Mississauga Road (Regional Road 1)

From Financial Drive to Queen Street West (Reg. Rd. 6)
Municipal Class Environmental Assessment
Stormwater Management Report

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Submitted to:

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1.0 Introduction

The Regional Municipality of Peel (Region of Peel) is completing a Schedule 'C' Municipal Class Environmental Assessment (Class EA) for planned transportation improvements to accommodate future travel demand on Mississauga Road from north of Financial Drive to north of Queen Street West (ref. Figure 1.1: Key Plan). Wood has been retained by Region of Peel to complete the study.

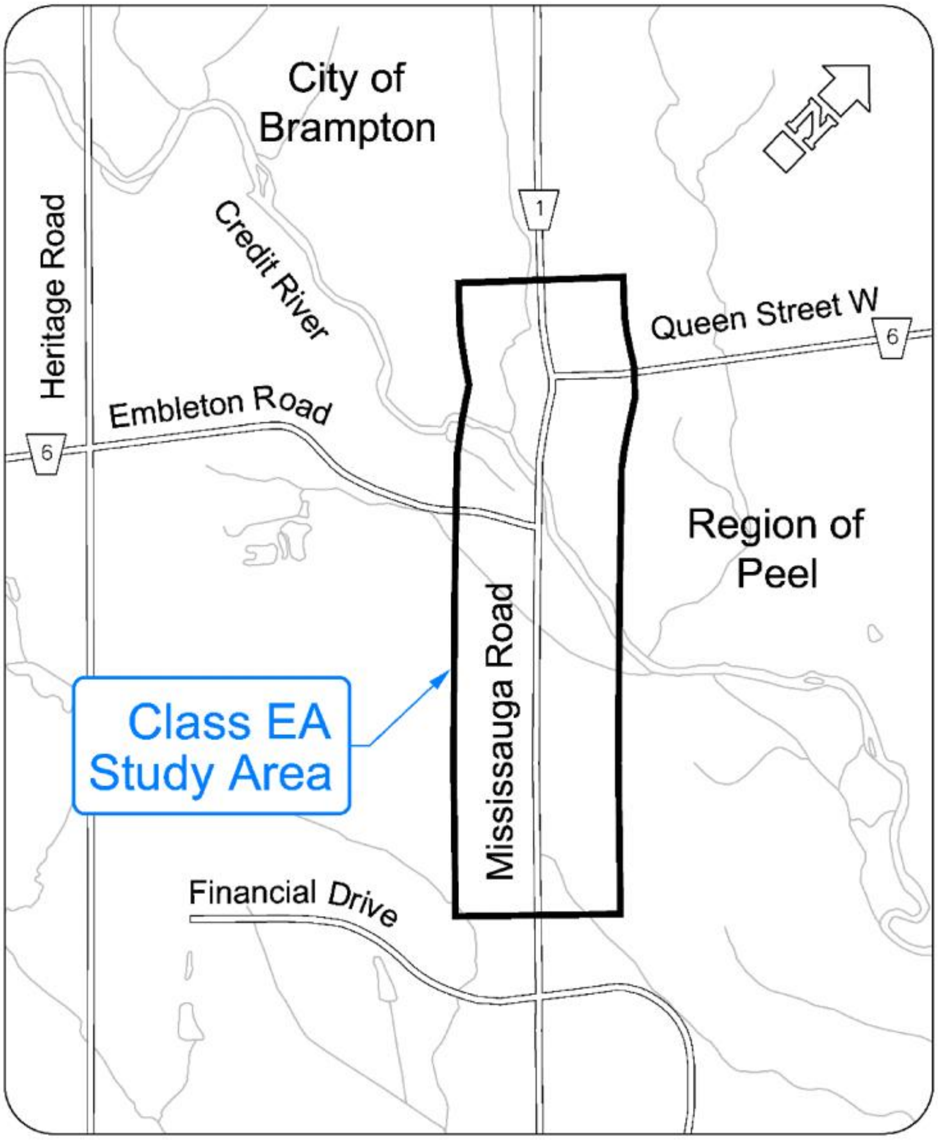


Figure 1.1 Key Plan

1.1 Project Description

Wood has been retained by the Region to undertake the technical studies required to complete a Schedule 'C' Municipal Class Environmental Assessment (Class EA) for this section of Mississauga Road.

In order to best address deficiencies (short-term and long-term issues related to future growth, operational, geometric and capacity issues) along Mississauga Road, a number of road improvement alternatives have been examined as part of the study, including widening of the roadway, cross-section improvements, intersection improvements, accommodation of pedestrians and cyclists and enhancement of traffic control. In addition, the impact of such improvements on the social and natural environments have been examined.

The proposed road improvements will include urbanization, widening and intersection improvements. This section of Mississauga Road, in its current 2017 condition, is urbanized and has various lane configurations. Immediately north of Financial Drive, 6 urbanized lanes exist, which is reduced to 4 lanes and turning lanes (at intersections) at the Lionhead Golf Club Road intersection to Queen Street.

The road improvements proposed by the Class EA will increase the Mississauga Road right-of-way (R.O.W.) from 4 to 6 lanes from Financial Drive to Queen Street West, with a fully urbanized R.O.W. (i.e. curb and gutter on both sides).

1.2 Background Information Collection and Review

The project limits, herein referred to as the Study Area, include approximately 1.85 km of Mississauga Road. The Study Area is a major north-south arterial road, located within the Credit River watershed. The Study Area contributes drainage directly to the Credit River and one (1) subwatershed, namely the Levi Creek subwatershed, for the road section south of Lionhead Golf Club Road to the study limits.

To assess the existing drainage systems and associated hydraulic crossings for the Study Area, previously completed reports, mapping, drawings and other documents have been obtained and reviewed. Summaries of the background information has been provided with this report as noted.

1.2.1 Reports

The following reports have been reviewed for background use in the drainage system assessment and analysis. Reports have been provided by the Region, City of Brampton and Aquafor Beech Ltd.

Design Brief, Region of Peel and Credit Valley Conservation Low Impact Development Design for Mississauga Road, Project 1: Mississauga Road (Credit River to Williams Parkway), Aquafor Beech Ltd., October 2016

The Design Brief outlines the detailed Low Impact Development (LID) design completed for Mississauga Road (Credit River to Williams Parkway). The Design Brief was prepared to address the need for quality controls for this section of Mississauga Road under its then current condition. The current condition consists of a 4 lane R.O.W. with a semi-urban cross-section.

The LID design is a combination of six (6) enhanced swales and one (1) bioswale, located within the center median adjacent to Stormwater Management (SWM) Facility W1 (northeast corner of Queen Street West and Mississauga Road Intersection). The LIDs receive runoff from a 27 mm storm event, collected and conveyed by the storm sewer within Mississauga Road. A flow splitter manhole is located at the intersection of Adamsville Road and Mississauga Road which directs the 27 mm peak flow to a storm sewer dedicated to the LIDs. The storm sewer conveys flows through an oil/grit separator (OGS) unit prior to discharging to an enhanced swale. The enhanced swales are connected in series, and are configured to allow flows to cascade from one to the next, and finally cascade to the bioswale. The LIDs are comprised of engineered soil media that promotes infiltration and evapotranspiration. Any runoff that filters through the entire series of LIDs is collected by an underdrain connected back to the Mississauga Road storm sewer, and conveyed to SWM Facility W1. The Design Brief also provides groundwater elevations along Mississauga Road between Queen Street and Bovaird Drive (ref. Section 2.3 for soils and groundwater information).

Stormwater Management Implementation Report, Draft Plan 21T-10020B, Four X Development Inc. Rand Engineering Corporation, September 2015.

Although not located within the Class EA limits, the section of road immediately adjacent to the Four X residential development drains south overland directly to the Credit River. As such this report provides background material for the Class EA.

The stormwater management report was prepared for the detailed design of two (2) SWM facilities located within the Four X residential development located west of Mississauga Road and north of Queen Street. The SWM facilities were sized to provide quantity controls for the 2-100 year and Regional Storm Events, and Enhanced (Level 1) water quality control for drainage from the Four X development. Erosion control is provided to meet extended detention criteria. The design of the SWM facilities does not account for drainage from the Mississauga Road R.O.W. However, prior to development the existing natural drainage outlet for a section of the Mississauga R.O.W. was through the Four X development site.

Stormwater Management Report, Bluegrass South Ltd. & Bluegrass Valley Properties Ltd., City of Brampton, Schaeffers Consulting Engineers, September 2013

Although not located within the Class EA limits, the section of Mississauga Road north of the Blue Grass residential development drains south overland directly to the Credit River, as such this report provides background material for the Class EA.

The stormwater management report was prepared for the detailed design of three (3) SWM facilities located within the Bluegrass South residential development, located east of Mississauga Road, on the north and south sides of Williams Parkway. One SWM facility of importance is SWM Facility H3, located south of Williams Parkway along Royal West Drive.

SWM Facility H3 was sized to provide quantity controls for the 2-100 year storm events, and Enhanced (Level 1) water quality control for drainage from the Bluegrass South residential development. Erosion control is provided to meet target outflow rates established based on erosion thresholds in the receiving watercourse. SWM Facility H3 outlets to Huttonville Creek.

The design of SWM Facility H3 accounted for storm drainage from 2.43 ha of the Mississauga Road R.O.W., between Williams Parkway and the drainage divide north of Williams Parkway, with the overland drainage being conveyed south to the Credit River.

Addendum to the Environmental Implementation Report for Riverview Heights/Block 40-3, City of Brampton, SLR Consulting Ltd. & R.J. Burnside & Associates Limited, January 2012

This report was prepared to address the proposed development known as Riverview Heights (Block 40-3 Bram West Secondary Plan). The development plan proposed a SWM facility adjacent to the Mississauga Road R.O.W. (ref. Figure 3.1 herein). The SWM facility captures and controls approximately 50.4 ha of the proposed development area, which includes a minor amount of overland drainage adjacent to Mississauga Road currently draining toward the R.O.W. All flows up to an including the Regional Storm Event discharge from the SWM Facility to a designated storm sewer located within the Mississauga Road R.O.W. The storm sewer outlets to the Credit River at Outlet 3. It is noted that the storm sewer conveys flows from the SWM Facility only (i.e. does not interact with drainage from the Mississauga Road R.O.W.).

Mississauga Road Widening, Highway 407 to Queen Street, Environmental Study Report Addendum #1, SNC Lavalin, July 2011

The stormwater management portion of this ESR Addendum outlines the design of the stormwater management strategy for Mississauga Road between Highway 407 to Queen Street, which covers the study area. The ESR Addendum was prepared subsequent to an original ESR completed by iTrans Consulting Inc. (September 2001, discussed below). The ESR recommended an increase from an original recommendation of a 4 lane R.O.W. to a 6 lane R.O.W. at Financial Drive (south limit of this study area). The report provides assessments of existing and proposed conditions, as well as recommended methods of stormwater quality and quantity treatment.

Although CVC criteria requires post-to-pre control for all storm events up to and including the Regional Storm (ref. Section 3.1.2), the report concluded that no stormwater quantity control would be required for the proposed road as the associated works would not adversely impact the receiving watercourses. The report concluded that enhanced level stormwater quality control is to be provided by use of oil/grit separators and various LIDs.

Contract 2 – Stormwater Management Report, Mississauga Road Improvement Project from Credit River Bridge to Williams Parkway, Queen Street from Royal West to Mississauga Road, The Municipal Infrastructure Group, July 2010

The stormwater management report outlines the design of the stormwater management strategy for a section of Mississauga Road identified as 'Contract 2'. The Contract 2 area extends from the Mississauga Road crossing of the Credit River to just north of Williams Parkway, as well as a portion of Queen Street West between Mississauga Road and Royal West Drive. The report was prepared as part of an earlier Class EA completed to expand the Contract 2 section of Mississauga Road from a rural R.O.W. to an urban R.O.W. between the Credit River Crossing and Ostrander Boulevard, and a semi-urban R.O.W. between Ostrander Boulevard and just north of Williams Parkway. The report provides assessments of existing and proposed conditions, as well as recommended methods of stormwater quality and quantity treatment.

The stormwater management strategy recommended in the report provides 10 year post-development to 10 year pre-development stormwater quantity control by the use of orifice plates and flood storage via storm sewers within the Mississauga Road R.O.W., as well as by utilizing adjacent stormwater management facilities W1 and H3, located east of the Mississauga Road R.O.W. Quality control is provided by OGS units and the SWM facilities. Erosion control is provided for the sections of Mississauga Road that drain to the SWM facilities. Multiple culverts were identified in the report, two of which were identified for replacement, and the rest identified for removal.

Stormwater Management Report, SWM Pond W1 (Regional Control), Chariot Subdivision 21T-05014B, Valdor Engineering Inc., December 2009

Although not located within the Class EA limits, the section of Mississauga Road north of and adjacent to the Chariot residential development drains south overland directly to the Credit River, as such this report provides background material for the Class EA. The Chariot residential development is located at the northwest corner of the Queen Street West and Mississauga Road interception.

The stormwater management report was prepared for the detailed design of SWM Facility W1, located at the northeast corner of Mississauga Road and Queen Street West. SWM Facility W1 was sized to provide quantity controls for the 2-100 year and Regional Storm Events, and Enhanced (Level 1) water quality control for drainage from the Chariot Subdivision. Erosion control is provided to meet target outflow rates established based on erosion thresholds in the receiving watercourse. SWM Facility W1 outlets to a tributary of the Credit River, located west of Mississauga Road.

The design of SWM Facility W1 accounted for storm drainage from a 45.0 m wide Mississauga Road R.O.W. between Queen Street West and Williams Parkway. The future Mississauga Road R.O.W. will range in width from 40.0 m to 55.0 m.

Stormwater Management Study, Mississauga Road, Class Environmental Assessment, Bovaird Drive to Queen Street, Trow Associates Inc., November 2006

This report provides background to the Class EA, based on the overland drainage from the Mississauga Road right-of-way north of Queen Street, being conveyed southerly to the Credit River, within the Class EA limits.

The stormwater management report outlines the design of the stormwater management strategy for a section of Mississauga Road between Bovaird Drive and Queen Street West. The report was prepared as part of an Class EA, to support the urbanization of Mississauga Road, in which the existing rural R.O.W. would be expanded and converted to a semi-urban R.O.W. The report provides assessments of existing and proposed conditions, as well as recommended methods of stormwater quality and quantity treatment.

The report concluded that no stormwater quantity control would be required for the proposed road as the associated works would not adversely impact the receiving watercourses. The report concluded that enhanced level stormwater quality control is to be provided by use of oil/grit separators and an enhanced swale.

Mississauga Road Class EA Highway 407 to Queen Street, iTRANS Consulting Inc., 2002

The Region of Peel completed a Schedule 'C' Class EA for Mississauga Road from Highway 407 northerly for approximately 4.5 km to Queen Street in the City of Brampton. The study recommended the following improvements in the study area:

- Widening of Mississauga Road to a 7 lane cross section from Highway 407 to Steeles Avenue, a 5 lane cross section from Steeles Avenue to just beyond the crest of the Credit River Valley and maintaining the 4 lane cross section from Embelton Road to Queen Street.
- Intersection improvements at Embelton Road.
- Allowance for traffic signals at Hallstone Road and the Lionhead Golf Course.

The Region of Peel completed an Addendum to the Mississauga Road Class EA from Highway 407 to Queen Street in 2011 as the Region identified the need for further improvements to Mississauga Road from Steeles Avenue northerly to Financial Drive. The EA addendum confirmed the need for 6 lanes along this section of Mississauga Road.

The Regional Municipality of Peel, Mississauga Road, Environmental Study Report, Highway 407 to Queen Street, iTRANS Consulting Inc., September 2001

The stormwater management portion of this ESR outlines the design of the stormwater management strategy for Mississauga Road between Highway 407 to Queen Street, which covers the study area. The ESR was prepared in support of a past Mississauga Road widening project that increased the number to lanes from 2 to 4 at Financial Drive (south limit of this study area). The report provides assessments of existing and proposed conditions, as well as recommended methods of stormwater quality and quantity treatment.

The report concluded that no stormwater quantity control would be required for the proposed road as the associated works would not adversely impact the receiving watercourses. The report concluded that enhanced level stormwater quality control is to be provided by use of oil/grit separators and various LIDs.

1.2.2 Mapping, Drawings and Documents

The following mapping, drawings and other documents have been reviewed for background use in the assessment and analysis of this study.

Credit Valley Conservation Authority (CVC)

- Subwatershed Maps; and
- CVC, Stormwater Management Criteria (August 2012).
- Credit River (Meadowvale to Norval) Flood Risk Map Sheets 4 to 6

Regional Municipality of Peel

- Guidelines for the Preparation of Stormwater Management Reports in Support of Municipal Class Environmental Assessment, Region of Peel, June 2014; and
- Various as-Constructed Plan and Profiles for Mississauga Road, prepared by SNC Lavalin (April 2013).

TMIG

- Mississauga Road Reconstruction (From Ostrander Blvd to Queen St) LID Drainage & Centre Median Design, Phase 2 LID Works, prepared by Aquafor Beech Ltd. (July 2016) – Issued for 90% Review;

Ministry of the Environment and Climate Change (MOECC)

- Amended ECA #2123-A8AR5D (May 7, 2016) for construction of stormwater infrastructure related to the retrofit of medians on Mississauga Road from Adamsville Road to Queen Street, in the City of Brampton.

1.2.3 Modelling

The following modelling has been reviewed for background use in the drainage system assessment and analysis.

Computational Hydraulics International (CHI)

A PCSWMM model of the LID retrofit strategy presented in the Aquafor Beech Project 1 Design Brief has been reviewed. The PCSWMM model extends from the Mississauga Road crossing of the Credit River to the drainage divide approximately 200 m north of Williams Parkway, as well as the section of Queen Street West between Mississauga Road and Royal West Drive that drains to the Credit River crossing. The model reflects the road conditions (lane configuration, imperviousness, etc.) that exist at this time. The model has been used as the base for the PCSWMM modelling completed for this EA Addendum.

Credit Valley Conservation Authority (CVC)

HEC-RAS hydraulic modelling for the Credit River and the Mississauga Road crossing has been reviewed. The HEC-RAS model provided by CVC is for the Credit River from Lake Ontario to Orangeville and includes peak flows for the 2 to 100 year storm events and Regional Storm Hurricane Hazel. The peak flows within the model, have been taken as the flows representative of current hydrologic conditions. Sections of interest for this Class EA include 9+844 to 8+797 which covers the Credit River crossing of Mississauga Road.

2.0 EXISTING CONDITIONS

2.1 Existing Conditions Storm Drainage

The existing roadway drainage is split between two (2) watercourses: the Credit River, and Levi Creek. The Credit River receives major system drainage from subcatchments north of Queen Street, as outlined herein.

That the minor system drains to Huttonville Creek and a tributary of the Credit River as outlined herein. As outlined in Section 1.1, the existing drainage system along Mississauga Road consists of a series of storm sewers conveying minor system flows, and a series of urban R.O.W.s (curb and gutter) conveying major system flows. The minor system conveys storm events up to the 10 year storm event, and the major system conveys storm events greater than the 10 year, up to the 100 year storm event. The overall existing drainage boundaries, minor and major systems drainage patterns, as well as storm sewers and LIDs are presented in Figure 3.1. Detailed subcatchment boundaries are presented in Figures 3.2 and 3.3. A description of the storm drainage systems, split between watercourses, is provided below. The following sections should be read in conjunction with Drainage Figures from the EA Addendum SWM Report (Mississauga Road, From North of Queen Street West to South of Bovaird Drive, Stormwater Management Report, 2017) (ref. Appendix C).

2.1.1 Huttonville Creek (Minor System)/ Credit River (Major System)

Drainage from Subcatchments S80 – S85 (0.72 ha, ref. Appendix C) undergoes a major/minor system split. The drainage from the east half of the R.O.W. is directed toward catchbasins located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are directed to the storm sewer system. The drainage from the west half of the R.O.W. is conveyed within the roadside ditch, and directed toward inlet pipes connecting to the storm sewer system. The storm sewer system, 300 mm in size, is conveyed by a storm sewer network through Mississauga Road, Williams Parkway, and Royal West Drive to SWM Facility H3 located along Royal West Drive, south of Williams Parkway. SWM Facility H3 outlets directly to Huttonville Creek and provides stormwater quantity, quality, and erosion control for the minor system drainage from Subcatchments S80 – S85, as well minor and major system drainage from the Bluegrass South residential development (Subcatchment SWMP-H3 – 43.95 ha) located on the northeast corner of the intersection of Williams Parkway and Mississauga Road (ref. Figure 3.1 in Appendix C). As per the "Stormwater Management Report, Bluegrass South Ltd. & Bluegrass Valley Properties Ltd" (Schaeffers Consulting Engineers, September 2013), SWM Facility H3 is sized to treat 2.43 ha of drainage from the Mississauga Road R.O.W. at 100 % imperviousness. The major system drainage from Subcatchments S80-S85 is conveyed by the semi-urban Mississauga Road R.O.W. to the Credit River Crossing, located south of Queen Street West (ref Figure 3.1 in Appendix C).

2.1.2 Tributary to Credit River (Minor System)/ Credit River (Major System)

Approximately 6.89 ha of the existing Mississauga Road R.O.W. is conveyed to the Tributary of the Credit River. As shown on Figures 3.2 – 3.4 (ref. Appendix C), drainage from Subcatchments S19 – S79 is conveyed south along Mississauga Road. Drainage on the east side of the R.O.W. is directed toward catchbasin manholes located along the curb/gutter of the urbanized R.O.W. Drainage from the west side of the R.O.W. is directed toward a roadside ditch which conveys major and minor system flows to inlet pipes located within Subcatchments S44 – S51. South of Subcatchment S44, the Mississauga Road R.O.W. becomes fully urbanized and drainage from both sides of the R.O.W. are directed toward catchbasins located along the curb/gutter. Drainage collected within the storm sewers north of Subcatchments S29 and S40 is conveyed to a flow splitter manhole located at the southeast corner of the Mississauga Road and Adamsville Road intersection (ref. Figure 3.1 in Appendix C). As per the "Design Brief, Region of Peel and Credit Valley Conservation Low Impact Development Design for Mississauga Road, Project 1: Mississauga Road (Credit River to Williams Parkway)" (Aquafor Beech Ltd., October 2016), the flow splitter manhole splits the minor system flows, directing flows from the first 27 mm of rainfall to an OGS and a series of enhanced swales and one (1) bioswale located within the center median of the Mississauga Road R.O.W. Flows in excess of the first 27 mm of rainfall are directed to a storm sewer located within the Adamsville Road R.O.W. The Adamsville Road storm sewer drains through a storm sewer network within the Chariot Subdivision residential development and outlets to the east forebay of SWM Facility W1, located at the northeast corner of Mississauga Road and Queen Street West (ref. Figure 3.1 in Appendix C).

The enhanced swales and bioswale located within the center median of the R.O.W. receive flows from a storm sewer designated for the 27 mm peak flows diverted by the flow splitter manhole (ref. Figure 3.1 in Appendix C). Flows entering the enhanced swales receives pre-treatment from an OGS unit (STC 6000) sized to provide 80% TSS removal. The storm sewer outlets to the surface of the first enhanced swale. The enhanced swales are oriented in series and spill in a cascading manner from one to the next, while the last enhanced swale spills to the bioswale. The bioswale contains an underdrain that collects any stormwater not absorbed by the media, and connects to the storm sewer within Mississauga Road, where drainage is conveyed to the west forebay of SWM Facility W1. The infiltration trenches were designed to provide Enhanced (Level 1) water quality treatment (80% TSS removal) for the area draining to it, as well as provide an erosion control benefit to the system by infiltrating the first 27 mm of rainfall (Aquafor Beech Ltd., October 2016). See Appendix 'A' for plan and cross-section details of the enhanced swales and bioswale.

Drainage south of Subcatchments S41 and S52 is directed toward catchbasins located along the curb/gutter of the urbanized R.O.W. Flows captured by the catchbasin manholes are directed to the storm sewer system, and conveyed to the west forebay of SWM Facility W1 (ref. Figure 3.1 in Appendix C). Flows within the storm sewer combine with flows from the bioswale collected by the underdrain.

SWM Facility W1 provides stormwater quantity, quality and erosion control for the minor system drainage from Subcatchments S19 – S79, as well as minor and major system drainage from the Chariot Subdivision residential development (Subcatchment SWMP-W1 – 43.45 ha) located along the east side of Mississauga Road (ref. Figure 3.1 in Appendix C). As per the "Stormwater Management Report, Chariot Subdivision (Valdor Engineering Inc., December 2009)", SWM Facility W1 is sized to treat 7.20 ha of drainage from the Mississauga Road R.O.W. at 100% imperviousness. SWM Facility W1 outlets to the tributary of the Credit River via a 1500 mm diameter storm sewer crossing beneath Mississauga Road, and through a headwall located on the west side of Mississauga Road (ref. Figure 3.4 in Appendix C). The major system drainage from Subcatchments S19 – S79 is conveyed by the Mississauga Road R.O.W. to the Credit River Crossing.

2.1.3 Credit River - Outlet 1

Drainage from 9.06 ha of the Mississauga Road R.O.W. is conveyed to the Credit River. Drainage from Subcatchments S1 – S18 (1.49 ha) is conveyed south along the Mississauga Road R.O.W. toward the Credit River Crossing (ref. Figure 3.4 in Appendix C). Drainage from Subcatchments S103 – S116 (1.87 ha) is conveyed west along the Queen Street West R.O.W. toward Mississauga Road (ref. Figure 3.5 in Appendix C). Minor and major system drainage Queen Street West combines with minor and major system drainage from Mississauga Road within the intersection. Minor system drainage within the Mississauga Road storm sewer is conveyed to Outlet 1, located immediately downstream of the Credit River Crossing (ref. Figures 3.1 and 3.2). This section of Mississauga Road, as well as Queen Street West are fully urbanized, and storm drainage is directed to catchbasin maintenance chambers located along the curb/gutters. The storm sewer system (ranging in size from 300 mm to 675 mm diameter) collects and conveys the minor system runoff to Outfall 1. Various portions of this section of the Mississauga Road R.O.W. are directed toward the center median and are initially collected by a series of planting beds containing a biomedia material. The planting beds are located between 20 m and 140 m south of Queen Street West. The planting beds contain an underdrain that collects any stormwater not absorbed by the biomedia, and conveys it to the storm sewer within Mississauga Road. Appendix 'A' provides plan and cross-section details of the enhanced swales and bioswale. As per the "Contract 2 – Stormwater Management Report" (TMIG, July 2015) described in Section 2.1, the minor system (10 year) peak flow rates generated by this portion of Mississauga Road are reduced to an established 10 year pre-development release rate. The peak flows are reduced by a 370 mm diameter orifice plate located within a control manhole, and 13 m3 of stormwater storage which is provided within the storm sewer. Prior to discharging to the Credit River, storm drainage conveyed by the storm sewer is treated by an Oil/Grit Separator (OGS) unit (CDS PMSU30_30_8) sized to provide 80% TSS removal.

Major system drainage from the Mississauga Road R.O.W. is conveyed within the R.O.W. to the low point of Mississauga Road, approximately 140 m south of the Credit River Crossing where the local sewer system collects and conveys drainage to Outlet 3.

2.1.4 Credit River - Outlet 2 (Minor System)

Minor system drainage from subcatchments S334, S335, S-EXCBMH5, and S-EXCBMH6 (0.43 ha) and subcatchments representing Embelton Road drainage (0.87 ha) is conveyed via the existing storm sewer system to Outlet 2, while the major system drainage is conveyed to Outlet 3, located immediately south of the Embelton Road and Mississauga Road intersection (ref. Figures 3.1 and 3.2).

2.1.5 Credit River - Outlet 3 (Minor System)

Outlet 3 is the minor system outlet located just north of the Mississauga Road Sag 1 (ref. Figures 3.1 and 3.2). Outlet 3 is the storm sewer system outlet for all of the Mississauga Road right-of-way drainage from the drainage divide between the Credit River and Levi Creek, located immediately south of the Mississauga Road and Lionhead Golf Club Road. Subcatchments S301 to S331A representing 3.49 ha outlet through Outlet 3. The storm sewer system, ranges from 300 mm to 675 mm in diameter. Prior to discharging to the Credit River, storm drainage conveyed by the storm sewer is treated by an Oil/Grit Separator unit (CDS PMSU30_35_6) sized to provide 80% TSS removal. The storm sewer outlet is a combined headwall, providing an outlet for the Mississauga Road storm sewer, as well as a storm sewer conveying flows from an upstream development. As shown on Figure 3.3, a future SWM Facility located within the Riverview Heights Development lands (Block 40-3 Bram West Secondary Plan), discharges to a storm sewer located within the Mississauga Road R.O.W. The storm sewer ranges in size from a 1200 mm diameter circular pipe to an 865 mm x 1355 mm elliptical pipe. The future SWM Facility storm sewer outlet does not collect any flows from the Mississauga Road R.O.W.

The existing storm sewer system conveying drainage from the Mississauga Road is surcharged during the 10 year storm event from the base of the Credit River valley wall to the storm sewer outlet to the Credit River.

2.1.6 Credit River – Mississauga Road Sag 1 (Major System)

The Mississauga Road Sag 1 located south of Outlet 3 provides the overland drainage (major system) route for drainage conveyed south to the Credit River and from the south limit of Subcatchments S310 and S311, to discharge to the Credit River. Outlet 3 receives 14.36 ha of overland drainage from Mississauga Road and sections of Queen Street and Embelton Road. That said, due to the depth of Road Sag 1 and the flow capacity of the storm sewer system, no overland flow is conveyed during the 100 year storm (ref. Figures 3.1 to 3.3).

2.1.7 Local Overland Outlets (Major System)

Local overland drainage outlet exists at the drainage boundaries of S324A/S324B and S302BA/S302B. Overland drainage for storm events greater than the 100 year is collected and conveyed to the storm sewer system on Mississauga Road due to road sag depths and conveyance capacity of the sewer system (ref. Figure 3.3).

Road Sag 2 provides 0.18 m of ponding depth prior to spilling north toward Road Sag 1. Road Sag 3 provides a ponding depth of 0.30 m of ponding depth prior to spilling east toward Lion Head Golf Club.

2.1.8 Levi Creek

Only a small area (<0.20 ha) of Mississauga Road, within the Class EA limits drains to the Levi Creek. This area is located north of Financial Drive, south of Lion Head Golf Club Road (ref. Figure 3.3). North of Financial Drive the storm sewer system ranges from 300 mm to 450 mm in diameter and collects and conveys the minor system runoff to the Levi Creek crossing. Levi Creek is located approximately 1.5 km to the south of Financial Drive. A storm sewer system located within the Mississauga Road R.O.W. collects and conveys storm drainage along the entire length of Mississauga Road to Levi Creek. Major system drainage is conveyed by the R.O.W. to the Levi Creek crossing. There are no flood controls existing for the Mississauga Road drainage to Levi Creek. Prior to discharging to Levi Creek, storm drainage conveyed by the storm sewer is treated by two (2) Oil/Grit Separator units (both are CDS PMSU40_40_10) sized to provide 80% TSS removal.

2.2 Hydraulic Crossings

As shown on Figure 3.1, there are four (4) hydraulic crossings within the Study Area. The Credit River Bridge is a 68 m +/- span by 18.6 m +/- wide structure with two (2) piers and three (3) spans each of 23 m +/- length within the Credit River Valley. CVC provided the current Credit River HEC-RAS (Version 4.1.0) hydraulic model for use in this study. The HEC-RAS model has been reviewed to ensure that parameters and computation methods of the model align with CVC Standard Parameters. The following items were noted to not follow the Standard Parameters:

- Friction Slope Method not set to "Program Selects Appropriate method"
- Maximum number of iterations was not set to 40
- Critical Depth Computation Method was not set to "Multiple Critical Depth Search"
- The Momentum Equation was not computing using the Weight Force Component
- The Bridge Modelling computations were not utilizing the Yarnell Equation
- A Max Low Chord was specified under the Bridge Modelling Approach Editor
- Several Manning's 'n' values did not match that standard CVC parameters
- Starting Water Surface Elevations were not specified as a downstream boundary condition for cross-section 0.000 located at Lake Ontario

The HEC-RAS model was revised to follow the CVC Standard Parameters, as listed above, with the exception of the discrepancies in Manning's 'n' values and starting water surface elevations. The Manning's 'n' values were not revised as the locations with discrepancy values are located outside of the study area, and therefore considered outside of the project scope. The starting water surface elevations were not assigned in the model as the study area is located several kilometres upstream of Lake Ontario, and Lake Ontario water levels are not considered to have any impact on the computed water surface elevations within the study area.

The Mississauga Road crossing has been modelled as a bridge. The Credit River Conservation Authority HEC-RAS hydraulic modelling has been updated based on existing drawings of the bridge structure. Details are provided in Table 2.1 below, and existing conditions floodlines are shown on Figure 6.1.

Table 2.1. Simulated Regional Storm Event Water Surface Elevations – Existing Crossing (m)

Cross Section I.D.	Water Level - Existing Conditions
9+844	186.00
9+570	185.38
Mississauga Road Crossing	
9+477	184.28
9+284	182.67

Further details pertaining to the WSELs for all storm events (2-100 year & Regional) are provided in Appendix 'B'. Based on the updated hydraulic modelling the crossing (with a bridge deck elevation of 185.00 m) is capable of conveying the 100 year storm event (maximum elevation of 183.70 m, which is at the bridge soffit), but is overtopped by the Regional Storm (maximum elevation of 185.68 m, at a flow depth of 0.68 m +/-). The maximum overtopping of Mississauga Road occurs approximately 140 m south of the structure at Road Sag 1 (maximum simulated elevation of 185.68 m for the Regional Storm, with a maximum depth of 1.18 m +/-). At the bridge crossing, based on the simulated 0.68 m overtopping road depth and 0.42 m/s +/- flow velocity, and using MNRF's vehicle ingress and egress requirements (Technical Guide – River and Stream Systems: Flooding Hazard Limit, 2002), vehicles would not be able to drive along Mississauga Road at the Credit River crossing during the Regional Storm Event. Vehicle passage would not be available at the Road Sag 1 due to the 1.18 m flow depth in the Regional Storm. Also, based on the simulated overtopping depth and flow velocity, and using CVCs floodproofing requirements (Watershed Planning and Regulation Policies, 2010), safe access criteria is not achieved by the existing roadway during the Regional Storm. CVC criteria allows a maximum overtopping depth of 0.3 m, and overtopping flow velocity of 1.3 m/s (ref. Section 7.5 of the Watershed Planning and Regulation Policies document).

The existing Credit River Regional Floodplain is presented in Figure 6.1 (attached). As indicated, the Regional Storm Floodplain overtops the Mississauga Road R.O.W, with flooding of the residential area just upstream of the bridge on the south side of the crossing.

The second crossing (Crossing C9) is a 1.4 m x 0.9 m CSP arch culvert that conveys runoff from west of Mississauga Road to the Credit River. The third crossing (Crossing C8) is adjacent to the CSP crossing, and is a 0.6 m diameter CSP culvert. The fourth crossing (Crossing C7) is located further south along Mississauga Road, just north of the Lion Head Golf Club Road, and is a 1.1 m x 0.7 m CSP arch culvert. Crossings C8 and C7, draining from west to east are considered to be equalization culverts. Crossing C9 is located within an unnamed tributary of the Credit River. The unnamed tributary is known to be a regulated watercourse.

2.3 Soils and Groundwater

The surficial soils beneath the Mississauga Road R.O.W. (just north of Queen Street West) consist primarily of fill material. Between Queen Street West and Williams Parkway, the fill material consists primarily of silty fine sand (saturated hydraulic conductivity = 6.3 mm/hr, Aquafor Beech Ltd., October 2016).

Surficial soils within the Bluegrass South and Chariot Subdivision residential developments are noted to consist of silty clay and clayey silt (Schaeffers Consulting Engineers, September 2013 & Valdor Engineering Inc., March 2007).

Borehole log information provided in the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) indicates that groundwater was not encountered in any boreholes between Queen Street West and approximately 140 m north of Williams Parkway, with the exception of BH110, located approximately 150 m south of Williams Parkway, where groundwater was encountered at 4.2 m below the existing road grade. Borehole depths in this section of Mississauga Road range from 3.8 m to 5.7 m. Between 140 m north of Williams Parkway to Bovaird Drive, groundwater was encountered in all boreholes, ranging in depths of 1.4 m – 4.4 m below the existing road grade. Appendix 'A' provides the soil stratigraphy and groundwater information provided in the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) and Hydrogeological Study (AES, November 2010).

Wood has advanced and prepared borehole logs for this section of Mississauga Road (ref. Appendix A). The soils beneath the Mississauga Road R.O.W. between Queen Street and Lion Head Gold Club Road are fill material consisting primarily of sand, with trace gravel and silt (saturated hydraulic conductivity of sand = 120 mm/hr, User's Guide to SWMM5, 13th Edition). Groundwater depths within this section of Mississauga Road range from 1.8 m to 5.5 m below existing grade, with some boreholes not encountering groundwater. Groundwater was encountered at 1.8 m below grade within the vicinity of Outlet 1, outside of the R.O.W. limits within borehole BH B6 at road station 11+550. The shallowest depth of groundwater encountered within the R.O.W. limits was 2.1 m within borehole BH25, south of Outlet 3 at road station 11+200.

2.4 Existing Conditions Hydrology

A hydrologic model of the existing conditions of the Mississauga Road R.O.W. has been developed in PCSWMM Version 7.0. The original PCSWMM model was developed as part of the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) by CHI and was designed to include the drainage to SWM Facilities H3 and W1, as well as the drainage to Huttonville Creek immediately downstream of Culvert C4, assessed as part of the Class EA Addendum (Mississauga Road, From North of Queen Street West to South of Bovaird Drive, Stormwater Management Report, 2017). The

PCSWMM modelling was updated for the hydrologic/hydraulic assessment within the Class EA Addendum. As a section of Mississauga Road drains southerly overland to the Credit River, the updated EA Addendum PCSWMM model has been extended by Wood for the hydrologic/hydraulic assessment of Mississauga Road within the spatial limits of the Class EA.

A review of the original PCSWMM model developed by CHI has been completed, and the following items in relation to the selected parameters are important to note:

Subcatchments

- The Manning's 'n' value assigned to impervious surfaces is 0.012. Typical industry standard for this parameter is 0.013;
- The Manning's 'n' value assigned to pervious surfaces is 0.24. Given the type of pervious surfaces being modelled (i.e. manicured grass), typical industry standard for this parameter is 0.025 (sheet flow);
- The depression storage assigned to impervious surfaces is 2.5 mm. Typical industry standard for this parameter is between 1 mm – 2 mm; and
- The initial deficit fraction assigned is 0.315. Based upon review of Table 24.2 within the User's guide to SWMM5, 13th Edition, the initial deficit fraction for soils described in the Design Brief, Project 1 (Aquafor Beech Ltd., October 2016) would be 0.217.

While the manning's 'n' and depression storage values assigned by CHI differ slightly from typical standards they are within a reasonable range and have been maintained in the model. In keeping with these values, additional subcatchments added to the PCSWMM model by Wood have maintained these base values. The initial deficit fraction has been changed to match Table 24.2 of the User's guide to SWMM5 for soils within this section of Mississauga Road. Subcatchments added to the PCSWMM model were assigned values from Table 24.2 corresponding to their respective subsurface soils conditions described in Section 2.3.

Storm Sewers

- The entrance and exit loss coefficients assigned to storm sewers are 0.2 and 0.4 respectively. Typical industry standards for these parameters ranges from 0.15 – 1 (reference U.S. Department of Transportation Federal Highway Administration Hydraulic Engineering Circular 22 – Urban Drainage Design Manual, September 2009);
- The Manning's 'n' value assigned to road surfaces is 0.014. Typical industry standard for this parameter is 0.013; and
- The Manning's 'n' value assigned to ditches is 0.03. Typical industry standard for this parameter is 0.25.

Although the entrance and exit loss coefficients and manning's 'n' values assigned to road surfaces are not per industry standard they are still within a reasonable range and have been maintained in the model. In keeping with these values, the storm sewers and road surfaces added to the

PCSWMM model were also assigned these values. Roadside ditches were not added to the PCSWMM model.

The PCSWMM model developed for existing conditions models the drainage boundaries presented in Figures 3.1 – 3.3 and EA Addendum Figures 3.1 – 3.5 (ref. Appendix C). The PCSWMM model also incorporates SWM Facility W1, the enhanced swales and bioswale located within the center median (Aquafor Beech Ltd., October 2016), and SWM Facility H3 (Schaeffers Consulting Engineers, September 2013).

The simulated results under existing conditions at the various minor and major system outlets for the Credit River and Levi Creek have been provided within Table 2.2. The Credit River subcatchments have been assessed for the 2 to 100 year storm events and the Levi Creek subcatchments have been assessed for the 2 to 100 year and Regional Storm Events. Regional Storm peak flows are required to be assessed for Levi Creek due to the Regional Storm control requirement (CVC Stormwater Management Criteria, 2012). In keeping with the "Credit Valley Subwatershed study, Huttonville Creek (7), Springbrook Creek (8a), Churchville Tributary (8b), draft Appendices" (Totten Sims Hubicki Associates, January 2004) the 24-hour SCS storm event has been modelled. Parameterization of the model incorporates the soils information described in Section 2.3.

It is noted that the PCSWMM model has not been calibrated, however the results of the model are considered appropriate for the current study as the applied parametrization is within reasonable range of industry standards, as outlined above. Refer to Figures 3.1 – 3.3 for locations of outlets.

Table 2.2. **Simulated Peak Flows for Nodes of Interest under Existing Conditions(m^3/s)**

Storm Event	Outlet 1 (11.13 ha) [1]	Outlet 2 (1.30 ha)	Outlet 3 (3.49 ha)	Road Sag 1 (14.70 ha) [2]	Road Sag 2 (1.72 ha)	Road Sag 3	Levi Creek
2 year	0.38	0.16	0.54	0	0	0	0.17
5 year	0.51	0.21	0.78	0	0	0	0.24
10 year	0.60	0.23	0.87	0	0	0	0.26
25 year	0.69	0.29	1.07	0	0	0	0.34
50 year	0.71	0.33	1.16	0	0	0	0.39
100 year	0.73	0.36	1.21	0	0	0	0.43
Regional	NA	NA	NA	NA	NA	NA	0.15

Notes: [1] Minor system drainage to Outlet 1 is only 3.53 ha.
[2] Inclusive of major system drainage from Outlets 1 and 2, and Road Sag 2.

The simulated peak flow results indicate that spill does not occur at Road Sags 1 – 3 for events up to the 100 year storm (i.e. flow equals zero), demonstrating that the R.O.W. drainage is self-contained under existing conditions. By extension of this result, it is noted that R.O.W. drainage does not have an impact on the quality and quantity aspects of the Provincially Significant Wetlands located on the east and west side of the R.O.W., adjacent to Subcatchments 324A – 327.

The simulated results also indicate that the 100 year peak flow for drainage to Levi Creek is greater than the Regional Storm peak flow under existing conditions. This is to be expected due to the small contributing area to Levi Creek from the R.O.W.

Existing minor and major system issues exist at the following locations:

- Moderate surcharge of the storm sewer from Outlet 3 to the base of Credit Valley
- Minor surcharge of the storm sewer system within Subcatchments 302 to 305
- Road Sag 1 ponding depths range from 0.11 m to 0.26 m +/- for the 10 year storm event to the 100 year storm event. Road Sag 2 ponding depths range from 0.08 m to 0.17 m +/- for the 10 year storm event to the 100 year storm event. Road Sag 3 ponding depths range from 0.12 m to 0.23 m +/- for the 10 year storm event to the 100 year storm event.

3.0 STORMWATER OBJECTIVES

3.1 Stormwater Management Design Criteria

The stormwater management analyses of the Mississauga Road widening will consider stormwater management design criteria from several agencies including; the Region of Peel, the City of Brampton (City), the Credit Valley Conservation Authority (CVC), the Ministry of Transportation (MTO), the Ministry of Natural Resources and Forestry (MNRF), and the Ministry of Environment and Climate Change (MOECC). The stormwater management criteria relevant to the Mississauga Road widening are outlined below.

3.1.1 The Region of Peel

- *Minor System:* Storm sewers are to convey the 10 year storm event, and are to be designed using local municipality (City of Brampton) IDF information;
- *Major System:* Regional road R.O.W.s, including both urban and rural, are to convey flows generated by the R.O.W. itself, up to the 100 year storm event;
- External lands should not drain to the Region's storm sewer system; and
- No overtopping of the roadway during the Regional Storm Event at cross culverts and bridges.

3.1.2 The Credit Valley Conservation Authority

Credit River – Norval to Port Credit

- *Quantity Control:* No control is required for all storm events;
- *Quality Control:* MOE Enhanced Level (Level 1) Water Quality Control. A treatment train solution is to be implemented;
- *Water Balance:* Minimum infiltration of 3 mm is required.
- *Erosion Control:* Minimum infiltration of 5 mm is required.

Levi Creek

- *Quantity Control:* Required for all storm events including Regional Storm (Hurricane Hazel);
- *Quality Control:* MOE Enhanced Level (Level 1) Water Quality Control. A treatment train solution is to be implemented;
- *Water Balance:* Minimum infiltration of 3 mm is required.
- *Erosion Control:* Minimum infiltration of 5 mm is required.

3.1.3 The Ministry of Transportation

- Culverts crossing beneath roads classified as Urban Arterial, with a span less than 6.0 m, are to convey the peak flow generated from a 50 year storm event; and
- Culverts crossing beneath roads classified as Urban Arterial, with a span greater than 6.0 m, are to convey the peak flow generated from a 100 year storm event.

- Culverts crossing beneath roads classified as Urban Arterial are required to provide a freeboard greater than or equal to 1.0 m.

3.1.4 The Ministry of Natural Resources and Forestry

- Levi Creek supports Redside Dace Habitat, and as such, thermal mitigation of stormwater discharging to Levi Creek is required.

3.1.5 The Ministry of Environment and Climate Change

As discussed with the Region of Peel, the SWM assessment completed as part of this Class EA incorporates the forthcoming MOECC criteria. The draft criteria, provided by the Region, is as follows:

- **Linear Development Volume Control**
  New linear projects without restrictions and subject to the approved Source Protection Plan, that results in the creation of impervious surface(s) and/or fully reconstructs the existing impervious surfaces, shall control per the mandatory control hierarchy the larger of the following:
  - The runoff generated from the geographically specific **90th percentile rainfall event from the new and/or fully reconstructed impervious surfaces on the site**, OR
  - The runoff generated from the geographically specific **90th percentile rainfall event from the net increase in impervious area(s) on the site.**
- The site shall be required to maintain the pre-development water balance.

