full | 2.9 | m² |
| K | 0.49500 | | HDS 5 Chart | 10 | |
| M | 0.66700 | | HDS 5 Scale | 2 | |
| C | 0.03140 | | Equation Form | 2 | |
| Υ | 0.82000 | | | | |

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

APPENDIX I: HEC-RAS OUTPUTS

August 22, 2019 I-1

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

EXISTING CONDITION

| | Existing Condition (Crossing C1) | | | | | | | | | | | |
|------------|----------------------------------|----------|---------------------|-----------|-----------|-----------|-------------|------------|------------|-----------|-----------|--------------|
| | | | HEC-RAS | Plan: 14 | mAFWNov17 | 7OnStr Ri | ver: 14Mile | Reach: Ma | ain Branch | | | |
| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
| | | | (m ³ /s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m²) | (m) | |
| MainBranch | 3610.812 | 2Y | 20 | 100 | 100.87 | | 101.01 | 0.006637 | 1.62 | 12.31 | 20.97 | 0.68 |
| MainBranch | 3610.812 | 5Y | 38.31 | 100 | 101.22 | | 101.4 | 0.005594 | 1.87 | 20.86 | 31.3 | 0.66 |
| MainBranch | 3610.812 | 10Y | 51.68 | 100 | 101.43 | | 101.63 | 0.004743 | 1.99 | 28.35 | 42.21 | 0.63 |
| MainBranch | 3610.812 | 25Y | 70.54 | 100 | 101.6 | 101.35 | 101.86 | 0.005055 | 2.29 | 36.87 | 60.8 | 0.67 |
| MainBranch | 3610.812 | 50Y | 84.47 | 100 | 101.98 | | 102.15 | 0.002482 | 1.92 | 74 | 125.06 | 0.49 |
| MainBranch | 3610.812 | 100Y | 98.93 | 100 | 102.34 | | 102.45 | 0.001357 | 1.63 | 123.75 | 146.44 | 0.37 |
| MainBranch | 3610.812 | Regional | 221.5 | 100 | 103.49 | | 103.58 | 0.0008 | 1.71 | 309.02 | 170.04 | 0.31 |
| MainBranch | 3597.283 | 2Y | 22.52 | 98.65 | 100.91 | 99.35 | 100.94 | 0.000322 | 0.8 | 28.09 | 22.62 | 0.17 |
| MainBranch | 3597.283 | 5Y | 42.68 | 98.65 | 101.24 | 99.72 | 101.33 | 0.000728 | 1.32 | 32.28 | 74.35 | 0.26 |
| MainBranch | 3597.283 | 10Y | 57.48 | 98.65 | 101.43 | 99.95 | 101.57 | 0.001046 | 1.66 | 34.63 | 86.04 | 0.32 |
| MainBranch | 3597.283 | 25Y | 78.22 | 98.65 | 101.58 | 100.24 | 101.81 | 0.001626 | 2.14 | 36.49 | 92.06 | 0.4 |
| MainBranch | 3597.283 | 50Y | 93.1 | 98.65 | 101.8 | 100.45 | 102.09 | 0.001811 | 2.37 | 39.22 | 97.25 | 0.43 |
| MainBranch | 3597.283 | 100Y | 107.3 | 98.65 | 102.02 | 100.62 | 102.36 | 0.001908 | 2.55 | 42.05 | 102.62 | 0.44 |
| MainBranch | 3597.283 | Regional | 256.1 | 98.65 | 103.42 | 102.16 | 103.56 | 0.00091 | 2.05 | 312.47 | 167.81 | 0.32 |
| MainBranch | 3573.439 | | Culvert | | | | | | | | | |
| | | | | | | | | | | | | |
| MainBranch | 3552.954 | 2Y | 22.52 | 98.6 | 100.9 | 99.3 | 100.93 | 0.000296 | 0.78 | 28.8 | 46.96 | 0.17 |
| MainBranch | 3552.954 | 5Y | 42.68 | 98.6 | 101.21 | 99.66 | 101.29 | 0.000694 | 1.3 | 32.71 | 79.53 | 0.26 |
| MainBranch | 3552.954 | 10Y | 57.48 | 98.6 | 101.37 | 99.9 | 101.51 | 0.001025 | 1.65 | 34.79 | 83.81 | 0.32 |
| MainBranch | 3552.954 | 25Y | 78.22 | 98.6 | 101.46 | 100.2 | 101.7 | 0.001693 | 2.17 | 36.01 | 86.28 | 0.41 |
| MainBranch | 3552.954 | 50Y | 93.1 | 98.6 | 101.63 | 100.4 | 101.93 | 0.001986 | 2.44 | 38.11 | 94.35 | 0.45 |
| MainBranch | 3552.954 | 100Y | 107.3 | 98.6 | 101.77 | 100.57 | 102.14 | 0.002251 | 2.68 | 39.96 | 102.84 | 0.48 |
| MainBranch | 3552.954 | Regional | 256.1 | 98.6 | 103.2 | 102.05 | 103.31 | 0.000761 | 1.77 | 329.33 | 171.55 | 0.29 |
| MainBranch | 3539.547 | 2Y | 22.52 | 100 | 100.63 | 100.63 | 100.86 | 0.01393 | 2.23 | 14.32 | 37.74 | 0.97 |
| MainBranch | 3539.547 | 5Y | 42.68 | 100 | 100.88 | 100.88 | 101.2 | 0.01333 | 2.71 | 24.7 | 45.49 | 0.98 |
| MainBranch | 3539.547 | 10Y | 57.48 | 100 | 100.88 | 100.88 | 101.2 | 0.012403 | 2.88 | 36.15 | 69.07 | 0.93 |
| MainBranch | 3539.547 | 25Y | 78.22 | 100 | 101.43 | 100.5 | 101.41 | 0.005198 | 2.5 | 62.63 | 75.79 | 0.69 |
| MainBranch | 3539.547 | 50Y | 93.1 | 100 | 101.43 | | 101.85 | 0.004097 | 2.44 | 78.67 | 79.4 | 0.63 |
| MainBranch | 3539.547 | 100Y | 107.3 | 100 | 101.82 | | 102.02 | 0.003459 | 2.41 | 93.58 | 83.23 | 0.59 |
| MainBranch | 3539.547 | Regional | 256.1 | 100 | 103.06 | | 103.26 | 0.002106 | 2.7 | 240.62 | 153.37 | 0.5 |

Existing Culvert C3 (River Station: 630.7433)

HEC-RAS Plan: 14mile-REV (08152019) OnlineStruc River: 14Mile Reach: McCraney

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|-----------|-----------|------------|---------|-----------|-----------|-----------|-----------|------------|----------|-----------|-----------|--------------|
| | | | (m3/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m2) | (m) | |
| McCraney | 674.5005 | 2yr | 4.66 | 108.00 | 109.10 | 108.37 | 109.10 | 0.000120 | 0.30 | 21.99 | 31.77 | 0.10 |
| McCraney | 674.5005 | 5yr | 7.55 | 108.00 | 109.51 | 108.46 | 109.52 | 0.000084 | 0.32 | 35.90 | 35.90 | 0.09 |
| McCraney | 674.5005 | 10yr | 9.47 | 108.00 | 109.76 | 108.51 | 109.76 | 0.000073 | 0.33 | 45.23 | 42.58 | 0.08 |
| McCraney | 674.5005 | 25yr | 12.03 | 108.00 | 110.07 | 108.57 | 110.07 | 0.000064 | 0.35 | 64.43 | 86.14 | 0.08 |
| McCraney | 674.5005 | 50yr | 13.87 | 108.00 | 110.27 | 108.61 | 110.27 | 0.000057 | 0.36 | 87.72 | 136.70 | 0.08 |
| McCraney | 674.5005 | 100yr | 15.62 | 108.00 | 110.49 | 108.65 | 110.49 | 0.000041 | 0.32 | 137.51 | 208.48 | 0.07 |
| McCraney | 674.5005 | Regional | 31.86 | 108.00 | 111.45 | 108.93 | 111.45 | 0.000018 | 0.27 | 441.11 | 346.28 | 0.05 |
| | | | | | | | | | | | | |
| McCraney | 657.1833 | 2yr | 4.66 | 108.00 | 109.02 | 108.57 | 109.08 | 0.001890 | 1.09 | 4.28 | 21.45 | 0.36 |
| McCraney | 657.1833 | 5yr | 7.55 | 108.00 | 109.41 | 108.75 | 109.49 | 0.001497 | 1.23 | 6.14 | 28.69 | 0.34 |
| McCraney | 657.1833 | 10yr | 9.47 | 108.00 | 109.65 | 108.85 | 109.74 | 0.001351 | 1.31 | 7.25 | 42.44 | 0.34 |
| McCraney | 657.1833 | 25yr | 12.03 | 108.00 | 109.94 | 108.99 | 110.04 | 0.001222 | 1.39 | 8.63 | 57.97 | 0.33 |
| McCraney | 657.1833 | 50yr | 13.87 | 108.00 | 110.13 | 109.07 | 110.24 | 0.001164 | 1.46 | 9.53 | 181.92 | 0.33 |
| McCraney | 657.1833 | 100yr | 15.62 | 108.00 | 110.34 | 109.15 | 110.46 | 0.001063 | 1.48 | 10.52 | 188.82 | 0.32 |
| McCraney | 657.1833 | Regional | 31.86 | 108.00 | 111.45 | 109.78 | 111.45 | 0.000012 | 0.20 | 499.23 | 346.27 | 0.04 |
| McCraney | 630.7433 | | Culvert | | | | | | | | | |
| McCraney | 530 | 2yr | 9.25 | 105.99 | 107.06 | 106.88 | 107.32 | 0.009446 | 2.26 | 4.08 | 9.11 | 0.75 |
| McCraney | 530 | 5yr | 14.72 | 105.99 | 107.00 | 107.19 | 107.52 | 0.009440 | 3.13 | 4.71 | 11.74 | 1.00 |
| McCraney | 530 | 10yr | 18.93 | 105.99 | 107.19 | 107.19 | 107.69 | 0.015330 | 3.13 | 5.59 | 17.48 | 1.00 |
| McCraney | 530 | 25yr | 24.80 | 105.99 | 107.56 | 107.38 | 107.96 | 0.015330 | 3.70 | 6.71 | 21.08 | 1.00 |
| McCraney | 530 | 50yr | 28.56 | 105.99 | 107.01 | 107.01 | 108.51 | 0.014339 | 3.70 | 7.37 | 23.91 | 1.00 |
| McCraney | 530 | 100yr | 31.85 | 105.99 | 107.75 | 107.75 | 108.69 | 0.013657 | 4.03 | 7.91 | 26.38 | 1.00 |
| McCraney | 530 | Regional | 39.18 | 105.99 | 107.80 | 107.86 | 100.09 | 0.013037 | 4.30 | 9.11 | 191.64 | 1.00 |
| Wiccianey | 330 | rtegioriai | 39.10 | 105.55 | 100.11 | 100.11 | 103.03 | 0.012033 | 4.30 | 9.11 | 131.04 | 1.00 |
| McCraney | 515.9195 | 2yr | 9.25 | 105.73 | 107.05 | 106.81 | 107.16 | 0.004136 | 1.43 | 7.44 | 14.95 | 0.54 |
| McCraney | 515.9195 | 5yr | 14.72 | 105.73 | 107.28 | 107.00 | 107.35 | 0.002575 | 1.31 | 33.08 | 157.11 | 0.44 |
| McCraney | 515.9195 | 10yr | 18.93 | 105.73 | 107.39 | 107.09 | 107.44 | 0.001883 | 1.19 | 50.99 | 157.36 | 0.38 |
| McCraney | 515.9195 | 25yr | 24.80 | 105.73 | 107.45 | 107.33 | 107.50 | 0.002207 | 1.33 | 60.43 | 157.49 | 0.42 |
| McCraney | 515.9195 | 50yr | 28.56 | 105.73 | 107.55 | 107.36 | 107.59 | 0.001681 | 1.22 | 75.78 | 157.69 | 0.37 |
| McCraney | 515.9195 | 100yr | 31.85 | 105.73 | 107.60 | 107.38 | 107.63 | 0.001668 | 1.24 | 82.66 | 157.78 | 0.37 |
| McCraney | 515.9195 | Regional | 39.18 | 105.73 | 107.70 | 107.43 | 107.73 | 0.001534 | 1.24 | 99.32 | 161.95 | 0.36 |

| | | | | | Existing | Condition (C | Crossing C6) | | | | | |
|--------|-----------|----------|---------------------|-----------|------------|--------------|--------------|------------|----------|-----------|-----------|--------------|
| | | | HEC- | RAS Plan: | : 14mAFWNo | v17OnStr | River: 14M | ile Reach: | Taplow | | | |
| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
| | | | (m ³ /s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m²) | (m) | |
| Taplow | 500 | 2yr | 1.99 | 103.82 | 104.3 | 104.3 | 104.42 | 0.0212 | 1.5 | 1.33 | 5.92 | 1.01 |
| Taplow | 500 | 5yr | 4.58 | 103.82 | 104.48 | 104.48 | 104.64 | 0.019171 | 1.77 | 2.59 | 8.38 | 1.02 |
| Taplow | 500 | 10yr | 6.42 | 103.82 | 104.65 | | 104.77 | 0.01015 | 1.53 | 4.2 | 10.52 | 0.77 |
| Taplow | 500 | 25yr | 9.22 | 103.82 | 105.04 | | 105.1 | 0.002235 | 1.05 | 8.8 | 12.38 | 0.4 |
| Taplow | 500 | 50yr | 11.23 | 103.82 | 105.22 | | 105.27 | 0.001694 | 1.02 | 11 | 13.01 | 0.35 |
| Taplow | 500 | 100yr | 13.13 | 103.82 | 105.36 | | 105.41 | 0.001437 | 1.02 | 12.92 | 13.54 | 0.33 |
| Taplow | 500 | Regional | 37.58 | 103.82 | 107.35 | | 107.38 | 0.000249 | 0.78 | 59.91 | 80.22 | 0.16 |
| | | | | | | | | | | | | |
| Taplow | 488.6925 | 2yr | 1.63 | 103.75 | 104.23 | 103.99 | 104.25 | 0.001497 | 0.59 | 2.75 | 6.42 | 0.29 |
| Taplow | 488.6925 | 5yr | 3.57 | 103.75 | 104.49 | 104.12 | 104.52 | 0.001669 | 0.81 | 4.38 | 6.48 | 0.32 |
| Taplow | 488.6925 | 10yr | 5.01 | 103.75 | 104.64 | 104.2 | 104.69 | 0.001738 | 0.93 | 5.39 | 6.52 | 0.33 |
| Taplow | 488.6925 | 25yr | 9.26 | 103.75 | 105 | 104.4 | 105.07 | 0.002014 | 1.2 | 7.73 | 6.6 | 0.35 |
| Taplow | 488.6925 | 50yr | 11.42 | 103.75 | 105.15 | 104.49 | 105.24 | 0.002123 | 1.31 | 8.75 | 6.64 | 0.36 |
| Taplow | 488.6925 | 100yr | 13.38 | 103.75 | 105.28 | 104.57 | 105.38 | 0.002213 | 1.39 | 9.62 | 6.67 | 0.37 |
| Taplow | 488.6925 | Regional | 39.72 | 103.75 | 107.18 | 105.37 | 107.34 | 0.001343 | 1.76 | 22.51 | 30.14 | 0.31 |
| | | | | | | | | | | | | |
| Taplow | 460.3691 | | Culvert | | | | | | | | | |
| | | | | | | | | | | | | |
| Taplow | 419.7275 | 2yr | 1.63 | 103.58 | 104.13 | 103.83 | 104.15 | 0.000857 | 0.49 | 3.36 | 7.41 | 0.23 |
| Taplow | 419.7275 | 5yr | 3.57 | 103.58 | 104.39 | 103.96 | 104.42 | 0.000984 | 0.68 | 5.22 | 7.9 | 0.26 |
| Taplow | 419.7275 | 10yr | 5.01 | 103.58 | 104.53 | 104.04 | 104.57 | 0.001085 | 0.8 | 6.26 | 8.17 | 0.28 |
| Taplow | 419.7275 | 25yr | 9.26 | 103.58 | 104.83 | 104.22 | 104.89 | 0.001441 | 1.1 | 8.44 | 8.73 | 0.33 |
| Taplow | 419.7275 | 50yr | 11.42 | 103.58 | 104.95 | 104.3 | 105.02 | 0.001618 | 1.23 | 9.29 | 8.95 | 0.35 |
| Taplow | 419.7275 | 100yr | 13.38 | 103.58 | 105.04 | 104.37 | 105.14 | 0.001751 | 1.33 | 10.03 | 9.14 | 0.37 |
| Taplow | 419.7275 | Regional | 39.72 | 103.58 | 105.89 | 105.13 | 106.19 | 0.003316 | 2.42 | 16.38 | 12.54 | 0.53 |
| | | | | | | | | | | | | |
| Taplow | 404.225 | 2yr | 1.63 | 103.5 | 104.04 | | 104.1 | 0.006102 | 1.1 | 1.48 | 3.87 | 0.57 |
| Taplow | 404.225 | 5yr | 3.57 | 103.5 | 104.24 | | 104.35 | 0.009066 | 1.51 | 2.36 | 5.23 | 0.72 |
| Taplow | 404.225 | 10yr | 5.01 | 103.5 | 104.37 | | 104.5 | 0.008919 | 1.61 | 3.1 | 6.2 | 0.73 |
| Taplow | 404.225 | 25yr | 9.26 | 103.5 | 104.51 | 104.48 | 104.78 | 0.013945 | 2.31 | 4.06 | 7.99 | 0.94 |
| Taplow | 404.225 | 50yr | 11.42 | 103.5 | 104.63 | 104.58 | 104.91 | 0.011262 | 2.35 | 5.21 | 10.28 | 0.87 |
| Taplow | 404.225 | 100yr | 13.38 | 103.5 | 104.82 | | 105.05 | 0.006906 | 2.14 | 7.23 | 11.09 | 0.71 |
| Taplow | 404.225 | Regional | 39.72 | 103.5 | 105.49 | 105.4 | 106.04 | 0.008547 | 3.43 | 15.68 | 13.99 | 0.87 |

