LAKEVIEW VILLAGE

CHANNEL DESIGN BRIEF

LAKEVIEW
COMMUNITY PARTNERS LIMITED

DECEMBER 2019

LAKEVIEW

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TACC CONSTRUCTION

Greenpark

CCI DEVELOPMENT

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Executive Summary

The subject lands are located on the former 177-acre site of the Lakeview Generating Station, a coal fired power plant that operated from 1962 to 2005. Following the closure of the plant and eventual decommissioning of the site, Ontario Power Generation (OPG) sold the lands through a competitive bidding process to the Lakeview Community Partners consortium in 2018. The purchase and sale agreement for these lands includes a provision which will ensure the conveyance of 67.1 ha of the OPG lands to the City of Mississauga. This report provides preliminary natural heritage design information in support of proposed Zoning By-Law Amendment and Draft Plan of Subdivision application for the subject lands.

This report fulfils DARC 18-20Z submission requirements and addresses City of Mississauga and Toronto Region Conservation Authority comments for the subject site. The channel design presented in this report has been developed in conjunction with the greater consulting team and should be considered in conjunction with their work.

The proposed Lakeview Village development will incorporate open space and channel features that will help the City of Mississauga and Credit Valley Conservation achieve their goal of creating a sustainable community and rehabilitated corridor connection to the waterfront.

The legal description of the site is Part of Lots 7, 8 and 9, Concession 3, south of Dundas Street in front of Lot 7 (Geographic Township of Toronto, County of Peel), City of Mississauga, Regional Municipality of Peel.

The Lakeview Village Development Master Plan (2018) identified several open space elements within the development which are to define Lakeview Village community. One of these elements is Serson Creek channel and the creation of a corridor that identifies, protects, restores and enhances the diversity and connectivity of natural areas and features.

1 Introduction

1.1 SERSON CREEK

The Lakeview Village Development Master Plan (2018) identified several open space elements within the development which are to define Lakeview Village community. One of these elements is Serson Creek channel and the creation of a Natural Heritage System (NHS) that identifies, protects, restores and enhances the diversity and connectivity of natural areas and features.

Serson Creek is a highly engineered / historically realigned channel within the Lakeview Village lands. The corridor is currently highly altered and impaired. The frequent flows in Serson Creek are currently diverted into a pipe north of the G.E. Booth Wastewater Treatment Plant (WWTP), which conveys flows to the lake at the southeast side of the WWTP. Downstream of the diversion, a straight stormwater channel is situated at the east limit of the Lakeview Village lands, adjacent to the WWTP. This channel conveys less frequent flood flows in Serson Creek directly to the lake. Given this configuration, fish are unable to migrate from Lake Ontario to Serson Creek as there is a physical separation in elevations downstream of the flow diversion. The current configuration of the creek is constrained in terms of conveyance capacity, which results in localized flooding on to the Lakeview Village lands, the Plaster Form Inc. lands (east of the creek, south of Lakeshore Road), and the WWTP (Region of Peel property).

A key element of the Serson Creek restoration is the realignment / redirection of the low flow channel from the current diverted alignment to the perched section of Serson Creek along the east limit of the Lakeview Village lands. The proposed realignment was recommended in the Lakeview Waterfront Connection Environmental Assessment (2014) as well as the recent CVC Living By the Lake Action Plan (2018). The ongoing WWTP upgrades also assume that the diversion will be completed.

1.2 REHABILITATION

Rehabilitation of Serson Creek downstream of the current flow diversion was identified as an objective through the City's master planning studies for the former Generating Station land as part of Inspiration Lakeview. Rehabilitation plans for this section of Serson Creek were subsequently developed by TRCA through the Lakeview Waterfront Connection project. While these rehabilitation plans have been approved by the responsible authorities and agencies, these plans do not give adequate consideration to future land uses being proposed for Lakeview Village.

As most of the Serson Creek corridor overlaps with the LCPL property, it is now necessary to review the plans within the context of the future redevelopment proposal to ensure that there is appropriate integration with the future uses. For this reason, the Lakeview Village consulting team has been working with the City, CVC and partner agencies to further refine the design for the rehabilitation of Serson Creek in a manner that meets the original environmental design objectives but also achieves better integration with the proposed redevelopment plan for Lakeview Village, while also accommodating the Region's requirements related to proposed upgrades to the WWTP .

1.3 SUPPORTING STUDIES

The servicing and development strategies presented in this report have been developed in conjunction with the greater consulting team and should be considered in conjunction with their work. The following studies are referenced in the appendices:

- Geotechnical Slope Stability Assessment - DS Consulting (July 2019)
- Shoreline Hazard Assessment - Baird (December 2018)
- Arborist Report - Beacon Environmental (February 2019)
- Environmental Impact Study - Beacon Environmental (August 2019)
- Lakeview Waterfront Connection - TRCA / GHD (December 2015)
- CVC Living by the Lake Action Plan - CVC (December 2018)
- Serson Creek Geomorphic Assessment and Rehabilitation Design – Beacon Environmental Limited (October 2019)

1.4 OBJECTIVES

The Living By the Lake study concisely summarized the key objectives and recommendations for Serson Creek between Lakeshore Road East and Lake Ontario. These objectives, and the means in which they are satisfied by the NHS design will be referenced in the relevant report sections:

R1-1 (Manage Stormwater Quantity)
Reduce flooding of structures in Serson Creek through improved flow conveyance and other methods (e.g., improve stormwater management, remove structures, etc.).
R1-5 (Improve Habitat Quality)
Improve instream and riparian habitat in Serson Creek by increasing diversity of structures and bed form through the Jim Tovey Lakeview Conservation Area and Lakeview Village initiatives.
R1-7 (Improve Habitat Quality)
Increase cover of wetlands in the coastal reach through Jim Tovey Lakeview Conservation Area. Channel works associated with land redevelopment should consider pocket wetlands within the creek corridor. Wet meadow should be considered in the hydro corridor associated with Serson Creek, as feasible.
R1-10 (Connect Habitat)
Maintain existing terrestrial connectivity between Serson Creek, G.E Booth woodland, Applewood Creek, and Marie Curtis Park.
R1-12 (Connect Habitat)
Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

Additional objectives established in the Lakeview Village DMP and Lakeview Waterfront Connection EA include:

- Elimination of the flow diversion towards the WWTP
- Restore channel to historical alignment, where feasible.
- Creation of pedestrian / cycling links between the lake and Lakeshore Road East

The objective of the proposed channel / NHS restoration described in the aforementioned studies and in this functional design brief is to achieve functional improvements over the existing system and to link existing fragmented natural features to create a strengthened, connected system extending to the future Jim Tovey Lakeview Conservation Area and Lake Ontario.


LAKEVIEW COFFEE

EXISTING CONDITIONS

EXISTING CONDITIONS

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2.1 EXISTING DRAINAGE

Serson Creek drains a 270 ha area comprised mainly of urbanized lands. South of Lakeshore Road East, Serson Creek flows through an open channel to the former rail line. Flows are then split. Baseflow is directed easterly through a wooded area and piped south underneath the G.E. Booth Waste Water Treatment Plan (WWTP) to Lake Ontario. Flood flows are directed south through an open constructed ditch along the easterly boundary of the LCPL property which outlets to Lake Ontario. This flow diversion impairs ecological functions within the westerly flood conveyance channel and represents a barrier to upstream fish migration from the Lake. The westerly flood conveyance channel is protected along the bed and banks with cobble and rip-rap. Serson Creek is characterized as an urbanized creek that responds rapidly to rainfall events and receives minimal sediment supply from the upstream drainage area. Downstream of Lakeshore Road East, the creek conditions were considered depositional due to backwater effects from Lake Ontario and shallow channel gradients.

2.2 REACH DELINEATION

Reach S1, at the downstream end of the existing corridor is located between the WWTP property line / fence and Lake Ontario. This reach consists of the portion of creek influenced by lake levels. The reach is confined and has been heavily modified. The corridor is trapezoidal in shape with no defined banks; however, corridor widths range between 10-12 m. A rapid assessment was not completed on this reach due to the lack of a defined channel.

Reach S2, the primary focus of this rehabilitation design is a stormwater conveyance corridor and is characterized as 'in-transition' or 'stressed' using RGA. The RSAT classified this reach as having 'fair' overall ecological health owing to poor riparian habitat conditions. Bankfull widths and depths ranged between 2.5-3.0 m, and 0.40-0.60 m, respectively.

Reach S3 was characterized as 'in adjustment' based on the RGA and was classified as 'fair' under the RSAT due to evidence of channel/scouring and sediment deposition. Bankfull widths and depths for Reach S3 ranged between 2.8-3.2 m and 0.50-0.70 m, respectively. Reach S3a was the section of channel from the Lakeshore Road East culvert to the WWTP property fence at Reach S3. This reach was unconfined and was characterized through the RGA as 'in regime' and through the RSAT as having a 'fair' degree of ecological health. Bankfull widths and depths ranged between 1.1-1.5 m and 0.20-0.30 m. Reach S3b, located downstream of S3a, was heavily influenced by the backwater effect of the undersized culvert opening north of the WWTP. RGA and RSAT were not completed for this reach. Please refer to Appendix A for further details.

2.3 EROSION HAZARD ASSESSMENT

The Serson Creek Geomorphic Assessment and Rehabilitation Design report (Beacon, Appendix A) includes an analysis of erosion hazard limits for Serson Creek on the subject property. The hazard lands associated with a river or stream system are considered a confined valley system or an unconfined valley system (Technical Guide - Rivers and Streams: Erosion Hazard Limit, MNR 2002). A confined valley system is one with visible physical valley slopes discernible from the surrounding landscape (MNR 2002). An unconfined valley system is a system where the valley contains a river or stream but there are no valley slopes discernible from the surrounding landscape (MNR 2002). The erosion hazard limits depend on the type of valley system through which the river or stream flows.

Based on the findings of the field investigations, the existing Reach S3 of Serson Creek was characterized as partially confined. The left bank (looking downstream) is unconfined and the right bank is confined. The long-term stable top of slope was identified by DS Consultants Ltd. (2019) for the right bank of the valley slope, which limits the erosion hazard for the west side of Reach 3. The meander belt width estimated by Beacon (23m) applies to the left / east side of Reach 3.

For the purposes of determining the erosion hazard limit for confined reaches within the subject property (i.e., those reaches where lateral migration is limited by the presence of valley walls), determination of a toe erosion allowance and a stable slope allowance is required. According to the MNR Technical Guidelines (2002), erosion hazard limits require the inclusion of a toe erosion allowance for areas where the watercourse is within 15 m of the valley toe of slope. Based on the findings of the field evaluation, Reach S2 and portions of Reach S3 of Serson Creek were determined to be in proximity to the valley wall. A toe erosion slope of 8m is recommended for both Reach S2 and the confined portions of Reach 3 based on the Technical Guidelines (MNR 2002; CVC 2014). Note that a toe erosion allowance adjacent to the WWTP has not been recommended as it is beyond the scope of this investigation. The recommended toe erosion allowance of 8m has been incorporated into the slope stability assessment for the confined valley slopes. Refer to Appendix A for details regarding the erosion hazard assessment. Please refer to Appendix A for further details.

2.4 SLOPE STABILITY

DS Consultants Ltd. (DS) was retained by Lakeview Community Partners Limited to undertake a geotechnical slope stability assessment for the Serson Creek bank slopes for the proposed Lakeview Village development at 800 Hydro Road in Mississauga, Ontario. The purpose of this study was to assess the stability of the existing west bank slope of Serson Creek and determine the location of the long-term stable top of slope (LTSTOS) line.

Nine boreholes were drilled near the creek area. The borehole location plan and relevant borehole logs are attached in Appendix A. The subsurface information in these boreholes are used in this slope stability study. Fill materials to variable depths were encountered in all boreholes, consisting of clayey silt, silty clay, sandy silt to sand. The fill was in a loose to compact state, with measured SPT 'N' values ranging from 4 to over 15 blows per 300 mm penetration. This fill layer is associated with the haul road that was built on native material adjacent to the channel. The native soils beneath the haul road consisted of cohesive deposits of clayey silt to silty clay (till) and cohesionless deposits of silt, sandy silt to sand. Shale bedrock in the boreholes was at depths ranging from 3.1 m to more than 20 m. Groundwater in the boreholes was within 6 m below the surface.

The existing slopes were observed to be generally well covered with mature trees and vegetation. No evidence of slope failure was observed along the creek. The 8m long-term toe erosion allowance from the Beacon erosion hazard findings were used to assess the long term stable slopes under existing and proposed conditions. Under existing conditions, the channel slopes steeper than 2.5:1 were considered unstable. Similarly, the proposed slopes have long-term stability at 2.5:1 or less. The long-term stable top of slope limit is illustrated on Drawing A and Figure 1 in the DS Consultants Ltd. report (Appendix B).

2.5 ECOLOGICAL CONDITIONS

The EIS prepared for the subject lands Beacon, 2019) characterized the existing environmental conditions on site including the existing Serson Creek Corridor. Under existing conditions, it was concluded that the Lakeview Village lands do not support any natural heritage features that may have originally occurred on the site. Existing Floodplain Mapping of the Serson Creek Corridor is included in Drawing FP-1.

With respect to aquatic habitat, Serson Creek itself is mainly composed of fine sediment such as silt, sand, and fine gravel. Benthic invertebrate sampling in 2011 indicated water quality was reflective of poor to fairly poor water quality with significant organic pollution (SENES 2014). Water quality in Serson Creek is described as impaired with high nutrient loads that have resulted in large algal blooms (CVC 2014). A water quality analysis was completed as part of the Lakeview Waterfront Connection EA. The results identified that Serson Creek exceeded the Provincial Water Quality Objectives PWQO for Total Phosphorus and E.Coli.

Beacon obtained CVC fish collection records for Serson Creek within the vicinity of the Study Area. The data contains fish sampling records from over a period beginning in 1992 through to 2017. Sampling attempts were made at two sites within Serson Creek. Serson Creek; however no fish species were captured. Serson Creek provides low quality fish habitat mainly due to the enclosure of the low flow channel and blockage of the high flow channel.

Based on existing habitat conditions, the only potion of the study area that supports natural features that could support habitat for endangered or threatened species is the forest community associated with the G.E. Booth Wastewater Treatment Facility (ELC Unit 9a and 9b). This area likely supports habitat for endangered bats. This feature corresponds a Fresh to Moist Lowland Ash Deciduous Forest. It is located on the adjacent G.E. Booth Wastewater Treatment Facility property. The feature is approximately 2.5 ha in area and satisfies the cover and density requirements of a woodland. As ELC Units 9a and 9b are greater than 0.5 hectares and are located within 30 m of a watercourse (Serson Creek), they meets the criteria of a Significant Woodland under MOP policy 6.3.12f.

Serson Creek, located on the western edge of the woodlot, provides some localized linkage functions by connecting natural area LV2 to the lake. Connectivity of the subject property to upstream areas of Serson Creek is largely precluded Lakeshore Road East which acts as a barrier. Currently, there is a large wetland at the mouth of this creek as part of the LWC project. It is also proposed that much of Serson Creek be re-configured and naturalized. It is anticipated that these efforts will enhance the linkage functions as well as improve fish and wildlife habitat along the creek.

AQUATIC AND TERRESTRIAL HABITAT

The existing Lakeshore Road East culvert crossing is approximately 27.5m long and has a conveyance area approximately 8.1m wide by 1.25m high (1.45m above the invert of the channel). The headwall structure includes two storm sewer outlets for Lakeshore Road. The crossing has a natural bottom and wingwalls. The culvert slope is approximately 0.55%.

Currently, Serson Creek is a “disconnected” system with approximately 60% of the channel “offline” in that it does not receive frequent flows. The following table summarizes the “online” and “offline components of the existing system as well as the existing channel lengths through each property. The area noted on the table corresponds to the approximate vegetated corridor width measured from the apparent top of channel banks / “valley” where applicable.

Existing	Online Channel Area and Length	Offline Channel Area and Length	Total Channel Area and Length
Lakeview Village	0.20 ha / 250 m	0.72 ha / 520 m	0.90 ha / 770 m
Plaster Form Inc.	0.17 ha / 158 m	-	0.17 ha / 158 m
WWTP	-	-	-
Total	0.37 ha / 408 m	0.72 ha / 520 m	1.07 ha / 928 m

2.6 CHANNEL HYDRAULICS

Appendix C describes the hydraulic modelling completed as part of the evaluation of the existing corridor as well as the proposed corridor design. This memo summarizes the following:

- Existing Flood Mapping
- Proposed Flood Mapping
- Interim Flood Mapping
- Riparian Storage Analysis (Existing vs. Proposed)
- Culvert sizing
- Channel velocities
- Flood Depth Analysis

REQUIREMENT	DELIVERABLE	IMPACT
Existing Flood Mapping	Drawing FP-1: Delineation of Existing Flood Hazard	Does not affect proposed NHS design but included for comparison purposes.
Proposed Flood Mapping	Drawing FP-3: Delineation of Proposed / Ultimate Flood Hazard for establishing development limits.	Required to demonstrate that the channel block is sufficiently sized for conveyance
Interim Flood Mapping	Drawing FP-2: Delineation of Interim Flood Hazard for establishing development limits if channel is partially completed.	Required to demonstrate that the proposed modifications in Phase 1 do not negatively impact existing lands upstream.
Riparian Storage Analysis (Existing vs. Proposed)	Summarize existing riparian storage volume targets for range of return period events and the Regional Storm; Ensure riparian storage in the interim and ultimate channel corridors matches or exceeds existing riparian storage;	Not required for this reach of Serson Creek – there are no lands downstream of this reach as it discharges to the Lake and flooding is not a concern.
Culvert sizing	Guide culvert sizing for the future road crossing at Remembrance Road (to be refined during Stage 2 detailed channel design);	Required to demonstrate that the preliminary culvert size for the New Haig / Street "I" crossings is sufficiently sized for conveyance
Channel velocities	Establish channel velocities	Required at detailed design for input into the fluvial geomorphological analysis / low flow channel design.

MODEL METHODOLOGY

To achieve the modelling objectives described in the preceding section, the U.S. Army Corps of Engineers' River Analysis System (HEC-RAS) was utilized. HEC-RAS is designed to perform one-dimensional steady and unsteady flow river hydraulics calculations, sediment transport-mobile bed modelling, and water temperature analysis. The HEC-RAS software supersedes the HEC-2 river hydraulics package.

The modelling system calculates water surface profiles for steady gradually varied flow. The system can handle a full network of channels, a dendritic system, or a single river reach. The steady flow component is capable of modelling subcritical, supercritical, and mixed flow regime water surface profiles.

The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation is utilized in situations where the water surface profile is rapidly varied. These situations include mixed flow regime calculations (i.e., hydraulic jumps), hydraulics of bridges, and evaluating profiles at river confluences (stream junctions).

This model has the ability to consider the effects of various obstructions, such as bridges, culverts, dams, weirs, and other structures in the floodplain on water levels. The steady flow system is designed for application in floodplain management, estimation of floodplain storage, and for assessing the change in water surface profiles due to channel modifications.

The model requires the following input:

- channel geometry (low flow centerline profile and cross-sections; culvert crossing details);
- Manning's roughness for main channel and overbank areas;
- cumulative flow; and,
- downstream boundary conditions.

2 EXISTING CONDITIONS

EXISTING CONDITION MODELLING

The updated existing condition model was obtained from CVC staff in May 2019 and updated to reflect current site conditions / improved topographic mapping. The Manning's roughness for the existing channel (main channel and overbank areas) varied considerably in the CVC model; this was updated to conservative values of 0.035 for the main channel and 0.080 for the overbank areas. Buildings within the floodplain were modeled as blocked obstructions.

Contraction and expansion coefficients were set to 0.3 and 0.5, respectively, for smooth transitions between cross-sections. At abrupt transitions (upstream and downstream of culverts, bends in channel direction, and wetlands), the contraction and expansion coefficients were increased to 0.3 and 0.5, respectively. The downstream water level boundary condition used in the CVC model was 74.8m.

The channel geometry was based on the CVC cross-section data, augmented with additional topographic mapping data. The existing design flows in the HEC-RAS model provided by CVC are included in Appendix C.

As shown in the existing flood mapping Drawings FP-1A and FP-1B, the current Serson Creek configuration results in overtopping of the channel banks and flooding within the Lakeview Village, Plaster Form Inc., and WWTP (Region of Peel) lands. The following table indicates the approximate area of flooding on each property:

Existing	Floodplain area
Lakeview Village	1.29 ha
Plaster Form Inc.	1.06 ha
WWTP	1.42 ha + SPILL
Total	3.77 ha + SPILL

CORRIDOR DESIGN

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CORRIDOR DESIGN

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3.1 PROPOSED NATURAL HERITAGE SYSTEM CONCEPT

The proceding sections illustrate how the key objectives for the Serson Creek rehabilitation can be achieved.

The realignment of Serson Creek will be completed in two phases:

Phase 1 - downstream from the flow diversion pipe to the Jim Tovey Lakeview Conservation Area, and
Phase 2 - upstream from the flow diversion pipe to Lakeshore Road East.

The second phase will be designed as part of a future project, dependent on participating owners / property limits, and will incorporate aquatic and wildlife passage details for the proposed new Haig Boulevard extension culvert crossing.

The primary objective for the corridor design in Phase 1 is to rehabilitate and enhance the Serson Creek corridor to accommodate redirected low flows away from the WWTP while improving flood conveyance, terrestrial and aquatic habitat quality and connectivity to the Jim Tovey Lakeview Conservation Area. The following sections provide an overview of the proposed corridor hydraulics, low flow channel design considerations, bioengineering elements, and enhancement details. The design incorporates CVC Living by the Lake Action Plan (2018) objectives and recommendations for Serson Creek including stormwater management, habitat quality improvement and connectivity objectives. The overall corridor design is being completed by the LCPL consultant team.

There is an overall net gain in "online" corridor length and area and a net reduction in total floodplain area, which benefits not only the Lakeview Village lands but also the adjacent properti es (Plaster Form Inc. and the Region of Peel's WWTP). The following table compares the existing and proposed Serson Creek system and demonstrates the net gain achievable.

Existing	Online Area and Length	Offline Area and Length	Total Corridor Area and Length	Floodplain Area
Lakeview Village	0.20 ha / 250 m	0.72 ha / 530 m	0.90 ha / 780 m	1.29 ha
Plaster Form Inc.	0.17 ha / 158 m	-	0.17 ha / 158 m	1.06 ha
WWTP	-	-	-	1.42 ha & SPILL
Total	0.37 ha / 408 m	0.72 ha / 530 m	1.07 ha / 938 m	3.77 ha & SPILL
Proposed	**Online NHS Area and Length**	**Offline NHS area and Length**	**Total Corridor area and Length**	**Floodplain area**
Lakeview	1.17 ha / 742 m	-	1.17 ha / 742 m	1.17 ha
Plaster Form Inc.	1.00 ha / 400 m	-	1.00 ha / 400 m	1.00 ha
WWTP	-	-	-	-
Total	2.39 ha / 1142 m		2.39 ha / 1142 m	2.17 ha
Change	**Online NHS Area and Length**	**Offline NHS area and Length**	**Total Corridor area and Length**	**Floodplain area**
Lakeview	+0.97 ha / +492 m	-0.72 ha / -530 m	+0.27 ha / -38 m	-0.12 ha
Plaster Form Inc.	+0.83 ha / +242 m	-	+0.83 ha / +242 m	-0.06 ha
WWTP	-	-	-	-1.42 ha & NO SPILL

3. 2 NATURAL CHANNEL DESIGN

The following section provides an overview and supporting technical analysis for proposed corridor and channel design elements.

The proposed stream corridor design provides an opportunity to restore a more natural planform to Serson Creek. The corridor design is being completed by Urbantech and was sized primarily for flood storage and conveyance. Note that the proposed corridor dimension is limited by proposed future redevelopment, integration with the future land uses, and the limits of the WWTP. As a result of the land use constraints, flood modelling, and slope design, the proposed corridor floor ranges from 11 to 15 m in width. From a geomorphic perspective, if the corridor floor (i.e., lower floodplain) is not sufficiently wide to accommodate long-term natural migration tendencies of the channel (i.e., meander belt width), additional design features should be included to mitigate potential erosion impacts.

Dimensions for the riffles and pools were governed by the bankfull design discharge. Determination of the design discharge for the proposed channel design utilized the available peak flow information from CVC, as well as a field-based approach which utilizes information from the detailed assessment.

Bankfull flows for watercourses in Southern Ontario are typically between the 1 and 2-year return period. However, when peak flows are considered, it appears that the governing bankfull discharge is much lower than the 2-year flow. The estimated bankfull discharge was similar to the bankfull discharge of 1.40 m3/s estimated as part of the EA (Parish Geomorphic, 2014).

The proposed channel design incorporates riffle and pool geometry as shown on Drawings CH-1 to CH-3 and Table 8 in Appendix A.

The sizing of substrate materials was guided by a review of hydraulic conditions (i.e., tractive force, flow competency) within the typical channel cross-sections based on permissible velocities (Komar, 1987; Fischenich, 2001). Substrate sizing varies within the proposed upstream portion of the channel and the steeper downstream portion.

Channel stability for grade control is critical, and therefore a factor of safety was incorporated into the material stone sizing at the crest.

To mitigate erosion potential, vegetated rock buttresses have been proposed along the entire toe of slope for the corridor and most of the banks on the outside of meanders. Where adequate distance from slopes allowed, the remaining banks will be designed with woody debris bank treatments. A range of stone size of 300 mm to 500 mm will be used along the toe of slope and the outside banks. Given the hydraulic conditions within the corridor, any deflection or diversion of flows towards the toe of slope due to debris jams or other obstructions could result in higher velocities than the estimated overbank velocity. The factor of safety also takes into account other variables which could influence entrainment such as stone spacing, shape and ice plucking or abrasion.

3.3 CHANNEL HYDRAULICS

ULTIMATE CONDITIONS

Under ultimate conditions, the existing flow diversion to the WWTP will be eliminated, and the channel will be partially realiged south of Lakeshore Road East in an effort to return the NHS to it's original alignment and provide a connection to the G.E. Booth Woodland.

The ultimate flows in the channel are assumed to be equivalent to the existing flows in the May 2019 CVC model. The 100-year peak flow was used for hazard mapping.

The proposed Manning's roughness and other hydraulic loss parameters were identical to the existing model as it is assumed that the channel will be similarly vegetated in the future.

It was assumed that the channel invert elevations will remain relatively similar to existing conditions, since the channel grades are fixed at Lakeshore Road and at the Jim Tovey Lakeview Conservation Area / Lake Ontario. A trapezoidal channel geometry was established to convey the peak flows without overtopping the channel banks. The model was iterated with a range of bottom widths and depths to optimize the flow conveyance. The resulting channel sections capable of conveying the peak flow are described below:

The resulting floodplain can be fully contained in the proposed channel sections as shown on Drawing FP-2A (interim conditions / Phase 1) and Drawing FP-3A (ultimate conditions / Phase 2), and significant floodplain reductions can be realized as illustrated in the following table. Note that the ultimate floodplain area increases on the Plaster Form Inc. lands due to the proposed ultimate alignment. However, the total floodplain area is less than the existing floodplain area on this property and the resulting tableland area is more efficient for development.

Floodplain Area	Existing (Drawing FPA-1)	Ultimate (Drawing FPA-3)
Lakeview	1.29 ha	1.17 ha
Plaster Form Inc.	1.06 ha	1.00 ha
WWTP	1.42 ha + Spill	-
Total	3.77 ha + Spill	2.17 ha

Objective achieved: R1-1 (Manage Stormwater Quantity) - Reduce flooding of structures in Serson Creek through improved flow conveyance and other methods (e.g., improve stormwater management, remove structures, etc.).

3.4 CROSSINGS

The existing Lakeshore Road East culvert crossing is approximately 27.5m long and has a conveyance area approximately 8.1m wide by 1.25m high (1.45m above the invert of the channel). The headwall structure includes two storm sewer outlets for Lakeshore Road. The crossing has a natural bottom and wingwalls. The culvert slope is approximately 0.55%.

The proposed Draft Plan indicates a crossing of the Serson Creek corridor with future New Haig Road / Street "I". This culvert is situated less than 200m downstream of the Lakeshore Road crossing, therefore as a preliminary estimate, the proposed culvert will be identical in size / height to the culvert at Lakeshore Road East. This culvert is proposed to be an open span crossing to allow for a naturalized channel bottom to promote fish movement through the crossing. A dry "shelf" will be implemented above the low flow channel within the crossing to encourage wildlife passage.

Objectives achieved: R1-12 (Connect Habitat) – Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

3.4 BIOENGINEERING TREATMENTS AND HABITAT FEATURES

The proposed design will enhance the quality and function of existing aquatic habitat conditions, removal of barriers to fish passage, formalization of the low flow and bankfull channel, creation of pool-riffle sequences, introduction of in-stream habitat features, and redirection of base flow down the corridor and increased connectivity to the lake.

The proposed design will enhance the quality and functions of riparian and terrestrial habitat types by introducing a greater diversity of habitat types and micro-habitat features for local wildlife. All created habitat will be vegetated with native species found in the watershed. The riparian and floodplain zones will planted with lowland and wetland species, while the valley slopes will be planted with native upland species.

Vegetated rock buttresses will be installed along the entire toe of slope for the corridor, as well as, most outside meander banks. A vegetated rock buttress consists of the installation of a combination of rocks, vegetation and plantings to provide bank protection and promote flow training and deflection. The stone provides harder bioengineered protection, but also provides roughness to reduce the flow velocity, and morphological variability as plantings establish. The vegetation will also provide additional stability and enhance aquatic habitat by providing shade and overhanging vegetation.

Woody debris bank treatment will be installed on the remaining banks not designed with vegetated rock buttress. The woody debris bank treatment consists of the root fan or ball, and a portion of the tree trunk. They are typically installed at the toe of the channel bank and integrated with plantings. The bank is backfilled with stone to provide further bank protection and stability. This treatment acts to deflect erosive flows away from the channel bank while providing aquatic habitat. Scour may be enhanced at the base of the woody debris to provide additional habitat benefit. Woody debris also acts to collect sediment and debris, further protecting the channel bank from erosion.

Offline wetland features will be installed in the lower reach on the floodplain next to the channel to provide greater variety in terrestrial habitat and a more natural floodplain form. These features will also provide a short-term water retention function as well as a sediment bank within the floodplain. The irregular form provides an increased perimeter for a given area and thus extensive transition zones between aquatic and terrestrial habitats.

Woody debris features are provided to create micro-habitat features for wildlife and greater variety in terrestrial habitat within the floodplain. The features are located sporadically along the floodplain and will consist of mounds of locally-sourced stable interconnected wood debris.

To improve the quality and function of the riparian habitats, the riparian zone will be planted with a diverse mix of native shrubs and groundcovers using nursery stock and terraseeding. The densities of the proposed plantings in the bioengineered treatments will provide for additional stability. Further information regarding habitat features is provided in Appendix A.

AQUATIC AND TERRESTRIAL HABITAT

The proposed ecological rehabilitation of Serson Creek will benefit from the removal of the diversion, as well as debris and seasonal barriers to improve fish passage and wildlife movement. A suitable wildlife shelf will be implemented into the proposed culvert design.

Connectivity between the G.E. Booth Woodland will be improved with the proposed channel alignment, which approximates the historical channel that originally traversed the lands east of Lakeview Village. An increase in the riparian area and native riparian vegetation is proposed and the low flow channel will be designed with intermittent online wetlands and bio-engineered habitat features.

Collectively, the revitalized creek corridor will enhance fish and wildlife habitat and strengthen ecological connectivity between the Jim Tovey Lakeview Conservation Area and City of Mississauga Natural Area LV2.

ECOLOGICAL OBJECTIVES ACHIEVED

R1-7 (Improve Habitat Quality) - Increase cover of wetlands in the coastal reach through Jim Tovey Lakeview Conservation Area. Channel works associated with land redevelopment should consider pocket wetlands within the creek corridor. Wet meadow should be considered in the hydro corridor associated with Serson Creek, as feasible.

R1-10 (Connect Habitat) - Maintain existing terrestrial connectivity between Serson Creek, G.E Booth woodland, Applewood Creek, and Marie Curtis Park.

R1-12 (Connect Habitat) – Improve fish passage from the lake to the upper reaches of Serson Creek for spawning, feeding and rearing.

Additional objectives achieved:

- Elimination of flow diversion to WWTP
- Restore channel to original alignment, as feasible.

3.6 RESTORATION AND TRAILS

Landscaping plans for area outside the immediate channel riparian zone have been prepared by NAK Design Strategies (Drawings SC1, SC2, SC3, SC4), with ecological input from Beacon

The following considerations are proposed for the various Serson Creek restoration design components:

Main channel:
- All plantings to be comprised of native tree and shrub species
- The main channel and slopes will be planted with shrubs.
- The top of valley will be planted with a mix of trees and shrubs.
- Generous fish and wildlife habitat elements to be incorporated

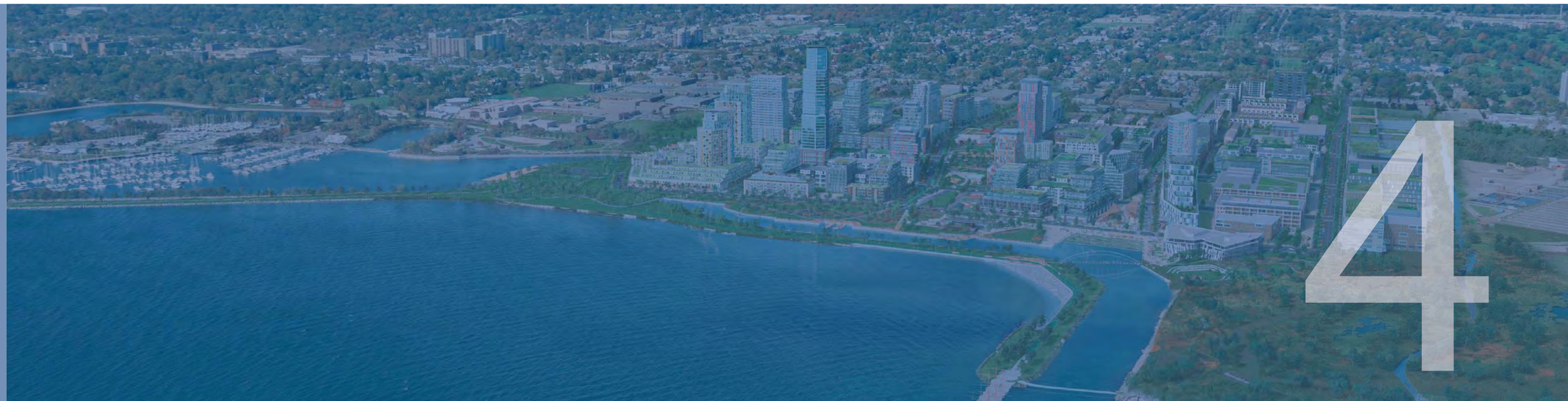
West side (private setback along Serson Innovation Corridor):
- The west interface will comprise a combination of future commercial, residential and employment uses (Serson Innovation Corridor), with building, parking and open spaces forming the edge condition along Serson Corridor.
- A *minimum 6m setback* is proposed on private property from the top of bank to satisfy the provincial requirement for access to the channel. The setback is proposed to be entirely within *private property* and will form part of the Serson Innovation Corridor "Campus" / trail system.
- The setback will vary in size and will consist of pedestrian / cycling trails, plantings, and will connect the channel to the Serson Innovation Corridor area
- The continuously linked trail and cycling system will be a key component of Lakeview Village, connecting future neighbourhoods with the surrounding community, parks and conservation lands.
- A 2.4m wide trail (granular or asphalt) to be provided above the top of bank along the west side of the corridor.