4.0 FUTURE CONDITIONS

4.1 Future Conditions Storm Drainage

Future conditions storm drainage boundaries are presented in Figures 4.1 – 4.3 (attached). Under future conditions, Mississauga Road will be widened to a six (6) lane R.O.W., including additional turning lanes where required. Between Financial Drive and the driveway entrance to 8672 Mississauga Road, located north Lionhead Golf Club Road, widening works will take place on the west side of the R.O.W. From the driveway entrance, north to Embelton Road, road widening will be generally aligned along the existing road centerline (i.e. equal widening on both sides of the roadway). South of Embelton Road there will be 3 m wide multi-use pathways (MUPs) on either side of the road. North of the Embelton Road widening works will take place on the east side of the R.O.W., and the MUP will only exist on the east side of the road, thus reducing the required width of the proposed Credit River bridge.

To determine the impacts of the widening works, the PCSWMM model developed for existing conditions (as per Section 2.4) has been modified to represent future conditions storm drainage. Table 4.1 presents the simulated changes in peak flows at each outlet without quantity controls. These results have been compared against the previously simulated results for existing conditions (Table 2.1); Table 4.2 presents the resulting percentage change in peak flows.

Table 4.1. Future Conditions Peak Flows (m^3/s)

Storm Event	Outlet 1 (11.76 ha)*	Outlet 2 (1.40 ha)	Outlet 3 (4.28 ha)	Road Sag 1 (16.02 ha)**	Road Sag 2 (2.04 ha)**	Road Sag 3 (1.43 ha)**	Levi Creek (2.09 ha)
2 year	0.40	0.15	0.68	0	0	0	0.17
5 year	0.56	0.20	0.99	0	0	0	0.24
10 year	0.62	0.21	1.09	0	0	0	0.26
25 year	0.80	0.26	1.41	0	0	0	0.34
50 year	0.89	0.29	1.58	0	0	0	0.39
100 year	0.98	0.32	1.62	0	0	0	0.43
Regional	NA	NA	NA	NA	NA	NA	0.15

Notes: * Minor system drainage to Outlet 1 is only 3.63 ha.
** Inclusive of major system drainage from Outlets 1 and 2, and Road Sag 2.

Table 4.2. Percent Difference Between Existing and Future Conditions Peak Flows (%)

Storm Event	Outlet 1	Outlet 2	Outlet 3	Road Sag 1	Road Sag 2	Road Sag 3	Levi Creek
2 year	4%	-5%	26%	0%	0%	0%	0%
5 year	10%	-7%	27%	0%	0%	0%	0%
10 year	3%	-8%	25%	0%	0%	0%	0%
25 year	15%	-9%	32%	0%	0%	0%	0%
50 year	25%	-12%	36%	0%	0%	0%	0%
100 year	35%	-13%	34%	0%	0%	0%	0%
Regional	NA	NA	NA	NA	NA	NA	0%

As expected, peak flow results presented in Table 4.1 and 4.2 indicate that under future conditions, peak flows would be expected to increase for Credit River Outlets 1 and 3. Peak flows would be expected to decrease at Outlet 2, which although unexpected, is likely due to the steepening of Mississauga Road grades resulting from the increased deck elevation proposed by the Credit River crossing replacement (ref. Section 4.2). Steepening of the road grades reduces the inlet capacity of the catchbasins, resulting in additional drainage by-passing the catchbasins and being directed to Road Sag 1 point.

The simulated results under future conditions indicate that there is no spill at Road Sags 1 – 3, demonstrating that the R.O.W. drainage remains self-contained under future conditions and that the 100 year storm is conveyed by the storm sewer system and roadway right of way. In keeping with existing conditions, it is noted that R.O.W. drainage does not have an impact on the quality and quantity aspects of the Provincially Significant Wetlands located on the east and west side of the R.O.W., adjacent to Subcatchments 324 – 327B.

Simulated ponding depths at Road Sag 1 range from 0.15 m +\- for the 10 year storm event to 0.30 m +\- for the 100 year storm event. Simulated ponding depths at Road Sag 2 range from 0.11 m +\- for the 10 year storm event to 0.27 m +\- for the 100 year storm event. At Road Sag 3 south of the Credit River Valley, simulated ponding depths range from 0.21 m +/- for the 10 year storm event to 0.28 m +\- for the 100 year storm event. It is noted that the simulated ponding depths remain at or below 0.30 m at the gutter, which should allow for passenger vehicle passage per MNRF's vehicle ingress and egress requirements.

Surcharging of the storm sewer system remained for the future right-of-way conditions, indicating that storm sewer upgrades are required. See Section 6.0 for recommended storm sewer upgrades.

The simulated results for Levi Creek indicate that quantity controls do not need to be implemented within the section of the Mississauga Road R.O.W. to achieve the quantity control criteria outlined in Section 3.1.2, as no increase in peak flows is indicated. A review of SWM alternatives is provided in Section 5.0.

Section 5.0 provides a review of SWM opportunities for the Mississauga Road R.O.W. to achieve the objectives outlined in Section 3.0.

4.2 Future Conditions Hydraulics

The current crossing of the Credit River is proposed to be replaced in order to facilitate a 6 lane roadway and 3 m MUP A preliminary general arrangement (GA) drawing has been prepared (ref. Sheet S1 in Appendix 'B') for the proposed bridge replacement. As indicated in the GA, the deck elevation is proposed to be raised by approximately 1.60 m as compared to the existing elevation. The total span is proposed to increase from 68 m to 103 m. Similar to the existing crossing, the proposed bridge will consist of three (3) spans supported by two (2) piers. In an effort to remove the existing piers from the waterway away, the piers will be relocated to the bank area. The two (2) outside sections will span 29 m +/-, while the middle section will span 45 m +/-. The bridge width is proposed to increase from 18.6 m +/- to 27.2 m +/- to accommodate the 6-lane roadway and MUP. In order to facilitate the proposed raising of the crossing, re-grading of Mississauga Road will be required. Preliminary re-grading limits extend between 50 m north of the crossing to 120 m south of the crossing. A preliminary plan and profile is provided in Appendix 'B'.

In order to determine the impacts to the water surface elevations (WSELs) upstream and downstream of the crossing, the HEC-RAS hydraulic model of the Credit River (as discussed in Section 2.2) has been revised to incorporate the preliminary proposed (future) general arrangement. Table 4.3 below provides a comparison of the simulated WSELs under existing and proposed conditions for the Regional Storm Event. The existing and preliminary proposed (future) Regional Storm and 100 year floodlines are presented in Figure 6.1.

Table 4.3. Simulated Impacts to Regional Storm Event Water Surface Elevations – Preliminary Crossing Replacement (m)

Cross Section I.D.	Water Level - Existing Conditions	Water Level – Future Conditions	Difference
9+844	186.00	185.82	-0.18
9+570	185.38	185.01	-0.37
Mississauga Road Crossing			
9+477	184.28	184.28	0
9+284	182.67	182.67	0

The results in Table 4.3 indicate that the proposed crossing will reduce the Regional WSEL upstream of the crossing by 0.37 m. The crossing is capable of conveying the Regional Storm at an elevation of 185.07 m, which is slightly below the soffit elevation of 185.13 m. Overtopping of Mississauga Road will still occur at the low point of Mississauga Road (south of the crossing) during the Regional Storm. The depth of overtopping will be 0.57 m +/-, compared to the existing depth of overtopping of 1.18 m +/-. Based on a flow depth of 0.57 m and a flow velocity of 0.42 m/s +/-, and using MNRF's vehicle ingress and egress maximum depth requirement of 0.90 m and maximum overtopping velocity of 4.5 m/s, emergency vehicles would be able to safely drive along Mississauga Road at the Credit River crossing during the Regional Storm Event. It is noted that the existing overtopping depth does not allow for emergency vehicle passage, therefore the proposed crossing provides the benefit of safe access through this section of Mississauga Road.

As the proposed crossing is capable of conveying the Regional Storm, CVCs floodproofing requirements are achieved at the crossing. Unfortunately, the overtopping occurring at the low point of Mississauga Road does not meet CVC criteria. It is noted, however, that proposed simulated overtopping depth and flow velocity is less than existing conditions, and satisfies CVC criteria outlined under Section 7.5 d) of the Watershed Planning and Regulation Policies document.

The proposed Credit River Regional Storm Floodplain is presented on Figure 6.1. As shown, the Regional Storm Floodplain overtops the Mississauga Road R.O.W, with flooding of the residential area just upstream of the bridge on the south side of the crossing. Further details pertaining to the WSELs for all storm events (2-100 year & Regional) are provided in Appendix ‘B’.

Existing Crossings C7 – C9 are to remain under future conditions and will be lengthened to accommodate the proposed road widening. Crossing C9 is located within a regulated watercourse, and therefore its performance under existing and proposed conditions must be verified. MTO nomographs Chart D5-1H and Chart D5-2E have been used to verify the capacity of the existing crossing and are provided in Appendix B. WSELs used to determine the head acting on the crossing were obtained from the existing conditions HEC-RAS model. It has been determined that the existing culvert capacity is governed by the culvert inlet, and therefore would not change under future conditions. The 100 year and Regional Storm capacities are 3.3 m^3/s and 4.5 m^3/s respectively.

5.0 STORMWATER MANAGEMENT OPPORTUNITIES

5.1 General Stormwater Management Opportunities

Stormwater Management practices (SWMPs) for the management of roadway runoff generally fall into two categories: those that address stormwater quantity (including erosion) and those that manage stormwater quality of surface runoff. In addition, Low Impact Development (LID) best management practices (BMPs) are designed to provide water quality treatment and quantity control for smaller, more frequent storm events (i.e. typically the 27 mm storm event).

Stormwater quantity management issues relate to the proper sizing of minor (sewer) and major (overland flow) conveyance systems for roadway runoff. In addition, stormwater quantity management strategies can include the need for facilities to address downstream flood and erosion potential from the expansion of the roadway right-of-way. Stormwater quantity objectives for the proposed works have been provided within Section 3, and are limited to Levi Creek (as quantity controls are not required for the Credit River. Based on the simulated lack of increase in peak flows for the Mississauga Road area contributing to Levi Creek, no quantity controls are required. Instead, major and minor system improvements may be required to convey the future condition peak flows.

In terms of stormwater quality, the SWMPs relate to the treatment of new pavement and where possible, the treatment of existing pavement; however, current legislation solely relates to the former. Typically, the treatment level is related to the standards defined in a watershed or subwatershed planning study, which are dependent on the quality and sensitivity of the receiving stream system (i.e. Type 1, Type 2, etc.). Mississauga Road drainage discharge requires Enhanced (Level 1 – 80% average annual TSS removal) stormwater quality controls.

Pending MOECC Guidelines will require capture of the 90th percentile storm event (27 mm in Brampton) and infiltration practices to be assessed. The Region of Peel has requested that the 27 mm storm event be infiltrated at a minimum for the two (2) additional road lanes. If feasible, additional infiltration should be implemented along the roadway to both compensate for road sections that under existing conditions do not have infiltration systems, and to reduce runoff volumes being conveyed to SWM facilities H3 and W1.

Various Best Management Practices or Stormwater Management practices are available to address both the quantity and quality of runoff from roadways. Due to the linear nature of roadway corridors however, not all stormwater management practices are considered to be appropriate.

5.1.1 Alternative Stormwater Management Practices

Quantity Management (Flood and Erosion Control)

Quantity control impacts (including erosion) due to increased runoff from expanded paved surfaces can typically be mitigated by on-site storage and infiltration techniques and/or off-site mitigation measures, such as regulation or stream stabilization.

For the current project, only erosion controls are required. The expected focus is therefore on storage and infiltration based techniques.

Quality Management

There are numerous stormwater management practices which can be used to treat contaminated stormwater runoff from roadway surfaces. These include the following:

i. Wet ponds/wetlands/hybrids (generally linear facilities)
ii. Enhanced grass swales
iii. Filter strips
iv. Oil and grit separators
v. Off-site stormwater management facilities (existing, retrofitted and/or proposed)
vi. LID BMPs – (Bioretention systems and other infiltration systems)

The respective characteristics, advantages and disadvantages of the foregoing have been well documented in existing Municipal and Provincial literature and hence this information has not been repeated within this document. Some brief advantages and disadvantages, though, are discussed in the following.

5.1.2 General Assessment

The advantages and disadvantages of the various Best Management Practices associated with both quantity and quality control measures are as follows:

Erosion Control

Controlling runoff in stormwater management facilities requires land and future management/maintenance by municipal staff. The advantages relate to maintaining existing sizing of drainage infrastructure or smaller infrastructure across the roadway, as well as downstream. Disadvantages include the cost of land, infrastructure and maintenance. Increasing the size of drainage infrastructure, while somewhat more costly to the municipality, reduces the need for future maintenance and eliminates the need for the dedication of stand-alone land for surface controls. Inter-subcatchment diversions can be effective on a minor scale in optimizing and/or reducing the number of crossings and are typically followed to address both major and minor runoff conditions.

For erosion control, on-site measures to reduce peak flow impacts can be highly constraining due to the general lack of properly configured land. Roadway corridors, due to their inherent linear nature, can only effectively manage relatively small volumes of increased runoff (peak flows), in the absence of stand-alone land acquisition. Combination of measures to mitigate impacts through some on-site storage, along with off-site upgrades as necessary, is often the ‘best’ approach, where impacts exceed allowable minimums, that said, Mississauga Road currently does not drain to any stormwater management facilities.

The following erosion controls have been screened from further consideration due to the reason provided herein:

i. Wet ponds/wetlands/hybrids

Constructing a new wet pond, wetland or hybrid pond is not feasible within the Mississauga Road right of way based on space constraints. As such this alternative has not been considered further.

ii. Super Pipe Storage

Super pipe storage would require upgrading the existing storm sewer to a larger storm sewer capable of storing additional runoff to meet the erosion control targets. This would require manholes to be replaced, storm sewer sections to be upgraded and the road to be re-paved. In addition super pipe storage is one of the most costly methods of providing underground storage. As such this method of erosion control has been screened from further consideration.

iii. Conventional Underground Storage (Concrete Tanks)

Conventional underground storage for Mississauga Road would require multiple concrete tanks connected by equalization pipes. The concrete tanks would be connected to the downstream end of the existing/proposed storm sewers to maximize the contributing drainage area to the storage elements. Underground concrete tanks are considered costly to implement. In addition, conventional underground tanks do not filter or infiltrate captured runoff. As such conventional underground storage (concrete tanks) have been screened from further consideration.

iv. Conventional Underground Storage (Cellular Systems)

Notwithstanding the preceding, more cost effective underground storage systems could be considered to achieve erosion control requirements. This includes cellular type tank systems such as Brentwood^{TM}, Cultec^{TM} or Triton^{TM} systems.

v. Low Impact Development Best Management Practices (LID BMPs)

Low Impact Development Best Management Practices (LID BMPs) can address erosion control requirements by retaining and infiltrating stormwater runoff for more frequent storm events, which are typically those of concern for erosion impacts. These options have been discussed further in the subsequent section with respect to quality control, but are considered a feasible alternative for erosion control as well.

Quality Control

i. Wet ponds, Wetlands, Hybrids

These systems generally require the dedication of land that most often is not available in linear corridors for roadway projects. Most often when applied to roadway runoff, these SWMPs are located adjacent to creek crossings of roads. Typically these systems provide an excellent level of treatment and as end-of-pipe systems, the management and performance is more visible, hence less prone to failure. For Mississauga Road this particular opportunity is considered impractical due to lack of available land. In addition the Region of Peel's recent SWM strategy is to reduce the use of traditional end-of-pipe SWM facilities as well as r the runoff volume from Regional property discharging to end-of-pipe SWM facilities. As such, end of pipe SWM facilities have been screened from further consideration.

ii. Enhanced Grassed Swales

Grassed swales designed with a trapezoidal geometry and flat longitudinal profiles with largely un-maintained turf can provide excellent filtration and treatment for storm runoff from roadways. It is generally conceded that treatment levels are at a minimum, Normal (formerly Level 2) water quality treatment, and combined with other practices can provide Enhanced (Level 1) stormwater quality treatment. Their application in linear corridors is also particularly appropriate and can be further enhanced through the introduction of check dams to provide additional on-line storage. Their application in urbanized roadway cross-sections (i.e. curb and gutter) often requires alternative grading and roadway configurations which can compromise the function of the roadway itself, and are therefore typically not preferred in those cases. Notwithstanding, gutter outlets along outside lanes have been demonstrated to function effectively where the right-of-way can accommodate the design. Based on the proposed Mississauga Road ultimate urbanized road ROW, enhanced grassed swales are not considered a practical stormwater quality treatment measure and have been screened from further consideration.

iii. Filter Strips

Filter strips are typically designed for small drainage areas (less than 2 ha +\-), and are applied as part of a treatment train. Filter strips require flat areas with slopes ranging from 1 to 5% and are usually in the range of 10 to 20 m in length in the direction of flow. Flow leaving filter strips should be a maximum of 0.10 m depth, based on a 10 mm storm event. Based on the limited space within the Mississauga Road ROW, filter strips are not considered a practical stormwater quality solution and have been screened from further consideration.

iv. Oil and Grit Separators (OGS)

These end-of-pipe systems tend to service smaller drainage areas (2 ha +\-) and provide varying levels of stormwater quality treatment depending on the model selected. OGS units are typically encouraged as part of a "treatment train" approach; many municipalities and regulators will not credit the full TSS removal function of OGS units accordingly (i.e. typical maximum credit of 50% to 70% TSS removal). Disadvantages include the need for frequent maintenance, as well as relatively high capital costs and the ability to service smaller drainage areas. As a pre-treatment approach to infiltrative LID BMPs, oil and grit separators can be implemented as part of the "treatment train" approach and have been carried forward for further consideration.

v. Off-Site Stormwater Management Facilities

While facilities can often not be constructed within roadway right-of-way lands, roadway runoff can be directed towards existing and proposed subdivisions, which would have their runoff managed by future stormwater management facilities. No sections of the Mississauga Road minor system are currently connected to off-site stormwater management facilities. Although a SWM

Facility is proposed adjacent to the Mississauga Road R.O.W., within the Riverview Heights residential development, the SWM Facility is not planned to accept drainage from the R.O.W. As such this alternative has been screened from further consideration.

vi. Low Impact Development Best Management Practices

Low Impact Development represents the application of a suite of BMPs normally related to source and conveyance storm water management controls to promote infiltration and pollutant removal on a local site by site basis. These measures rely on eliminating the direct connection between impervious surfaces such as roads and the storm drainage system, as well as the promotion of infiltration of road drainage. General design guidelines and considerations for source and conveyance controls have been advanced since the early 1990's as part of the MMAH "Making Choices" and in 1994 as part of the Ministry of the Environment's original Best Management Practices Guidelines.

Subsequent to the 1994 MOE Guidelines, technologies and standards have been developed further for the application of source and conveyance controls. These have evolved into a class of Best Management Practices (BMPs) referred to as Low Impact Development (LID) practices, which have advanced as an integrated form of site planning and storm servicing to maintain water balance and providing storm water quality control for urban developments. Initial results from studies in other settings have demonstrated that LID practices provide benefits by way of reducing the erosion potential within receiving watercourses and thereby reducing the total volume of end-of-pipe storm water erosion control requirements. In addition, due to volumetric controls afforded by LID BMP's, water quality is also improved through a reduction in mass loading. The benefits from LID storm water management practices are generally focused on the more frequent storm events (e.g. 2 year storm) of lower volumes as opposed to the less frequent storm events (e.g. 100 year storm) with higher volumes. It is also recognized that the forms of LID practices which promote infiltration or filtration through a granular medium provide thermal mitigation for storm runoff.

Guidelines regarding the application of LID practices and techniques have been developed within various jurisdictions in the United States and Canada. The Toronto and Region Conservation Authority and Credit Valley Conservation have produced the 2010 Low Impact Development Storm water Management Manual, for the design and application of LID measures. Various LID techniques, as well as their function that are applicable to road projects, are summarized in Table 5.1, not including grassed swales and filter strips which have already been screened as appropriate SWM measures for Mississauga Road.

Table 5.1. LID Source and Conveyance Controls

Technique	Function
Bio-retention Cell	- Vegetated technique for filtration of storm runoff - Storm water quality control provided through filtration of runoff through soil medium and vegetation - Infiltration / evapotranspiration/ water balance maintenance and additional erosion control may be achieved if no subdrain provided
Infiltration Trenches	- Infiltration technique to provide storm water quality control and maintain water balance - Erosion controls may be achieved depending upon soil conditions
Permeable Pavers/Pavement	- Infiltration technique to reduce surface runoff volume - Benefits to storm water quality and erosion control are informal
Pervious Pipes	- Technique to reduce storm runoff through the implementation of perforated pipes as part of the storm sewer system (typically a separate lower perforated pipe, with the conventional storm sewer as the "overflow") - Promotion of infiltration maintains water balance and provides storm water quality and erosion control benefits

Further discussion is provided on LID BMPs in the following:

Bioretention Systems

Bioretention systems provide effective removal of pollutants by sedimentation, filtering, soil adsorption, microbial processes and plant uptake. Bioretention systems should be approximately 10 to 20% in size of the contributing drainage area, with typical drainage areas of 0.50 ha and a maximum drainage area of 0.8 ha. Slopes within bioretention systems are typically 1 % to 5 %. Bioretention systems are preferred in areas that have reasonable infiltration properties (15 mm/ hr, $1x10^{-6}$ cm/s), but can be implemented in all soil types as long as the water quality event can be temporarily stored (typical depths 0.15 m to 0.25 m) before infiltrating and an underdrain is provided.

Based on the ultimate proposed six (6) lane ROW configuration, there is a 1 m +/- wide landscape strip, then a 3 m wide multiuse path. The multiuse path could be reset to the west ROW limit which would provide up to a 2 m width for bioretention systems. It is noted that a significant length of the ROW would have less than a 2 m width available, however, should the Region consider it beneficial and economically viable during the detailed design stage, bioretention systems could be added as an infiltrative LID BMP at specific locations or as supplemental SWM control beyond requirements. The bioretention systems should have forebays for a form of surface water pre-treatment. Catchbasins fitted with goss traps should also be used to filter out floatable debris before directing runoff to the infiltrative component of the bioretention system.

Infiltrative Trenches

Infiltrative Trenches could be implemented as they are similar to bioretention systems but could be positioned not only within the 2 m wide landscaped areas but under the proposed 3 m wide multiuse pathway. All catchbasins should be fitted with goss traps to filter floatable debris. The infiltration trench could be designed to capture the 27 mm storm event with no discharge by setting the overflow to the storm sewer system above the 27 mm storm event capture storage depth.

Permeable Pavers/ Pavement

The Region of Peel has used permeable pavement for multiple pilot projects within the last five (5) years (e.g. Dixie Road project incorporated pervious concrete as a pilot project). Permeable pavement could be used for entirety or sections of the proposed westerly 3 m wide multiuse pathway. As a standalone LID BMP, a multiuse permeable paved multiuse path would not meet either stormwater quality and/or erosion control targets as it would treat a limited area, and would not treat the roadway itself (which would be expected to generate the highest contaminant loadings). However, a permeable MUP would reduce the runoff volume from paved surfaces within the urban road ROW. This LID BMP would have to be selected by the Region to complement other SWM measures during the detailed design stage.

Pervious Pipes

Pervious pipes could be used in combination with either bioretention systems or infiltration trenches. As a standalone SWM measure, pervious pipes can be a cost-effective and relatively simple method to accomplish erosion control and infiltration requirements, while eliminating the need for surface space within the right-of-way.

Based on the foregoing, the following erosion, infiltration and water quality controls have been short-listed:

- Oil and Grit Separators
- Bioretention Systems
- Infiltration Trenches
- Permeable Pavers/Pavement
- Pervious Pipes

6.0 SHORT-LISTED STORMWATER MANAGEMENT ALTERNATIVES ASSESSMENT

To understand the level of infiltration, erosion and water quality controls required, a comparison of the existing and future conditions impervious coverages / areas has been provided in Table 6.1. As expected for the future right-of-way conditions, the majority of the increase in impervious coverage would occur for Outlet 2, with Outlets 1 and 3 representing 270 m and 160 m of the 1600 m +/- length of proposed improvements for Mississauga Road. Required road improvements and widening within the catchment area for Outlet 1 are considered to be minimal based on the existing two travel lanes, two turning lanes and painted median within the northbound lanes, thus reducing the recommended northbound road widening.

Table 6.1. Comparison of Existing Conditions and Future Conditions Impervious Areas (ha)

Outlet	Existing Condition	Future Condition	Difference/ % Difference
1	2.15	2.24	0.09/ 4%
2	0.98	1.07	0.09/ 9%
3	2.90	3.75	0.85/ 29%

Stormwater management alternatives to achieve the requirements for infiltration, erosion and quality objectives for the Credit River Outlets 1-3 have been assessed in the following. As the Mississauga Road area draining to Levi Creek will not incur an increase in impervious coverage, no infiltration, erosion and water quality controls are required for Levi Creek.

Credit River Outlet 1

Based on the existing minor and major drainage systems, there will be a 0.09 ha increase in impervious coverage collected and conveyed within the existing storm sewer system to Outlet 1. Based on the steep road grade entering the Credit River Valley on the north side of the river crossing, there is limited opportunity to implement LID BMPs prior to the storm sewer outlet located at the north east side of the Credit River bridge (ref. Figure 4.2). Prior to discharging to the Credit River, storm drainage conveyed by the storm sewer is currently treated by an Oil/Grit Separator (OGS) unit (CDS PMSU30_30_8) sized to provide a minimum of 80% TSS removal. Based on the foregoing and given the requirement to provide erosion and infiltration controls in addition to stormwater quality controls for the 0.09 ha increase in impervious coverage, stormwater management controls (infiltration, erosion and water quality) for Outlet 1 will be incorporated into the sizing requirements for SWM controls for Outlet 3 on the south side of the Credit River. The simulated change in peak flows to Outlet 1 has been documented in Table 6.2.

Table 6.2. Comparison of Existing and Future Peak Flows at Outlet 1 (m^3/s)

Storm Event	Existing	Future	% Difference
2 year	0.38	0.40	4%
5 year	0.51	0.56	10%
10 year	0.60	0.62	3%
25 year	0.69	0.80	15%
50 year	0.71	0.89	25%
100 year	0.73	0.98	35%

To improve the minor drainage system hydraulic performance and eliminate surcharging for the 10 year storm event, the existing 370 mm diameter orifice plate upstream of the CDS OGS unit could be removed However, if the plate were removed, confirmation of the OGS unit performance would be required during detailed design of the road improvements. Removal of the orifice plate would eliminate storm sewer surcharging, and bring the sewer in compliance with the Region of Peel's storm sewer performance requirements (i.e. conveyance of the 10 year storm flow under free flow conditions).

Credit River Outlet 2

The increase in impervious coverage for Outlet 2 under future conditions would be 0.09 ha +/-. Stormwater management for Outlet 2 would have to consider the infiltration, erosion and water quality requirement for both Outlets 1 and 2, as such controls would be required for a combined 0.18 ha increase in impervious coverage. As discussed due to the limited space at Outlet 2 on the north side of the Credit River bridge at the Mississauga Road and Embelton Road intersection, infiltration trenches would be limited in size. As such, stormwater management controls (infiltration, erosion and water quality) should be located at Outlet 3 immediately to the south. Notwithstanding, there is an opportunity to retrofit the existing storm sewer outlet with an oil/grit separator to provide an Enhanced Level of quality control for the contributing 1.40 ha drainage area and 1.07 ha of impervious coverage (ref. Figure 4.2). The type and size of the oil/grit separator could be determined during the detailed design stage. No storm sewer improvements would be required based on the existing minor system hydraulic performance.

Credit River Outlet 3

The combined increase in impervious coverage for Outlets 1 (0.09 ha), 2 (0.09 ha) and 3 (0.85 ha) would be 1.03 ha +/- for the proposed right-of-way condition. A distributed approach to placing infiltration trenches within the contributing drainage area for Outlet 3 has been proposed, based on the available space within the relatively low grade areas of the R.O.W., and the efficiency of capturing flows at road sags (ref. Figures 4.2 and 4.3). As such, SWM controls for 0.22 ha of the 1.03 ha increase in impervious coverage would be provided south of the Credit River Valley (contributing area of 1.43 ha and existing and proposed impervious coverages of 1.11 ha and 1.33 ha respectively). The remaining 0.81 ha increase in impervious coverage for Outlet 3 would be managed in stormwater management controls within the Credit River Valley (contributing area of

4.28 ha and existing and proposed impervious coverages of 2.90 ha and 3.75 ha respectively). In both locations, infiltration trenches will be located on both the east and west side of the R.O.W.

To achieve the draft MOECC criteria outlined in Section 3.1.5, and the water balance and erosion infiltration volumes outlined in Section 3.1.2, infiltration trenches as described in Section 5.1.2 would capture and infiltrate the additional runoff resulting from the additional impervious surfaces for a 27 mm storm event for both Outlets 1, 2 and 3.

The PCSWMM model of future conditions has been modified to include the infiltration trenches (ref. Figures 4.2 and 4.3). The infiltration trenches have been assessed to determine to impact to peak flow targets to Outlet 3, although no quantity controls are required for the Credit River. The results of the assessment are presented below in Table 6.3.

Table 6.3. Comparison of Existing and Future Condition Flows at Outlet 3 (m^3/s) with Infiltration Trenches in Place

Storm Event	Existing	Future	% Difference
2 year	0.54	0.65	21%
5 year	0.78	0.95	22%
10 year	0.87	1.06	22%
25 year	1.07	1.37	28%
50 year	1.16	1.48	28%
100 year	1.21	1.56	30%

Four (4) infiltration trenches have been preliminarily sized to capture the additional runoff volume from a 27 mm event resulting from the additional impervious surfaces added to the right-of-way. Preliminary volume requirements are provided below in Table 6.4.

Table 6.4. 27 mm Storm Event Preliminary Infiltration Trench Volume Requirements for Outlet 3 (m^3)

Location	Existing Runoff Volumes from R.O.W.	Future Runoff Volumes from R.O.W.	Infiltration Volume Required	Preliminary Infiltration Volume Provided
West Side in Credit River Valley	289	338	49	54
East Side in Credit River Valley (Includes Outlets 1 and 2 Infiltration Requirements)	323	442	119	137
West Side South of Credit River Valley	137	148	12	18
East Side South of Credit River Valley	116	152	36	44

Results in Table 6.4 show that the infiltration trenches can provide the required infiltration volume for the increase in impervious coverage for the R.O.W. The table also shows that the infiltration volume requirements are larger for the infiltration trenches on the east side of the R.O.W. This is required due to road widening occurring more on the east than on the west side of the R.O.W.

A comparison of the runoff volumes at Outlet 3, resulting from a 27 mm event, is provided in Table 6.5 below for existing conditions, future conditions, and future conditions with infiltration trenches.

Table 6.5. 27 mm Storm Event Preliminary Runoff Volumes at Outlet 3 (m^3)

Location	Existing Runoff Volumes from R.O.W.	Future Runoff Volumes from R.O.W.	Infiltration Volume Required	Preliminary Infiltration Volume Provided
West Side in Credit River Valley	289	338	49	54
East Side in Credit River Valley (Includes Outlets 1 and 2 Infiltration Requirements)	323	442	119	137
West Side South of Credit River Valley	137	148	12	18
East Side South of Credit River Valley	116	152	36	44

Results in Table 6.5 show that the preliminarily sized trenches are expected to reduce the future conditions runoff volumes down to the existing conditions levels. At the detailed design stage, a monitoring plan should be developed to assess the capture rate of the proposed infiltration trenches against the intended design.

Flow splitting devices could be retrofitted into the catchbasins and catchbasin manholes to divert the required 27 mm infiltration volumes to infiltration trenches. Pipes connecting from the catchbasins can convey the diverted flow to the infiltration trenches within the boulevard area. A typical detail of an infiltration trench configuration is provided on Figure 5.1. At the detailed design stage, the position and dimensions of the infiltration trenches must be reviewed to ensure there are no conflicts with surrounding infrastructure (e.g. utilities located within the boulevard). Furthermore, per MNRF policy, an offset from the unnamed tributary conveyed by Culvert C9 must be applied and the limits of the infiltration trenches must not encroach the offset.

The water balance and erosion infiltration volume requirements are to provide infiltration volumes equivalent to the runoff generated by the additional impervious surfaces during 3 mm and 5 mm storm events respectively. By infiltrating the volume requirement of the pending MOECC criteria (90th percentile storm – 27 mm), the water balance and erosion criteria can be achieved. Although thermal mitigation is not required for the Credit River, the infiltration trenches will provide thermal mitigation of captured runoff. Based on capture of the 90th percentile storm (27 mm) and the use of goss traps within catchbasins, the water quality requirement of Enhanced Level control would be obtained.

Storm sewer improvements are required to convey the minor system (10 year storm event) under free flow conditions. A preliminary assessment of the storm sewer performance has determined that storm sewers within the Credit River Valley and south of the Credit River Valley will require upsizing. Storm sewers located along the Credit River Valley wall are noted to be freely conveying flows and do not require upsizing. Preliminary sizing has determined that storm sewers near Outlet 3 will be required to increase from 675 mm to 900 mm in diameter, decreasing in size moving upstream to the Credit River Valley wall. Outside of the Credit River Valley, existing 450 mm and 375 mm diameter storm sewers will be required to increase to 527 mm. It is noted that minor surcharging will remain in this section of the storm sewer, however due to downstream storm sewer sizes, the surcharged storms sewer cannot be increase in diameter any further. As storm sewers are required to increase in size, a re-alignment has been proposed to position the storm sewers beneath the proposed curb (ref. Figures 4.2 and 4.3)

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Based on the results presented and discussed in this Stormwater Management Report, the following conclusions can be made:

i. The Class EA study area primarily drains to the Credit River via three (3) drainage outlets, with all events up to and including the 100 year event being captured and conveyed by the existing storm sewer and roadway right-of-way. Various sections of the storm sewer surcharge, but do not flood during the 100 year storm event. Less than 0.2 ha of the study area drains to Levi Creek.
ii. The existing Credit River Bridge is able to convey all storm events up to and including the 100 year storm event, but is not able of conveying the Regional Storm Event, with overtopping depths of up to 1.18 m at Road Sag 1, making it impassable during the Regional Storm.
iii. In addition to the Credit River Bridge three CSP culverts exist, one of which is located in a regulated watercourse.

7.2 Recommendations

The following recommendations have been made for hydraulic improvements and stormwater management:

i. Based on the limited drainage area to Levi Creek within the study area limits, no stormwater management controls are considered to be required.
ii. To meet the water quality control, water balance, erosion infiltration, and the pending MOECC infiltration criteria for the Credit River Outlets 1, 2, and 3, LID BMPs must be implemented within the ultimate R.O.W. A preliminary review of the site constraints has determined that infiltration trenches, located within the contributing area to Outlet 3 and the ultimate R.O.W. can accommodate the volume requirements of the criteria.
iii. Flow splitter devices must be implemented within the catchbasins and catchbasin manholes to divert the runoff volumes required to be infiltrated during a 27 mm storm event to the infiltration trenches.
iv. A monitoring plan should be developed at the detailed design stage to assess the capture rate of the proposed infiltration trenches against the intended design.
v. The existing Credit River Bridge is recommended to be replaced with a structure that reduces the Regional Storm overtopping south of the bridge at Road Sag 1 to 0.57 m +/- by increasing the flow area under the bridge. The bridge deck will be raised from an elevation of 185.00 m to 187.60 m.

8.0 APPROVAL AND REVIEW REQUIREMENTS

The aforementioned SWM recommendations are subject to the review and approval of the Region of Peel, Credit Valley Conservation, Ministry of Natural Resources and Forestry, and the City of Brampton.

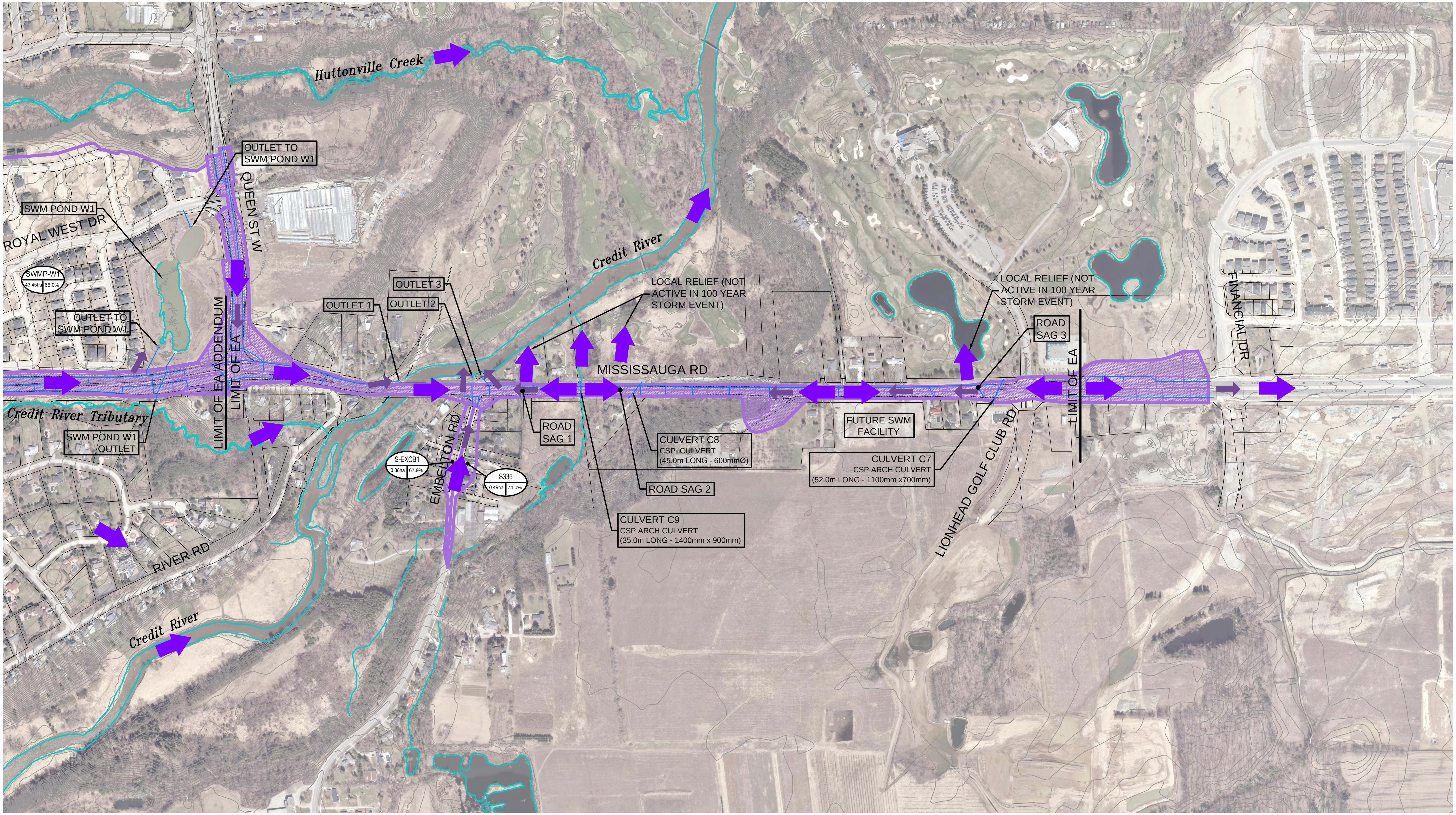
LICENSED PROFESSIONAL ENGINEER
11/21/2018
S. CHIPPS
PROVINCE OF ONTARIO

Sincerely,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Matt Britton, EIT
Water Resources Engineering Intern

Per: Steve Chipps, P.Eng.
Senior Associate, Water Resources



LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING STORM SEWER
EXISTING CULVERT

SUBCATCHMENT BOUNDARY
SUBCATCHMENT ID#
PERCENTAGE OF IMPERVIOUS AREA
SUBCATCHMENT AREA
M114
0.75ha | 73.4%
MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION

REFER TO MISSISSAUGA ROAD DRAINAGE BOUNDARY PLANS (FIG. 3.2–3.3)

SCALE VALID ONLY FOR 24"x36" VERSION

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR
REGION OF PEEL

OVERALL STORM
DRAINAGE BOUNDARIES
(EXISTING CONDITION)

wood.

Scale 1:3500
0 37.5 75 150

Consultant File No.
TP115085

Figure No.
3.1

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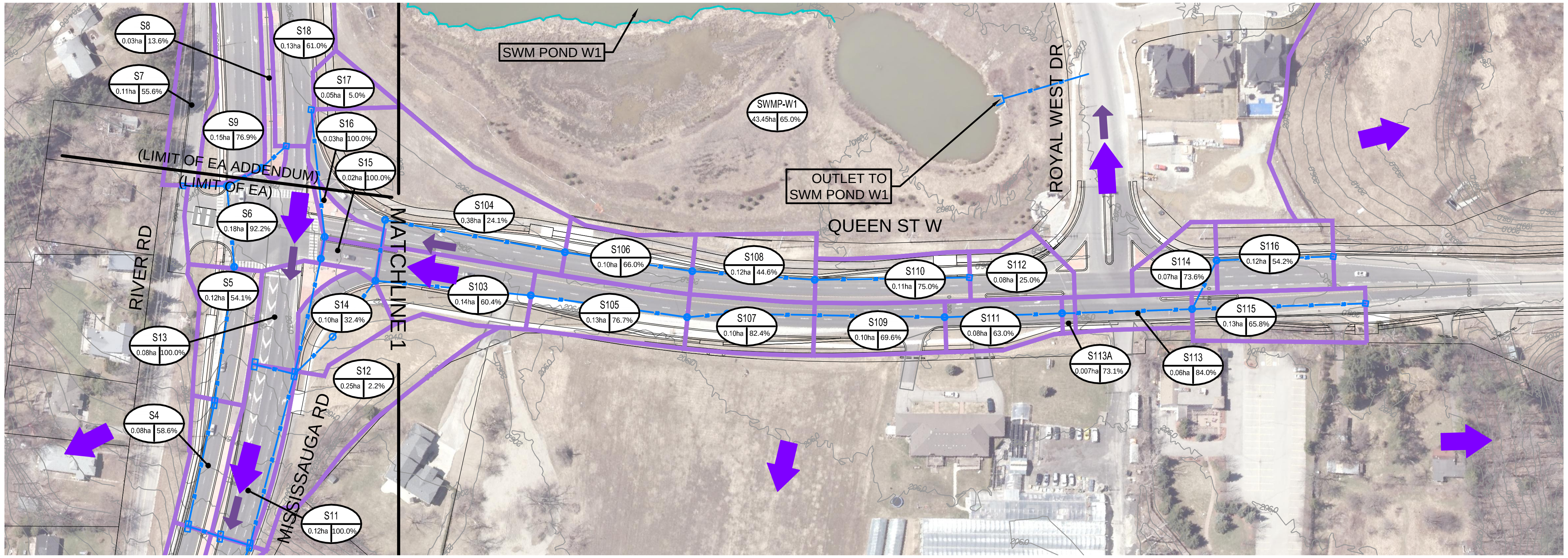

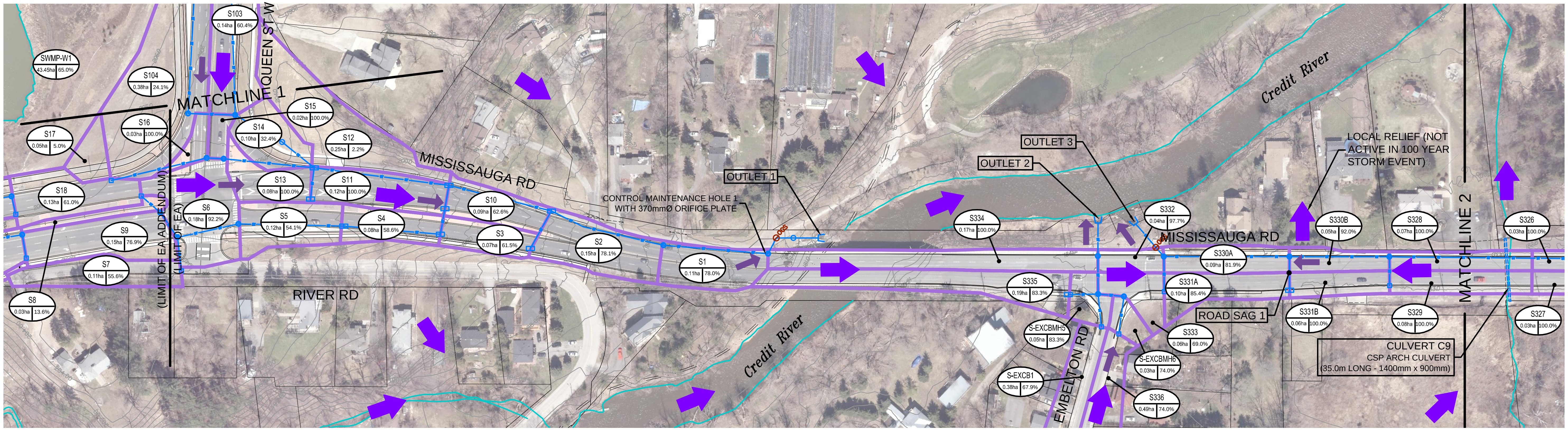

LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING CULVERT
EXISTING OIL/GRIT SEPARATOR
EXISTING STORM SEWER SYSTEM

MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION
SUBCATCHMENT BOUNDARY
M114 — SUBCATCHMENT ID#
73.4% — PERCENTAGE OF IMPERVIOUS AREA
0.75ha — SUBCATCHMENT AREA

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SCALE VALID ONLY FOR 24"x36" VERSION

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR

REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

wood.