| | Existing Condition (Crossing C7) | | | | | | | | | | | |
|----------|----------------------------------|----------|---------|-----------|-----------|-----------|-------------|------------|-----------|-----------|-----------|--------------|
| | | | HEC-F | RAS Plan: | 14mAFW-No | v17OnSt | River: 14Mi | le Reach: | Glen Oaks | | | |
| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
| | | | (m³/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m²) | (m) | |
| GlenOaks | 2908.99 | 2Years | 5.87 | 105.17 | 106.72 | 105.92 | 106.73 | 0.000406 | 0.54 | 10.95 | 11.53 | 0.18 |
| GlenOaks | 2908.99 | 5Years | 8.84 | 105.17 | 106.88 | 106.05 | 106.9 | 0.000582 | 0.69 | 12.86 | 12.18 | 0.21 |
| GlenOaks | 2908.99 | 10Years | 10.77 | 105.17 | 106.91 | 106.12 | 106.95 | 0.000795 | 0.81 | 13.25 | 12.31 | 0.25 |
| GlenOaks | 2908.99 | 25Years | 13.75 | 105.17 | 106.98 | 106.22 | 107 | 0.000654 | 0.76 | 31.29 | 44.95 | 0.23 |
| GlenOaks | 2908.99 | 50Years | 18.44 | 105.17 | 107.01 | 106.36 | 107.05 | 0.001059 | 0.99 | 32.69 | 46.87 | 0.29 |
| GlenOaks | 2908.99 | 100Years | 22.78 | 105.17 | 107.03 | 106.47 | 107.09 | 0.001517 | 1.2 | 33.6 | 48.06 | 0.35 |
| GlenOaks | 2908.99 | Regional | 37.78 | 105.17 | 107.07 | 106.81 | 107.21 | 0.003648 | 1.9 | 35.62 | 50.65 | 0.55 |
| | | | | | | | | | | | | |
| GlenOaks | 2888.56 | 2Years | 14.3 | 104.87 | 106.68 | 105.7 | 106.71 | 0.000667 | 0.87 | 16.69 | 67.35 | 0.23 |
| GlenOaks | 2888.56 | 5Years | 21.02 | 104.87 | 106.85 | 105.9 | 106.89 | 0.000772 | 0.92 | 40.46 | 132.91 | 0.25 |
| GlenOaks | 2888.56 | 10Years | 25.01 | 104.87 | 106.87 | 106 | 106.92 | 0.001006 | 1.06 | 43.53 | 137.77 | 0.29 |
| GlenOaks | 2888.56 | 25Years | 30.42 | 104.87 | 106.91 | 106.12 | 106.97 | 0.001207 | 1.18 | 55.68 | 168.75 | 0.32 |
| GlenOaks | 2888.56 | 50Years | 35.14 | 104.87 | 106.94 | 106.21 | 107.01 | 0.001437 | 1.31 | 60.61 | 173.44 | 0.35 |
| GlenOaks | 2888.56 | 100Years | 39.04 | 104.87 | 106.96 | 106.29 | 107.04 | 0.001613 | 1.4 | 64.85 | 177.37 | 0.37 |
| GlenOaks | 2888.56 | Regional | 46.82 | 104.87 | 107.05 | 106.44 | 107.14 | 0.001729 | 1.51 | 81.32 | 223.4 | 0.39 |
| | | | | | | | | | | | | |
| GlenOaks | 2876.394 | | Culvert | | | | | | | | | |
| | | | | | | | | | | | | |
| GlenOaks | 2864.348 | 2Years | 14.3 | 104.78 | 106.45 | 105.59 | 106.54 | 0.00173 | 1.3 | 11.05 | 47.27 | 0.33 |
| GlenOaks | 2864.348 | 5Years | 21.02 | 104.78 | 106.65 | 105.83 | 106.74 | 0.001796 | 1.43 | 35.85 | 135.45 | 0.34 |
| GlenOaks | 2864.348 | 10Years | 25.01 | 104.78 | 106.73 | 105.96 | 106.81 | 0.001855 | 1.5 | 47.15 | 150.99 | 0.35 |
| GlenOaks | 2864.348 | 25Years | 30.42 | 104.78 | 106.83 | 106.11 | 106.91 | 0.001756 | 1.51 | 63.87 | 164.75 | 0.35 |
| GlenOaks | 2864.348 | 50Years | 35.14 | 104.78 | 106.9 | 106.62 | 106.98 | 0.001707 | 1.53 | 76.01 | 167.6 | 0.34 |
| GlenOaks | 2864.348 | 100Years | 39.04 | 104.78 | 106.96 | 106.72 | 107.03 | 0.00167 | 1.54 | 85.5 | 169.79 | 0.34 |
| GlenOaks | 2864.348 | Regional | 46.82 | 104.78 | 107.06 | 106.82 | 107.13 | 0.001616 | 1.56 | 102.96 | 173.75 | 0.34 |
| | | | | | | | | | | | | |
| GlenOaks | 2843.745 | 2Years | 14.3 | 104.7 | 106.11 | 106.07 | 106.4 | 0.012652 | 2.4 | 5.97 | 10.38 | 0.92 |
| GlenOaks | 2843.745 | 5Years | 21.02 | 104.7 | 106.37 | 106.37 | 106.62 | 0.008266 | 2.3 | 15.19 | 51.74 | 0.78 |
| GlenOaks | 2843.745 | 10Years | 25.01 | 104.7 | 106.47 | 106.47 | 106.7 | 0.007502 | 2.33 | 20.38 | 63.06 | 0.75 |
| GlenOaks | 2843.745 | 25Years | 30.42 | 104.7 | 106.56 | 106.56 | 106.8 | 0.007245 | 2.42 | 26.65 | 78.11 | 0.75 |
| GlenOaks | 2843.745 | 50Years | 35.14 | 104.7 | 106.63 | 106.63 | 106.87 | 0.006812 | 2.46 | 33.24 | 93.3 | 0.74 |
| GlenOaks | 2843.745 | 100Years | 39.04 | 104.7 | 106.68 | 106.68 | 106.92 | 0.006881 | 2.54 | 37.44 | 96.73 | 0.74 |
| GlenOaks | 2843.745 | Regional | 46.82 | 104.7 | 106.75 | 106.75 | 107.01 | 0.007082 | 2.69 | 45.2 | 103.5 | 0.76 |

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

PROPOSED CONDITION

Proposed Culvert C1 (River Station: 3573.439)

HEC-RAS Plan: 14mAFWNov17OnStr River: 14Mile Reach: MainBranch

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|------------|------------|-----------|---------|-----------|-----------|-----------|-----------|------------|----------|-----------|-----------|---------------|
| reacii | Triver ota | 1 Tollie | (m3/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m2) | (m) | 1 TOUGE # OTT |
| MainBranch | 3610.812 | 2Y | 20.00 | 100.00 | 100.88 | (111) | 101.01 | 0.006220 | 1.59 | 12.60 | 21.14 | 0.66 |
| MainBranch | 3610.812 | 5Y | 38.31 | 100.00 | 101.23 | | 101.41 | 0.005296 | 1.83 | 21.29 | 31.97 | 0.64 |
| MainBranch | 3610.812 | 10Y | 51.68 | 100.00 | 101.44 | | 101.64 | 0.004493 | 1.96 | 29.03 | 43.13 | 0.61 |
| MainBranch | 3610.812 | 25Y | 70.54 | 100.00 | 101.62 | 101.35 | 101.87 | 0.004871 | 2.26 | 37.63 | 62.81 | 0.65 |
| MainBranch | 3610.812 | 50Y | 84.47 | 100.00 | 101.77 | 101.48 | 102.04 | 0.004422 | 2.34 | 50.15 | 96.78 | 0.64 |
| MainBranch | 3610.812 | 100Y | 98.93 | 100.00 | 101.94 | 101.61 | 102.20 | 0.003808 | 2.34 | 69.04 | 122.41 | 0.60 |
| MainBranch | 3610.812 | Regional | 221.50 | 100.00 | 103.86 | 101.01 | 103.92 | 0.000487 | 1.43 | 372.27 | 173.57 | 0.25 |
| WallBranon | 0010.012 | rtogionai | 221.00 | 100.00 | 100.00 | | 100.02 | 0.000107 | 1.10 | 012.21 | 170.07 | 0.20 |
| MainBranch | 3597.283 | 2Y | 22.52 | 98.65 | 100.92 | 99.35 | 100.95 | 0.000358 | 0.73 | 31.26 | 23.04 | 0.17 |
| MainBranch | 3597.283 | 5Y | 42.68 | 98.65 | 101.27 | 99.71 | 101.33 | 0.000715 | 1.15 | 38.09 | 76.32 | 0.25 |
| MainBranch | 3597.283 | 10Y | 57.48 | 98.65 | 101.47 | 99.94 | 101.57 | 0.000962 | 1.42 | 42.06 | 87.52 | 0.30 |
| MainBranch | 3597.283 | 25Y | 78.22 | 98.65 | 101.63 | 100.23 | 101.79 | 0.001417 | 1.80 | 45.33 | 93.21 | 0.36 |
| MainBranch | 3597.283 | 50Y | 93.10 | 98.65 | 101.77 | 100.50 | 101.98 | 0.001668 | 2.03 | 48.14 | 96.56 | 0.40 |
| MainBranch | 3597.283 | 100Y | 107.30 | 98.65 | 101.91 | 100.70 | 102.16 | 0.001859 | 2.21 | 50.96 | 99.91 | 0.42 |
| MainBranch | 3597.283 | Regional | 256.10 | 98.65 | 103.01 | 101.96 | 103.71 | 0.003420 | 3.75 | 73.03 | 154.45 | 0.61 |
| | | | | | | | | | | | | |
| MainBranch | 3573.439 | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| MainBranch | 3552.954 | 2Y | 22.52 | 98.60 | 100.91 | 99.30 | 100.93 | 0.000321 | 0.67 | 33.62 | 47.49 | 0.17 |
| MainBranch | 3552.954 | 5Y | 42.68 | 98.60 | 101.24 | 99.66 | 101.30 | 0.000633 | 1.06 | 40.25 | 80.48 | 0.24 |
| MainBranch | 3552.954 | 10Y | 57.48 | 98.60 | 101.43 | 99.90 | 101.52 | 0.000850 | 1.30 | 44.06 | 85.54 | 0.28 |
| MainBranch | 3552.954 | 25Y | 78.22 | 98.60 | 101.58 | 100.29 | 101.72 | 0.001268 | 1.66 | 47.00 | 89.07 | 0.35 |
| MainBranch | 3552.954 | 50Y | 93.10 | 98.60 | 101.71 | 100.49 | 101.89 | 0.001499 | 1.88 | 49.62 | 99.11 | 0.38 |
| MainBranch | 3552.954 | 100Y | 107.30 | 98.60 | 101.85 | 100.65 | 102.06 | 0.001670 | 2.05 | 52.31 | 107.07 | 0.41 |
| MainBranch | 3552.954 | Regional | 256.10 | 98.60 | 102.88 | 101.79 | 103.51 | 0.003126 | 3.51 | 73.05 | 165.34 | 0.59 |
| | | | | | | | | | | | | |
| MainBranch | 3539.547 | 2Y | 22.52 | 100.00 | 100.63 | 100.63 | 100.86 | 0.013928 | 2.23 | 14.33 | 37.74 | 0.97 |
| MainBranch | 3539.547 | 5Y | 42.68 | 100.00 | 100.88 | 100.88 | 101.20 | 0.012457 | 2.71 | 24.71 | 45.50 | 0.98 |
| MainBranch | 3539.547 | 10Y | 57.48 | 100.00 | 101.07 | 100.90 | 101.41 | 0.010584 | 2.88 | 36.18 | 69.08 | 0.93 |
| MainBranch | 3539.547 | 25Y | 78.22 | 100.00 | 101.44 | | 101.66 | 0.005152 | 2.49 | 62.85 | 75.84 | 0.69 |
| MainBranch | 3539.547 | 50Y | 93.10 | 100.00 | 101.64 | | 101.85 | 0.004071 | 2.43 | 78.86 | 79.45 | 0.63 |
| MainBranch | 3539.547 | 100Y | 107.30 | 100.00 | 101.82 | | 102.02 | 0.003458 | 2.41 | 93.59 | 83.23 | 0.59 |
| MainBranch | 3539.547 | Regional | 256.10 | 100.00 | 103.06 | | 103.27 | 0.002105 | 2.70 | 240.65 | 153.37 | 0.50 |

Proposed Culvert C3 (River Station: 630.7433)

HEC-RAS Plan: 14mile(REV 08-15-2019)-Online-Struc River: 14Mile Reach: McCraney

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|----------|-----------|----------|---------|-----------|-----------|-----------|-----------|------------|----------|-----------|-----------|--------------|
| | | | (m3/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m2) | (m) | |
| McCraney | 674.5005 | 2yr | 4.66 | 108.00 | 109.10 | 108.37 | 109.10 | 0.000120 | 0.30 | 21.99 | 31.77 | 0.10 |
| McCraney | 674.5005 | 5yr | 7.55 | 108.00 | 109.51 | 108.46 | 109.52 | 0.000084 | 0.32 | 35.90 | 35.90 | 0.09 |
| McCraney | 674.5005 | 10yr | 9.47 | 108.00 | 109.76 | 108.51 | 109.76 | 0.000073 | 0.33 | 45.23 | 42.58 | 0.08 |
| McCraney | 674.5005 | 25yr | 12.03 | 108.00 | 110.07 | 108.57 | 110.07 | 0.000064 | 0.35 | 64.43 | 86.14 | 0.08 |
| McCraney | 674.5005 | 50yr | 13.87 | 108.00 | 110.27 | 108.61 | 110.27 | 0.000057 | 0.36 | 87.72 | 136.70 | 0.08 |
| McCraney | 674.5005 | 100yr | 15.62 | 108.00 | 110.49 | 108.65 | 110.49 | 0.000041 | 0.32 | 137.51 | 208.48 | 0.07 |
| McCraney | 674.5005 | Regional | 31.86 | 108.00 | 111.45 | 108.93 | 111.45 | 0.000018 | 0.27 | 441.11 | 346.28 | 0.05 |
| McCraney | 657.1833 | 2yr | 4.66 | 108.00 | 109.02 | 108.57 | 109.08 | 0.001890 | 1.09 | 4.28 | 21.45 | 0.36 |
| McCraney | 657.1833 | 5yr | 7.55 | 108.00 | 109.41 | 108.75 | 109.49 | 0.001497 | 1.23 | 6.14 | 28.69 | 0.34 |
| McCraney | 657.1833 | 10yr | 9.47 | 108.00 | 109.65 | 108.85 | 109.74 | 0.001351 | 1.31 | 7.25 | 42.44 | 0.34 |
| McCraney | 657.1833 | 25yr | 12.03 | 108.00 | 109.94 | 108.99 | 110.04 | 0.001222 | 1.39 | 8.63 | 57.97 | 0.33 |
| McCraney | 657.1833 | 50yr | 13.87 | 108.00 | 110.13 | 109.07 | 110.24 | 0.001164 | 1.46 | 9.53 | 181.92 | 0.33 |
| McCraney | 657.1833 | 100yr | 15.62 | 108.00 | 110.34 | 109.15 | 110.46 | 0.001063 | 1.48 | 10.52 | 188.82 | 0.32 |
| McCraney | 657.1833 | Regional | 31.86 | 108.00 | 111.45 | 109.78 | 111.45 | 0.000012 | 0.20 | 499.23 | 346.27 | 0.04 |
| McCraney | 630.7433 | | Culvert | | | | | | | | | |
| | | | | | | | | | | | | |
| McCraney | 530 | 2yr | 9.25 | 105.99 | 107.06 | 106.88 | 107.32 | 0.009446 | 2.26 | 4.08 | 9.11 | 0.75 |
| McCraney | 530 | 5yr | 14.72 | 105.99 | 107.19 | 107.19 | 107.69 | 0.015982 | 3.13 | 4.71 | 11.74 | 1.00 |
| McCraney | 530 | 10yr | 18.93 | 105.99 | 107.38 | 107.38 | 107.96 | 0.015330 | 3.38 | 5.59 | 17.48 | 1.00 |
| McCraney | 530 | 25yr | 24.80 | 105.99 | 107.61 | 107.61 | 108.31 | 0.014339 | 3.70 | 6.71 | 21.08 | 1.00 |
| McCraney | 530 | 50yr | 28.56 | 105.99 | 107.75 | 107.75 | 108.51 | 0.013897 | 3.87 | 7.37 | 23.91 | 1.00 |
| McCraney | 530 | 100yr | 31.85 | 105.99 | 107.86 | 107.86 | 108.69 | 0.013657 | 4.03 | 7.91 | 26.38 | 1.00 |
| McCraney | 530 | Regional | 39.18 | 105.99 | 108.11 | 108.11 | 109.05 | 0.012899 | 4.30 | 9.11 | 191.64 | 1.00 |
| McCraney | 515.9195 | 2yr | 9.25 | 105.73 | 107.05 | 106.81 | 107.16 | 0.004136 | 1.43 | 7.44 | 14.95 | 0.54 |
| McCraney | 515.9195 | 5yr | 14.72 | 105.73 | 107.28 | 107.00 | 107.35 | 0.002575 | 1.31 | 33.08 | 157.11 | 0.44 |
| McCraney | 515.9195 | 10yr | 18.93 | 105.73 | 107.39 | 107.09 | 107.44 | 0.001883 | 1.19 | 50.99 | 157.36 | 0.38 |
| McCraney | 515.9195 | 25yr | 24.80 | 105.73 | 107.45 | 107.33 | 107.50 | 0.002207 | 1.33 | 60.43 | 157.49 | 0.42 |
| McCraney | 515.9195 | 50yr | 28.56 | 105.73 | 107.55 | 107.36 | 107.59 | 0.001681 | 1.22 | 75.78 | 157.69 | 0.37 |
| McCraney | 515.9195 | 100yr | 31.85 | 105.73 | 107.60 | 107.38 | 107.63 | 0.001668 | 1.24 | 82.66 | 157.78 | 0.37 |
| McCraney | 515.9195 | Regional | 39.18 | 105.73 | 107.70 | 107.43 | 107.73 | 0.001534 | 1.24 | 99.32 | 161.95 | 0.36 |