East side (channel banks along WWTP):
- The interface condition along the east side will be predominantly characterized by the G.E. Booth Wastewater Treatment Facility.
- Additional planted screening is desired along this edge to buffer undesirable views to the plant facilities.

Additional Objectives Achieved
- Creation of pedestrian / cycling links between the lake and Lakeshore Road East

Figure 7a - Preliminary Inspiration Point district concept

STORMWATER MANAGEMENT



4

STORMWATER MANAGEMENT

4.1 STORMWATER MANAGEMENT

Some of the future development lands adjacent to the proposed realigned channel can potentially discharge directly into Serson Creek as opposed to the future subdivision storm sewer system.

Due to the proximity to the lake, quantity control is not required. However, any proposal to discharge stormwater directly into the channel must consider the capacity of the proposed realigned corridor.

Quality control (80% TSS removal) is required for any stormwater discharge from hard surfaces. All outlets to the channel should be designed with adequate erosion protection.

The total flow directed to Serson Creek should not exceed the existing flow since the proposed hydraulic capacity is based on existing flood flows.

4.2 DRAINAGE DIVERSION FROM G.E. BOOTH WWTP

The existing Serson Creek alignment through the woodlot and beneath the G.E. Booth WWTP results in potential flooding concerns and development constraints on the Region's property. While the proposed Serson Creek realignment will eliminate the majority of the flows entering the treatment plant from the north, there will remain a small drainage area (around 8 hectares) north of the existing TRCA haul road, consisting of the woodlot north of the WWTP and some of the industrial lands to the north which will continue to drain through the existing channel and into the WWTP. The Region would still have to deal with this drainage, albeit much less than current conditions. See Drawing SWM-1 for details.

In order to completely divert / eliminate flows approaching the existing 900mm culvert at the access road north of the WTTP, the following modifications are recommended:

- Upgrade Serson Creek corridor on the Lakeview Village property (west of the WWTP) and divert flows from north of Lakeshore Road into realigned channel as described in this design brief. This will prevent more than 90% of the existing flow from entering the WWTP.

- To divert the remaining 8 ha of drainage woodlot towards the realigned Serson Creek corridor, the existing 900mm culvert under the access road on the Region's property should be blocked or otherwise decommissioned.

- A storm sewer (600mm) or swale on the Region's property is required to direct the woodlot drainage west, to the realigned channel on the Lakeview Village lands. This will divert the remaining drainage area away from the WWTP south of the access road, eliminating the need to accommodate any external drainage within the WWTP. Drawing SWM-2 illustrates the proposed connection.

It should be noted that these works are almost entirely on the Region's property and therefore the final design and maintenance obligations would have to be accepted by the Region.

There may be some ponded water in the woodlot area resulting from the proposed works as shown on Drawing SWM-1. There are elevation differences between the existing woodlot channel upstream of the 900mm culvert and the proposed realigned channel (approximately 10cm). The woodlot channel is slightly deeper than the proposed realigned channel, meaning the woodlot channel cannot drain by gravity until it fills up to reach the proposed pipe or swale elevation, at which point it will drain by gravity to the realigned Serson Cree (to tie in at half-bankfull elevation). Refer to the following section for details regarding the potential impact to the woodlot.

4.3 EFFECT ON WOODLAND

The Serson Woodland forms part of the City's Natural Heritage System. Mississauga Natural Area Inventory (NAI) identifies the woodland as a Significant Natural Area and Special Management Area (see Figure 1) The woodland developed on agricultural lands that were abandoned 50 years ago. It is not a remnant forest.

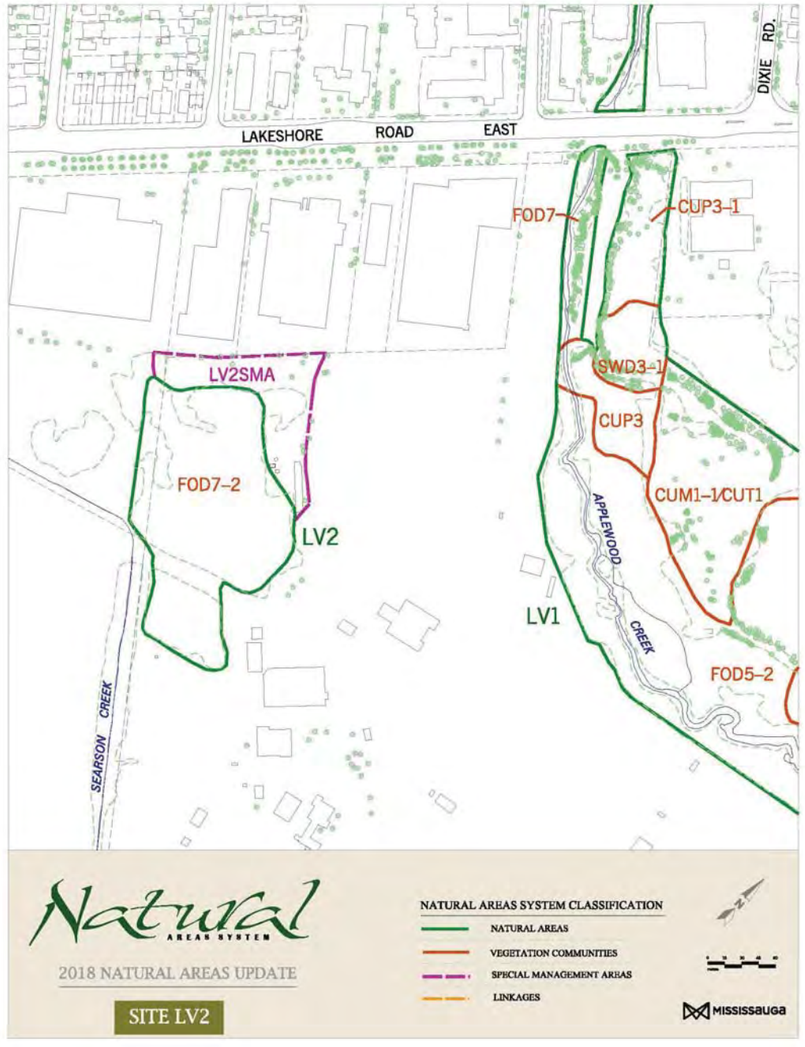
Serson Creek flows southeasterly through the woodland. In the late 1960's, a spur rail line was constructed through the woodland dividing into a north and south section. A culvert was installed under the spur line for Serson Creek. In the 1970's, a channel was constructed along the eastern edge of the woodland to convey most of the Serson Creek flows. Some flows still pass through the old channel in the woodland. The woodland is classified as a Fresh to Moist Lowland Ash Deciduous Forest (FOD7-2). The tree canopy is dominated by Green Ash and White Elm, most of which are dead due to EAB and DED. The understorey is dominated by highly invasive Common Buckthorn and Tartarian Honeysuckle. The ground flora is comprised of invasive Garlic Mustard as well as some Raspberry and Jewelweed. A large patch of invasive Japanese Knotweed is present on the western edge of the woodland. The NAI ranks the overall condition of the woodland is poor on account of the abundance of invasive species, garbage, noise, low species diversity. There are no rare or significant species associated with the woodland.

The proposed flow diversion via the relief pipe will result in inundation of low-lying areas associated with the former creek channel. Much of this area is presently subjected to inundation as the existing culvert under the road (former rail line) is already perched. Most of the trees in the area to be inundated are dead or dying and the understorey is dominated by non-native invasive shrubs. It is expected that additional inundation of this area will result in the transformation of the Lowland Ash Forest to a combination of Deciduous Swamp, Swamp Thicket and Marsh wetland communities. While this transformation will impact upon existing conditions, it is important to recognize that it also represents an opportunity for enhancement.

The City's NAI acknowledges that that Serson Woodland is in poor condition recommends that the City develop a Management Plan to address the impacts of EAB and DED as well as the invasive species.

This proposal creates an opportunity to address not only the flooding issue, but also the management of this natural area in a manner that can reset its ecological trajectory for years to come. Replacement of dead, diseased and invasive species with native species suited to the site conditions can greatly enhance the ecological functions of the woodland. Such enhancements will compliment not only the proposed works along the Serson Creek channel, but also those being implemented in the Jim Tovey Conservation Area.

NATURAL AREAS SYSTEM CLASSIFICATION




STOP

IMPLEMENTATION

5

5 IMPLEMENTATION

5.1 CHANNEL STAGING

The following items are recommended as part of the NHS Design implementation / construction:

Pre-Construction Meeting – A start-up meeting should be held with all project team members to ensure that the contractor and site personnel are aware and familiar with the approved activities, monitoring requirements, and their rationale. All participating approval agencies shall be notified of the meeting, anticipated start-up construction date and schedule.

Permits – Prior to construction, all applicable permits shall be provided to the project team members and contractor. The permits will be reviewed to ensure that all pertinent timelines and conditions are understood by the responsible parties. Valid copies of the permits shall be kept onsite and by key personnel responsible for carrying out conditions of the permits. The Contract Administrator must be notified if there is any deviation from the permit conditions that may impact implementation of the approved activities. CVC and DFO have already issued permits for the Phase 1 works based on the previous GHD restoration design / TRCA plans for the Jim Tovey Lakeview Conservation Area. Opportunities to amend the permits based on the updated design will be explored with the agencies.

Phasing and Erosion and Sediment Control (PESC) – It is recommended that channel works be constructed in the dry and stabilized prior to the introduction of flows. Phasing plans and erosion and sediment control plan will need to be developed based on the coordination with agencies, proposed development phasing and the WWTP. The erosion and sediment control plan should incorporate best management practices (BMPs) and follow pertinent guideline documents during all phases of construction in accordance with site conditions.

Construction Inspection – A qualified inspector should be present or available during construction to ensure proper implementation of approved drawings, design details, construction techniques, and permit conditions. Inspection will enable immediate and appropriate response to construction issues, ensure function of the design, and that the constructed design elements are stable prior to connection with the active channel system. A construction monitoring report should be completed to document the implementation of the approved activities.

Site Maintenance – All materials and equipment shall be properly maintained to prevent deleterious substances from entering the water. All vehicles and equipment entering the isolated channel area shall be free of fluid leaks and externally cleaned/degreased to prevent deleterious substances from entering the water. A staging/storage area, with appropriate erosion controls, shall be placed well away from the work area. All vehicle and equipment refuelling and/or maintenance shall be conducted in the staging/storage area.

Refer to Drawing STG-1 for staging details.

5.2 EROSION AND SEDIMENT CONTROL

Erosion and sediment control will be implemented for all construction activities including tree removal, topsoil stripping, earthworks, and stockpiling of materials and will remain in place and functional until bare surfaces are stabilized. Generally, the Phase 1 works will be completed in the "dry" due to the low-flow channel bypass into the WWTP lands. This facilitates construction and minimizes risk of erosion and sedimentation during construction in the Phase 1 channel corridor. Adequate measures must be taken to prevent downstream impacts to the lake / connection to the Jim Tovey Lakeview Conservation Area.

- The following erosion and sediment control measures are recommended for the channel construction (Phase 1) works:
- Natural features, property lines and fill regulation limits to be staked.
- Sediment control fence and snow fence placed prior to earthworks / channel construction. Placement of filter socks and other measures at connection to lake.
- Logistics/construction plan will be implemented to limit the size of disturbed areas and on-going TRCA haul operations.
- Minimizing the non-essential clearing and grading areas.
- All temporary erosion and sediment control measures will be routinely inspected/monitored and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.
- The "multiple barrier approach" will be applied to all construction stages to ensure erosion is prevented rather than reduced. Recommended measures are to be installed prior to the initiation of the earthworks and grading.
- All reasonable measures will be taken to ensure that sediment loading to the lake is minimized both during and following construction.

The proposed Erosion and Sediment Control plans will be prepared in accordance with the recommendations in the Guidelines for Erosion and Sediment Control for Urban Construction Sites prepared by the Greater Toronto Conservation Authorities (2006) as well as the Draft TRCA E&SC design guidelines (March 2019). Refer to Drawing STG-2 for Erosion and Sediment Control details.

IMPLEMENTATION

5.3 NHS OPERATION AND MAINTENANCE

The Beacon design brief (Appendix A) outlines the following operations and maintenance recommendations including a monitoring protocol:

Post-Construction Monitoring – Monitoring requirements will be confirmed in consultation with CVC. However, it is recommended that a general field reconnaissance along the entire length of the constructed design immediately after the first large flooding event to identify any potential areas of concern. In addition, it is recommended that monitoring include:

- Repeated detailed monitoring of the cross-sectional shape and longitudinal profile immediately following construction to obtain reference data for comparison with subsequent surveys;
- Monumented (georeferenced and same direction) photographs to observe the performance of geomorphic and habitat features; and
- Survey of condition of riparian plantings two years post construction

APPENDIX A

Serson Creek Geomorphic Assessment and Rehabilitation Design

(Beacon Environmental Limited (October 2019)

BEACON ENVIRONMENTAL

GUIDING SOLUTIONS IN THE NATURAL ENVIRONMENT

Serson Creek Geomorphic Assessment and Rehabilitation Design Lakeview Village

City of Mississauga

Prepared For:

Lakeview Community Partners Limited

Prepared By:

Beacon Environmental Limited

Date: *Project:*

October 2019 **217424**

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1. Introduction

Beacon Environmental Limited (Beacon) was retained by Lakeview Community Partners Limited (LCPL) to undertake a geomorphic assessment and channel rehabilitation design of Serson Creek within the property located at 800 Hydro Road in the City of Mississauga ('subject property'). The subject property is located between Lakeshore Road East and Lake Ontario, immediately east of the Region of Peel's G.E. Booth Wastewater Treatment Facility (WWTF), within the former Ontario Power Generation coal plant lands known as the Lakeview Generating Station (**Figure 1**).

Historically, Serson Creek south of Lakeshore Road East, flowed south easterly to Lake Ontario crossing agricultural lands on lands presently occupied by the WWTF. Its confluence with the lake was approximately 250 m to the west of Applewood Creek (**Appendix A**). To facilitate the construction of the Lakeview Generation Station and WWTF in the late 1950's, the lower section of Serson Creek was diverted along the eastern boundary of the subject property and portion of the upper section was diverted south to a ditch along a rail spur line which serviced both sites. Flows in Serson Creek are currently split by a barrier at the rail crossing. Low flows are diverted to a pipe under the WWTF that generally follows the historical channel and outlets to the lake through a headwall structure. High flows pass through the constructed ditch between the two site and outlets to the lake at the Jim Tovey Lakeview Conservation Area. The pipe and the diversion barrier prevent upstream fish migration from the lake under seasonal low flow conditions. It is anticipated that the diversion will be removed in 2021, once Serson Creek has been reconstructed.

LCPL are proposing to redevelop the subject property. Referred to as Lakeview Village, the proposed redevelopment will consist of a progressive and sustainable mixed-use community that will include a mix of residential, commercial, institutional and open space uses. Nearly 40% (27 ha) of the site that fronts Lake Ontario will be transferred to the City of Mississauga as public waterfront space. The proposed redevelopment plan for Lakeview Village also includes a plan to realign and rehabilitate the entire Serson Creek corridor south of Lakeshore Road East.

Rehabilitation of this section of Serson Creek was identified as an objective through the City's master planning studies for the former Generating Station land as part of Inspiration Lakeview. Rehabilitation plans for this section of Serson Creek were subsequently developed by TRCA through the Lakeview Waterfront Connection project. While these rehabilitation plans have been approved by the responsible authorities and agencies, these plans do not give adequate consideration to future land uses being proposed for Lakeview Village. As most of the Serson Creek corridor overlaps with the LCPL property, it is now necessary to review the plans within the context of the future redevelopment proposal to ensure that there is appropriate integration with the future uses. For this reason, the Lakeview Village consultant team has been working with the City and partner agencies the further refine the design for the rehabilitation of Serson Creek in a manner that meets the original environmental design objectives but also achieves better integration with the proposed redevelopment plan for Lakeview Village and also accommodated the Region's requirements related to proposed upgrades to the WWTF.

The purpose of this report is to outline the design of the proposed Serson Creek rehabilitation including characterization existing geomorphic conditions and an erosion hazard assessment for the existing of Serson Creek on the subject property, as requested by CVC (M. Marinas, email dated April 30, 2019). The primary objective for the design is to rehabilitate and enhance the Serson Creek to carry redirected low flows while improving flood conveyance, terrestrial and aquatic habitat quality and connectivity.

2. Policy Context

2.1 Provincial Policy Statement (2014)

The Provincial Policy Statement (MNRF 2014) issued under the Planning Act (1990) outlines areas of provincial interest with respect to natural hazards. In support of the Policy Statement, a Technical Guide - Rivers and Streams: Erosion Hazard Limit document was prepared (MNR 2002) to outline standardized procedures for the delineation and management of riverine erosion hazards in the Province of Ontario. The guide presents erosion hazard protocols based on two generalized landform systems through which watercourses flow: confined and unconfined valley systems. Through this approach, the meander belt width plus an erosion access allowance is defined to determine the erosion hazard limit of an unconfined valley system. For confined valley systems, the erosion hazard limit is governed by geotechnical considerations, including the stable slope allowance and an applicable toe erosion allowance (i.e., channel migration component).

The intent of the toe erosion allowance is to mitigate risk to the adjacent tablelands by accounting for the potential of the stream to migrate laterally into the valley wall and erode the toe of slope. This process can result in subsequent slope adjustments or failure and cause the loss of property or pose a risk to human life. Policy dictates that, for confined valley systems, an initial screening must be undertaken to determine whether the valley wall is less than 15 m from the watercourse. Where soil conditions are not known, a 15 m toe erosion allowance is recommended. Based on a more detailed evaluation, the Technical Guide provides recommendations for the toe erosion allowance referencing existing soil structure and channel stability conditions (**Table 1**).

Table 1. Minimum Toe Erosion Allowance based on Existing Conditions (MNR 2002).

Type of Material Native Soil Structure	Evidence of Active Erosion or where the Bankfull Flow Velocity is Greater than Competent Flow Velocity	No Evidence of Active Erosion		
		Bankfull Width		
		<5m	5-30m	>30m
Hard Rock (e.g. granite)	0-2 m	0 m	0 m	1 m
Soft Rock (shale, limestone), cobbles, boulders	2-5 m	0 m	1 m	2 m
Clays, clay-silt, gravels	5-8 m	1 m	2 m	4 m
Sand, silt	8-15 m	1-2 m	5 m	7 m

2.2 Region Municipality of Peel Official Plan (2016)

Section 2.4 of the Region of Peel Official Plan contain policies that apply to natural hazards. Specific sections deal with ravine, valley and stream corridors, and riverine floodplains. These policies commit the Region to work in conjunction with area municipalities and Conservation Authorities towards the following three objectives:

Site Location	Figure 1
Serson Creek Rehabilitation Design Lakeview Village, City of Mississauga	
BEACON ENVIRONMENTAL	Project: 217424 Last Revised: September, 2019
Client: Lakeview Community Partners Limited	Prepared by: DU Checked by: AS
N 1:10,000	Inset Map:1:50,000
Contains information licensed under the Open Government License–Ontario Orthoimagery Baselayer: FBS Peel 2018	

C:\Dropbox\Dropbox (Beacon)\All GIS Projects\2017\217424 Lakeview DD\MXD\MBW\2019-09-19_Figure01_SiteLocation_217424_1.mxd

1. To ensure that development and site alterations are not permitted in areas where site conditions or location may pose a danger to public safety, public health or result in property damage;
2. To encourage a coordinated approach to the use of land and the management of water in areas subject to flooding in order to minimize social disruption; and
3. To ensure that methods used to protect existing development at risk from natural hazards do not negatively impact the integrity of the ecosystem.

2.3 City of Mississauga Official Plan (2017)

Section 6.3 of the Mississauga Official Plan (MOP) contains policies pertaining to the protection of the Green System. The Green System is composed of 1) the Natural Heritage System, 2) the Urban Forest, 3) Natural Hazard Lands; and 4) Parks and Open Spaces. The Natural Heritage System is conceptually illustrated on Schedule 3 of the MOP.

Components of the Green System that overlap with the subject property include the Natural Heritage System and Natural Hazard Lands. Policies pertaining to the Natural Hazard Lands are discussed below.

2.3.1 Natural Hazard Lands

Natural Hazard Lands are associated with valley and watercourse corridors and the Lake Ontario shoreline. These areas are prone to flooding and erosion and are generally unsuitable for development.

With respect to valleylands, it is the policy of the City that *development adjacent to valleylands and watercourse features must incorporate measures to ensure public health and safety; protection of life and property; as well as enhancements and restoration of the Natural Heritage System*.

Policy 6.3.47 states:

> *Development and site alteration will not be permitted within erosion hazards associated with valleyland and watercourse features. In addition, development and site alteration must provide appropriate buffer to erosion hazards, as established to the satisfaction of the City and appropriate conservation authority.*

Policy 6.3.48 states:

> *Development adjacent to valleyland and watercourse features may be required to be supported by detailed slope stability and stream erosion studies, where appropriate.*

With respect to flood plains, it is the policy of the City that:

> *Lands subject to flooding are a danger to life and property and, as such, development is generally prohibited. However, it is recognized that some historic development has occurred within flood plains and may be subject to special flood plain policy consideration.*

Policy 6.3.51 states:

> *Development and site alteration is generally prohibited on lands subject to flooding.*

Policy 6.3.52 states:

> *Where historic development has occurred in the flood plain, minor works may be permitted subject to detailed studies to the satisfaction of the City and appropriate conservation authority.*

Policy 6.3.53 states:

> *The construction of buildings or structures permitted in or adjacent to the flood plain will be protected to the elevation of the Regulatory Flood and will not impact upstream or downstream properties. Additional flood protection measures to be implemented relative to individual development applications will be determined by the City and the appropriate conservation authority.*

Policy 6.3.54 states:

> *Access for development adjacent to or within the flood plain will be subject to appropriate conservation authority policies and the policies of the City.*

2.4 Credit Valley Conservation Authority Policies and Regulations

2.4.1 Ontario Regulation 168/06

The Credit Valley Conservation Authority (CVC) regulates activities within and adjacent to wetlands, watercourses and hazard lands under *Ontario Regulation 168/06 - Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* under Section 28 of the *Conservation Authorities Act*. *Regulation 168/06* is implemented by Credit Valley Conservation (CVC) according to their *Watershed Planning and Regulation Policies* (CVC 2010).

2.4.2 Slope Stability Definition and Determination Guideline (CVC 2014)

The CVC (2014) *Slope Stability Definition and Determination Guideline* defines the Long-Term Stable Slope Line as consisting of a Stability Component and the Erosion Component. The Erosion Component is further defined as:

> *The regression of the slope toe/channel bank due to erosion over the design life of the structure at the crest of the slope and is measured as a horizontal distance.*

Factors for identified within the Guideline for consideration in the determination of the Erosion Component include:

- Proximity of the slope toe to the watercourse;

- Sediment load carried by the watercourse;
- Average and peak flow rates and velocities of the watercourse;
- Fluvial geomorphological processes affecting the reach within which the site is located;
- Susceptibility of the soils to erosion;
- Increases in surface runoff over the slope;
- Type and extent of vegetation; and
- Weathering of slope face.

As illustrated in Figure 4a of the Guideline, delineation of the Erosion Component consists of two separate factors:

1. Determination of the distance from the toe of the valley wall to the watercourse channel bank; and
2. Determination of the design toe erosion allowance.

The design toe erosion allowance can either be calculated based on historical records for the site or based on suggested allowances as identified in the guideline (**Table 2**).

Table 2. Suggested Design Toe Erosion Allowance (CVC 2014).

Material at Channel Bank or Bankfull	Bank Condition		
	Active Erosion of Bank	Erosion Not Currently Evident	Existing Bank Protection in Place and Maintained Along Bank
Limestone/Dolostone	2 m	1 m	0 m
Shale	5 m	2 m	0 m
Cohesive Soils (Silty Clays, Clayey Silts)	8 m	4 m	0 m
Cohesionless Soils (Silts, Sands)	15 m	7 m	0 m

2.4.3 Fluvial Geomorphic Guidelines (CVC 2015)

The *CVC Fluvial Geomorphic Guidelines (2015) Fact Sheet I* define geomorphological hazard delineation for watercourses based on whether the valley system through which it flows is confined or unconfined. The guidelines state:

> *In unconfined systems the hazard is from channel erosion and migration. As such, unconfined systems require a meander belt width and associated erosion allowance to be determined. Confined systems, on the other hand, require both channel migration or erosion and slope processes to be considered. As such, they require both a toe erosion allowance and a stable slope allowance.*

Methods for determining meander belt widths are outlined in the Toronto and Region Conservation Authority's Belt Width Delineation Procedure, 2004.

3. Background Review

3.1 Lakeview Waterfront Connection Environmental Assessment – Fluvial Geomorphology Technical Report

As part of the Lakeview Waterfront Connection (LWC) Environmental Assessment (EA), PARISH Geomorphic (2014) produced a Fluvial Geomorphology Technical Report. The purpose of the report was to characterize the existing function of the portions of Serson Creek and Applewood Creek within the study area, and evaluate design alternatives identified in the LWC with respect to geomorphic considerations. Tasks undertaken in support of the study included reach delineation, field assessment to confirm existing geomorphic conditions, and recommendations of erosion thresholds to inform stormwater management design parameters for both Applewood Creek and Serson Creek.

The report characterized Applewood Creek and Serson Creek as urbanized creeks that respond rapidly to rainfall events and receive minimal sediment supply from the upstream drainage area. Downstream of Lakeshore Road East, the creek conditions were considered depositional due to backwater effects from Lake Ontario and shallow channel gradients.

Serson Creek drains a 270 ha area comprised mainly of urbanized lands. South of Lakeshore Road East, Serson Creek flows through an open channel to the former rail line. Flows are then split. Baseflow is directed easterly through a wooded area and piped south underneath the G.E. Booth Waste Water Treatment Facility (WWTF) to Lake Ontario. Flood flows are directed south through an open constructed ditch along the easterly boundary of the LCPL property which outlets to Lake Ontario. The report notes that this flow diversion impairs ecological functions within the westerly flood conveyance channel and represents a barrier to upstream fish migration from the lake. The westerly flood conveyance channel is protected along the bed and banks with cobble and rip-rap.

The westerly flood conveyance channel, identified as Reach SC-2 in the report, was classified as 'in-regime' with a score of 0.11 according to a Rapid Geomorphic Assessment (RGA). The report described the channel as heavily overgrown due to a lack of regular discharge. The channel is confined by large berms with few natural characteristics. The Rapid Stream Assessment Technique (RSAT) score for this reach was determined to be 12, resulting in a ranking of 'low' due to limited opportunities to develop natural channel characteristics which support aquatic habitat. Bankfull widths were estimated to range between 2.4-3.1 m and the average bankfull depth was noted as 0.5 m.

The report also recommended design parameters for the proposed extension of lower Serson Creek as part of the Lakeview Waterfront Connection Project (LCW) Island Beach preferred design alternative. The main goal of the channel design was to adequately convey the 2-year storm event and provide additional capacity for the 5-year flood.

3.2 Preliminary Geotechnical Investigation – 800 Hydro Road

A preliminary geotechnical investigation was completed for the subject property at 800 Hydro Road by exp Services Inc. (2017). The purpose of the investigation was to determine subsurface soil and groundwater conditions to provide preliminary geotechnical engineering guidelines for site development

planning. Boreholes were advanced to assess subsurface conditions, bedrock elevation and quality, and water levels, among other criteria. Results from the boreholes indicated that the soil stratigraphy was generally comprised of fill, followed by native deposits of clayey silt, clayey silt till, sandy silt till, silt till and silt overlying shale bedrock.

3.3 Lakeview Waterfront Connection Project - Applewood and Serson Creeks Design Brief

GHD (2015) was retained by Toronto and Region Conservation Authority (TRCA) on behalf of CVC and the Region of Peel to prepare detailed designs for the restoration and extension of Serson Creek and Applewood Creeks through the LWC project area. Downstream of Lakeshore Road East, the study delineated Serson Creek into three reaches.

Reach S1 is located between the WWTF property fence and Lake Ontario. This reach consisted of the portion of creek influenced by lake levels. The reach was confined and had been heavily modified. The corridor was trapezoidal in shape with no defined banks; however, corridor widths ranged between 10-12 m. A rapid assessment was not completed on this reach due to the lack of a defined channel.

Reach S2, a stormwater corridor, was characterized as 'in-transition' or 'stressed' using RGA. The RSAT classified this reach as having 'fair' overall ecological health owing to poor riparian habitat conditions. Bankfull widths and depths ranged between 2.5-3.0 m, and 0.40-0.60 m, respectively.

Reach S3 was characterized as 'in adjustment' based on the RGA and was classified as 'fair' under the RSAT due to evidence of channel/scouring and sediment deposition. Bankfull widths and depths for Reach S3 ranged between 2.8-3.2 m and 0.50-0.70 m, respectively. Reach S3a was the section of channel from the outlet pipe to the WWTF property fence at Reach S3. This reach was unconfined and was characterized through the RGA as 'in regime' and through the RSAT as having a 'fair' degree of ecological health. Bankfull widths and depths ranged between 1.1-1.5 m and 0.20-0.30 m. Reach S3b, located downstream of S3a, was heavily influenced by the backwater effect of the undersized culvert opening north of the WWTF. RGA and RSAT were not completed for this reach.

Field observations by GHD were used to complement the topographic surveys previously completed by TRCA for Serson Creek. Two cross sections each were surveyed within reaches S1, S2, and S3a, and four cross sections were surveyed within reach S3, to characterize bank material and bank angle, channel substrate, root density, and depth. Additionally, pebble counts were conducted at these ten cross sections. The average bankfull width and depth obtained through these surveys were 3.9 m and 0.40 m, respectively. The average channel bankfull gradient was 0.19% and the channel bed gradient was 0.48%. Channel bed substrate consisted of gravel, with a D_{50} of 5 mm and a D_{84} of 45 mm. Applying a Manning's roughness of 0.035, a 'reference' bankfull discharge was back-calculated to be 1.64 m^3/s, with an average velocity of 1.03 m/s.

Referencing detailed geomorphic field data collected within representative cross-sections, a design for Serson Creek was presented with the objective of enhancing stormwater conveyance within the corridor within the identified land creation area. The proposed design would require widening the existing channel corridor by approximately 5.0 m and achieve the following design objectives:

- Redirection of flows below the 5-yr event down the stormwater corridor (flows above approximately the 2-yr event would overflow the bankfull channel and flow down the stormwater corridor;
- Creation of a slightly sinuous bankfull channel through the stormwater corridor which includes pools and riffle morphology;
- Increased riparian area and riparian vegetation;
- Improved flood conveyance;
- Toe of slope protection to prevent erosion into the valley walls; and
- Integration of a stormwater outlet from the WWTF.

4. Desktop Assessment

4.1 Climate

Climate provides the driving energy for a fluvial system and directly influences basin hydrology and rates of channel erosion, particularly through precipitation. Precipitation records obtained from climate normals (1981-2010) recorded at Oakville Southeast WPCP, southwest of the subject lands, averaged 61 mm per month in winter (November through February), and 77 mm in summer (July and August; Environment Canada 2018). This increase over the summer months is likely a result of convective thunderstorms. While total precipitation amounts are greater during the summer months, snowmelt and rain-on-snow events tend to produce the highest flows within a watershed.

4.2 Geology

The planimetric form of a watercourse is fundamentally a product of the channel flow regime and the availability of sediments (i.e., surficial geology) within the stream corridor. The ‘dynamic equilibrium’ of these inputs governs channel planform. These factors are influenced in smaller systems by physiography, riparian vegetation and land use. The subject property is located on the Ordovician grey shale of the Georgian Bay Formation consisting of a light grey siltstone and/or limestone interbeds. The shale is overlain by a thin layer of soil and glacial deposits which, once exposed, weathers rapidly under cycles of melting and drying.

4.3 Valley Slopes

DS Consultants Limited completed a Geotechnical Slope Stability Assessment (2019) for the Serson Creek bank slopes to assess the stability of the existing west bank slope of Serson Creek and determine the location of the long-term stable top of slope (LTSTOS) line. Stability analysis of the long-term stable slope recommended a stable slope allowance of 2.5H:1V. For long-term stability, a toe erosion allowance of 8 m was also identified. The results of the slope stability assessment have been incorporated into this geomorphic assessment where applicable.

4.4 Historical Assessment

In support of the historical assessment, information presented in the GHD (2015) report based on aerial imagery from 1946, 1954, 1978, 2002, and 2013 was reviewed, with a focus on trends in channel planform and land use change over time. The historical record for the years from the GHD report, are presented in **Appendix A**. The report described land use in 1946 as predominantly agricultural, with trees lining the fields and floodplain. Residential dwellings were located along the north side of Lakeshore Road. Serson Creek was described as a drainage channel flowing east-south-east through fields towards Lake Ontario.

By 1954, extensive development was observed north of Lakeshore Road East while land use within the subject property lands remained unchanged. Aside from shoreline hardening at the outlet of Serson Creek, the channel planform had remained consistent. Between 1954 and 1978 development of the agricultural lands south of Lakeshore Road could be observed. In 1961, the Lakeview WWTF had been established and, by 1962, the OPG Lakeview Generating Station had been constructed southeast of Serson Creek. To accommodate the WWTF and generating station, land reclamation efforts had extended the Lake Ontario shoreline. The construction of these two facilities resulted in the realignment of Serson Creek and the construction of a stormwater drainage channel between the hydro station and the WWTF. Little change in channel planform and surrounding land use was observed in 2002. In 2013, change in land use was limited to the decommissioning of the hydro site in 2005.

4.5 Reach Delineation

Reaches are sections of channel with homogeneous form and function and can, therefore, be expected to respond consistently along their length to changes in hydrology and sediment inputs, as well as to other modifying factors (Montgomery and Buffington 1997; Richards et al. 1997). In support of this study, reach delineation originally completed by PARISH Geomorphic Ltd. (2014) for the LWC Project Environmental Assessment, and GHD (2015) as part of the LWC Project Design Brief for Applewood and Serson Creeks were reviewed. For the purposes of this study, no refinements were made to the LWC Project reach extents.