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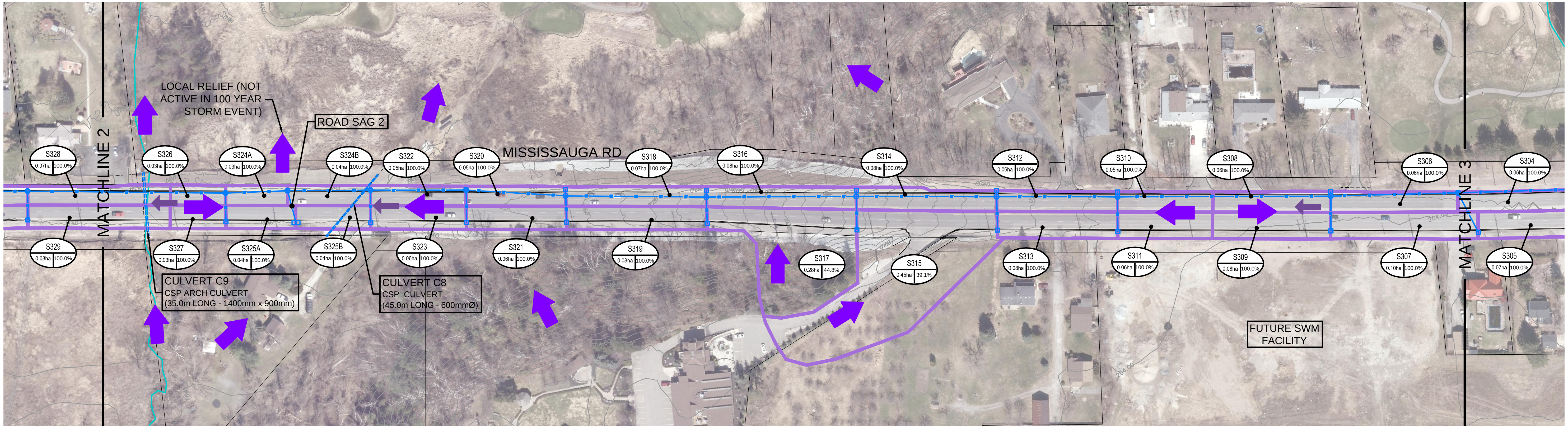
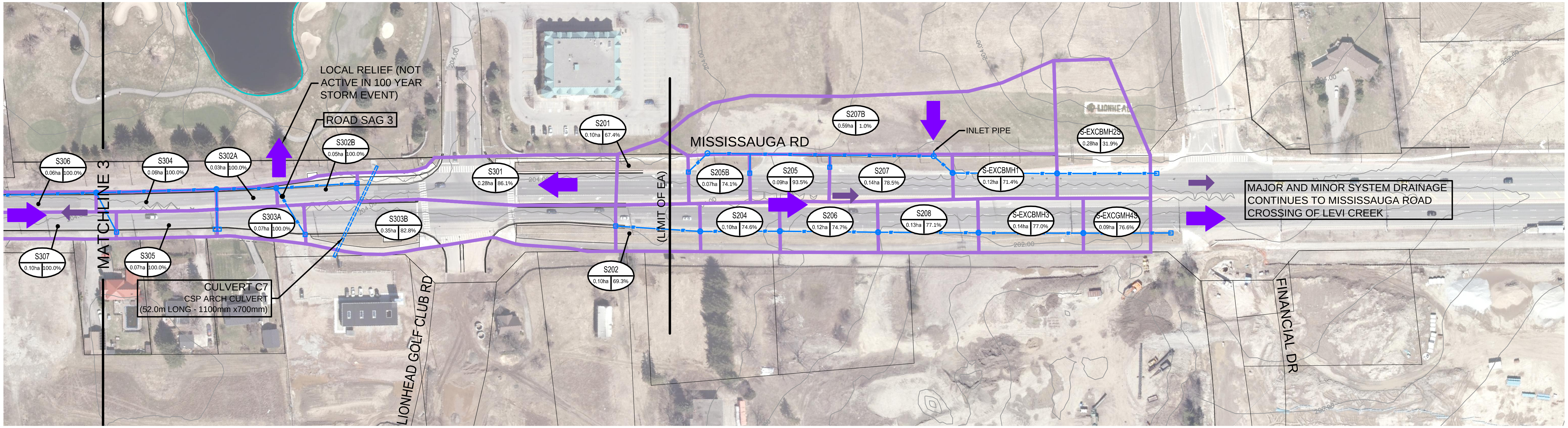
Consultant File No.
TP115085

Figure No.
3.2





LEGEND

───	PROPERTY BOUNDARY
〰	WATERCOURSE
───	CONTOUR (1m)
▭	EXISTING CULVERT
⊖OGS	EXISTING OIL/GRIT SEPARATOR
▫─●─▫	EXISTING STORM SEWER SYSTEM
➡	MAJOR SYSTEM FLOW DIRECTION
➡	MINOR SYSTEM FLOW DIRECTION
───	SUBCATCHMENT BOUNDARY

M114 — SUBCATCHMENT ID#
0.75ha — SUBCATCHMENT AREA
73.4% — PERCENTAGE OF IMPERVIOUS AREA

SCALE VALID ONLY FOR 24"x36" VERSION

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR

REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

wood.

Scale 1:1000
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Consultant File No.
TP115085

Figure No.
3.3

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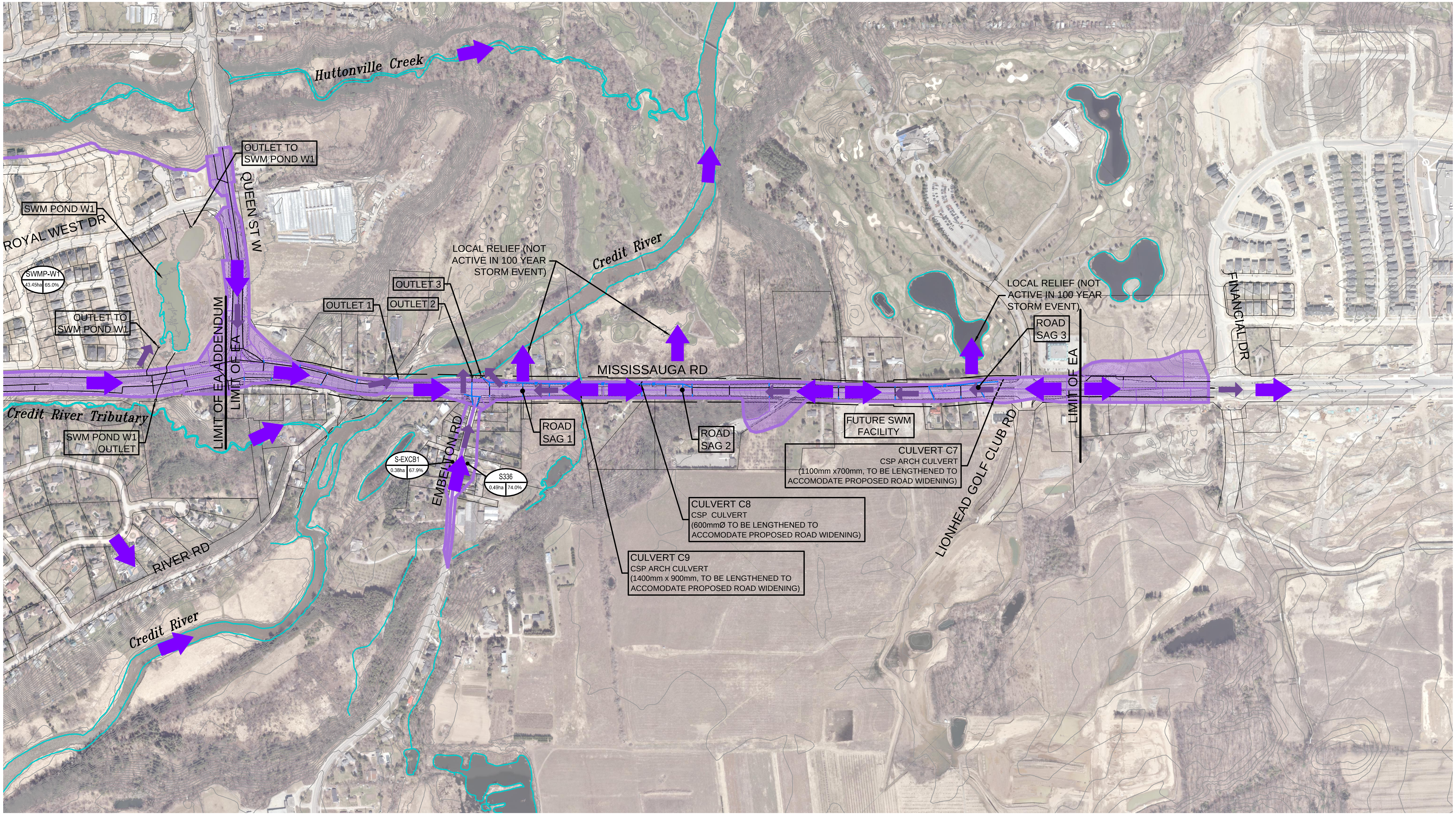

LEGEND

PROPERTY BOUNDARY

WATERCOURSE

CONTOUR (1m)

EXISTING CULVERT

EXISTING STORM SEWER SYSTEM

FUTURE STORM SEWER SYSTEM

SUBCATCHMENT BOUNDARY

M114 — SUBCATCHMENT ID#

0.75ha — SUBCATCHMENT AREA

73.4% — PERCENTAGE OF IMPERVIOUS AREA

MAJOR SYSTEM FLOW DIRECTION

MINOR SYSTEM FLOW DIRECTION

▨ REFER TO MISSISSAUGA ROAD DRAINAGE BOUNDARY PLANS (FIG. 4.2-4.3)

SCALE VALID ONLY FOR
24"x36" VERSION

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR

REGION OF PEEL

OVERALL STORM DRAINAGE BOUNDARIES
(FUTURE CONDITION)

wood.

Scale 1:3500
0 37.5 75 150

Consultant File No.
TP115085

Figure No.
4.1

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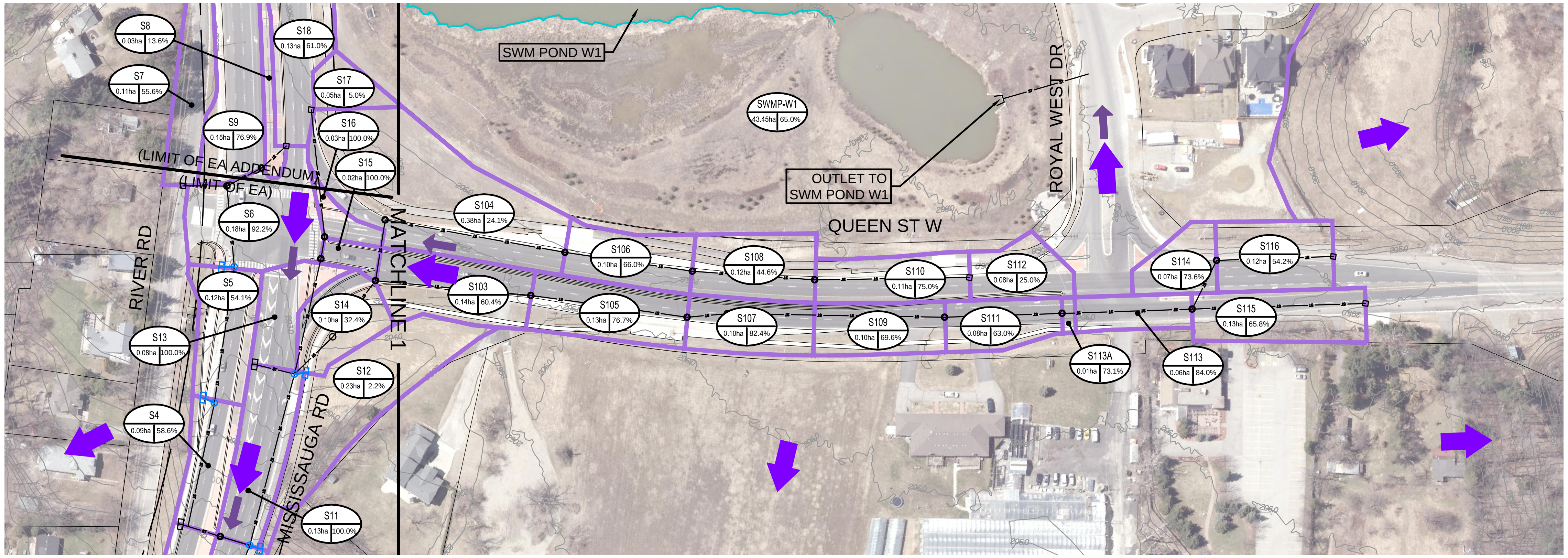

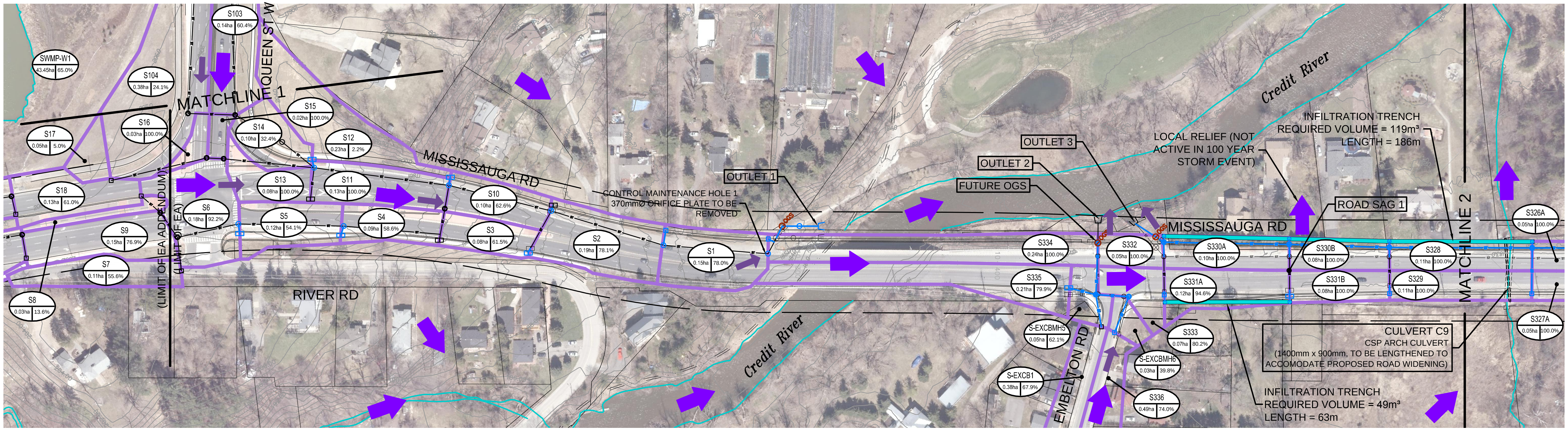

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LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING CULVERT
EXISTING OIL/GRIT SEPARATOR
EXISTING STORM SEWER SYSTEM
PROPOSED INFILTRATION TRENCH

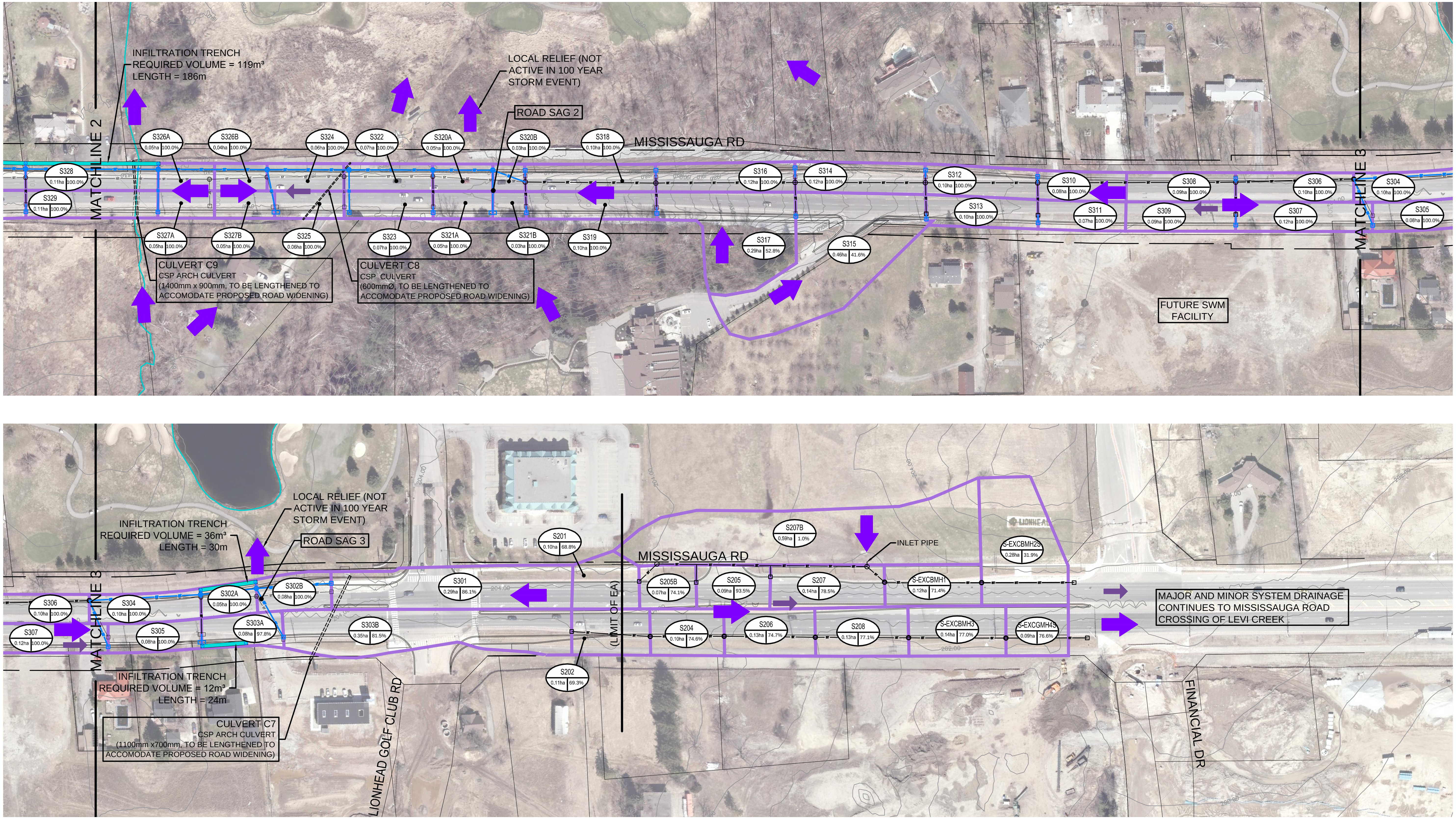
FUTURE CLEANOUT
FUTURE STORM SEWER SYSTEM
MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION
SUBCATCHMENT BOUNDARY

M114 0.75ha 73.4%
SUBCATCHMENT ID#
PERCENTAGE OF IMPERVIOUS AREA
SUBCATCHMENT AREA

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR
REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(FUTURE CONDITION)

SCALE VALID ONLY FOR 24"x36" VERSION
Scale 1:1000
0 10 20 40
Consultant File No.
TP115085
Figure No.
4.2



LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING CULVERT
EXISTING OIL/GRIT SEPARATOR
EXISTING STORM SEWER SYSTEM
PROPOSED INFILTRATION TRENCH
FUTURE CLEANOUT
FUTURE STORM SEWER SYSTEM
MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION
SUBCATCHMENT BOUNDARY

M114 — SUBCATCHMENT ID#
73.4% — PERCENTAGE OF IMPERVIOUS AREA
0.75ha — SUBCATCHMENT AREA

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR
REGION OF PEEL

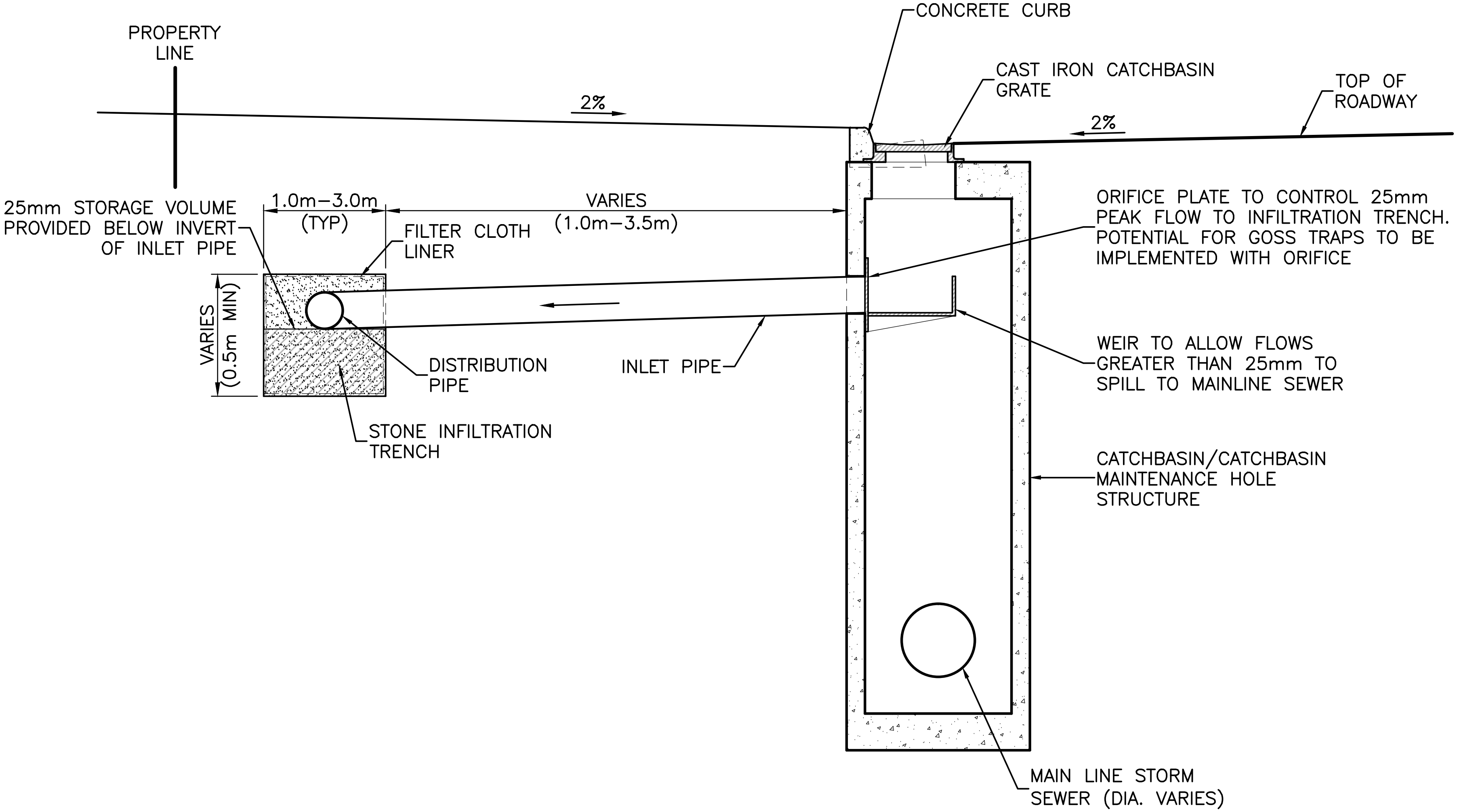
STORM DRAINAGE
BOUNDARIES
(FUTURE CONDITION)

wood.

SCALE VALID ONLY FOR 24"x36" VERSION
Scale 1:1000
0 10 20 40
Consultant File No. TP115085
Figure No. 4.3

Plotted: 2018-04-30 Plotted By: richard.bartolo
Last Saved: 2018-04-30 Last Saved By: richard.bartolo
Path: P:\Work\TP115085\Water\dwg\2017-09(Financial-Queen)\Fig4-2_4-3 Future-Plates.dwg

Plotted: 2018-04-30 Plotted By: richard.bartolo
Last Saved: 2017-10-04 Last Saved By: richard.bartolo Path: P:\Work\TP115085\Water\dwg\2017-09(Financial-Queen)\Fig5-1 Tanks.dwg

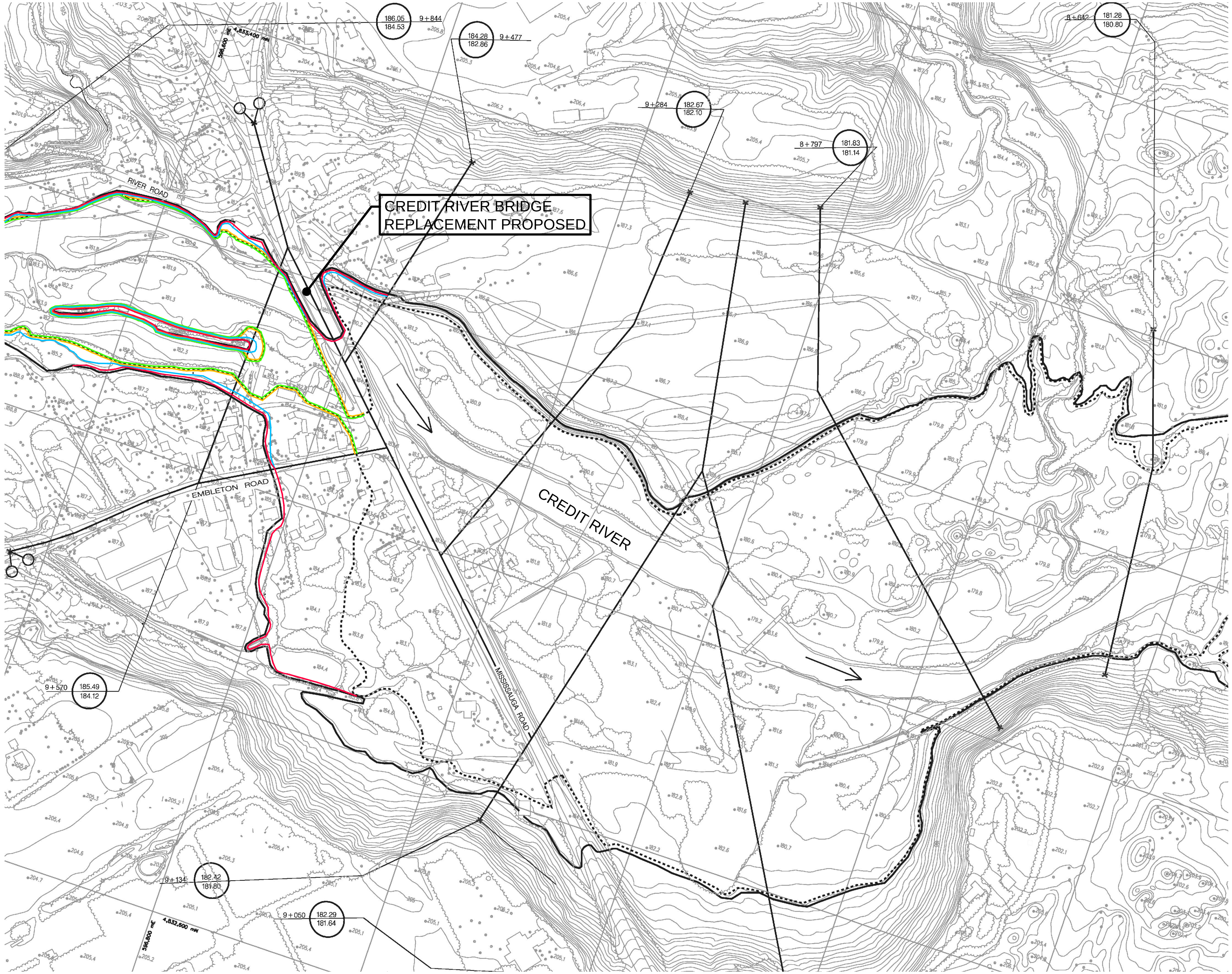


MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR
REGION OF PEEL

INFILTRATION TRENCH
CONFIGURATION

wood.

Scale 1:50
Consultant File No. TP115085
Figure No. 5.1



LEGEND

BRIDGE CROSS SECTION

CROSS SECTION

169.63
168.78
2+582

Regulatory Floodline

100 Year Floodline

Flow Arrow

REVISED EXISTING REGIONAL FLOODLINE	🟥
PRELIMINARY PROPOSED REGIONAL FLOODLINE	🟦
REVISED EXISTING 100 YEAR FLOODLINE	🟧
PRELIMINARY PROPOSED 100 YEAR FLOODLINE	🟩

NOTES:

1. PRELIMINARY PROPOSED REPLACEMENT RAISES BRIDGE DECK APPROXIMATELY 1.6m.
2. PRELIMINARY PROPOSED REPLACEMENT CONVEYS REGIONAL STORM.

SCALE

1:4000

CONTOUR INTERVAL 0.5 METRES:

SCALE VALID ONLY FOR
11"x17" VERSION

MISSISSAUGA ROAD EA
QUEEN ST W TO FINANCIAL DR
REGION OF PEEL

CREDIT RIVER
FLOODPLAIN LIMITS

wood.

Scale
AS NOTED

Consultant File No.
TP115085

Figure No.
6.1

Path: P:\Work\TP115085\Water\dwg\2017-09(Financial-Queen)\Fig6-1 Flood.dwg

Plotted By: richard.bartolo
Last Saved By: richard.bartolo

Plotted: 2018-04-30
Last Saved: 2017-10-04

Appendix A:
Background Information

Submitted to:

The Region of Peel and
Credit Valley Conservation

DESIGN BRIEF

REGION OF PEEL AND CREDIT VALLEY CONSERVATION LOW IMPACT DEVELOPMENT DESIGN FOR MISSISSAUGA ROAD

PROJECT 1: MISSISSAUGA ROAD (CREDIT RIVER TO WILLIAMS PARKWAY)

APPENDIX B

Geotechnical Investigation Summary

Mississauga Road - Project 1 and Project 2
Geotechnical Review and Summary

		Station	Asphalt/ Shoulder		Strat 1		Strat 2		Strat 3		WT	Proposed Road CL	Offset to WL
Project 1					Silty Sand		Sand and gravel		n/a				
	BH 101	9-811	191	188	188	186.5	186.5	183.5			187.4	192.3	4.9
					Silty Fine Sand		Clay bound Sand & Gravel		n/a				
	BH 102	9-918	200	198.5	198.5	195	195	EB			Dry	195	-
					Fill		Hard Silty Clay		W. Shale				
	BH 103	10-182	205	204	204	201.7	201.7	200.4	200.4	189.8	Dry	205.5	-
					Fill		Hard Silty Clay		W. Shale				
	BH 104	10-355	210.4	208	208	207.5	207.5	206	206	EB	Dry	210.2	-
					Fill		Hard Silty Clay		Shale				
	BH 105	10-588	218.2	217.5	217.5	217.2	217.2	216.3	216.3	EB	Cave @ 4.9 BGS	219	-
					Fill		Stiff Silty Clay/ Shaly Clay		Shale				
	BH 106	10-851	225	224.3	224.3	223.6	223.6	222.7	222.7	220.5	Dry	225.8	-
					Fill		Stiff Silty Clay/ Shaly Clay		n/a				
	BH 107	10-957	225.8	225.9	225.9	225	225	222.9			Dry	227.5	-
					Fill		Stiff Silty Clay/ Shaly Clay		W. Shale				
	BH 108	11-155	228.8	228.1	228.1	227	227	225.7	225.7	223.9	Dry	229.2	-
					Fill		Stiff Silty Clay/ Shaly Clay		W. Shale				
	BH 109	11-359	230.3	229.6	229.6	227.8	227.8	227.2	227.2	226.5	Dry	230.9	-
					Fill		Fine Silty Sand		H. Silty Clay				
	BH 110	11-597	233.5	232.8	232.8	231.3	231.3	229.1	229.1	227.8	229.8	234.1	4.3
					Silty Clay		Silt & fine Sand		Sand w Silt				
	BH 111	11-810	239	238.2	238.2	237.8	237.8	236.1	236.1	233.9	Dry	239.6	-
					Fill/ Silty Clay		Silty Sand		Sand & Gravel				
	BH 112	12-054	238.4	237.6	237.6	236.4	236.4	234.7	234.7	230.5	235.9	238.9	3
					Fill		Fine Sand & silt		Dense Fine Sand & silt				
	BH 113	12-282	236	235	235	234.5	234.5	230	230	229.4	234.4	236	1.6
					Fill		Sandy Silty Clay		Silt & fine Sand				
	BH 114	12-400	234.3	233.6	233.6	232.8	232.8	232.1	232.1	231.3	232.7	235.3	2.6

Project 2													
					Fill		Sandy Silty Clay		Weak Silty Sand				
	BH 115	12-571	233.2	232.5	232.5	231.5	231.5	231	231	228.2	229.8	234.2	4.4
					Fill		Silty Sand		Shaly Clay				
	BH 116	12-706	233.7	232.7	232.7	231.6	231.6	229.4	229.4	227.5	232.1	236.7	4.6
					Fill		Sandy Silty Clay		Shale				
	BH 117	12-812	235.1	234.3	234.3	233.5	233.5	229.5	229.5	EB	232.1	235.2	3.1
					Fill		Silty Sand		Shaly Clay				
	BH 118	12-917	235.6	235	235	233.2	233.2	232.1	232.1	EB	233.5	235.9	2.4
					Fill		Silty Clay - Silty Sand		W. Shale				
	BH 119	13-175	237.1	23.6.5	23.6.5	234.4	234.4	231.3	231.3	EB	234.2	237.3	3.1

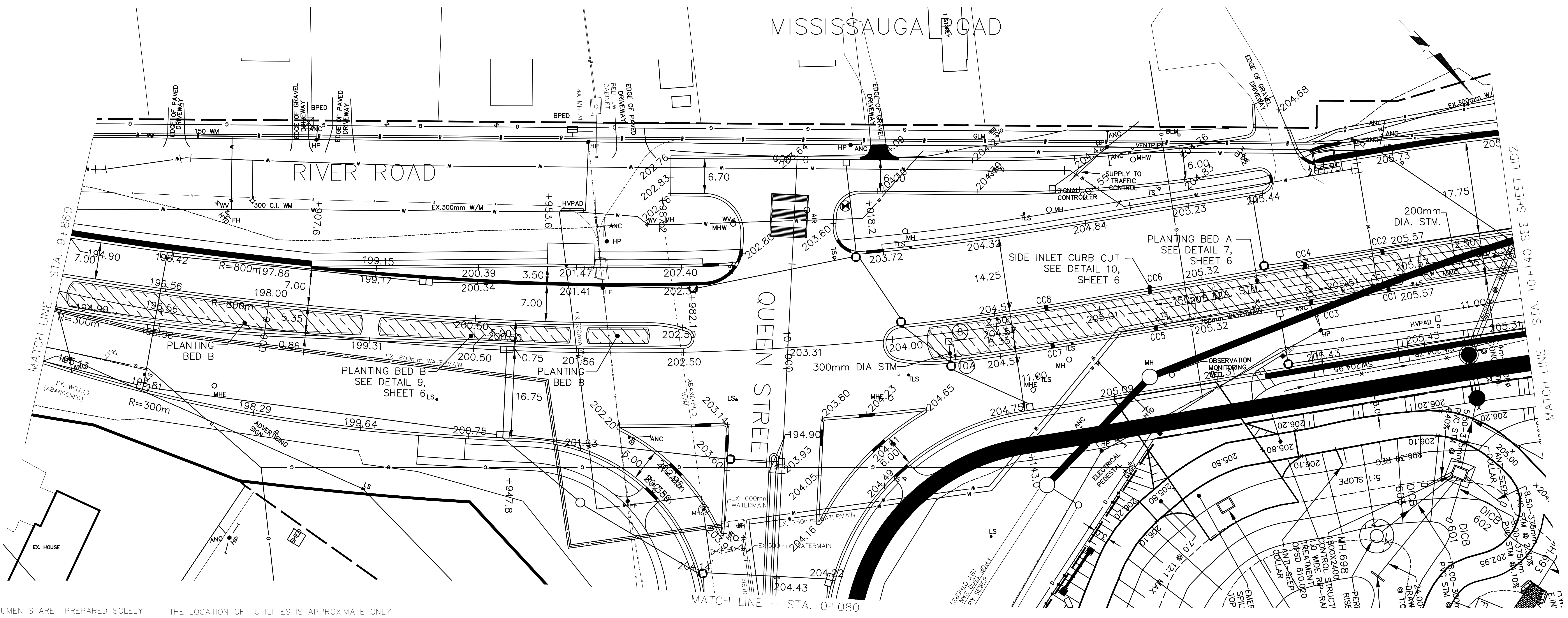
MISSISSAUGA ROAD
(FROM OSTRANDER BLVD TO QUEEN ST)
LID DRAINAGE & CENTRE MEDIAN DESIGN
90% DRAWING SUBMISSION

Aquafor Beech
Limited

#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089

55 REGAL ROAD, UNIT 3
GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224-3740
FAX: (519) 224-3750

Region of Peel
Working for you



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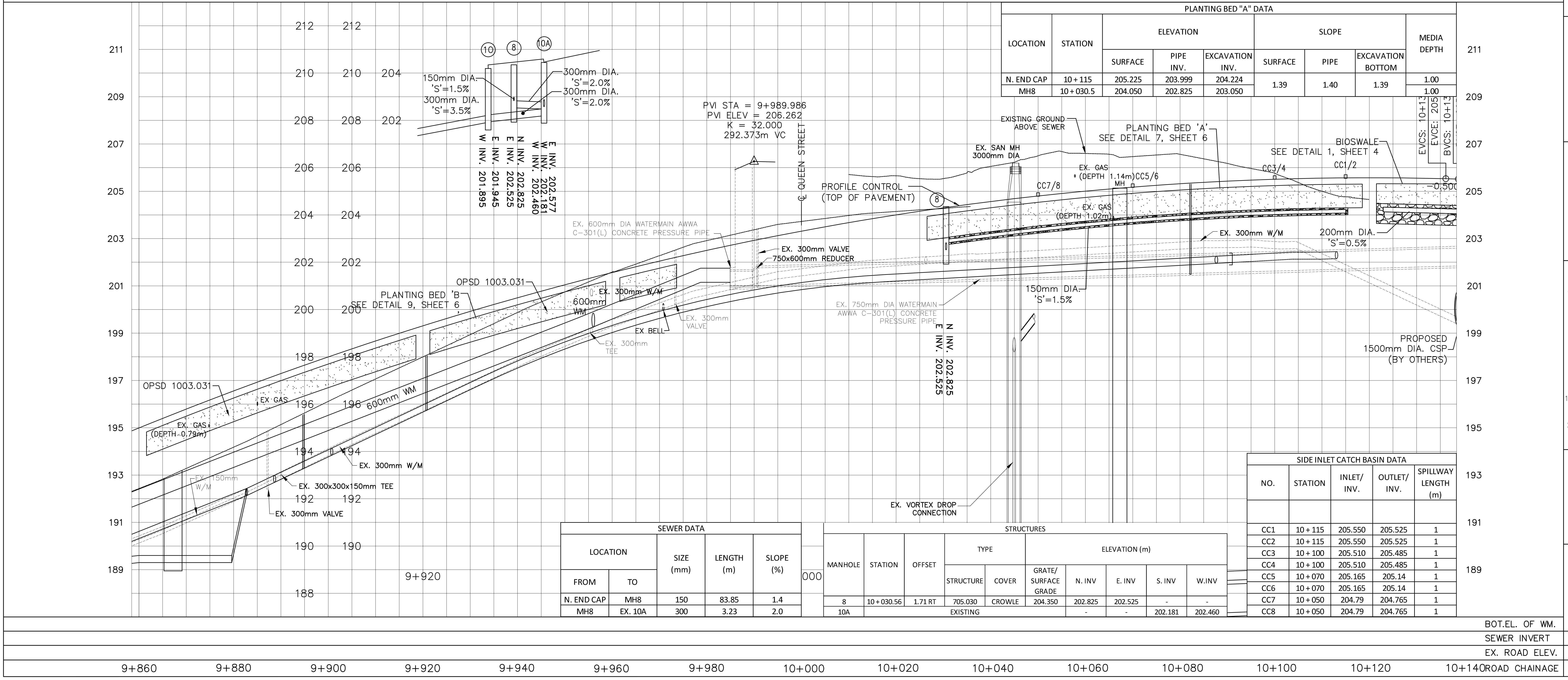


PLANTING BED "A" DATA

LOCATION	STATION	ELEVATION			SLOPE			MEDIA DEPTH
		SURFACE	PIPE INV.	EXCAVATION INV.	SURFACE	PIPE	EXCAVATION BOTTOM	
N. END CAP	10 + 115	205.225	203.999	204.224	1.39	1.40	1.39	1.00
MH8	10 + 030.5	204.050	202.825	203.050				1.00

SEWER DATA

LOCATION		SIZE (mm)	LENGTH (m)	SLOPE (%)
FROM	TO			
N. END CAP	MH8	150	83.85	1.4
MH8	EX. 10A	300	3.23	2.0

STRUCTURES

MANHOLE	STATION	OFFSET	TYPE		ELEVATION (m)				
			STRUCTURE	COVER	GRATE/ SURFACE GRADE	N. INV	E. INV	S. INV	W.INV
8	10 + 030.56	1.71 RT	705.030	CROWLE	204.350	202.825	202.525	-	-
10A	EXISTING					-	-	202.181	202.460

SIDE INLET CATCH BASIN DATA

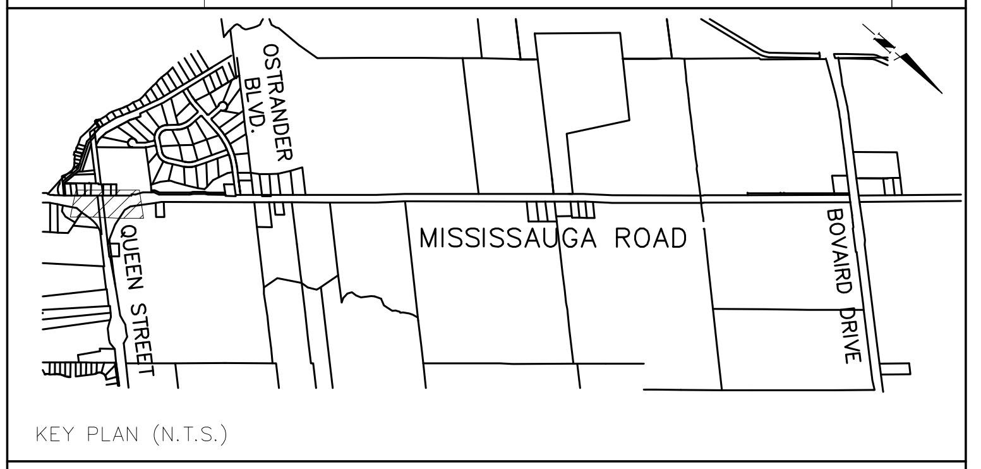
NO.	STATION	INLET/ INV.	OUTLET/ INV.	SPILLWAY LENGTH (m)
CC1	10 + 115	205.550	205.525	1
CC2	10 + 115	205.550	205.525	1
CC3	10 + 100	205.510	205.485	1
CC4	10 + 100	205.510	205.485	1
CC5	10 + 070	205.165	205.14	1
CC6	10 + 070	205.165	205.14	1
CC7	10 + 050	204.79	204.765	1
CC8	10 + 050	204.79	204.765	1

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C



KEY PLAN (N.T.S.)