Proposed Culvert C6 (River Station: 460.3691)

HEC-RAS Plan: 14mAFW-Nov17OnSt River: 14Mile Reach: Taplow

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|--------|-----------|----------|---------|-----------|-----------|-----------|-----------|------------|----------|-----------|-----------|--------------|
| | | | (m3/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m2) | (m) | |
| Taplow | 500 | 2yr | 1.99 | 103.82 | 104.30 | 104.30 | 104.42 | 0.021186 | 1.50 | 1.33 | 5.92 | 1.01 |
| Taplow | 500 | 5yr | 4.58 | 103.82 | 104.48 | 104.48 | 104.64 | 0.019161 | 1.77 | 2.59 | 8.38 | 1.02 |
| Taplow | 500 | 10yr | 6.42 | 103.82 | 104.65 | | 104.77 | 0.010145 | 1.53 | 4.20 | 10.53 | 0.77 |
| Taplow | 500 | 25yr | 9.22 | 103.82 | 105.04 | | 105.10 | 0.002233 | 1.05 | 8.80 | 12.38 | 0.40 |
| Taplow | 500 | 50yr | 11.23 | 103.82 | 105.22 | | 105.27 | 0.001693 | 1.02 | 11.01 | 13.01 | 0.35 |
| Taplow | 500 | 100yr | 13.13 | 103.82 | 105.36 | | 105.41 | 0.001436 | 1.02 | 12.92 | 13.54 | 0.33 |
| Taplow | 500 | Regional | 37.58 | 103.82 | 107.34 | | 107.37 | 0.000254 | 0.78 | 58.81 | 77.80 | 0.16 |
| | | | | | | | | | | | | |
| Taplow | 488.6925 | 2yr | 1.63 | 103.75 | 104.23 | 103.99 | 104.25 | 0.001496 | 0.59 | 2.75 | 6.42 | 0.29 |
| Taplow | 488.6925 | 5yr | 3.57 | 103.75 | 104.49 | 104.12 | 104.52 | 0.001664 | 0.81 | 4.39 | 6.48 | 0.32 |
| Taplow | 488.6925 | 10yr | 5.01 | 103.75 | 104.64 | 104.20 | 104.69 | 0.001737 | 0.93 | 5.40 | 6.52 | 0.33 |
| Taplow | 488.6925 | 25yr | 9.26 | 103.75 | 105.00 | 104.40 | 105.07 | 0.002012 | 1.20 | 7.73 | 6.60 | 0.35 |
| Taplow | 488.6925 | 50yr | 11.42 | 103.75 | 105.15 | 104.49 | 105.24 | 0.002122 | 1.30 | 8.75 | 6.64 | 0.36 |
| Taplow | 488.6925 | 100yr | 13.38 | 103.75 | 105.28 | 104.56 | 105.38 | 0.002212 | 1.39 | 9.62 | 6.67 | 0.37 |
| Taplow | 488.6925 | Regional | 39.72 | 103.75 | 107.17 | 105.37 | 107.33 | 0.001365 | 1.77 | 22.40 | 28.91 | 0.31 |
| | | | | | | | | | | | | |
| Taplow | 460.3691 | | Culvert | | | | | | | | | |
| | | | | | | | | | | | | |
| Taplow | 419.7275 | 2yr | 1.63 | 103.58 | 104.13 | 103.83 | 104.15 | 0.000856 | 0.49 | 3.36 | 7.41 | 0.23 |
| Taplow | 419.7275 | 5yr | 3.57 | 103.58 | 104.39 | 103.96 | 104.42 | 0.000979 | 0.68 | 5.23 | 7.90 | 0.26 |
| Taplow | 419.7275 | 10yr | 5.01 | 103.58 | 104.53 | 104.04 | 104.57 | 0.001084 | 0.80 | 6.26 | 8.17 | 0.28 |
| Taplow | 419.7275 | 25yr | 9.26 | 103.58 | 104.83 | 104.22 | 104.89 | 0.001440 | 1.10 | 8.44 | 8.73 | 0.33 |
| Taplow | 419.7275 | 50yr | 11.42 | 103.58 | 104.95 | 104.30 | 105.02 | 0.001617 | 1.23 | 9.29 | 8.95 | 0.35 |
| Taplow | 419.7275 | 100yr | 13.38 | 103.58 | 105.05 | 104.37 | 105.14 | 0.001750 | 1.33 | 10.03 | 9.14 | 0.37 |
| Taplow | 419.7275 | Regional | 39.72 | 103.58 | 105.89 | 105.13 | 106.19 | 0.003317 | 2.43 | 16.38 | 12.54 | 0.53 |
| | | | | | | | | | | | | |
| Taplow | 404.225 | 2yr | 1.63 | 103.50 | 104.04 | | 104.10 | 0.006094 | 1.10 | 1.48 | 3.87 | 0.57 |
| Taplow | 404.225 | 5yr | 3.57 | 103.50 | 104.24 | | 104.35 | 0.008894 | 1.50 | 2.38 | 5.25 | 0.71 |
| Taplow | 404.225 | 10yr | 5.01 | 103.50 | 104.37 | | 104.50 | 0.008930 | 1.62 | 3.10 | 6.20 | 0.73 |
| Taplow | 404.225 | 25yr | 9.26 | 103.50 | 104.51 | 104.48 | 104.78 | 0.013948 | 2.31 | 4.06 | 7.99 | 0.94 |
| Taplow | 404.225 | 50yr | 11.42 | 103.50 | 104.63 | 104.58 | 104.91 | 0.011258 | 2.35 | 5.21 | 10.28 | 0.87 |
| Taplow | 404.225 | 100yr | 13.38 | 103.50 | 104.82 | | 105.05 | 0.006906 | 2.14 | 7.23 | 11.09 | 0.71 |
| Taplow | 404.225 | Regional | 39.72 | 103.50 | 105.50 | 105.40 | 106.04 | 0.008487 | 3.42 | 15.73 | 14.01 | 0.86 |

Proposed Culvert C7 (River Station: 2876.394)

HEC-RAS Plan: Plan 04 (6.1x1.5) River: 14Mile Reach: GlenOaks

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|----------------------|----------------------|--------------------|----------------|------------------|------------------|-----------|------------------|----------------------|----------|----------------|-----------|--------------|
| | | | (m3/s) | (m) | (m) | (m) | (m) | (m/m) | (m/s) | (m2) | (m) | |
| GlenOaks | 2908.990 | 2Years | 5.87 | 105.17 | 106.72 | 105.93 | 106.73 | 0.000411 | 0.54 | 10.91 | 11.51 | 0.18 |
| GlenOaks | 2908.990 | 5Years | 8.84 | 105.17 | 106.92 | 106.05 | 106.94 | 0.000527 | 0.66 | 13.33 | 12.33 | 0.20 |
| GlenOaks | 2908.990 | 10Years | 10.77 | 105.17 | 106.98 | 106.12 | 107.00 | 0.000397 | 0.60 | 31.44 | 45.15 | 0.18 |
| GlenOaks | 2908.990 | 25Years | 13.75 | 105.17 | 107.51 | 106.22 | 107.52 | 0.000056 | 0.29 | 173.66 | 284.61 | 0.07 |
| GlenOaks | 2908.990 | 50Years | 18.44 | 105.17 | 107.14 | 106.36 | 107.17 | 0.000725 | 0.88 | 39.60 | 67.75 | 0.25 |
| GlenOaks | 2908.990 | 100Years | 22.78 | 105.17 | 107.23 | 106.47 | 107.27 | 0.000928 | 1.04 | 47.35 | 104.20 | 0.28 |
| GlenOaks | 2908.990 | Regional | 37.78 | 105.17 | 107.29 | 106.81 | 107.33 | 0.001107 | 1.17 | 112.63 | 256.85 | 0.31 |
| GlenOaks | 2897.894 | 2Years | 14.30 | 104.87 | 106.47 | 106.09 | 106.66 | 0.003953 | 1.95 | 7.35 | 10.92 | 0.57 |
| GlenOaks | 2897.894 | 5Years | 21.02 | 104.87 | 106.79 | 106.33 | 106.90 | 0.002496 | 1.47 | 19.63 | 72.06 | 0.44 |
| GlenOaks | 2897.894 | 10Years | 25.01 | 104.87 | 106.78 | 106.46 | 106.94 | 0.003693 | 1.78 | 18.68 | 69.98 | 0.54 |
| GlenOaks | 2897.894 | 25Years | 30.42 | 104.87 | 106.63 | 106.63 | 107.31 | 0.011772 | 3.65 | 8.33 | 19.25 | 1.00 |
| GlenOaks | 2897.894 | 50Years | 35.14 | 104.87 | 106.87 | 106.87 | 107.09 | 0.005059 | 2.17 | 29.46 | 109.05 | 0.63 |
| GlenOaks | 2897.894 | 100Years | 39.04 | 104.87 | 106.85 | 106.85 | 107.16 | 0.007161 | 2.55 | 23.71 | 81.89 | 0.75 |
| GlenOaks | 2897.894 | Regional | 46.82 | 104.87 | 106.99 | 106.99 | 107.23 | 0.005369 | 2.38 | 45.78 | 146.70 | 0.66 |
| GlenOaks | 2876.394 | | Culvert | | | | | | | | | |
| GlenOaks | 2855.014 | 2Years | 14.30 | 104.91 | 106.31 | 105.94 | 106.51 | 0.004025 | 1.97 | 7.25 | 16.49 | 0.58 |
| GlenOaks | 2855.014 | 5Years | 21.02 | 104.91 | 106.31 | 105.94 | 106.51 | 0.004025 | 2.70 | 7.25 | 22.78 | 0.36 |
| | | | | | | 106.18 | | | 2.70 | | 52.11 | |
| GlenOaks GlenOaks | 2855.014 2855.014 | 10Years 25Years | 25.01 30.42 | 104.91 104.91 | 106.52 106.68 | 106.51 | 106.80 106.89 | 0.006037 0.004442 | 2.37 | 15.06 35.31 | 141.75 | 0.70 0.61 |
| GlenOaks | 2855.014 | 50Years | 35.14 | 104.91 | 106.08 | 106.08 | 106.89 | 0.004442 | 2.21 | 44.95 | 154.79 | 0.61 |
| GlenOaks | 2855.014 | 100Years | 39.04 | 104.91 | 106.73 | 106.73 | 107.00 | 0.004332 | 1.93 | 66.51 | 166.57 | 0.50 |
| GlenOaks | 2855.014 | Regional | 46.82 | 104.91 | 107.00 | 106.86 | 107.10 | 0.002314 | 1.85 | 87.17 | 171.34 | 0.30 |
| | | | | | | | | | | | | |
| GlenOaks | 2843.745 | 2Years | 14.30 | 104.70 | 106.11 | 106.07 | 106.40 | 0.012654 | 2.40 | 5.97 | 10.38 | 0.92 |
| GlenOaks | 2843.745 | 5Years | 21.02 | 104.70 | 106.37 | 106.37 | 106.62 | 0.008275 | 2.30 | 15.17 | 51.71 | 0.78 |
| GlenOaks | 2843.745 | 10Years | 25.01 | 104.70 | 106.47 | 106.47 | 106.70 | 0.007495 | 2.33 | 20.39 | 63.09 | 0.75 |
| GlenOaks | 2843.745 | 25Years | 30.42 | 104.70 | 106.55 | 106.55 | 106.80 | 0.007282 | 2.43 | 26.56 | 77.88 | 0.75 |
| GlenOaks | 2843.745 | 50Years | 35.14 | 104.70 | 106.63 | 106.63 | 106.87 | 0.006860 | 2.47 | 33.10 | 93.18 | 0.74 |
| GlenOaks | 2843.745 | 100Years | 39.04 | 104.70 | 106.68 | 106.68 | 106.92 | 0.006871 | 2.54 | 37.47 | 96.76 | 0.74 |
| GlenOaks | 2843.745 | Regional | 46.82 | 104.70 | 106.75 | 106.75 | 107.01 | 0.007080 | 2.69 | 45.21 | 103.51 | 0.76 |