5. Existing Conditions

In order to confirm existing geomorphic conditions along the relevant portions of Serson Creek within the subject property, field investigations were conducted on September 21 and 28, 2018. A photographic record of watercourse conditions at the time of assessment is presented in **Appendix B**. Reach limits and photo locations are presented in **Figure 2.**

5.1 Rapid Assessments

5.1.1 Methods

The following standardized rapid visual assessment methods were applied:

i. Rapid Geomorphic Assessment (RGA – MOE 2003)

The RGA documents observed indicators of channel instability by quantifying observations using an index that identifies channel sensitivity. Sensitivity is based on evidence of aggradation, degradation, channel widening and planimetric form adjustment. The index produces values that indicate whether the channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40) or in adjustment (score >0.41).

ii. Rapid Stream Assessment Technique (RSAT – Galli 1996)

The RSAT uses an index to categorize overall stream health and includes the consideration of biological indicators (Galli 1996). Parameters such as channel stability, channel scouring/sediment deposition, physical in-stream habitat, water quality, and riparian habitat conditions are used to calculate a rating that indicates whether the channel is in poor (<13), fair (13-24), good (25-34), or excellent (35-42) condition.

iii. Downs Classification Method (Downs 1995)

The Downs (1995, outlined in Thorne et al. 1997) classification method infers present and future potential adjustments based on physical observations, which indicate the stage of evolution, and type of adjustments that can be anticipated based on the channel evolution model. The resultant index classifies streams as stable, laterally migrating, enlarging, undercutting, aggrading, or recovering.

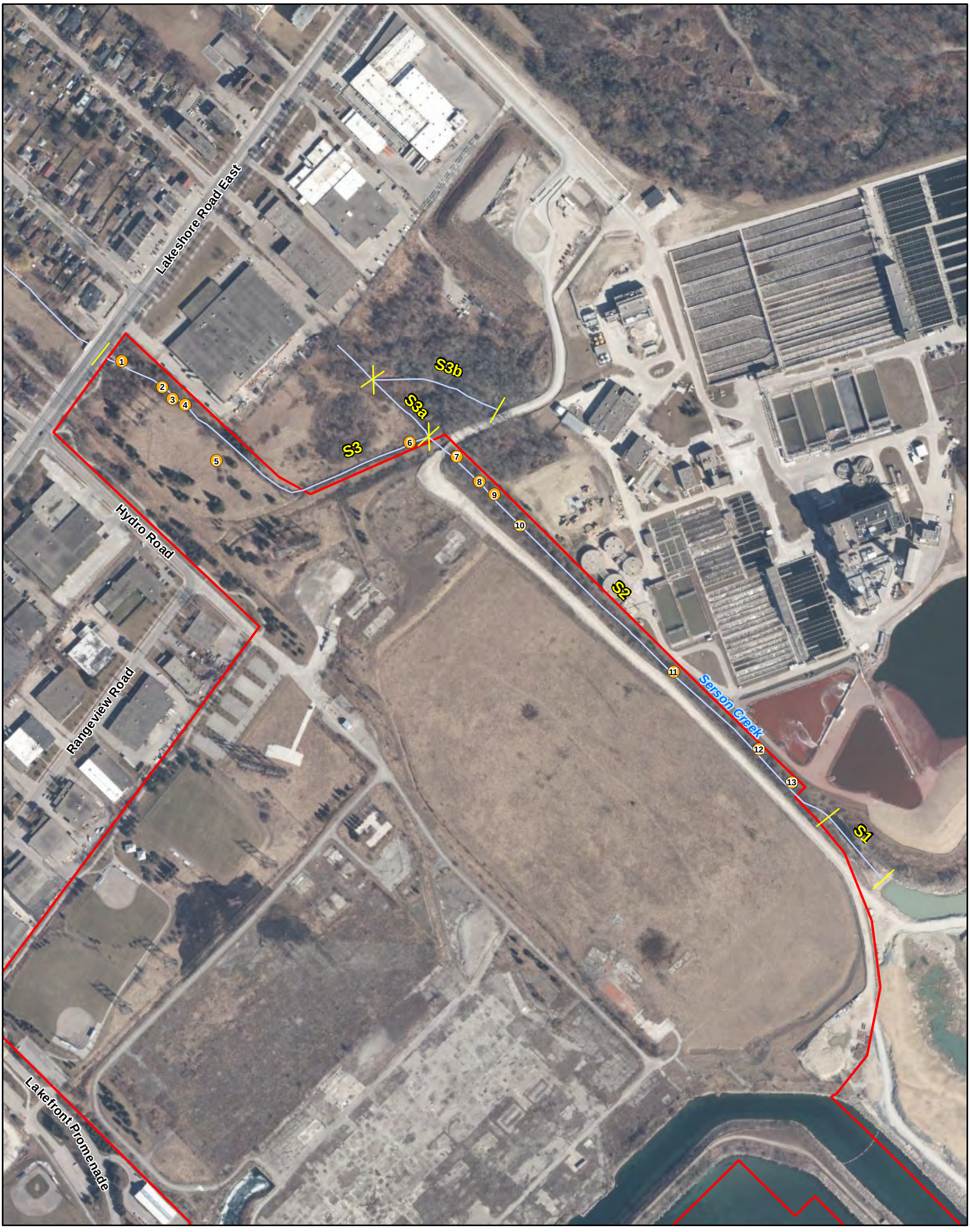
5.1.2 Results

Results of the rapid assessments are summarized in **Table 3** and **Table 4** below.

5.1.2.1 Serson Creek Reach S2

Reach S2 was characterized as a heavily modified channel situated within a confined valley setting. The channel maintained a low gradient, minimal sinuosity, and a moderate degree of entrenchment. Riparian vegetation was continuous, extending between 1-5 channel widths laterally, and was dominated by shrubs with trees, grasses, and herbaceous plants also present. Bank angles ranged between 30-90 degrees with evidence of erosion along 30-60% of the reach. Banks were composed of clay and silt. Riffle substrate was composed of clay/silt and gravel, pool substrate was composed of clay/silt. Rip-rap substrate was present in pools and riffles throughout the reach. Bankfull widths and depths were between 1.9-3.1 m and 0.4-0.7 m, respectively. Moderate quantities of woody debris were observed in the channel. Beaver activity and an associated backwater influence was observed at the downstream end of the reach. The degree of channel entrenchment was high at the upstream extent of the reach but decreased with distance downstream.

RGA results indicated that Reach S2 was 'in transition', with a score of 0.30. Channel widening was identified as the dominant mode of adjustment, as evident by numerous fallen trees, basal scour through both side of channel within riffles, active bank erosion observed in over 50% of the reach, and presence of fracture lines along the top of bank. Degradation was noted as a secondary process due to knickpoint



Legend

- Subject Property
- Watercourse (MNRF 2018)
- Reach Break
- Photo Locations

Reach and Photo Location | **Figure 2**

Serson Creek Rehabilitation Design
Lakeview Village, City of Mississauga

BEACON ENVIRONMENTAL

Project: 217424
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Client: Lakeview Community Partners Limited

Prepared by: DU
Checked by: AS

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migration, terraces cut through older bar material, exposed fence lines, and exposed overburden. Minor evidence of planimetric form adjustment was observed through thalweg misalignment and poor bar formation. An RSAT score of 20 indicated a 'fair' degree of overall ecological health with physical instream habitat and riparian habitat conditions acting as limiting factors. The Downs model classified this reach as a combination between S – 'stable' and e – 'enlarging' as there was evidence of channel downcutting and entrenchment.

5.1.2.2 Serson Creek Reach S3

Reach S3 was characterized as a well-defined channel situated within a partially confined valley setting (confined right bank, unconfined left bank, looking downstream). The channel was highly entrenched (6-8 m of entrenchment observed in some areas). The channel displayed a low gradient and minimal sinuosity. Riparian vegetation was continuous, extending between 1-5 channel widths laterally, and was dominated by trees and shrubs. Banks were generally steep (>60 degrees) and were composed of clay/silt. Banks had minimal vegetative cover and evidence of erosion was observed along 60-100% of channel banks within the reach. Bankfull widths and depths were between 2.4-3.5 m and 0.6-0.85 m, respectively. Riffle substrate was composed of clay/silt, sand, and gravel, and pool substrate was composed of clay/silt and sand. Low quantities of woody debris were observed in the channel. Backwatering due to beaver activity was observed at the downstream end of the reach.

RGA results indicated that Reach S3 was 'in adjustment', with a score of 0.41. There was evidence of widening in the form of large organic debris, exposed tree roots, and basal scour throughout the reach. Evidence of degradation was observed with knickpoint migration, terracing through older bar materials, cut face on bar forms, and exposed overburden. Minor evidence of aggradation was observed in lobate and medial bar formation and poor longitudinal bed material sorting. Minor evidence of planimetric form adjustment was also present with thalweg misalignment and poorly formed bar forms. An RSAT score of 19 indicated a 'fair' degree of overall ecological health with physical instream habitat and riparian habitat conditions acting as limiting factors. The Downs model classified this reach as C – 'compound' due to the presence of both bank erosion and sediment deposition on the bed.

Table 3. Serson Creek – General Reach Characteristics

Reach	Bankfull Width (m)	Bankfull Depth (m)	Riffle Substrate	Riparian Vegetation	Notes
S2	1.9-3.1	0.4-0.7	Clay/silt, gravel, rip-rap	Shrubs, trees, grasses, herbaceous plants	• Channel confinement reduction downstream • Rip-rap protection on lower banks
S3	2.4-3.5	0.6-0.8	Clay, silt, sand, gravel	Trees, shrubs, grasses	• Minimal root vegetation along banks • Entrenchment on the order of 6-8 m • Approx. 0.9 m flow depth upstream of beaver dam

Table 4. Serson Creek – Rapid Assessment Results

Reach	Rapid Geomorphic Assessment (RGA)			Rapid Stream Assessment Technique (RSAT)			Downs Classification Method
	Score	Condition	Dominant Mode of Adjustment	Score	Condition	Limiting Feature	
S2	0.30	In Transition	Widening	20	Fair	Physical Instream Habitat, Riparian Habitat	S 'stable', e – 'enlarging'
S3	0.41	In Adjustment	Widening	19	Fair	Physical Instream Habitat, Riparian Habitat	C – 'compound'

5.2 Detailed Assessment

In support of the design, a topographic survey was completed by the TRCA in 2014 for Serson Creek. Field observations were conducted by GHD (2015) to complement the topographic survey. A total of ten (10) cross-sections for Serson Creek (two (2) within Reach S1, two (2) within Reach S2, four (4) within Reach S3, and two (2) within Reach S3a) were examined for bank material and bank angle, channel substrate, root density and depth. In addition, pebble counts (Wolman 1954) were conducted at all ten (10) cross-sections in order to characterize the channel substrate. Bankfull discharge and velocity were calculated from these observations, and the results are summarized in **Table 5**.

Table 5. Summary of Detailed Field Results (GHD 2015)

Channel Parameter	Upstream	Stormwater Channel
Field-Based Measurements		
Channel bankfull gradient	0.19 %	N/A
Channel bed gradient	0.48 %	0.99 %
Average bankfull width	3.9 m	N/A
Average bankfull depth	0.4 m	N/A
D_{50}	5 mm	2 mm
D_{84}	45 mm	70 mm
Estimated Manning's 'n' value	0.035	0.035
Derived Parameters		
Bankfull discharge	1.64 m^3/s	N/A
Bankfull velocity	1.03 m/s	N/A
Tractive force (bankfull)	17.2 N/m^2	N/A
Flow competency for D_{50}	0.4 m/s	0.3 m/s
Flow competency for D_{84}	1.1 m/s	1.4 m/s

6. Determination of Erosion Hazard Limits

This section of the report includes an analysis of erosion hazard limits for Serson Creek on the subject property. The hazard lands associated with a river or stream system are considered a confined valley system or an unconfined valley system (Technical Guide - Rivers and Streams: Erosion Hazard Limit, MNR 2002). A confined valley system is one with visible physical valley slopes discernible from the surrounding landscape (MNR 2002). An unconfined valley system is a system where the valley contains a river or stream but there are no valley slopes discernible from the surrounding landscape (MNR 2002). The erosion hazard limits depend on the type of valley system through which the river or stream flows.

6.1 Unconfined Valley System – Meander Belt

According to the *Technical Guide to River Erosion Hazards* (MNR 2002), when a river or stream flows within an unconfined valley corridor, the greater of the flood hazard limit or meander belt width allowance (along with the erosion access allowance) represents the erosion hazard limit. The meander belt width is generally defined as the lateral extent that a meandering channel has historically occupied and will likely occupy in the future.

Based on the findings of the field investigations, Reach S3 of Serson Creek was characterized as partially confined. The left bank (looking downstream) is unconfined and the right bank is confined.

As discussed in **Section 6.2**, the long-term stable top of slope was identified by DS Consultants Ltd. (2019) for the right bank of the valley slope. The following section outlines methods applied to determine the meander belt limit for the unconfined portion (left bank) of the valley slope.

Due to the historical channelization of the channel, an empirical modelling approach referencing geomorphic field assessment data was employed as a more appropriate to assess meander belt width dimensions. The approach uses power functions based on average bankfull width (W_b), following relations from Williams (1986; Equation 1) and Ward *et al*. (2002; Equation 2). Research by Ward *et al*. (2002) indicated that the Williams (1986) equation, at times, under-predicted the belt width dimensions. As such, a modified approach to the relation, which incorporates the average bankfull width and a 20% factor of safety, was applied.

$$B_w = ([4.3*W_b^{1.12}]+W_b)*1.2 \qquad \textbf{[Eq. 1]}$$

$$B_w = [6*W_b^{1.12}] \quad \text{(feet converted to meters)} \qquad \textbf{[Eq. 2]}$$

The results of the empirical analysis are summarized in **Table 5**. An illustration of the recommended meander belt limit for Reach S3 as shown on **Figure 3**. Note that the meander belt limit along the confined (right bank) of the valley slope was adjusted to illustrate the long-term stable top of slope as discussed in **Section 6.2**.

Table 6. Serson Creek – Recommended Meander Belt (Reach S3)

Reach	Rapid Geomorphic Assessment (RGA)			Modelled Meander Belt Width (m)		Recommended Meander Belt (m)
	Score	Condition	Dominant Mode of Adjustment	Williams (1986)	Ward (2002)	
S3	0.41	In Adjustment	Widening	21	24	**23**

6.2 Confined Valley Systems – Toe Erosion Allowance

For the purposes of determining the erosion hazard limit for confined reaches within the subject property (i.e., those reaches where lateral migration is limited by the presence of valley walls), determination of a toe erosion allowance and a stable slope allowance is required. According to the MNR Technical Guidelines (2002), erosion hazard limits require the inclusion of a toe erosion allowance for areas where the watercourse is within 15 m of the valley toe of slope. Based on the findings of the field evaluation, Reach S2 and portions of Reach S3 of Serson Creek were determined to be in proximity to the valley wall.

The toe erosion allowance can be determined through calculation of the annual recession rate (100-year migration rate) using reliable (historical) data records. However, due to the scale and resolution of available historical aerial imagery, degree of vegetative cover and historical channelization, annual recession rates could not be reliably determined for the subject property. As a result, the recommended toe erosion allowance of 8 m as presented in **Table 6** was determined using suggested ranges provided in the Technical Guidelines (MNR 2002; CVC 2014) and in consideration of the Geotechnical Slope Stability Assessment (DS Consultants Ltd. 2019). Note that a toe erosion allowance adjacent to the WWTF has not been recommended as it is beyond the scope of this investigation.

Table 7. Serson Creek – Recommended Toe Erosion Allowance (Reach S2 and S3)

Reach	Rapid Geomorphic Assessment (RGA)			Channel Bank	Toe Erosion Allowance[1]			
	Score	Condition	Dominant Mode of Adjustment	Native Soil Structure	Active Erosion (Y/N)	Within 15 m of toe of slope (Y/N)	Bankfull Width (m)	Setback (m)
S2	0.30	In Transition	Widening	Soft/Firm Cohesive Soil	Y	Y	< 5	**8**
S3 (right bank)	0.41	In Adjustment	Widening	Soft/Firm Cohesive Soil	Y	Y	< 5	**8**

[1] MNR Natural Hazards Technical Guides for River and Stream Systems – Table 3, p. 38.
[2] CVC Slope Stability Definition and Determination Guideline – p 5.

Legend

- Subject Property
- Watercourse (MNRF 2018)
- Reach Break
- Meander Belt Limit (Beacon 2019)
- Long Term Stable Top of Slope (DS Consulting)

Meander Belt | **Figure 3**

Serson Creek Rehabilitation Design
Lakeview Village, City of Mississauga

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Project: 217424
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Prepared by: DU
Checked by: AS

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The recommended toe erosion allowance of 8 m has been incorporated in the slope stability assessment for confined valley slopes (DS Consulting Ltd. 2019). As discussed in **Section 6.1**, the meander belt limit for Reach S3 of Serson Creek was adjusted to reflect the recommended long-term stable top of slope along the right bank of the valley slope. The recommended watercourse erosion hazard components (meander belt limit and long-term stable top of slope), are illustrated in **Figure 3**. The combined erosion hazard and flood hazard constraints are illustrated in **Appendix C** (Urbantech, 2019).

6.3 Policy Conformance

It is our opinion that the findings above, to support the determination of the erosion hazard limits, are in conformance with the Provincial Policy Statement (2014), MNR (2002) Technical Guide to River Erosion Hazards, the Peel Region Official Plan (2016), the City of Mississauga Official Plan (2017), and CVC Policies and Regulations.

7. Rehabilitation Design

The realignment of Serson Creek will be completed in two phase: 1) downstream from the flow diversion pipe to the Jim Tovey Lakeview Conservation Area, and 2) upstream from the flow diversion pipe to Lakeshore Road East. The second phase will be designed as part of a future project, dependent on property limits, and will incorporate aquatic and wildlife passage details for the proposed Haig Blvd. extension culvert crossing. The primary objective for the corridor design in phase one is to rehabilitate and enhance the Serson Creek corridor to carry redirected low flows away from the WWTF while improving flood conveyance, terrestrial and aquatic habitat quality and connectivity to the Jim Tovey Lakeview Conservation Area. The following sections provide an overview of the proposed corridor and low flow channel design considerations, bioengineering elements, and enhancement details. The design incorporates CVC Living by the Lake Action Plan (2018) objectives and recommendations for Serson Creek including stormwater management, habitat quality improvement and connectivity objectives. The overall corridor design is being completed by the LCPL consultant team.

The following channel rehabilitation design drawings have been included in the overall Functional NHS Design submission package completed by Urbantech:

- CH-1, CH-2, CH-3 - Plan and Profile;
- SEC-1, SEC-2, SEC-3, SEC-4 - Cross Sections; and
- D-1 - Restoration Details.

7.1 Design Considerations

The proposed channel design provides a riffle-pool channel with a more sinuous planform within the corridor. The channel is designed as a stable channel with bank stabilization treatments to minimize

channel movement. In developing the proposed channel design, the following objectives and constraints were considered:

- Upstream and downstream tie-in elevations – matching the channel bed and banks to the upstream existing outlet pipe and downstream extent of the proposed channel realignment will provide proper transitioning to the channel within the Jim Tovey Lakeview Conservation Area. The downstream tie-in limit will need to be confirmed with TRCA.

- Corridor capacity – The proposed design must meet or increase the corridor capacity in order to prevent increase in flood levels along Serson Creek. The channel corridor was designed by Urbantech to meet these objectives for flood storage and conveyance.

- Hazard mitigation – The urbanized peak flow regime and natural tendency of the channel to migrate and adjust must be addressed to ensure long-term stability and limit erosion. As the corridor is sized primarily for flood conveyance, the design incorporates appropriately-sized bioengineered measures to mitigate erosion impacts.

- Aquatic habitat enhancement – The proposed design will enhance the quality and function of existing aquatic habitat conditions, removal of barriers to fish passage, formalization of the low flow and bankfull channel, creation of pool-riffle sequences, introduction of in-stream habitat features, and redirection of base flow down the corridor and increased connectivity to the lake.

- Riparian and terrestrial habitat – The proposed design will enhance the quality and functions of riparian and terrestrial habitat types by introducing a greater diversity of habitat types and micro-habitat features for local wildlife. All created habitat will be vegetated with native species found in the watershed. The riparian and floodplain zones will planted with lowland and wetland species, while the valley slopes will be planted with native upland species.

- Construction timing – All in-water works will be carried out during the July 1 - March 31 construction window, or as otherwise stipulated by the approval agencies.

7.2 Design Elements

The following section provides an overview and supporting technical analysis for proposed corridor and channel design elements.

7.2.1 Channel Corridor

The proposed stream corridor design provides an opportunity to restore a more natural planform to Serson Creek. The corridor design is being completed by Urbantech and was sized primarily for flood storage and conveyance. We note that the proposed corridor dimension is limited by proposed future redevelopment, integration with the future land uses, and the limits of the WWTF. As a result of the land use constraints, flood modelling, and slope design, the proposed corridor floor ranges from 11 to 15 m in width. From a geomorphic perspective, if the corridor floor (i.e., lower floodplain) is not sufficiently

wide to accommodate long-term natural migration tendencies of the channel (i.e., meander belt width), additional design features should be included to mitigate potential erosion impacts.

7.2.2 Bankfull Channel

Dimensions for the riffles and pools were governed by the bankfull design discharge. Determination of the design discharge for the proposed channel design utilized the available peak flow information from CVC, as well as a field-based approach which utilizes information from the detailed assessment. Data from the detailed topographic survey (GHD 2015) was used to determine a reference flow by entering channel dimensions and governing energy gradient into the Manning's 'n' equation along with an estimated roughness coefficient. Based on this approach, the bankfull discharge was 1.64 m^3/s (GHD 2015). It was noted that Serson Creek upstream of the stormwater corridor had a terraced cross section with a lower bankfull channel and a larger upper terrace which conveyed approximately 6.90 m^3/s. This was similar to the estimated 2-yr flow of 5.0 m^3/s as provided by CVC. This larger corridor was likely formed during past channel realignment and floodplain filling. The smaller defined channel was more representative of a bankfull channel.

Bankfull flows for watercourses in Southern Ontario are typically between the 1 and 2-yr return period. However, when peak flows are considered, it appears that the governing bankfull discharge is much lower than the 2-yr flow. The estimated bankfull discharge was similar to the bankfull discharge of 1.40 m^3/s estimated as part of the EA (Parish Geomorphic, 2014).

Proposed riffle and pool geometries, as well as anticipated bankfull flow conditions, are provided in **Table 8**.

Table 8. Parameters of the Bankfull Channel – Serson Creek

Channel Parameter	Sta. 0+000 to 0+378		Sta. 0+378 to 0+561	
	Riffle	Pool	Riffle	Pool
Gradient (%)	2.20	0.46	4.70	0.73
Roughness (Manning's n)	0.045	0.037	0.045	0.037
Bankfull width (m)	2.90	3.45	2.15	4.00
Average bankfull depth (m)	0.36	0.48	0.36	0.57
Maximum bankfull depth (m)	0.55	0.90	0.75	1.10
Bankfull width-to-depth ratio	8	7	6	7
Discharge to accommodate (m^3/s)	1.64	1.64	1.64	1.64
Mean bankfull velocity (m/s)	1.58	1.03	2.14	1.43
Calc. Bankfull discharge (m^3/s)	1.65	1.70	1.67	3.26
Froude number	0.84	0.47	1.14	0.61
Maximum shear (bed) (N/m^2)	119	41	346	79
Stream power (W/m)	356	77	769	234
Unit stream power (W/m^2)	123	22	358	58
Max. grain size entrained (m)	0.12	0.04	0.33	0.09
Max. grain material	Cobble-Small	Gravel-Very Coarse	Boulder-Small	Cobble-Small
Mean grain size entrained (m)	0.09	0.03	0.19	0.06
Mean grain material	Cobble-Small	Gravel-Coarse	Cobble-Large	Gravel-Very Coarse

7.2.3 Hydraulic Modelling

The updated existing HEC RAS model was modified with the proposed design. The design velocities at stations within the lower corridor design are provided below in **Table 9**.

Table 9. Proposed conditions stream velocity summary for Serson Creek

Station	Range of Proposed Channel Velocities (m/s)	
	Channel	Floodplain
10588.4	1.46-2.40	0.40-0.81
1055	1.55-2.38	0.40-0.83
10466	1.44-2.24	0.39-0.75
10465	1.33-2.20	0.37-0.74
10464.6	1.36-2.29	0.38-0.76
10464	1.63-2.43	0.42-0.82
10351	1.52-2.39	0.41-0.79

Station	Range of Proposed Channel Velocities (m/s)	
	Channel	Floodplain
10350	1.48-2.47	0.40-0.83
10349.5	1.48-2.67	0.39-0.90
10349	1.68-2.83	0.43-0.95
10212	1.65-2.87	0.43-0.94
10211.9	1.68-2.76	0.45-1.02
10211.6	1.85-2.93	0.50-1.07
10211.4	1.82-2.93	0.52-1.02
10211	1.68-2.63	0.48-0.96
10118	1.55-2.52	0.46-0.91
10117.4	2.11-3.78	0.57-1.35
10117	2.24-3.54	0.18-0.71
10037	1.64-2.52	-

7.2.4 Substrate Sizing

The sizing of substrate materials was guided by a review of hydraulic conditions (i.e., tractive force, flow competency) within the typical channel cross-sections based on permissible velocities (Komar, 1987; Fischenich, 2001). Substrate sizing varies within the proposed upstream portion of the channel and the steeper downstream portion.

The upstream riffles will be composed of a mixture of approximately 25% 50-100 mm riverstone, 50% 100-150 mm riverstone, and 25% granular ‘b’ between the larger stone. The granular ‘b’ material will fill the interstitial spaces. The downstream riffles will be composed of a slightly coarser mixture of approximately 25% 150-200 mm riverstone, 50% 200-300 mm riverstone, and 25% granular ‘b’ between the larger stone. The larger substrate in the proposed mix will provide stability of the structure at the crest of the riffle and will be overlain with smaller substrate material. Channel stability for grade control is critical, and therefore a factor of safety was incorporated into the material stone sizing at the crest.

To mitigate erosion potential, vegetated rock buttresses have been proposed along the entire toe of slope for the corridor and most of the banks on the outside of meanders. Where adequate distance from slopes allowed, the remaining banks will be designed with woody debris bank treatments. A range of stone size of 300 mm to 500 mm will be used along the toe of slope and the outside banks. Given the hydraulic conditions within the corridor, any deflection or diversion of flows towards the toe of slope due to debris jams or other obstructions could result in higher velocities than the estimated overbank velocity. The factor of safety also takes into account other variables which could influence entrainment such as stone spacing, shape and ice plucking or abrasion.

7.2.5 Bioengineering Treatments and Habitat Features

- Vegetated rock buttress – will be installed along the entire toe of slope for the corridor, as well as, most outside meander banks. A vegetated rock buttress consists of the installation of a combination of rocks, vegetation and plantings to provide bank protection and promote flow training and deflection. The stone provides harder bioengineered protection, but also provides roughness to reduce the flow velocity, and morphological variability as plantings establish. The vegetation will also provide additional stability and enhance aquatic habitat by providing shade and overhanging vegetation.

- Woody debris bank treatment – will be installed on the remaining banks not designed with vegetated rock buttress. The woody debris bank treatment consists of the root fan or ball, and a portion of the tree trunk. They are typically installed at the toe of the channel bank and integrated with plantings. The bank is backfilled with stone to provide further bank protection and stability. This treatment acts to deflect erosive flows away from the channel bank while providing aquatic habitat. Scour may be enhanced at the base of the woody debris to provide additional habitat benefit. Woody debris also acts to collect sediment and debris, further protecting the channel bank from erosion.

- Offline wetland features – in the lower reach, offline wetland features will be installed on the floodplain next to the channel to provide greater variety in terrestrial habitat and a more natural floodplain form. These features will also provide a short-term water retention function as well as a sediment bank within the floodplain. The irregular form provides an increased perimeter for a given area and thus extensive transition zones between aquatic and terrestrial habitats.

- Woody debris habitat features – micro-habitat features for wildlife to provide greater variety in terrestrial habitat within the floodplain. The features are located sporadically along the floodplain and will consist of mounds of locally-sourced stable interconnected wood debris.

- Earth plug – will be installed along the channel at the upstream end to block off the existing bankfull channel redirecting flows along the new bankfull channel. The earth plug will consist of compacted fill protected by a vegetated rock buttress facing the bankfull channel. The lee side of the earth will be composed of cobble sized material mixed with topsoil and plantings to provide stability.

7.2.6 Riparian Zone

To improve the quality and function of the riparian habitats, the riparian zone will be planted with a diverse mix of native shrubs and groundcovers using nursery stock and terraseeding. The densities of the proposed plantings in the bioengineered treatments will provide for additional stability.

Landscaping plans for area outside the immediate channel riparian zone have been prepared by NAK Design Strategies (Drawings SC1, SC2, SC3, SC4), with ecological input from Beacon, and are presented under separate cover.

7.2.7 Interim Erosion Control

A non-woven erosion control blanket (i.e., coir cloth/jute mat) will be installed along the perimeter of the proposed channel bank, immediately following construction to provide immediate soil erosion protection while allowing the native vegetation to establish. Straw mulch cover and a native seed mix will also be placed in disturbed areas beyond the channel.

8. Conclusions

Beacon was retained by Lakeview Community Partners Limited to conduct a geomorphic assessment and prepare a channel rehabilitation design for a section of Serson Creek located adjacent to their property a at 800 Hydro Road, in the City of Mississauga. In support of development applications for the subject property, this report summarized the design details of the proposed rehabilitation of Serson Creek including characterization existing geomorphic conditions of Serson Creek on the subject property and an erosion hazard assessment for the existing corridor (i.e., meander belt and toe erosion allowance).

Key study findings of the geomorphic assessment are as follows:

- Reach S2 of Serson Creek was characterized as a historically modified channel situated within a confined valley;
- Reach S3 of Serson Creek was characterized as a well-defined channel situated within a partially confined valley;
- Rapid assessment techniques indicated that Reach S2 and Reach S3 of Serson Creek were characterized as ‘in-transition’ and ‘in adjustment’, respectively and both reaches displayed ‘fair’ overall ecological health;
- The recommended toe erosion allowance for Reach S2 and the confined right bank of Reach S3 is 8 m based on the MNR and CVC Technical Guidelines, and in consideration of the existing flow diversion through the WWTF;
- The erosion hazard limit for Reach S2 of Serson Creek is the long-term stable top of slope as determined by DS Consulting Ltd.; and
- The erosion hazard limit for partially confined Reach S3 is defined as follows:
  - East Side - meander belt limit; and
  - West Side - long-term stable top of slope (DS Consulting Ltd. 2019).

The proposed channel design provides a rehabilitated and enhanced section of the Serson Creek channel that while morphologically diverse, provides the channel stability required to maintain flood conveyance and improve terrestrial and aquatic habitat quality and connectivity. We note that the realignment of Serson Creek upstream to Lakeshore Road will be designed as part of a future project phase and will incorporate wildlife passage details for the proposed Haig Blvd. extension culvert crossing of the channel. To assist with the implementation of the channel rehabilitation design, the following recommendations are provided and should be incorporated, where appropriate, in the design drawings and contract documents:

- Pre-Construction Meeting – A start-up meeting should be held with all project team members to ensure that the contractor and site personnel are aware and familiar with the approved

activities, monitoring requirements, and their rationale. All participating approval agencies shall be notified of the meeting, anticipated start-up construction date and schedule.

- Permits – Prior to construction, all applicable permits shall be provided to the project team members and contractor. The permits will be reviewed to ensure that all pertinent timelines and conditions are understood by the responsible parties. Valid copies of the permits shall be kept onsite and by key personnel responsible for carrying out conditions of the permits. The Contract Administrator must be notified if there is any deviation from the permit conditions that may impact implementation of the approved activities.

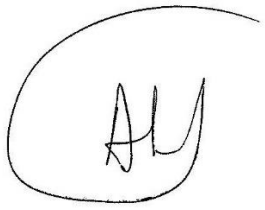
- Phasing and Erosion and Sediment Control (PESC) – It is recommended that channel works be constructed in the dry and stabilized prior to the introduction of flows. Phasing plans and erosion and sediment control plan will need to be developed based on the coordination with agencies, proposed development phasing and the WWTF. The erosion and sediment control plan should incorporate best management practices (BMPs) and follow pertinent guideline documents during all phases of construction in accordance with site conditions.

- Construction Inspection – A qualified inspector should be present or available during construction to ensure proper implementation of approved drawings, design details, construction techniques, and permit conditions. Inspection will enable immediate and appropriate response to construction issues, ensure function of the design, and that the constructed design elements are stable prior to connection with the active channel system. A construction monitoring report should be completed to document the implementation of the approved activities.

- Site Maintenance – All materials and equipment shall be properly maintained to prevent deleterious substances from entering the water. All vehicles and equipment entering the isolated channel area shall be free of fluid leaks and externally cleaned/degreased to prevent deleterious substances from entering the water. A staging/storage area, with appropriate erosion controls, shall be placed well away from the work area. All vehicle and equipment refuelling and/or maintenance shall be conducted in the staging/storage area.

- Post-Construction Monitoring – Monitoring requirements will be confirmed in consultation with CVC. However, it is recommended that a general field reconnaissance along the entire length of the constructed design immediately after the first large flooding event to identify any potential areas of concern. In addition, it is recommended that monitoring include:
    - Repeated detailed monitoring of the cross-sectional shape and longitudinal profile immediately following construction to obtain reference data for comparison with subsequent surveys;
    - Monumented (georeferenced and same direction) photographs to observe the performance of geomorphic and habitat features; and
    - Survey of condition of riparian plantings two years post construction.

Prepared by:
Beacon Environmental



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Appendix A

Historical Aerial Imagery (GHD, 2015)

Legend

Subject Property

Historical Aerial Imagery	1946
Geomorphic Assessment, Serson Creek Lakeview Village, City of Mississauga	
BEACON ENVIRONMENTAL	Project: 217424 Last Revised: August, 2019
Client: Lakeview Community Partners	Prepared by: DU Checked by: AS
N 1:12,000	0 150 300 m

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Legend

Subject Property

Historical Aerial Imagery	1954
Geomorphic Assessment, Serson Creek Lakeview Village, City of Mississauga	
BEACON ENVIRONMENTAL	Project: 217424 Last Revised: August, 2019
Client: Lakeview Community Partners	Prepared by: DU Checked by: AS
N 1:12,000	0 150 300 m

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Legend

Subject Property

Historical Aerial Imagery	1978
Geomorphic Assessment, Serson Creek Lakeview Village, City of Mississauga	
BEACON ENVIRONMENTAL	Project: 217424 Last Revised: August, 2019
Client: Lakeview Community Partners	Prepared by: DU Checked by: AS
N 1:12,000	0 150 300 m

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Legend

Subject Property

Historical Aerial Imagery	2002
Geomorphic Assessment, Serson Creek Lakeview Village, City of Mississauga	
BEACON ENVIRONMENTAL	Project: 217424 Last Revised: August, 2019
Client: Lakeview Community Partners	Prepared by: DU Checked by: AS
N 1:12,000	0 150 300 m

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Legend

Subject Property

Historical Aerial Imagery	2009
Geomorphic Assessment, Serson Creek Lakeview Village, City of Mississauga	
BEACON ENVIRONMENTAL	Project: 217424 Last Revised: August, 2019
Client: Lakeview Community Partners	Prepared by: DU Checked by: AS
N 1:12,000	0 150 300 m

Contains information licensed under the Open Government License–Ontario Orthoimagery Baselayer: FBS Mississauga 2009

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Appendix B

Photographic Record

Photo 1. Location 1.
Reach S3. Upstream view of designed cobble lined channel and Lakeshore Road E culvert. September 21, 2018.