LEGEND

———	Proposed Solid Pipe
— —	Proposed Perforated Pipe
W1	Proposed Flow Control Weir
■	Proposed Armourstone
▨	Proposed Bioswale Area
▨	Proposed Enhanced Swale Area
▨	Proposed Planting Bed Areas
+227.82	Ex. Road Grade
■ CC1	Proposed Curb Cut

General Notes

— — All Driveways ASPHALT Unless Otherwise Noted.
— — All Service Locations Are Approximate And Must Be Located Accurately In The Field
◎ Denotes Building – Not Located
▭ Denotes Building Located
Type 'B' Bedding Unless Otherwise Noted (SAN)

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Designed by
_____ _____ _____ _____ Chkd. _____

Approved by
_____ _____ _____ _____ _____

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HYDRO ONE BRAMPTON

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ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)
L.I.D – PLAN AND PROFILE 1
STA. 9+860 TO STA. 10+140

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 04/12/14	Sheet 1 of 6	Plan No. LID 1

File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\ASB Design CAD\ABL_MissABL Mississauga Rd_Phase 1_90%_DESIGN_V6(FEB 19, 2015).dwg, Layout : LID 1 Date :Feb 23, 2015 - 10:19am, Edit By : Will

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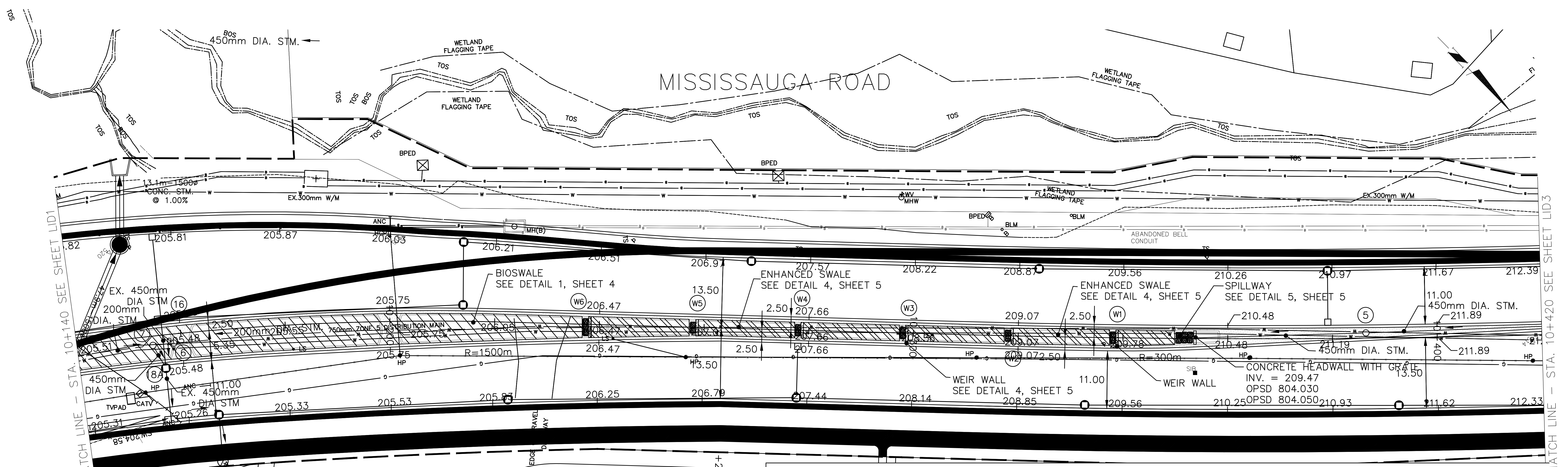

BIOSWALE DATA

LOCATION	STATION	ELEVATION				SLOPE			DEPTH		
		SURFACE GRADE	PIPE INV.	EXCAVATION INV.	TOP OF GRAVEL	SURFACE GRADE	PIPE	EXCAVATION	MEDIA	CLEAR STONE	TOTAL
W6	10 + 238.16	205.981	-	204.237	205.087	0.85	-	0.99	0.894	0.850	1.744
N. END CAP	10 + 236.39	205.881	204.712	204.212	205.062		1.0		0.819	0.850	1.669
MH 6	10 + 158.50	205.300	203.950	203.450	204.300	-	-	-	1.000	0.850	1.850
S. END CAP	10 + 122.93	205.320	204.131	203.631	204.481	0.056	0.5	0.51	0.839	0.850	1.689

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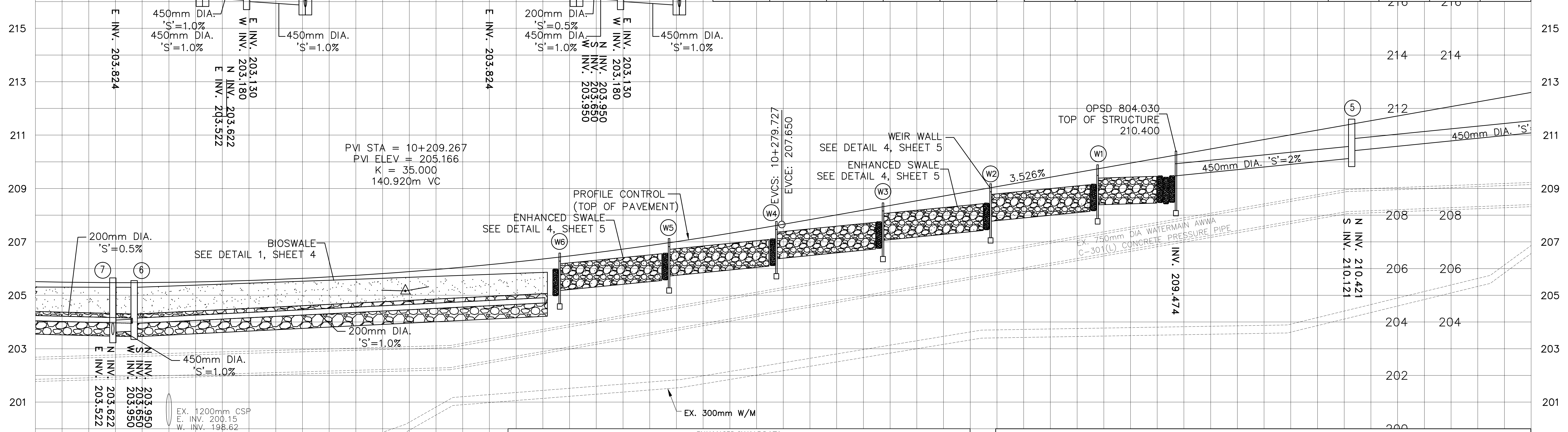
SEWER DATA

LOCATION		SIZE (mm)	LENGTH (m)	SLOPE (%)
FROM	TO			
MH 5	OUTLET	450	32.33	2.0
N. END CAP	MH 6	200	76.16	1.0
S. END CAP	MH 6	200	36.24	0.5
MH6	MH7	450	2.80	1.0
MH7	EX. 18A	450	3.54	1.0

STRUCTURES

MANHOLE	STATION	OFFSET	TYPE		ELEVATION (m)				
			STRUCTURE	COVER	GRATE/ SURFACE GRADE	N. INV	E. INV	S. INV	W.INV
5	10 + 386.40	0.98m LT	701.010	401.020	211.600	210.421	-	210.121	-
OUTLET	10 + 353.50	0.30m LT	804.030	804.050	210.400	209.474	-	-	-
6	10 + 158.50	1.76 RT	701.010	CROWLE	205.550	203.950	-	203.650	203.950
7	10 + 154.51	1.78 RT	701.010	401.020	205.650	203.622	203.522	-	-
18A	EXISTING					-	203.130	-	203.487



ENHANCED SWALE DATA

NO.	LENGTH (m)	SLOPE (%)	SURFACE ELEVATION		U/S SWALE INV. BELOW U/S WEIR CREST (m)	SWALE DEPTH U/S (m)	SWALE DEPTH D/S (m)	AVG. SWALE DEPTH (m)
			U/S	D/S				
1	14.39	0.59	209.474	209.389	0.00	0.926	0.500	0.713
2	19.52	2.00	209.168	208.778	0.32	0.721	0.400	0.560
3	19.64	2.00	208.456	208.063	0.42	0.722	0.400	0.561
4	19.46	2.00	207.757	207.368	0.41	0.706	0.400	0.553
5	19.57	2.00	207.114	206.723	0.35	0.654	0.400	0.527
6	19.94	2.00	206.580	206.181	0.24	0.543	0.400	0.472

WEIR DATA

NO.	STATION	OFFSET	ELEVATION			TOTAL SPAN (m)	CREST WIDTH (m)	CREST HEIGHT (m)
			TOP	CREST	WEEP HOLE INV.			
W 1	10 + 338.84	0	209.889	209.489	208.789	3.0	2.0	0.400
W 2	10 + 318.81	0	209.178	208.878	208.178	3.0	2.0	0.300
W 3	10 + 298.66	0	208.463	208.163	207.463	3.0	2.0	0.300
W 4	10 + 278.71	0	207.768	207.468	206.768	3.0	2.0	0.300
W 5	10 + 258.63	0.10 RT	207.123	206.823	206.123	3.2	2.0	0.300
W 6	10 + 238.16	0.5m RT	206.581	206.281	205.581	4.0	3.0	0.300

BOT.EL. OF WM.
SEWER INVERT
EX. ROAD ELEV.
10+140 10+160 10+180 10+200 10+220 10+240 10+260 10+280 10+300 10+320 10+340 10+360 10+380 10+400 10+420 ROAD CHAINAGE

SERVICE DATA

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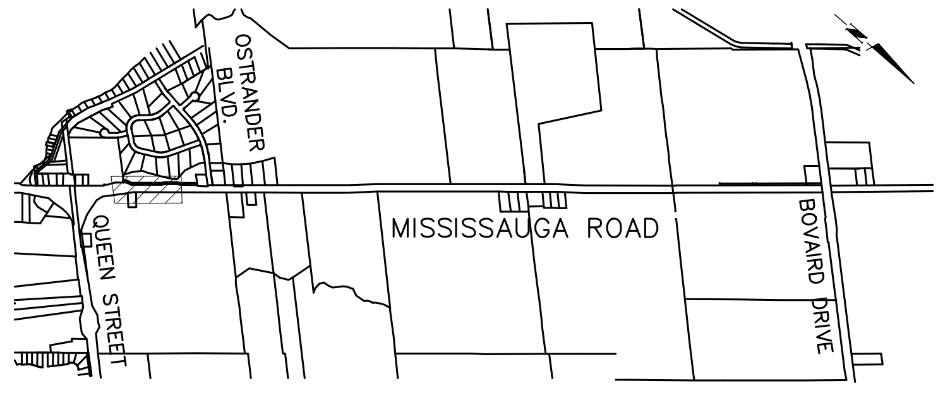

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▨	Proposed Planting Bed Areas
_227.82	Ex. Road Grade
■ CC1	Proposed Curb Cut

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Designed by ____ Chkd. ____ Approved by ____

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ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

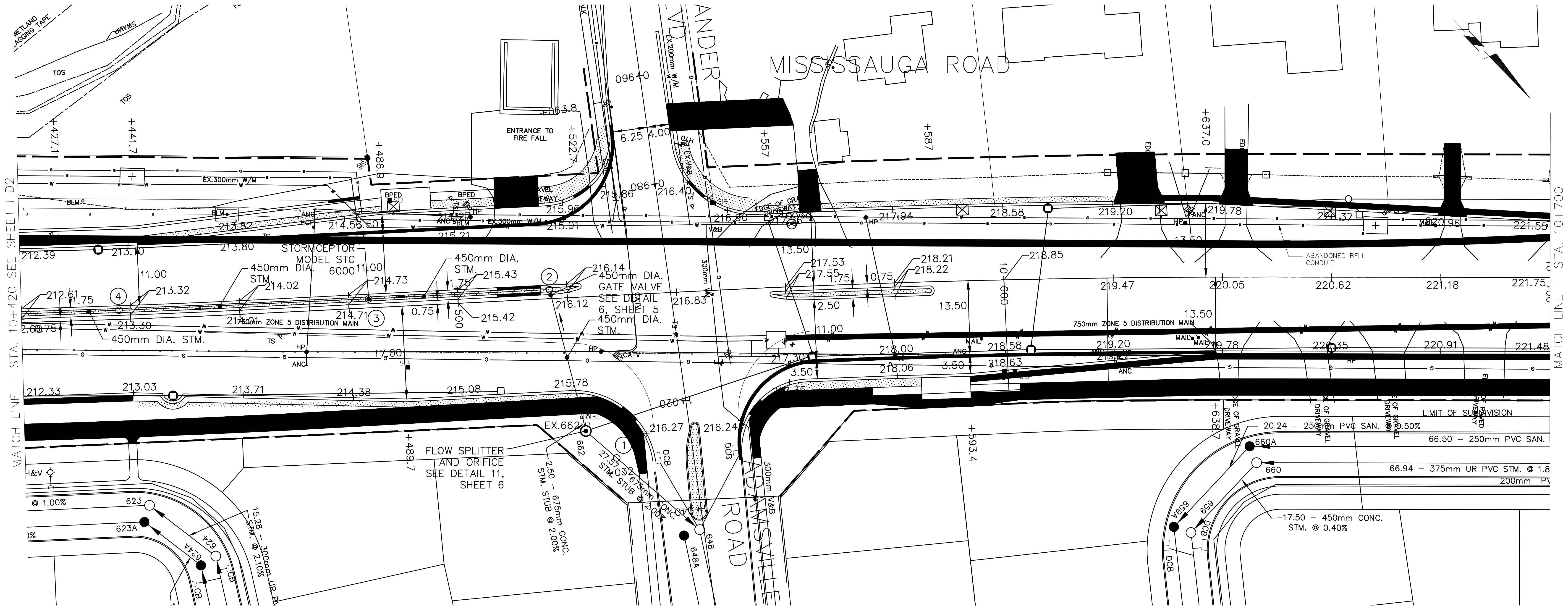
10m 0 10 20 30m HORIZONTAL SCALE
2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)
L.I.D – PLAN AND PROFILE 2
STA. 10+140 TO STA. 10+420

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 04/12/14	Sheet 2 of 6	Plan No. LID 2

File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\A$B Design CAD\ABL_MissABL Mississauga Rd_Phase 1_90%_DESIGN_V6(FEB 19, 2015).dwg,   Layout : LID 3   Date :Feb 23, 2015 - 10:19am, Edit By : Will



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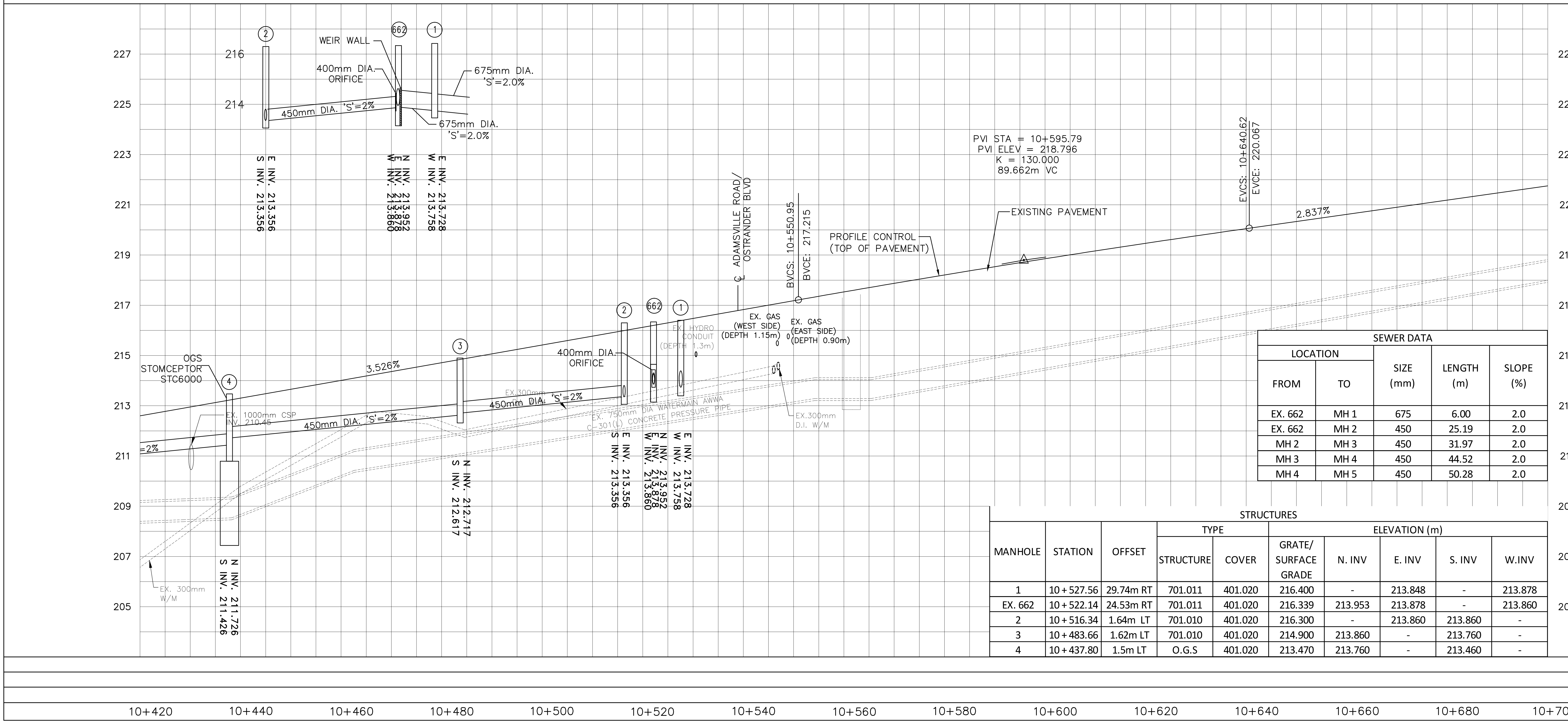


SEWER DATA				
LOCATION		SIZE (mm)	LENGTH (m)	SLOPE (%)
FROM	TO			
EX. 662	MH 1	675	6.00	2.0
EX. 662	MH 2	450	25.19	2.0
MH 2	MH 3	450	31.97	2.0
MH 3	MH 4	450	44.52	2.0
MH 4	MH 5	450	50.28	2.0

STRUCTURES

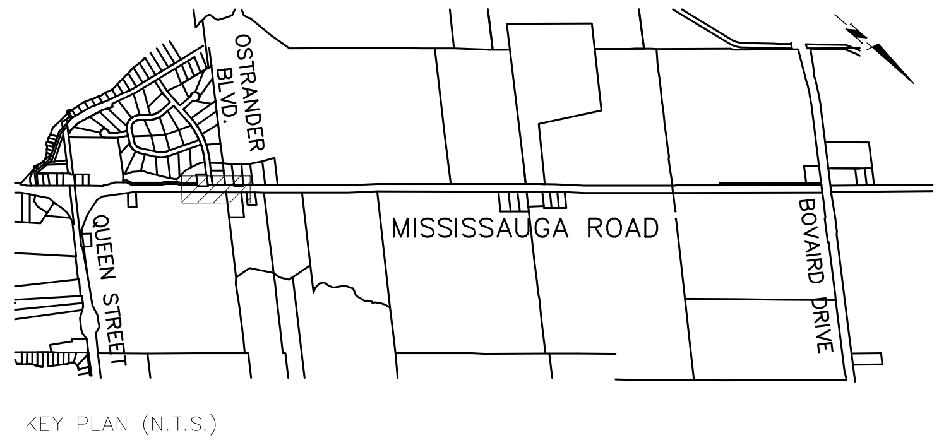
MANHOLE	STATION	OFFSET	TYPE		ELEVATION (m)				
			STRUCTURE	COVER	GRATE/ SURFACE GRADE	N. INV	E. INV	S. INV	W.INV
1	10 + 527.56	29.74m RT	701.011	401.020	216.400	-	213.848	-	213.878
EX. 662	10 + 522.14	24.53m RT	701.011	401.020	216.339	213.953	213.878	-	213.860
2	10 + 516.34	1.64m LT	701.010	401.020	216.300	-	213.860	213.860	-
3	10 + 483.66	1.62m LT	701.010	401.020	214.900	213.860	-	213.760	-
4	10 + 437.80	1.5m LT	O.G.S	401.020	213.470	213.760	-	213.460	-

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C



KEY PLAN (N.T.S.)

LEGEND

———	Proposed Solid Pipe
— —	Proposed Perforated Pipe
W1	Proposed Flow Control Weir
▮	Proposed Armourstone
▨	Proposed Bioswale Area
▨	Proposed Enhanced Swale Area
▨	Proposed Planting Bed Areas
_227.82	Ex. Road Grade
▪ CC1	Proposed Curb Cut

General Notes

— — All Driveways ASPHALT Unless Otherwise Noted.
— — All Service Locations Are Approximate And Must Be Located Accurately In The Field
◎ Denotes Building – Not Located
▭ Denotes Building Located
Type 'B' Bedding Unless Otherwise Noted (SAN)

B.M. No. Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor. For final layout approval prior to installation, please contact Tahar Singh at 905–874–2750 ext 2397 or Chris Lafleur ext 2358.

Designed by
_____ _____ _____ _____ Chkd. _____

Approved by
_____ _____ _____ _____ _____

Aquafor Beech Limited

#6–202–2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629–0099
FAX: (905) 629–0089

55 REGAL ROAD, UNIT 3
GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224–3740
FAX: (519) 224–3750

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED–GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD

(FROM QUEEN STREET TO BOVAIRD DRIVE)

L.I.D – PLAN AND PROFILE 3

STA. 10+420 TO STA. 10+700

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 04/12/14	Sheet 3 of 6	Plan No. LID 3

BIOSWALE GENERAL NOTES:

1. BIOMEDIA AS PER TABLE 1 SHOULD BE OBTAINED PREMIXED FROM HERMANNS CONTRACTING LTD (905-939-1230), J.JENKINS AND SON LANDSCAPE CONTRACTORS LTD. (416 783-6137) OR EQUIVALENT. VENDOR TO PROVIDE TESTING RESULTS PRIOR TO INSTALLATION. DELIVERED MEDIA SHALL BE TESTED AND APPROVED BY FIELD ENGINEER PRIOR TO INSTALLATION. MEDIA INSTALLED WITHOUT FIELD ENGINEER CLEARANCE SHALL BE REMOVED AT THE CONTRACTOR'S EXPENSE IF DEEMED NECESSARY BY THE FIELD ENGINEER. THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR ALL REQUIRED MEDIA TESTING EXPENSES. MEDIA TESTING RESULTS CAN BE EXPECTED APPROXIMATELY 2 - 3 WEEKS AFTER SUBMISSION TO LAB. THE CONTRACTOR IS RESPONSIBLE FOR ANY DELAYS SUFFERED AS A RESULT OF TESTING. NO COMPENSATION WILL BE PROVIDED FOR DELAYS DUE TO MEDIA ANALYSIS.

TABLE 1: MEDIA FOR BIOSWALES & PLANTING BED

MEDIA	SIZE	% BY WEIGHT
1 - SAND	2 to 0.05mm	85 - 88%
2 - FINES	< 0.050mm	8 - 12%
3 - LEAF COMPOST (Organic Matter)	–	3 - 5%

Notes:
- CEC greater than 10 mg/100g
- PH = 5.5 - 7.5
- K greater than 25mm/hr

Soil Texture Classification:
No objects greater than 50mm
Media obtained from vendor to be tested to confirm design specifications prior to installation. Field engineer to confirm conformance with specification prior to installation.

ENHANCED SWALES

Enhanced Swale media shall be comprised of the biomedia specified in Table 1 in addition to 20mm Ø washed clearstone 50% by Volume

2. UNDERDRAIN PERFORATED PIPE CONSTRUCTED IN ACCORDANCE WITH OPS 405. 10mm DIAMETER PERFORATIONS IN PIPE.ENDS TO BE CAPPED. NOTE: PIPES SHOULD TERMINATE 0.3m SHORT OF THE SIDES OF THE EXCAVATED OPENING

3. GEOTEXTILES SHALL BE PLACED ON THE SIDES OF EXCAVATION. SECURE IN PLACE TO PREVENT WRINKLING AND OVERLAP A MINIMUM OF 0.6m IN THE DIRECTION TO DRAINAGE. GEOTEXTILE FABRIC MUST CONFORM TO OPSS 1860 FOR CLASS II GEOTEXTILE FABRICS. ACCEPTABLE FABRICS INCLUDE ONE OF THE FOLLOWING:

A) NON-WOVEN NEEDLE PUNCHED FABRICS MUST HAVE AN APPARENT OPENING SIZE (AOS) OF ≤0.3mm (MAXIMUM AVERAGE ROLL VALUE)

OR

B) WOVEN MONOFILAMENT FABRICS MUST HAVE A PERCENT OPEN AREA (POA) OF ≥ 4% UNACCEPTABLE FABRICS INCLUDE 'WOVEN SILT FILMS' AND OR 'NON-WOVEN HEAT BONDED FABRICS.

4. MANHOLE AND OVERFLOW GRATE ARE TO BE INSTALLED FROM THE UNDERDRAIN TO THE BIOSWALE SURFACE TO ACCOMMODATE OVERFLOW CONDITIONS AS PER BIOSWALE CROSS-SECTIONS AND CAN BE USED FOR MONITORING AND MAINTENANCE OF THE UNDERDRAIN SYSTEM.

5. SEDIMENT CONTROLS SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION TO PREVENT RUNOFF FROM CONTAMINATING EXCAVATED SURFACE OF THE NATIVE SOILS AND OR THE AGGREGATE BASE COURSES AND OF THE BIOSWALES.

6. FINAL GRADE OF THE BIOSWALE FACILITIES TO BE EXCAVATED IMMEDIATELY PRIOR TO BACKFILLING WITH SPECIFIED AGGREGATE + MEDIA TO AVOID PREMATURE FACILITY CLOGGING.

7. ALL CONSTRUCTION MATERIALS ARE TO BE STORED DOWN-GRADIENT OF EXCAVATED SITE WHENEVER POSSIBLE. MATERIALS STORED UP-GRADIENT OF THE EXCAVATED SITE ARE TO BE ENCLOSED BY APPROPRIATE SEDIMENT CONTROL FENCING.

8. SEDIMENT LOGS/SOCKS TO BE PLACED & SCREENED AT ALL CURB CUT LOCATIONS & ENTRY POINTS TO PREVENT SEDIMENT ENTER INTO PROPOSED BIOSWALES.

9. APPROVED BIOMEDIA MIXES SHALL BE INSTALLED IMMEDIATELY PRIOR TO INSTALLATION OF THE PLANTINGS AND STABILIZATION MEASURES.

UNDERDRAIN/ PERFORATED PIPE NOTES

1. UNDERDRAIN PERFORATED PIPE TO BE CONSTRUCTED IN ACCORDANCE WITH OPS 405. MINIMUM PIPE DIAMETER 150mm & 200mm, 10mm DIAMETER PERFORATIONS IN PIPE.
   NOTE: PIPES SHOULD TERMINATE 0.3m SHORT OF THE ENDS OF THE EXCAVATED OPENING. ENDS TO BE CAPPED.
2. UNDERDRAIN MATERIAL SHOULD BE RESISTANT TO THE CHEMICALS PRESENT IN SOILS AND GROUNDWATER AND SHALL PROVIDE PROTECTION AGAINST DEGRADATION BY ULTRA - VIOLET LIGHT.
3. TUBING MUST BE UNIFORM IN COLOUR AND DENSITY AND FREE FROM VISIBLE DEFECTS
4. PERFORATED PIPE - WATER OPENING AREA SHALL NOT BE LESS THAN 16cm^2/m OF TUBING. WATER OPENING SHOULD BE LOCATED IN THE BOTTOM OF EXTERIOR CORRUGATION VALLEYS
5. THE TUBING SHALL HAVE A STIFFNESS OF NO LESS THAN 170kN//m^2 AT 5% DEFLECTION AND 130kN/m^2 AT 10% DEFLECTION WHEN TESTED IN ACCORDANCE WITH ASTM D2412.

UNDERDRAIN/ PERFORATED PIPE NOTES, CON'T

1. DRAINAGE PIPES SHALL BE INSTALLED WITH CONSTANT GRADES TO DRAIN, HAVE SMOOTH TRANSITIONS AND ALL APPROPRIATE FITTINGS ACCORDING TO MANUFACTURER'S SPECIFICATIONS. CLEANOUT RISERS SHALL BE INSTALLED WHERE JUNCTIONS, GRADE OR DIRECTION CHANGES MAY CAUSE SILTATION WITHIN THE DRAIN LINES. MINIMUM SLOPE FOR UNDERDRAINS SHALL BE 0.5%.
2. PIPES SHALL BE LAID IN A TRUE LINE AND GRADIENT ON A FIRM BED, FREE FROM LOOSE MATERIAL. PIPES ARE NOT TO BE LAID ON SOIL BACKFILL OR IN A SLURRY AND ARE TO BE SECURELY POSITIONED TO AVOID DISPLACEMENT BEFORE BACKFILLING
3. THE INSIDE OF THE UNDERDRAIN SHALL BE KEPT CLEAN AND FREE OF DEBRIS DURING CONSTRUCTION. ALL DEBRIS SHOULD BE REMOVED BEFORE ADDITIONAL PIPE IS INSTALLED.
4. AGGREGATE BACKFILL MATERIAL SHALL BE FREE FROM FROZEN SNOW, ICE, FROZEN MATERIALS, TRASH, BRICK, CLAY LUMPS, BROKEN CONCRETE, TREE ROOTS, SOD, ASHES, GLASS PLASTER, VEGETABLE MATTER AND ANY OTHER FOREIGN MATTER.
5. UNDERDRAIN PIPES ARE TO BE JOINED USING APPROPRIATE FITTINGS AS PER PIPE MANUFACTURER SPECIFICATIONS.
6. ALL CONNECTIONS TO MANHOLES AND CATCH BASIN SHALL BE PER OPSD AND REGION STANDARDS

GENERAL CONSTRUCTION SEQUENCING:

1. EROSION AND SEDIMENTATION PROTECTION MEASURES ARE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY AND ALL EXCAVATION ACTIVITIES.
2. FLOW SPLITTER AND CONNECTION WITH EXISTING MANHOLE 662 SHALL NOT BE CONNECT/CONSTRUCTED UNTIL THE FINAL STAGES OF CONSTRUCTION SUCH THAT STORMWATER CONTINUES TO BYPASS TO THE EXISTING SWM POND DURING CONSTRUCTION.
3. REMOVED EXISTING PLANTER RETAINING WALLS IN AREAS TO BE REPLACED BY ENHANCED SWALES, BIOSWALE AND PLANTING BEDS
4. REMOVED CURB AND CENTER MEDIAN SURFACE TREATMENT AS REQUIRED TO INSTALL PROPOSED STORM SEWERS, MANHOLES AND OGS UPSTREAM OF OUTLET TO ENHANCED SWALES. EXIST CURB SHALL BE MAINTAINED AS MUCH AS POSSIBLE.
5. INSTALL PROPOSED STORM SEWERS, MANHOLES, OGS, GATE VALVE, UPSTREAM OF OUTLET TO ENHANCED SWALES
6. EXCAVATE ENHANCED SWALES AND INSTALL HEADWALLS AND WEIR STRUCTURES AT DESIGNATED LOCATIONS.
7. EXCAVATE BIOSWALE AND PLANTING BEDS "A" AND "B"
8. INSTALL SIDE INLET CURB CUTS ALONG PLANTING BED "A" AND ENSURE ESC CONTROLS (WOODEN BARRIERS) ARE IN PLACE
9. INSTALL ALL CLEARSTONE, UNDERDRAINS, BIOMEDIA AND CLEARSTONE/CLEAR STONE BIOMEDIA MIXES WITHIN LID SYSTEMS AND INSTALL ESC AS REQUIRED. MAKE CONNECTIONS WITH EXISTING STORM SEWER NETWORK AS DETAILED ON THE GENERAL PLANS.
10. INSTALL SURFACE TREATMENTS FOR EACH LID SYSTEM AND PLANTING MATERIAL PER LANDSCAPE PLAN.
11. ONCE SYSTEMS ARE STABLIZED AS APPROVED BY CONTRACT ADMINISTRATOR, CONSTRUCT FLOW SPLITTER AND INSTALL ORIFICE WITHIN EXISTING MANHOLE 662.TO BRING SYSTEMS ONLINE.

LID SYSTEM SPECIFIC CONSTRUCTION SEQUENCING:

1. EROSION AND SEDIMENTATION PROTECTION MEASURES ARE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY AND ALL EXCAVATION ACTIVITIES.
2. ROUGH EXCAVATION OF THE BIOSWALES, ENHANCED SWALES, AND PLANTING BED IS PERMITTED TO A MAXIMUM 100mm OF FINAL GRADE. FINAL GRADE OF THE BIOSWALE FACILITY TO BE EXCAVATED IMMEDIATELY PRIOR TO BACKFILLING WITH SPECIFIED AGGREGATE + MEDIA TO AVOID PREMATURE FACILITY CLOGGING.
3. EXCAVATION, BACKFILLING AND MEDIA INSTALLATION IS ONLY TO OCCUR AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED.
4. EXCAVATION OF FINAL 100mm OF NATIVE MATERIAL TO FINAL FACILITY INVERT AS PER DESIGN DRAWINGS AND INSTALL GEOTEXTILE FABRIC, AS REQUIRED. SURFACE OF EXCAVATION SHALL BE SCARIFIED PRIOR TO INSTALLATION OF BACKFILL MATERIALS.
   A - FOR BIOSWALE AND PLANTING BED "A", PLACE DESIRED DEPTH OF 20mm ø WASHED CLEAR STONE BENEATH UNDERDRAIN SYSTEM. SHOULD BE CLEAN WASHED; NO FINES SHOULD BE PRESENT IN MATERIAL (LESS THAN 1% PASSING 0.075MM SIEVE). (SEE GENERAL UNDERDRAIN/PERFORATED PIPE NOTES).

   B - FOR BIOSWALE AND PLANTING BED "A", INSTALL UNDERDRAIN /PERFORATED PIPE AS PER DRAWING, PLACE REMAINING 20mm ø WASHED CLEAR STONE TO DESIGN ELEVATION. (SEE GENERAL UNDERDRAIN/PERFORATED PIPE NOTES).

   C - FOR ALL SYSTEMS, APPLY BIOMEDIA OR BIOMEDIA + 20mm WASHED CLEARSTONE MIX IN 300mm LIFTS UNTIL DESIRED ELEVATION IS ACHIEVED. THOROUGHLY WET EACH LIFT BEFORE ADDING NEXT LIFT. ALLOW WATER TO FULLY PERCOLATE THROUGH THE SOIL BEFORE ADDING EACH COURSE.

   D - FINISH GRADING:
      A. THE BIOMEDIA OR BIOMEDIA + 20mm WASHED CLEARSTONE MIX SHALL BE FINE GRADED AFTER PLACEMENT. FINISHED GRADING SHALL CONFORM TO THE GRADE ELEVATIONS AND CONTOURS AS SHOWN ON THE DESIGN DRAWINGS AND SHALL BE FREE OF DEBRIS AND OTHER MATERIALS THAT WOULD BE DETRIMENTAL TO THE PERFORMANCE OF THE GROWING MEDIA.

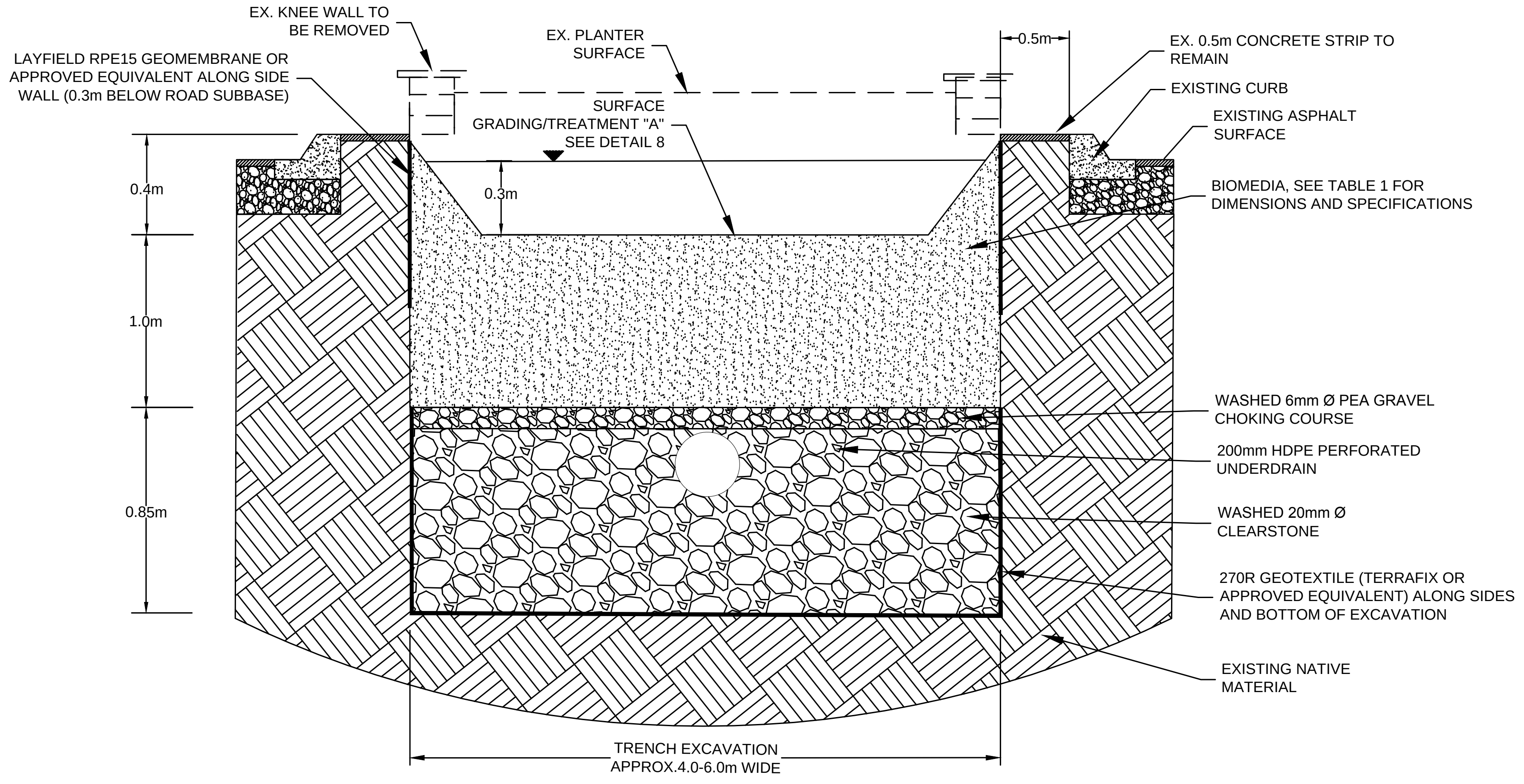
      B. THE FINISHED SURFACE SHALL BE SMOOTH AND UNIFORM, AND BE FIRM AGAINST DEEP FOOTPRINTING, WITH A FINE LOOSE SURFACE TEXTURE.

      C. PROTECTION OF THE FINISHED GRADE AND CORRECTION OF ANY IRREGULARITIES CAUSED BY WORK OPERATIONS OVER THE FINISHED GRADE SHALL BE ENFORCED.

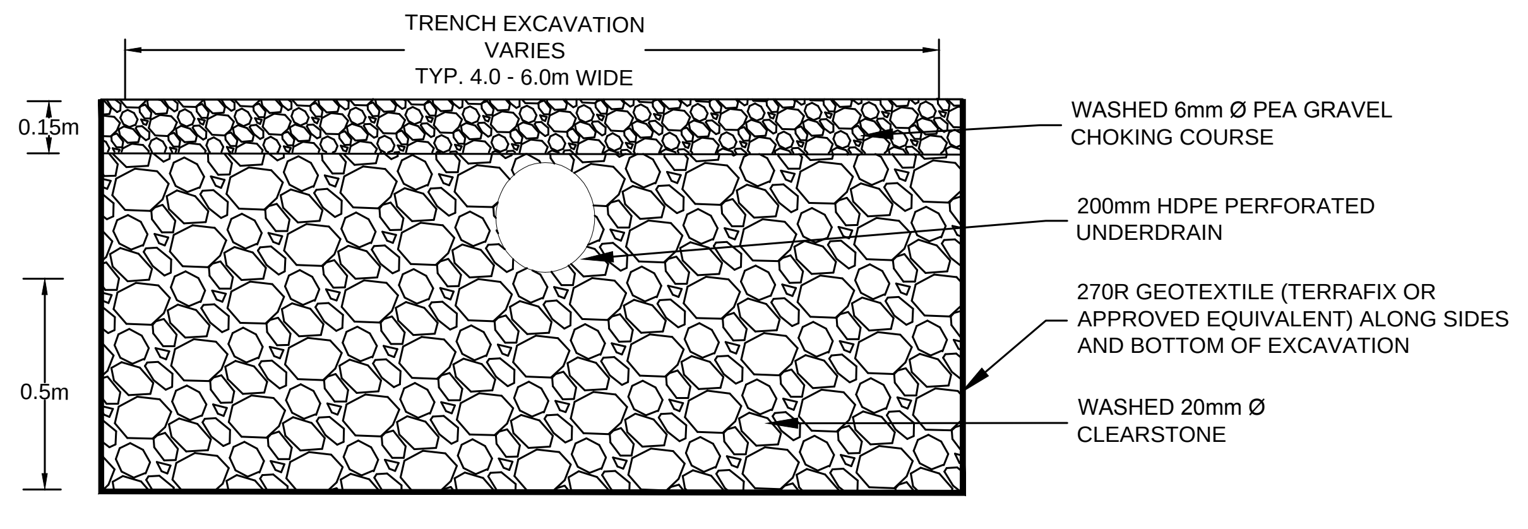
      D. SETTLING OF ANY FINISHED GRADE SHALL NOT BE MORE THAN 10mm FROM SPECIFIED ELEVATIONS, AND IF SETTLING IS GREATER, THE CONTRACTOR SHALL BRING THE GRADE TO THE SPECIFIED ELEVATIONS.
6. APPLY APPROPRIATE SURFACE TREATMENT "A" OR "B" FOR EACH SYSTEM AS INDICATED ON THE DESIGN DETAILS
6. PLANTINGS ARE TO OCCUR IN ACCORDANCE WITH THE LANDSCAPE PLANS. AS NECESSARY, PROVIDE A MINIMUM OF 1 IRRIGATION PER WEEK IN THE FIRST 2 MONTHS.
7. THE LID SYSTEMS SHOULD BE INSPECTED BY THE CONTRACTOR AFTER EACH STORM > 10mm OR A MIN. OF TWICE POST INSTALLATION DURING THE FIRST SIX MONTHS AFTER PLACING THE FACILITY ON-LINE. ANY DEVIATIONS FROM DESIGN DRAWINGS TO BE CORRECTED.
9. ALL LID SYSTEMS ARE TO BE INSPECTED A MIN. ONCE ANNUALLY (TYPICALLY IN SPRING) AND AFTER EACH EVENT GREATER THAN 10mm.

ESC NOTES

1. DURING CONSTRUCTION, PROVISIONS SHALL BE MADE FOR PROPER WATER MANAGEMENT AND DRAINAGE OF THE SITE. THIS SHALL INCLUDE SILT TRAPS, ALL EROSION CONTROL MEASURES, TEMPORARY WATER COLLECTION DITCHES AND OVERFLOW STRUCTURE, AS WELL AS THE PROPER MAINTENANCE OF SUCH THROUGHOUT THE CONSTRUCTION PERIOD. AT NO TIME SHALL SEDIMENT LADEN WATER BE ALLOWED TO ENTER THE EXCAVATED/BACKFILLED OR COMPLETED BIOSWALE , ENAHNCED SWALE, OR PLANTING BED AREAS. PRIOR TO THE STABILIZATION OF THE LID SYSTEMS, NO SITE DRAINAGE AND/OR STORM DRAINAGE IS TO ENTER THE PROPOSED LID AREAS. SHOULD SEDIMENT ENTER THE FACILITY PRIOR TO RECEIVING APPROVAL FROM FIELD ENGINEER/ LANDSCAPE ARCHITECT, THE INFILTRATION RATE OF THE CONTAMINATED AREA SHOULD BE TESTED USING THE GUELPH PERMEAMETER TEST TO CONFIRM NO LOSS IN INFILTRATION POTENTIAL. SHOULD A LOSS OF INFILTRATION CAPACITY BE CONFIRMED, THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPAIR/ REMEDIATION OF THE CONTAMINATED AREA TO THE SATISFACTION OF THE CLIENT/ ENGINEER/ LANDSCAPE ARCHITECT, USING APPROVED MEASURES/ MATERIALS AND PRACTICES.
2. ADHERENCE TO CONSTRUCTION SEQUENCING IS REQUIRED AS PART OF THE ESC PLAN. CONSTRUCTION SEQUENCING IS AN INTEGRAL COMPONENT OF ESC PROCEDURES/ PRACTICES AND HAS BEEN DESIGNED IN ORDER TO ENSURE THAT NO CONTAMINATION/ REDUCTION IN INFILTRATION CAPACITY TAKES PLACE AS A RESULT OF CONSTRUCTION ACTIVITIES.
3. TEMPORARY SEDIMENT CONTROLS TO BE INSTALLED PRIOR TO THE START OF CONSTRUCTION.
4. SEDIMENT CONTROL FOR THE SIDE INLET CATCH BSAINS SHALL CONSIST OF WOODED BARRIER (IF REQUIRED) AND SEDIMENT SOCKS INSTALLED ALONG SIDE INLET OPENING TO PREVENT FLOWS FROM ENTERING THE LID FACILITIES. THE WOODEN BARRIER SHALL BE STALKED SECURELY IN PLACE ON THE BACKSIDE OF THE PROPOSED SIDE INLET CURB CUTS. FILTER CLOTH SHALL BE PLACED BETWEEN THE CURB CUT AND THE WOODEN BARRIER TO PREVENT SEDIMENT FROM BYPASSING THE WOODEN BARRIERS VIA CRACKS OR SMALL OPENINGS. BARRIER MATERIALS SHALL BE APPROVED BY THE FIELD ENGINEER PRIOR TO INSTALLATION.
5. THE CONTRACTOR SHALL PLACE SEDIMENT LOGS/SOCKS AT CURB-CUT LOCATIONS AND ENTRY POINTS TO THE PLANTING BEDS TO PREVENT SEDIMENT ENTRY INTO THE PROPOSED BIOSWALES.
6. SEDIMENT TRAPS OR APPROVED EQUIVALENT SHALL BE INSTALLED AT PROPOSED ALL CATCH BASINS AND STORM SEWER INLET POINTS PRIOR TO LID CONSTRUCTION TO PREVENT SEDIMENT ENTERING THE STORM SEWER NETWORK.
7. CONTRACTOR IS RESPONSIBLE FOR ANY REMEDIATION/REPAIR OF INFILTRATION FACILITIES DAMAGED AS A RESULT OF INADEQUATE OR IMPROPER SEDIMENT CONTROL.
8. THE CONTRACTOR SHALL DELINEATE THE REQUIRED WORKING AREA ON-SITE PRIOR TO THE START OF WORK AND SHALL CONFINE OPERATIONS WITHIN THE DEFINED AREA.
9. TEMPORARY TOPSOIL AND/OR FILL MATERIAL STOCKPILE AREAS TO BE ENCLOSED WITH SILTATION CONTROL PER THE ESC PLAN. MATERIALS ARE NOT TO BE STOCKPILED UPSTREAM OF PROPOSED FACILITIES.
10. LOCATION OF STOCKPILE AREAS TO BE DETERMINED ON-SITE PRIOR TO CONSTRUCTION AND APPROVED BY THE ENGINEER.
11. WORKING AREAS, ACCESS REQUIREMENTS, AND TEMPORARY MATERIAL STORAGE AREAS TO BE MAINTAINED IN GOOD CONDITION BY THE CONTRACTOR AT ALL TIMES. AREAS AFFECTED BY THE CONTRACTOR'S ACTIVITIES TO BE REINSTATED TO THE EXISTING CONDITIONS OR BETTER.
12. NO RUNOFF FROM EXCAVATED OR UNVEGETATED AREAS SHALL BE DISCHARGED OFF SITE INTO ACTIVE AND/OR INACTIVE STORM SEWERS OR WATERCOURSES.
13. ALL ACCUMULATED SEDIMENTS TO BE REMOVED PRIOR TO THE REMOVAL OF CONTROLS AND DISPOSED OF IN AN APPROVED ON-SITE LOCATION BY THE CONTRACTOR (LOCATION TO BE DETERMINED IN THE FIELD).
14. ON-SITE EQUIPMENT REFUELING AND MAINTENANCE TO BE ONLY COMPLETED IN DESIGNATED AREAS.
15. SEDIMENT CONTROLS TO BE INSPECTED WEEKLY AND AFTER EACH RAINFALL EVENT. SEDIMENT CONTROLS TO BE MAINTAINED AND REPAIRED BY THE CONTRACTOR UNTIL COMPLETION OF CONSTRUCTION AND SITE RESTORATION.
16. ALL SITE RESTORATION TO BE IN ACCORDANCE WITH THE RESTORATION PLAN AND DETAILS.
17. ALL ROADWAYS TO BE CLEANED OF SEDIMENTS RESULTING FROM CONSTRUCTION TRAFFIC FROM THE SITE EACH DAY.
18. EROSION PROTECTION TO BE PROVIDED AROUND ALL EXISTING STORM AND SANITARY MHs , DICBs AND CBs PRIOR TO CONSTRUCTION.
19. REMOVE TEMPORARY SEDIMENT CONTROLS FOLLOWING COMPLETION OF CONSTRUCTION AND SITE RESTORATION, AND REINSTATE AFFECTED AREAS TO EXISTING CONDITIONS OR BETTER.



BIOSWALE CONSTRUCTION DETAIL
N.T.S.

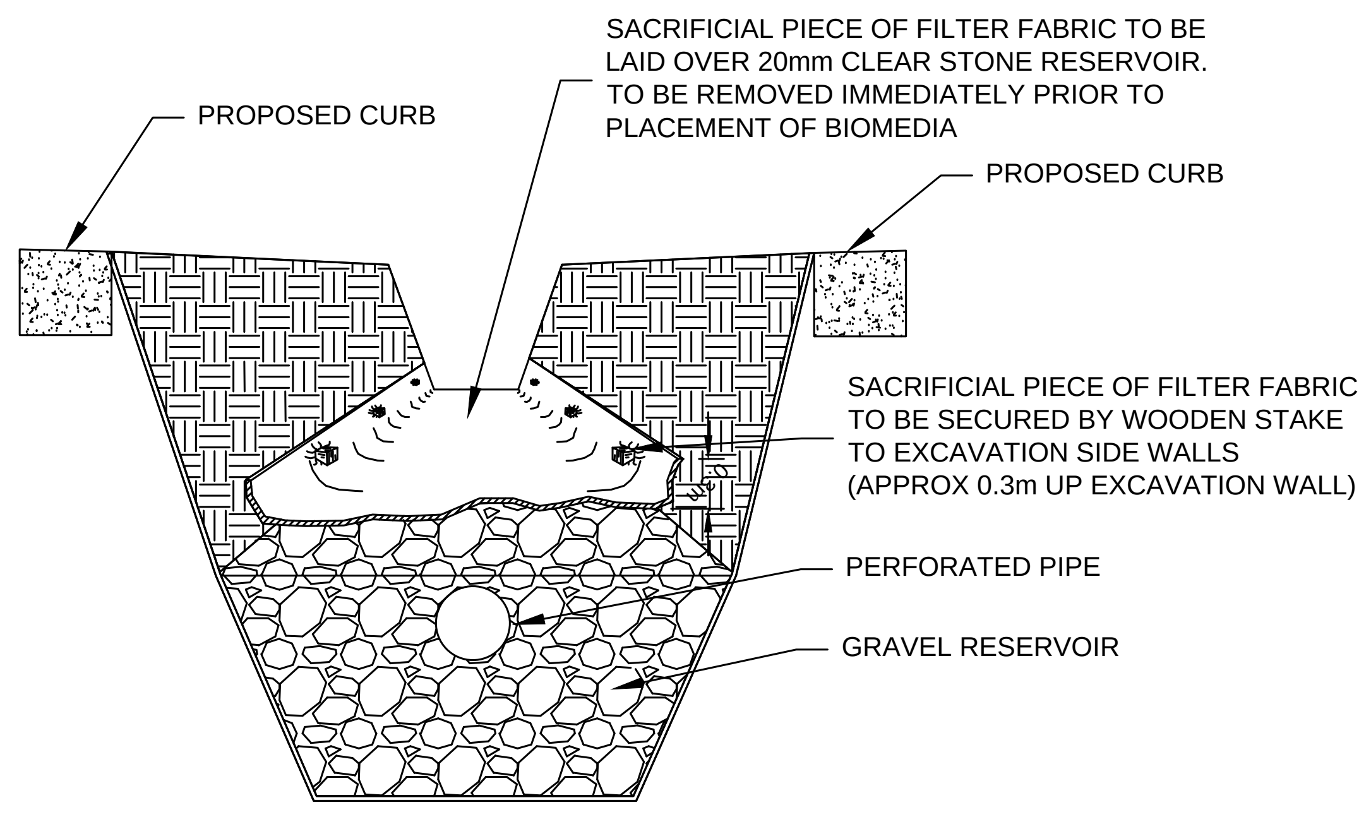


BIOSWALE UNDERDRAIN DETAIL
N.T.S.