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

APPENDIX J: STORM SEWER DESIGN SHEETS

August 22, 2019 J-1

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

EXISTING CONDITION

| Wyecroft Town of C | Dakville | | | | | | | | | | | | | | | | | |
|---------------------|------------------------|--------------------|-------------|----------------|-----------|----------------|--------|--------|------|--------|--------|---------|----------|--------|---------|--------|------|--------|
| Storm Sewer | | | | | | | | | | | | | | | | | | |
| Storm Sewer | | | Existing Ro | oad Subcatch | ment Data | | | | | | Propos | sed Roa | d Subca | tchmen | t Data | | | |
| From | То | Catchment | Area | | Runoff | A2- | Runoff | Avg. | AC | Accum. | Α | A1 | Runoff | A2 | Runoff | Avg. | AC | Accum. |
| Manhole | Manhole | | Total | A1-Imperv. | Coef.1 | Perv. | Coef.3 | Runoff | | AC | Total | - | Coeff. 1 | Perv. | Coeff.2 | Runoff | | AC |
| | | | ha | ha | С | ha | С | С | ha | ha | ha | ha | С | ha | С | С | ha | ha |
| | hment to Bronte 10+88 | 0 to 10+000 | | 1 | | | | | | | | | | | | | | |
| 32796 | 33300 | 1 | 1.986 | 1.741 | 0.90 | 0.245 | 0.20 | 0.81 | 1.62 | 1.62 | 2.18 | 1.85 | 0.90 | 0.33 | 0.20 | 0.79 | 1.73 | 1.73 |
| External Area | Area=1.49 Ha. | 4 | 1.493 | 1.441 | 0.90 | 0.052 | 0.20 | 0.50 | 0.07 | 4.00 | 0.47 | 0.00 | 0.00 | 0.07 | 0.00 | 0.50 | 0.10 | 4.00 |
| 33300 | 33243 | 1 | 0.113 | 0.064 | 0.90 | 0.049 | 0.20 | 0.59 | 0.07 | 1.68 | 0.17 | 0.09 | 0.90 | 0.07 | 0.20 | 0.59 | 0.10 | 1.83 |
| 22242 | 24427 | 4 | 2.242 | 0.744 | 0.00 | 0.400 | 0.00 | 0.70 | 2.54 | 4.00 | 2.17 | 2.60 | 0.00 | 0.40 | 0.00 | 0.70 | 0.54 | 4.24 |
| 33243 External Area | 34137 Area=2.84 Ha. | 1 | 3.213 | 2.714 2.485 | 0.90 | 0.499 0.354 | 0.20 | 0.79 | 2.54 | 4.23 | 3.17 | 2.68 | 0.90 | 0.49 | 0.20 | 0.79 | 2.51 | 4.34 |
| External Flow | Flow=1280 l/s | (900mm Pipe) | 2.839 | 2.400 | 0.90 | 0.334 | 0.20 | | | | | | | | | | | |
| 34137 | 34708 | (900Hilli Fipe) | 0.496 | 0.263 | 0.90 | 0.234 | 0.20 | 0.57 | 0.28 | 4.51 | 0.59 | 0.40 | 0.90 | 0.19 | 0.20 | 0.67 | 0.40 | 4.74 |
| 34137 | 34700 | ı | 0.490 | 0.203 | 0.90 | 0.234 | 0.20 | 0.57 | 0.20 | 4.51 | 0.55 | 0.40 | 0.50 | 0.19 | 0.20 | 0.07 | 0.40 | 4.74 |
| 34708 | 35037 | 1 | 1.016 | 0.898 | 0.90 | 0.119 | 0.20 | 0.82 | 0.83 | 5.34 | 1.15 | 1.04 | 0.90 | 0.11 | 0.20 | 0.83 | 0.96 | 5.69 |
| External Area | Area=0.81 Ha. | - | 0.806 | 0.763 | 0.90 | 0.044 | 0.20 | 3.02 | 3.00 | 3.54 | | | 3.50 | J. 11 | 5.20 | 3.00 | 3.00 | 3.00 |
| 35037 | 35339 | 1 | 0.320 | 0.161 | 0.90 | 0.159 | 0.20 | 0.55 | 0.18 | 5.52 | 0.23 | 0.14 | 0.90 | 0.09 | 0.20 | 0.62 | 0.14 | 5.83 |
| External Flow | Flow=1280 l/s | (900mm Pipe) | | | | | | | | | | | | | | | | |
| 35339 | Outlet 1 Bronte Road | 1 | 0.662 | 0.385 | 0.90 | 0.277 | 0.20 | 0.61 | 0.40 | 5.92 | 0.62 | 0.52 | 0.90 | 0.00 | 0.20 | 0.90 | 0.56 | 6.39 |
| External Flow | Flow=594 l/s | (675mm Pipe) | | | | | | | | | | | | | | | | |
| | Т | otal Internal Area | 2.67 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| Westgate Road | 11+260 to 11+040 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | T | | | | | | | | | | | | | | | | | |
| 32316 | 32217 | 2 | 0.6197 | 0.3617 | 0.90 | 0.26 | 0.20 | 0.61 | 0.38 | 0.38 | 0.64 | 0.37 | 0.90 | 0.27 | 0.20 | 0.60 | 0.39 | 0.39 |
| 20047 | 0 11 1 0 1 1 1 1 1 1 1 | | 5.0000 | 0.4004 | 0.00 | 0.7070 | 0.00 | 0.50 | 0.70 | 0.70 | 5.04 | 0.77 | 0.00 | 0.40 | 0.00 | 0.50 | 0.00 | 0.00 |
| 32217 | Outlet 2 Westgate Rd | 2 | 5.2203 | 2.4824 | 0.90 | 2.7379 | 0.20 | 0.53 | 2.78 | 2.78 | 5.64 | 2.77 | 0.90 | 3.16 | 0.20 | 0.53 | 2.98 | 2.98 |
| 21404 | 214040 | 2 | 0.0100 | 0.0000 | 0.90 | 0.02 | 0.20 | 0.20 | 0.00 | 0.00 | 0.02 | 0.00 | 0.90 | 0.02 | 0.20 | 0.20 | 0.00 | 0.00 |
| 31494 | 31494a | | 0.0190 | 0.0000 | 0.90 | 0.02 | 0.20 | 0.20 | 0.00 | 0.00 | 0.02 | 0.00 | 0.90 | 0.02 | 0.20 | 0.20 | 0.00 | 0.00 |
| 31494a | 31494b | 2 | 0.9313 | 0.2319 | 0.90 | 0.70 | 0.20 | 0.37 | 0.35 | 0.35 | 1.03 | 0.29 | 0.90 | 1.03 | 0.20 | 0.35 | 0.36 | 0.37 |
| External Area | Area=0.82 Ha. | | 0.8232 | 0.1646 | 0.90 | 0.66 | 0.20 | 0.07 | 0.00 | 0.00 | 1.00 | 0.20 | 0.00 | 1.00 | 0.20 | 0.00 | 0.00 | 0.07 |
| External / troa | 71100 0.02 110. | | 0.0202 | 0.1010 | 0.00 | 0.00 | 0.20 | | | | | | | | | | | |
| 31494b | 31494c | 2 | 0.8264 | 0.7438 | 0.90 | 0.08 | 0.20 | 0.83 | 0.69 | 1.04 | 0.83 | 0.74 | 0.90 | 0.08 | 0.20 | 0.83 | 0.69 | 1.05 |
| External Area | Area=0.83 Ha. | | 0.8264 | 0.7438 | 0.90 | 0.08 | 0.20 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 31494c | 32217a | 2 | 0.2395 | 0.1113 | 0.90 | 0.13 | 0.20 | 0.53 | 0.13 | 1.16 | 0.54 | 0.34 | 0.90 | 0.21 | 0.20 | 0.63 | 0.35 | 1.40 |
| | | | | | | | | | | | | | | | | | | |
| 32217a | 32217 | 2 | 2.5843 | 1.0337 | 0.90 | 1.55 | 0.20 | 0.48 | 1.24 | 2.40 | 2.58 | 1.03 | 0.90 | 1.55 | 0.20 | 0.48 | 1.24 | 2.64 |
| External Area | Area=1.95 Ha. | | 1.9473 | 0.7789 | 0.90 | 1.17 | 0.20 | | | | | | | | | | | |
| External Area | Area=0.64 Ha. | | 0.6370 | 0.2548 | 0.90 | 0.38 | 0.20 | | | | | | | | | | | |
| External Flow | Flow=594 l/s | (675mm Pipe) | | | | | | | | | | | | | | | | |
| 144 % 6 d d | | otal Internal Area | 0.97 | | | | | | | | | | | | | | | |
| Wyecroft Catchme | | | | | | | | | | | | | | | | | | |
| EX | 31497 | 3 | | | | | | | | | | | | | | | | |
| 24407 | 22202 | 2 | 6.0400 | 2.50 | 0.00 | 0 E4 | 0.00 | 0.40 | 2.05 | 2.05 | 6.00 | 2.40 | 0.00 | 2.52 | 0.00 | 0.40 | 2.05 | 2.05 |
| 31497 | 32293 | 3 | 6.0123 | 2.50 | 0.90 | 3.51 | 0.20 | 0.49 | 2.95 | 2.95 | 6.03 | 2.49 | 0.90 | 3.53 | 0.20 | 0.49 | 2.95 | 2.95 |
| External Area | Area=5.61Ha. | | 5.6100 | 2.2440 | 0.90 | 3.3660 | 0.20 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

| Dakville | | | | | | | | | | | | | | | | | |
|-----------------------|--|---------------------------------|--|---|---|--|--|---------------------------------|---------------------------------|---------------------------------|---------|---|---------------------------------|--|--|--|--|
| | | | | | | | | | | | | | | | | | |
| | | Existing R | oad Subcatch | ment Data | | | | | | Propos | sed Roa | ad Subca | tchmen | t Data | | | |
| То | Catchment | Area | | Runoff | A2- | Runoff | Avg. | AC | Accum. | Α | A1 | Runoff | A2 | Runoff | Avg. | AC | Accum. |
| Manhole | | Total | A1-Imperv. | Coef.1 | Perv. | Coef.3 | Runoff | | AC | Total | Imperv. | Coeff. 1 | Perv. | Coeff.2 | Runoff | | AC |
| | | ha | ha | С | ha | С | С | ha | ha | ha | ha | С | ha | С | С | ha | ha |
| nment to Bronte 10+88 | 30 to 10+000 | | | | | | | | _ | | | | | | | | |
| 32293a | 3 | 0.48 | 0.2811 | 0.90 | 0.20 | 0.20 | 0.61 | 0.29 | 3.24 | 0.70 | 0.40 | 0.90 | 0.30 | 0.20 | 0.60 | 0.42 | 3.37 |
| 42259 | 3 | 4.6211 | 1.8699 | 0.90 | 2.75 | 0.20 | 0.48 | 2.23 | 5.48 | 4.74 | 2.01 | 0.90 | 2.73 | 0.20 | 0.50 | 2.35 | 5.73 |
| Area=4.351Ha. | | 4.3500 | 1.7400 | 0.90 | 2.6100 | 0.20 | | | | | | | | | | | |
| 41804 | 3 | 0.2768 | 0.17473 | 0.90 | 0.10 | 0.20 | 0.64 | 0.18 | 5.66 | 0.39 | 0.15 | 0.90 | 0.24 | 0.20 | 0.47 | 0.18 | 5.91 |
| Area=2.73Ha. | | 2.7300 | | | | | 0.75 | 2.05 | 2.05 | | | | | | | | |
| 41401 | 3 | 0.4731 | 0.2805 | 0.90 | 0.1926 | 0.20 | 0.62 | 0.29 | 5.95 | 0.67 | 0.40 | 0.90 | 0.27 | 0.20 | 0.62 | 0.41 | 6.33 |
| Area=2.61Ha. | | 2.6100 | | | | | 0.75 | 1.96 | 1.96 | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 44260 | 3 | 0.3231 | 0.2467 | 0.90 | 0.0764 | 0.20 | 0.73 | 0.24 | 6.18 | 0.45 | 0.32 | 0.90 | 0.14 | 0.20 | 0.69 | 0.31 | 6.64 |
| Flow=270 l/s | | | | | | | | | | | | | | | | | |
| 44239 | 3 | 0.3138 | 0.2304 | 0.90 | 0.0833 | 0.20 | 0.71 | 0.22 | 6.41 | 0.36 | 0.25 | 0.90 | 0.10 | 0.20 | 0.70 | 0.25 | 6.89 |
| | Total Internal Area | 2.54 | | | | | | | | | | | | | | | |
| | | 0.00 | 0.0000 | 0.90 | 0.00 | 0.20 | | | | 0.00 | 0.00 | 0.90 | 0.00 | 0.20 | | | |
| Flow=186 l/s | 300mm Pipe | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | 1 | | T | 1 | T I | | 1 | | T | T 1 | | | | | T |
| | | 0.9196 | 0.5866 | 0.90 | 0.3330 | 0.20 | 0.65 | 0.59 | 0.59 | 0.88 | 0.52 | 0.90 | 0.36 | 0.20 | 0.61 | 0.54 | 0.54 |
| | | 0.0040 | 0.0045 | 2.00 | | 2.22 | 0.00 | 2.22 | 0.00 | 0.05 | 0.40 | 2.00 | 2.42 | 0.05 | 2.22 | 2.24 | |
| 6933 | 11 | 0.2948 | 0.2045 | 0.90 | 0.0903 | 0.20 | 0.69 | 0.20 | 0.80 | 0.35 | 0.19 | 0.90 | 0.16 | 0.25 | 0.60 | 0.21 | 0.75 |
| Outlet 11 | 11 | | | | | | | | 0.00 | | 0.00 | 0.90 | | 0.25 | | | |
| | | | | | | | | | | | | | | | | | |
| 7375 | 11 | 0.3613 | 0.2480 | 0.90 | 0.1133 | 0.20 | 0.68 | 0.25 | 0.25 | 0.39 | 0.22 | 0.90 | 0.17 | 0.20 | 0.60 | 0.24 | 0.24 |
| Flow=797 l/s | (675mm Pipe) | | | | | | | | | | | | | | | | |
| 6933 | | 0.3992 | 0.2134 | 0.90 | 0.1858 | 0.20 | 0.57 | 0.23 | 0.48 | 0.33 | 0.18 | 0.90 | 0.15 | 0.20 | 0.59 | 0.19 | 0.43 |
| | Total Internal Area | 1.97 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | To Manhole hment to Bronte 10+88 32293a 42259 Area=4.351Ha. 41804 Area=2.73Ha. 41401 Area=2.61Ha. 44260 Flow=270 l/s 44239 Outlet 3 Third Line Flow=186 l/s 15+300 to Drainage Ch 6952 Flow=1280 l/s 6933 Outlet 11 Drainage Channel 7375 Flow=797 l/s 6933 | To Catchment Manhole Manhole | To Catchment Area Total ha hment to Bronte 10+880 to 10+000 32293a 3 0.48 42259 3 4.6211 Area=4.351Ha. 4.3500 41804 3 0.2768 Area=2.73Ha. 2.7300 41401 3 0.4731 Area=2.61Ha. 2.6100 44260 3 0.3231 Flow=270 l/s 44239 3 0.3138 Total Internal Area Outlet 3 Third Line Flow=186 l/s 300mm Pipe 15+300 to Drainage Channel 15+100 6952 11 0.9196 Flow=1280 l/s (900mm Pipe) 6933 11 0.2948 Outlet 11 11 Drainage Channel 7375 11 0.3613 Flow=797 l/s (675mm Pipe) 6933 0.3992 | Existing Road Subcatch Area Total A1-Imperv. ha ha hament to Bronte 10+880 to 10+000 32293a 3 0.48 0.2811 42259 3 4.6211 1.8699 Area=4.351Ha. 4.3500 1.7400 41804 3 0.2768 0.17473 Area=2.73Ha. 2.7300 41401 3 0.4731 0.2805 Area=2.61Ha. 2.6100 44260 3 0.3231 0.2467 Flow=270 l/s 44239 3 0.3138 0.2304 Total Internal Area 2.54 Outlet 3 Third Line Flow=186 l/s 300mm Pipe 15+300 to Drainage Channel 15+100 6952 1 0.9196 0.5866 Flow=1280 l/s (900mm Pipe) 6933 11 0.2948 0.2045 Outlet 11 11 Drainage Channel 7375 11 0.3613 0.2480 Flow=797 l/s (675mm Pipe) 6933 0.3992 0.2134 Catcher Catcher | Existing Road Subcatchment Data Area Total A1-Imperv. Coef.1 ha ha C Coef.1 ha ha C Coef.1 ha ha C Coef.1 ha ha C C Coef.1 ha ha C C C Coef.1 ha ha C C C C C C C C C | Existing Road Subcatchment Data To Catchment Area A1-Imperv. Coef. 1 Perv. ha ha C ha ha C ha ha | Existing Road Subcatchment Data Area Runoff A2- Runoff A3- R | Existing Road Subcatchment Data | Existing Road Subcatchment Data | Existing Road Subcatchment Data | Propose | Existing Road Subcatchment Data Proposed Road Runoff A2- Runoff | Existing Road Subcatchment Data | To Catchment Area Manhole Catchment Area | Existing Road Subcatchment Data Proposed Road Subcatchment Data Area Al-Imperv. Coef. 1 Perv. Coef. 2 Runoff Az Runoff A | Existing Road Subcatchment Data Proposed Road Subcatchment Data Runoff A2c Runoff A2 | To Catchment Area At-Imperv. Coef. 1 Perv. Coef. 2 Perv. Coef. 3 P |

Notes:

1. A1- Impervious Area is the pavement area -

runoff coefficient of 0.90

A2. Pervious area is any vegated area, sidewalks, and MUT -runoff coefficient of 0.20 sidewalks, and MUT -runoff coefficient of 0.20

- 2. Pipe sizes and slope taken from As-Built drawings.
- 3. External areas and flows from As-Built drawings are used.
- 4. Other external areas are delineated from information provided by Town of Oakville.