Photo 2. Location 1.

Reach S3. Downstream view of designed cobble lined channel. September 21, 2018.

Photo 3. Location 2.

Upstream view of Reach S3 general conditions. September 21, 2018.

Photo 4. Location 3.
Reach S3. Upstream view of rooted knickpoint leading into pool. September 21, 2018.

Photo 5. Location 4.
Reach S3. Upstream view of pool with terracing on right bank. September 21, 2018.

Photo 6. Location 5.

Reach S3. Floodplain along top of right bank, view towards Lakeshore Road E. September 21, 2018.

Photo 7. Location 6.
Reach S3. Downstream view of backwatering from beaver activity at channel confluence. September 21, 2018.

Photo 8. Location 7.
Reach S2. Upstream view towards property line at top end of reach. September 28, 2018.

Photo 9. Location 8.
Reach S2. Downstream view of woody debris jam. September 28, 2018.

Photo 10. Location 9.
Reach S2. Downstream view of typical valley section: confined slope on right bank. September 28, 2018.

Photo 11. Location 10.
Reach S2. Rip-rap protection along lower bank. September 28, 2018.

Photo 12. Location 11.
General conditions downstream in Reach S2. September 28, 2018.

Photo 13. Location 12.
Reach S2. General wooded valley and channel location. September 28, 2018.

Photo 14. Location 13.

Reach S2. Widening channel at property line due to backwatering and variable lake levels. September 28, 2018.

Appendix C

Consolidated Flood and Erosion Hazard Constraints Figure (Urbantech 2019)

LAKESHORE ROAD EAST

Plaster Form Inc.

EXISTING TRCA HAUL ROAD

LAKEVIEW VILLAGE

G.E.BOOTH WASTEWATER TREATMENT PLANT

SERSON CREEK

LEGEND

- 247.00 — EXISTING CONTOUR AND ELEVATION
- LAKEVIEW PROPERTY LIMIT
- EXISTING REGIONAL FLOODLINE
- MEANDER BELT LIMIT
- LONG TERM STABLE TOP OF SLOPE
- EXISTING OPEN CHANNEL C/L
- EXISTING OPEN DITCH C/L
- EXISTING DISCONNECTED CHANNEL C/L

BEACON ENVIRONMENTAL

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tel: 905.946.9461 fax: 905.946.9595
www.urbantech.com

LAKE VIEW COMMUNITY

EXISTING VS. MODIFIED GHD DESIGN CONSTRAINT

DWG No A

SCALE: 1:800 | DATE: SEP. 2019 | PROJECT No: 17-549

File: P:\Projects\17-549-OPG Lakeview\Reports\FSR\Figures\17-549-Existing vs modified GHD (9m).dwg • Revised by <DLEE> : Fri, Oct 26 2018 - 2:38pm

APPENDIX B

Geotechnical Slope Stability Assessment

DS Consulting (July 2019)

Report on

Geotechnical Slope Stability Assessment
Serson Creek
Lakeview Village, 800 Hydro Road
Mississauga, Ontario

Prepared For:

Lakeview Community Partners Limited

Project No. 18-519-102
July 19, 2019

DS CONSULTANTS LTD.
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Vaughan, Ontario, L4H 0K8
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Table of Contents

FIGURES

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Lakeview Community Partners Limited to undertake a geotechnical slope stability assessment for the Serson Creek bank slopes for the proposed Lakeview Village development at 800 Hydro Road in Mississauga, Ontario.

The purpose of this study was to assess the stability of the existing west bank slope of Serson Creek and determine the location of the long-term stable top of slope (LTSTOS) line.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional 0borings and reporting before the recommendations can cater to the changed design.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Lakeview Community Partners Limited, its architect and designers. Use of this report by third party without DS consent is prohibited.

2. SUBSURFACE CONDITIONS

DS Consultants Ltd. carried out a preliminary geotechnical investigation, documented in the report No. 18-519-10, dated October 15, 2018. Nine (9) boreholes (BH18-01, BH18-03, BH18-04, BH18-36, BH18-38, BH18-41, BH18-42, BH18-43, and BH18-48) were drilled near the creek area. The borehole location plan and relevant borehole logs are attached in **Appendix A**. The subsurface information in these boreholes are used in this slope stability study.

Fill materials to variable depths were encountered in all boreholes, consisting of clayey silt, silty clay, sandy silt to sand. The fill was in a loose to compact state, with measured SPT 'N' values ranging from 4 to over 15 blows per 300 mm penetration. The native soils consisted of cohesive deposits of clayey silt to silty clay (till) and cohesionless deposits of silt, sandy silt to sand. Shale bedrock in the boreholes was at depths ranging from 3.1 m to more than 20 m.

Groundwater in the boreholes was within 6 m below the surface. In the slope area near the creek, the groundwater level will fluctuate with the water level in the creek.

3. SLOPE CONDITIONS AND PROFILES

A site visit was made by a senior geotechnical engineer from DS Consultants Ltd. on June 17, 2019. Selected photographs taken during our site visits are presented in **Appendix B**. The subject creek slopes are located between Lakeshore Blvd and about 100 m north of Lake Ontario.

For the convenience of discussion, Lakeshore Blvd. in the area is assumed in the east-west alignment. There is an existing bridge for the excess road from WWTP to the site. According to the slope conditions, the creek slopes are considered consisting of 2 reaches as follows:

- Reach S2 is located from the access road bridge to Lake Ontario, along the WWTP and the access road.
- Reach S3 is located from Lakeshore Blvd to the access road bridge.

Based on our site observations, the slope conditions are described as follows:

- The slope in Reach 3 area was generally 2 to 3 m in height, with steepness of 2H:1V to 3H:1V or flatter.
- The height of the west bank slope in Reach S2 area ranged from about 6 m near the bridge to about 3 m near the lake, decreasing toward south. The steepness of the slope was about 2H:1V to 3H:1V or flatter. At the south part, there was a ditch of 1 to 1.5 m in depth between the creek slope and the access road (see Photos B17 and B18 in **Appendix B**).
- The slope surface is generally well covered with mature trees and other vegetation.
- The width of the creek was generally 2 to 3 m. The water depth of creek was within 0.5 m during our site visit on June 17, 2019, while the creek bed in the area near the access road bridge was dry.
- No evidence of slope failure was observed during our site visit. Slope toe erosion at the creek water level were observed at various locations along the creek.

The existing slope profiles at 14 Sections (A-A to N-N, see Figure 1 for locations) were provided to us by Urbantech, as presented on Figures 2 to 15.

4. EROSION CONSIDERATIONS

In the Geomorphic Assessment Report by Beacon Environmental Limited, a long-term toe erosion allowance of 8 m is recommended for the Serson Creek bank slopes across the site (Reach S2 and S3). This recommended toe erosion allowance for the creek bank slopes is used in the slope stability assessment.

5. SOIL PARAMETERS

Based on the borehole information and our site observations, soil parameters used in the slope stability analyses are given on **Table 1**.

Table 1: Soil Parameters for Long-term Slope Stability Analyses

Soil Type	Unit Weight (kN/m^3)	Cohesion c' (kPa)	Friction Angle ϕ' (degree)
Fill	20	0	30
Silty clay/clayey silt	21	5	28
Compact sandy silt to sand	21	0	32
Dense sandy silt to sand	21	0	34

6. STABILITY ANALYSES OF EXISTING SLOPES

The existing slope profiles at Sections A-A to N-N (see Figure 1 for locations) are presented on Figures 2 to 15. Long-term stability analyses of the existing slopes at three typical Sections A-A, L-L and N-N have been carried out with the computer program SLIDE (Version 8) using the Simplified Bishop method, Simplified Janbu method and GLE/Morgenstern-Price method. The analysis results are presented in Figures 16 to 18 and are summarized on Table 2 below.

Table 2: Long-term Stability Analysis Results of Existing Slopes

Slope Location	Approximate Steepness	Calculated Factor of Safety (FS)	Long-Term Stability
Section A-A (See Figure 16)	2H:1V	1.23	FS<1.5, Not stable
Section L-L (See Figure 17)	2.5H:1V	1.56	FS>1.5, Stable
Section N-N (See Figure 18)	2.2H:1V	1.43	FS<1.5, Not Stable

The calculated factor of safety of the existing slope at Section L-L is 1.56, which is greater than the CVC's minimum acceptable value of 1.5. The existing slope at Section L-L is considered stable in terms of long-term stability based on CVC's requirements.

The calculated factors of safety of the existing slopes at Sections A-A and N-N range from 1.23 to 1.43, which are less than the CVC's minimum acceptable value of 1.5. The existing slopes at Sections A-A and N-N are considered not stable in terms of long-term stability based on CVC's requirements.

7. STABILITY ANALYSES OF LONG-TERM STABLE SLOPE

As discussed previously, the existing slope at Section L-L is about 2.5H:1V, and is considered stable in terms of long-term stability. The existing slopes at Sections A-A and N-N are relatively steeper, and are considered not stable in terms of long-term stability.

For long-term stability, a toe allowance of 8 m is also required for analysing the long-term stable slope.

In order to determine the long-term stable slope, analysis of a 2.5H:1V slope with a toe erosion allowance of 8 m at Section A-A have been carried out, and the results are presented on Figure 19. The calculated factor of safety of the 2.5H:1V slope at Section A-A is 1.62, which is greater than the minimum acceptable value of 1.5. Similarly, stability analyses of stable slopes at Sections L-L and N-N are carried out, and the results are presented on Figures 20 and 21. Table 3 presents a summary of the results of long-term stable slopes.

Table 3: Long-term Stability Analysis Results of Stable Slopes

Slope Location	Approximate Steepness	Toe Erosion Allowance (m)	Calculated Factor of Safety (FS)	Long-Term Stability
Section A-A (See Figure 19)	2.5H:1V	8.0	1.53	FS>1.5, Stable
Section L-L (See Figure 20)	2.5H:1V	8.0	1.57	FS>1.5, Stable
Section N-N (See Figure 21)	2.5H:1V	8.0	1.57	FS>1.5, Stable

The factor of safety values of the slopes as summarized on Table 3 are greater than the minimum required value of 1.5. Based on the analysis results, it can be concluded that a slope of 2.5H:1V with a toe erosion allowance of 8m is stable and acceptable in terms of long-term stability.

8. LONG-TERM STABLE TOP OF SLOPE (LTSTOS)

Based on the slope stability analysis results presented above, Points “S1”, “S12” and “S14” in Figures 19 to 21 represent the long-term stable top of slope (LTSTOS) at Sections A-A, L-L and N-N, respectively. Accordingly, Points “S1”, “S12” and “S14” are also shown in profile Figures (Figure 2, Figure 13 and Figure 15) at Sections A-A, L-L and N-N, respectively.

Similarly, the long-term stable top of slope (LTSTOS) at other sections (B-B to K-K, and N-N) can be obtained using a stable slope of 2.5H:1V and a toe erosion allowance of 8m, as shown in Figures 3 to 12, and Figure 14.

Based on the analysis results, the points representing the long-term stable top of slope (LTSTOS) at Sections A-A to N-N are as follows.

- Point “S1” on Figure 2 represents the long-term stable top of slope at Section A-A.
- Point “S2” on Figure 3 represents the long-term stable top of slope at Section B-B.
- Point “S3” on Figure 4 represents the long-term stable top of slope at Section C-C.
- Point “S4” on Figure 5 represents the long-term stable top of slope at Section D-D.
- Point “S5” on Figure 6 represents the long-term stable top of slope at Section E-E.
- Point “S6” on Figure 7 represents the long-term stable top of slope at Section F-F.
- Point “S7” on Figure 8 represents the long-term stable top of slope at Section G-G.
- Point “S8” on Figure 9 represents the long-term stable top of slope at Section H-H.
- Point “S8” on Figure 10 represents the long-term stable top of slope at Section I-I.
- Point “S10” on Figure 11 represents the long-term stable top of slope at Section J-J.
- Point “S11” on Figure 12 represents the long-term stable top of slope at Section K-K.
- Point “S12” on Figure 13 represents the long-term stable top of slope at Section L-L.
- Point “S13” on Figure 14 represents the long-term stable top of slope at Section M-M.
- Point “S14” on Figure 15 represents the long-term stable top of slope at Section N-N.

Based on the long-term stable top of slope (LTSTOS) at Sections A-A to N-N, and our field observations, the recommended long-term stable top of slope line (**Line S10-S11 … S8-S9)** is shown on Figure 1.

The derived the long-term stable top of slope (LTSTOS) line is based on the grade at the time of site survey for the topographic map in Figure 1. Where the grade elevation in the area along the creek slope has changed since the site survey, the location of long-term stable top of slope (LTSTOS) line may need to be adjusted.

9. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the

test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD.

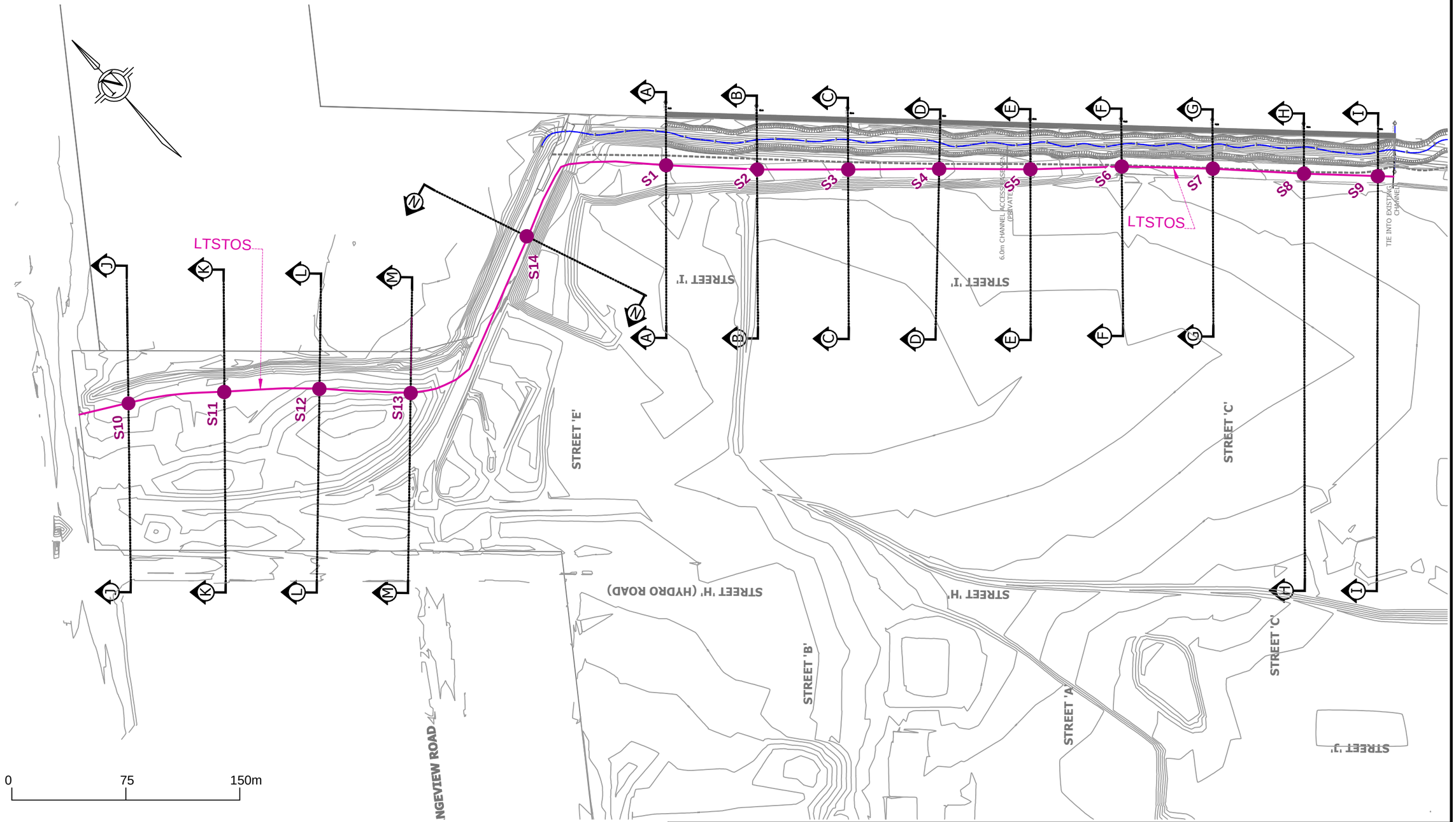
LICENSED PROFESSIONAL ENGINEER
A. SANGAR
100141185
PROVINCE OF ONTARIO

Alka Sangar, M.Eng., P.Eng.

LICENSED PROFESSIONAL ENGINEER
F. ZHU
PROVINCE OF ONTARIO

Fanyu Zhu, Ph.D., P.Eng.

Figures



Long-Term Stable Top of Slope (LTSTOS) Line
(S10 - S11 .....S8 - S9)

Path:----

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

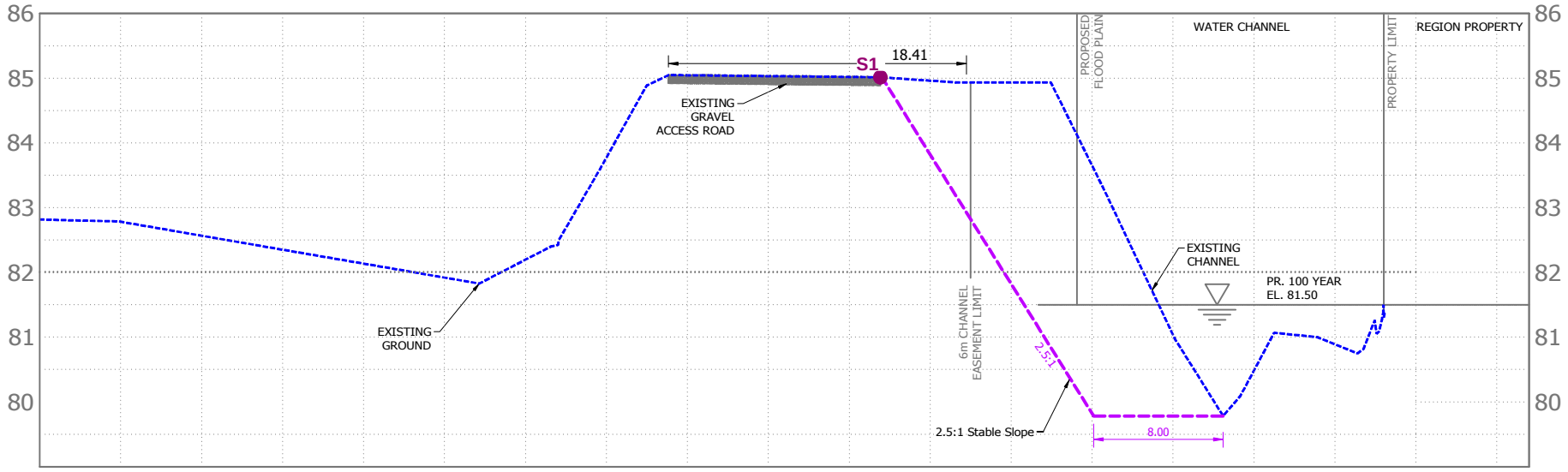
Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE LOCATION PLAN**

Client: LAKEVIEW COMMUNITY PARTNERS LIMITED

Size:	Approved By:	Drawn By:	Date:
11 X 17	F.Z	S.Y	July 2019
Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. 1

Path:j:\2018 projects\18-519-102 slope stability at serson creek_lakeview community partners limited\drawings\17-549-existing serson creek sections - sept 03.dwg



SECTION A-A
ALTERNATIVE
STA.0+087

0 5 10m

Horizontal Scale

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6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION A-A**

Client: LAKEVIEW COMMUNITY PARTNERS LIMITED

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	F.Z	S.Y	July 2019
Rev.	Scale:	Project No:	Figure No.
	As Shown	18-519-102	**2**

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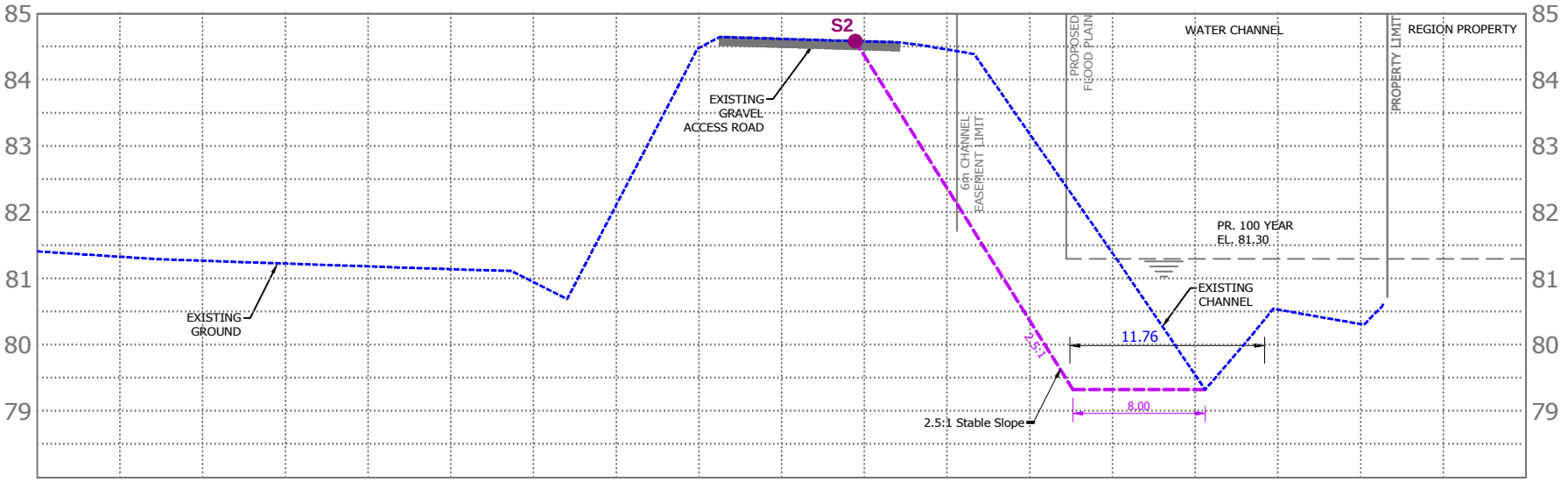

SECTION B-B
ALTERNATIVE
STA.0+147

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD. 6221 Highway 7, UNIT 16 Vaughan, Ontario L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project: SERSON CREEK SLOPE STABILITY ASSESSMENT			
	Title: **SLOPE PROFILE AT SECTION B-B**			
Client: LAKEVIEW COMMUNITY PARTNERS LIMITED	Size: 8.5 x 11	Approved By: F.Z	Drawn By: S.Y	Date: July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **3**

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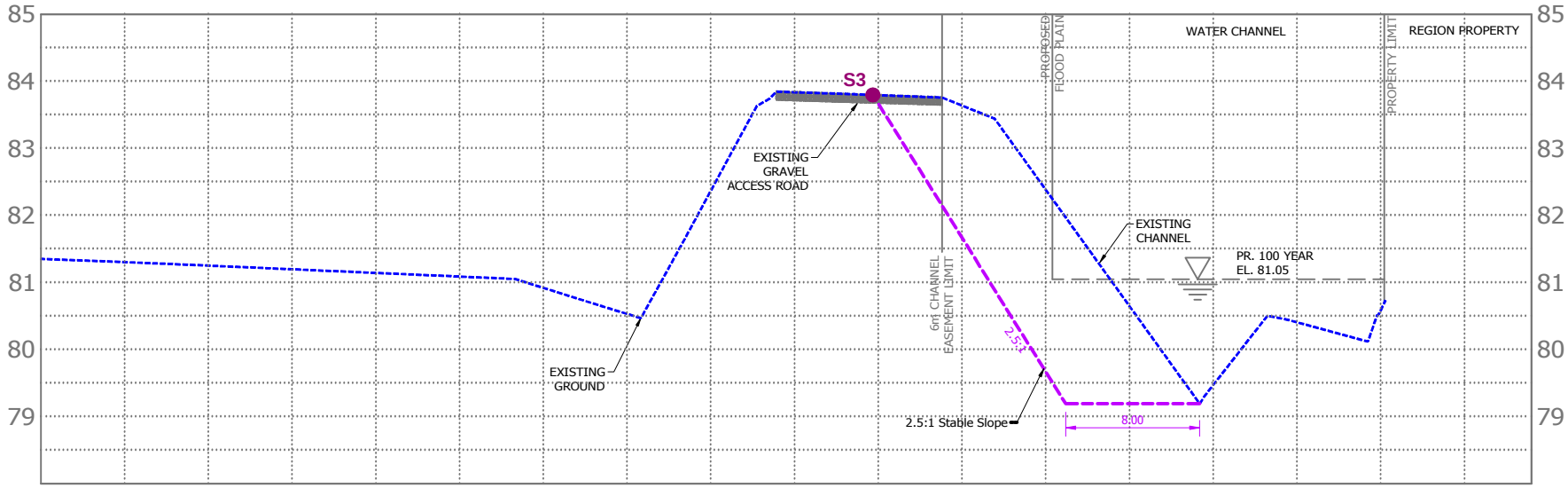

SECTION C-C
ALTERNATIVE
STA.0+207

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD. 6221 Highway 7, UNIT 16 Vaughan, Ontario L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project: SERSON CREEK SLOPE STABILITY ASSESSMENT			
	Title: **SLOPE PROFILE AT SECTION C-C**			
Client: LAKEVIEW COMMUNITY PARTNERS LIMITED	Size: 8.5 x 11	Approved By: F.Z	Drawn By: S.Y	Date: July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **4**

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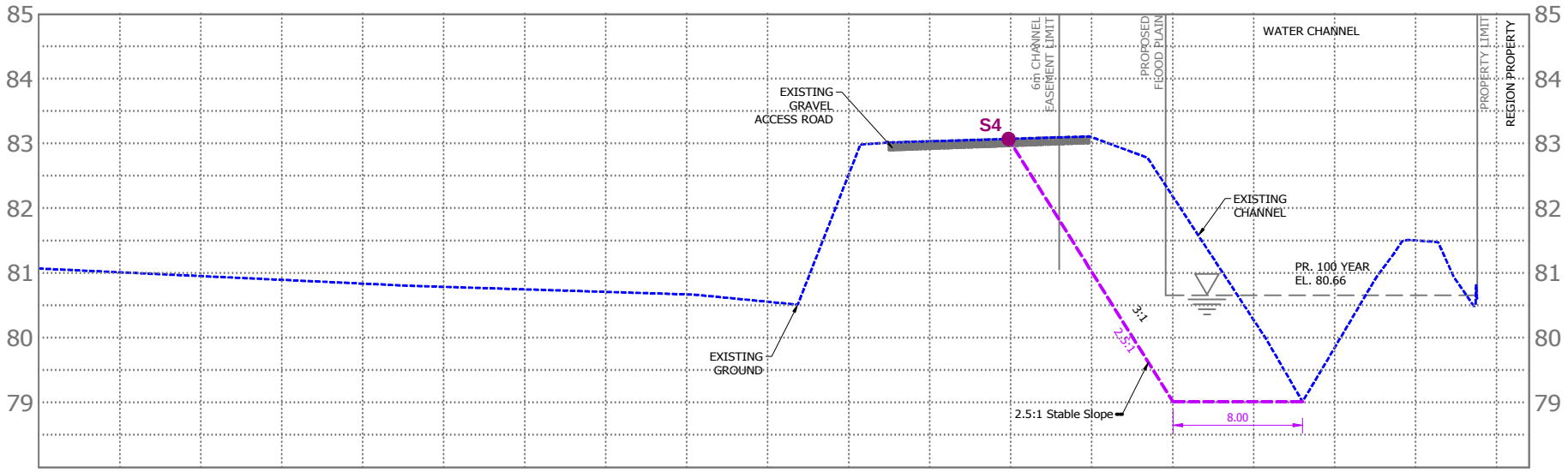

SECTION D-D
ALTERNATIVE
STA.0+268

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION D-D**

Client: LAKEVIEW COMMUNITY PARTNERS LIMITED

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	F.Z	S.Y	July 2019
Rev.	Scale:	Project No:	Figure No.
	As Shown	18-519-102	**5**

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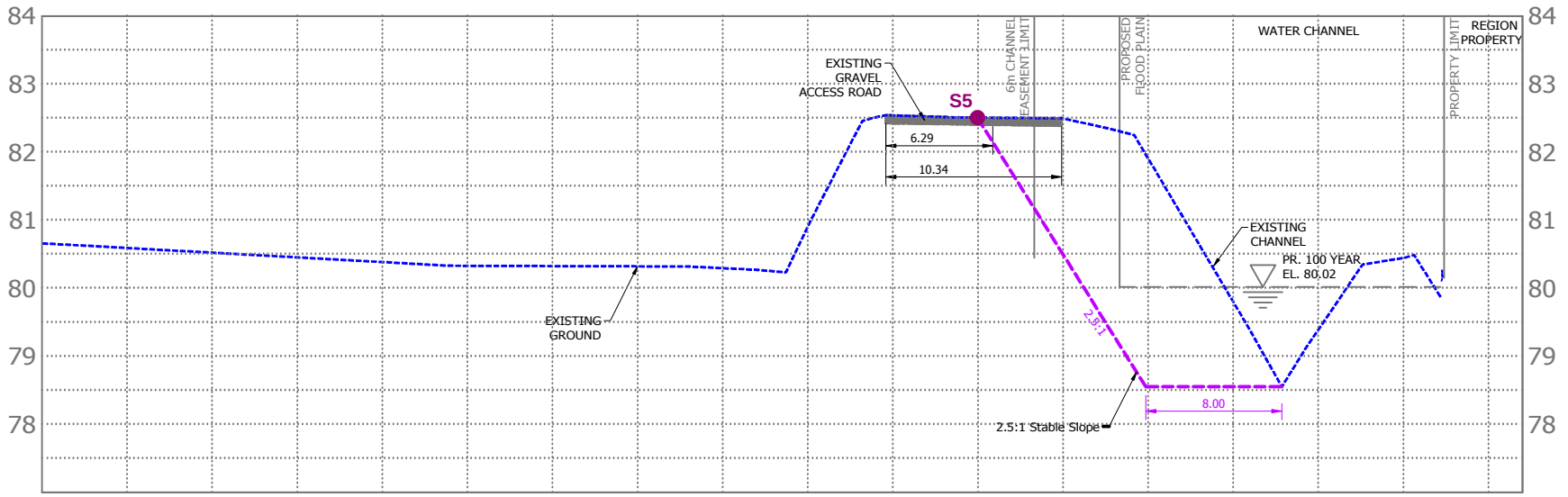


SECTION E-E
ALTERNATIVE
STA.0+328

0 5 10m

Horizontal Scale

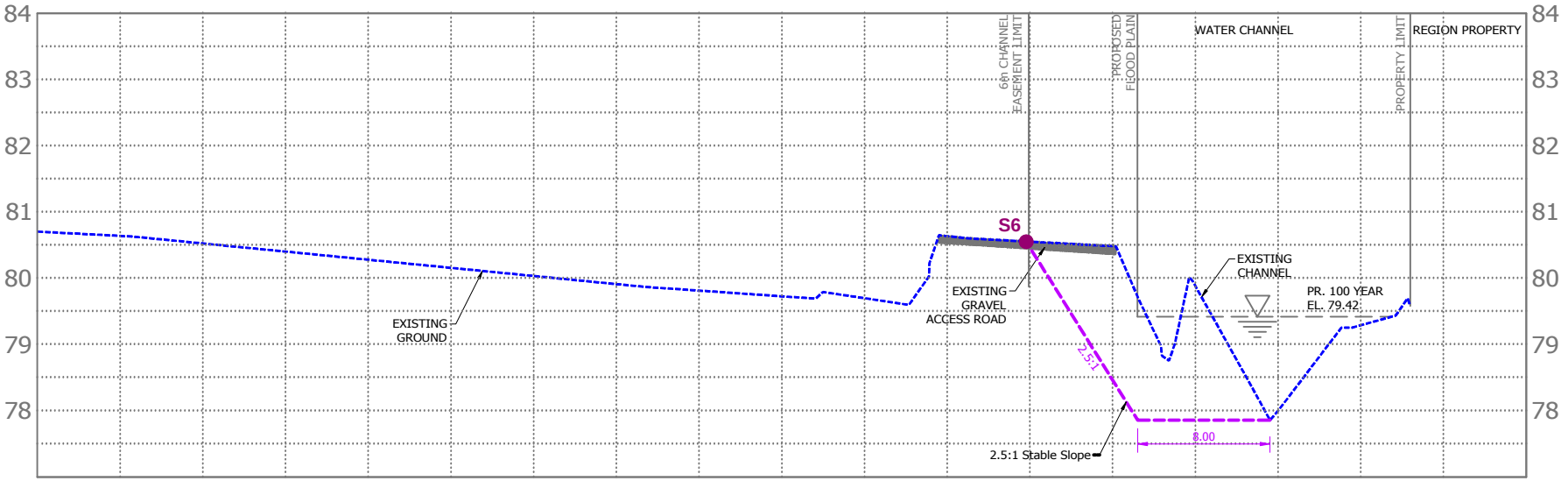
DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION E-E**

Client:	Size:	Approved By:	Drawn By:	Date:
LAKEVIEW COMMUNITY PARTNERS LIMITED	8.5 x 11	F.Z	S.Y	July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. 6

Path:j:\2018 projects\18-519-102 slope stability at serson creek_lakeview community partners limited\drawings\17-549-existing serson creek sections - sept 03.dwg