Notes:

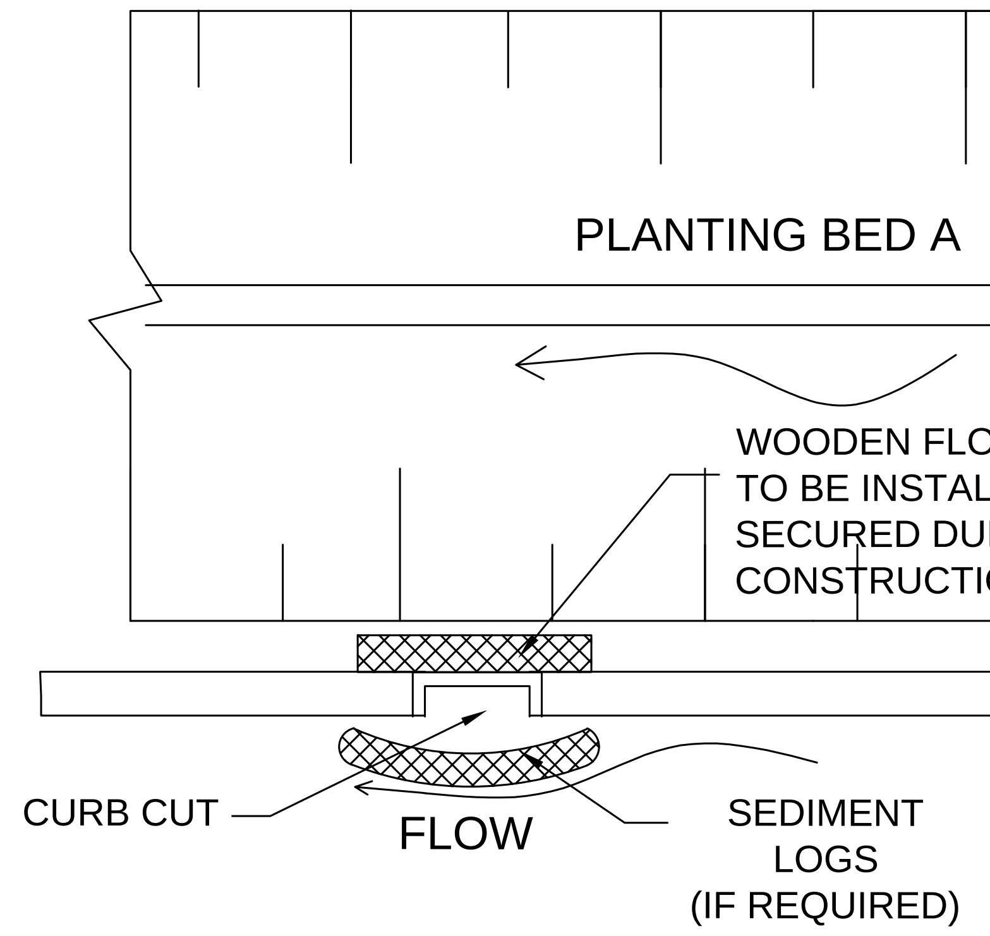
1. TRENCH WIDTH SHALL VARY WHERE UTILITIES ARE ENCOUNTERED. TRENCH WITH MAY BE DECREASED, AS APPROVED BY THE FIRLED ENGINEER, IN ORDER TO AVOID UTILITIES OR OTHER OBSTRUCTION ENCOUNTERED DURING EXCAVATION.
2. PIPE CONFIGURATION DETAILED ON THE PLAN MAY BE ALTERED IN THE FIELD AS APPROVED BY THE FIELD ENGINEER IN ORDER TO AVOID UTILITIES OR OBSTRUCTIONS.
3. EXCAVATION AND CLEARSTONE GRADING SHALL FOLLOW EMBEDDED PIPE GRADE AS SPECIFIC ON ACCOMPANYING DATA TABLES. BIOMEDIA DEPTHS SHALL VARY SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.
4. FINAL GRADING OF BIOMEDIA SHALL ACCOUNT FOR REQUIRED SURFACE TREATMENTS SUCH THAT SPEFICIED SURFACE GRADING IS ACHIEVED.

DETAIL 1
BIOSWALE DETAILS
N.T.S.



Notes:

1. SACRIFICIAL FILTER FABRIC SHALL SPAN THE ENTIRE LENGTH OF THE BIOSWALE TO PREVENT SEDIMENT FROM CLOGGING THE GRAVEL RESERVOIR OR THE FILTER FABRIC WHICH WRAPS THE RESERVOIR.
2. THE SACRIFICIAL PIECE OF FILTER FABRIC SHALL BE INSTALLED IMMEDIATELY FOLLOWING THE PLACEMENT OF THE UNDERDRAINS AND WASHED 20mm CLEAR STONE AND REMAIN IN PLACE UNTIL THE PLACEMENT OF BIOMEDIA APPROVED BY THE FIELD ENGINEER
3. THE CONDITION OF THE SACRIFICIAL PRICE OF FILTER FABRIC SHALL BE INSPECTED DAILY ESPECIALLY FOLLOWING A SIGNIFICANT STORM EVENT IN WHICH SEDIMENT ENTERS THE FACILITY. IN SUCH CASE THE SACRIFICIAL PIECE OF FILTER FABRIC SHALL BE REMOVED AND REPLACE AS SPECIFIED BY THE FIELD ENGINEER.
4. THE SACRIFICIAL PRICE OF FILTER FABRIC SHALL BE FREE OF ANY RIPS OF TEARS. SHALL AND RIPS OF TEARS BE PRESENT THE SECTION SHALL BE CUT, REMOVED AND REPLACED.
5. THE SACRIFICIAL PIECE OF FILTER FABRIC SHALL BE STAKED IN PLACE USING WOODEN STAKE EVERY 1.0m ALONG THE EDGE OF THE FABRIC. THE FABRIC SHALL EXTEND UP THE WALLS OF EXCAVATION 0.3m.



Notes:

1. SEDIMENT LOGS SHALL BE INSTALLED FOLLOWING THE LAYOUT OF THE PLANTERS PRIOR TO EXCAVATION AND EARTH MOVING ACTIVITIES.
2. SEDIMENT LOGS DAMAGES DURING CONSTRUCTION ACTIVITIES SHALL BE REMOVED AND REPLACED PRIOR TO CONTINUING THE WORKS
3. SEDIMENT LOGS & WOODEN BARRIERS SHALL BE INSTALLED AT ALL CURB CURB OPENINGS AND STAKED IN PLACE.

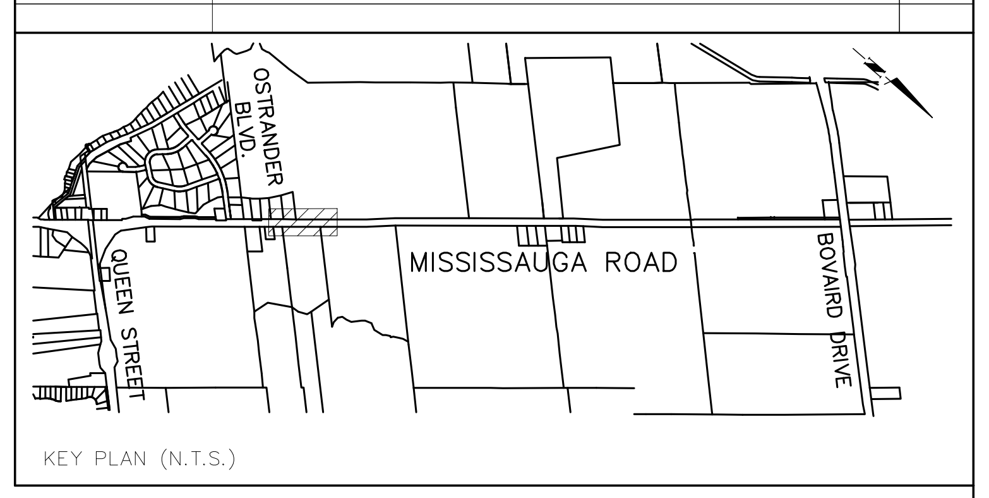
DETAIL 2: EROSION AND SEDIMENTATION CONTROL DETAILS
N.T.S.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/01/2015	90% DESIGN SUBMISSION	W.C



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6. WORKING AREAS, ACCESS REQUIREMENTS, SEDIMENT CONTROL MEASURES, AND TEMPORARY MATERIAL STORAGE AREAS TO BE MAINTAINED IN GOOD REPAIR BY THE CONTRACTOR AT ALL TIMES. AREAS AFFECTED BY THE CONTRACTORS ACTIVITIES ARE TO BE REINSTATED TO THE EXISTING CONDITIONS OR BETTER. ALL DISTURBED AREAS WILL BE RESTORED WITH NATIVE NON-INVASIVE VEGETATION SPECIES FOLLOWING CONSTRUCTION. ANY DAMAGED SOD SHALL BE REMOVED AND REPLACED WITH SOD (TYP.) AND TOPSOIL AS REQUIRED AT THE CONTRACTORS OWN EXPENSE.
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8. EROSION AND SEDIMENT CONTROL MEASURES WILL BE IMPLEMENTED PRIOR TO AND MAINTAINED DURING THE CONSTRUCTION PHASES TO PREVENT ENTRY OF SEDIMENT INTO ANY WATER. THESE EROSION AND SEDIMENT CONTROL MEASURES WILL BE REMOVED FOLLOWING CONSTRUCTION COMPLETION AND WHEN DISTURBED AREAS HAVE BEEN STABILIZED AND VEGETATION ESTABLISHED. ALL AREAS WHICH REMAIN DISTURBED FOR MORE THAN 30 DAYS MUST BE STABILIZED TO THE SATISFACTION OF THE RELEVANT AGENCIES, THE CLIENT AND OR THE SITE ENGINEER.
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12. ALL GENERAL BACKFILL, INCLUDING ALL BERM STRUCTURES TO BE OF APPROVED MATERIAL AND COMPACTED TO A MINIMUM 95% STANDARD PROCTOR DENSITY (SPD) UNLESS OTHERWISE STATED. ACCEPTABLE SOILS SHALL BE LOW PERMEABILITY SOILS AND APPROVED BY GEOTECHNICAL AND OR SITE ENGINEER.
13. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSAL OF ALL DEBRIS AND SHALL BECOME THE OWNER OF ANY AND ALL UNUTILIZED OR SURPLUS MATERIALS.
14. ALL SEDIMENTS AND EROSION CONTROL MEASURES SHALL BE INSPECTED DAILY TO ENSURE THAT THEY ARE FUNCTIONING PROPERLY AND ARE MAINTAINED AND/OR UPGRADED AS REQUIRED.
15. ALL PROPOSED GRADES ARE FINAL GRADES WHICH MUST INCLUDE HEIGHT/THICKNESS OF SOD OR MULCH MATERIALS. ALL PONDING DEPTHS SHALL BE MAINTAINED PER THE DESIGN DRAWINGS.
16. HYDRO DUCT DETAILS AND DRAWINGS SHALL BE MADE AVAILABLE BY THE TOWN UPON REQUEST. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL UTILITIES AND FOLLOWING PROPER EXCAVATION PROCEDURES AS SPECIFIED BY THE LOCATES (I.E. HAND DIGGING AND DAYLIGHTING). VERIDIAN CONNECTIONS MUST BE NOTIFIED MIN 36 HOURS PRIOR TO EXCAVATION NEAR HYDRO DUCT.

General Notes

— — All Driveways ASPHALT Unless Otherwise Noted.
— — All Service Locations Are Approximate And Must Be Located Accurately In The Field
◎ Denotes Building – Not Located
▭ Denotes Building Located
Type 'B' Bedding Unless Otherwise Noted (SAN)

B.M. No. Elev.

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Designed by
Chkd.

Approved by

Aquafor Beech Limited

#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089

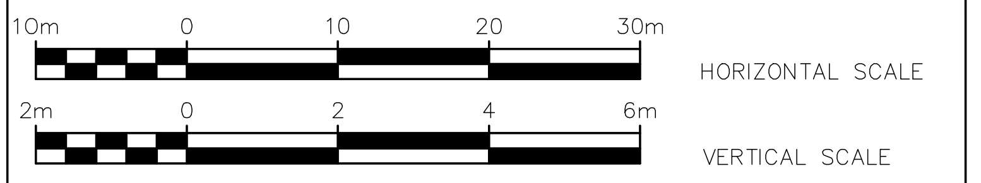
55 REGAL ROAD, UNIT 3
GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224-3740
FAX: (519) 224-3750

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)



Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)

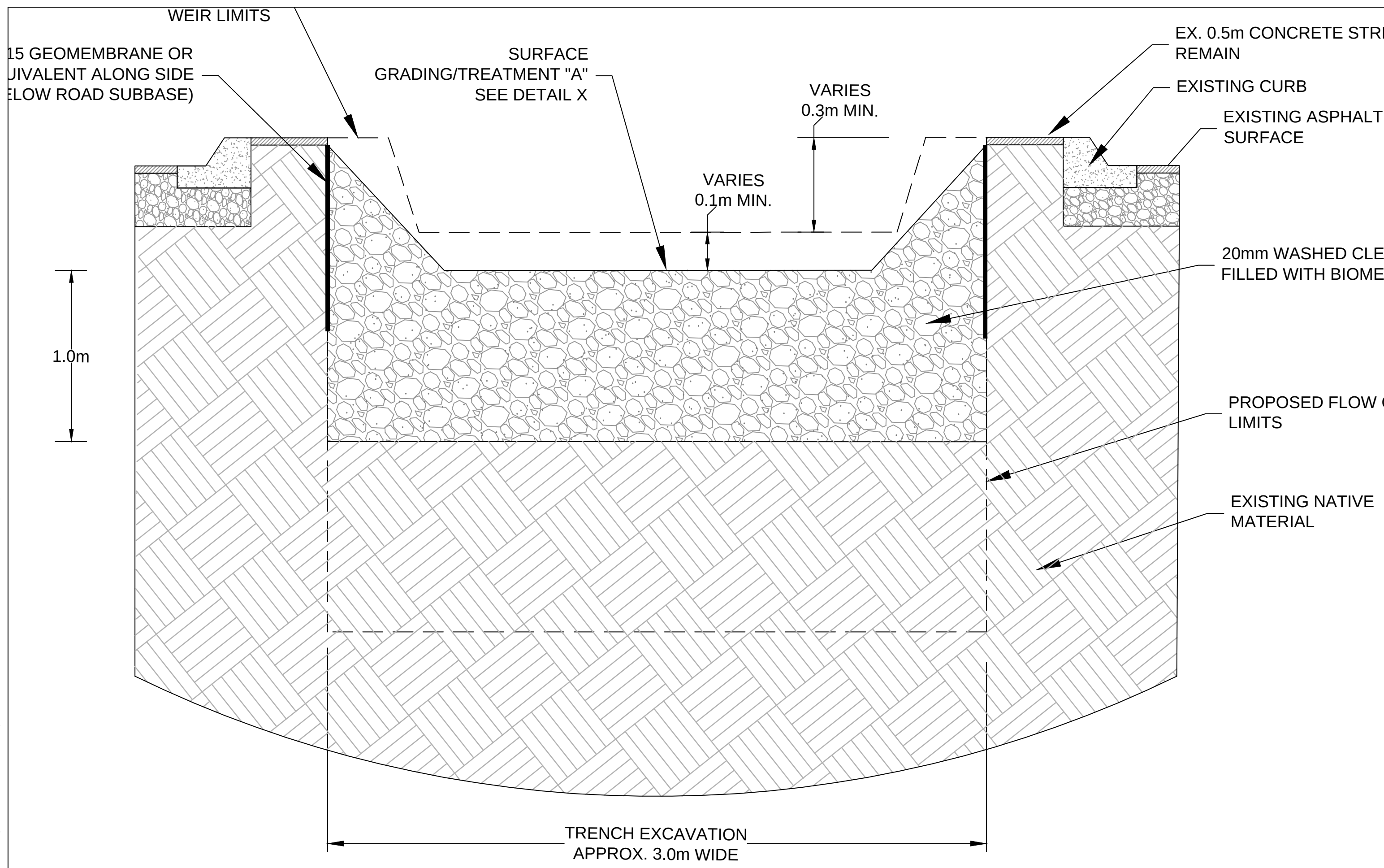
LID CONSTRUCTION DETAILS

CAD Area
Area
Project No.
Checked by
Drawn by HT
Date 17/02/15
Sheet 4 OF 6
Plan No. LID 4

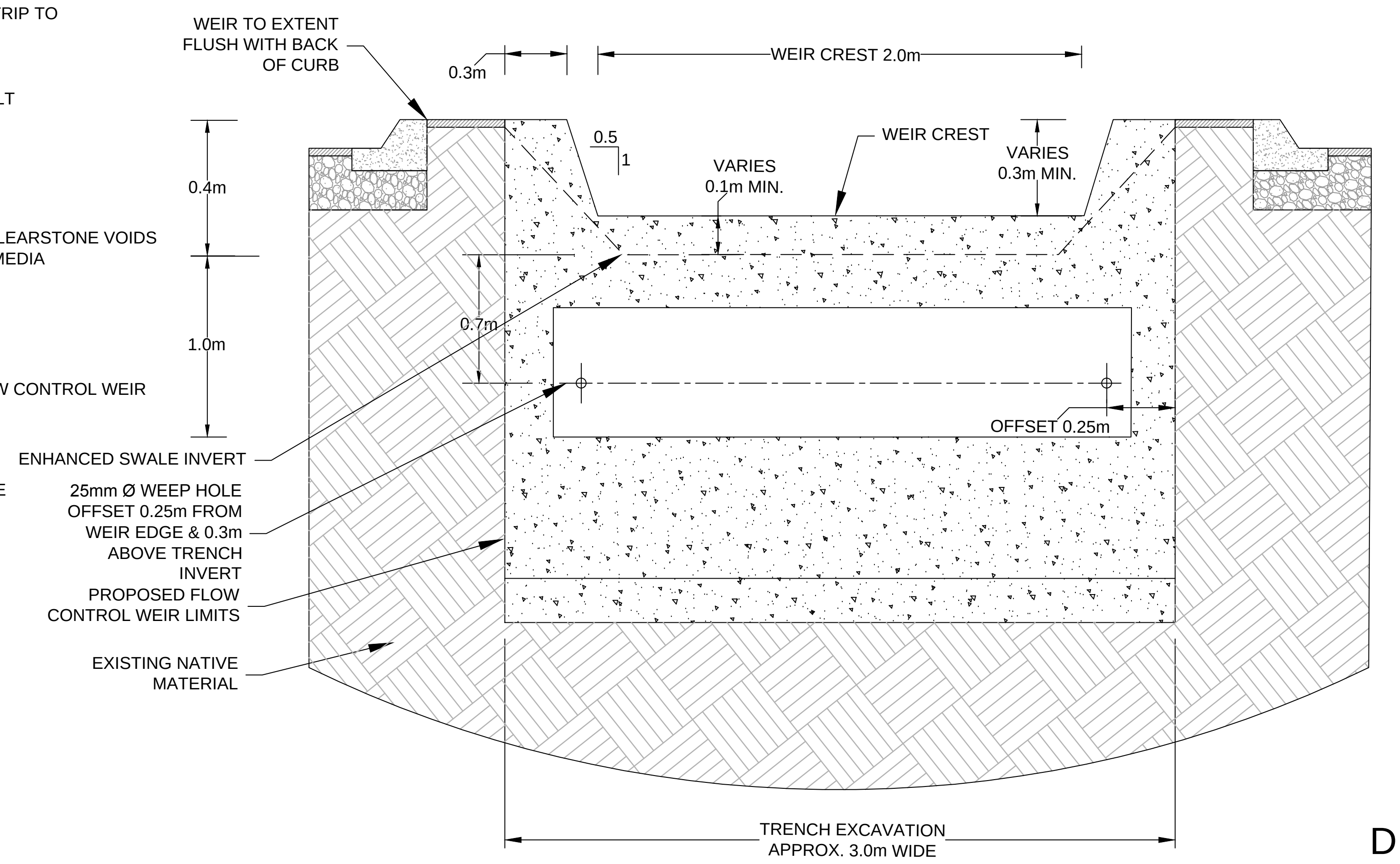
File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\A$B Design CAD\ABL_MissABL Mississauga Rd_Phase 1_100%_DESIGN DETAILS_V1 (APRIL 21, 2015).dwg, Layout : DESIGN DETAILS 1 (LID 4) Date :May 04, 2015 - 4:46pm, Edit By : Will

THIS IS 2 mm

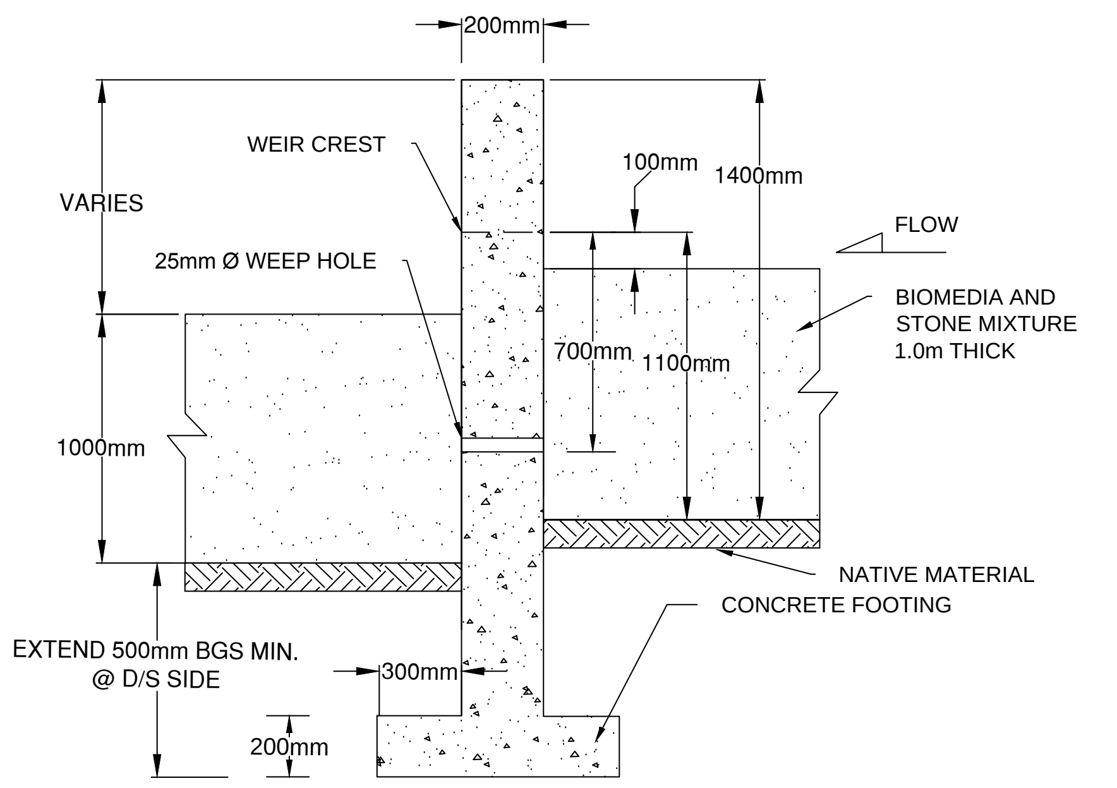
File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\ASB Design CAD\ABL_MissABL Mississauga Rd_Phase 1_100%_DESIGN DETAILS_V1 (APRIL 21, 2015).dwg, Layout : DESIGN DETAILS 2 (LID 5) Date :May 04, 2015 - 4:46pm, Edit By : Will



ENHANCED SWALE CONSTRUCTION DETAIL



ENHANCED SWALE WEIR CONSTRUCTION DETAIL

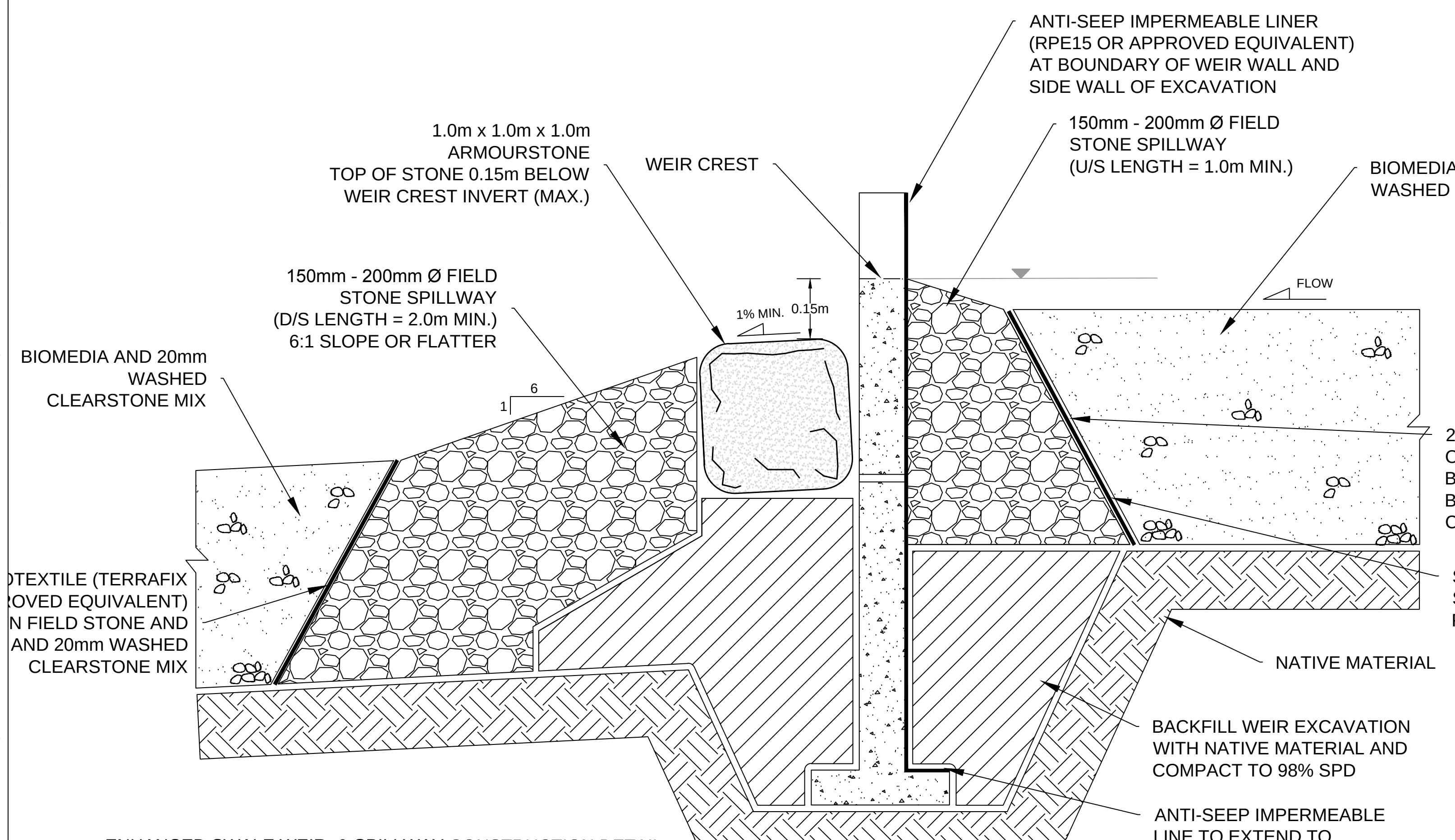


Notes:

1. CONTRACTOR SHALL ACQUIRE FOOTING AND REBAR DESIGN BY STRUCTURAL /GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION

ENHANCED SWALE WEIR CONSTRUCTION DETAIL
CROSS-SECTION

DETAIL 3: ENHANCED SWALE AND WEIR CONSTRUCTION DETAILS
N.T.S.



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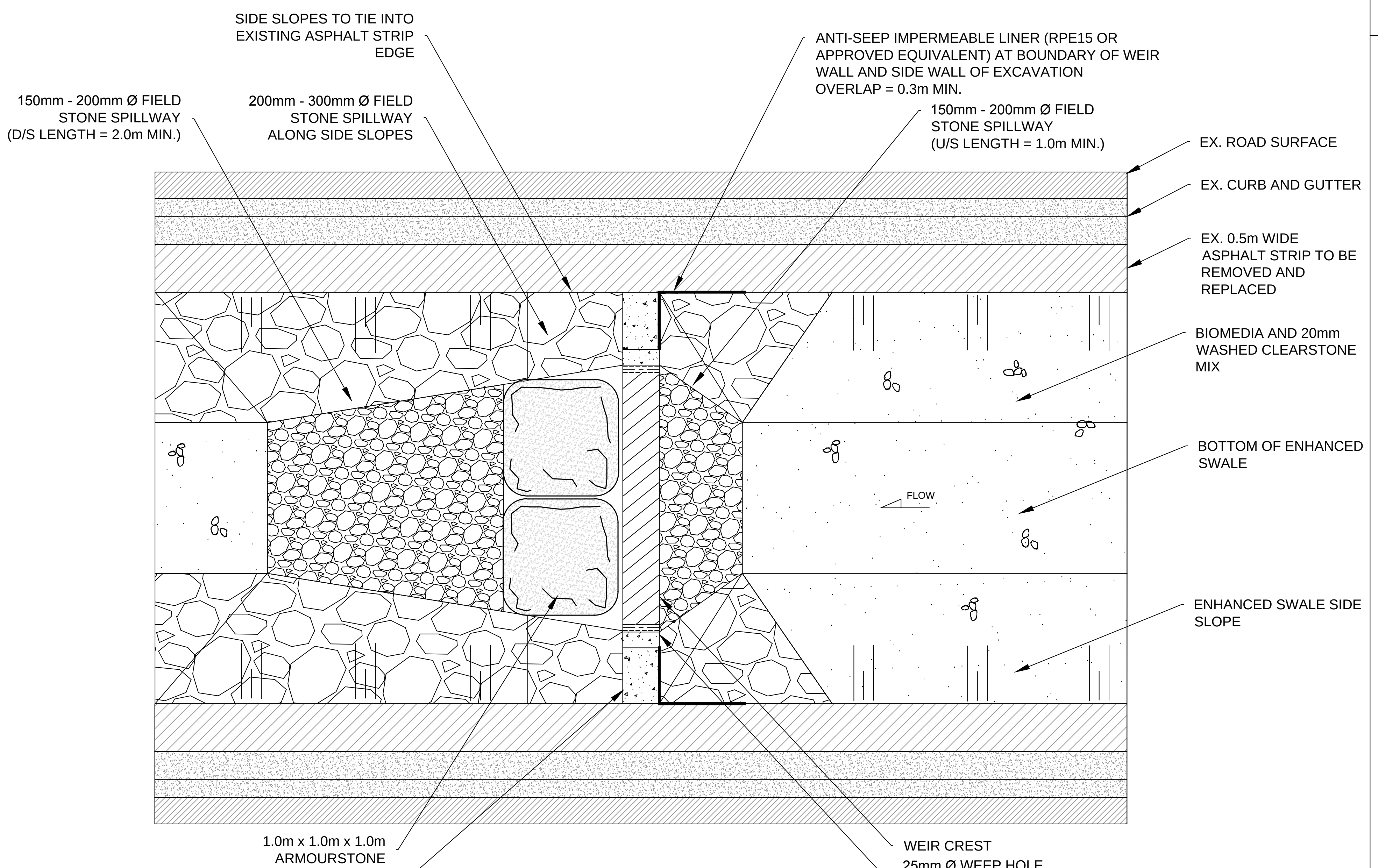
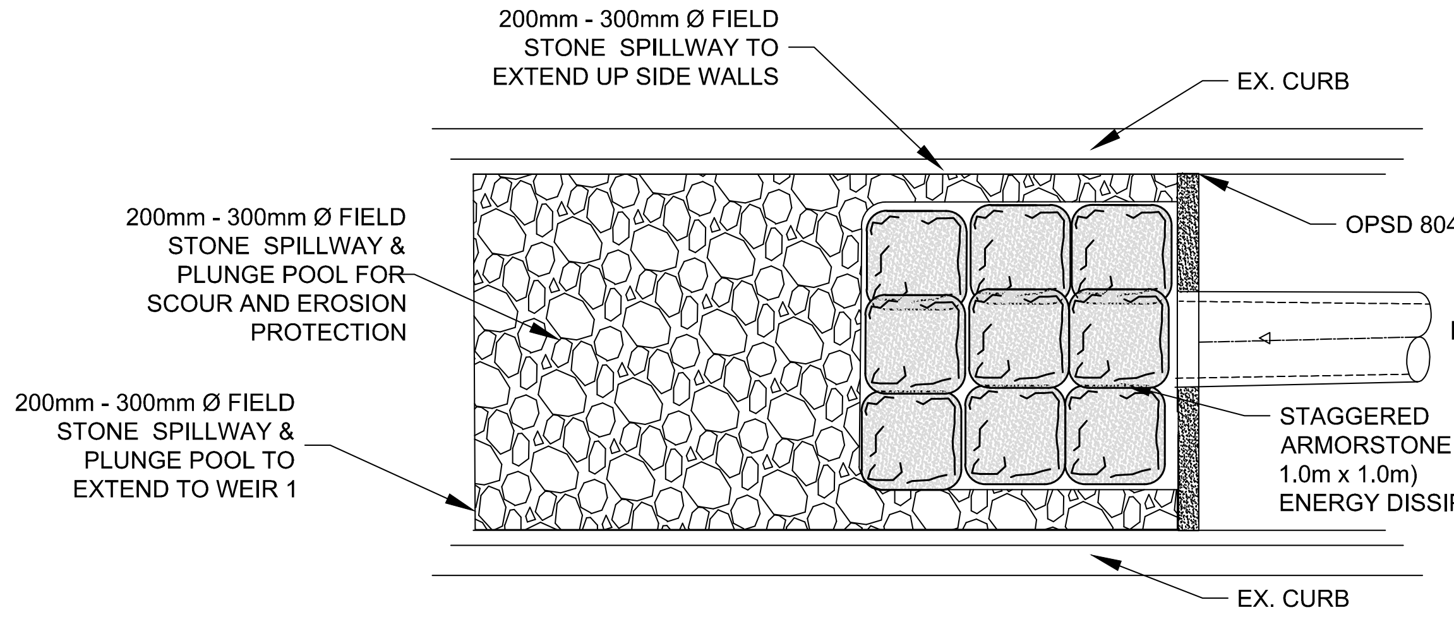
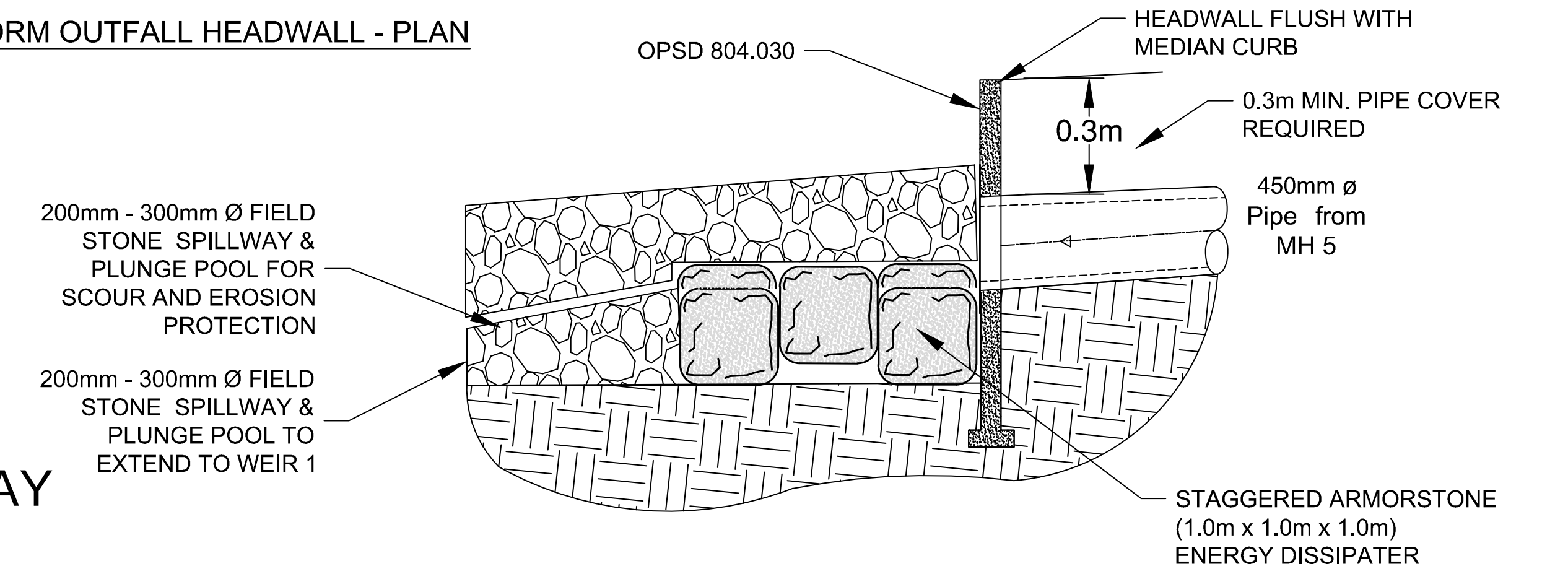
ENHANCED SWALE WEIR & SPILLWAY CONSTRUCTION DETAIL
CROSS-SECTION



ENHANCED SWALE WEIR & SPILLWAY CONSTRUCTION DETAIL
PLAN SECTION

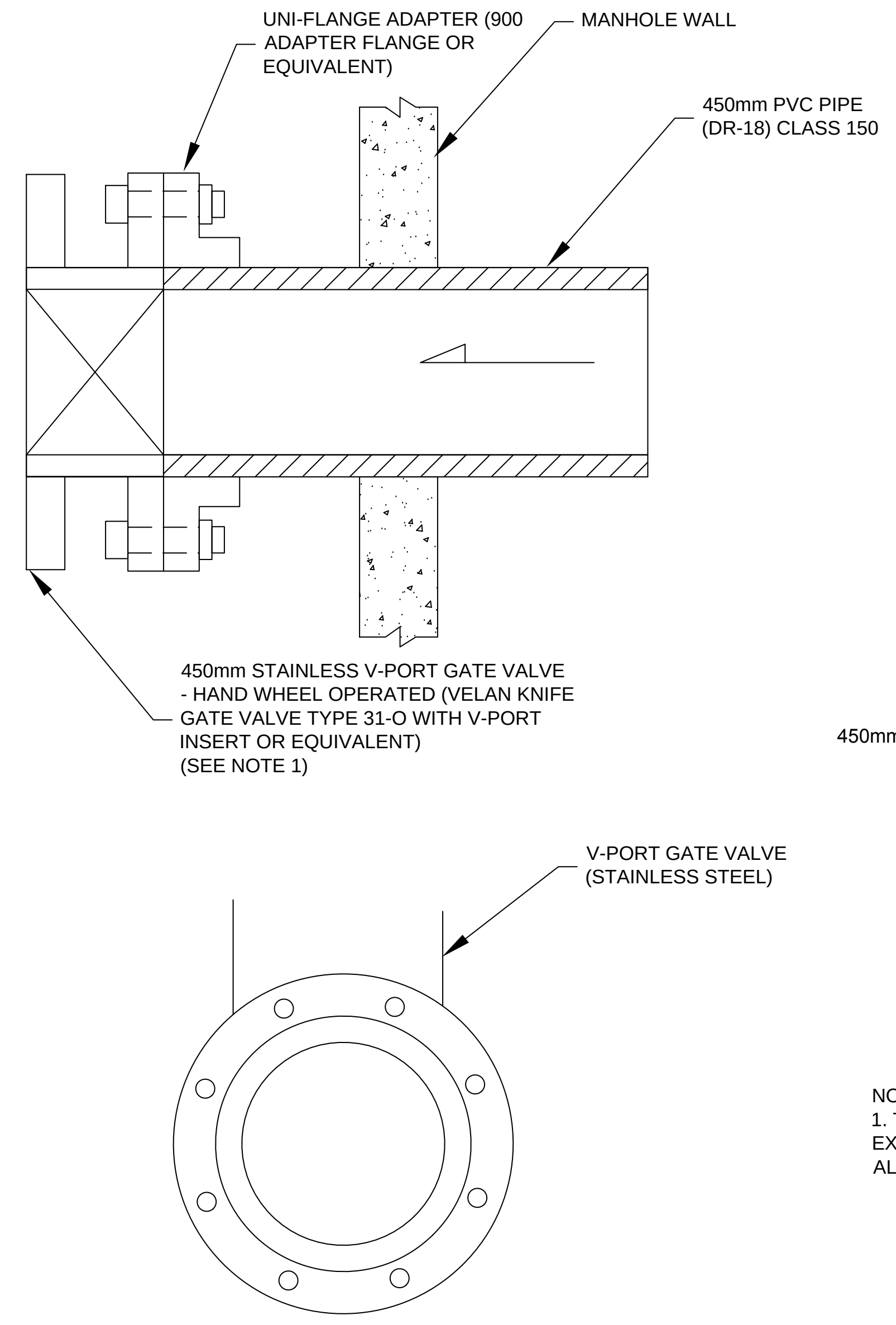


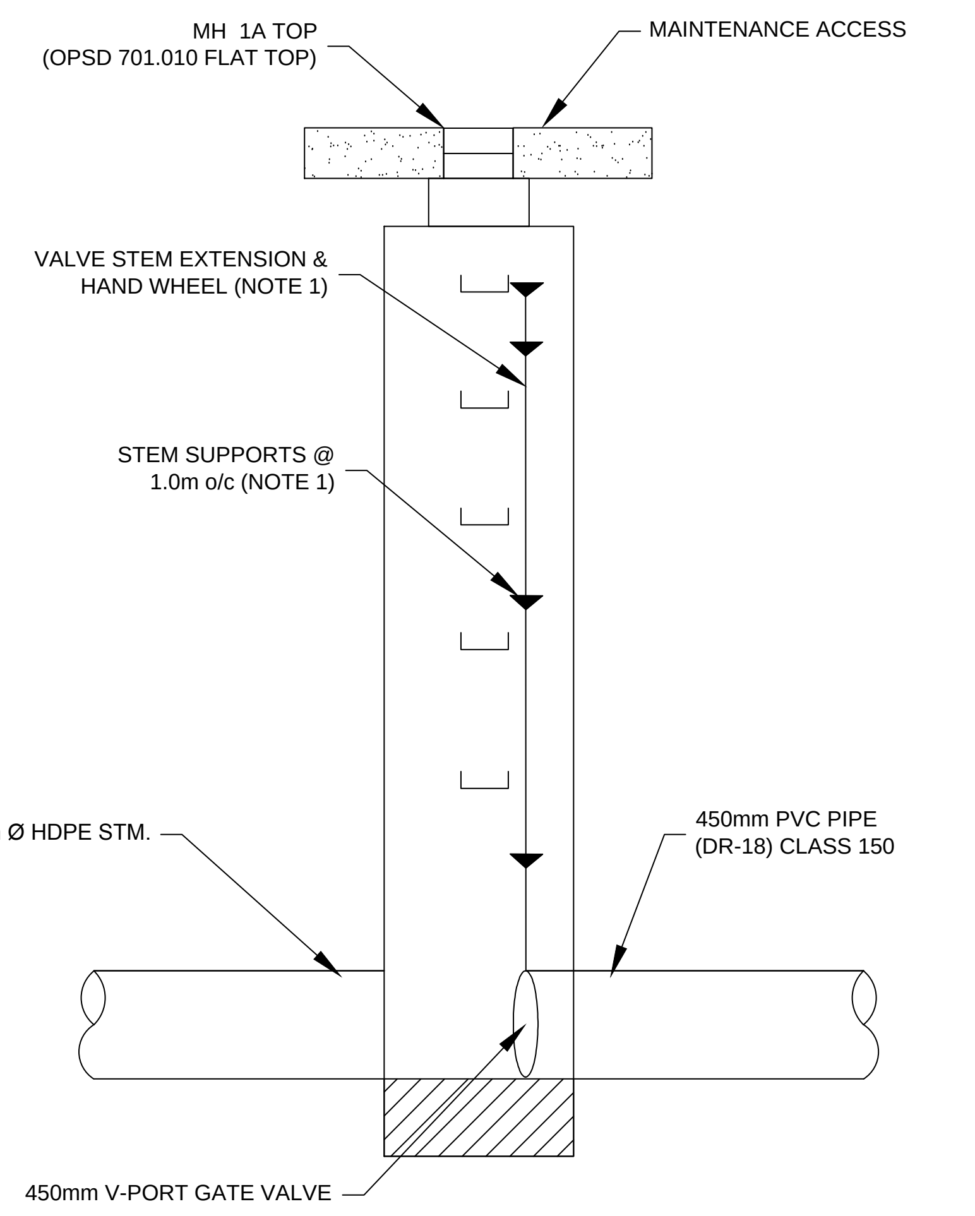
STORM OUTFALL HEADWALL - PLAN



STORM OUTFALL HEADWALL - SECTION

DETAIL 4: OUTLET SPILLWAY DETAIL
N.T.S.