| Wyecroft Town of C | Dakville | | Storm Sewer | Capacity | / | | | | | | | | | | |
|------------------------|------------------------|----------------------|-----------------|-----------|-------------|--------------|---------|---------|-----------|----------|-------------|--------|----------|---------------|-----------------------------|
| Storm Sewer | | | Conc. $n = 0.0$ | 013, P.V. | .C. n = 0.0 | 013, CSP n = | = 0.021 | | | Town | of Oakville | Intens | sitv 5vr | · = 1170/(tc+ | 5.8) ^{0.843} |
| Storm Sewer | | | Design Flo | w Peak | Rate | · | | Storm S | ewer Data | | | | | Capacity E | |
| From | То | Catchment | Tc | I | Q Exist. | Q Prop. | Туре | Size | Length | S | Q | V | Т | Q Exist. | NOTES |
| Manhole | Manhole | | | 5 yr | 5 Yr | 5 Yr | Pipe | | Pipe | Slope | Capacity | | | % of Full | |
| | | | min. | mm/hr | L/s | L/s | | m | m | % | L/s | m/s | min. | Capacity | |
| | hment to Bronte 10+88 | 0 to 10+000 | Wycroft Cat | - | | | 0+000 | , , | | | | | | | |
| 32796 | 33300 | 1 | 10.0 | 114 | 513 | 549 | | | | | | | | | |
| External Area | Area=1.49 Ha. | | | | | | CONC | 0.825 | 79.0 | 0.56 | 1075 | 2.0 | 0.7 | 48% | |
| 33300 | 33243 | 1 | 10.7 | 110 | 516 | 561 | | | | | | | | | |
| | | | | | | | CONC | 0.825 | 91.0 | 0.56 | 1075 | 2.0 | 0.8 | 48% | |
| 33243 | 34137 | 1 | 11.4 | 106 | 2528 | 2562 | | | | | | | | | |
| External Area | Area=2.84 Ha. | /2.2.2 - 1. \ | | | | | 22112 | | | <u> </u> | | | | 2.101 | |
| External Flow | Flow=1280 l/s | (900mm Pipe) | 10.5 | 101 | 1280 | 00.10 | CONC | 1.500 | 150.2 | 0.34 | 4122 | 2.3 | 1.1 | 61% | Ex. 900mm Pipe capacity |
| 34137 | 34708 | 1 | 12.5 | 101 | 2546 | 2610 | 00110 | 4.500 | 404.5 | 0.00 | 0000 | 0.0 | 1.0 | 0.40/ | |
| 0.4700 | 05007 | 1 | 40.4 | 07 | 0740 | 0040 | CONC | 1.500 | 131.5 | 0.32 | 3999 | 2.3 | 1.0 | 64% | |
| 34708 | 35037 | 1 | 13.4 | 97 | 2716 | 2810 | CONO | 4.000 | 105.5 | 0.05 | E740 | 2.2 | 0.0 | 470/ | |
| External Area 35037 | Area=0.81 Ha. 35339 | 1 | 14.2 | 94 | 3994 | 4076 | CONC | 1.800 | 105.5 | 0.25 | 5748 | 2.3 | 0.8 | 47% | <u> </u> |
| External Flow | Flow=1280 l/s | (900mm Pipe) | 14.∠ | 94 | 1280 | 40/0 | CONC | 1.800 | 91.5 | 0.25 | 5748 | 2.3 | 0.7 | 69% | Ex. 900mm Pipe capacity |
| 35339 | Outlet 1 Bronte Road | (900Hilli Pipe) | 14.9 | 91 | 4650 | 4770 | CONC | 1.000 | 91.5 | 0.23 | 3740 | 2.3 | 0.7 | 0976 | Lx. 900mm ripe capacity |
| External Flow | Flow=594 l/s | (675mm Pipe) | 14.9 | 91 | 594 | 4770 | CONC | 1.800 | 123.5 | 0.27 | 5973 | 2.3 | 0.9 | 78% | Ex. 675mmPipe capacity |
| External Flow | | otal Internal Area | | | 594 | | CONC | 1.000 | 123.5 | 0.27 | 3973 | 2.3 | 0.9 | 7070 | Lx. 07 3111111 lpe capacity |
| | | otal internal Area | | | | | | | | | | | | | |
| Westgate Road | 1 11+260 to 11+040 | | | | | | | | | | | | | | |
| Trootgato read | 111200101111010 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 32316 | 32217 | 2 | 10.0 | 114 | 120 | 123 | | | | | | | | | |
| <u> </u> | V== 1. | _ | | | 1=0 | .=\$ | CONC | 0.375 | 88.5 | 0.7 | 148 | 1.3 | 1.1 | 81% | |
| 32217 | Outlet 2 Westgate Rd | 2 | 12.3 | 102 | 1381 | 1436 | | | | | | | | | |
| | Ĭ | | | | | | CONC | 0.900 | 95.0 | 0.50 | 1281 | 2.0 | 0.8 | 108% | |
| 31494 | 31494a | 2 | 10.0 | 114 | 1 | 1 | | | | | | | | | |
| | | | | | | | CONC | 0.675 | 69.0 | 0.42 | 545 | 1.5 | 0.8 | 0% | |
| 31494a | 31494b | 2 | 10.8 | 110 | 108 | 112 | | | | | | | | | |
| External Area | Area=0.82 Ha. | | | | | | | | | | | | | | |
| | | | | | | | CONC | 0.675 | 95.0 | 0.4 | 545 | 1.5 | 1.0 | 20% | |
| 31494b | 31494c | 2 | 11.8 | 104 | 301 | 305 | | | | | | | | | |
| External Area | Area=0.83 Ha. | | | | | | | | | | | | | | |
| | | | | | | | CONC | 0.675 | 19.0 | 0.42 | 545 | 1.5 | 0.2 | 55% | |
| 31494c | 32217a | 2 | 12.0 | 103 | 334 | 401 | | | | | | | | | |
| | | | | | | | CONC | 0.675 | 28.5 | 0.4 | 545 | 1.5 | 0.3 | 61% | |
| 32217a | 32217 | 2 | 12.3 | 102 | 1274 | 1341 | | | | | | | | | |
| External Area | Area=1.95 Ha. | | | | | | | | | | | | | | |
| External Area | Area=0.64 Ha. | (0== | - | | | | | | | | | | | | E 075 D: " |
| External Flow | Flow=594 l/s | (675mm Pipe) | | | 594 | | 00110 | 0.000 | 44.5 | | 4001 | | | 40001 | Ex. 675mmPipe capacity |
| Ny same ft Octob | | otal Internal Area | | | | | CONC | 0.900 | 14.6 | 0.5 | 1281 | 2.0 | 0.1 | 100% | |
| Nyecroft Catchme | | 0 | 44.0 | | 0700 | 0700 | | | | | | | | | |
| EX | 31497 | 3 | 44.8 | | 3709 | 3709 | CONO | 4.000 | 45.0 | 0.00 | 2700 | 0.0 | 0.4 | 4000/ | |
| 21407 | 32293 | 2 | 44.0 | 43 | 4060 | 4050 | CONC | 1.200 | 15.9 | 0.90 | 3700 | 2.3 | 0.1 | 100% | |
| 31497 | 32293 Area=5.61Ha. | 3 | 44.9 | 43 | 4060 | 4059 | CONC | 1.500 | 158.5 | 0.26 | 3605 | 2.0 | 1.3 | 113% | |
| External Area | | | | | | | | | | | | | | | |

| Wyecroft Town of O | akville | | Storm Sewer | Capacity | ′ | | | | | | | | | | |
|--------------------|------------------------|--------------------|-----------------|----------|--------------|---------------|------------|---------|-----------|--------|-------------|--------|----------|--------------|---------------------------------|
| Storm Sewer | | | Conc. $n = 0.0$ | 13, P.V. | C. $n = 0$. | 013, CSP n : | = 0.021 | | | Town o | of Oakville | Intens | sity 5yr | = 1170/(tc+5 | $(5.8)^{0.843}$ |
| Storm Sewer | | | Design Flow | v Peak I | Rate | | | Storm S | ewer Data | | | | | Capacity E | |
| From | То | Catchment | Тс | | Q Exist. | Q Prop. | Туре | Size | Length | S | Q | V | Τ | Q Exist. | NOTES |
| Manhole | Manhole | | | 5 yr | 5 Yr | 5 Yr | Pipe | | Pipe | Slope | Capacity | | | % of Full | |
| | | | min. | mm/hr | L/s | L/s | | m | m | % | L/s | m/s | min. | Capacity | |
| Wycroft Catch | ment to Bronte 10+88 | 0 to 10+000 | Wycroft Cate | hment t | o Bronte | e 10+880 to 1 | 0+000 | | | _ | | | | | |
| 32293 | 32293a | 3 | 46.2 | 42 | 4086 | 4101 | | | | | | | | | |
| | | | | | | | CONC | 1.500 | 115.0 | 0.42 | 4582 | 2.6 | 0.7 | 89% | |
| 32293a | 42259 | 3 | 47.0 | 41 | 4338 | 4367 | | | | | | | | | |
| External Area | Area=4.351Ha. | | | | | | | - | | _ | | 1 | 1 | | |
| | | | | | | | CONC | 1.500 | 108.0 | 0.33 | 4061 | 2.3 | 0.8 | 107% | |
| 42259 | 41804 | 3 | 47.8 | 41 | 5864 | 5893 | | | | | | | | | |
| External Area | Area=2.73Ha. | | | 266 | 1513 | | CONC | 1.800 | 132.0 | 0.45 | 7711 | 3.0 | 0.7 | 76% | Replaced from 1.5 to 1.8 |
| 41804 | 41401 | 3 | 48.5 | 40 | 7336 | 7378 | | | | | | | | | |
| External Area | Area=2.61Ha. | | | 266 | 1447 | | | | | | | | | | |
| | | - | | | | | CONC | 1.800 | 113.0 | 0.50 | 8128 | 3.2 | 0.6 | 90% | Replaced from 1.5 to 1.8 |
| 41401 | 44260 | 3 | 49.1 | 40 | 7626 | 7677 | 20110 | 4.000 | 4.50.0 | 0.15 | | | | 200/ | |
| External Flow | Flow=270 l/s | - | | | 270 | | CONC | 1.800 | 156.0 | 0.45 | 7711 | 3.0 | 0.9 | 99% | Replaced from 1.5 to 1.8 |
| 44260 | 44239 | 3 | 49.9 | 39 | 7642 | 7694 | 22112 | 2 122 | | | | | | | |
| | | otal Internal Area | | | | | CONC | 2.400 | 19.6 | 0.11 | 8209 | 1.8 | 0.2 | 93% | Replaced from 1.5 to 2.4 |
| 44239 | Outlet 3 Third Line | 222 51 | | | 7828 | 7880 | 20110 | 0.400 | | 0.11 | 2222 | 4.0 | | 0.50/ | D 15 15 0.4 |
| External Flow | Flow=186 l/s | 300mm Pipe | | | 186 | | CONC | 2.400 | 36.5 | 0.11 | 8209 | 1.8 | 0.3 | 95% | Replaced from 1.5 to 2.4 |
| WELLED COURT 4 | FLOOD to Duning one Ob | | | | | | | | | | | | | | |
| | 5+300 to Drainage Cha | | 40.0 | 444 | 4400 | 4.450 | | | | | | | | | |
| 6663 | 6952 | 11 | 10.0 | 114 | 1469 | 1452 | OONO | 4.005 | 00.0 | 0.4 | 4000 | | 107 | 040/ | Depleted from 0.075 to 1.025 |
| External Flow | Flow=1280 l/s | (900mm Pipe) | 40.7 | 110 | 1280 | 4500 | CONC | 1.025 | 82.0 | 0.4 | 1620 | 2.0 | 0.7 | 91% | Replaced from 0.975 to 1.025 |
| 6952 | 6933 | 11 | 10.7 | 110 | 1524 | 1509 | CONC | 1.050 | 71.0 | 0.5 | 1021 7 | 2.2 | 0.5 | | Ex. 900mmPipe capacity |
| 6933 | Outlet 11 | 11 | 10.8 | 110 | 2465 | 2437 | CONC | 1.050 | 71.0 | 0.5 | 1931.7 | 2.2 | 0.5 | 79% | |
| 0933 | Outlet 11 | 11 | 10.8 | 110 | 2405 | 2437 | FLUDTICAL | 1 250 | 12.0 | 0.5 | 2775 | 2.6 | 0.1 | 650/ | ELLIPTICAL1.095x1.73 |
| 7875 | Drainage Channel 7375 | 11 | 10.0 | 114 | 875 | 872 | ELLIPTICAL | 1.350 | 13.0 | 0.5 | 3775 | 2.0 | 0.1 | 65% | ELLIF HUALI.090X1.73 |
| External Flow | 7375 Flow=797 l/s | (675mm Pipe) | 10.0 | 114 | 797 | 012 | CONC | 0.825 | 95.0 | 0.5 | 1015.6 | 1.0 | 0.8 | 86% | Replaced from 0.750 to 0.825 |
| 7375 | 6933 | (oronnin ripe) | 10.8 | 109 | 941 | 927 | CONC | 0.023 | 90.0 | 0.5 | 1013.0 | 1.9 | 0.0 | 0070 | 1.6piaced IIOIII 0.750 to 0.025 |
| 1310 | | otal Internal Area | | 109 | 341 | 321 | CONC | 0.975 | 96.0 | 0.6 | 1662.7 | 2.2 | 0.7 | 57% | |
| | | otal Internal Area | | | | | CONC | 0.873 | 90.0 | 0.0 | 1002.7 | 2.2 | 0.7 | 3170 | |
| | | | | | | | | | | | | | | | |

Notes:

- 1. A1- Impervious Area is the pavement area runoff coefficient of 0.90
- A2. Pervious area is any vegated area, sidewalks, and MU sidewalks, and MUT -runoff coefficient of 0.20
- 2. Pipe sizes and slope taken from As-Built drawings.
- 3. External areas and flows from As-Built drawings are used.
- 4. Other external areas are delineated from information provided by Town of Oakville.

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

PROPOSED CONDITION

Wyecroft Town of Oakville Storm Sewer Capacity (Conc. n = 0.013, P.V.C. n = 0.013, CSP n = 0.021)