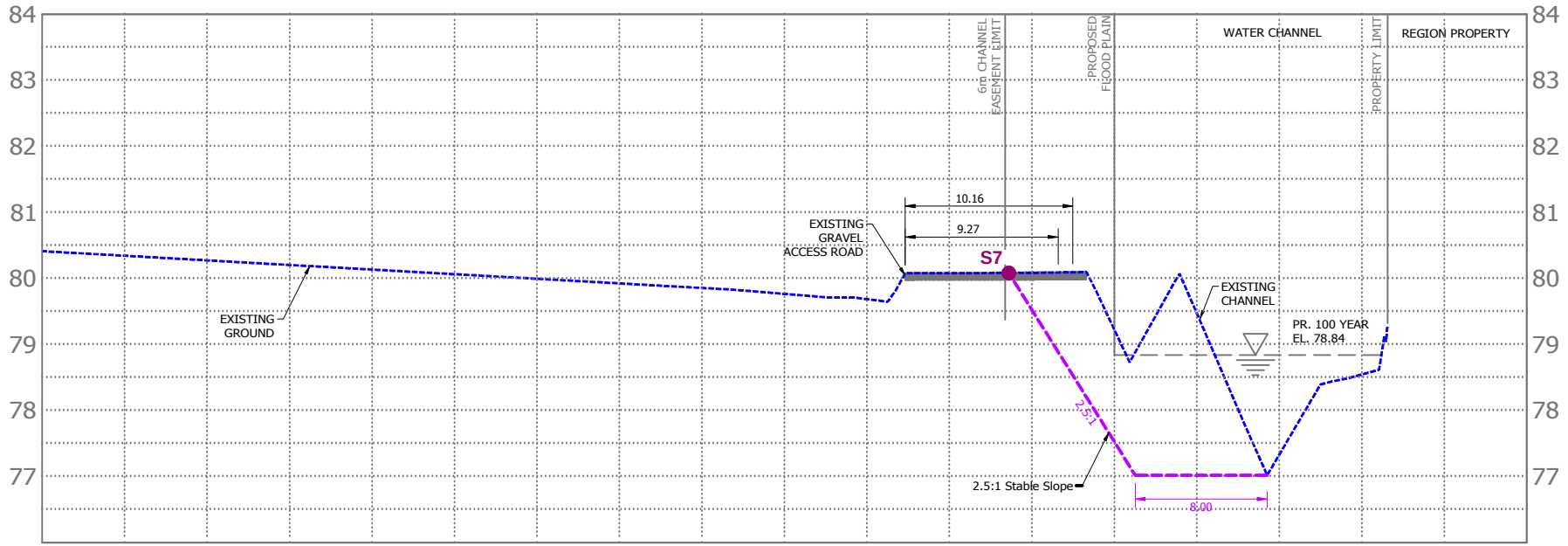
SECTION F-F
ALTERNATIVE
STA.0+389

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD. 6221 Highway 7, UNIT 16 Vaughan, Ontario L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project: SERSON CREEK SLOPE STABILITY ASSESSMENT			
	Title: **SLOPE PROFILE AT SECTION F-F**			
Client: LAKEVIEW COMMUNITY PARTNERS LIMITED	Size: 8.5 x 11	Approved By: F.Z	Drawn By: S.Y	Date: July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **7**

Path:j:\2018 projects\18-519-102 slope stability at serson creek_lakeview community partners limited\drawings\17-549-existing serson creek sections - sept 03.dwg



SECTION G-G
ALTERNATIVE
STA.0+448

0 5 10m

Horizontal Scale

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6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION G-G**

Client:	Size:	Approved By:	Drawn By:	Date:
LAKEVIEW COMMUNITY PARTNERS LIMITED	8.5 x 11	F.Z	S.Y	July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **8**

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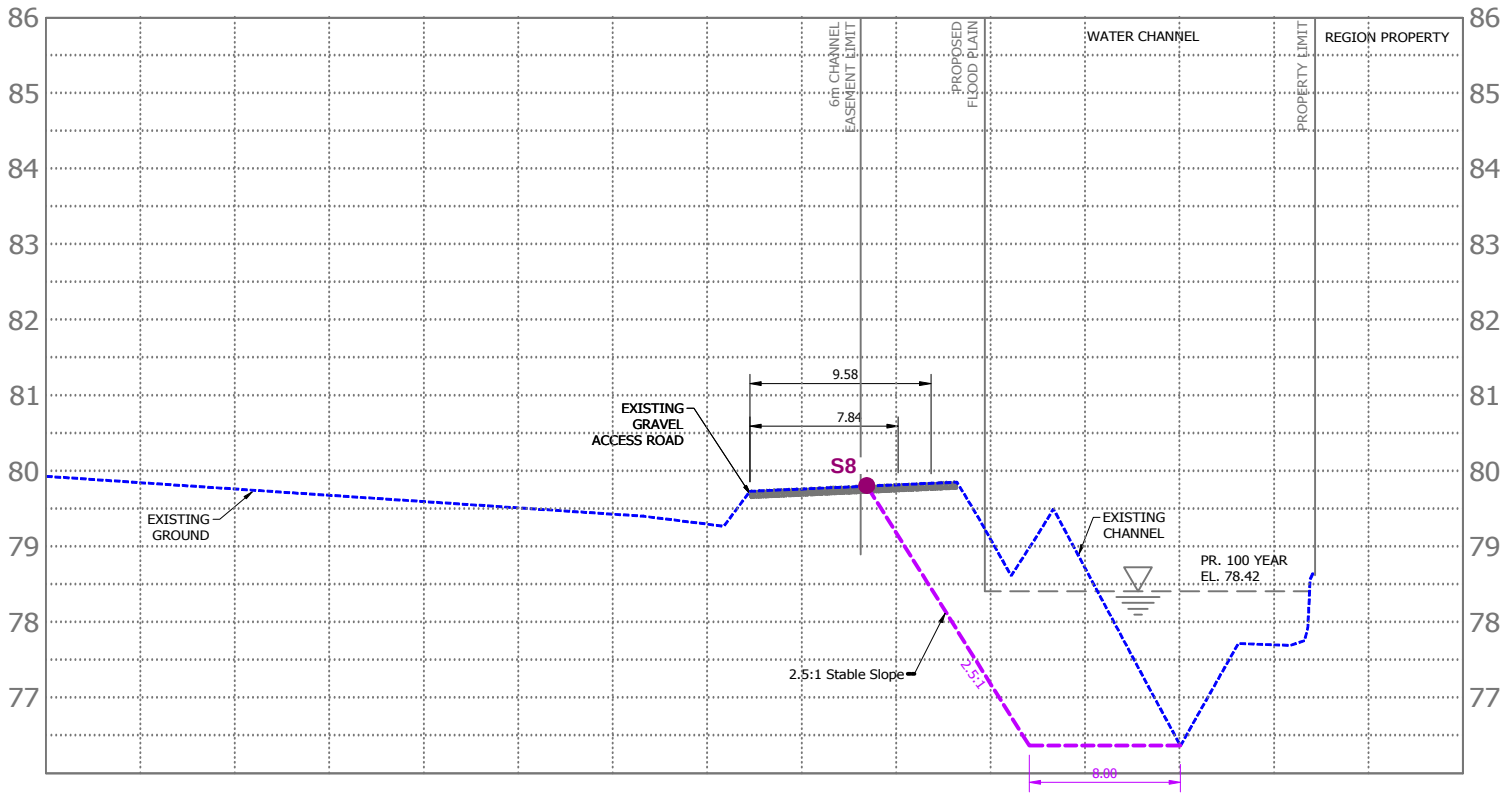

SECTION H-H
ALTERNATIVE
STA.0+510

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD.
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Vaughan, Ontario L4H 0K8
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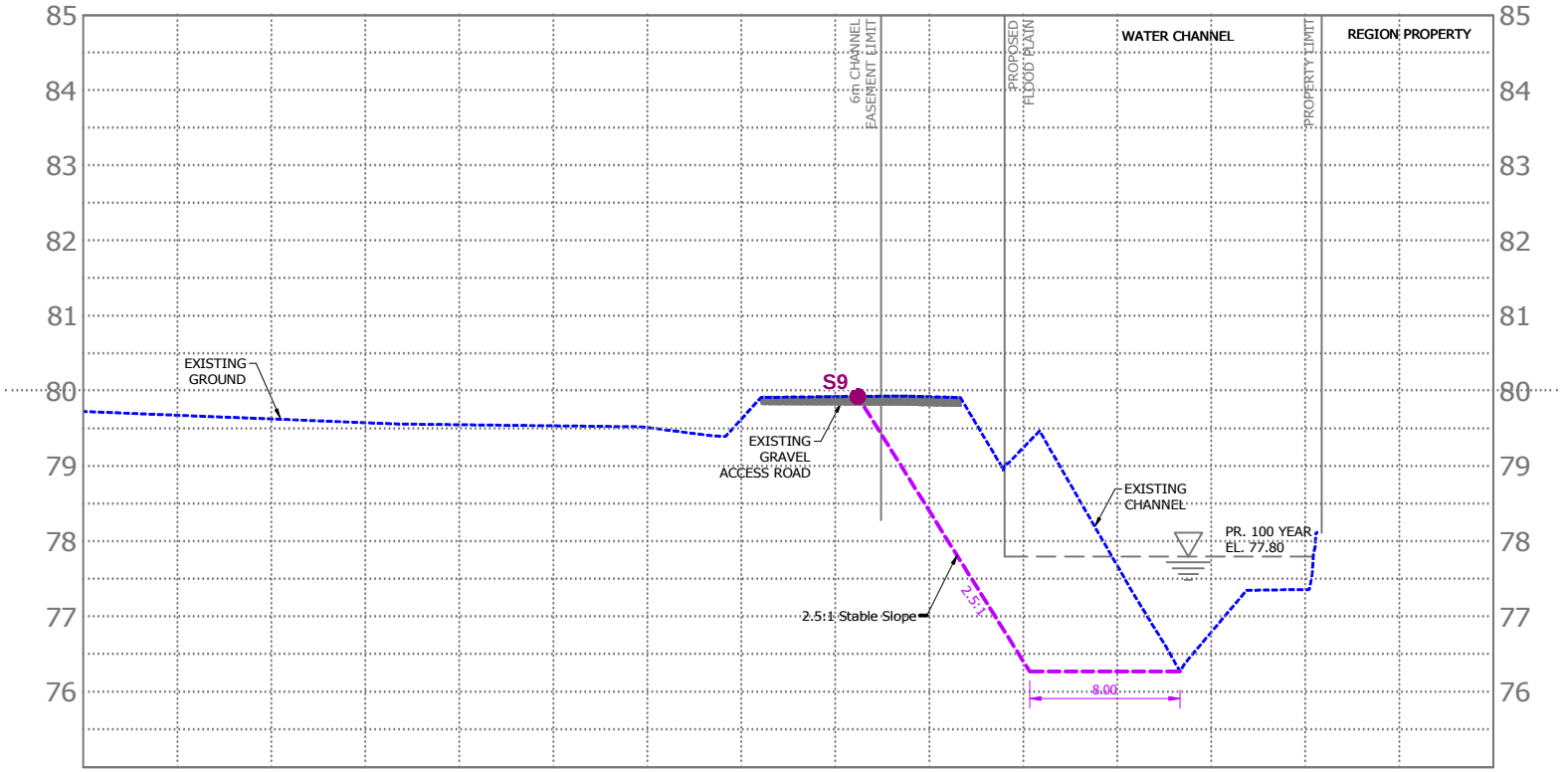
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION H-H**

Client:	Size:	Approved By:	Drawn By:	Date:
LAKEVIEW COMMUNITY PARTNERS LIMITED	8.5 x 11	F.Z	S.Y	July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. 9

Path:j:\2018 projects\18-519-102 slope stability at serson creek_lakeview community partners limited\drawings\17-549-existing serson creek sections - sept 03.dwg



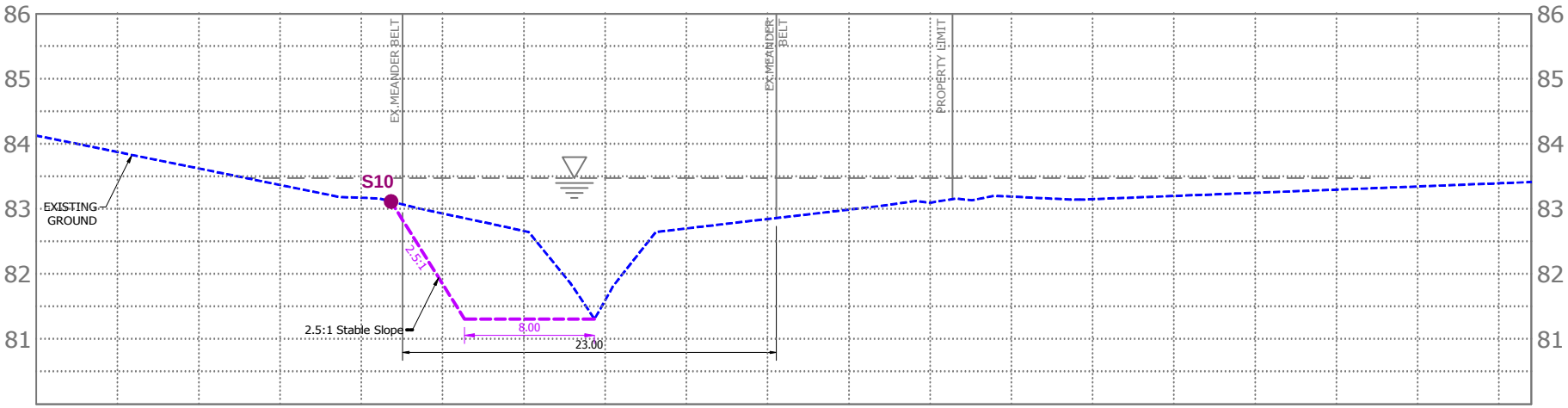
SECTION I-I
ALTERNATIVE
STA.0+087

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD. 6221 Highway 7, UNIT 16 Vaughan, Ontario L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project: SERSON CREEK SLOPE STABILITY ASSESSMENT			
	Title: **SLOPE PROFILE AT SECTION I-I**			
Client: LAKEVIEW COMMUNITY PARTNERS LIMITED	Size: 8.5 x 11	Approved By: F.Z	Drawn By: S.Y	Date: July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **10**

Path:j:\2018 projects\18-519-102 slope stability at serson creek_lakeview community partners limited\drawings\17-549-existing serson creek sections - sept 03.dwg



SECTION
J-J (1)

0 5 10m

Horizontal Scale

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6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION J-J**

Client: LAKEVIEW COMMUNITY PARTNERS LIMITED

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	F.Z	S.Y	July 2019
Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. 11

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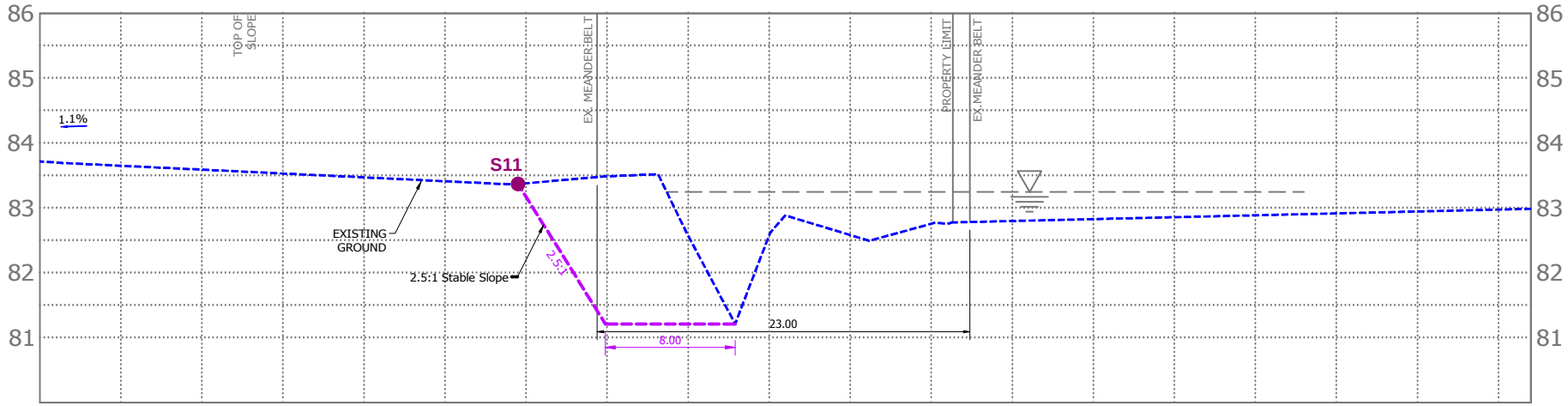

SECTION
K-K (1)

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION K-K**

Client:	Size:	Approved By:	Drawn By:	Date:
LAKEVIEW COMMUNITY PARTNERS LIMITED	8.5 x 11	F.Z	S.Y	July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **12**

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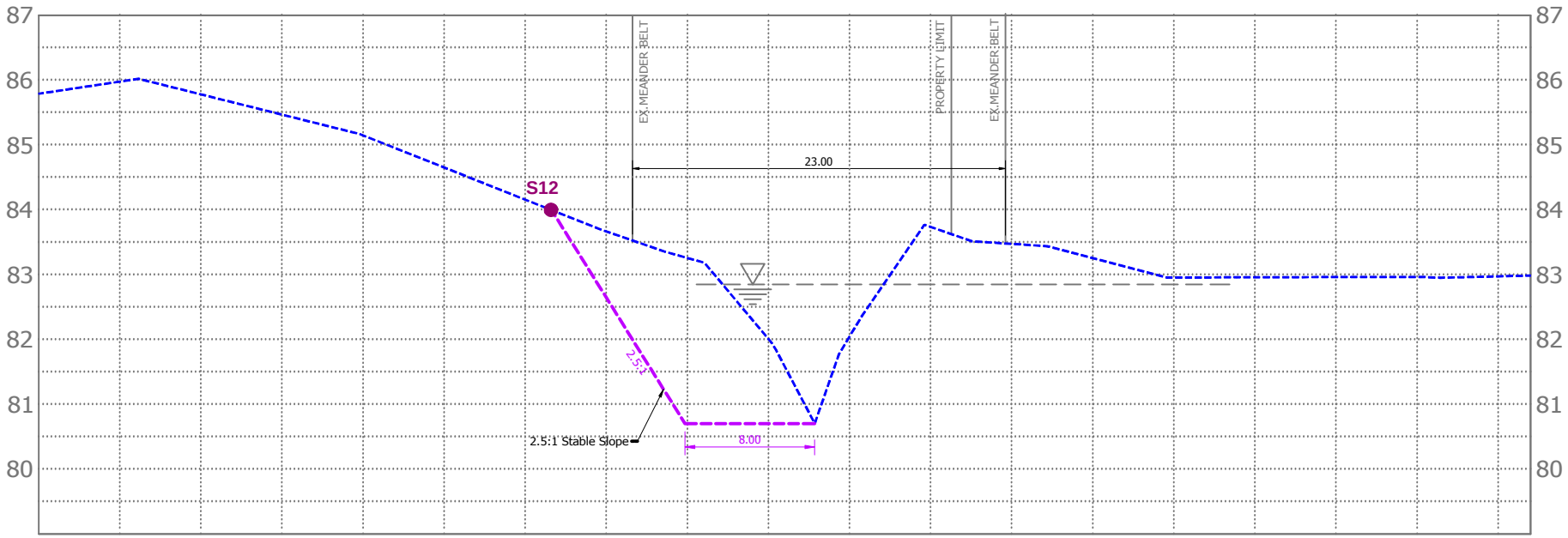


SECTION
L-L (1)

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

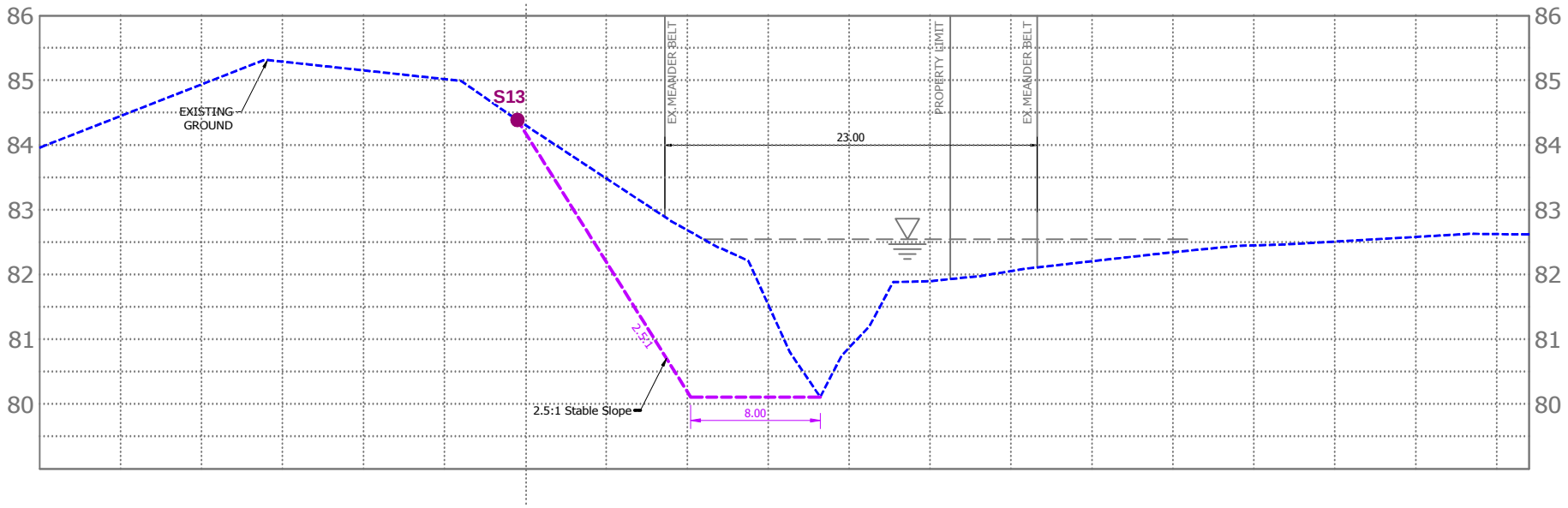
Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION L-L**

Client: LAKEVIEW COMMUNITY PARTNERS LIMITED

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	F.Z	S.Y	July 2019
Rev.	Scale:	Project No:	Figure No.
	As Shown	18-519-102	**13**

Path:j:\2018 projects\18-519-102 slope stability at serson creek_lakeview community partners limited\drawings\17-549-existing serson creek sections - sept 03.dwg



SECTION
M-M (1)

0 5 10m

Horizontal Scale

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION M-M**

Client:	Size:	Approved By:	Drawn By:	Date:
LAKEVIEW COMMUNITY PARTNERS LIMITED	8.5 x 11	F.Z	S.Y	July 2019
	Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. **14**

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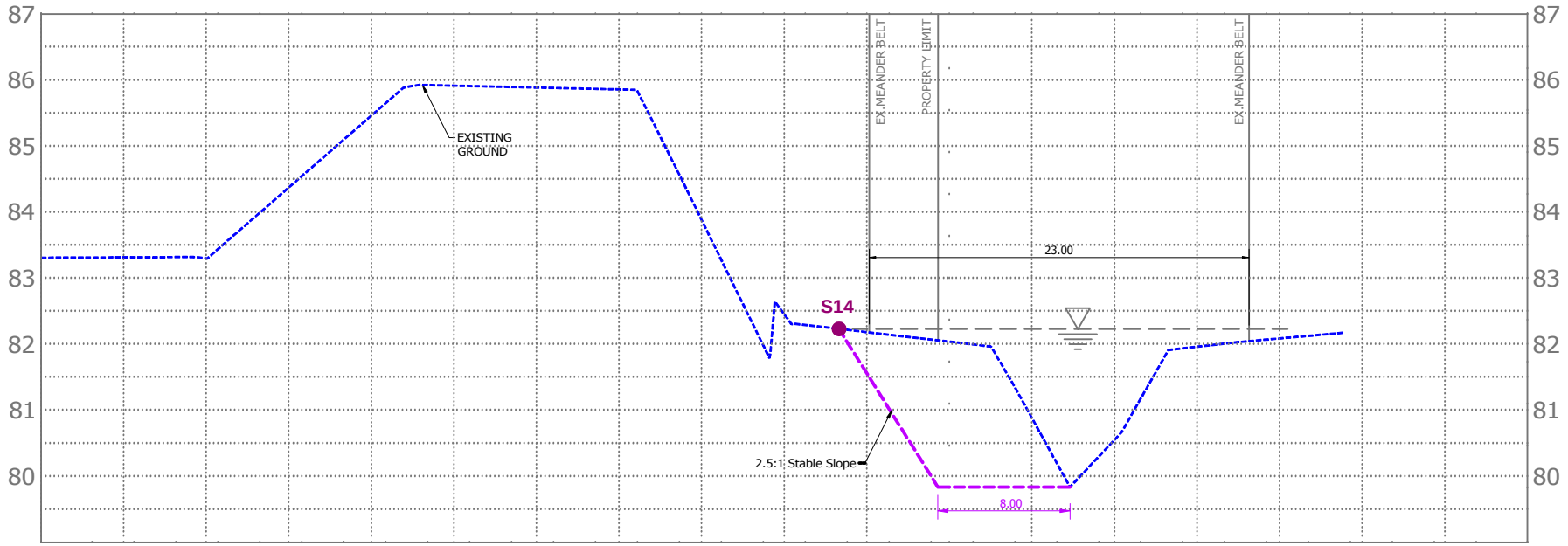

SECTION
N-N

0 5 10m

Horizontal Scale

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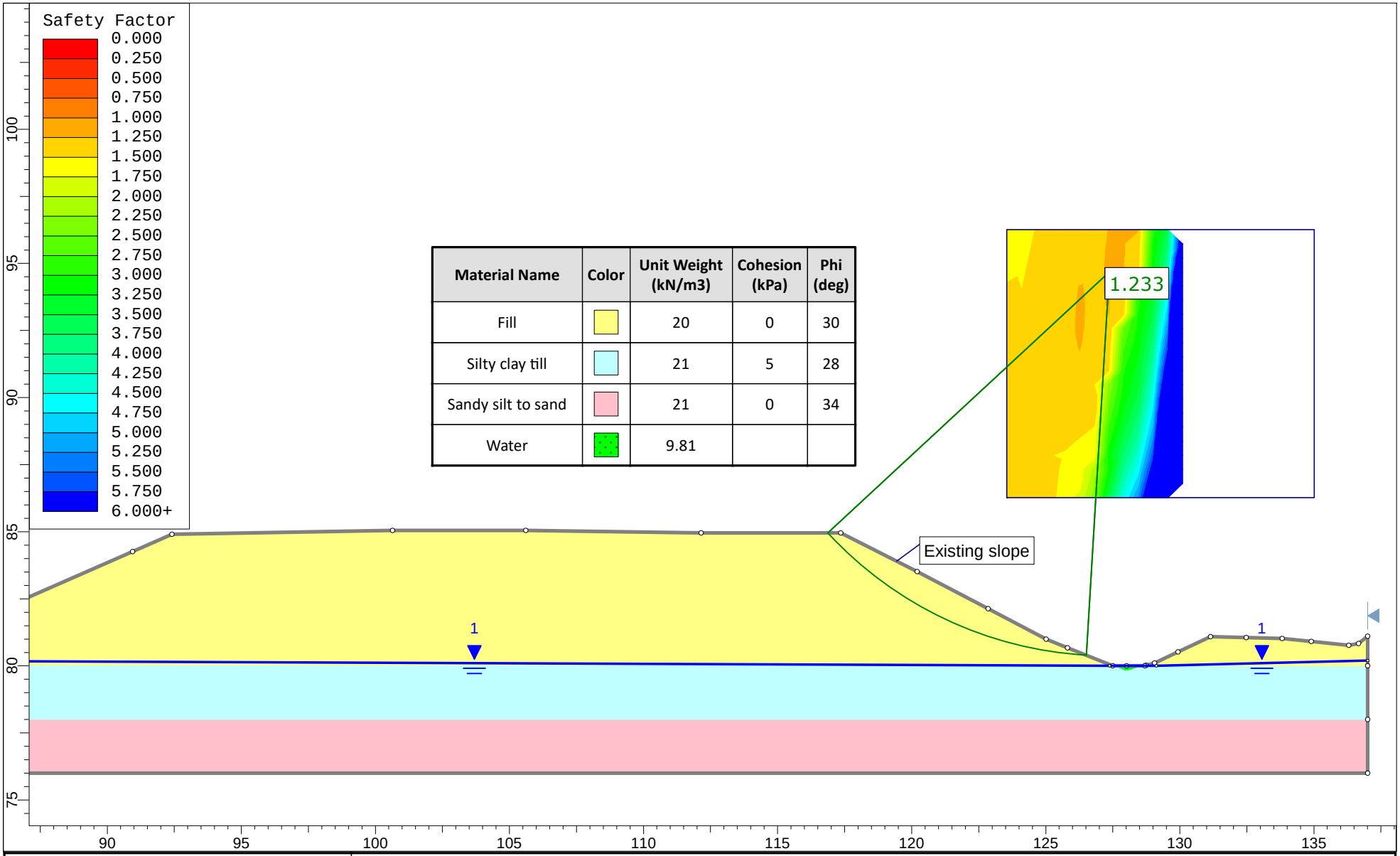
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: SERSON CREEK SLOPE STABILITY ASSESSMENT

Title: **SLOPE PROFILE AT SECTION N-N**

Client: LAKEVIEW COMMUNITY PARTNERS LIMITED

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	F.Z	S.Y	July 2019
Rev.	Scale: As Shown	Project No: 18-519-102	Figure No. 15

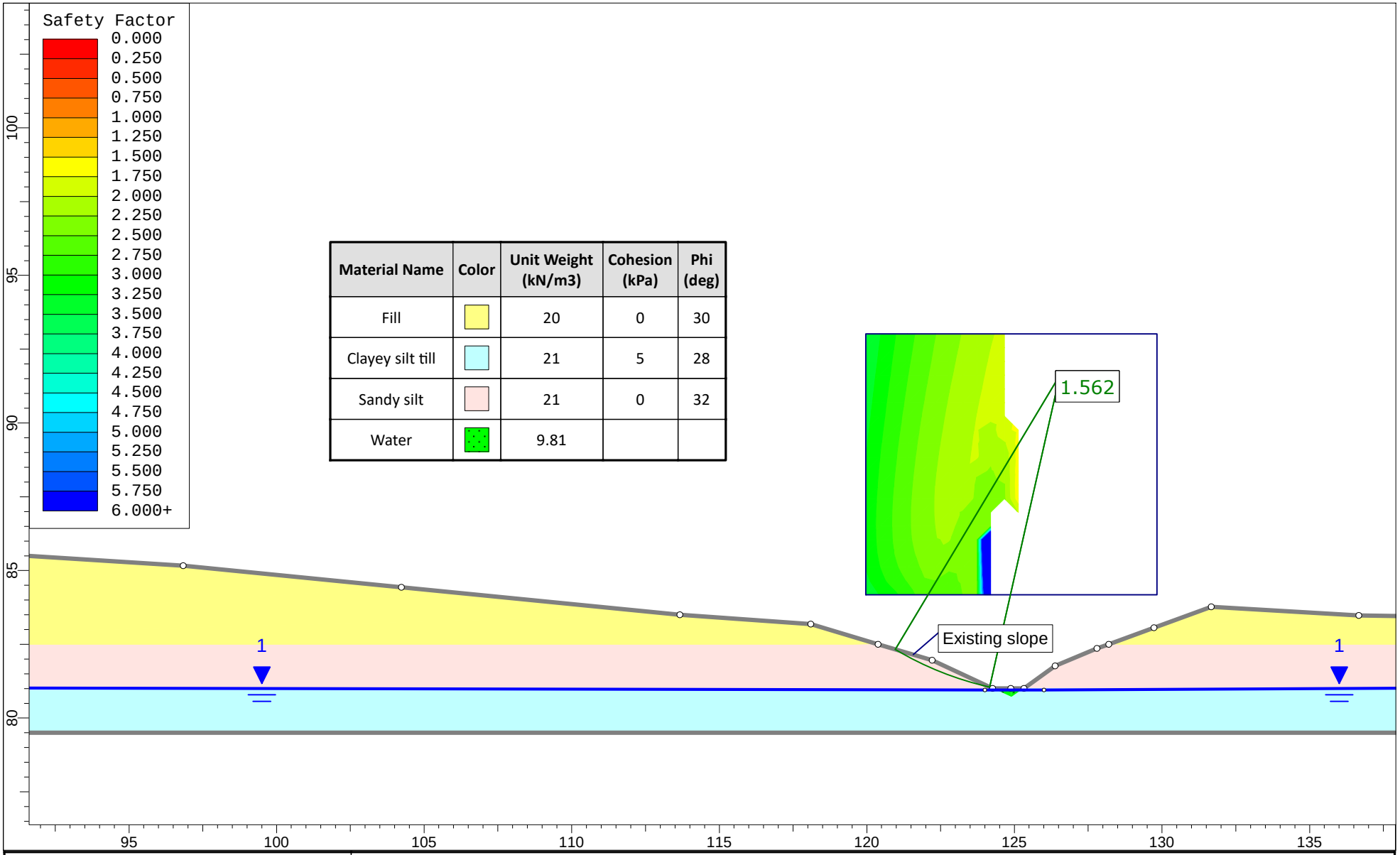


Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Fill		20	0	30
Silty clay till		21	5	28
Sandy silt to sand		21	0	34
Water		9.81		

rocscience

SLIDEINTERPRET 8.024

Project	Slope Stability of Serson Creek Bank Slopes		
Analysis Description	Existing West Bank Slope at Section A-A		
Drawn By	DS	*Scale* 1:200	*Company* DS Consultants Ltd.
Date	July 2019		*File Name* Figure 16 - Existing West Bank at Section A-A.slmd