NOTE
1. THE V-PORT GATE VALVE SHALL BE PROVIDED WITH A HANDWHEEL AND STEM EXTENSION TO 450mm (MIN) BELOW THE MANHOLE TOP. VALVE STEM SUPPPORTS SHALL ALSO BE PLACED AS DETAILED

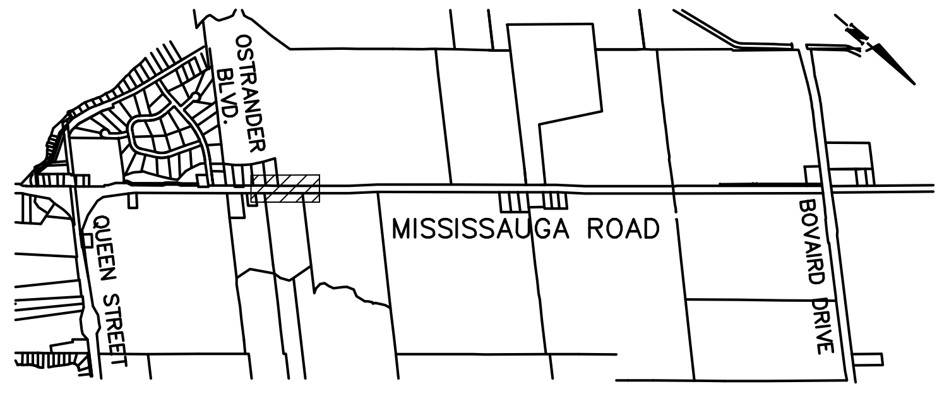
DETAIL 5: GATE VALVE DETAIL
N.T.S.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/02/2015	90% DESIGN SUBMISSION	W.C



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Designed by ____ ____ ____ ____ Chkd. ____

Approved by ____ ____ ____ ____ ____

Aquafor Beech Limited

#6–202–2600 SKYMARK Ave,
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55 REGAL ROAD, UNIT 3
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ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

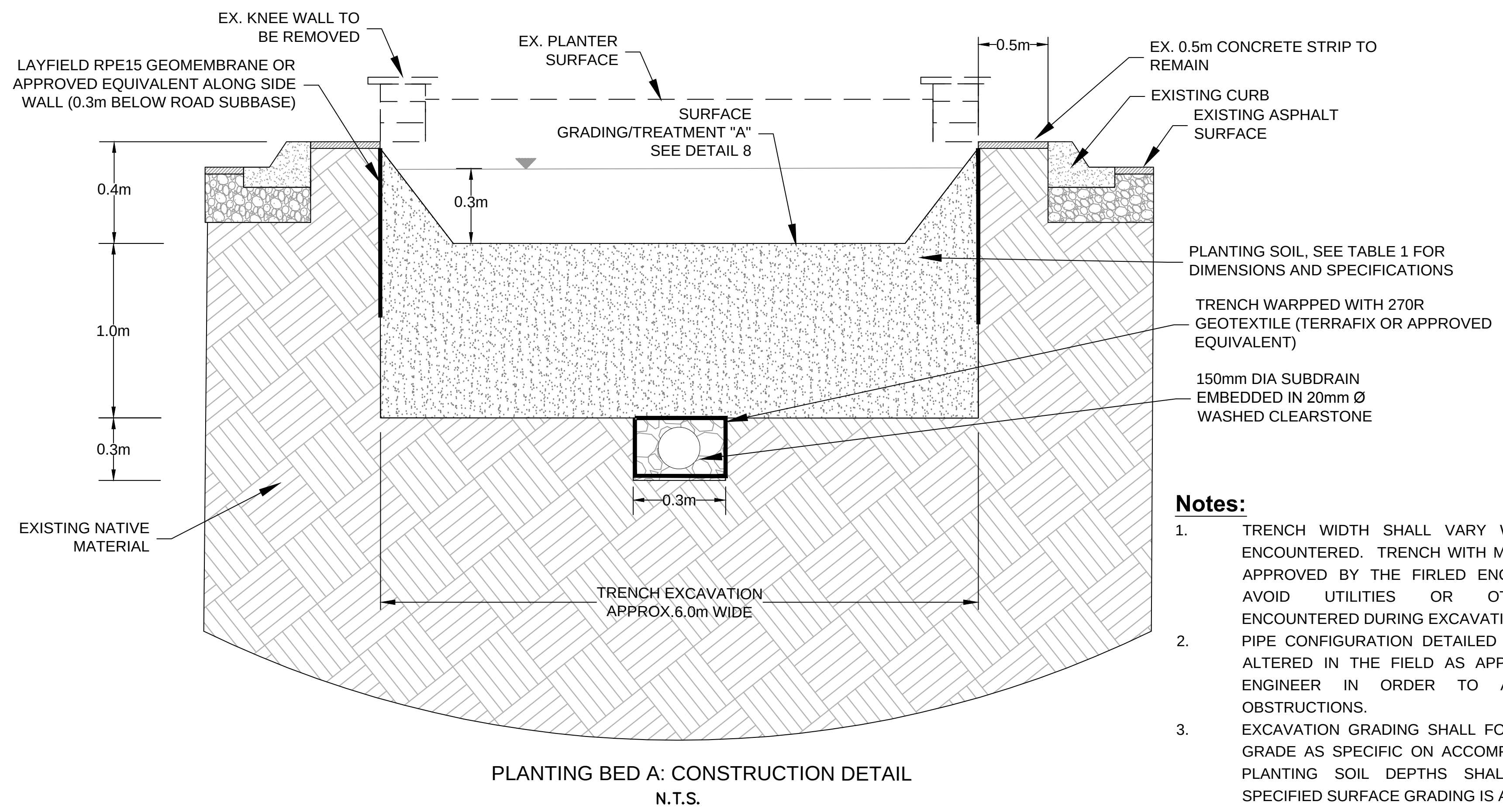
Region of Peel
Working for you

MISSISSAUGA ROAD

LID CONSTRUCTION DETAILS

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 17/02/15	Sheet 5 OF 6	Plan No. LID 5

File : C:\Users\Will\WORK PROJECTS\CVC\65567 - Miss Road LID Retrofit\Project 1 Retrofit - Credit to Williams Pkwy\ASB Design CAD\ABL_Miss\ABL Mississauga Rd_Phase 1_100%_DESIGN DETAILS_V1 (APRIL 21, 2015).dwg.   Layout : DESIGN DETAILS 3 (LID 6)   Date :May 04, 2015 - 4:46pm,   Edit By : Will

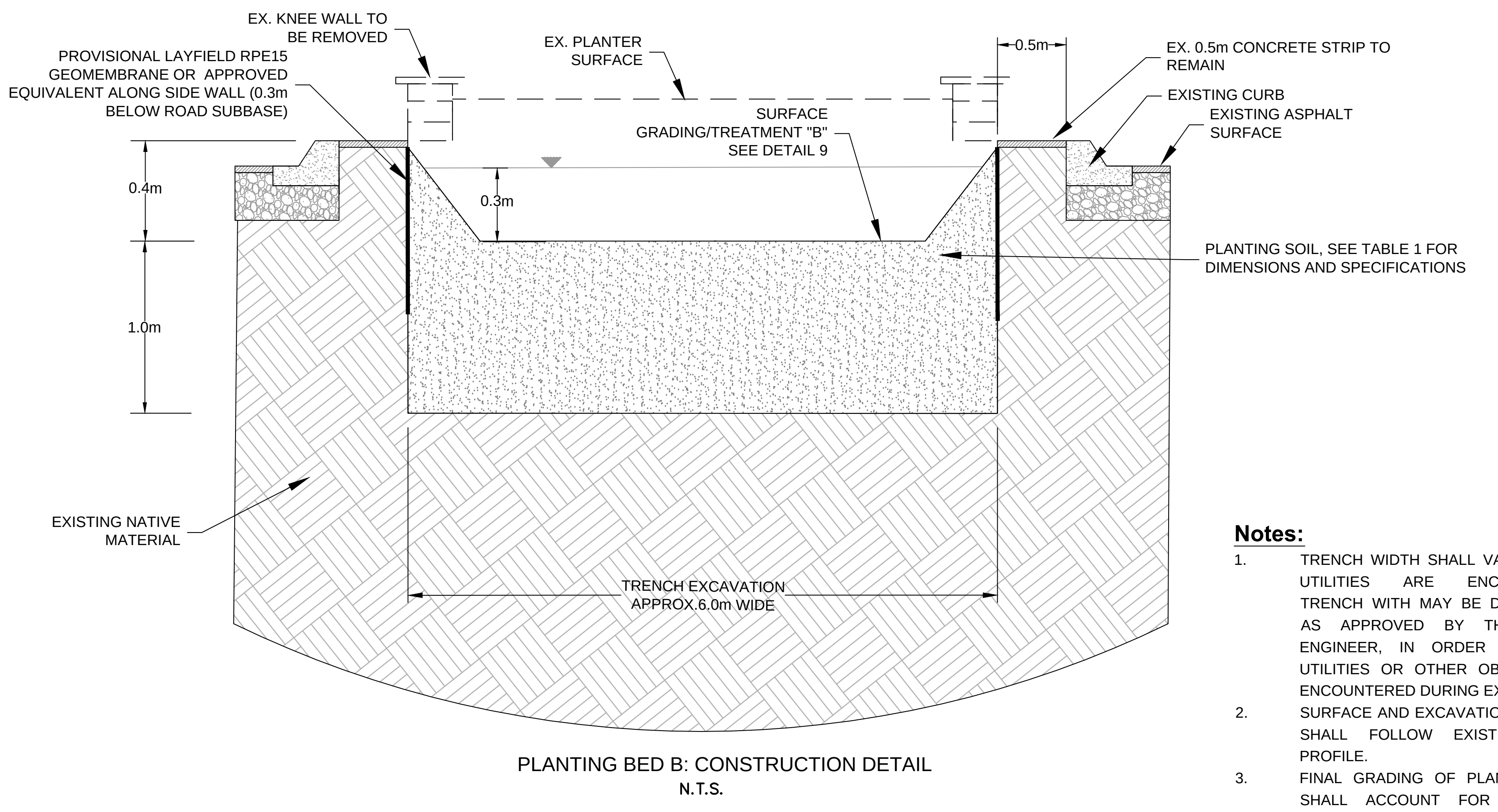


PLANTING BED A: CONSTRUCTION DETAIL
N.T.S.

Notes:

1. TRENCH WIDTH SHALL VARY WHERE UTILITIES ARE ENCOUNTERED. TRENCH WITH MAY BE DECREASED, AS APPROVED BY THE FIRLED ENGINEER, IN ORDER TO AVOID UTILITIES OR OTHER OBSTRUCTION ENCOUNTERED DURING EXCAVATION.
2. PIPE CONFIGURATION DETAILED ON THE PLAN MAY BE ALTERED IN THE FIELD AS APPROVED BY THE FIELD ENGINEER IN ORDER TO AVOID UTILITIES OR OBSTRUCTIONS.
3. EXCAVATION GRADING SHALL FOLLOW EMBEDDED PIPE GRADE AS SPECIFIC ON ACCOMPANYING DATA TABLES. PLANTING SOIL DEPTHS SHALL VARY SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.
4. FINAL GRADING OF PLANTING SOIL SHALL ACCOUNT FOR REQUIRED SURFACE TREATMENTS SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.

DETAIL 6: PLANTING BED "A" DETAIL
N.T.S.

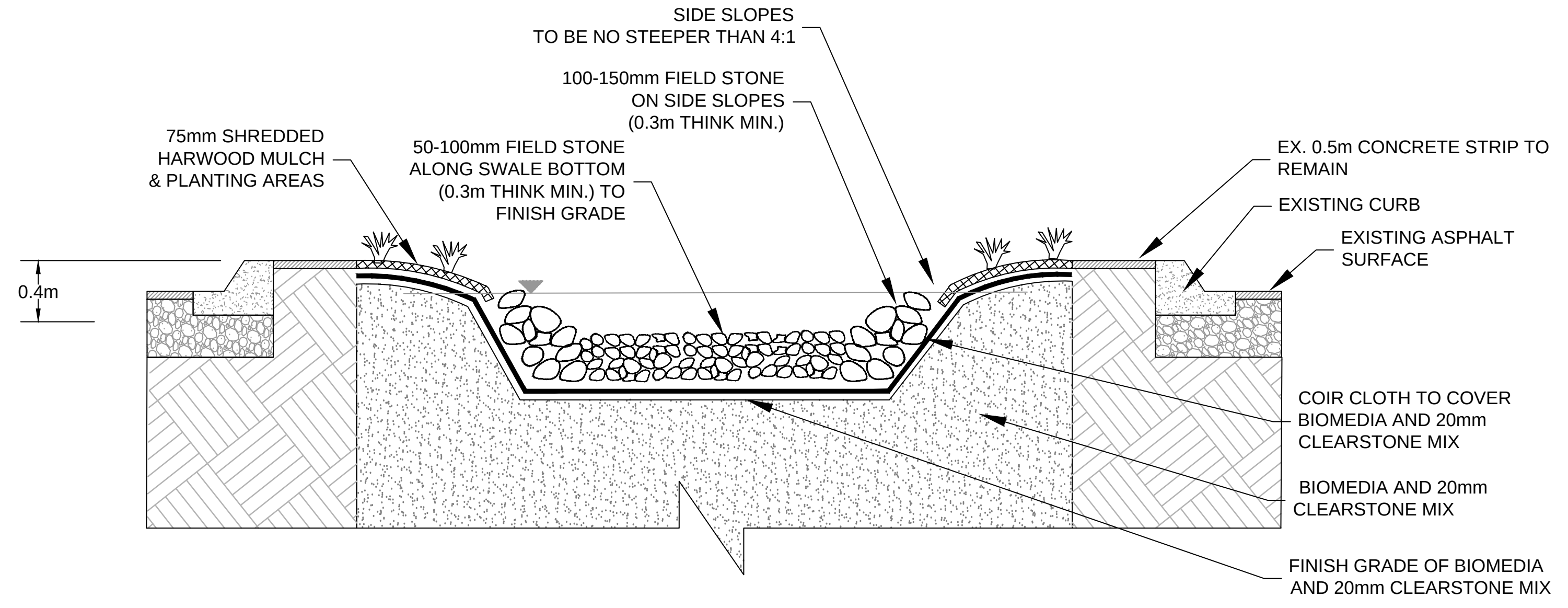


PLANTING BED B: CONSTRUCTION DETAIL
N.T.S.

Notes:

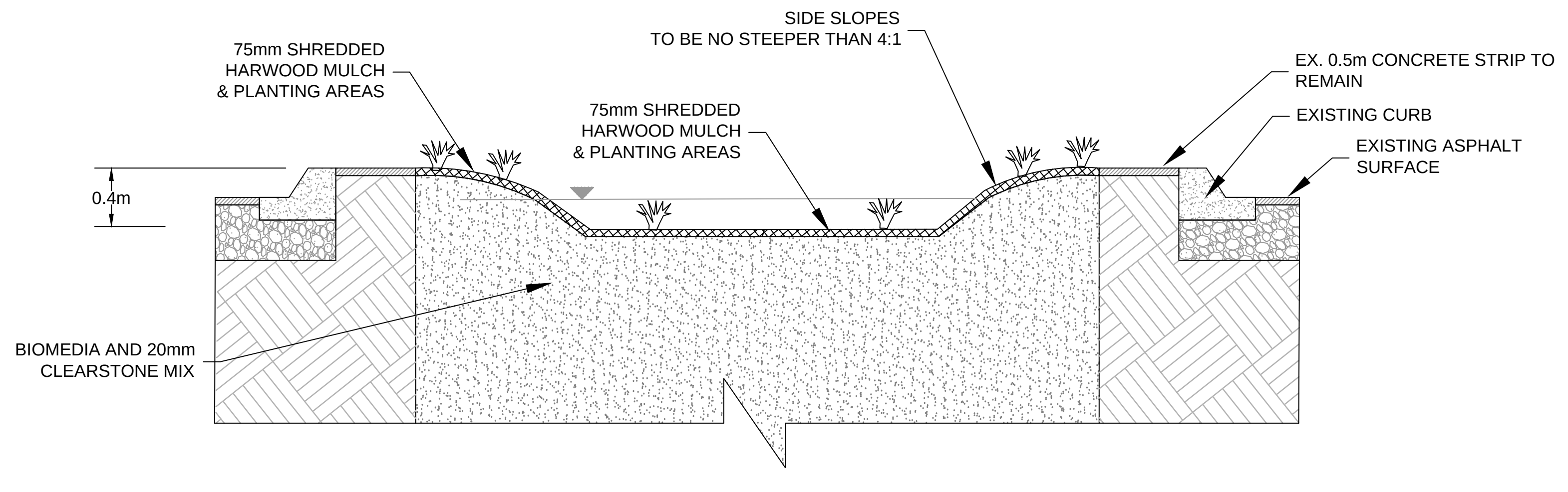
1. TRENCH WIDTH SHALL VARY WHERE UTILITIES ARE ENCOUNTERED. TRENCH WITH MAY BE DECREASED, AS APPROVED BY THE FIRLED ENGINEER, IN ORDER TO AVOID UTILITIES OR OTHER OBSTRUCTION ENCOUNTERED DURING EXCAVATION.
2. SURFACE AND EXCAVATION GRADING SHALL FOLLOW EXISTING CURB PROFILE.
3. FINAL GRADING OF PLANTING SOIL SHALL ACCOUNT FOR REQUIRED SURFACE TREATMENTS SUCH THAT SPECIFIED SURFACE GRADING IS ACHIEVED.

DETAIL 7: PLANTING BED "B" DETAIL
N.T.S.



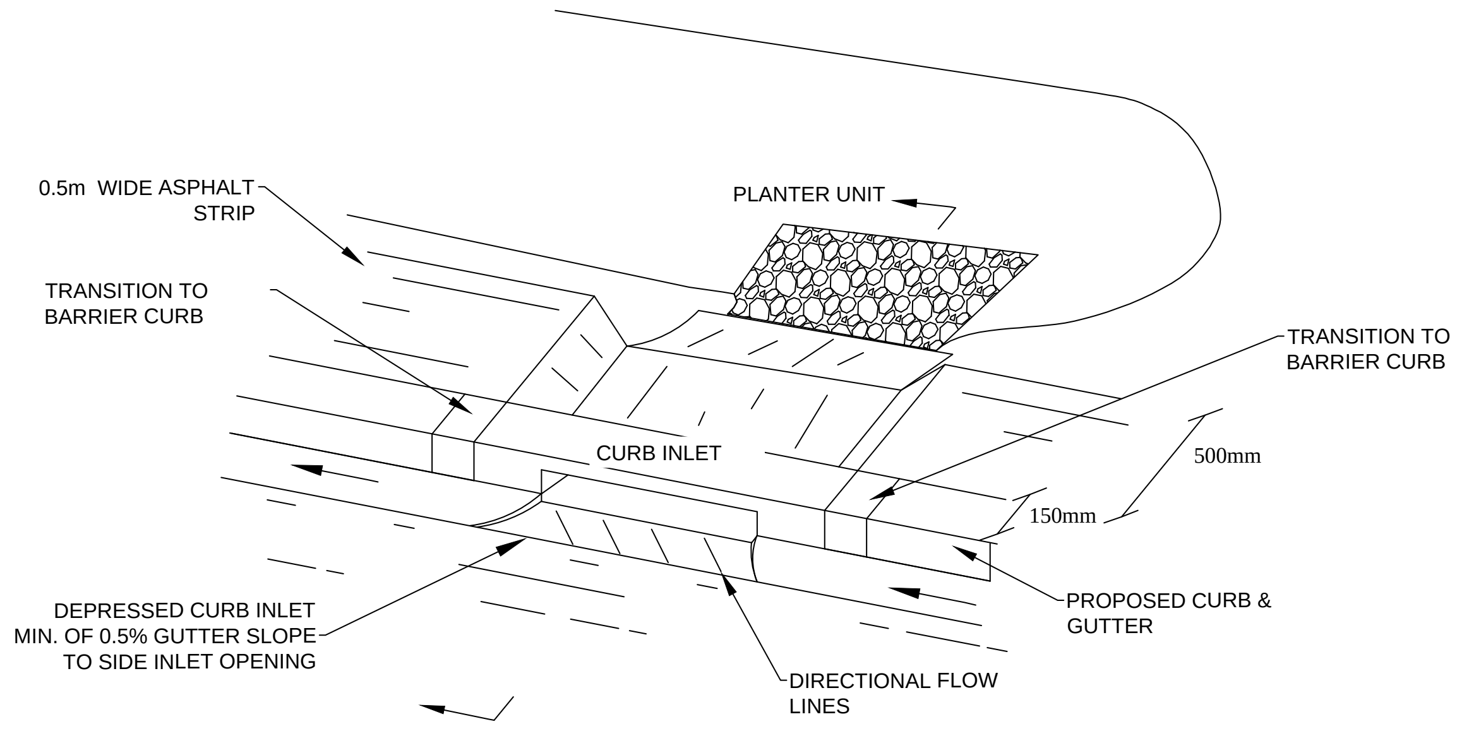
SURFACE TREATMENT "A"
N.T.S.

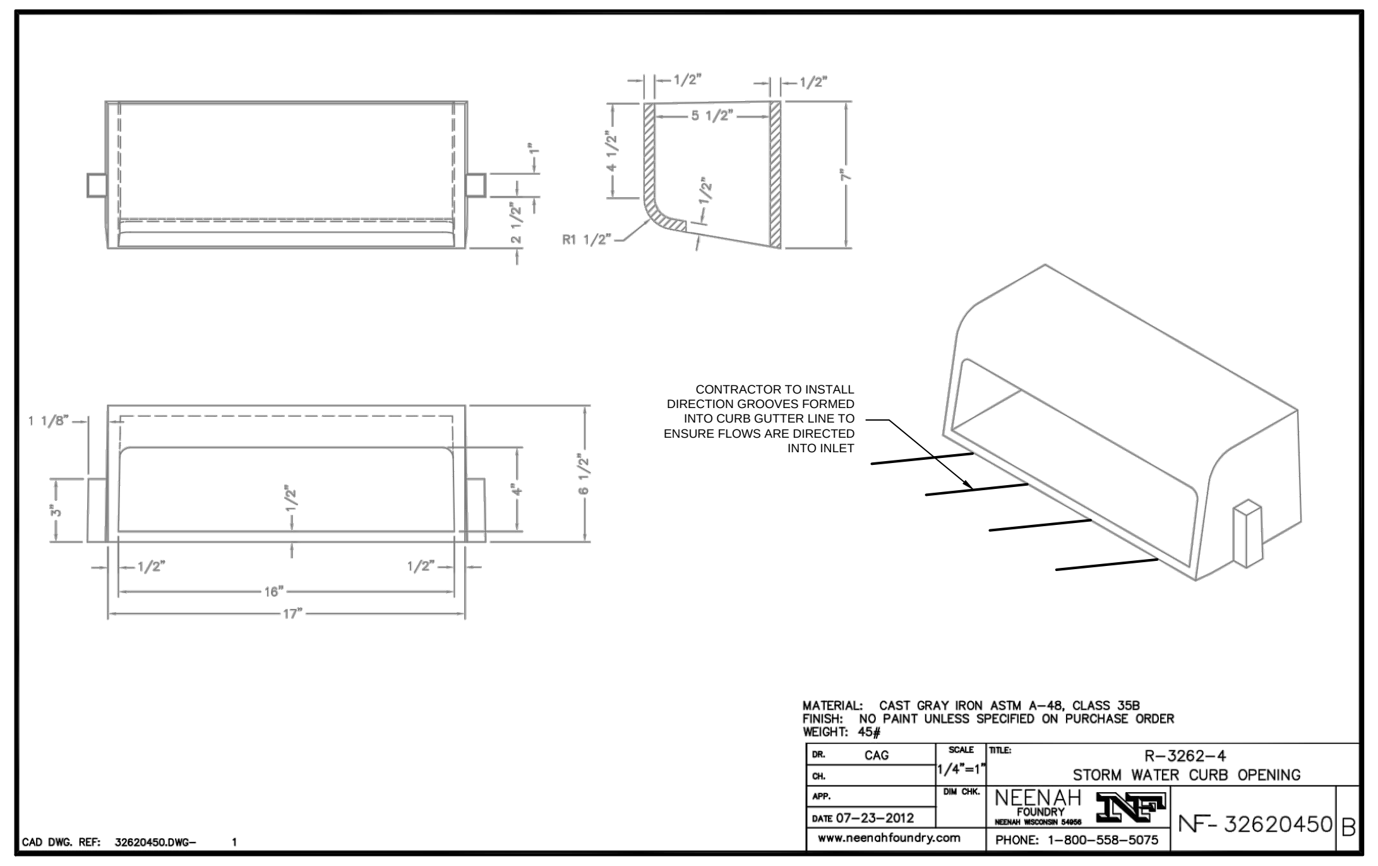
DETAIL 8: SURFACE TREATMENT "A" DETAIL
N.T.S.



SURFACE TREATMENT "B"
N.T.S.

DETAIL 9: SURFACE TREATMENT "B" DETAIL
N.T.S.



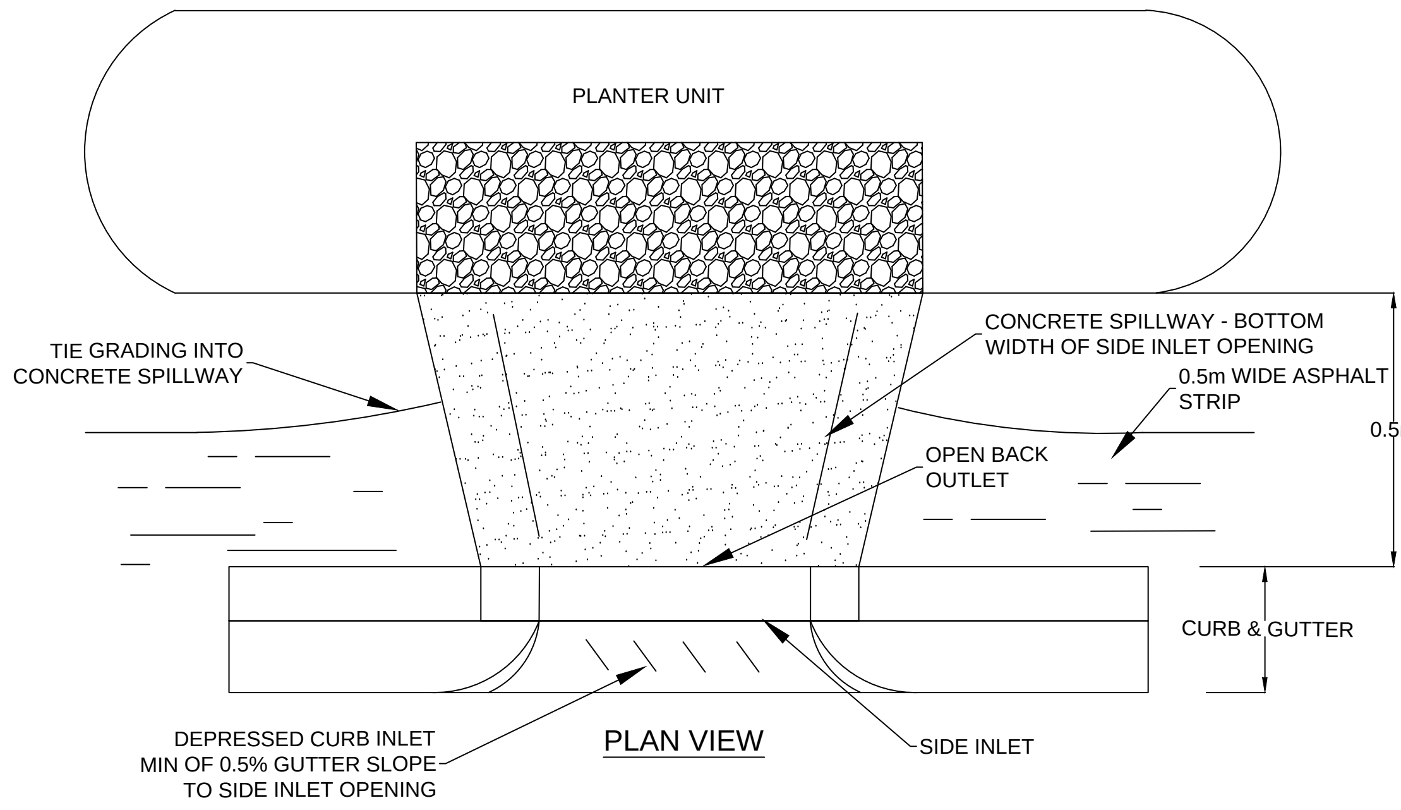


CONTRACTOR TO INSTALL DIRECTION GROOVES FORMED INTO CURB GUTTER LINE TO ENSURE FLOWS ARE DIRECTED INTO INLET

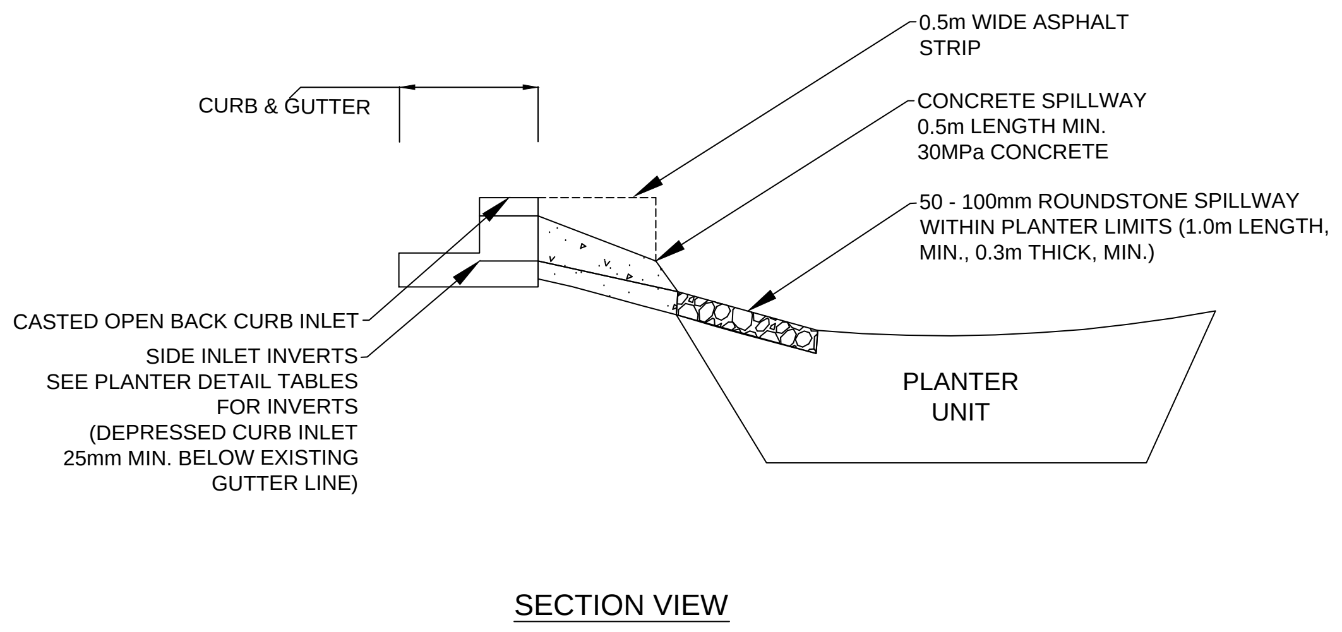
MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
FINISH: NO PAINT UNLESS SPECIFIED ON PURCHASE ORDER
WEIGHT: 45#

DR. CAG	SCALE 1/4"=1"	TITLE: R-3262-4 STORM WATER CURB OPENING
CH.		
APP.	DIM CHK.	NEENAH FOUNDRY NEENAH WISCONSIN 54956
DATE 07-23-2012		NF- 32620450 B
www.neenahfoundry.com		PHONE: 1-800-558-5075

CAD DWG. REF: 32620450.DWG- 1

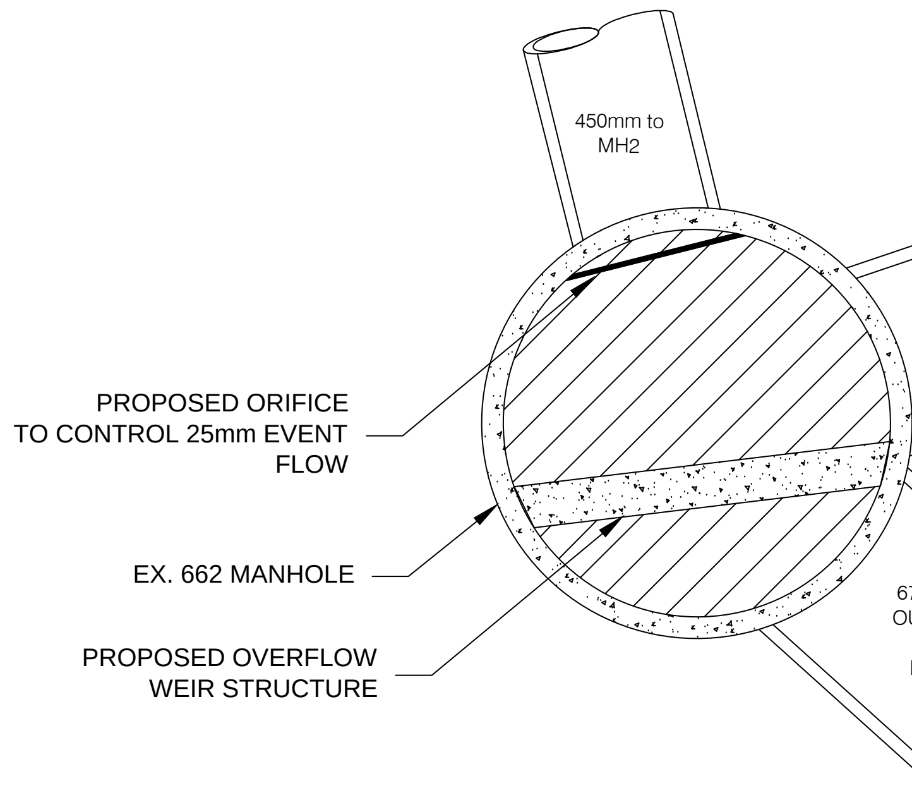


PLAN VIEW



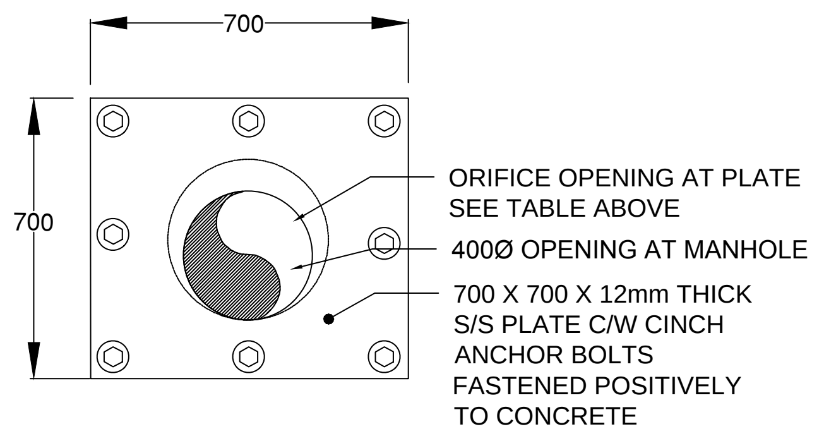
SECTION VIEW

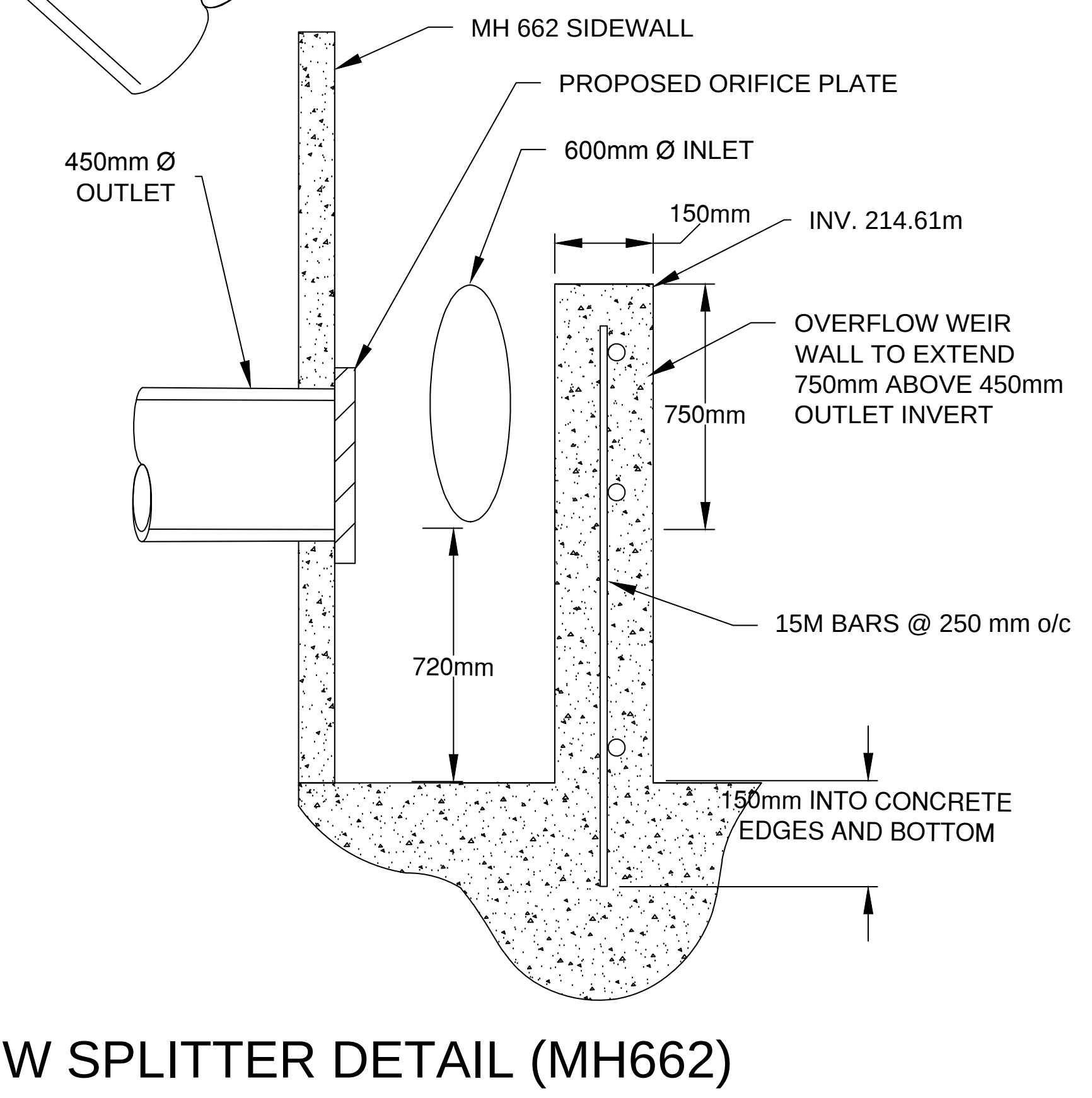
DETAIL 10: SIDE INLET CURB CUT DETAIL
N.T.S.



FLOW CONTROL STRUCTURE DETAILS

FLOW CONTROL	DETAILS
ORIFICE	INV= 213.86 SIZE= 400mm
OVERFLOW WEIR	SPAN = 1.4m HEIGHT= 0.75m CREST ELEVATION = 214.61





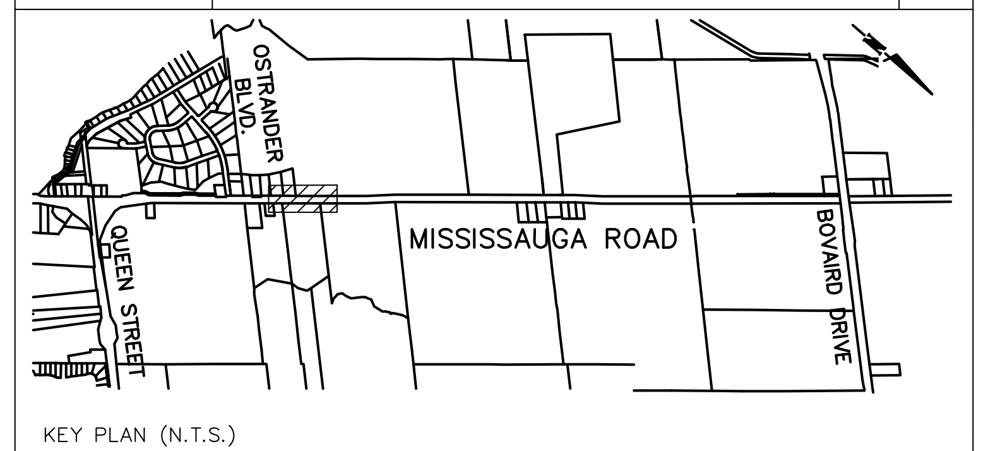
DETAIL 11: FLOW SPLITTER DETAIL (MH662)
N.T.S.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
05/12/2014	60% DESIGN SUBMISSION	W.C
17/02/2015	90% DESIGN SUBMISSION	W.C



KEY PLAN (N.T.S.)

1. ALL ELEVATIONS ARE IN METRES AND REFERENCED TO LOCAL DATUM. ALL DIMENSIONS ARE IN METRIC UNITS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT AND SURVEY CONTROL DURING CONSTRUCTION.
3. THE CONTRACTOR IS RESPONSIBLE FOR LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
4. LOCATIONS OF THE EXISTING INFRASTRUCTURE INCLUDING SUBSURFACE PIPING AND MANHOLES ARE BASED ON AVAILABLE SURVEY AND BACKGROUND INFORMATION AND ARE NOT EXACT. THE CONTRACTOR IS RESPONSIBLE FOR LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
5. THE CONTRACTOR SHALL DELINEATE THE REQUIRED WORKING AREA ON-SITE PRIOR TO THE START OF WORK AND SHALL CONFINE OPERATIONS WITHIN THE DEFINED AREA. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO ANY WATER/WATERCOURSE/WETLAND NATURAL FEATURE. VEHICLE REFUELING AND MAINTENANCE MUST BE CONDUCTED AT LEAST 30 METRES FROM ANY WATER/WATERCOURSE/WETLAND NATURAL FEATURE. ON-SITE EQUIPMENT REFUELING AND MAINTENANCE TO BE ONLY COMPLETED IN DESIGNATED AREAS.
6. WORKING AREAS, ACCESS REQUIREMENTS, SEDIMENT CONTROL MEASURES, AND TEMPORARY MATERIAL STORAGE AREAS TO BE MAINTAINED IN GOOD REPAIR BY THE CONTRACTOR AT ALL TIMES. AREAS AFFECTED BY THE CONTRACTORS ACTIVITIES ARE TO BE REINSTATED TO THE EXISTING CONDITIONS OR BETTER. ALL DISTURBED AREAS WILL BE RESTORED WITH NATIVE NON-INVASIVE VEGETATION SPECIES FOLLOWING CONSTRUCTION. ANY DAMAGED SOD SHALL BE REMOVED AND REPLACED WITH SOD (TYP.) AND TOPSOIL AS REQUIRED AT THE CONTRACTORS OWN EXPENSE.
7. EROSION AND SEDIMENT CONTROLS (E&SC) SHOWN ON ESC1 (SHEET 7) ARE THE MINIMUM THAT IS REQUIRED. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL E&SCS ARE FUNCTIONAL AND ARE REQUIRED TO USE ADDITIONAL APPROPRIATE ESC MEASURES IF NEEDED AND AS NEEDED, TO PREVENT THE RELEASE OF SEDIMENT INTO ANY ADJACENT WATERCOURSE, WATERBODY, ADJACENT NATURAL FEATURE,AND RAIN GARDEN AREA.
8. EROSION AND SEDIMENT CONTROL MEASURES WILL BE IMPLEMENTED PRIOR TO AND MAINTAINED DURING THE CONSTRUCTION PHASES TO PREVENT ENTRY OF SEDIMENT INTO ANY WATER. THESE EROSION AND SEDIMENT CONTROL MEASURES WILL BE REMOVED FOLLOWING CONSTRUCTION COMPLETION AND WHEN DISTURBED AREAS HAVE BEEN STABILIZED AND VEGETATION ESTABLISHED. ALL AREAS WHICH REMAIN DISTURBED FOR MORE THAN 30 DAYS MUST BE STABILIZED TO THE SATISFACTION OF THE RELEVANT AGENCIES, THE CLIENT AND OR THE SITE ENGINEER.
9. THE CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS BEFORE CONSTRUCTION TO ENSURE THAT WORK WILL BE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS (I.E. DRY CONDITIONS). EROSION AND SEDIMENT CONTROLS SHALL BE CHECKED AND REINFORCED WHERE MAINTENANCE IS REQUIRED TO REDUCE THE RISK OF SEDIMENT RELEASE DURING THE STORM EVENT. THE CONTRACTOR IS RESPONSIBLE FOR MONITORING SITE CONDITIONS IF WET WEATHER IS EXPECTED, INCLUDING OVERNIGHT, WEEKENDS AND HOLIDAYS.
10. ALL SITE RESTORATION TO BE IN ACCORDANCE WITH THE REHABILITATION/PLANTING PLANS AND DETAILS.
11. THE CONTRACTOR IS TO PROVIDE THE REGION OF PEEL WITH 48 HOURS ADVANCE NOTICE PRIOR TO INITIATION OF CONSTRUCTION.
12. ALL GENERAL BACKFILL, INCLUDING ALL BERM STRUCTURES TO BE OF APPROVED MATERIAL AND COMPACTED TO A MINIMUM 95% STANDARD PROCTOR DENSITY (SPD) UNLESS OTHERWISE STATED. ACCEPTABLE SOILS SHALL BE LOW PERMEABILITY SOILS AND APPROVED BY GEOTECHNICAL AND OR SITE ENGINEER.
13. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSAL OF ALL DEBRIS AND SHALL BECOME THE OWNER OF ANY AND ALL UNUTILIZED OR SURPLUS MATERIALS.
14. ALL SEDIMENTS AND EROSION CONTROL MEASURES SHALL BE INSPECTED DAILY TO ENSURE THAT THEY ARE FUNCTIONING PROPERLY AND ARE MAINTAINED AND/OR UPGRADED AS REQUIRED.
15. ALL PROPOSED GRADES ARE FINAL GRADES WHICH MUST INCLUDE HEIGHT/THICKNESS OF SOD OR MULCH MATERIALS. ALL PONDING DEPTHS SHALL BE MAINTAINED PER THE DESIGN DRAWINGS.
16. HYDRO DUCT DETAILS AND DRAWINGS SHALL BE MADE AVAILABLE BY THE TOWN UPON REQUEST. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL UTILITIES AND FOLLOWING PROPER EXCAVATION PROCEDURES AS SPECIFIED BY THE LOCATES (I.E. HAND DIGGING AND DAYLIGHTING). VERIDIAN CONNECTIONS MUST BE NOTIFIED MIN 36 HOURS PRIOR TO EXCAVATION NEAR HYDRO DUCT.