| | Storm Sewer | | | | Propo | sed Road S | ubcatchmer | nt Data | | | Desi | ign Flow Pe | ak Rate | <u> </u> | | St | orm Sewe | er Data - Pro | posed Condition | n | | |
|----------------------------|----------------------------|--------------|-------------------|----------------|----------|----------------|--------------|--------------|----------------|--------|----------|-------------|----------------|--|-------|-----------------|----------|---------------|-----------------|-----|--------------|------------------|
| From | То | | Α | A1 | Runoff | A2 | Runoff | Avg. | AC | Accum. | Tc | I (5 yrs) | Q Prop.(5 yrs) | | Size | Pipe Length (L) | Fall | Slope (S) | Capacity (Q) | V | т | Q Prop. Capacity |
| Manhole | Manhole | Catchment ID | Total | Imperv. | Coeff. 1 | Perv. | Coeff.2 | Runoff | | AC | | | | Pipe Type | Size | Fipe Length (L) | Fall | Slope (3) | | V | ' | |
| | 15+857 to 16+222 | | ha | ha | С | ha | С | С | ha | ha | min. | mm/hr | L/s | | m | m | m | % | L/s | m/s | min. | % of Full |
| MH14-1 | MH14-2 | 14 | 0.129 | 0.064 | 0.90 | 0.065 | 0.20 | 0.55 | 0.070 | 0.743 | 10.0 | 114 | 236 | | | Τ | 1 | | | | | |
| Ex. Area(B-222) | Area=0.810Ha. | 14 | 0.129 | 0.729 | 0.90 | 0.003 | 0.20 | 0.83 | 0.672 | 0.743 | 10.0 | 114 | 230 | | | + | | | | | | |
| | | | | | | | | | | | | | | CONC | 0.450 | 95.5 | 0.955 | 1 | 285 | 1.8 | 0.9 | 83% |
| MH14-2 | MH14-3 | 14 | 0.267 | 0.143 | 0.90 | 0.124 | 0.20 | 0.58 | 0.154 | 0.896 | 10.9 | 109 | 272 | | | | | | | | | |
| MH14-3 | MH14-4 | 14 | 0.149 | 0.084 | 0.90 | 0.065 | 0.20 | 0.59 | 0.089 | 1.401 | 11.4 | 107 | 415 | CONC | 0.525 | 57.0 | 0.57 | 1.00 | 430 | 2.0 | 0.5 | 63% |
| Ex. Area(B-215) | Area=0.279Ha. | 14 | 0.149 | 0.004 | 0.90 | 0.003 | 0.20 | 0.83 | 0.089 | 1.401 | 11.4 | 107 | 415 | | | | | | | | | |
| Ex. Area(B-191) | Area=0.205Ha. | | 0.205 | 0.205 | 0.90 | 0.000 | 0.20 | 0.90 | 0.185 | | | | | CONC | 0.600 | 73.2 | 0.73 | 1.00 | 614 | 2.2 | 0.6 | 68% |
| MH14-4 | MHCB14-1 | 14 | 0.207 | 0.109 | 0.90 | 0.099 | 0.20 | 0.57 | 0.117 | 1.519 | 11.9 | 104 | 438 | | | | | | | | | |
| Ex. Area(B-191) | Area=0.509Ha. | | 0.509 | 0.509 | 0.90 | 0.000 | 0.20 | 0.90 | 0.458 | | | | | CONC | 0.600 | 51.0 | 0.51 | 1.00 | 614 | 2.2 | 0.4 | 71% |
| MHCB14-1 | MH14-5 | 14 | 0.179 | 0.080 | 0.90 | 0.099 | 0.20 | 0.51 | 0.091 | 2.124 | 12.3 | 102 | 601 | CONC | 0.600 | 51.0 | 0.51 | 1.00 | 014 | 2.2 | 0.4 | 7 1 70 |
| Ex. Area(B-175) | Area=0.577Ha. | | 0.577 | 0.570 | 0.90 | 0.007 | 0.20 | 0.89 | 0.514 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | CONC | 0.750 | 45.0 | 0.45 | 1.00 | 1114 | 2.5 | 0.3 | 54% |
| MH14-5 | BY Other | 14 | 0.158 0.768 | 0.068 | 0.90 | 0.090 | 0.200 | 0.502 | 0.079 | 2.868 | 12.6 | 100 | 800 | | | | | | | | | |
| Ex. Area(B-175) | Area=0.768Ha. | | 0.768 | 0.730 | 0.90 | 0.038 | 0.200 | 0.865 | 0.664 | | | | | CONC | 1.200 | 95.0 | 0.95 | 1.00 | 3900 | 3.5 | 0.5 | 21% |
| | 15+857 to 12-13 | l | | l | | | | <u>I</u> | | 1 | | l | | 1 00110 | 1.200 | 00.0 | 0.00 | 1.00 | 0000 | 0.0 | 0.0 | 2170 |
| | | _ | | | | | | | | | | _ | | | | | | | | | | |
| MH13-1 | OUTLET 13 | 13 | 0.127 | 0.065 | 0.90 | 0.063 | 0.20 | 0.56 | 0.071 | 0.071 | 10.0 | 114 | 22 | 20110 | | | 0.40 | 0.50 | 101 | | | 100/ |
| MH13-2 | (Ex. 900mm Pipe) MH13-3 | 13 | 0.277 | 0.158 | 0.90 | 0.118 | 0.20 | 0.60 | 0.166 | 0.237 | 10.0 | 114 | 75 | CONC | 0.375 | 36 | 0.18 | 0.50 | 124 | 1.1 | 0.5 | 18% |
| WII 113-2 | WII 113-5 | 13 | 0.211 | 0.130 | 0.90 | 0.110 | 0.20 | 0.00 | 0.100 | 0.237 | 10.0 | 117 | 75 | CONC | 0.375 | 40.0 | 0.17 | 0.44 | 116 | 1.1 | 0.6 | 65% |
| MH13-3 | MH12-1 | 13 | 0.238 | 0.128 | 0.90 | 0.110 | 0.20 | 0.58 | 0.137 | 0.374 | 10.6 | 110 | 115 | 00110 | | | | <u> </u> | | | | |
| | | | | | | | | | | | | | | CONC | 0.450 | 86.0 | 0.38 | 0.44 | 188 | 1.2 | 1.2 | 61% |
| MH12-1 | MH12-2 | 13 | 0.249 | 0.106 | 0.90 | 0.143 | 0.20 | 0.50 | 0.124 | 0.498 | 11.8 | 104 | 144 | CONC | 0.450 | 55.0 | 0.24 | 0.44 | 100 | 1.0 | 0.0 | 76% |
| MH12-2 | OUTLET 12 | 13 | 0.299 | 0.139 | 0.90 | 0.161 | 0.20 | 0.52 | 0.157 | 0.655 | 12.6 | 100 | 183 | CONC | 0.450 | 55.0 | 0.24 | 0.44 | 188 | 1.2 | 0.8 | 76% |
| IVII I I Z | OUTLET 12 | 10 | 0.200 | 0.100 | 0.00 | 0.101 | 0.20 | 0.02 | 0.107 | 0.000 | 12.0 | 100 | 100 | CONC | 0.525 | 24.0 | 0.10 | 0.44 | 284 | 1.3 | 0.3 | 64% |
| 15+ | +500 to Existing MH 6663 | | | • | | | | | • | • | | • | • | • | | • | • | | | | | |
| | | | | 1 | T | · | | T | T | 1 | | 1 | T | | | | 1 | | T | | | |
| MH11-1 | MH11-3 | 11 | 0.310 | 0.194 | 0.90 | 0.116 | 0.20 | 0.64 | 0.198 | 0.198 | 10.0 | 114 | 63 | CONC | 0.375 | 76 | 0.38 | 0.50 | 124 | 1.1 | 1 1 | 51% |
| MH11-3 | 6663 | 11 | 0.225 | 0.139 | 0.90 | 0.086 | 0.20 | 0.63 | 0.142 | 0.340 | 11.1 | 108 | 102 | CONC | 0.375 | 76 | 0.36 | 0.50 | 124 | 1.1 | 1.1 | 51% |
| | OUTLET 11 | | | | | 0.000 | 0.20 | 0.00 | J | | | | | CONC | 0.375 | 100 | 0.50 | 0.50 | 124 | 1.1 | 1.5 | 82% |
| | 14+770 to 14+483 | | | | | | | | | | | | | | | | | | | | | |
| | | | 0.450 | 0.000 | T 000 | | | T | T | | | | T | | | <u> </u> | I | | T | | | |
| MH10-1 Ex. Area(B-451) | OGS10-1 Area=1.0Ha. | 10 | 0.156 1.100 | 0.089 0.880 | 0.90 | 0.067 0.220 | 0.20 0.20 | 0.60 0.76 | 0.094 0.836 | 0.930 | 10.0 | 114 | 295 | | | | | | | | | |
| Ex. Alea(B-431) | Alea-1.01ia. | | 1.100 | 0.000 | 0.90 | 0.220 | 0.20 | 0.70 | 0.630 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | CONC | 0.600 | 46 | 0.23 | 0.50 | 435 | 1.5 | 0.5 | 68% |
| OGS10-1 | OUTLET 10 | 10 | 0.123 | 0.069 | 0.90 | 0.054 | 0.20 | 0.59 | 0.073 | 1.945 | 11.6 | 105 | 569 | | | | | | | | | |
| Ex. Area(B-465) | Area=1.24 Ha. | | 1.240 | 0.992 | 0.90 | 0.248 | 0.20 | 0.76 | 0.942 | | | | + | CONC | 0.750 | 11.0 | 0.06 | 0.50 | 788 | 1.8 | 0.1 | 72% |
| MH10-2 | OGS10-2 | 10 | 2.296 | 0.101 | 0.90 | 2.195 | 0.20 | 0.23 | 0.530 | 1.822 | 10.0 | 114 | 579 | JOING | 0.700 | 11.0 | 0.00 | 0.00 | 7.00 | 1.0 | 0.1 | 12/0 |
| Ex. Area(B-837) | Area=0.42 Ha. | | 0.42 | | | | | | | | | | | | | | | | | | | |
| Ex. Area(B610) | Area=1.7 Ha. | | 1.7 | 1.360 | 0.90 | 0.340 | 0.20 | 0.76 | 1.292 | 0.5=5 | | 455 | | CONC | 0.750 | 120.0 | 0.60 | 0.50 | 788 | 1.8 | 1.1 | 73% |
| OGS10-2 Ex. Area(B-473) | OUTLET 10 Area=0.67 Ha. | 10 | 1.1841662 0.67 | 0.276 0.670 | 0.90 | 0.908 | 0.20 | 0.36 | 0.430 | 2.252 | 11.1 | 108 | 675 | | | | | | | | | |
| Ex. Alea(B-473) | Alea-0.07 Ha. | | 0.07 | 0.070 | | | | | | | | | | CONC | 0.825 | 46.0 | 0.16 | 0.35 | 850 | 1.6 | 0.5 | 79% |
| | 14+243 to 14+328 | • | | | • | | | • | • | • | | | • | | | | | | | | . | |
| | | | | ı | | T | | <u> </u> | | | | 1 | | , | | | 1 | | | | | |
| MH9-1 | OGS9-1 | 9 | 0.121 | 0.086 | 0.90 | 0.035 | 0.20 | 0.70 | 0.084 | 0.084 | 10.0 | 114 | 203 | | | - | | | | | | |
| Ex. Flow Equestrian Cr | n 176 l/s | | | | | | | | | | | | 470 | 00110 | 0.450 | | 0.0- | 0 =0 | 222 | 4 = | 0.0 | 0.50/ |
| OGS9-1 | OUTLET 9 | q | 0.159 | 0.096 | 0.90 | 0.062 | 0.20 | 0.63 | 0.099 | 0.184 | 10.6 | 111 | 176 233 | CONC | 0.450 | 50 | 0.35 | 0.70 | 239 | 1.5 | 0.6 | 85% |
| | OUTLETS | 9 | 0.100 | 0.000 | 0.00 | 0.002 | 0.20 | 0.03 | 0.033 | 0.104 | 10.0 | 111 | 200 | CONC | 0.450 | 17.0 | 0.70 | 1.35 | 331 | 2.1 | 0.1 | 70% |
| | 14+770 to 13+770 | • | | | | | • | • | • | • | • | | • | · | · · | · · | | <u> </u> | • | | | |
| | | | | | | T | | <u> </u> | | | | 1 | _ | , | | | 1 | | 1 | | | |
| MH8-2 | MH8-3 | 8 | 0.228 | 0.135 | 0.90 | 0.094 | 0.20 | 0.61 | 0.140 | 0.140 | 10.0 | 114 | 44 | 0010 | 0.075 | 05 | 0.00 | 0.40 | 444 | 4.0 | 4.0 | 400/ |
| | | | | 1 | 1 | <u> </u> | l | 1 | L | | <u> </u> | 1 | L | CONC | 0.375 | 95 | 0.38 | 0.40 | 111 | 1.0 | 1.6 | 40% |

Wyecroft Town of Oakville Storm Sewer Capacity (Conc. n = 0.013, P.V.C. n = 0.013, CSP n = 0.021)

| | Storm Sewer | | | | Propo | sed Road S | ubcatchmen | t Data | | | Desi | gn Flow Pea | ak Rate | | | St | orm Sew | er Data - Pro | posed Condition | on | | |
|-------------------------|-------------------------|--------------|----------------|----------------|---------------|-------------|--------------|-------------|--------|----------|--------------|-------------|----------------|-----------|--------|-----------------|---------|---------------|-----------------|-------|------|------------------|
| From | То | | Α | A1 | Runoff | A2 | Runoff | Avg. | AC | Accum. | Tc | I (5 yrs) | Q Prop.(5 yrs) | | Size | Pipe Length (L) | Fall | Slope (S) | Capacity (Q) | V | т | Q Prop. Capacity |
| Manhole | Manhole | Catchment ID | Total | Imperv. ha | Coeff. 1 C | Perv. ha | Coeff.2 C | Runoff C | ha | AC ha | | mm/hr | | Pipe Type | | | | % | | 700/0 | min. | % of Full |
| MH8-3 | OGS8-2 | 8 | ha 0.264 | 0.161 | 0.90 | 0.103 | 0.20 | 0.63 | 0.165 | 0.305 | min. 11.3 | 107 | L/s 90 | | m | m | m | 70 | L/s | m/s | min. | % OF Full |
| 141110 | 00002 | | 0.20 | 5.1.5 1 | 0.00 | 0.100 | 0.20 | 0.00 | 0.100 | 0.000 | 11.0 | 101 | | CONC | 0.375 | 60.0 | 0.24 | 0.40 | 111 | 1.0 | 1.0 | 81% |
| OGS8-2 | OUTLET8 | 8 | 0.243 | 0.141 | 0.90 | 0.102 | 0.20 | 0.61 | 0.147 | 0.147 | 11.6 | 105 | 43 | | | | | | | | | |
| N4110.4 | 00004 | | 0.007 | 0.405 | 0.00 | 0.404 | 0.00 | 0.00 | 0.404 | 0.404 | 40.0 | 444 | 24 | CONC | 0.375 | 30.0 | 0.12 | 0.40 | 111 | 1.0 | 0.5 | 39% |
| MH8-1 | OGS8-1 | 8 | 0.307 | 0.185 | 0.90 | 0.121 | 0.20 | 0.62 | 0.191 | 0.191 | 10.0 | 114 | 61 | CONC | 0.375 | 91.0 | 0.46 | 0.50 | 124 | 1 1 | 1.3 | 49% |
| OGS8-1 | OUTLET8 | 8 | 0.238 | 0.145 | 0.90 | 0.093 | 0.20 | 0.63 | 0.149 | 0.340 | 11.3 | 107 | 101 | OONO | 0.575 | 31.0 | 0.40 | 0.50 | 124 | 1.1 | 1.0 | 4570 |
| | | | | | | | | | | | | | | CONC | 0.375 | 23.0 | 0.12 | 0.50 | 124 | 1.1 | 0.3 | 81% |
| | 13+490 to 13+770 | | | | | | | | | | | | | | | | | | | | | |
| MH7-1 | MH7-2 | 7 | 0.205 | 0.091 | 0.90 | 0.113 | 0.20 | 0.51 | 0.105 | 0.105 | 10.0 | 114 | 33 | | | | | | | | | |
| | | | | | | | | | | | | | | CONC | 0.375 | 96 | 0.29 | 0.30 | 96 | 0.9 | 1.8 | 35% |
| MH7-2 | OGS7-1(C4) | 7 | 0.545 | 0.246 | 0.90 | 0.299 | 0.20 | 0.52 | 0.281 | 0.386 | 11.8 | 104 | 112 | 00110 | 0.450 | 400.0 | 0.00 | 0.00 | 450 | 4.0 | 4.7 | 700/ |
| | 13+060 to 13+490 | 1 | | | 1 | <u> </u> | <u> </u> | <u> </u> | | | | | 1 | CONC | 0.450 | 100.0 | 0.30 | 0.30 | 156 | 1.0 | 1.7 | 72% |
| MH6-1 | MH6-2 | 6 | 0.063 | 0.036 | 0.90 | 0.027 | 0.20 | 0.60 | 0.038 | 0.038 | 10.0 | 114 | 12 | | | | | | 1 | | | |
| | 2 | | | | | ,,,,,, | | | | | | | | CONC | 0.375 | 97 | 0.22 | 0.23 | 84 | 0.8 | 2.1 | 14% |
| MH6-2 | OGS6-1 | 6 | 0.085 | 0.057 | 0.90 | 0.028 | 0.20 | 0.67 | 0.057 | 0.095 | 14.5 | 92 | 24 | | | | | | | | | |
| OGS6-1 | OUTLET6 | 6 | 0.071 | 0.063 | 0.90 | 0.007 | 0.20 | 0.83 | 0.058 | 0.153 | 12.1 | 103 | 44 | CONC | 0.375 | 76.0 | 0.18 | 0.23 | 84 | 0.8 | 1.7 | 29% |
| 0030-1 | OOTLETO | 0 | 0.071 | 0.003 | 0.90 | 0.007 | 0.20 | 0.03 | 0.056 | 0.100 | 12.1 | 103 | 44 | CONC | 0.375 | 16.0 | 0.04 | 0.23 | 84 | 0.8 | 0.3 | 52% |
| MH6-3 | OGS6-2 | 6 | 0.056 | 0.023 | 0.90 | 0.034 | 0.20 | 0.48 | 0.027 | 0.027 | 12.5 | 101 | 8 | 33.13 | 0.07.0 | 10.0 | 0.01 | 0.20 | 1 | 0.0 | 0.0 | 0270 |
| | | | | | | | | | | | | | | CONC | 0.375 | 119.0 | 0.45 | 0.38 | 107 | 1.0 | 2.0 | 7% |
| OGS6-2 | OUTLET6 | 6 | 0.113 | 0.068 | 0.90 | 0.045 | 0.20 | 0.62 | 0.070 | 0.097 | 14.5 | 92 | 25 | 0010 | 0.075 | 44.0 | 0.05 | 0.00 | 407 | 4.0 | 0.0 | 000/ |
| | 12+600 to 13+060 | | | | | | | | | | | | | CONC | 0.375 | 14.0 | 0.05 | 0.38 | 107 | 1.0 | 0.2 | 23% |
| MH5-1 | OGS5-1 | 5 | 0.066 | 0.045 | 0.90 | 0.021 | 0.20 | 0.68 | 0.045 | 0.045 | 10.0 | 114 | 14 | | | | | | 1 | | | |
| | | | | | | | 0.20 | 0.00 | 0.0.10 | | 7010 | | | CONC | 0.375 | 100 | 0.35 | 0.35 | 104 | 0.9 | 1.8 | 14% |
| OGS5-1 | OUTLET5 | 5 | 0.067 | 0.058 | 0.90 | 0.009 | 0.20 | 0.81 | 0.054 | 0.098 | 11.8 | 104 | 29 | | | | | | | | | |
| MUEA 1 | MUEA 2 | <i>E</i> | 0.055 | 0.049 | 0.90 | 0.006 | 0.20 | 0.00 | 0.045 | 0.045 | 10.0 | 114 | 14 | CONC | 0.375 | 20 | 0.07 | 0.35 | 104 | 0.9 | 0.4 | 28% |
| MH5A-1 | MH5A-2 | 5 | 0.055 | 0.049 | 0.90 | 0.006 | 0.20 | 0.83 | 0.045 | 0.045 | 10.0 | 114 | 14 | CONC | 0.375 | 100 | 0.35 | 0.35 | 104 | 0.9 | 1.8 | 14% |
| MH5A-2 | OGS5A-1 | 5 | 0.049 | 0.045 | 0.90 | 0.004 | 0.20 | 0.85 | 0.042 | 0.087 | 11.8 | 104 | 25 | 00110 | 0.070 | 100 | 0.00 | 0.00 | 101 | 0.0 | 1.0 | 1170 |
| | | | | | | | | | | | | | | CONC | 0.375 | 100 | 0.35 | 0.35 | 104 | 0.9 | 1.8 | 24% |
| OGS5A-1 | OUTLET5 | 5 | 0.016 | 0.016 | 0.90 | 0.000 | 0.20 | 0.90 | 0.014 | 0.101 | 13.5 | 96 | 27 | 00110 | 0.075 | 100 | 0.05 | 0.05 | 101 | 0.0 | 4.0 | 1 |
| | 12+080 to 12+000 | | | | | | | | | | | | | CONC | 0.375 | 100 | 0.35 | 0.35 | 104 | 0.9 | 1.8 | 26% |
| MH4-1 | MHCB4-2 | 4 | 0.211 | 0.152 | 0.90 | 0.059 | 0.20 | 0.70 | 0.148 | 0.148 | 10.0 | 114 | 47 | | | | | | | | | |
| | | | | | | | | | | | | | | CONC | 0.375 | 60 | 0.30 | 0.50 | 124 | 1.1 | 0.9 | 38% |
| MHCB4-2 | OUTLET 4 | 4 | 0.259 | 0.149 | 0.90 | 0.110 | 0.20 | 0.60 | 0.156 | 0.305 | 10.9 | 109 | 92 | CONO | 0.075 | 4.4 | 0.07 | 0.50 | 404 | 4.4 | 0.0 | 740/ |
| MH4-2 | MH4-3 | 1 | 0.096 | 0.060 | 0.90 | 0.036 | 0.20 | 0.64 | 0.061 | 0.061 | 10.0 | 114 | 19 | CONC | 0.375 | 14 | 0.07 | 0.50 | 124 | 1.1 | 0.2 | 74% |
| IVII 1 '1 -2 | IVII I II -U | + + | 0.030 | 0.000 | 0.30 | 0.000 | 0.20 | 0.04 | 0.001 | 0.001 | 10.0 | 117 | 19 | CONC | 0.375 | 90 | 0.25 | 0.27 | 92 | 0.8 | 1.8 | 21% |
| MH4-3 | MH4-4 | 4 | 0.297 | 0.103 | 0.90 | 0.194 | 0.20 | 0.44 | 0.132 | 0.193 | 11.8 | 104 | 56 | | | | | | | | | |
| | | | | | | | | | | | | | | CONC | 0.375 | 40 | 0.11 | 0.27 | 92 | 0.8 | 0.8 | 61% |
| MH4-4 | MH4-5 | 4 | 0.157 | 0.044 | 0.90 | 0.112 | 0.20 | 0.40 | 0.062 | 0.256 | 12.6 | 100 | 71 | CONO | 0.075 | F0 | 0.44 | 0.07 | 00 | 0.0 | 4.0 | 700/ |
| MH4-5 | MHCB4-1 | 4 | 0.216 | 0.066 | 0.90 | 0.150 | 0.20 | 0.41 | 0.089 | 0.345 | 13.6 | 96 | 92 | CONC | 0.375 | 52 | 0.14 | 0.27 | 92 | 0.8 | 1.0 | 78% |
| 1411 1-7 | WII IODT 1 | - | J. <u>_</u> 10 | 0.000 | 0.00 | 3.100 | 0.20 | J.71 | 0.000 | 0.070 | 10.0 | | <u> </u> | CONC | 0.450 | 100 | 0.27 | 0.27 | 149 | 0.9 | 1.8 | 62% |
| MHCB4-1 | OUTLET4 | 4 | 0.510 | 0.256 | 0.90 | 0.254 | 0.20 | 0.55 | 0.281 | 0.736 | 15.4 | 89 | 182 | | | | | | - | | - | |
| 25 : : | | <u> </u> | 0.476 | 0.10= | | | 2.25 | 2.25 | | 0.11- | | | | CONC | 0.525 | 15 | 0.04 | 0.27 | 225 | 1.0 | 0.2 | 81% |
| CB4-1 | MHCB4-1 | 4 | 0.176 | 0.107 | 0.90 | 0.069 | 0.20 | 0.63 | 0.110 | 0.110 | 10.0 | 114 | 35 | CONC | 0.200 | 40 | 0.20 | 0.50 | 60 | 1.0 | 0.7 | E40/ |
| | | | | | 1 | | | <u> </u> | | | | | | CONC | 0.300 | 40 | 0.20 | 0.50 | 68 | 1.0 | 0.7 | 51% |