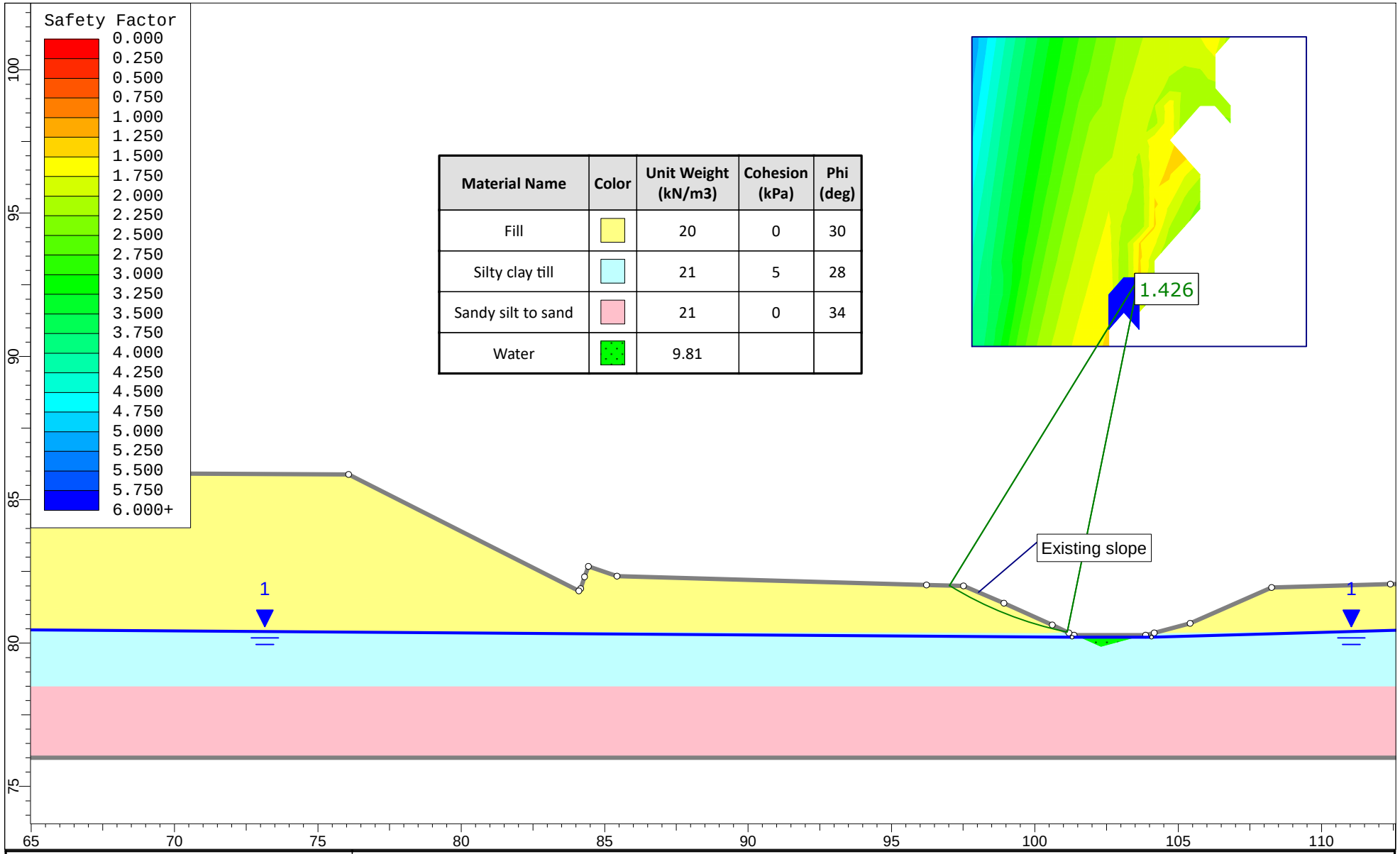


Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Fill		20	0	30
Clayey silt till		21	5	28
Sandy silt		21	0	32
Water		9.81		

rocscience

SLIDEINTERPRET 8.024

Project	Slope Stability of Serson Creek Bank Slopes		
Analysis Description	Existing West Bank Slope at Section L-L		
Drawn By	DS	*Scale* 1:182	*Company* DS Consultants Ltd.
Date	July 2019		*File Name* Figure 17 - Existing West Bank at Section L-L.slmd

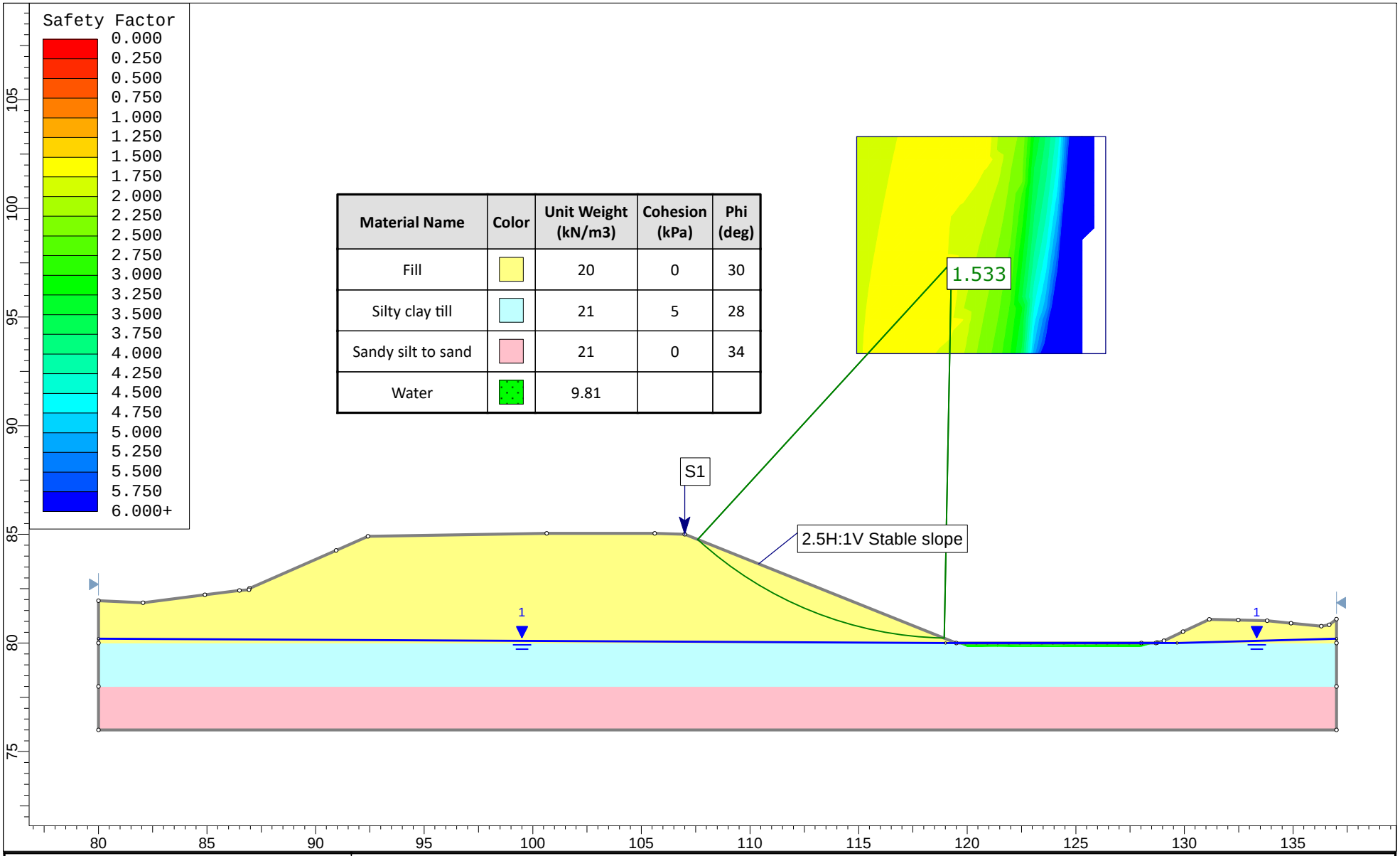


Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Fill		20	0	30
Silty clay till		21	5	28
Sandy silt to sand		21	0	34
Water		9.81		

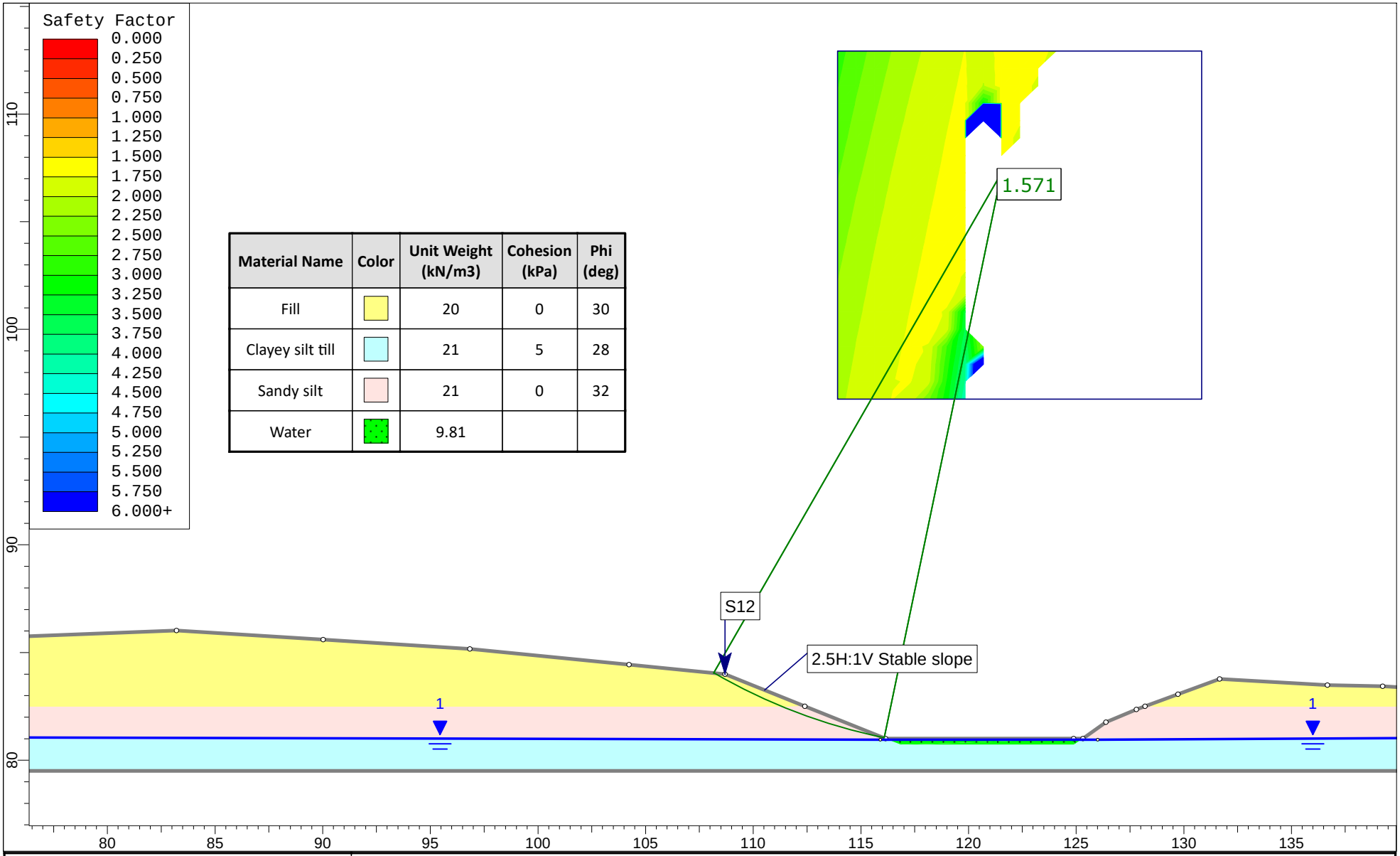
rocscience

SLIDEINTERPRET 8.024

Project	Slope Stability of Serson Creek Bank Slopes		
Analysis Description	Existing South Bank Slope at Section N-N		
Drawn By DS	*Scale* 1:187	*Company* DS Consultants Ltd.	
Date July 2019		*File Name* Figure 18 - Existing South Bank at Section N-N.slmd	



rocscience	*Project*	Slope Stability of Serson Creek Bank Slopes	
	Analysis Description	Long-term Stable West Bank Slope at Section A-A with 8 m Toe Erosion Allowance	
	Drawn By DS	*Scale* 1:247	*Company* DS Consultants Ltd.
SLIDEINTERPRET 8.024	*Date* July 2019		*File Name* Figure 19 - Stable West Bank at Section A-A.slmd

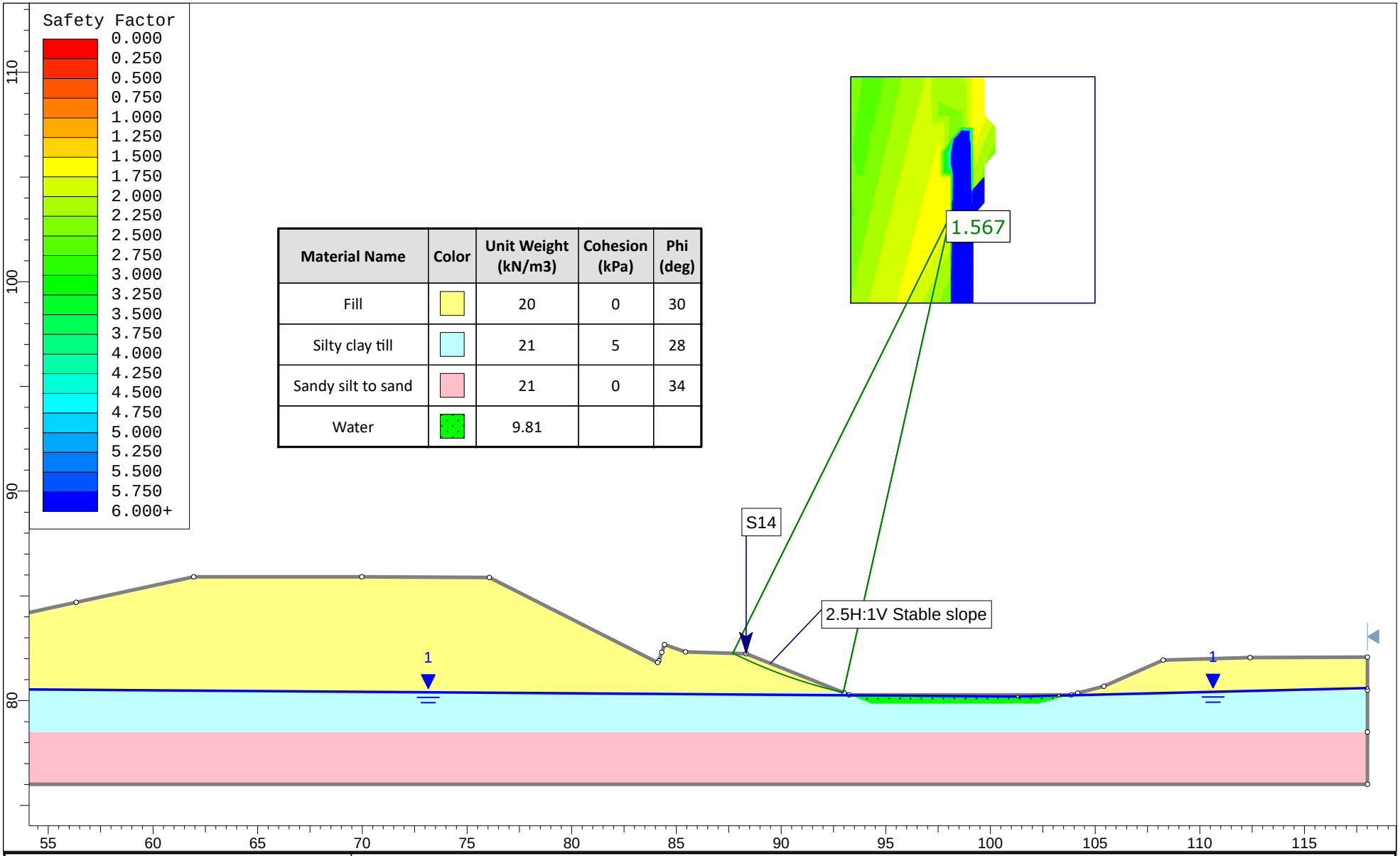


Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Fill		20	0	30
Clayey silt till		21	5	28
Sandy silt		21	0	32
Water		9.81		

rocscience

SLIDEINTERPRET 8.024

Project	Slope Stability of Serson Creek Bank Slopes		
Analysis Description	Long-term Stable West Bank Slope at Section L-L with 8 m Toe Erosion Allowance		
Drawn By	DS	*Scale* 1:250	*Company* DS Consultants Ltd.
Date	July 2019		*File Name* Figure 20 - Stable West Bank at Section L-L.slmd



Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Fill		20	0	30
Silty clay till		21	5	28
Sandy silt to sand		21	0	34
Water		9.81		

rocscience

SLIDEINTERPRET 8.024

Project	Slope Stability of Serson Creek Bank Slopes		
Analysis Description	Long-term Stable South Bank Slope at Section N-N with 8 m Toe Erosion Allowance		
Drawn By	DS	*Scale* 1:257	*Company* DS Consultants Ltd.
Date	June 2019		*File Name* Figure 21 - Stable South Bank at Section N-N.slmd

Appendix A

Location Plan and Logs of Boreholes by DS Consultants Ltd.

J:\-GIS\18-519-10 800 Hydro Road, Mississuaga\1-QGIS\Geotechnical\Figure 1- BH Location Plan.qgs

100 0 100 200 m

Image Source: Imagery @2018 Google

Legend:

Boreholes

- Monitoring Well
- Borehole

DS CONSULTANTS LTD.
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Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

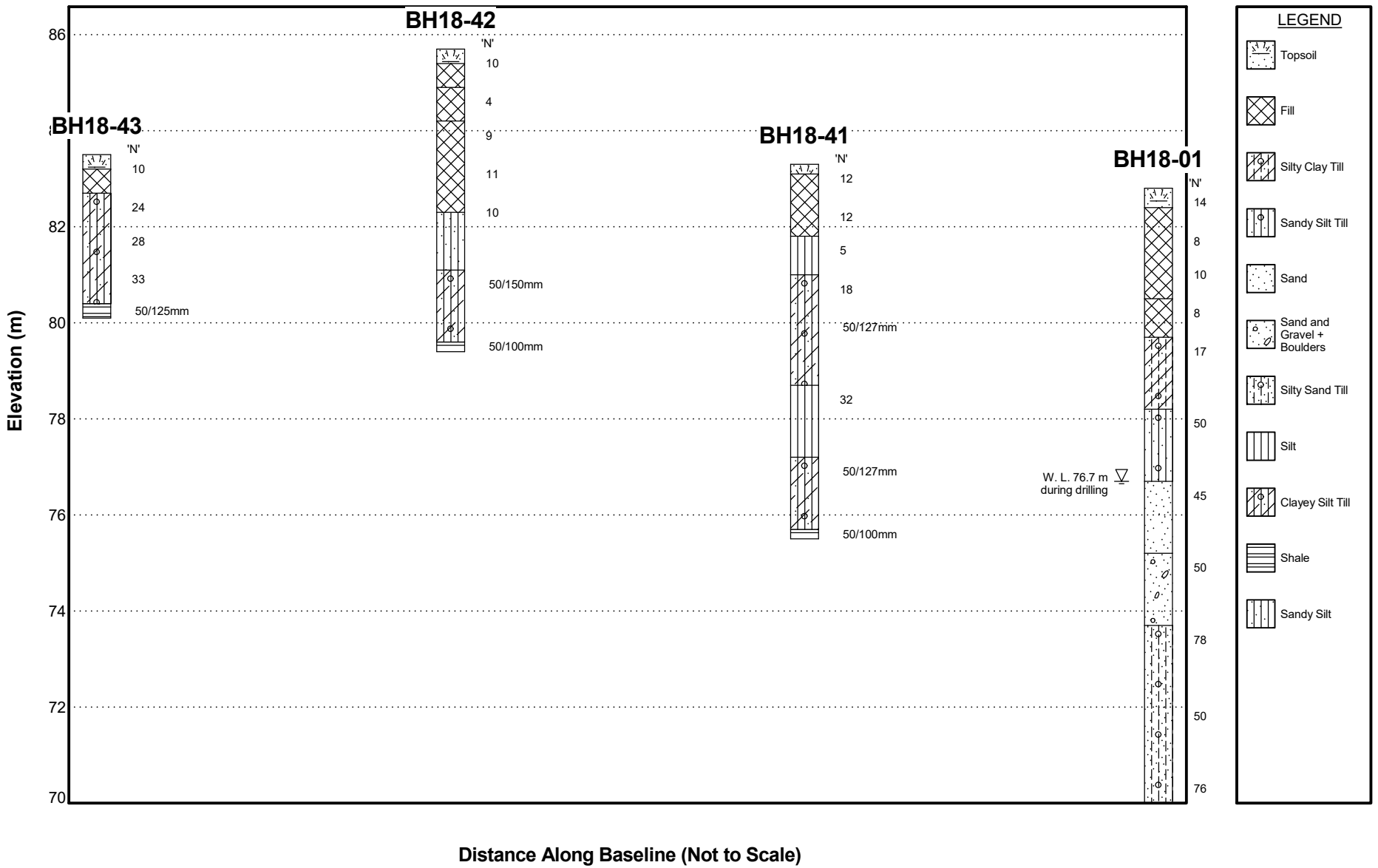
Client:
INFRASTRUCTURE ONTARIO
800 Hydro Road
Mississauga, ON

Project: GEOTECHNICAL INVESTIGATION

Title: **BOREHOLE LOCATION PLAN**

Approved By:	Drawn By:	Date:
N.W	S.Y	September 2018

Scale:	Project No.:	Figure No.:
As Shown	18-519-10	1



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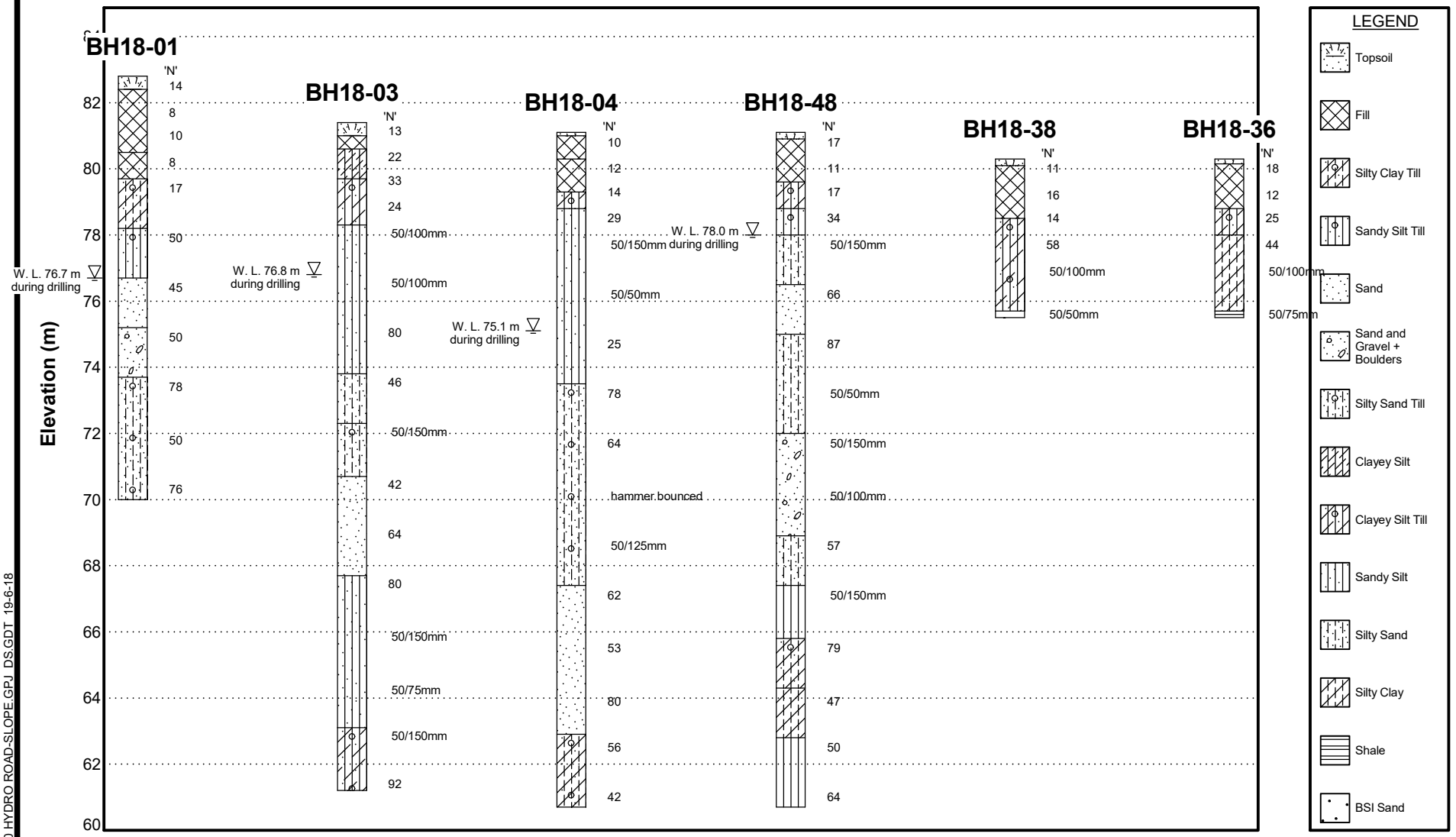
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

Generalized Sub-surface Profile

DRAWING NO.	A1
JOB NO.	18-519-10
DATE	June 2019

DS FENCE (M) 18-519-10 800 HYDRO ROAD-SLOPE.GPJ DS.GDT 19-6-18



Distance Along Baseline (Not to Scale)

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Generalized Sub-surface Profile

DRAWING NO.	A2
JOB NO.	18-519-10
DATE	June 2019

DS FENCE (M) 18-519-10 800 HYDRO ROAD-SLOPE.GPJ DS.GDT 19-6-18

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH18-01

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200 mm
Date: Jul-18-2018

REF. NO.: 18-519-10
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m
82.8 / 0.0	**TOPSOIL:**350mm		1	SS	14
82.4 / 0.4	**FILL:** clayey silt, some organics, trace gravel, grey, moist, stiff		2	SS	8
			3	SS	10
80.5 / 2.3	**FILL:** sandy silt, some organics, grey, moist, loose		4	SS	8
79.7 / 3.1	**SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff		5	SS	17
78.2 / 4.6	**SANDY SILT TILL:** trace to some clay, trace gravel, grey, moist, very dense		6	SS	50
76.7 / 6.1	**SAND:** trace silt, brown, wet, dense		7	SS	45
75.2 / 7.6	**SAND AND GRAVEL:** trace silt, brown, wet, very dense		8	SS	50
73.7 / 9.1	**SILTY SAND TILL:** some gravel to gravelly, occassional cobble/boulders, trace clay, grey, moist to wet, very dense		9	SS	78

GROUND WATER CONDITIONS: ▽ W. L. 76.7 m during drilling

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa): 225

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	15	47	37

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

LOG OF BOREHOLE BH18-01

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200 mm
Date: Jul-18-2018

REF. NO.: 18-519-10
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY SAND TILL: some gravel to gravelly, occassional cobble/boulders, trace clay, grey, moist to wet, very dense(Continued)										
11			10	SS	50		72		○		
12	wet below 12.2 m		11	SS	76		71		○		
70.0							70				
12.8	**END OF BOREHOLE** Notes: 1) Water level at 6.1 mbgl during drilling										

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-03

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-25-2018

REF. NO.: 18-519-10
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
81.4							
0.0 / 81.0	**TOPSOIL:** 350mm		1	SS	13		81
0.4 / 80.6	**POSSIBLE FILL:** clayey silt, brown, moist, stiff						
0.8 / 79.7	**CLAYEY SILT:**some sand, occassional sand seams, brown, moist, very stiff to hard		2	SS	22		80
1.7 / 78.3	**CLAYEY SILT TILL :** some sand, trace gravel, occassional sand seams, brown, moist, very stiff		3	SS	33		
			4	SS	24		79
3.1 / 73.8	**SANDY SILT TO SILTY SAND** trace clay, trace gravel, brown, moist to wet , very dense		5	SS	50/ 100mm		78
	grey, wet below 4.6 m		6	SS	50/ 100mm	▽ W. L. 76.8 m during drilling	77
			7	SS	80		76
7.6 / 72.3	**SILTY SAND TO SAND:** trace clay, grey, wet, dense		8	SS	46		75
9.1	**SILTY SAND TILL:** trace to some clay, trace gravel, occasional cobble/boulder, grey, wet, very dense		9	SS	50/ 150mm		74
							73
							72

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
>225
>225

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH18-03

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-25-2018

REF. NO.: 18-519-10
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
70.7	**SILTY SAND TILL:** trace to some clay, trace gravel, occasional cobble/boulder, grey, wet, very dense(Continued)						71					
10.7	**SAND:** trace silt, grey, wet, dense to very dense		10	SS	42							0 95 (5)
11							70					
12			11	SS	64		69					
13												
67.7							68					
13.7	**SANDY SILT TO SILTY SAND:** trace to some clay, some gravel, grey, wet, very dense		12	SS	80							
14							67					
15			13	SS	50/ 150mm		66					
16												
17			14	SS	50/ 75mm		65					
18							64					
63.1												
18.3	**CLAYEY SILT TILL:** sandy, trace gravel, occasssional cobble/boulders, grey, moist, hard		15	SS	50/ 150mm		63					
19												
20							62					

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH18-03

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-25-2018

REF. NO.: 18-519-10
ENCL NO.: 4

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
61.2			16	SS	92				>225		
20.2	**END OF BOREHOLE** Notes: 1) Water level at 4.6 mbgl during drilling										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH18-04

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-22-2018

REF. NO.: 18-519-10
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m
81.1 / 0.0	**TOPSOIL:** 150mm				
81.0 / 0.1	**FILL:** silty sand and gravel, brown, moist, compact		1	SS	10
80.3 / 0.8	**FILL:** silt to clayey silt, trace organics, trace gravel, grey, moist, compact		2	SS	12
79.3 / 1.8	**CLAYEY SILT TILL:** sandy, trace gravel, trace cobble, brown, moist, very stiff		3	SS	14
78.8 / 2.3	**SANDY SILT TO SILTY SAND:** trace clay, trace to some gravel, brown, moist to wet, very dense to compact		4	SS	29
			5	SS	50/ 150mm
			6	SS	50/ 50mm
	grey and wet below 6.1 m		7	SS	25
73.5 / 7.6	**SILTY SAND TILL:** trace clay, some gravel, occassional cobble/boulders, grey, wet, very dense		8	SS	78
			9	SS	64

GROUND WATER CONDITIONS: W. L. 75.1 m during drilling

ELEVATION: 81, 80, 79, 78, 77, 76, 74, 73, 72

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

LOG OF BOREHOLE BH18-04

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-22-2018

REF. NO.: 18-519-10
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	SILTY SAND TILL: trace clay, some gravel, occassional cobble/boulders, grey, wet, very dense(Continued)						71
11			10	SS	hammer bounced		70
12			11	SS	50/ 125mm		69
13							68
67.4							
13.7	**SAND:** trace silt, grey, wet, very dense		12	SS	62		67
15	interbed of silt at 15.5 m		13	SS	53		66
16							65
17			14	SS	80		64
18							
62.9							63
18.2	**SILTY CLAY TILL:** some sand, trace gravel, grey, moist, hard		15	SS	56		
19							62
20							

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

>225

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

LOG OF BOREHOLE BH18-04

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-22-2018

REF. NO.: 18-519-10
ENCL NO.: 5

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
60.7	**SILTY CLAY TILL:** some sand, trace gravel, grey, moist, hard(Continued)		16	SS	42		61			>225	
20.4	**END OF BOREHOLE** Notes: 1) Water level at 6.0 mbgl during drilling										

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ε_f=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-36

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-27-2018

REF. NO.: 18-519-10
ENCL NO.: 33

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
80.3 / 0.0	**TOPSOIL :**150 mm						
80.2 / 0.2	**FILL:** clayey silt, trace asphalt/concrete fragments, trace organics, grey to dark grey, moist, compact		1	SS	18		80
			2	SS	12		79
78.8 / 1.5	**CLAYEY SILT TILL:** sandy, trace gravel, brown, moist, very stiff		3	SS	25		
78.0 / 2.3	**SILTY CLAY:**some sand, brown, moist, hard		4	SS	44		78
			5	SS	50/ 100mm		77
75.7 / 4.6	**SHALE:** Georgian Bay Formation, weathered, grey		6	SS	50/ 75mm		76
75.5 / 4.8	**END OF BOREHOLE:** Notes: 1) Borehole dry and open upon completion.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	11	57	32

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-38

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-27-2018

REF. NO.: 18-519-10
ENCL NO.: 35

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
80.3 / 0.0	**TOPSOIL:** 230mm						
80.1 / 0.2	**FILL:** clayey silt, trace gravel, trace cobbles, asphalt fragments, dark brown to dark grey, very moist, compact		1	SS	11		80
			2	SS	16		79
78.5 / 1.8	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/boulder, brown, moist, stiff to hard		3	SS	14		
			4	SS	58		78
			5	SS	50/ 100mm		77
75.7 / 4.6	**SHALE:** Georgian Bay Formation, weathered, grey		6	SS	50/ 50mm		76
75.5 / 4.8	**END OF BOREHOLE**						

Notes:
1) Borehole dry and open upon completion.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-41

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Jul-26-2018

REF. NO.: 18-519-10
ENCL NO.: 38

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
83.3 / 0.0	**TOPSOIL:** 152mm						
83.1 / 0.2	**FILL:** clayey silt, trace rootlet, trace asphalt, brown, moist, stiff		1	SS	12		83
			2	SS	12		
81.8 / 1.5	**SILT :** some sand, trace clay, brown, wet, loose		3	SS	5		82
81.0 / 2.3	**CLAYEY SILT TILL :** some sand, trace gravel, trace cobble, brown to grey, moist, very stiff to hard		4	SS	18		81
			5	SS	50/ 127mm		80
78.7 / 4.6	**SILT :** some sand, trace clay, grey, very moist to wet, dense		6	SS	32		79
77.2 / 6.1	**CLAYEY SILT TILL :** some sand, trace gravel, trace cobble, grey, moist, hard		7	SS	50/ 127mm		78
75.7 / 7.6	**SHALE:** Georgian Bay Formation, weathered, grey		8	SS	50/ 100mm		77
75.5 / 7.8	**END OF BOREHOLE** Notes: 1) Borehole open and dry upon completion						76

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-42

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-29-2018

REF. NO.: 18-519-10
ENCL NO.: 39

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
85.7												
0.0 / 85.4	**TOPSOIL:** 350 mm											
0.3 / 84.9	**FILL:** silty sand, trace topsoil/rootlets, some gravel, brown, moist, compact		1	SS	10		85					
0.8 / 84.2	**FILL:** sandy silt, trace clay, brown, wet, loose		2	SS	4							
1.5 / 82.3	**FILL:** clayey silt, trace organics, grey, moist, stiff		3	SS	9		84					
			4	SS	11		83					
			5	SS	10							
3.4 / 81.1	**SANDY SILT:** trace clay, brown, moist, compact						82					
4.6 / 79.6	**CLAYEY SILT TILL:** trace gravel, brown, moist, hard		6	SS	50/ 150mm		81			>225		
6.1 / 79.4	**SHALE:** Georgian Bay Formation, weathered, grey		7	SS	50/ 100mm		80					
6.3	**END OF BOREHOLE** Notes: 1) Borehole dry and open upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-43