General Notes

— — All Driveways ASPHALT Unless Otherwise Noted.
— — All Service Locations Are Approximate And Must Be Located Accurately In The Field
◎ Denotes Building – Not Located
▭ Denotes Building Located
Type 'B' Bedding Unless Otherwise Noted (SAN)

B.M. No.   Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor. For final layout approval prior to installation, please contact Tahar Singh at 905-874-2750 ext 2397 or Chris Lafleur ext 2358.

Designed by ____ ____ ____ ____ Chkd. ____

Approved by ____ ____ ____ ____ ____

Aquafor Beech Limited

#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099
FAX: (905) 629-0089

55 REGAL ROAD, UNIT 3
GUELPH, ONTARIO, N1K 1B6
PHONE: (519) 224-3740
FAX: (519) 224-3750

NOTICE TO CONTRACTOR
48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL CANADA
ENBRIDGE INCORPORATED-GAS DISTRIBUTION
ONTARIO MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ONE NETWORKS
ENERSOURCE, HYDRO MISSISSAUGA
HYDRO ONE BRAMPTON

CABLE TELEVISION/FIBREOPTIC PROVIDERS:
BELL CANADA
ENERSOURCE TELECOM
HYDRO ONE TELECOM
ROGERS CABLE
ALLSTREAM
PSN (PUBLIC SECTOR NETWORK)
FUTUREWAY (FCI BROADBAND)

10m 0 10 20 30m HORIZONTAL SCALE

2m 0 2 4 6m VERTICAL SCALE

Region of Peel
Working for you

MISSISSAUGA ROAD
(FROM QUEEN STREET TO BOVAIRD DRIVE)
L.I.D – CONSTRUCTION DETAILS
STA. 10+700 TO STA. 10+980

CAD Area	Area	Project No.
Checked by	Drawn by HT	
Date 17/02/15	Sheet 6 OF 6	Plan No. LID 6


Queen Street West
River Road
Credit River
Mississauga Road
Mill Lane
Emberton Road
Huron
Villanova Road
Sky Harbour Drive
Financial Drive
LIONHEAD
11+850
11+800
11+750
11+700
11+650
11+600
11+550
11+500
11+450
11+400
11+350
11+300
11+250
11+200
11+150
11+100
11+050
11+000
10+950
10+900
10+850
10+800
10+750
10+700
10+650
10+600
10+550
10+500
10+450
10+400
10+380
10+350
10+300
10+250
10+200
10+150
10+100
10+050
10+000
BH 42
BH 40
BH 41
BH 39
BH B6
BH 38
BH 37 / BH B1
BH B2
BH 36
BH B5
BH B4
BH 34 / BH B3
BH 35
BH 33
BH 32
BH 31
BH 30
BH 28
BH 29
BH 27
BH 26
BH 25
BH 24
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BH 5
BH 4
BH 3
BH 2
BH 1
8951
8935
8947
8837
8827
8811
9034
4
14
16
18
20
22
21
26
8921
2014
2016
2020
2024
8854
8846
2015
2025
8789
8672
8646
8640
8627
8619
8601
8586
8568
8562
8501
8500
8472
8394
8383
8386
LEGEND
BOREHOLE LOCATION (1.5m depth)
BOREHOLE LOCATION (3m depth)
BOREHOLE LOCATION (6 - 15m depth)

RECORD OF BOREHOLE No. BH 1

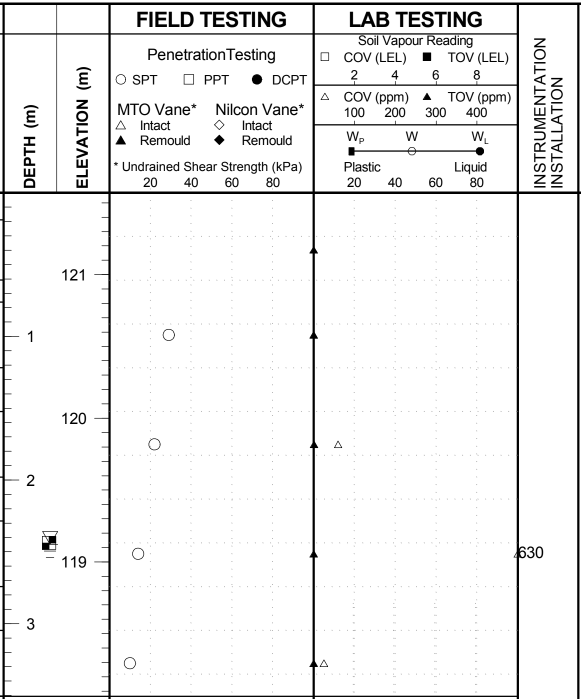
Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**
Drilling Location: **NBL, MDL on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augering**
Drilling Machine: **Truck Mounted Drill**
Date Started: **13 Jun 17** Date Completed: **13 Jun 17**

Logged by: **JF** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

Local Ground Surface Elevation: 121.6 m

LITHOLOGY PROFILE – DESCRIPTION	Elevation (m) / Depth (m) at base
about 190mm ASPHALT	121.4 0.2
Sand and Gravel (19mm Crusher Run) FILL moist	121.1 0.5
Sand and Gravel (50mm Crusher Run) FILL moist	120.9 0.7
brown **Sand and Gravel FILL** moist	120.2 1.4
dark brown **Sandy Silt FILL** trace clay with organics, trace wood chips moist	119.4 2.1
brown **SAND** some silt compact wet	118.1 3.5
End of Borehole	

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
AU	1		
SS	2	100	29
SS	3	78	22
SS	4	67	14
SS	5	56	10



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole located on NBL, on lane 2, about 6.2 m from CL.

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Groundwater depth during drilling on 13/06/2017 at a depth of: 2.4 m.

Cave in depth after removal of augers: 2.4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH 13

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**
Drilling Location: **NBL, MDL on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **13 Jun 17** Date Completed: **13 Jun 17**

Logged by: **JF** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

LITHOLOGY PROFILE

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 119.8 m
■	**about 180 mm ASPHALT** 119.6
▨	**Sand and Gravel (19mm Crusher Run) FILL** 0.2 moist 119.3
▨	**Sand and Gravel (50mm Crusher Run) FILL** 0.5 moist 118.9
▨	brown 0.9 **Sand FILL** trace to some silt, trace gravel moist 116.3
	End of Borehole 3.5

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
AU	1		
SS	2	100	21
SS	3	100	21
SS	4	100	14
SS	5	100	11

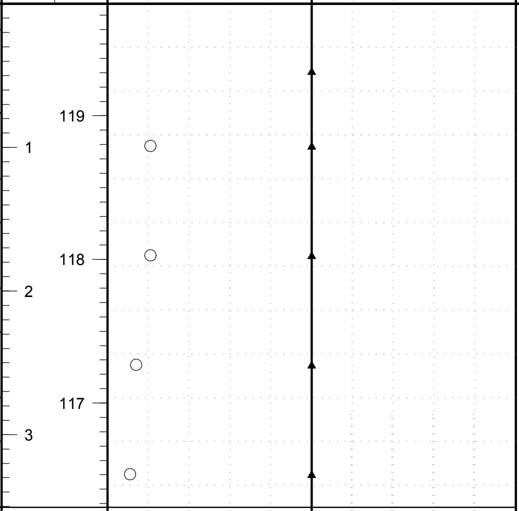
FIELD TESTING

PenetrationTesting
○ SPT ☐ PPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING

Soil Vapour Reading
☐ COV (LEL) ■ TOV (LEL) 2 4 6 8
△ COV (ppm) ▲ TOV (ppm) 100 200 300 400
W_P W W_L
Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole located on NBL, on lane 2.

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH 23

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**
Drilling Location: **NBL, Sidewalk, on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **15 Jun 17** Date Completed: **15 Jun 17**

Logged by: **DU** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

LITHOLOGY PROFILE

Local Ground Surface Elevation: 99.6 m

DESCRIPTION	Elevation (m) / Depth (m)
about 100 mm ASPHALT	99.5 0.1
brown **Gravelly Sand FILL** some silt to silty moist	99.3 0.3
brown **Sand and Gravel FILL** some silt to silty moist	99.0 0.6
19mm Crusher Run Granular FILL moist	98.4 1.2
brown **Sand and Gravel FILL** some silt, trace cobbles moist	97.5 2.1
brown / reddish brown **SILTY SAND / SANDY SILT / SAND** trace to some clay, trace gravel with organics loose wet	96.6 3.0
greyish brown **SAND AND GRAVEL** some silt, trace cobbles and boulders dense wet	94.4 5.2
End of Borehole	

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
AU	1		
AU	2		
SS	3	100	65
SS	4	44	25
SS	5	83	9
SS	6	67	34
SS	7	58	36

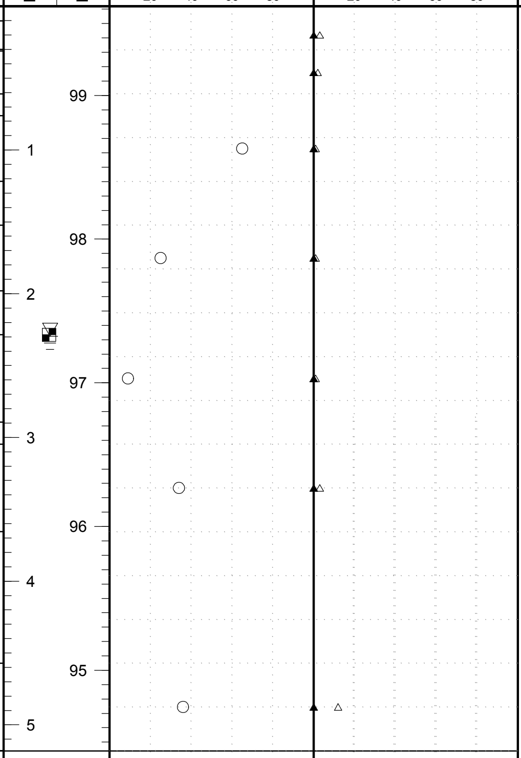
FIELD TESTING

PenetrationTesting
○ SPT ☐ PPT ● DCPT
MTO Vane* Nilcon Vane*
△ Intact ◇ Intact
▲ Remould ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING

Soil Vapour Reading
☐ COV (LEL) ■ TOV (LEL)
2 4 6 8
△ COV (ppm) ▲ TOV (ppm)
100 200 300 400
W_P W W_L
Plastic Liquid
20 40 60 80

INSTRUMENTATION INSTALLATION



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole located on sidewalk.

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Groundwater depth during drilling on 15/06/2017 at a depth of: 2.3 m.

Cave in depth after removal of augers: 2.3 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH 25

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**
Drilling Location: **NBL, MDL on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **14 Jun 17** Date Completed: **14 Jun 17**

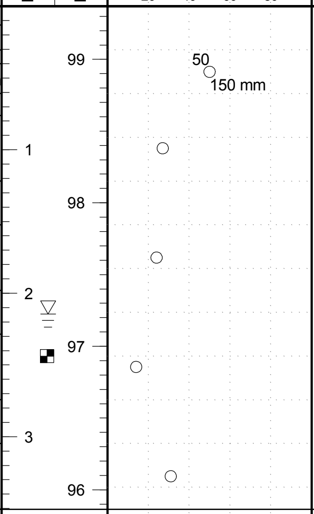
Logged by: **DU** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

Local Ground Surface Elevation: 99.4 m

DESCRIPTION	Elev. / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
about 130 mm ASPHALT	99.2				
Sand and Gravel (19mm Crusher Run) FILL moist	0.1 99.0	AU	1		
Sand and Gravel (50mm Crusher Run) FILL moist	0.4 98.7	SS	2	83	50 / 150mm
brown **Gravelly Sand FILL** some silt moist	0.7 98.0	SS	3	78	27
brown **Sand and Gravel FILL** some silt moist	1.4 97.2	SS	4	89	24
brown **Sand FILL** some silt, trace to some gravel wet	2.1 96.5	SS	5	78	14
brown **SANDY GRAVEL** some silt dense wet	2.9 95.9	SS	6	89	31
End of Borehole	3.5				

FIELD TESTING

PenetrationTesting
○ SPT ☐ PPT ● DCPT
MTO Vane* Nilcon Vane*
△ Intact ◇ Intact
▲ Remould ◆ Remould
* Undrained Shear Strength (kPa)



LAB TESTING

Soil Vapour Reading
☐ COV (LEL) ■ TOV (LEL) 2 4 6 8
△ COV (ppm) ▲ TOV (ppm) 100 200 300 400
W_P W W_L
Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Borehole located on NBL, on lane 2, about 5.0 m east of CL.

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

∇ Groundwater depth during drilling on 14/06/2017 at a depth of: 2.1 m.

▚ Cave in depth after removal of augers: 2.4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

Page: 1 of 1

RECORD OF BOREHOLE No. BH 28

Project Number:	TP115085	Drilling Location:	NBL, MDL on Mississauga Road
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augers
Project Name:	Geotechnical Investigation and Pavement Analysis	Drilling Machine:	Truck Mounted Drill
Project Location:	Mississauga Road	Date Started:	15 Jun 17
		Date Completed:	15 Jun 17

Logged by: DU
Compiled by: DU
Reviewed by: SM
Revision No.: 0, 23/8/17

LITHOLOGY PROFILE

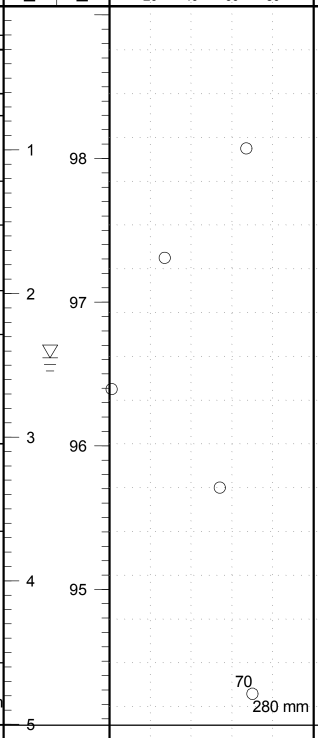
Local Ground Surface Elevation: 99.1 m

DESCRIPTION	Elevation (m)	Depth (m)
about 200 mm **ASPHALT**	98.9	0.2
dark brown **Sand and Gravel FILL** some silt moist	98.8	0.3
light brown **Gravelly Sand FILL** moist	98.5	0.6
Sand and Gravel (19mm Crusher Run) FILL moist	98.2	0.9
reddish brown **Sand and Gravel / Gravelly Sand FILL** some silt, trace cobbles moist to wet	96.2	2.9
greyish brown **SILTY SAND / SANDY SILT TILL** trace clay, some gravel to gravelly, cobbles and boulders very dense moist	94.1	5.0
End of Borehole		

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
AU	1		
AU	2		
AU	3		
SS	4	89	67
SS	5	67	27
SS	6	27	1
SS	7	58	54
SS	8	47	70 / 280mm

FIELD TESTING



PenetrationTesting
○ SPT ☐ PPT ● DCPT
MTO Vane* △ Intact ▲ Remould
Nilcon Vane* ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING

Soil Vapour Reading
☐ COV (LEL) ■ TOV (LEL) 2 4 6 8
△ COV (ppm) ▲ TOV (ppm) 100 200 300 400
W_P W W_L Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole located on SBL, on lane 2, about 5.0 m west of CL. Borehole moved from shoulder to lane 2.

Hard augering.

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ Groundwater depth during drilling on 15/06/2017 at a depth of: 2.4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B1 / BH 37

Project Number:	TP115085	Drilling Location:	NBL, MDL on Mississauga Road
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augers
Project Name:	Geotechnical Investigation and Pavement Analysis	Drilling Machine:	Truck Mounted Drill
Project Location:	Mississauga Road	Date Started:	16 Jun 17 Date Completed: 16 Jun 17

Logged by: KK Compiled by: DU Reviewed by: SM Revision No.: 0, 23/8/17

LITHOLOGY PROFILE **SOIL SAMPLING** **FIELD TESTING** **LAB TESTING**

Lithology Plot | DESCRIPTION | Sample Type | Sample Number | Recovery (%) | SPT 'N' / RQD (%) | DEPTH (m) | ELEVATION (m)

Local Ground Surface Elevation: 101.4 m

FIELD TESTING: PenetrationTesting ○ SPT ☐ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Soil Vapour Reading ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole located on NBL, on lane 2, about 6.5 m from CL.

Elevation (m) / Depth (m)	Description
101.3 0.2	**about 160 mm ASPHALT**
101.0 0.5	brown **Sand and Gravel FILL** moist
100.7 0.7	brown **Gravelly Sand FILL** trace cobbles moist
97.4 4.0	grey / brown **Silty Sand FILL** trace to some clay and gravel moist to wet
95.9 5.6	brown **Silty Clay / Clayey Silt FILL** trace gravel, with sand pockets
91.5	brown / reddish brown **SAND AND GRAVEL** trace clay, some silt, trace cobbles dense to very dense wet

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Field Testing	W	GR	SA	SI	CL
SS	1	58	47	○	4				
SS	2	42	50	○	6				
SS	3	83	20	○	11				
SS	4	89	20	○	9				
SS	5	89	12	○	11				
SS	6	89	7	○	13				
SS	7	100	43	○	11	32	50	15	3
SS	8	100	50 / 100mm	50 ○ 100 mm	15				
SS	9	100	50 / 130mm	50 ○ 130 mm	11				

DEPTH (m): 1 2 3 4 5 6 7 8 9 10

ELEVATION (m): 101 100 99 98 97 96 95 94 93 92

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∇ Groundwater depth during drilling on 17/06/2017 at a depth of: 4.3 m.

▚ Cave in depth after removal of augers: 5.2 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

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RECORD OF BOREHOLE No. BH B1 / BH 37

Project Number: **TP115085**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**

FIELD TESTING: PenetrationTesting ○ SPT ☐ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Soil Vapour Reading ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L Plastic Liquid 20 40 60 80

LITHOLOGY PROFILE: Lithology Plot	LITHOLOGY PROFILE: DESCRIPTION	SOIL SAMPLING: Sample Type	SOIL SAMPLING: Sample Number	SOIL SAMPLING: Recovery (%)	SOIL SAMPLING: SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%): GR	SA	SI	CL
⁙	10.0 brown / brownish grey **SILTY SAND** trace clay, some gravel, trace cobbles hard													
							91							
		SS	10	100	50 / 130mm			50 130 mm	11		14	53	25	8
						11								
							90							
						12								
	89.1	SS	11	100	50 / 80mm			50 80 mm	12					
	End of Borehole due to Auger Refusal 12.3	SS	12	100	50 / 30mm			50 30 mm	14					

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B2

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**

Drilling Location: **SBL, MDL on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **16 Jun 17** Date Completed: **16 Jun 17**

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Logged by: **KK/DU** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

LITHOLOGY PROFILE | **SOIL SAMPLING** | **FIELD TESTING** | **LAB TESTING** | INSTRUMENTATION INSTALLATION | **COMMENTS & GRAIN SIZE DISTRIBUTION (%)**

Local Ground Surface Elevation: 101.7 m

Penetration Testing: ○ SPT ☐ PPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa): 20 40 60 80

Soil Vapour Reading: ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400
W_P W W_L — Plastic / Liquid: 20 40 60 80

Elevation (m) / Depth (m)	Description
101.6 / 0.2	**about 155 mm ASPHALT**
101.0 / 0.7	brown **Sand and Gravel FILL** trace clay and silt moist
100.3 / 1.4	greyish brown **Sand FILL** trace clay, trace silt, trace gravel moist
97.7 / 4.0	greyish brown / brown **SAND** trace clay and gravel, some silt compact moist
96.1 / 5.6	reddish brown **SILTY CLAY / CLAYEY SILT** some sand, trace gravel stiff
	brown / reddish brown **SAND AND GRAVEL** some silt, trace clay and cobbles very dense wet

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	W (%)	GR	SA	SI	CL	Comments
SS	1	89	55	4					Borehole located on SBL, on lane 2, about 5.3 m from CL.
SS	2	78	31	7					
SS	3	56	24	10					
SS	4	100	18	6					
SS	5	100	12	6	9	71	16	4	
SS	6	94	13	16					
SS	7	100	62	9	35	40	19	6	
SS	8	100	50 / 80mm	13					Hard augering starting about 7.5 m depth.
SS	9	60	50 / 130mm	7					

Field testing: 50 / 80 mm; 50 / 130 mm

Depth (m): 1 2 3 4 5 6 7 8 9 10
Elevation (m): 101 100 99 98 97 96 95 94 93 92

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▽ Groundwater depth during drilling on 16/06/2017 at a depth of: 5.5 m.

▚ Cave in depth after removal of augers: 5.8 m.

Scale: 1 : 53

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RECORD OF BOREHOLE No. BH B2

Project Number: **TP115085** Project Name: **Geotechnical Investigation and Pavement Analysis**

Project Location: **Mississauga Road**

LITHOLOGY PROFILE

Lithology Plot	DESCRIPTION	Elevation (m)	Depth (m)
	brown / reddish brown **SAND AND GRAVEL** some silt, trace clay and cobbles very dense wet	90.2	11.5
	reddish brown **SILTY CLAY / CLAYEY SILT** trace sand and gravel, with shale fragments hard	88.7	13.0
	grey **WEATHERED SHALE** hard moist	87.4	14.3
	End of Borehole due to Auger Refusal		

SOIL SAMPLING / FIELD TESTING / LAB TESTING

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Penetration Testing	W
SS	10	100	50 / 100mm	50 100 mm	8
SS	11	100	50 / 30mm	50 30 mm	7
SS	12	100	50 / 100mm	50 100 mm	13
SS	13	100	50 / 30mm	50 30 mm	14

DEPTH (m): 11, 12, 13, 14

ELEVATION (m): 91, 90, 89, 88

PenetrationTesting
○ SPT ☐ PPT ● DCPT

MTO Vane* Nilcon Vane*
△ Intact ◇ Intact
▲ Remould ◆ Remould

* Undrained Shear Strength (kPa)
20 40 60 80

Soil Vapour Reading
☐ COV (LEL) ■ TOV (LEL)
2 4 6 8
△ COV (ppm) ▲ TOV (ppm)
100 200 300 400

W_P W W_L
Plastic Liquid
20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B3 / BH 34

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**
Drilling Location: **SBL, MDL on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **19 Jun 17** Date Completed: **19 Jun 17**

Logged by: **JF** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

Local Ground Surface Elevation: 100.9 m

DESCRIPTION	Elevation / Depth (m)
about 150 mm ASPHALT	100.8
brown **Gravelly Sand FILL**	100.7 0.2
about 90 mm ASPHALT	100.6 0.2
Gravelly Sand FILL trace cobbles	0.3
brown **Silty Sand FILL** with silty clay pockets moist	99.9 1.0
brown **Sand FILL** trace clay, silt and gravel with silty clay pockets moist to wet	99.4 1.5
brown **Sandy Clayey Silt FILL** trace gravel wet	96.9 4.0
reddish brown **SILTY CLAY / CLAYEY SILT** sandy, trace gravel, trace cobbles with limestone and shale fragments hard	95.4 5.6

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Penetration Testing (SPT)	W (%)	GR	SA	SI	CL
AU	1				5				
SS	2	79	19		3				
SS	3	100	21		11				
SS	4	83	33		7				
SS	5	67	9		9				
SS	6	56	6		13				
SS	7	56	20		15				
SS	8	100	50 / 150mm	50 150 mm	9	6	39	43	12
SS	9	106	97 / 280mm	97 280 mm	11				
SS	10	91	50 / 130mm	50 130 mm	8				

FIELD TESTING: PenetrationTesting ○ SPT ☐ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Soil Vapour Reading ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on SBL, on lane 2, about 5.3 m from CL.

Hard augering starting about 7.5 m depth.

Groundwater depth during drilling on 19/06/2017 at a depth of: 4.4 m.

Cave in depth after removal of augers: 9.1 m.

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Scale: 1 : 53

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RECORD OF BOREHOLE No. BH B3 / BH 34

Project Number: **TP115085**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ☐ PPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8 △ COV (ppm) ▲ TOV (ppm) 100 200 300 400 W_P W W_L Plastic Liquid 20 40 60 80		GR SA SI CL
reddish brown **SILTY CLAY / CLAYEY SILT** sandy, trace gravel, trace cobbles with limestone and shale fragments hard	90.2 10.7	SS	11	100	50 / 80mm			50 80 mm	7		
grey **WEATHERED SHALE** hard moist	89.8 11.1	SS	12	100	50 / 30mm	11	90	50 30 mm			

End of Borehole due to Auger Refusal

Monitoring Well Installation Details:
(50 mm Diameter)

Flush mount casing Installed
Concrete: 0 - 0.3 m
Sand: 0.3 - 0.9 m
Bentonite: 0.9 - 5.5 m
Sand Filter: 5.5 - 6.1 m
Screen: 6.1 - 7.6 m
Bentonite: 7.6 - 11.1 m

Measured Groundwater Depth:

on 23 July 2017: 0.0 m

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B4

Project Number:	TP115085	Drilling Location:	NBL, MDL on Mississauga Road
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm / 200 mm Solid Stem Augers / Hollow Stem Augers
Project Name:	Geotechnical Investigation and Pavement Analysis	Drilling Machine:	Truck Mounted Drill
Project Location:	Mississauga Road	Date Started:	14 Jun 17
		Date Completed:	16 Jun 17
Logged by:	DU	Compiled by:	DU
Reviewed by:	SM	Revision No.:	0, 23/8/17

LITHOLOGY PROFILE

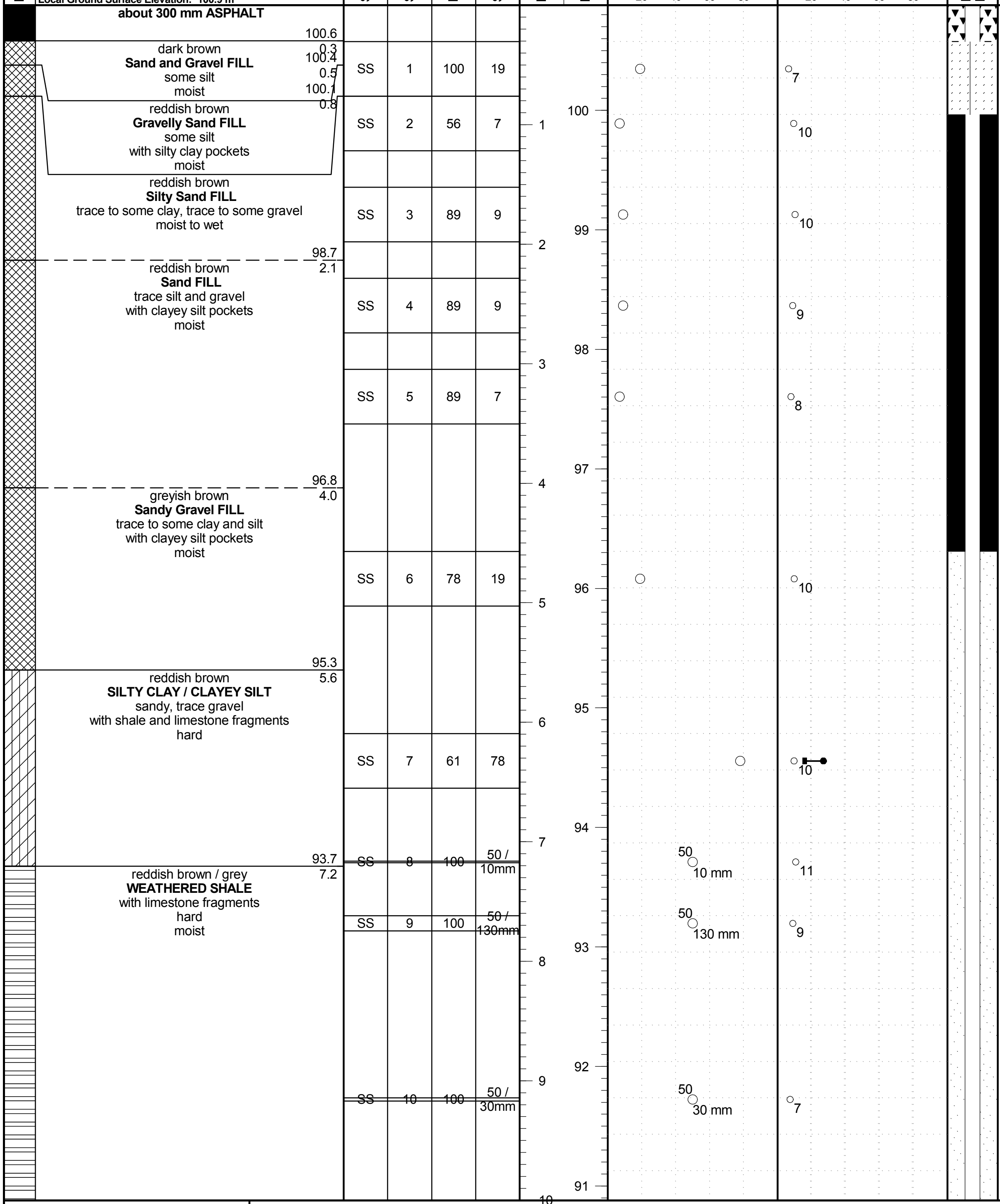
Local Ground Surface Elevation: 100.9 m

Elevation / Depth (m)	DESCRIPTION
	about 300 mm ASPHALT
100.6 0.3	dark brown **Sand and Gravel FILL** some silt moist
100.4 0.5	reddish brown **Gravelly Sand FILL** some silt with silty clay pockets moist
100.1 0.8	reddish brown **Silty Sand FILL** trace to some clay, trace to some gravel moist to wet
98.7 2.1	reddish brown **Sand FILL** trace silt and gravel with clayey silt pockets moist
96.8 4.0	greyish brown **Sandy Gravel FILL** trace to some clay and silt with clayey silt pockets moist
95.3 5.6	reddish brown **SILTY CLAY / CLAYEY SILT** sandy, trace gravel with shale and limestone fragments hard
93.7 7.2	reddish brown / grey **WEATHERED SHALE** with limestone fragments hard moist

SOIL SAMPLING / FIELD TESTING / LAB TESTING

PenetrationTesting: ○ SPT ☐ PPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80
Soil Vapour Reading: ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400
W_P W W_L Plastic Liquid 20 40 60 80

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Water Content	GR	SA	SI	CL
SS	1	100	19	7				
SS	2	56	7	10				
SS	3	89	9	10				
SS	4	89	9	9				
SS	5	89	7	8				
SS	6	78	19	10				
SS	7	61	78	10	3	32	49	16
~~SS~~	~~8~~	~~100~~	50 / 10mm	11				
SS	9	100	50 / 130mm	9				
~~SS~~	~~10~~	~~100~~	50 / 30mm	7				



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on NBL, on lane 2, about 6.5 m from CL. When reached about 7.2 m depth, auger refusal and borehole moved about 1 m towards south.

Hard augering starting about 6.1 m depth.

Due to cave-ins, borehole was terminated. On 16 June 2017 borehole was redrilled, at the same location, using Hollow Stem Augers.

No freestanding groundwater measured in open borehole on completion of drilling.

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Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

Continued on Next Page

RECORD OF BOREHOLE No. BH B4

Project Number: **TP115085** Project Name: **Geotechnical Investigation and Pavement Analysis**

Project Location: **Mississauga Road**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT ☐ PPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading ☐ COV (LEL) ■ TOV (LEL) 2 4 6 8 △ COV (ppm) ▲ TOV (ppm) 100 200 300 400 W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	reddish brown / grey **WEATHERED SHALE** with limestone fragments hard moist	SS	11	100	50 / 30mm	11	90	50 30 mm	14		
	89.3 **End of Borehole due to Auger Refusal** 11.6	SS	12	100	50 / 30mm			50 30 mm	9		

Monitoring Well Installation Details:
(50 mm Diameter)

Flush mount casing Installed
Concrete: 0 - 0.3 m
Sand: 0.3 - 0.9 m
Bentonite: 0.9 - 5.5 m
Sand Filter: 5.5 - 10.0 m
Screen: 10.0 - 11.5 m

Measured Groundwater Depth:

on 23 July 2017: 0.0 m

Scale: 1 : 53

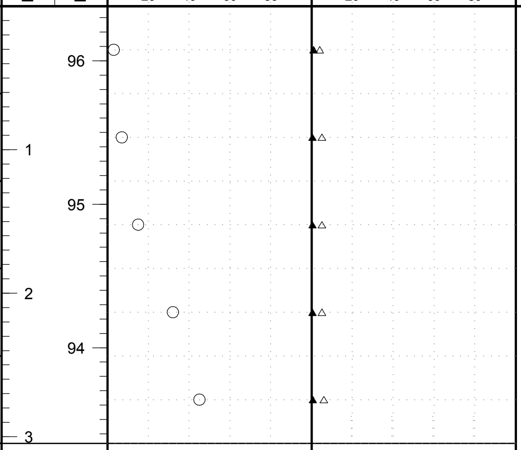
RECORD OF BOREHOLE No. BH B5

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**
Drilling Location: **SBL, EP on Mississauga Road**
Drilling Method: **100 mm Solid Stem Augers / Hand Drilling**
Drilling Machine: **Hand Drill**
Date Started: **19 Jun 17** Date Completed: **19 Jun 17**

Logged by: **JF** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

Local Ground Surface Elevation: 96.4 m

DESCRIPTION	Elevation / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
about 120 mm TOPSOIL	96.3 0.1				
brown **Silty Sand FILL** trace clay, trace gravel and cobbles with rootlets and organics wet		SS	1	42	3
		SS	2	83	7
	94.6	SS	3	33	15
brown **SAND AND GRAVEL** trace clay and silt, trace cobbles with organics dense moist	1.8	SS	4	42	32
	93.5	SS	5	42	45
reddish brown **SILTY CLAY / CLAYEY SILT** hard	2.9 93.3 3.0				
End of Borehole					



INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Borehole located at southwest corner of bridge at the toe of slope, about 10 m from CL and about 15 m from BH B3.

Borehole was moved to the north due to auger refusal.

Borehole moved again due to auger refusal on cobbles/boulders.

No freestanding groundwater measured in open borehole on completion of drilling.

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Scale: 1 : 53

RECORD OF BOREHOLE No. BH B6

Project Number:	**TP115085**	Drilling Location:	**NBL, EP on Mississauga Road**
Project Client:	**The Regional Municipality of Peel**	Drilling Method:	**150 mm Solid Stem Augers**
Project Name:	**Geotechnical Investigation and Pavement Analysis**	Drilling Machine:	**Truck Mounted Drill**
Project Location:	**Mississauga Road**	Date Started:	**14 Jun 17** Date Completed: **14 Jun 17**

Logged by: **DU** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

LITHOLOGY PROFILE

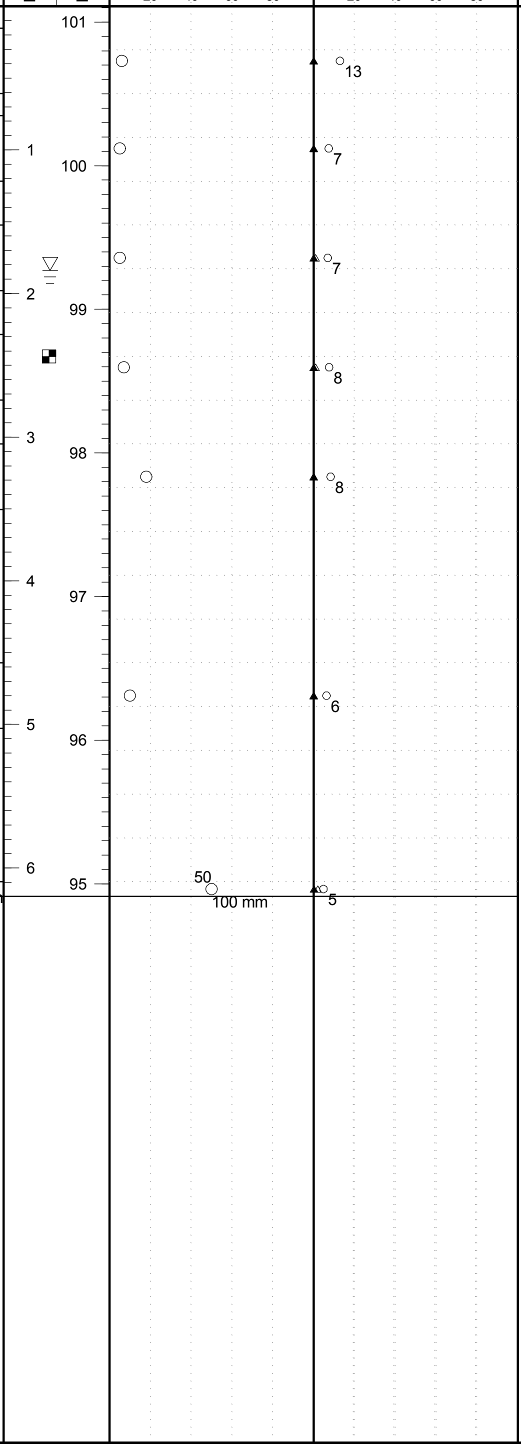
Local Ground Surface Elevation: 101.1 m

Elevation / Depth (m)	DESCRIPTION
101.0	**Sand and Gravel (19mm Crusher Run) FILL** moist
0.2	dark brown **Clayey Silt FILL** some sand to sandy, trace gravel moist
100.4 0.7	brown **Gravelly Sand FILL** some silt moist to wet
99.0 2.1	brown **Sandy Gravel FILL** trace silt wet
95.5 5.6	brown **SANDY GRAVEL** trace silt very dense wet
94.9 6.2	**End of Borehole**

SOIL SAMPLING

Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	GR	SA	SI	CL
SS	1	44	6				
SS	2	33	5				
SS	3	33	5				
SS	4	44	7				
SS	5	56	18				
SS	6	67	10	68	25	(7)	
SS	7	100	50 / 100mm				

FIELD TESTING / LAB TESTING



INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located at northeast corner of bridge, about 13.5 m east from CL.

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∇ Groundwater depth during drilling on 14/06/2017 at a depth of: 1.8 m.

▚ Cave in depth after removal of augers: 2.4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH R1

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**

Drilling Location: **NBL, Top of Slope, on Mississauga**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **13 Jun 17** Date Completed: **13 Jun 17**

Logged by: **SN/DU** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

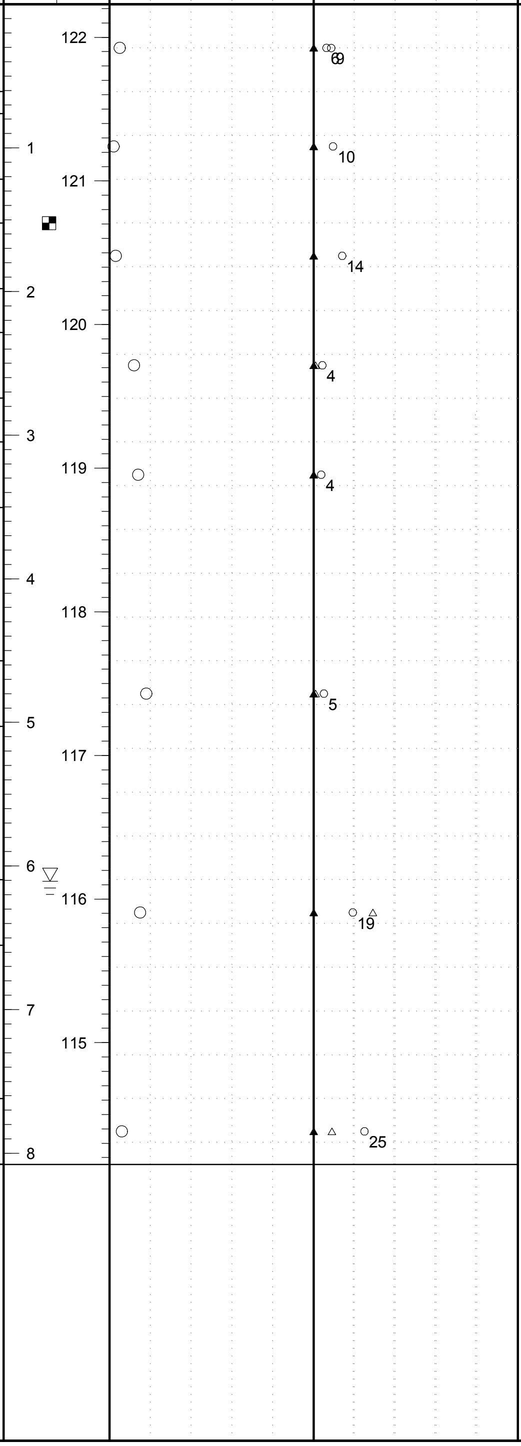
Local Ground Surface Elevation: 122.2 m

LITHOLOGY PROFILE DESCRIPTION	Elev. / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	LAB TESTING	GR	SA	SI	CL	COMMENTS
about 150 mm TOPSOIL	122.1										Borehole located on top of slope.
brown / reddish brown **Silty Sand FILL** trace clay, trace gravel with organics and rootlets moist	0.2	SS	1	75	5	6 9					
		SS	2	100	2	10					
		SS	3	89	3	14					
brown / light brown **SAND** trace clay and silt, trace gravel loose to compact moist	120.1 2.1	SS	4	100	12	4					
		SS	5	100	14	4					
		SS	6	100	18	5					
------- wet		SS	7	100	15	19					
		SS	8	100	6	25	0	94	4	2	
End of Borehole	114.2 8.1										

FIELD TESTING
PenetrationTesting
○ SPT ☐ PPT ● DCPT
MTO Vane* Nilcon Vane*
△ Intact ◇ Intact
▲ Remould ◆ Remould
* Undrained Shear Strength (kPa)
20 40 60 80

LAB TESTING
Soil Vapour Reading
☐ COV (LEL) ■ TOV (LEL)
2 4 6 8
△ COV (ppm) ▲ TOV (ppm)
100 200 300 400
W_P W W_L
Plastic Liquid
20 40 60 80

INSTRUMENTATION INSTALLATION



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∇ Groundwater depth during drilling on 13/06/2017 at a depth of: 6.1 m.

▚ Cave in depth after removal of augers: 1.5 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH R2

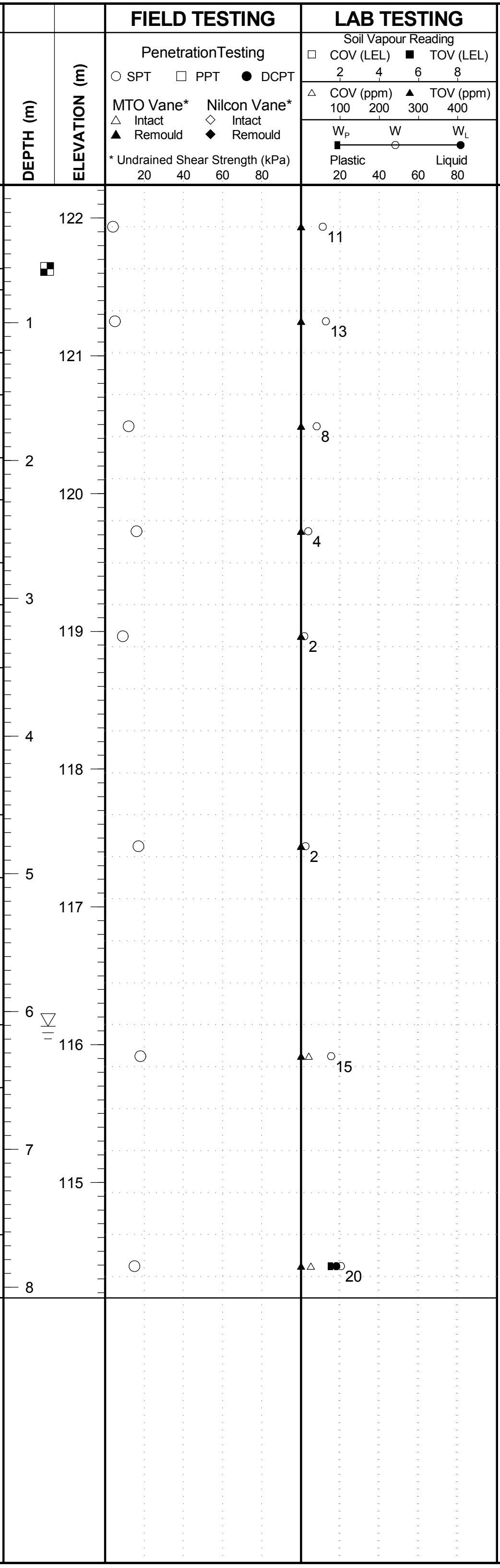
Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Analysis**
Project Location: **Mississauga Road**

Drilling Location: **NBL, Top of Slope, on Mississauga**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Track Mounted Drill**
Date Started: **13 Jun 17** Date Completed: **13 Jun 17**

Logged by: **SN** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 23/8/17**

Local Ground Surface Elevation: 122.2 m

DESCRIPTION	Elevation (m) / Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	GR	SA	SI	CL
about 150 mm TOPSOIL									
brown **Silty Sand FILL** loose moist	121.9 0.3	SS	1	100	4				
		SS	2	100	5				
brown **SAND** trace silt, trace gravel compact moist	120.9 1.4	SS	3	100	12				
		SS	4	67	16				
		SS	5	67	9				
		SS	6	67	17				
brown **SILTY SAND** compact wet	116.7 5.6	SS	7	100	18				
brown **SILT** trace clay and gravel, some sand compact wet	115.2 7.1	SS	8	100	15	2	12	78	8
End of Borehole	114.2 8.1								



INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on top of slope.

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

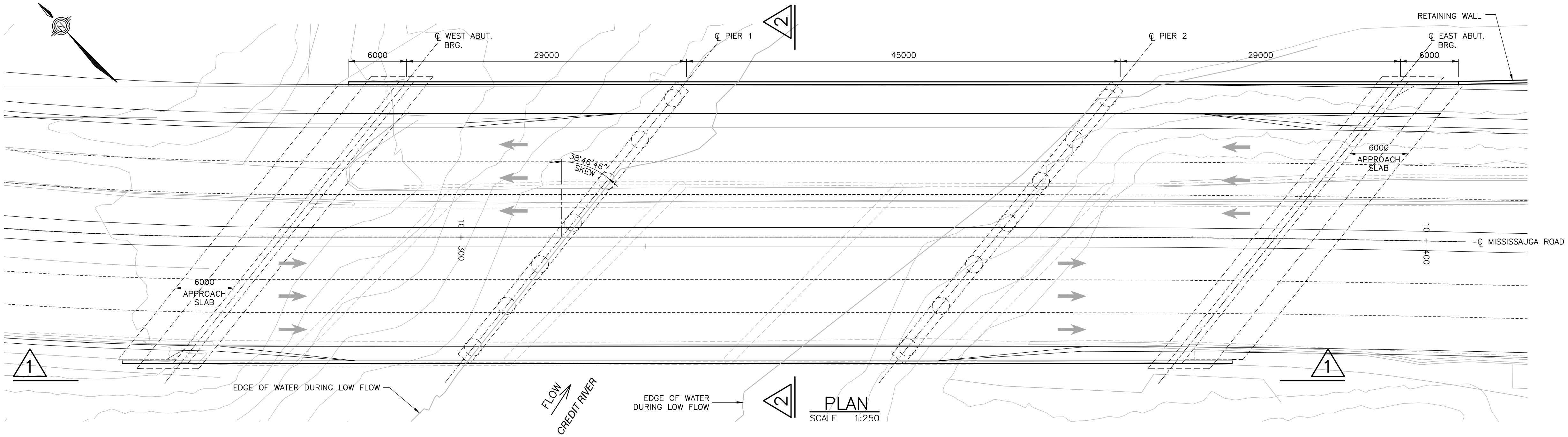
Groundwater depth during drilling on 13/06/2017 at a depth of: 6.1 m.