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

APPENDIX K: PAVEMENT AREA ANALYSIS & WATER BALANCE CALCULATIONS

August 22, 2019 K-1

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

Wyecroft Road From Bronte Road to Kerr Street Stormwater Management Summary

| | | | | Water Balar | nce Control | |
|---------------------|--------------------|----------|--|------------------|---|----------------------|
| Location/Station | Drainage Catchment | Required | | | Criteria | |
| 20041011701411011 | Catchment ID | (Yes/No) | Comments | Storm Event (mm) | Requirement | Reference |
| | C1 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C2 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C3 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C4 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C5 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C6 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| Wyecroft Road (from | C7 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| Bronte Road to Kerr | C8 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| Street) | C9 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C10 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C11 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C12 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C13 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | C14 | Yes | permeable pavement & vegetation infiltration | 5 | on-site storage of run-off from the storm event | MECP SMPDM 5.2.2 ii) |
| | Total | - | - | - | - | - |

K-2

Town of Oakville
Wyecroft Road Improvements Bronte Road to Kerr Street
Stormwater Management Report
Prepared by IBI Group

| | | | | | | | | | Pre-Deve | lopment Co | ndition | | | | | | | | | | |
|---------------------|--------------------|--------------|------------|-----------------------|-------|------------|----------|-------------------------------|------------------------|----------------|----------------|-----------------|-----------------|-----------------|------------------|----------------|----------------|----------|-----------------|-----------------|------------------|
| Location/Station | Drainage Catchment | | Area | (ha) | | % | Runof | f Coefficient (-) | Time of | | | Rainfall Inte | nsity (mm/hı | ·) | | | | Flow | v (m³/s) | | |
| | Catchment ID | Hard Surface | Vegetation | Permeable Pavement | Total | Impervious | Actual C | C Used in Flow Calculation | Concentration (min) | i ₂ | i ₅ | i ₁₀ | i ₂₅ | i ₅₀ | i ₁₀₀ | Q ₂ | Q ₅ | Q_{10} | Q ₂₅ | Q ₅₀ | Q ₁₀₀ |
| | C1 | 1.5400 | 1.1300 | 0.0000 | 2.67 | 57.68 | 0.60 | 0.60 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.368 | 0.511 | 0.604 | 0.726 | 0.815 | 0.899 |
| | C2 | 0.5500 | 0.4200 | 0.0000 | 0.97 | 56.70 | 0.60 | 0.60 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.132 | 0.184 | 0.217 | 0.261 | 0.293 | 0.323 |
| | C3 | 1.6100 | 0.9300 | 0.0000 | 2.54 | 63.39 | 0.64 | 0.64 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.373 | 0.519 | 0.612 | 0.737 | 0.827 | 0.912 |
| | C4 | 0.8600 | 1.1400 | 0.0000 | 2.00 | 43.00 | 0.50 | 0.50 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.229 | 0.318 | 0.375 | 0.451 | 0.507 | 0.559 |
| | C5 | 0.6300 | 0.5100 | 0.0000 | 1.14 | 55.26 | 0.59 | 0.59 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.153 | 0.212 | 0.250 | 0.301 | 0.338 | 0.373 |
| | C6 | 0.6900 | 0.6400 | 0.0000 | 1.33 | 51.88 | 0.56 | 0.56 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.171 | 0.238 | 0.280 | 0.337 | 0.379 | 0.418 |
| Wyecroft Road (from | C7 | 0.4170 | 0.3630 | 0.0000 | 0.78 | 53.46 | 0.57 | 0.57 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.102 | 0.142 | 0.168 | 0.202 | 0.227 | 0.250 |
| Bronte Road to Kerr | C8 | 0.8030 | 0.6370 | 0.0000 | 1.44 | 55.76 | 0.59 | 0.59 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.194 | 0.270 | 0.318 | 0.383 | 0.430 | 0.474 |
| Street) | C9 | 0.6900 | 0.2200 | 0.0000 | 0.91 | 75.82 | 0.73 | 0.73 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.152 | 0.211 | 0.249 | 0.300 | 0.336 | 0.371 |
| | C10 | 0.5600 | 0.4900 | 0.0000 | 1.05 | 53.33 | 0.57 | 0.57 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.137 | 0.191 | 0.225 | 0.271 | 0.304 | 0.336 |
| | C11 | 1.2500 | 0.7300 | 0.0000 | 1.98 | 63.13 | 0.64 | 0.64 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.290 | 0.403 | 0.476 | 0.573 | 0.643 | 0.709 |
| | C12 | 0.7900 | 0.4700 | 0.0000 | 1.26 | 62.70 | 0.64 | 0.64 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.184 | 0.255 | 0.301 | 0.363 | 0.407 | 0.449 |
| | C13 | 0.3400 | 0.2700 | 0.0000 | 0.61 | 55.74 | 0.59 | 0.59 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.082 | 0.114 | 0.135 | 0.162 | 0.182 | 0.201 |
| | C14 | 0.8100 | 0.7300 | 0.0000 | 1.54 | 52.60 | 0.57 | 0.57 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.200 | 0.278 | 0.328 | 0.394 | 0.443 | 0.488 |
| | Total | 11.5400 | 8.6800 | 0.0000 | 20.22 | 57.07 | 0.60 | - | - | - | - | - | - | - | - | 2.767 | 3.846 | 4.539 | 5.460 | 6.130 | 6.761 |

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Town of Oakville
Wyecroft Road Improvements Bronte Road to Kerr Street
Stormwater Management Report
Prepared by IBI Group

| | | | | | | | | | Post-Deve | elopment Co | ndition | | | | | | | | | | | |
|---------------------|--------------------|--------------|------------|-----------------------|-------|------------|---------------|---------------------|----------------|----------------|-----------------|-----------------|-----------------|------------------|----------------|----------------|-----------------|-----------------|------------------------|------------------|---------------------|----------------|
| Location/Station | Drainage Catchment | | Area (h | na) | | % | Runoff | Time of | | | Rainfall Inte | nsity (mm/h | nr) | | | | Flow | (m³/s) | | | Required Storage | Required Water |
| , | Catchment ID | Hard Surface | Vegetation | Permeable Pavement | Total | Impervious | Coefficient (| Concentration (min) | i ₂ | i ₅ | i ₁₀ | i ₂₅ | i ₅₀ | i ₁₀₀ | Q ₂ | Q ₅ | Q ₁₀ | Q ₂₅ | Q ₅₀ | Q ₁₀₀ | Volume (m³) | Balance (m³) |
| | C1 | 2.1033 | 0.7947 | 0.4024 | 3.30 | 63.73 | 0.65 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.487 | 0.677 | 0.798 | 0.961 | 1.078 | 1.189 | 227.88 | 165.02 |
| | C2 | 0.8236 | 0.3662 | 0.1745 | 1.36 | 60.36 | 0.62 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.194 | 0.269 | 0.318 | 0.383 | 0.430 | 0.474 | 103.43 | 68.22 |
| | C3 | 2.1126 | 0.7664 | 0.2953 | 3.17 | 66.55 | 0.67 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.483 | 0.671 | 0.791 | 0.952 | 1.069 | 1.179 | 218.45 | 158.72 |
| | C4 | 0.9934 | 1.0694 | 0.0983 | 2.16 | 45.97 | 0.52 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.257 | 0.358 | 0.422 | 0.508 | 0.570 | 0.629 | 94.83 | 108.06 |
| | C5 | 0.5025 | 0.4624 | 0.0693 | 1.03 | 48.59 | 0.54 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.128 | 0.177 | 0.209 | 0.252 | 0.282 | 0.312 | 0.00 | 51.71 |
| | C6 | 0.5211 | 0.6626 | 0.0768 | 1.26 | 41.34 | 0.49 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.141 | 0.196 | 0.231 | 0.278 | 0.312 | 0.344 | 0.00 | 63.02 |
| Wyecroft Road (from | C7 | 0.3375 | 0.3745 | 0.0980 | 0.81 | 41.67 | 0.49 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.091 | 0.126 | 0.149 | 0.179 | 0.201 | 0.222 | 0.00 | 40.50 |
| Bronte Road to Kerr | C8 | 0.8162 | 0.5385 | 0.1653 | 1.52 | 53.70 | 0.58 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.200 | 0.278 | 0.328 | 0.394 | 0.443 | 0.488 | 63.58 | 76.00 |
| Street) | C 9 | 0.6389 | 0.2832 | 0.0679 | 0.99 | 64.54 | 0.65 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.147 | 0.205 | 0.242 | 0.291 | 0.326 | 0.360 | 0.00 | 49.50 |
| | C10 | 0.5351 | 0.3093 | 0.1245 | 0.97 | 55.22 | 0.59 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.130 | 0.180 | 0.213 | 0.256 | 0.287 | 0.317 | 0.00 | 48.45 |
| | C11 | 1.1192 | 0.7199 | 0.2189 | 2.06 | 54.38 | 0.58 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.273 | 0.379 | 0.447 | 0.538 | 0.604 | 0.667 | 0.00 | 102.90 |
| | C12 | 0.7063 | 0.5969 | 0.0337 | 1.34 | 52.83 | 0.57 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.174 | 0.242 | 0.285 | 0.343 | 0.385 | 0.425 | 0.00 | 66.85 |
| | C13 | 0.2856 | 0.1614 | 0.0554 | 0.50 | 56.85 | 0.60 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.069 | 0.095 | 0.112 | 0.135 | 0.152 | 0.168 | 0.00 | 25.12 |
| | C14 | 0.7136 | 0.7265 | 0.1703 | 1.61 | 44.31 | 0.51 | 10.00 | 82.18 | 114.21 | 134.79 | 162.17 | 182.06 | 200.80 | 0.188 | 0.261 | 0.308 | 0.370 | 0.415 | 0.458 | 0.00 | 80.52 |
| | Total | 12.2089 | 7.8318 | 2.0507 | 22.09 | 55.27 | 0.59 | - | 1 | - | - | - | - | - | 2.960 | 4.113 | 4.854 | 5.840 | 6.556 | 7.231 | 708.18 | 1104.58 |

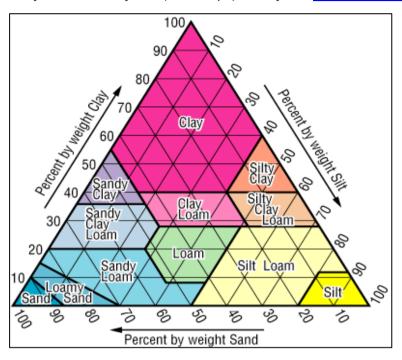
K-4 August 22, 2019

Water Balance Calculations

| | | Water | Balance Control - Infiltr | ation | | | |
|----------------------------|---|----------------------|---------------------------|-----------------------------|----------------------------------|------------------------|--------------------------------------|
| Location/Station | Required Infiltration Volume (m ³) | Type of Infiltration | Infiltration Area (m²) | ⁽¹⁾ Soil Texture | (2) Infiltration Rate (mm/hr) | Detention Time (hr) | Provided Infiltration Volume (m³) |
| Wyecroft Road (from Bronte | | Permeable Pavement | 20507.07 | Silty Clay | 4.83 | 24 | 2375.21 |
| Road to Kerr Street) | 1104.58 | Vegetation | 78318.47 | Silty Clay | 4.83 | 24 | 9071.16 |
| Road to Kerr Street) | | Total | 98825.54 | - | - | - | 11446.37 |

Notes:

⁽²⁾ Infiltration rate of soils (0-4% slope) taken from https://gcode.us/codes/sacramentocounty/view.php?topic=14-14 10-14 10 110



August 22, 2019 K-5

⁽¹⁾ Soil texture along Wyecroft Road corridor classified based on historical geotechnical reports completed for projects in the Oakville geographical area.