Cave in depth after removal of augers: 0.6 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

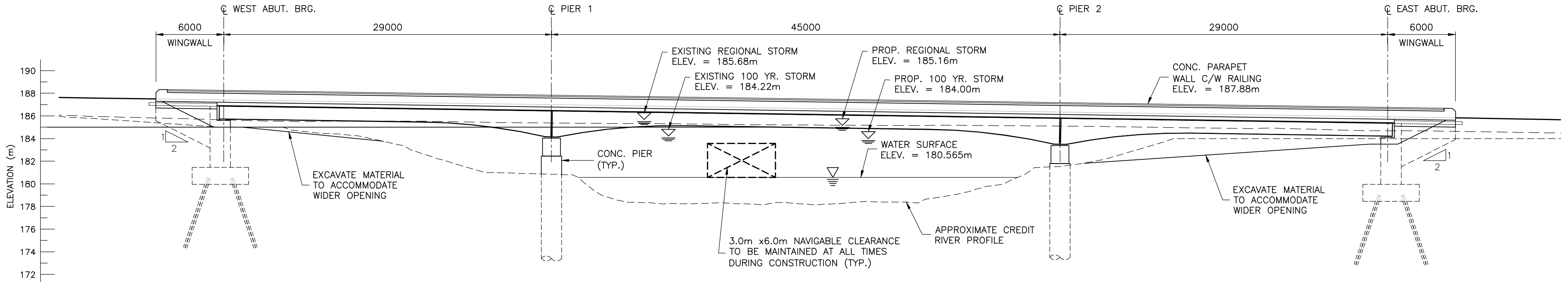
Appendix B:
Hydraulics



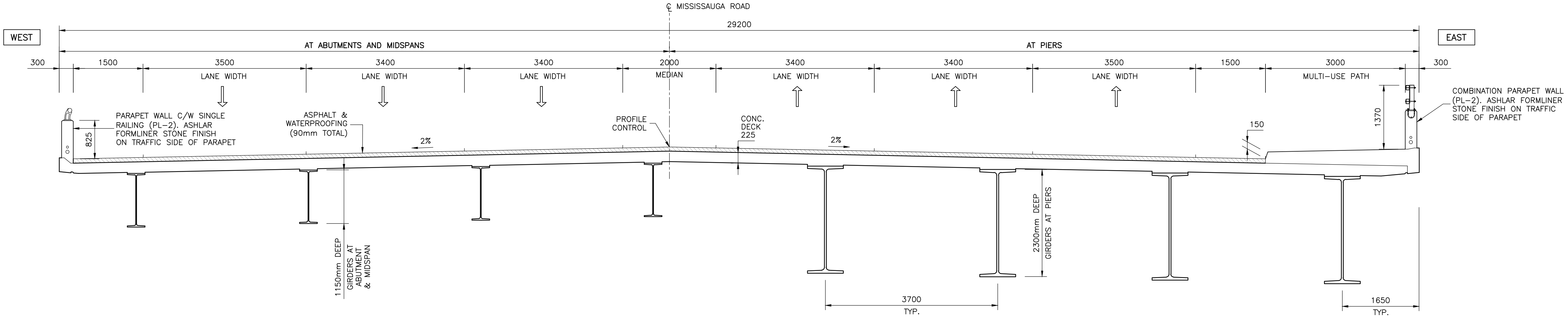
PLAN
SCALE 1:250

GENERAL NOTES

1. DESIGN CODE AND LOADING SHALL BE TO CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) CAN/CSA–S6–14 CL.625–ONT LIVE LOADING.
2. CLASS OF CONCRETE
   50 MPa. HPC – DECK, PARAPET WALL, SIDEWALK, MEDIAN.
   30 MPa. – FOOTING.
   35 MPa. – PIERS, PIER CAPS, ABUTMENTS, WINGWALLS.
3. CLEAR COVER TO REINFORCING STEEL
   FOOTING .... 100 ±25
   DECK .... TOP 70 ±20
   BOTTOM 40 ±10
   REMAINDER .... 70 ±20 UNLESS OTHERWISE NOTED
4. REINFORCING STEEL
   - REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa UNLESS OTHERWISE SPECIFIED.
   - BAR MARKS WITH PREFIX "S" DENOTES STAINLESS STEEL BAR.
   - UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES SHALL BE CLASS B.
   - BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12–1 UNLESS INDICATED OTHERWISE.
5. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND ELEVATIONS SHOWN ON STRUCTURAL DRAWINGS AGAINST SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING WITH WORK.



ELEVATION 1 (TAKEN AT SOUTH SIDE OF BRIDGE)
SCALE 1:250



TYPICAL CROSS–SECTION 2
SCALE 1:50

Path: P:\Work\TP115085\Str\Dwg\Contract\TP115085-S1.dwg

Plotted By: jason.stahl
Last Saved By: jason.stahl

Plotted: 2018-06-07
Last Saved: 2018-06-07

No	Date	Drawn	Appr'd	Revisions

APPROVALS

Design	N.T.	Checked	
Drawn	C.B.	Checked	N.T.
Scale	AS SHOWN		
Date	SEPTEMBER 2017		

PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION

RECONSTRUCTION OF
MISSISSAUGA ROAD
REGION OF PEEL

MISSISSAUGA ROAD
OVER CREDIT RIVER
STRUCTURE REPLACEMENT
GENERAL ARRANGEMENT

amec foster wheeler

Contract No.
Consultant File No. TP115085
Drawing No.
SHEET S1 OF

MISSISSAUGA ROAD

1:1000

MISSISSAUGA ROAD

HOR 1:1000
VER 1:200

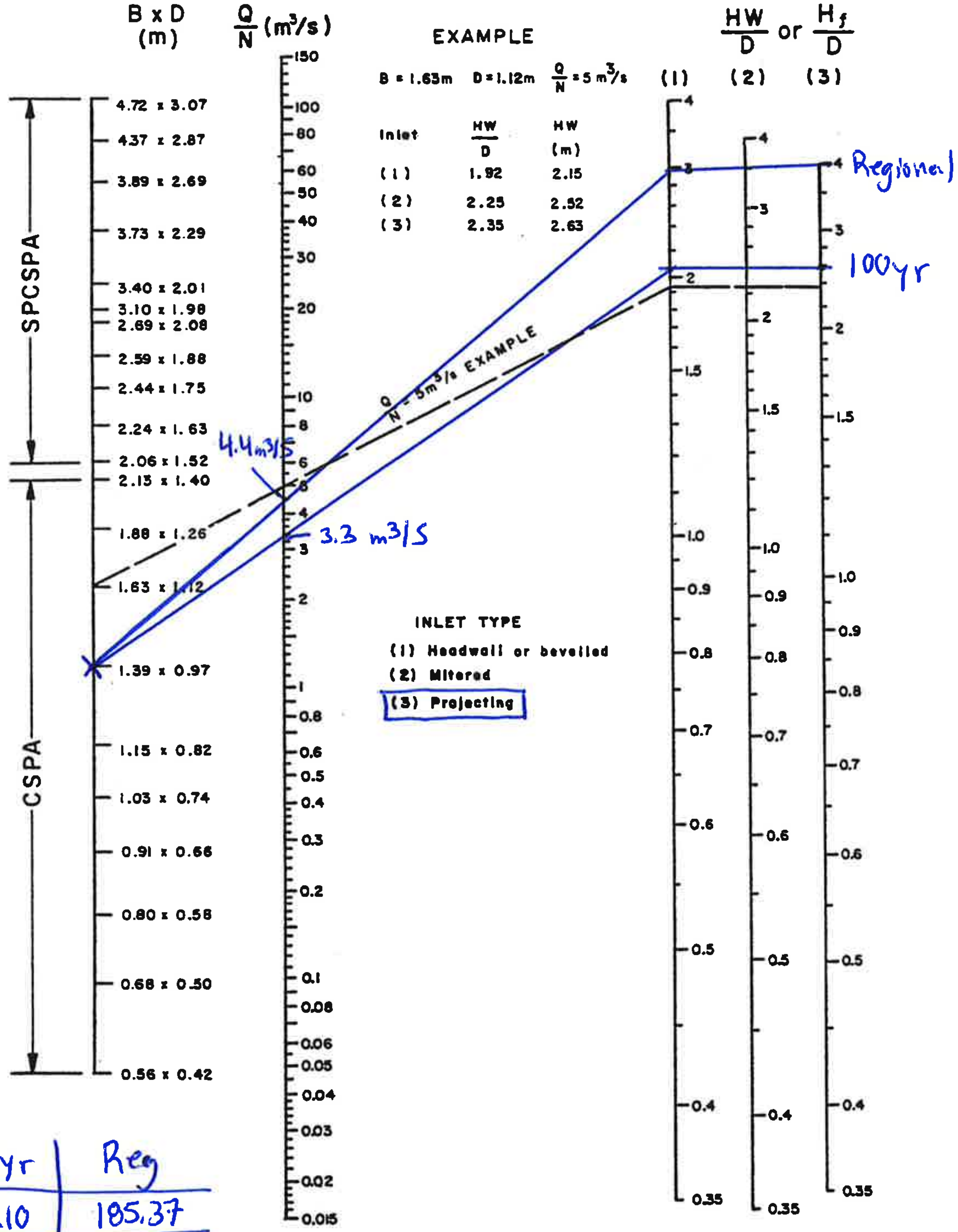
HEC-RAS Results

River	Reach	River Station	Profile	Water Surface Elevation (m)		
				Existing Conditions	Proposed Conditions	Difference
CreditRiver	1	11644	Regional	189.56	189.56	0
CreditRiver	1		100 year	188.57	188.57	0
CreditRiver	1		50 year	188.31	188.31	0
CreditRiver	1		25 year	188.05	188.05	0
CreditRiver	1		10 year	187.71	187.71	0
CreditRiver	1		5 year	187.42	187.42	0
CreditRiver	1		2 year	186.64	186.64	0
CreditRiver	1	11320	Regional	188.62	188.62	0
CreditRiver	1		100 year	187.69	187.69	0
CreditRiver	1		50 year	187.42	187.42	0
CreditRiver	1		25 year	187.15	187.15	0
CreditRiver	1		10 year	186.8	186.8	0
CreditRiver	1		5 year	186.52	186.52	0
CreditRiver	1		2 year	185.84	185.84	0
CreditRiver	1	11015	Regional	188.39	188.39	0
CreditRiver	1		100 year	187.54	187.54	0
CreditRiver	1		50 year	187.28	187.28	0
CreditRiver	1		25 year	187.03	187.03	0
CreditRiver	1		10 year	186.68	186.68	0
CreditRiver	1		5 year	186.42	186.42	0
CreditRiver	1		2 year	185.73	185.73	0
CreditRiver	1	10720	Regional	187.97	187.97	0
CreditRiver	1		100 year	187.24	187.24	0
CreditRiver	1		50 year	187.01	187.01	0
CreditRiver	1		25 year	186.78	186.78	0
CreditRiver	1		10 year	186.48	186.48	0
CreditRiver	1		5 year	186.23	186.23	0
CreditRiver	1		2 year	185.61	185.61	0
CreditRiver	1	10490	Regional	187.58	187.59	0.01
CreditRiver	1		100 year	186.94	186.94	0
CreditRiver	1		50 year	186.74	186.74	0
CreditRiver	1		25 year	186.53	186.53	0
CreditRiver	1		10 year	186.26	186.26	0
CreditRiver	1		5 year	186.04	186.04	0
CreditRiver	1		2 year	185.49	185.49	0
CreditRiver	1	10230	Regional	186.65	186.54	-0.11
CreditRiver	1		100 year	185.83	185.83	0
CreditRiver	1		50 year	185.71	185.71	0
CreditRiver	1		25 year	185.58	185.58	0
CreditRiver	1		10 year	185.42	185.42	0
CreditRiver	1		5 year	185.29	185.29	0
CreditRiver	1		2 year	184.56	184.56	0

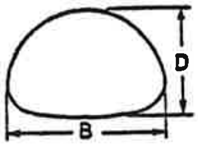
CreditRiver	1	9844	Regional	186	185.78	-0.22
CreditRiver	1		100 year	184.59	184.41	-0.18
CreditRiver	1		50 year	184.22	183.96	-0.26
CreditRiver	1		25 year	184.04	183.54	-0.5
CreditRiver	1		10 year	183.06	183.03	-0.03
CreditRiver	1		5 year	182.67	182.64	-0.03
CreditRiver	1		2 year	181.65	181.64	-0.01
CreditRiver	1	9570	Regional	185.38	184.99	-0.39
CreditRiver	1		100 year	184.19	183.93	-0.26
CreditRiver	1		50 year	183.89	183.5	-0.39
CreditRiver	1		25 year	183.81	183.1	-0.71
CreditRiver	1		10 year	182.66	182.6	-0.06
CreditRiver	1		5 year	182.26	182.21	-0.05
CreditRiver	1		2 year	181.29	181.26	-0.03
CreditRiver	1	9560	Regional	185.67	185.37	-0.3
CreditRiver	1		100 year	184.35	184.1	-0.25
CreditRiver	1		50 year	184.01	183.66	-0.35
CreditRiver	1		25 year	183.89	183.23	-0.66
CreditRiver	1		10 year	182.76	182.7	-0.06
CreditRiver	1		5 year	182.34	182.3	-0.04
CreditRiver	1		2 year	181.32	181.3	-0.02
CreditRiver	1	9550	Regional	185.68	185.16	-0.52
CreditRiver	1		100 year	184.23	184.02	-0.21
CreditRiver	1		50 year	183.93	183.59	-0.34
CreditRiver	1		25 year	183.84	183.18	-0.66
CreditRiver	1		10 year	182.71	182.67	-0.04
CreditRiver	1		5 year	182.31	182.27	-0.04
CreditRiver	1		2 year	181.31	181.29	-0.02
CreditRiver	1	9518	Mississauga Road Crossing			
CreditRiver	1	9510	Regional	185.11	184.99	-0.12
CreditRiver	1		100 year	183.95	183.96	0.01
CreditRiver	1		50 year	183.53	183.54	0.01
CreditRiver	1		25 year	183.12	183.13	0.01
CreditRiver	1		10 year	182.62	182.62	0
CreditRiver	1		5 year	182.23	182.23	0
CreditRiver	1		2 year	181.24	181.24	0
CreditRiver	1	9500	Regional	185.05	185.05	0
CreditRiver	1		100 year	183.98	183.98	0
CreditRiver	1		50 year	183.55	183.55	0
CreditRiver	1		25 year	183.14	183.14	0
CreditRiver	1		10 year	182.62	182.62	0
CreditRiver	1		5 year	182.22	182.22	0
CreditRiver	1		2 year	181.23	181.23	0
CreditRiver	1	9477	Regional	184.27	184.27	0
CreditRiver	1		100 year	182.77	182.77	0
CreditRiver	1		50 year	182.54	182.54	0
CreditRiver	1		25 year	182.32	182.32	0
CreditRiver	1		10 year	182.01	182.01	0
CreditRiver	1		5 year	181.77	181.77	0
CreditRiver	1		2 year	181.04	181.04	0

CreditRiver	1	9284	Regional	182.55	182.55	0
CreditRiver	1		100 year	182.06	182.06	0
CreditRiver	1		50 year	181.89	181.89	0
CreditRiver	1		25 year	181.72	181.72	0
CreditRiver	1		10 year	181.5	181.5	0
CreditRiver	1		5 year	181.35	181.35	0
CreditRiver	1		2 year	180.63	180.63	0
CreditRiver	1	9134	Regional	182.41	182.41	0
CreditRiver	1		100 year	181.8	181.8	0
CreditRiver	1		50 year	181.64	181.64	0
CreditRiver	1		25 year	181.48	181.48	0
CreditRiver	1		10 year	181.29	181.29	0
CreditRiver	1		5 year	181.21	181.21	0
CreditRiver	1		2 year	180.46	180.46	0

CHART D5 - 1H



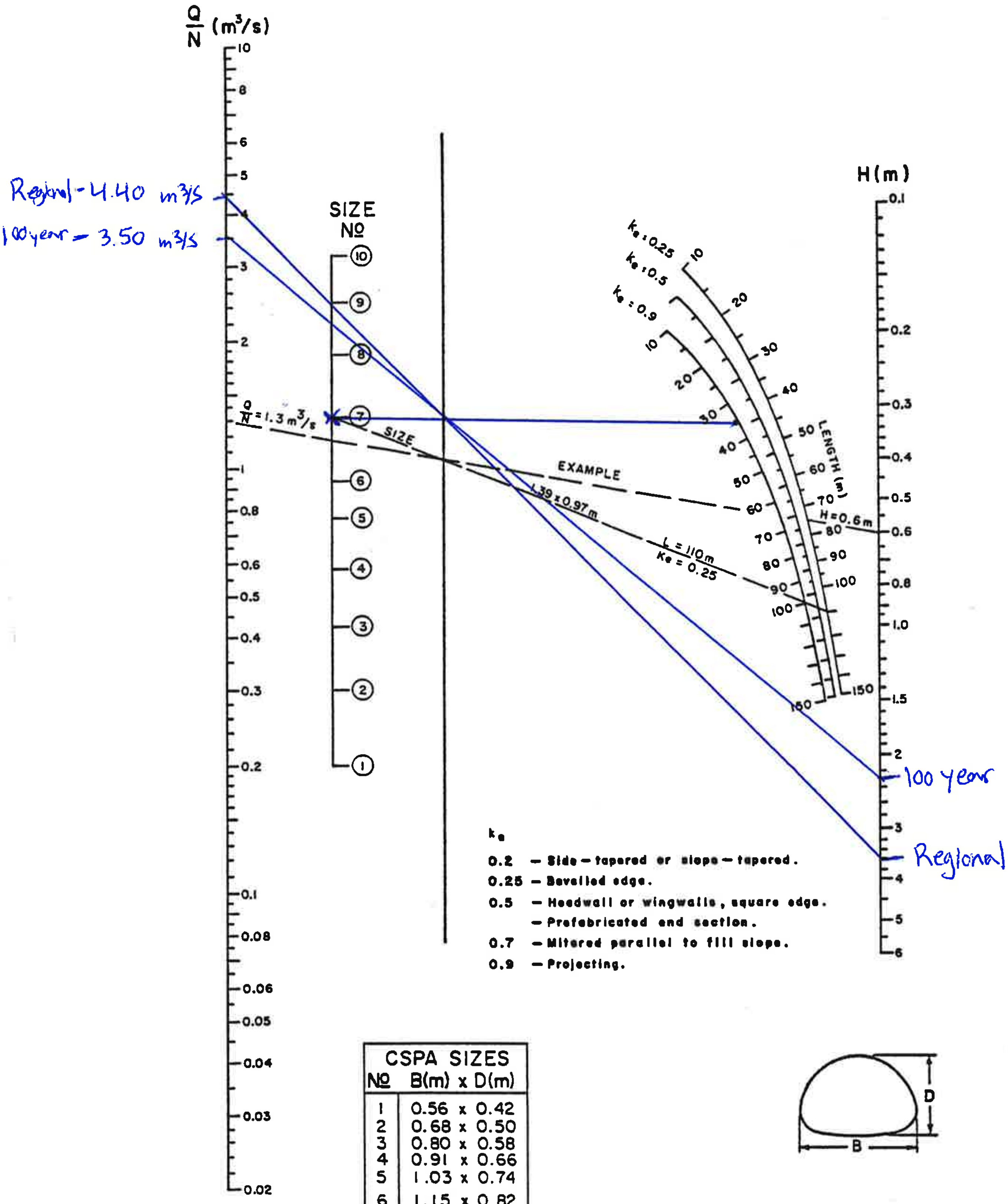
	100yr	Reg
WSEL	184.10	185.37
Inv.	181.80	181.80
Δ	2.30	3.57
HW/D	2.6	4



INLET CONTROL
CSPA & SPCSPA
CULVERT

FHA 63 01
METRIC FHA 74 06 (51)

CHART D5 - 2E



k_e

0.2 — Side — tapered or slope — tapered.

0.25 — Bevelled edge.

0.5 — Headwall or wingwalls, square edge.

— Prefabricated end section.

0.7 — Mitered parallel to fill slope.

0.9 — Projecting.

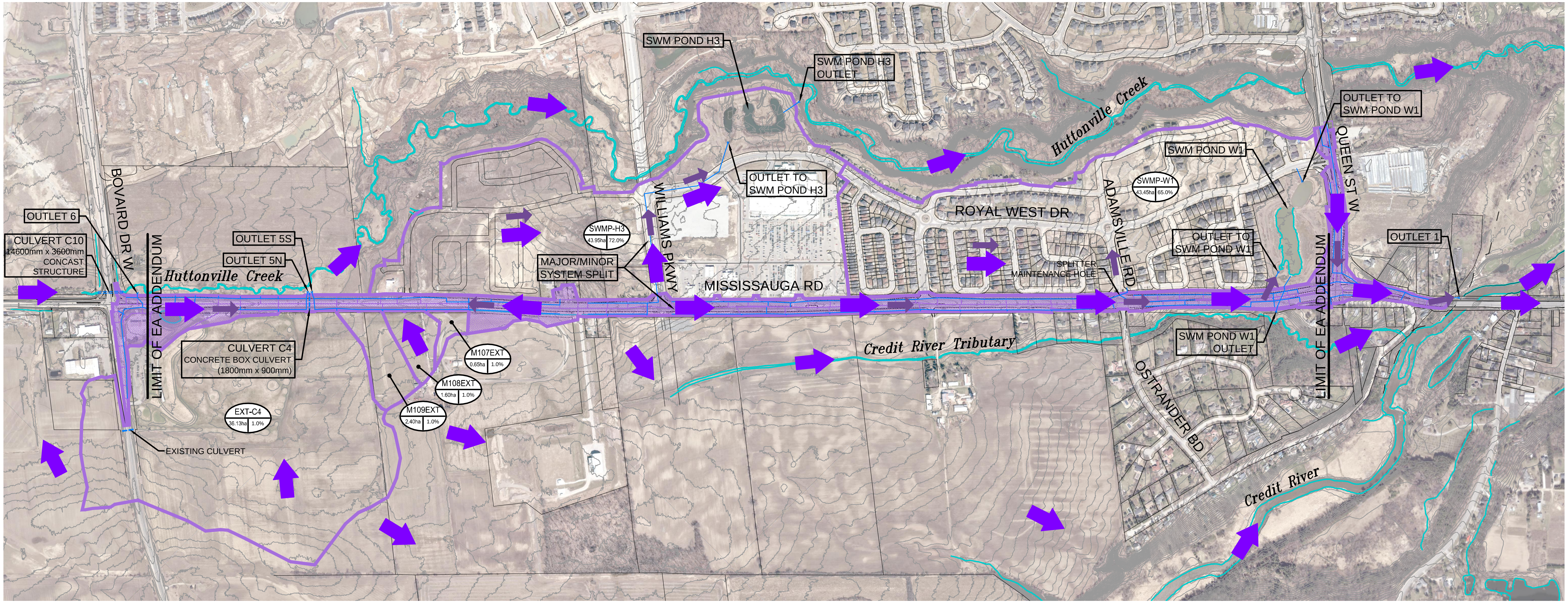
CSPA SIZES	
Nº	B(m) x D(m)
1	0.56 x 0.42
2	0.68 x 0.50
3	0.80 x 0.58
4	0.91 x 0.66
5	1.03 x 0.74
6	1.15 x 0.82
7	1.39 x 0.97
8	1.63 x 1.12
9	1.88 x 1.26
10	2.13 x 1.40

OUTLET CONTROL
CORRUGATED STEEL PIPE ARCH
FLOWING FULL
n=0.024

FHA 63 01
METRIC FHA 74 06 (51)

Appendix C

EA Addendum Drainage Figures



Path: P:\Work\TP115085\Water\dwg\2017-07\Fig3-1 Existing-Overall.dwg

Plotted By: richard.bartolo
Last Saved By: richard.bartolo

Plotted: 2017-08-14
Last Saved: 2017-08-14

LEGEND

PROPERTY BOUNDARY
WATERCOURSE
CONTOUR (1m)
EXISTING STORM SEWER
EXISTING CULVERT

SUBCATCHMENT BOUNDARY
M114 — SUBCATCHMENT ID#
0.75ha 73.4% — PERCENTAGE OF IMPERVIOUS AREA; SUBCATCHMENT AREA
MAJOR SYSTEM FLOW DIRECTION
MINOR SYSTEM FLOW DIRECTION

▨ REFER TO MISSISSAUGA ROAD DRAINAGE BOUNDARY PLANS (FIG. 3.1–3.4)

MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

OVERALL STORM
DRAINAGE BOUNDARIES
(EXISTING CONDITION)

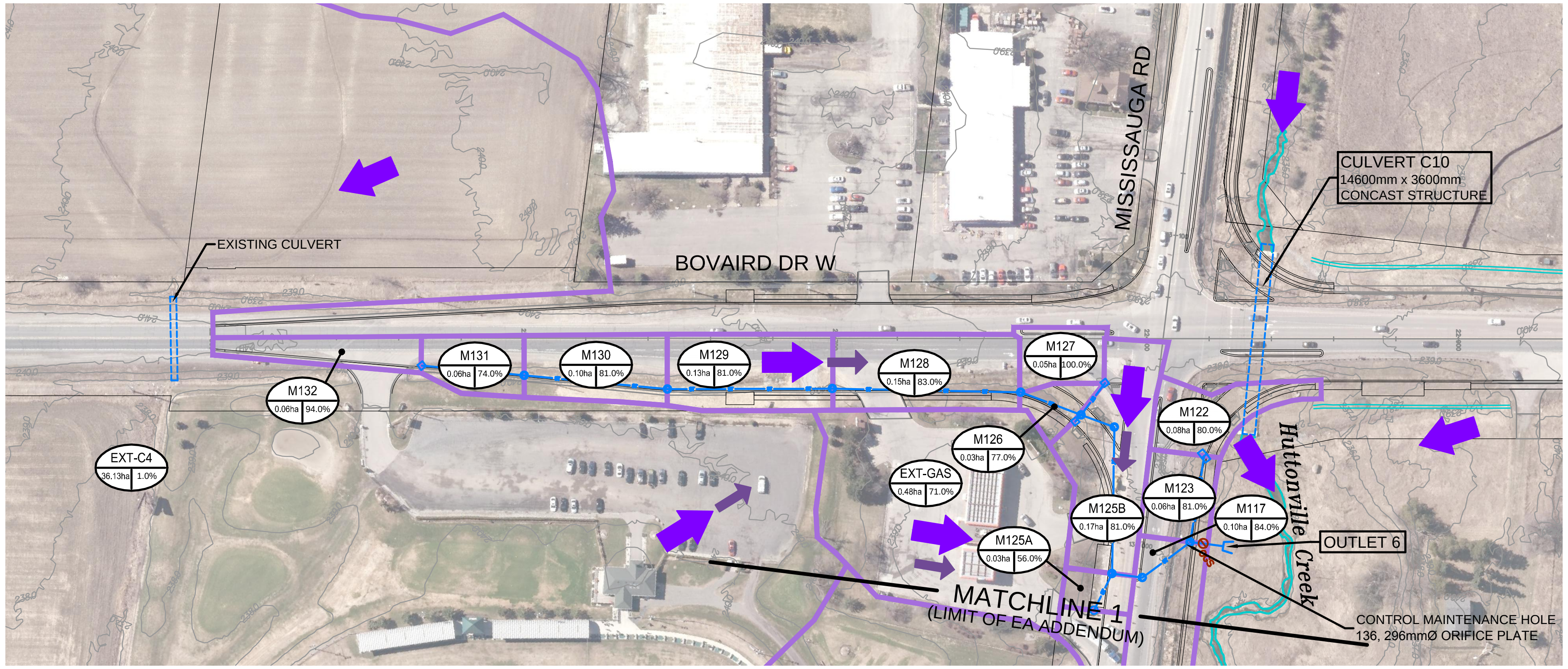
amec
foster
wheeler

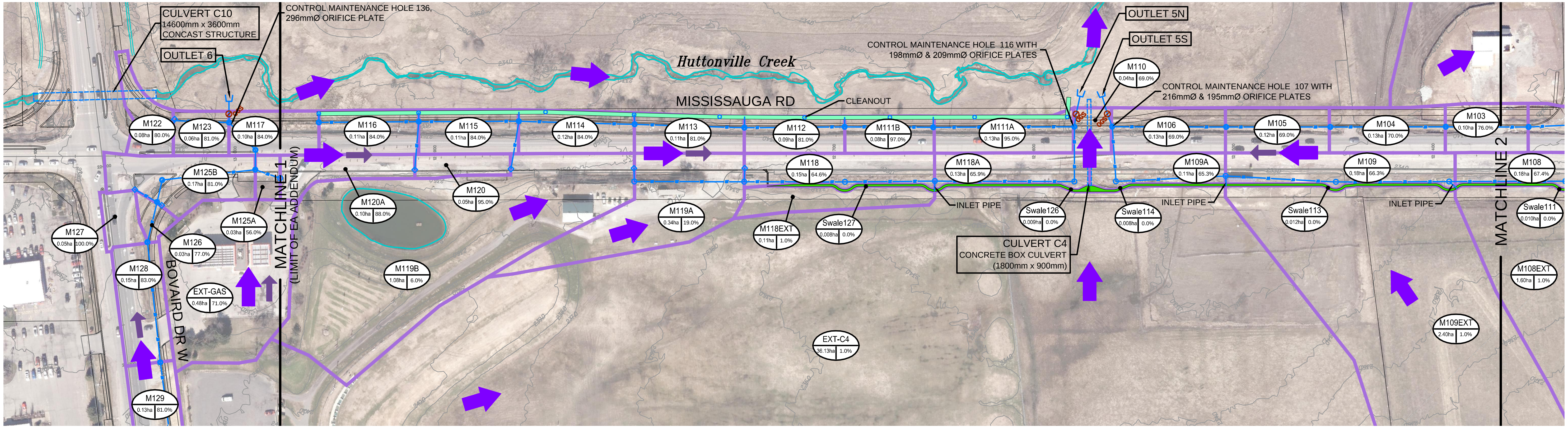
SCALE VALID ONLY FOR
24"x36" VERSION

Scale 1:5000
0 50 100 200

Consultant File No.
TP115085

Figure No.
3.1





LEGEND

—	PROPERTY BOUNDARY	▭	EXISTING CULVERT	—	SUBCATCHMENT BOUNDARY
〰	WATERCOURSE	○	EXISTING CLEANOUT	M114	SUBCATCHMENT ID#
—	CONTOUR (1m)	⊖OGS	EXISTING OIL/GRIT SEPARATOR	73.4%	PERCENTAGE OF IMPERVIOUS AREA
🟩	EXISTING INFILTRATION TRENCH	○—●—○	EXISTING STORM SEWER SYSTEM	0.75ha	SUBCATCHMENT AREA
🟩	EXISTING ENHANCED SWALE	➡	MAJOR SYSTEM FLOW DIRECTION		
🟫	EXISTING BIOSWALE	➡	MINOR SYSTEM FLOW DIRECTION		

MISSISSAUGA ROAD
EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

amec
foster
wheeler

SCALE VALID ONLY FOR
24"x36" VERSION

Scale 1:1000
0 10 20 40

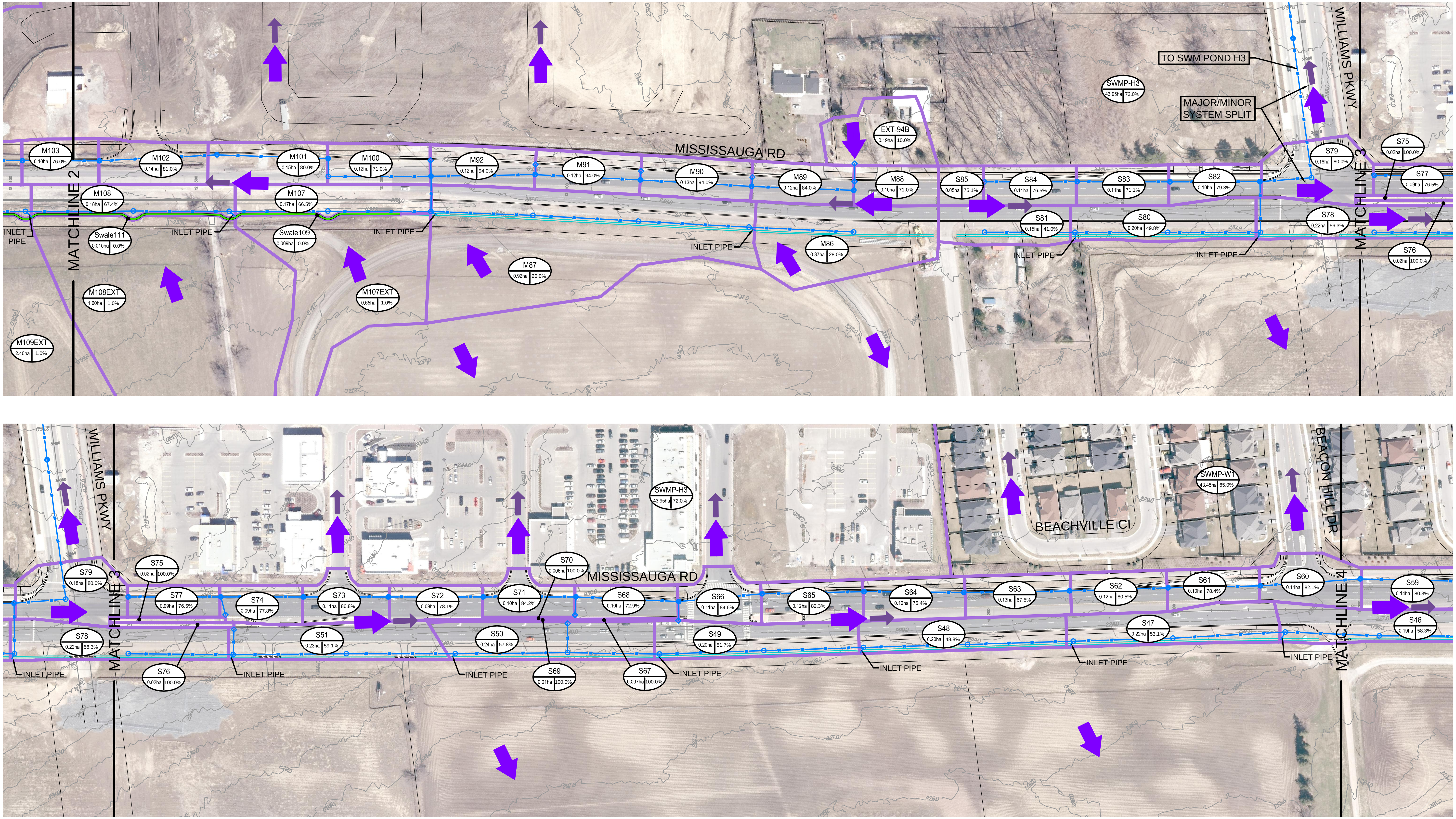
Consultant File No.
TP115085

Figure No.
3.2

Path: P:\Work\TP115085\Water\dwg\2017-07\Fig3-2_3-5 Existing-Plates.dwg

Plotted By: richard.bartolo
Last Saved By: richard.bartolo

Plotted: 2017-08-14
Last Saved: 2017-08-14



LEGEND

─	PROPERTY BOUNDARY	▭	EXISTING CULVERT	━	SUBCATCHMENT BOUNDARY
～	WATERCOURSE	○	EXISTING CLEANOUT	M114	SUBCATCHMENT ID#
─	CONTOUR (1m)	⊖OGS	EXISTING OIL/GRIT SEPARATOR	73.4%	PERCENTAGE OF IMPERVIOUS AREA
🟩	EXISTING INFILTRATION TRENCH	●─●	EXISTING STORM SEWER SYSTEM	0.75ha	SUBCATCHMENT AREA
🟩	EXISTING ENHANCED SWALE	➡	MAJOR SYSTEM FLOW DIRECTION		
🟫	EXISTING BIOSWALE	→	MINOR SYSTEM FLOW DIRECTION		

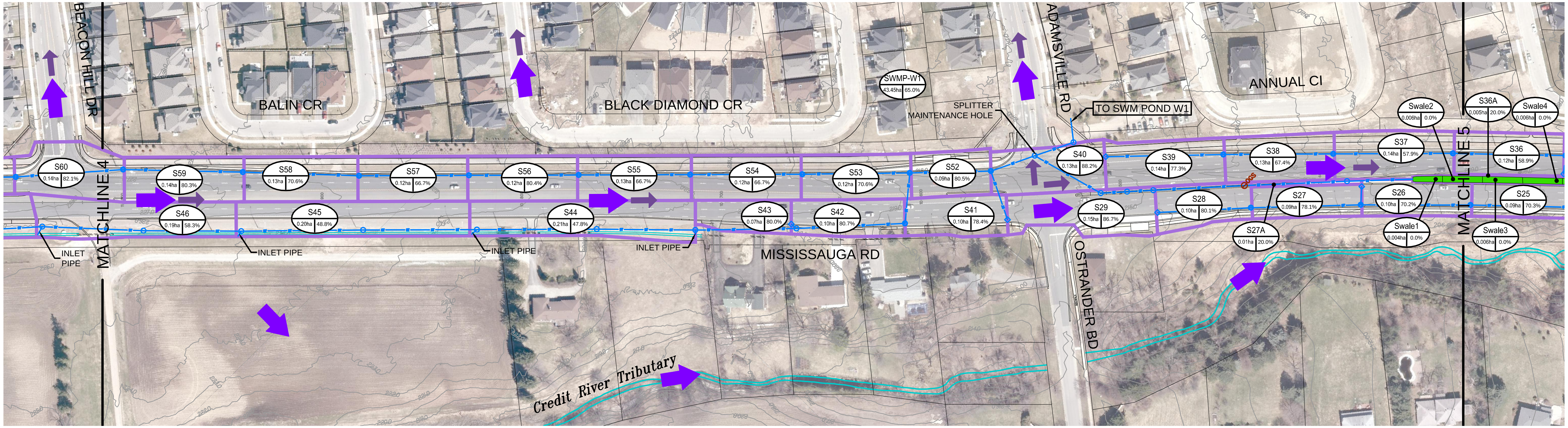
MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

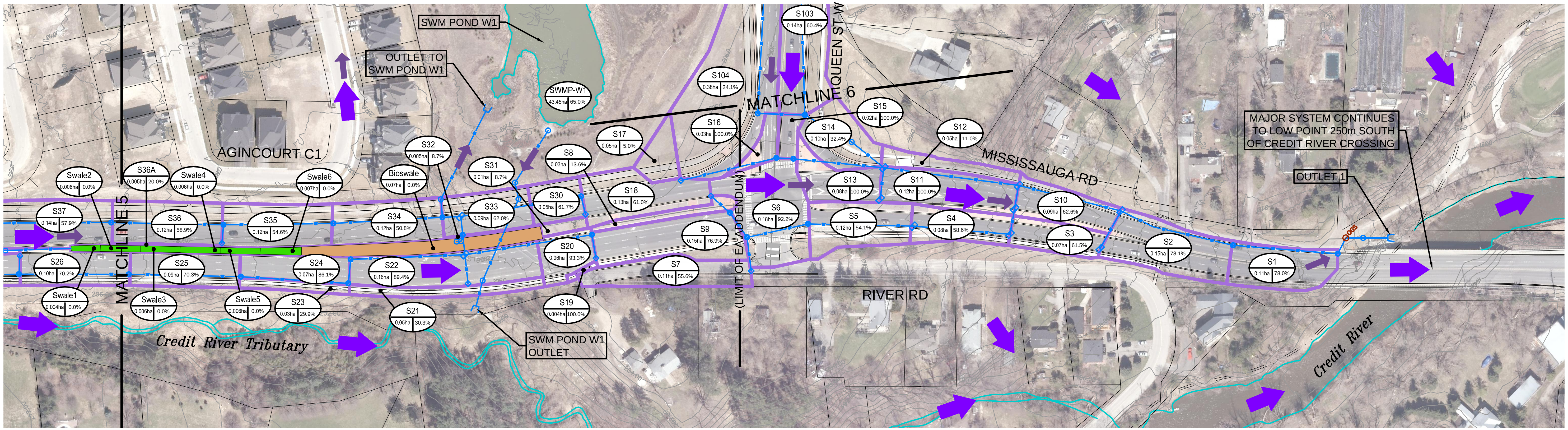
STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

amec foster wheeler

SCALE VALID ONLY FOR 24"x36" VERSION
Scale 1:1000
0 10 20 40
Consultant File No. TP115085
Figure No. 3.3

Path: P:\Work\TP115085\Water\dwg\2017-07\Fig3-2_3-5 Existing-Plates.dwg
Plotted: 2017-08-14 Plotted By: richard.bartolo
Last Saved: 2017-08-14 Last Saved By: richard.bartolo





LEGEND

—	PROPERTY BOUNDARY	┅	EXISTING CULVERT	—	SUBCATCHMENT BOUNDARY
∼	WATERCOURSE	○	EXISTING CLEANOUT	M114	SUBCATCHMENT ID#
∼	CONTOUR (1m)	⊖OGS	EXISTING OIL/GRIT SEPARATOR	73.4%	PERCENTAGE OF IMPERVIOUS AREA
🟩	EXISTING INFILTRATION TRENCH	○–●–○	EXISTING STORM SEWER SYSTEM	0.75ha	SUBCATCHMENT AREA
🟩	EXISTING ENHANCED SWALE	➡	MAJOR SYSTEM FLOW DIRECTION		
🟧	EXISTING BIOSWALE	➡	MINOR SYSTEM FLOW DIRECTION		

SCALE VALID ONLY FOR 24"x36" VERSION

MISSISSAUGA ROAD
EA ADDENDUM
REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

amec foster wheeler

Scale 1:1000
0 10 20 40

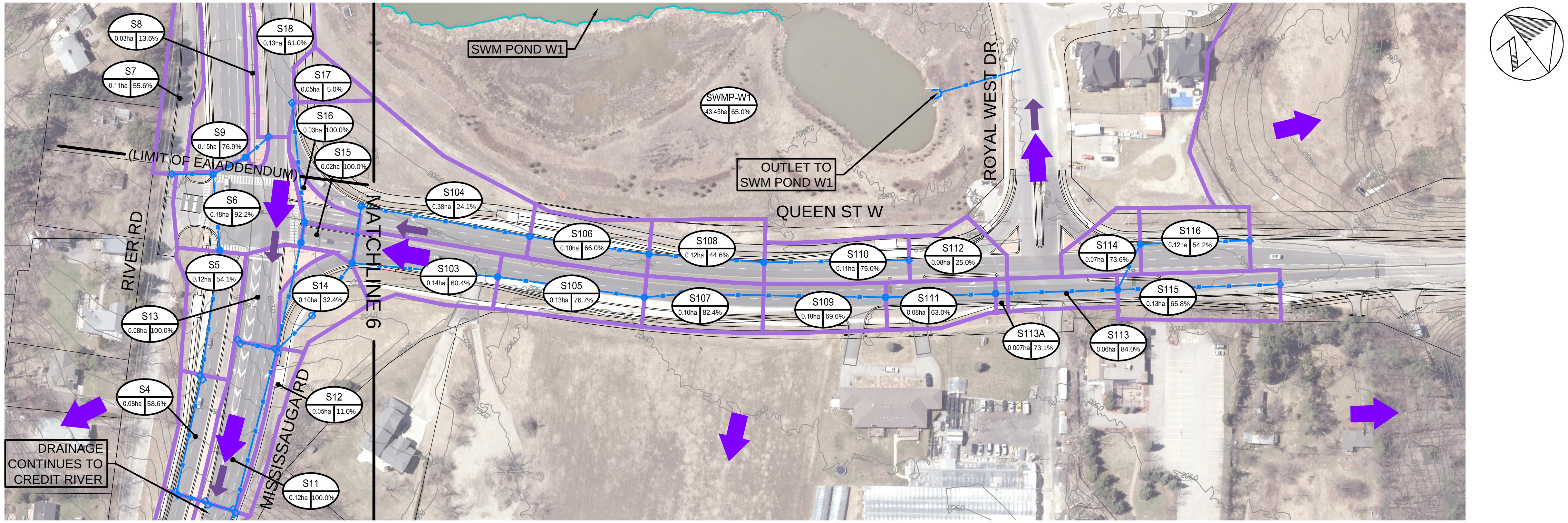
Consultant File No.
TP115085

Figure No.
3.4

Path: P:\Work\TP115085\Water\dwg\2017-07\Fig3-2_3-5 Existing-Plates.dwg

Plotted By: richard.bartolo
Last Saved By: richard.bartolo

Plotted: 2017-08-14
Last Saved: 2017-08-14



LEGEND

- PROPERTY BOUNDARY
- WATERCOURSE
- CONTOUR (1m)
- 🟩 EXISTING INFILTRATION TRENCH
- 🟩 EXISTING ENHANCED SWALE
- 🟧 EXISTING BIOSWALE
- EXISTING CULVERT
- ○ EXISTING CLEANOUT
- ⊖OGS EXISTING OIL/GRIT SEPARATOR
- EXISTING STORM SEWER SYSTEM
- ➡ MAJOR SYSTEM FLOW DIRECTION
- ➡ MINOR SYSTEM FLOW DIRECTION
- SUBCATCHMENT BOUNDARY

M114
0.75ha 73.4%

- SUBCATCHMENT ID#
- PERCENTAGE OF IMPERVIOUS AREA
- SUBCATCHMENT AREA

MISSISSAUGA ROAD
EA ADDENDUM

REGION OF PEEL

STORM DRAINAGE
BOUNDARIES
(EXISTING CONDITION)

amec
foster
wheeler

SCALE VALID ONLY FOR
24"x36" VERSION

Scale 1:1000
0 10 20 40

Consultant File No.
TP115085

Figure No.
3.5

Plotted: 2017-08-14 Plotted By: richard.bartolo
Last Saved: 2017-08-14 Last Saved By: richard.bartolo
Path: P:\Work\TP115085\Water\dwg\2017-07\Fig3-2_3-5 Existing-Plates.dwg