Storage Calculation for 100-Year Storm

Location/Station: Wyecroft Road (from Bronte Road to Kerr Street)

Catchment ID:

 $Q_{100} (m^3/s) = 1.189$ **Post-Development:** 100-year storm $Q_{100} (m^3/s) = 0.899$ **Pre-Development:** 100-year storm

 $Q_{control} (m^3/s) = 0.899$

| Inflow Paramo | eters (Post-Developm | ent) | | | | | | | | |
|----------------|----------------------|------|--|--|--|--|--|--|--|--|
| Area = 3.30 ha | | | | | | | | | | |
| R.C = | 0.65 | | | | | | | | | |

| IDE Curvo Data /Tourn | A = | 2150 |
|--|-----|-------|
| IDF Curve Data (Town of Oakville 100-Year) | B = | 5.7 |
| of Oakville 100-Teary | C = | 0.861 |

| Time | Intensity | Peak Flow | Inflow Volume | Release Rate | Outflow Volume | Storage |
|--------|-----------|-----------|-------------------|---------------------|-------------------|-------------------|
| (min) | (mm/hr) | (m³/s) | (m ³) | (m ³ /s) | (m ³) | (m ³) |
| 1.00 | 418.01 | 2.476 | 148.56 | 0.899 | 53.95 | 94.61 |
| 2.00 | 370.83 | 2.197 | 263.58 | 0.899 | 107.90 | 155.69 |
| 3.00 | 333.82 | 1.977 | 355.92 | 0.899 | 161.85 | 194.07 |
| 4.00 | 303.97 | 1.801 | 432.12 | 0.899 | 215.80 | 216.33 |
| 5.00 | 279.34 | 1.655 | 496.39 | 0.899 | 269.74 | 226.65 |
| 6.00 | 258.66 | 1.532 | 551.57 | 0.899 | 323.69 | 227.88 |
| 7.00 | 241.03 | 1.428 | 599.62 | 0.899 | 377.64 | 221.98 |
| 8.00 | 225.80 | 1.337 | 641.99 | 0.899 | 431.59 | 210.40 |
| 9.00 | 212.51 | 1.259 | 679.73 | 0.899 | 485.54 | 194.19 |
| 10.00 | 200.80 | 1.189 | 713.65 | 0.899 | 539.49 | 174.16 |
| Storag | | | | | | 227.88 |

Storage Calculation for 100-Year Storm

Location/Station: Wyecroft Road (from Bronte Road to Kerr Street)

Catchment ID:

 $Q_{control} (m^3/s) = 0.323$

 $Q_{100} (m^3/s) = 0.474$ **Post-Development:** 100-year storm $Q_{100} (m^3/s) = 0.323$ **Pre-Development:** 100-year storm

Inflow Parameters (Post-Development) Area = 1.36 ha R.C = 0.62

A = 2150 **IDF Curve Data (Town** B = 5.7 of Oakville 100-Year) C = 0.861

| Time | Intensity | Peak Flow | Inflow Volume | Release Rate | Outflow Volume | Storage |
|-------|---------------------|----------------------|----------------------|---------------------------|-----------------------------------|-------------------|
| (min) | (mm/hr) | (m ³ /s) | (m ³) | (m³/s) | (m³) | (m ³) |
| 1.00 | 418.01 | 0.986 | 59.17 | 0.323 | 19.38 | 39.80 |
| 2.00 | 370.83 | 0.875 | 104.99 | 0.323 | 38.75 | 66.23 |
| 3.00 | 333.82 | 0.788 | 141.77 | 0.323 | 58.13 | 83.64 |
| 4.00 | 303.97 | 0.717 | 172.12 | 0.323 | 77.51 | 94.61 |
| 5.00 | 279.34 | 0.659 | 197.72 | 0.323 | 96.89 | 100.83 |
| 6.00 | 258.66 | 0.610 | 219.70 | 0.323 | 116.26 | 103.43 |
| 7.00 | 241.03 | 0.569 | 238.84 | 0.323 | 135.64 | 103.20 |
| 8.00 | 225.80 | 0.533 | 255.72 | 0.323 | 155.02 | 100.70 |
| 9.00 | 212.51 | 0.501 | 270.75 | 0.323 | 174.40 | 96.35 |
| 10.00 | 200.80 | 0.474 | 284.26 | 0.323 | 193.77 | 90.48 |
| Stora | ge required to cont | rol 100-year post-de | evelopment peak flov | v to 100-year pre-develop | ment flow rate (m ³): | 103.43 |

August 22, 2019 K-6

Storage Calculation for 100-Year Storm

Location/Station: Wyecroft Road (from Bronte Road to Kerr Street)

Catchment ID:

 $Q_{100} (m^3/s) = 1.179$ **Post-Development:** 100-year storm $Q_{100} (m^3/s) = 0.912$ **Pre-Development:** 100-year storm

| $Q_{control} (m^3/s) = 0.91$ | $\mathbf{Q}_{\text{control}}$ | (m³/s) | = | 0.912 |
|------------------------------|-------------------------------|--------|---|-------|
|------------------------------|-------------------------------|--------|---|-------|

| Inflow Parameters (Post-Development) | | | |
|--------------------------------------|------|--|--|
| Area = 3.17 h | | | |
| R.C = | 0.67 | | |

| IDE Curvo Data /Town | A = | 2150 |
|--|-----|-------|
| IDF Curve Data (Town of Oakville 100-Year) | B = | 5.7 |
| | C = | 0.861 |

| Time | Intensity | Peak Flow | Inflow Volume | Release Rate | Outflow Volume | Storage |
|--------|--------------------|----------------------|----------------------|---------------------------|-----------------------------------|-------------------|
| (min) | (mm/hr) | (m ³ /s) | (m ³) | (m ³ /s) | (m ³) | (m ³) |
| 1.00 | 418.01 | 2.454 | 147.26 | 0.912 | 54.72 | 92.54 |
| 2.00 | 370.83 | 2.177 | 261.28 | 0.912 | 109.44 | 151.84 |
| 3.00 | 333.82 | 1.960 | 352.80 | 0.912 | 164.16 | 188.65 |
| 4.00 | 303.97 | 1.785 | 428.34 | 0.912 | 218.87 | 209.46 |
| 5.00 | 279.34 | 1.640 | 492.05 | 0.912 | 273.59 | 218.45 |
| 6.00 | 258.66 | 1.519 | 546.74 | 0.912 | 328.31 | 218.43 |
| 7.00 | 241.03 | 1.415 | 594.37 | 0.912 | 383.03 | 211.34 |
| 8.00 | 225.80 | 1.326 | 636.37 | 0.912 | 437.75 | 198.62 |
| 9.00 | 212.51 | 1.248 | 673.78 | 0.912 | 492.47 | 181.31 |
| 10.00 | 200.80 | 1.179 | 707.40 | 0.912 | 547.19 | 160.22 |
| Storag | e required to cont | rol 100-year post-de | evelopment peak flov | v to 100-year pre-develop | ment flow rate (m ³): | 218.45 |

Storage Calculation for 100-Year Storm

Location/Station: Wyecroft Road (from Bronte Road to Kerr Street)

Catchment ID: C4

Post-Development: $Q_{100} (m^3/s) = 0.559$ **Pre-Development:** 100-year storm

 $Q_{100} (m^3/s) = 0.629$ 100-year storm

| Inflow Parameters (Post-Development) | | | |
|--------------------------------------|------|----|--|
| Area = | 2.16 | ha | |
| R.C = | 0.52 | | |

| IDE Curvo Data /Town | A = | 2150 | |
|--|-----|-------|--|
| IDF Curve Data (Town of Oakville 100-Year) | B = | 5.7 | |
| | C = | 0.861 | |

| | . 3 | | | |
|----------|-----|-----|-----|-------|
| Qcontrol | (m) | /c) | = 0 | 1.559 |

| Time | Intensity | Peak Flow | Inflow Volume | Release Rate | Outflow Volume | Storage |
|--------|---|---------------------|-------------------|---------------------|----------------|---------|
| (min) | (mm/hr) | (m ³ /s) | (m ³) | (m ³ /s) | (m³) | (m³) |
| 1.00 | 418.01 | 1.309 | 78.56 | 0.559 | 33.53 | 45.03 |
| 2.00 | 370.83 | 1.162 | 139.39 | 0.559 | 67.07 | 72.32 |
| 3.00 | 333.82 | 1.046 | 188.22 | 0.559 | 100.60 | 87.61 |
| 4.00 | 303.97 | 0.952 | 228.51 | 0.559 | 134.14 | 94.38 |
| 5.00 | 279.34 | 0.875 | 262.50 | 0.559 | 167.67 | 94.83 |
| 6.00 | 258.66 | 0.810 | 291.68 | 0.559 | 201.20 | 90.47 |
| 7.00 | 241.03 | 0.755 | 317.09 | 0.559 | 234.74 | 82.35 |
| 8.00 | 225.80 | 0.707 | 339.50 | 0.559 | 268.27 | 71.22 |
| 9.00 | 212.51 | 0.666 | 359.45 | 0.559 | 301.81 | 57.65 |
| 10.00 | 200.80 | 0.629 | 377.39 | 0.559 | 335.34 | 42.05 |
| Storag | Storage required to control 100-year post-development peak flow to 100-year pre-development flow rate (m³): 94.83 | | | | | |

August 22, 2019 K-7 Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

Storage Calculation for 100-Year Storm

Location/Station: Wyecroft Road (from Bronte Road to Kerr Street)

Catchment ID: C8

Post-Development:100-year storm Q_{100} (m³/s) = 0.488Pre-Development:100-year storm Q_{100} (m³/s) = 0.474

| Alea – | |
|--------|--|
| R.C = | |
| | |

| IDF Curve Data (Town of Oakville 100-Year) | A = | 2150 | |
|--|-----|-------|--|
| | B = | 5.7 | |
| | C = | 0.861 | |

Inflow Parameters (Post-Development)

1.52

0.58

ha

| | . 2 | | |
|----------------------|-----|-------|---------|
| Q _{control} | (m³ | /s) = | - 0.474 |

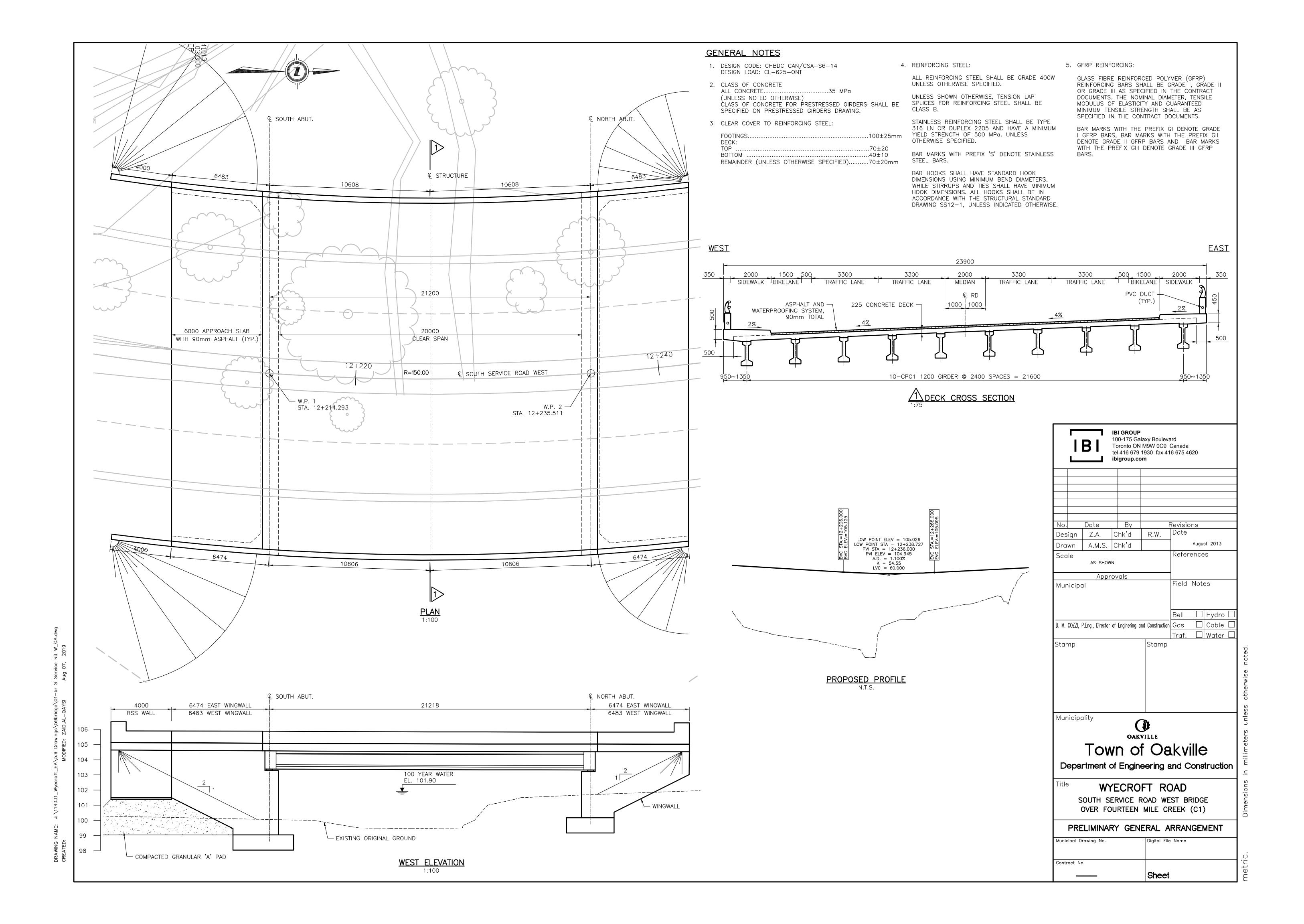
| Time | Intensity | Peak Flow | Inflow Volume | Release Rate | Outflow Volume | Storage |
|--|-----------|---------------------|-------------------|---------------------|-------------------|-------------------|
| (min) | (mm/hr) | (m ³ /s) | (m ³) | (m ³ /s) | (m ³) | (m ³) |
| 1.00 | 418.01 | 1.016 | 60.98 | 0.474 | 28.45 | 32.53 |
| 2.00 | 370.83 | 0.902 | 108.20 | 0.474 | 56.90 | 51.30 |
| 3.00 | 333.82 | 0.812 | 146.10 | 0.474 | 85.35 | 60.75 |
| 4.00 | 303.97 | 0.739 | 177.38 | 0.474 | 113.80 | 63.58 |
| 5.00 | 279.34 | 0.679 | 203.77 | 0.474 | 142.25 | 61.51 |
| 6.00 | 258.66 | 0.629 | 226.42 | 0.474 | 170.70 | 55.71 |
| 7.00 | 241.03 | 0.586 | 246.14 | 0.474 | 199.15 | 46.99 |
| 8.00 | 225.80 | 0.549 | 263.53 | 0.474 | 227.60 | 35.93 |
| 9.00 | 212.51 | 0.517 | 279.03 | 0.474 | 256.05 | 22.97 |
| 10.00 | 200.80 | 0.488 | 292.95 | 0.474 | 284.50 | 8.45 |
| Storage required to control 100-year post-development peak flow to 100-year pre-development flow rate (m ³): | | | | | | 63.58 |

August 22, 2019 K-8

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

APPENDIX L: PRELIMINARY GENERAL ARRANGEMENT DRAWING

August 22, 2019 L-1



Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group

APPENDIX M: SITE PHOTOGRAPHS

August 22, 2019 M-1

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



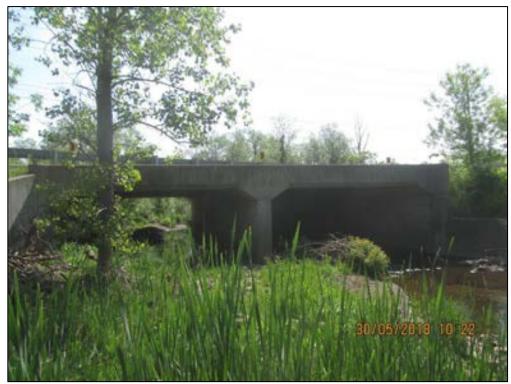
C1 - Upstream (1 of 6)



C1 - Upstream (2 of 6)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group





Upstream (3 of 6)



C1 - Upstream (4 of 6)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C1 – Upstream (5 of 6)



C1 - Upstream (6 of 6)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C1 - Upstream (North Chamber)



C1 - Downstream (North Chamber)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C1 - Downstream (South Chamber) (1 of 3)



C1 - Downstream (South Chamber) (2 of 3)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C1 - Downstream (South Chamber) (3 of 3)



C1 - Downstream (1 of 2)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C1 - Downstream (2 of 2)



C2 - Downstream (1 of 8)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C2 - Downstream (2 of 8)



C2 - Downstream (3 of 8)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C2 - Downstream (4 of 8)



C2 - Downstream (5 of 8)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C2 - Downstream (6 of 8)



C2 - Downstream (7 of 8)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C2 - Downstream (8 of 8)



C3 - Downstream (1 of 6)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C3 - Downstream (2 of 6)



C3 - Downstream (3 of 6)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C3 - Downstream (4 of 6)



C3 – Downstream (5 of 6)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C3 - Downstream (6 of 6)



C3 - Upstream (1 of 2)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C3 – Upstream (2 of 2)



C4 – Downstream (1 of 3)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C4 - Downstream (2 of 3)



C4 - Downstream (3 of 3)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C4 – Upstream (1 of 3)



C4 – Upstream (2 of 3)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C4 – Upstream (3 of 3)



C6 - Downstream (1 of 5)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C6 - Downstream (2 of 5)



C6 - Downstream (3 of 5)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C6 - Downstream (4 of 5)



C6 - Downstream (5 of 5)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C6 – Upstream (1 of 7)



C6 – Upstream (2 of 7)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C6 – Upstream (3 of 7)



C6 – Upstream (4 of 7)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C6 – Upstream (5 of 7)



C6 – Upstream (6 of 7)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C6 – Upstream (7 of 7)



C7 - Downstream (1 of 5)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C7 - Downstream (2 of 5)



C7 - Downstream (3 of 5)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C7 - Downstream (4 of 5)



C7 - Downstream (5 of 5)

Wyecroft Road Improvements Bronte Road to Kerr Street Stormwater Management Report Prepared by IBI Group



C7 – Upstream (1 of 2)



C7 – Upstream (2 of 2)