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jun-29-2018

REF. NO.: 18-519-10
ENCL NO.: 40

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
83.5												
0.0 / 83.2	**TOPSOIL:** 350mm											
0.3 / 82.7	**FILL:** clayey silt, brown, moist, stiff		1	SS	10		83		○			
0.8	**CLAYEY SILT TILL:** sandy, trace gravel, brown, moist, very stiff to hard		2	SS	24				○			
1			3	SS	28		82		○	>225		
2	grey below 2.3 m		4	SS	33		81		○			
3 / 80.4												
3.1 / 80.1	**SHALE:** Georgian Bay Formation, weathered, grey		5	SS	50/125mm				○			
3.4	**END OF BOREHOLE** Notes: 1) Borehole open and dry upon completion											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH18-48

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jul-05-2018

REF. NO.: 18-519-10
ENCL NO.: 45

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
81.1 / 0.0	**TOPSOIL:** 200mm						81
80.9 / 0.2	**FILL :** clayey silt mixed with asphalt, trace organics, some sand, dark grey, moist, compact		1	SS	17		
1			2	SS	11		80
79.6 / 1.5	**CLAYEY SILT TILL:** sandy, trace gravel, greyish brown, moist, very stiff		3	SS	17		79
2 / 78.8 / 2.3	**SANDY SILT TILL :** trace to some clay, trace gravel, brown, moist, dense		4	SS	34		
3 / 78.0 / 3.1	**SILTY SAND :** trace clay, brown, wet, very dense		5	SS	50/ 150mm	▽ W. L. 78.0 m during drilling	78
4							77
76.5 / 4.6	**SAND:** trace silt, trace gravel, grey, wet, very dense		6	SS	66		
5 / 75.0 / 6.1	**SILTY SAND:** trace clay, grey, wet, very dense		7	SS	87		76
7							75
8			8	SS	50/ 50mm		74
9 / 72.0 / 9.1	**SAND AND GRAVEL:** trace silt, grey, wet, very dense		9	SS	50/ 150mm		73
10							72

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH18-48

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jul-05-2018

REF. NO.: 18-519-10
ENCL NO.: 45

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3 m	ELEVATION
	SAND AND GRAVEL: trace silt, grey, wet, very dense(Continued)					71
11			10	SS	50/ 100mm	70
12 68.9						69
12.2	**SILTY SAND:** trace clay, grey, wet, very dense		11	SS	57	
13 67.4						68
13.7	**SILT :** trace clay, grey, wet, very dense		12	SS	50/ 150mm	
14 15 65.8						67
15.3	**SILTY CLAY TILL :** some sand to sandy, trace gravel, grey, moist hard		13	SS	79	66
16 64.3						65
16.8	**SILTY CLAY:** trace sand, grey, moist, hard		14	SS	47	64
17 18 62.8						63
18.3	**SILT TO CLAYEY SILT:** trace sand, grey, very moist, very dense		15	SS	50	
19 20						62

GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
>225
>225
>225

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH18-48

PROJECT: Preliminary Geotechnical Investigation- Proposed Development
CLIENT: Lakeview Community Partners Ltd.
PROJECT LOCATION: 800 Hydro Road, Mississauga, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 150mm
Date: Jul-05-2018

REF. NO.: 18-519-10
ENCL NO.: 45

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
60.7	**SILT TO CLAYEY SILT:** trace sand, grey, very moist, very dense(Continued)		16	SS	64		61		○	>225	
20.4	**END OF BOREHOLE:** Notes: 1) Water level at 3.1 mbgl during drilling										

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 18-519-10 800 HYDRO ROAD.GPJ DS.GDT 18-10-12

Appendix B

Site Photographs
(taken on June 17, 2019)

Photo B1: Creek and Concrete Culvert at Lakeshore Blvd (looking north - upstream)

Photo B2: Creek conditions at south of Lakeshore Blvd (looking south - downstream)

Photo B3: Creek conditions at north of Section L-L (looking north - upstream)

Photo B4: Creek conditions at north of Section L-L (looking south - downstream)

Photo B5: Top of slope conditions to north of Section M-M (looking north toward Lakeshore Blvd)

Photo B6: Creek conditions at the turning point to south of Section M-M (looking northeast)

Photo B7: Creek conditions at west of Section N-N (looking east)

Photo B8: Top of slope conditions in area of and to west of Section N-N (looking east from Borehole BH18-41 area – See Appendix A)

Photo B9: Creek conditions at west of Section N-N (looking northwest)

Photo B10: Top of slope conditions to west of Section N-N (looking west)

Photo B11: Slope conditions to east of Section N-N near road bridge (looking west)

Photo B12: Creek conditions at north of Bridge (looking south - downstream)

Photo B13: Road Bridge area (looking east)

Photo B14: Top of slope conditions and road to west of creek in Reach S2 area (looking south)

Photo B15: Creek conditions to south of bridge (looking north - upstream)

Photo B16: Creek and slope conditions to south of bridge (looking south from bridge – looking downstream)

Photo B17: Ditch between Creek and Road at south part of Reach S2 area (looing south - downstream)

Photo B18: Ditch between Creek and Road at south part of Reach S2 area (looing north - upstream)

Photo B19: Creek Conditions to South of Steel Wire Fence at south end of Each S2 (looking north - upstream)

Photo B20: Slope Conditions at South of Steel Wire Fence to south end of Reach S2 area (looking northwest)

APPENDIX C

Hydraulics Memorandum

Urbantech Consulting (October 2019)

urbantech

MEMORANDUM

Date: **December 2019**

Project No: **17-549**

Re: **Appendix C**
Serson Creek Technical Memo– Channel Hydraulics
Lakeview Village
City of Mississauga
Region of Peel

HYDRAULIC MODELLING OBJECTIVES

The following are the primary objectives of the hydraulic modelling completed for the detailed Serson Creek NHS design. The detailed NHS design has been carried out in two (2) phases – Phase 1 (interim conditions) within the lands currently held by Lakeview Village Partners and Phase 2 (ultimate conditions) which will occur in the fullness of time when the Plaster Form Inc. lands participate. The staged approach to channel design and approval necessitates continuous updating of the hydraulic model. The hydraulic modelling results presented herein describe the channel hydraulics based on the detailed Phase 1 design and the preliminary Phase 2 design.

The following tasks were undertaken:

- Review existing CVC model
- Update existing CVC model based on available site information
- Provide comparison to CVC model
- Determine flood elevations for the existing watercourse
- Coordinate proposed channel design (slopes, section) with geomorphologist
- Determine flood elevations for the proposed watercourse under interim scenario/ Phase 1
- determine flood elevations for the proposed watercourse under ultimate scenario/ Phase 2

Urbantech Consulting, A Division of Leighton-Zec Ltd.
25 Royal Crest Court, Suite 201 Markham, Ontario L3R 9X4
TEL: 905.946.9461 FAX: 905.946.9595
www.urbantech.com

MODEL METHODOLOGY

To achieve the modelling objectives described in the preceding section, the U.S. Army Corps of Engineers' River Analysis System (HEC-RAS) was utilized. HEC-RAS is designed to perform one-dimensional steady and unsteady flow river hydraulics calculations, sediment transport-mobile bed modelling, and water temperature analysis. The HEC-RAS software supersedes the HEC-2 river hydraulics package.

The modelling system calculates water surface profiles for steady gradually varied flow. The system can handle a full network of channels, a dendritic system, or a single river reach. The steady flow component is capable of modelling subcritical, supercritical, and mixed flow regime water surface profiles.

The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation is utilized in situations where the water surface profile is rapidly varied. These situations include mixed flow regime calculations (i.e., hydraulic jumps), hydraulics of bridges, and evaluating profiles at river confluences (stream junctions).

This model has the ability to consider the effects of various obstructions, such as bridges, culverts, dams, weirs, and other structures in the floodplain on water levels. The steady flow system is designed for application in floodplain management, estimation of floodplain storage, and for assessing the change in water surface profiles due to channel modifications.

The model requires the following input:

- channel geometry (low flow centerline profile and cross-sections; culvert crossing details);
- Manning's roughness for main channel and overbank areas;
- cumulative flow; and,
- downstream boundary conditions.

OBJECTIVE 1 - FLOOD MAPPING

A) EXISTING CONDITIONS

The existing CVC model for Serson Creek was provided to Urbantech in May 2019. This model included the following flows and a starting tailwater elevation of 74.80m.

Storm Event	Flow change location (m^3/s)						
	XS 12072	XS 11956	XS 11533	XS 11504	XS 11471	XS 11137	XS 10718
2-year	0.3	1	4.3	4.3	4.3	4.9	5
5-year	0.5	1.5	7.1	6.6	7.1	8.2	8.1
10-year	0.6	2.2	10.4	8.9	10.4	11.8	11.5
25-year	0.8	2.8	12.4	10.3	12.4	14.3	13.8
50-year	1.1	3.4	14.5	11.5	14.5	16.7	15.9
100-year	1.3	4	16.6	12.2	16.6	19.2	18.3
Regional	1.5	3.9	15.9	14	15.9	19.1	20.5

Based on the available topographic mapping and survey data for the Lakeview Village and G.E. Booth Wastewater Treatment Plant (WWTP), updates to the model cross-sections from Lakeshore Road East to the downstream end of the channel were made. No changes were made to the peak flows or tailwater / starting water level boundary condition.

The following table summarizes the differences between the CVC and Urbantech (updated) existing conditions model. As noted below, the updates to the model demonstrate fairly good agreement to the CVC model, with the exception of the increased water levels associated with the inclusion of the bridge structure / haul road crossing. **Drawing FP-1** illustrates the CVC existing floodplain and the Urbantech existing floodplain.

Existing Conditions Model - CVC Versus Urbantech

Section	Existing Conditions			Note
	CVC	Urbantech	Difference	
	Water Surface Elevation (m)			
11137	83.7	83.71	0.01	No appreciable change
11116	Lakeshore Road East			No appreciable change; no change to culvert structure elevations or dimensions
11096	83.32	83.33	0.01	No appreciable change
11051	83.15	83.25	0.10	Urbantech cross-sections based on detailed / recent survey of Serson Creek. Water level increase due to inclusion of bridge crossing structure at 10589.43
10998	83.04	83.14	0.10	
10917	82.65	82.62	-0.03	
10861	82.5	82.51	0.01	
10797	82.21	82.40	0.19	
10718	81.93	82.36	0.43	
10591	-	82.34	-	Added section
10590	-	82.34	-	Added section
10589.4	Existing Bridge			Existing bridge structure; not included in CVC model.
10589	-	81.74	-	Added section
10588.7	-	81.78	-	Added section
10588	81.62	81.57	-0.05	Urbantech cross-sections based on detailed / recent survey of Serson Creek.
10465	-	81.43	-	Added Section
10464	81.14	81.22	0.08	Urbantech cross-sections based on detailed / recent survey of Serson Creek.
10350	-	80.55	-	Added Section
10349	79.91	79.75	-0.16	Urbantech cross-sections based on detailed / recent survey of Serson Creek.
10211	78.2	78.15	-0.05	
10117	76.97	76.97	0.0	
10037	75.74	75.79	0.05	

B) PROPOSED CHANNEL

For the proposed channel, the design is divided into two stages.

Phase 1, (i.e., the current stage), is the interim condition in which the ultimate channel between the Plaster Form Inc. and the connection to the Jim Tovey Lakeview Conservation Area is constructed, with an interim channel connection to the existing ditch along the former rail corridor. The existing channel between this location upstream to Lakeshore Road East will be maintained in this phase. These works eliminate the low-flow bypass towards the G.E. Booth WWTP.

Phase 2 represents the ultimate conditions in which the remaining portion of Serson Creek is realigned from Lakeshore Road East to the Phase 1 channel limit. The methodology will be discussed separately for each stage. Detailed proposed channel cross-sections and profiles are available in the HEC-RAS model input files.

PROPOSED GEOMETRY - INTERIM

The channel geometry in the post-development interim hydraulic model is based on the NHS alignment and grading provided on attached grading plans and channel profiles for the Phase 1 corridor. The main channel elevations and sections were based on collaboration between the fluvial geomorphologic design by Beacon and preliminary design by Urbantech to optimize the capacity of the channel within the constraints associated with the existing and future development. Refer to **Drawings CH-1 to CH-3** for the channel plan and profile drawings and **Drawings SEC-1 to SEC-4** for the channel sections.

PROPOSED BOUNDARY AND FLOW CONDITIONS – INTERIM & ULTIMATE

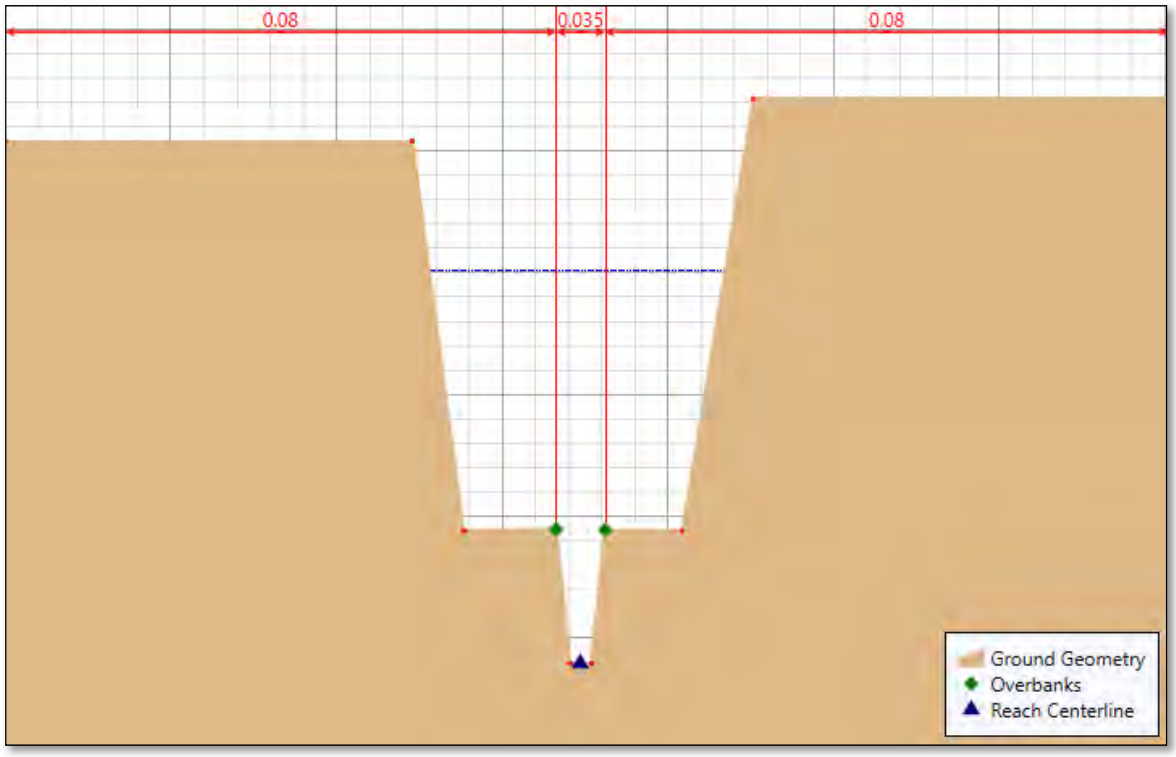
The flow rates and boundary conditions in the May 2019 CVC model were used to establish the interim (and ultimate) channel flow rates. It is assumed that the channel flows will not increase beyond existing conditions; i.e. any future development drainage from the adjacent Lakeview Village or Plaster Form Inc. lands directed to the channel will not exceed the existing flow rates from those lands. If increased flows are proposed, the HEC-RAS analysis should be revisited to confirm channel capacity.

PROPOSED MODEL PARAMETERS – INTERIM

Manning's roughness for the proposed channel (main channel and overbank areas) was deemed to be uniform throughout the length of the channel as per CVC modelling recommendations. A value of 0.035 for the main channel and 0.080 for wooded overbank areas was utilized.

Manning's roughness for the proposed culverts was based on the USACE HEC-RAS Hydraulic Reference Manual. No additional culvert was proposed for the interim condition. The only culvert in the interim condition model is the existing culvert on Lakeshore Road East. The same culvert parameters from the existing model were adapted where the concrete box culvert has a Manning's roughness of 0.013 for the top and 0.035 for the bottom.

Contraction and expansion coefficients were set to 0.3 and 0.5, respectively, for smooth transitions between cross-sections. At abrupt transitions (upstream and downstream of culverts, bends in channel direction, and wetlands), the contraction and expansion coefficients were increased to 0.3 and 0.5, respectively.



Typical Assignment of Manning's Roughness

PROPOSED GEOMETRY – ULTIMATE

The channel geometry in the post-development interim hydraulic model is based on the conceptual NHS alignment and grading provided in the Development Master Plan. Preliminary grading and channel profiles were developed for the ultimate alignment.

PROPOSED MODEL PARAMETERS - PROPOSED

Manning's roughness for the proposed channel (main channel and overbank areas) was deemed to be uniform throughout the length of the channel as per CVC modelling recommendations. A value of 0.035 for the main channel and 0.080 for wooded overbank areas was utilized.

Manning's roughness for the proposed culverts was based on the USACE HEC-RAS Hydraulic Reference Manual. The same parameters from the existing condition model were adapted for the existing culvert Lakeshore Road East, as well as the future crossing of New Haig Boulevard. The concrete box culvert has a Manning's roughness of 0.013 for the top and 0.035 for the bottom.

Contraction and expansion coefficients were set to 0.3 and 0.5, respectively, for smooth transitions between cross-sections. At abrupt transitions (upstream and downstream of culverts, bends in channel direction, and wetlands), the contraction and expansion coefficients were increased to 0.3 and 0.5, respectively.

C) PROPOSED FLOODPLAIN MAPPING

The proposed interim and ultimate flood mapping scenarios Were completed by running the proposed channel geometry (culverts included) with the existing flow rates as per the May 2019 CVC model. The steady-state model engine was used for this simulation. The resulting water surface elevations were used to plot the proposed interim (Drawing FP-2A) and ultimate (Drawing FP-3A) flood lines on the proposed ultimate ground surface.

The proposed interim and ultimate condition models ("with culverts") are provided in this appendix. The interim flood line is plotted on **Drawing FP-2** and the ultimate Regional Storm flood line is plotted on **Drawing FP-3.** The proposed interim and ultimate channel design contains the maximum design flows with sufficient freeboard to private property (minimum 0.30m) aside from locations already within the existing Regional floodplain (i.e., on the lands immediately east of the NHS corridor (WWTP). However, all flooding is contained within the corridor.

The following table illustrates the interim flood elevations compared to the existing (Urbantech / updated) flood elevations. There is a considerable decrease in water level at most section as a result from increasing the width and overall capacity of the reach between the WWTP bypass and the lake.

Interim vs. Existing Conditions Results

Sections	Existing Condition VS. Interim Condition			
	Existing Conditions	Interim Conditions	Difference	Note
	Water Surface Elevation (m)			
11137	83.71	83.71	0.00	Existing Channel
11116	Lakeshore Rd			Existing Culvert
11096	83.33	83.33	0.00	Existing Channel
11051	83.25	83.24	-0.01	
10998	83.14	83.14	0.00	
10917	82.62	82.54	-0.08	
10861	82.51	82.34	-0.17	
10797	82.40	82.11	-0.29	
10718	82.36	81.50	-0.86	
10588.4	-	80.85	-	Phase 1 Interim Channel
10588	81.57	80.75	-0.82	
10466	-	80.66	-	
10465	81.43	80.49	-0.94	
10464.6	-	80.41	-	
10464	81.22	80.24	-0.98	
10351	-	80.15	-	
10350	80.55	79.98	-0.57	
10349.5	-	79.79	-	
10349	79.75	79.63	-0.12	
10212	-	79.43	-	
10211.9	-	79.32	-	
10211.6	-	79.04	-	
10211.4	-	78.79	-	
10211	78.15	78.60	0.45	
10118	-	78.51	-	
10117.4	-	77.85	-	
10117	76.97	76.80	-0.17	Existing Channel
10037	75.79	75.81	0.02	

E) ULTIMATE WATER LEVEL COMPARISON

The water elevation comparison between the existing conditions and the proposed ultimate condition is included in the following table but is considered preliminary.

Ultimate vs. Existing Conditions Results

Sections	Existing Condition VS. Ultimate Condition			
	Existing Conditions	Ultimate Conditions	Difference	Note
	Water Surface Elevation (m)			
11137	83.71	83.59	-0.12	Existing Channel
11116	Lakeshore Rd			Existing Culvert
11096	83.33	82.76	-0.57	Phase 2 Ultimate Channel
11051	83.25	82.60	-0.65	
10998	83.14	82.45	-0.69	
10997	-	82.35	-	
10917	82.62	82.30	-0.32	
10916	-	81.85	-	
10915	New Culvert			New Culvert
10861	82.51	81.82	-0.69	Phase 1 Interim Channel
10850	-	81.77	-	
10797	82.40	81.74	-0.66	
10718	82.36	81.61	-0.75	
10591.4	-	81.49	-	
10590.4	-	81.40	-	
10589.4	-	81.22	-	
10588.9	-	81.01	-	
10588.4	-	80.85	-	
10588	81.57	80.75	-0.82	
10466	-	80.66	-	
10465	81.43	80.49	-0.94	
10464.6	-	80.41	-	
10464	81.22	80.24	-0.98	
10351	-	80.15	-	
10350	80.55	79.98	-0.57	
10349.5	-	79.79	-	
10349	79.75	79.63	-0.12	
10212	-	79.43	-	
10211.9	-	79.32	-	

Sections	Existing Condition VS. Ultimate Condition			
	Existing Conditions	Ultimate Conditions	Difference	Note
	Water Surface Elevation (m)			
10211.6	-	79.04	-	
10211.4	-	78.79	-	
10211	78.15	78.60	0.45	
10118	-	78.51	-	
10117.4	-	77.85	-	
10117	76.97	76.80	-0.17	
10037	75.79	75.81	0.02	

FIGURES AND DRAWINGS

DWG. FP-1 – Existing Flood Mapping

DWG. FP-2 – Interim Flood Mapping

DWG. FP-3 – Ultimate Flood Mapping

APPENDIX D

Drawings:

CH-1 to CH-3: Channel Plan & Profile

SEC-1 to SEC-4: Channel Cross-Sections

DET-1: Channel Detail drawing

STG-1: Staging Plan

STG-2: Staging / Erosion & Sediment Control Details

FP-1: Existing Floodplain

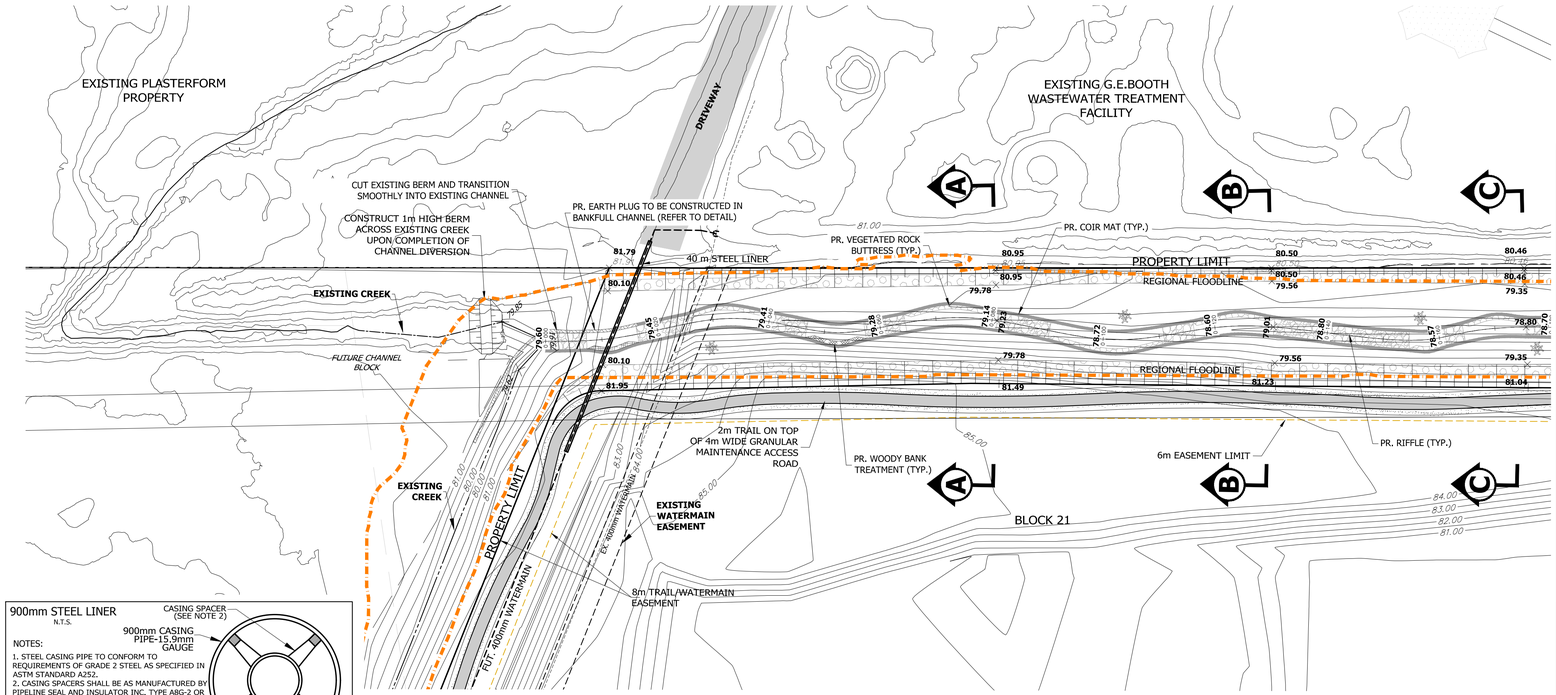
FP-2: Interim Floodplain

FP-3: Ultimate Floodplain

SWM-1: Storm Diversion Plan

SWM-2: Storm Diversion Plan Cross-Section

SC-1 TO SC-4: Landscaping Plans



900mm STEEL LINER
N.T.S.

NOTES:
1. STEEL CASING PIPE TO CONFORM TO REQUIREMENTS OF GRADE 2 STEEL AS SPECIFIED IN ASTM STANDARD A252.
2. CASING SPACERS SHALL BE AS MANUFACTURED BY PIPELINE SEAL AND INSULATOR INC. TYPE ABG-2 OR APPROVED EQUAL.
3. CONTRACTOR TO PROVIDE SHOP DRAWINGS OF OPERATIONS AND TO VERIFY THAT LINER THICKNESS IS ADEQUATE FOR HIS METHOD OF INSTALLATION.
4. LINER ENDS TO BE CAPPED WITH DIAPER OR APPROVED EQUIVALENT TO THE SATISFACTION OF THE ENGINEER AND REGION OF PEEL.

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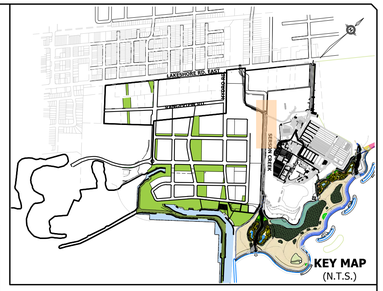
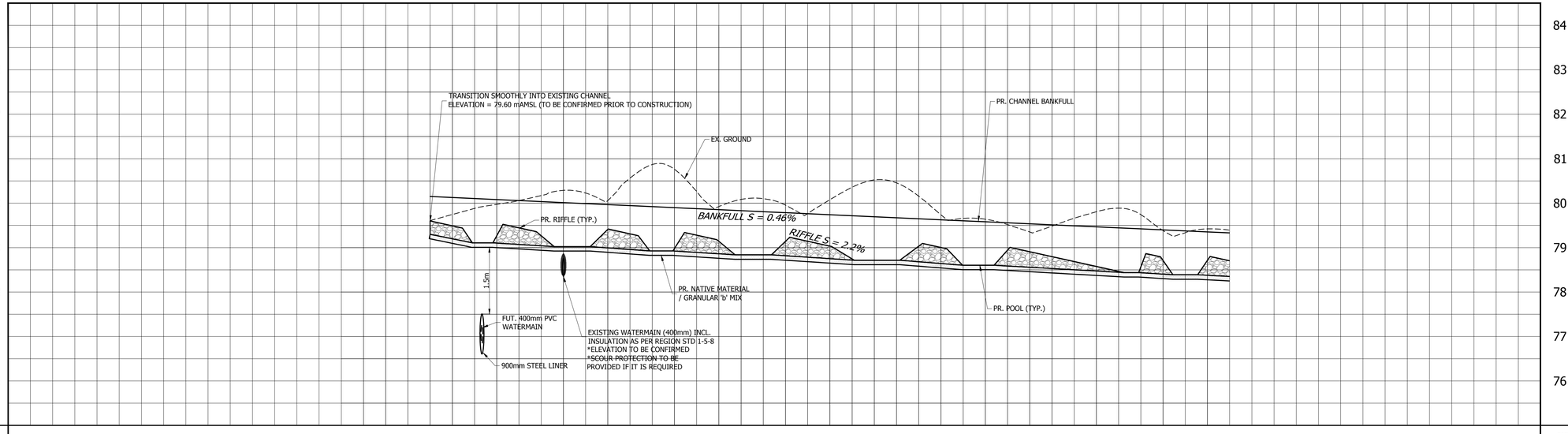


LEGEND:

- 81.00 — EXISTING ELEVATION
- 78.00 — PROPOSED ELEVATION
- RIFFLE
- VEGETATED ROCK BUTTRESS (CHANNEL BANK)
- VEGETATED ROCK BUTTRESS (TOE OF SLOPE)
- WOODY BANK TREATMENT
- EARTH PLUG
- BIODEGRADABLE EROSION CONTROL BLANKET
- WOODY DEBRIS HABITAT FEATURE
- OFFLINE WETLAND FEATURE



NOTE:

REFER TO SEC 1 TO SEC 4 FOR CROSS SECTION DRAWINGS

RIFFLE ID#										
BANKFULL ELEVATION	79.600	79.446	79.409	79.279	79.140	78.715	78.609	78.797	78.568	78.704
CHANNEL BOTTOM /EXISTING ELEVATION	80.150	80.059	80.060	80.264	79.950	80.524	79.658	79.484	79.242	79.330
CHANNEL BOTTOM CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180

BEACON ENVIRONMENTAL

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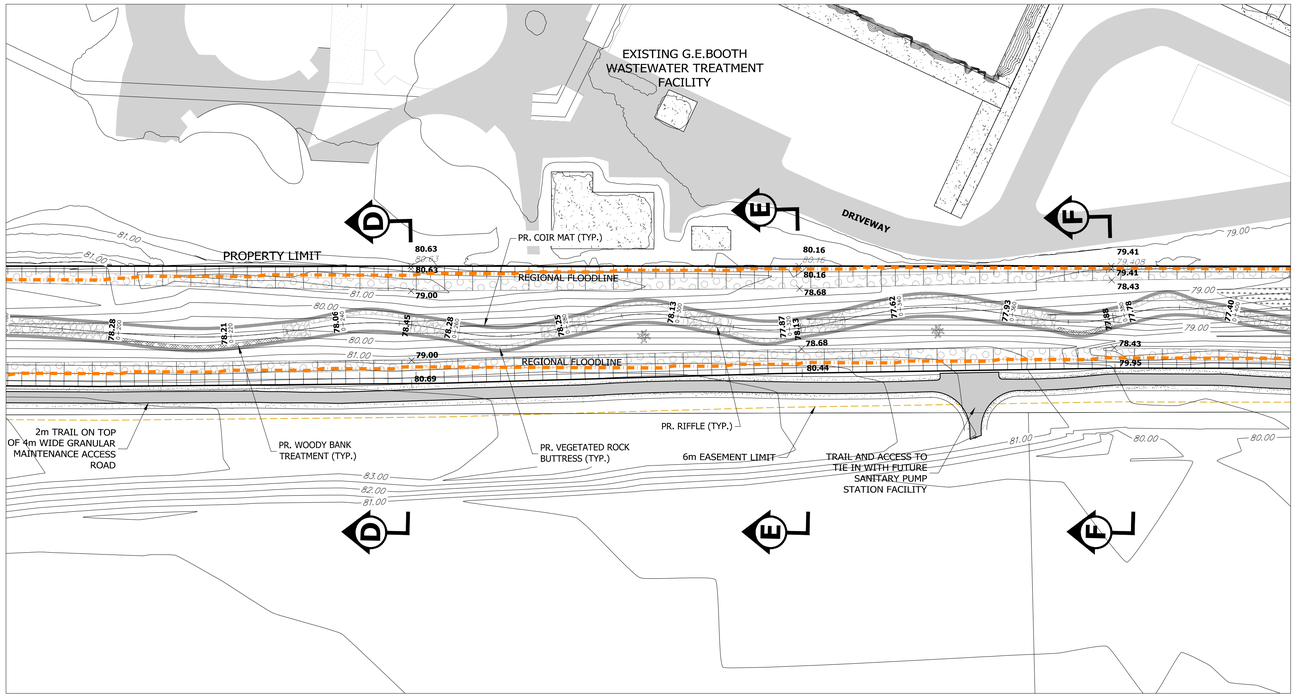
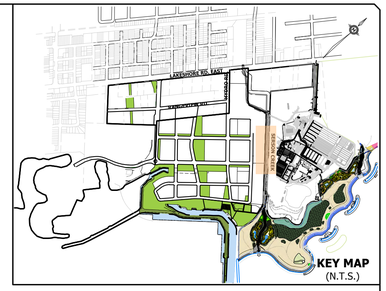
web: www.urbantech.com

LAKEVIEW COMMUNITY PARTNERS LTD.
SERSON CREEK

CHANNEL PLAN & PROFILE
(STA. 0+000 TO 0+180)

SURVEYED BY:	J.D.B.	DATE:	NOVEMBER, 2016	CONTRACT NO.	
DRAWN BY:	R.B.	CHECKED BY:	J.O.	PROJECT NUMBER	SHEET NO.
DESIGNED BY:	J.O.	CHECKED BY:	J.O.	17-549	CH-1
SCALE:	H: 500, V: 50	DATE:	NOVEMBER, 2019		





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LEGEND:

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- 78.00 — PROPOSED ELEVATION
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- WOODY BANK TREATMENT
- EARTH PLUG
- BIODEGRADABLE EROSION CONTROL BLANKET
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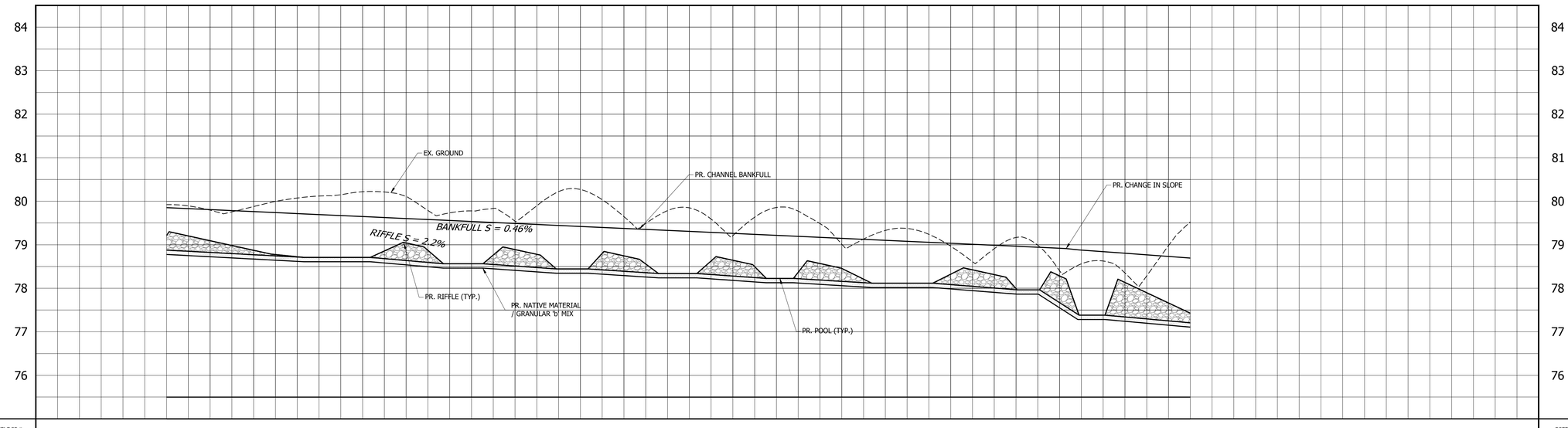

	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+360	0+380	0+400
RIFFLE ID#												
BANKFULL ELEVATION	79.331	79.240	79.149	79.058	78.967	78.876	78.785	78.694	78.603	78.512	78.421	78.268
CHANNEL BOTTOM /EXISTING ELEVATION	78.704 / 79.393	78.276 / 79.468	78.210 / 79.719	78.064 / 79.233	78.280 / 79.398	78.245 / 79.147	78.128 / 79.091	77.868 / 79.274	77.617 / 76.830	77.925 / 78.113	77.784 / 77.901	77.399 / 77.786
CHANNEL BOTTOM CHAINAGE												

NOTE:

REFER TO SEC 1 TO SEC 4 FOR CROSS SECTION DRAWINGS

BEACON ENVIRONMENTAL

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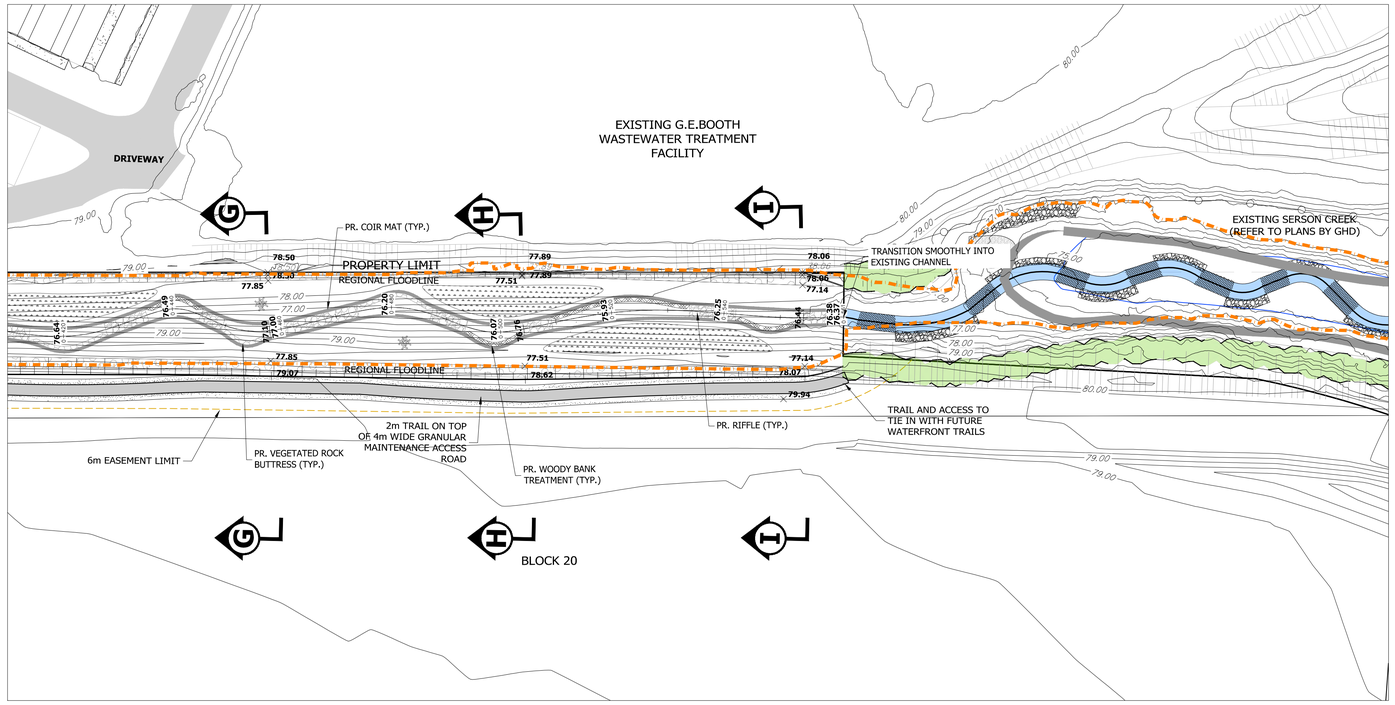
www.urbantech.com

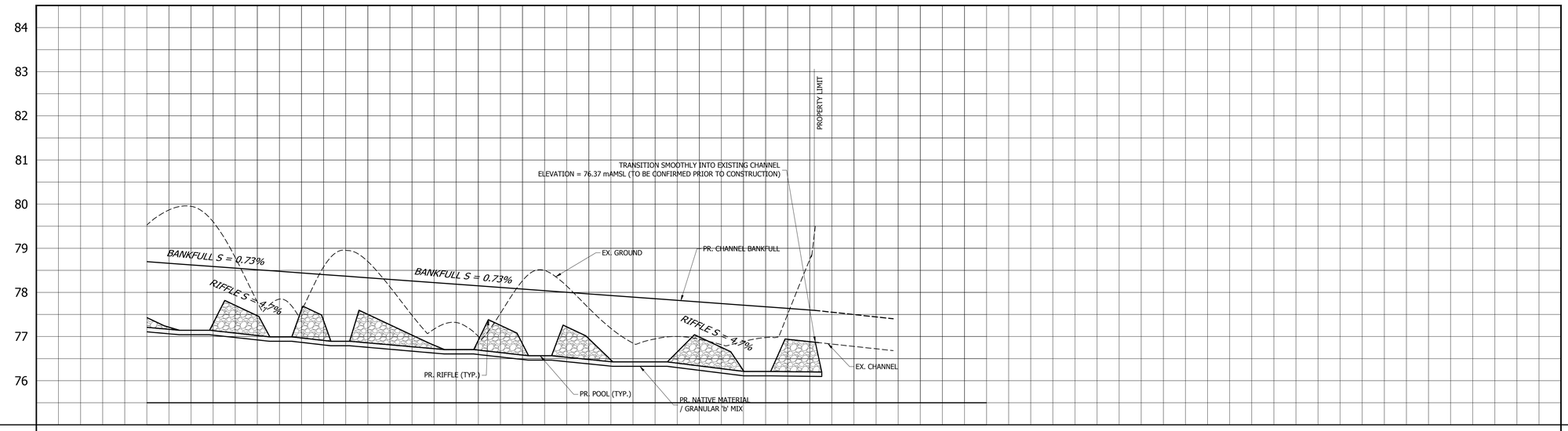
LAKEVIEW COMMUNITY PARTNERS LTD.
SERSON CREEK

CHANNEL PLAN & PROFILE
(STA. 0+180 TO 0+410)

SURVEYED BY:	J.D.B.	DATE:	NOVEMBER, 2016	CONTRACT NO.	
DRAWN BY:	R.B.	CHECKED BY:	J.O.	PROJECT NUMBER	SHEET NO.
DESIGNED BY:	J.O.	CHECKED BY:	J.O.	17-549	CH-2
SCALE:	H: 500, V: 50	DATE:	NOVEMBER, 2019		

File: P:\Projects\17-549\CPG Lakeview\Reports\NHS Design Brief\Drawings\CH1_4-NHS-Plan & Profiles.dwg • Revised by <BRACHER> • Fri, Nov 29 2019 • 2:51pm





RIFFLE ID#								
BANKFULL ELEVATION	78.123	77.977	77.831	77.685	77.539	77.393	77.247	77.101
CHANNEL BOTTOM /EXISTING ELEVATION	76.642 / 79.451	76.493 / 77.348	77.002 / 78.199	76.204 / 76.818	76.066 / 77.998	75.926 / 76.351	76.255 / 76.315	76.383 / 78.252
CHANNEL BOTTOM CHAINAGE	0+420	0+440	0+460	0+480	0+500	0+520	0+540	0+560

RIFFLE ID#	
BANKFULL ELEVATION	
CHANNEL BOTTOM /EXISTING ELEVATION	
CHANNEL BOTTOM CHAINAGE	0+580

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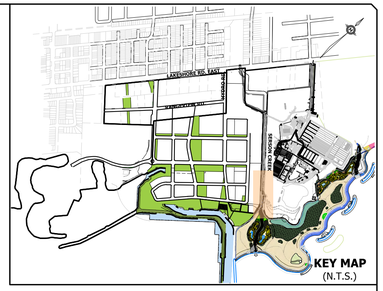

LEGEND:

- 81.00 — EXISTING CONTOUR ELEVATION
- 78.00 — PROPOSED ELEVATION
- RIFFLE
- VEGETATED ROCK BUTTRESS (CHANNEL BANK)
- VEGETATED ROCK BUTTRESS (TOE OF SLOPE)
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- EARTH PLUG
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- OFFLINE WETLAND FEATURE

NOTE:

REFER TO SEC 1 TO SEC 4 FOR CROSS SECTION DRAWINGS

BEACON ENVIRONMENTAL

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www.urbantech.com

LAKEVIEW COMMUNITY PARTNERS LTD.
SERSON CREEK

CHANNEL PLAN & PROFILE
(STA. 0+410 TO 0+561)

SURVEYED BY:	J.D.B.	DATE:	NOVEMBER, 2016	CONTRACT NO.	
DRAWN BY:	R.B.	CHECKED BY:	J.O.	PROJECT NUMBER	SHEET NO.
DESIGNED BY:	J.O.	CHECKED BY:	J.O.	17-549	CH-3
SCALE:	H: 500, V: 50	DATE:	NOVEMBER, 2019		

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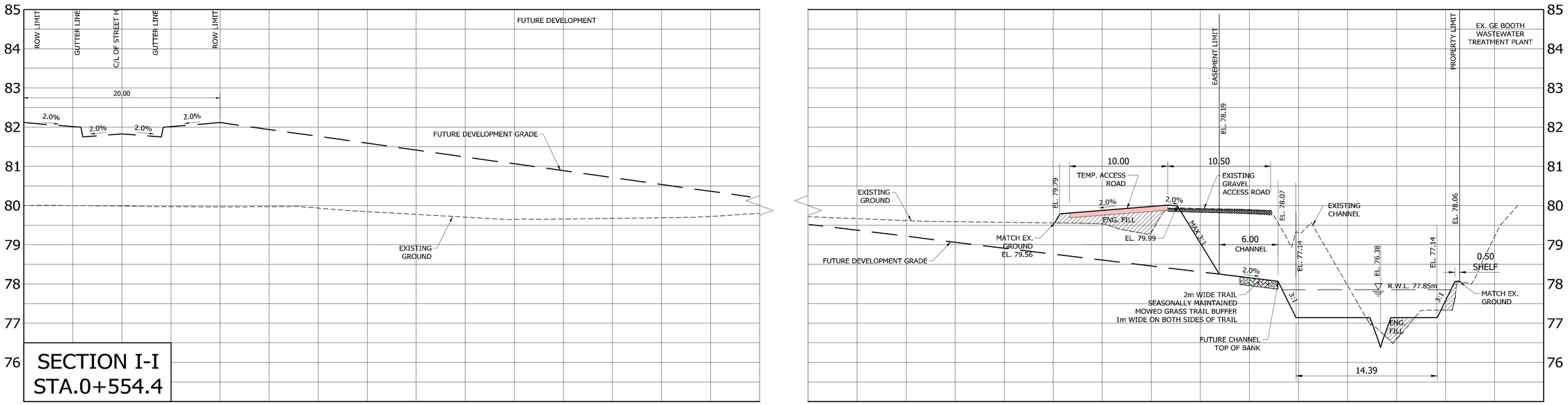

SECTION I-I
STA.0+554.4

NOTE:
FOR LOW FLOW CHANNEL AND CHANNEL BANK
REFER TO CHANNEL DETAILS DRAWING

urbantech
Urbantech Consulting, A Division of Leighton-Zec Ltd.
3760 14th Ave, Suite 301, Markham, Ontario L3R 3T7
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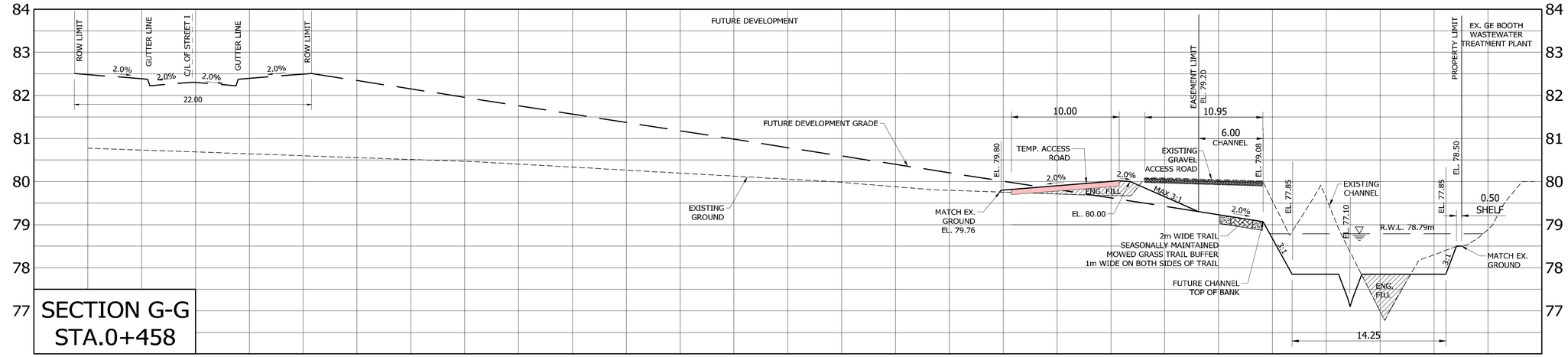
BEACON ENVIRONMENTAL

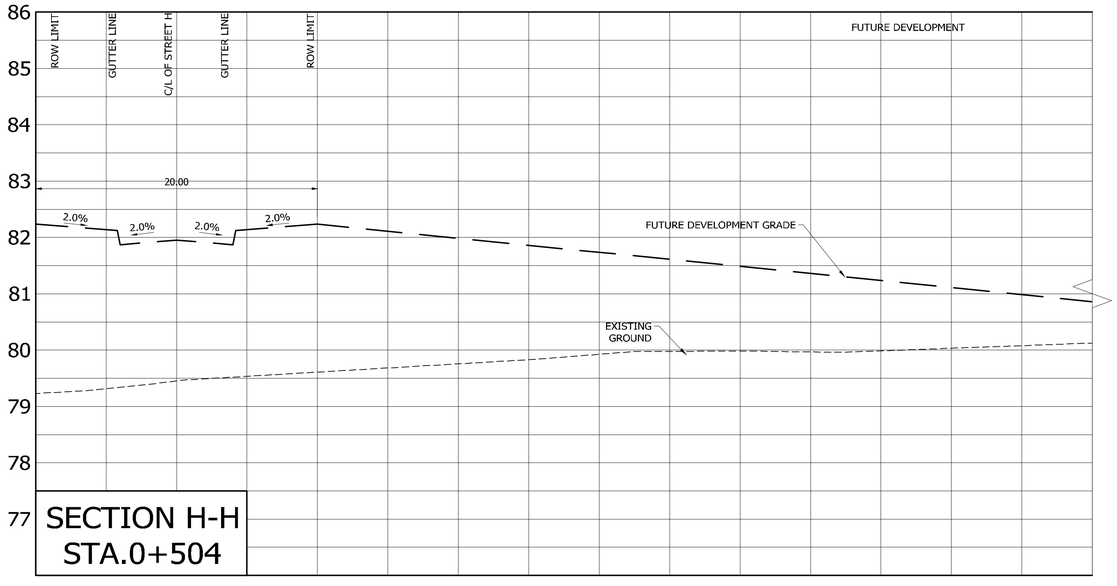
OPG LAKEVIEW COMMUNITY
CITY OF MISSISSAUGA

SERSON CREEK
CROSS SECTION I-I

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	H: 1:200 V: 1:50	SEC-4



SECTION G-G
STA.0+458



SECTION H-H
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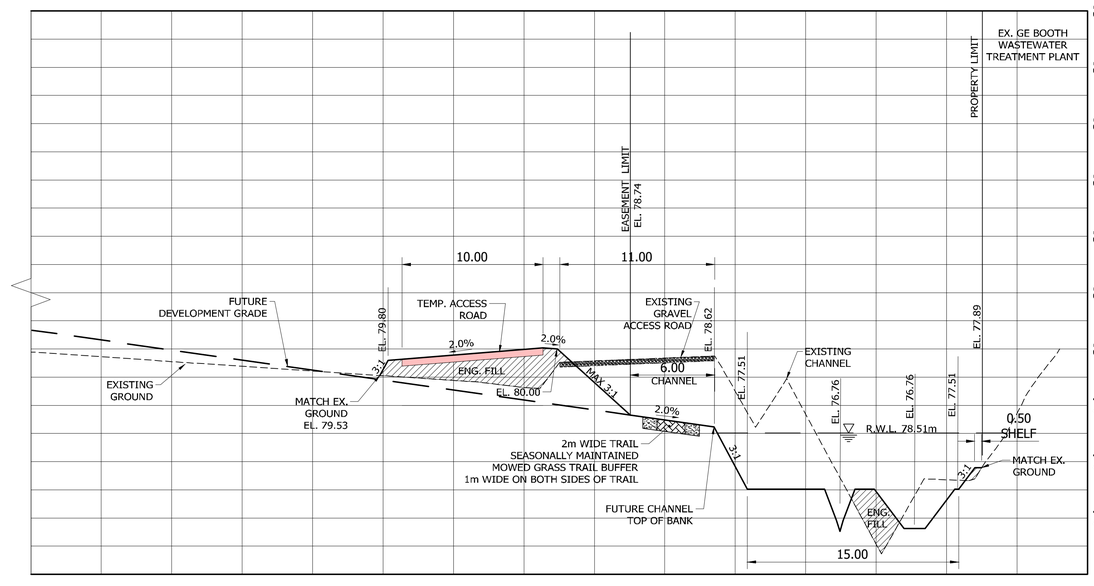

NOTE:
FOR LOW FLOW CHANNEL AND CHANNEL BANK
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BEACON ENVIRONMENTAL

OPG LAKEVIEW COMMUNITY
CITY OF MISSISSAUGA

SERSON CREEK
CROSS SECTIONS G-G TO H-H

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	H: 1:200 V: 1:50	SEC-3

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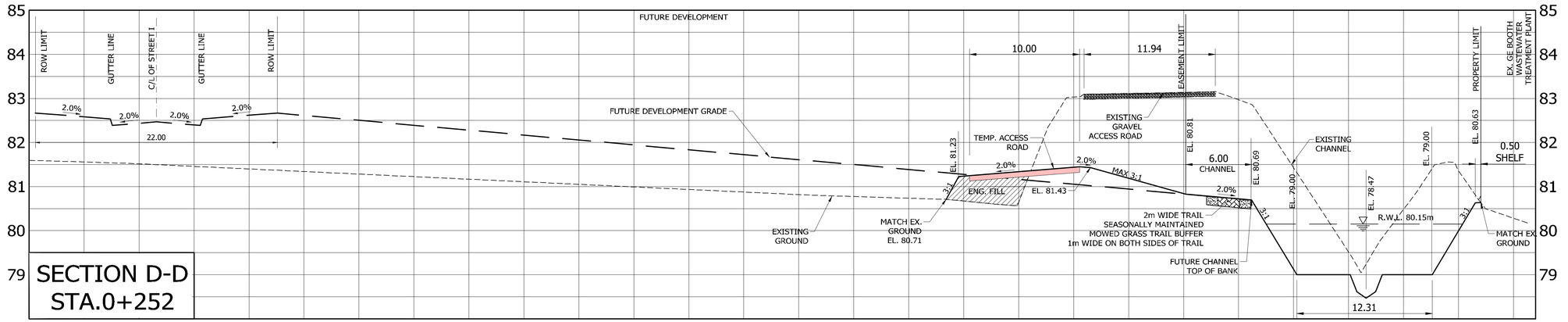

SECTION D-D
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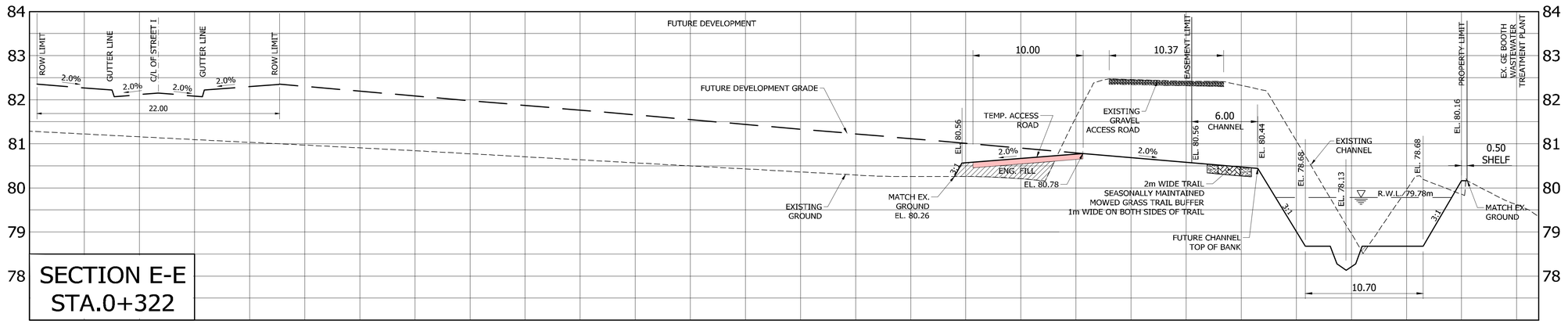
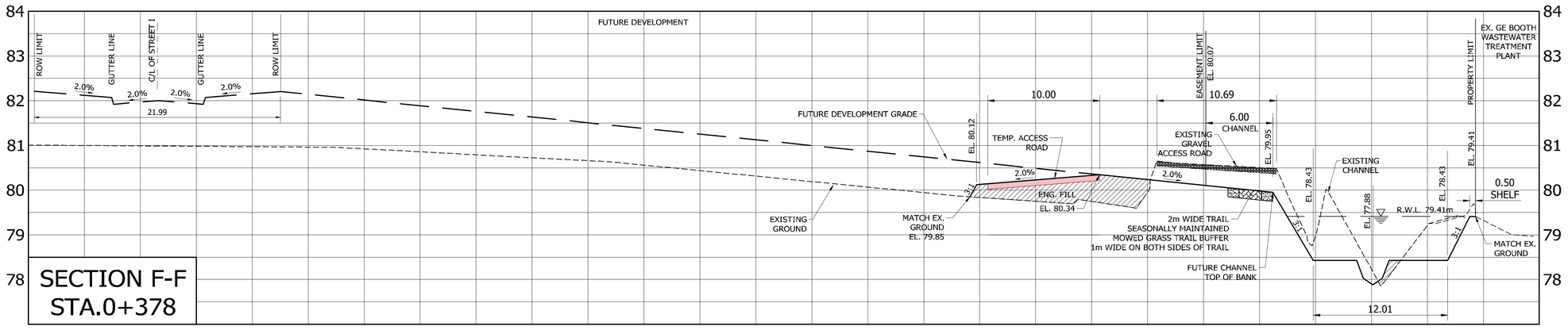


SECTION E-E
STA.0+322



SECTION F-F
STA.0+378

NOTE:
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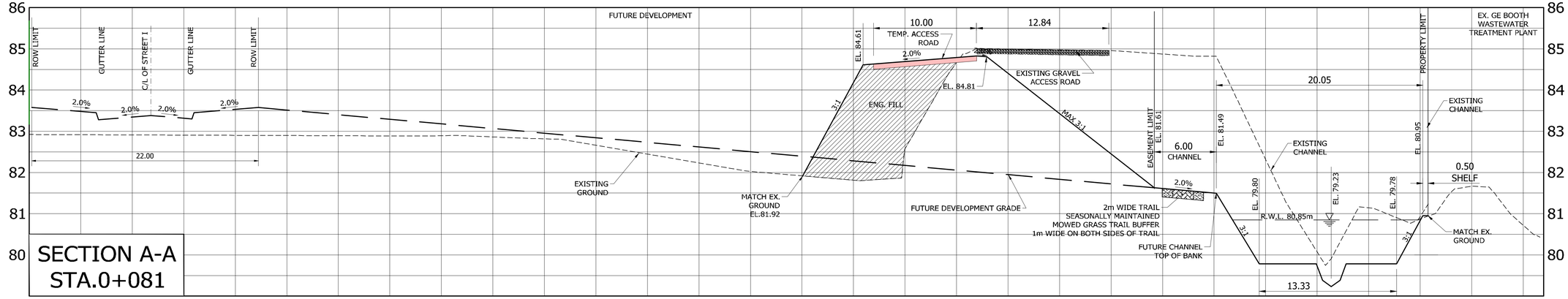
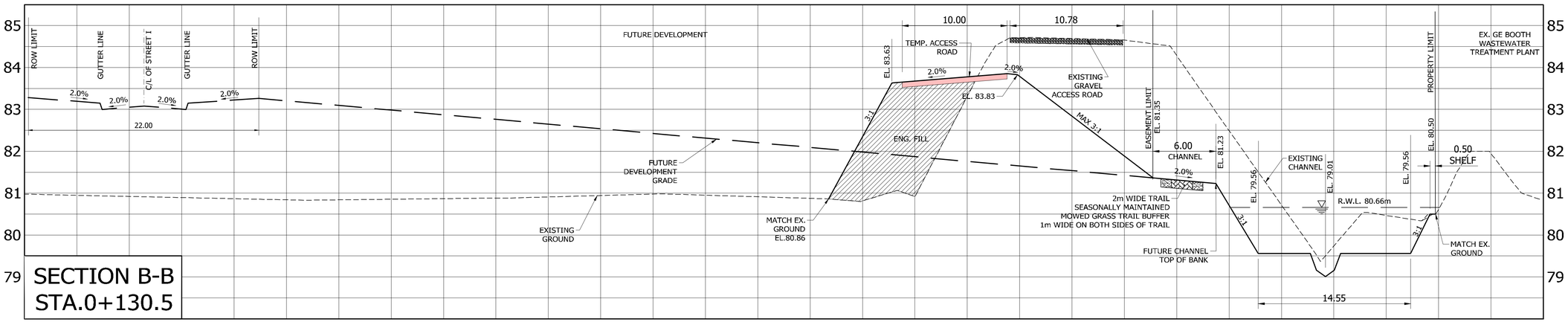
BEACON ENVIRONMENTAL

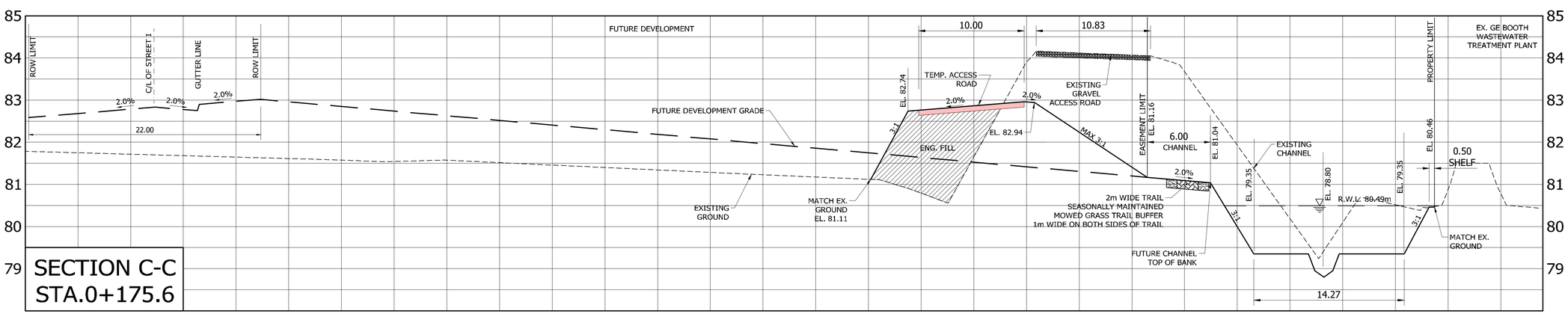
OPG LAKEVIEW COMMUNITY
CITY OF MISSISSAUGA

SERSON CREEK
CROSS SECTIONS D-D TO F-F

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	H: 1:200 V: 1:50	SEC-2







NOTE:
FOR LOW FLOW CHANNEL AND CHANNEL BANK
REFER TO CHANNEL DETAILS DRAWING

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BEACON ENVIRONMENTAL

OPG LAKEVIEW COMMUNITY
CITY OF MISSISSAUGA

SERSON CREEK
CROSS SECTION A-A TO C-C

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	H: 1:200 V: 1:50	SEC-1

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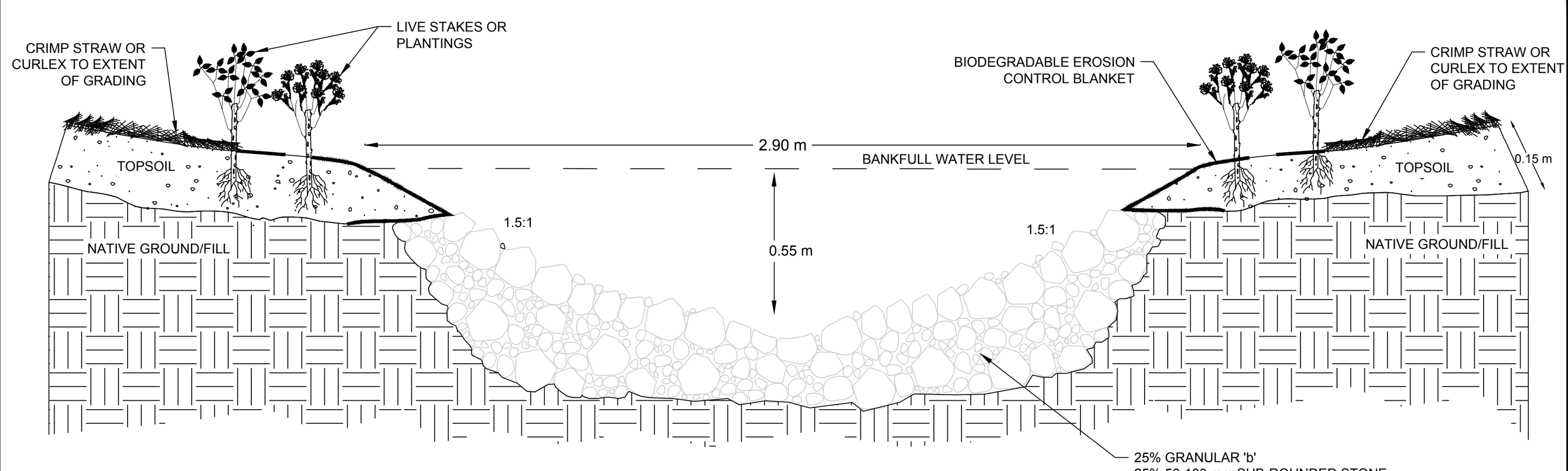
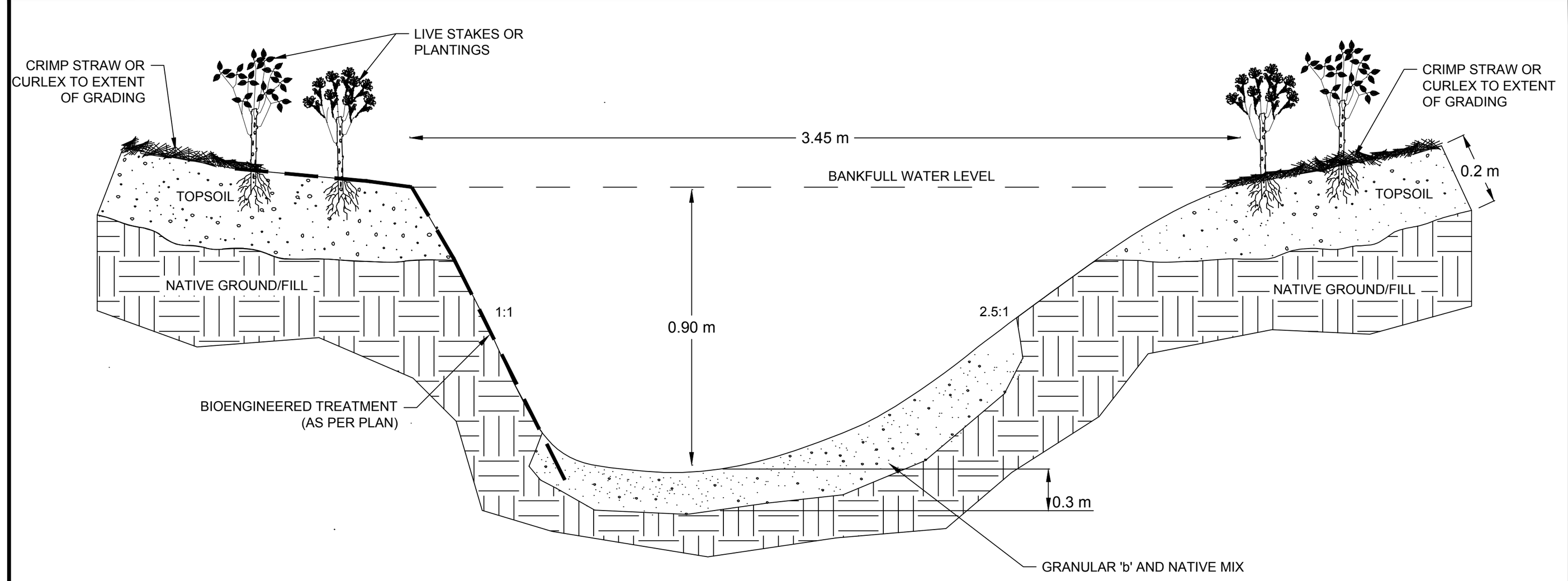
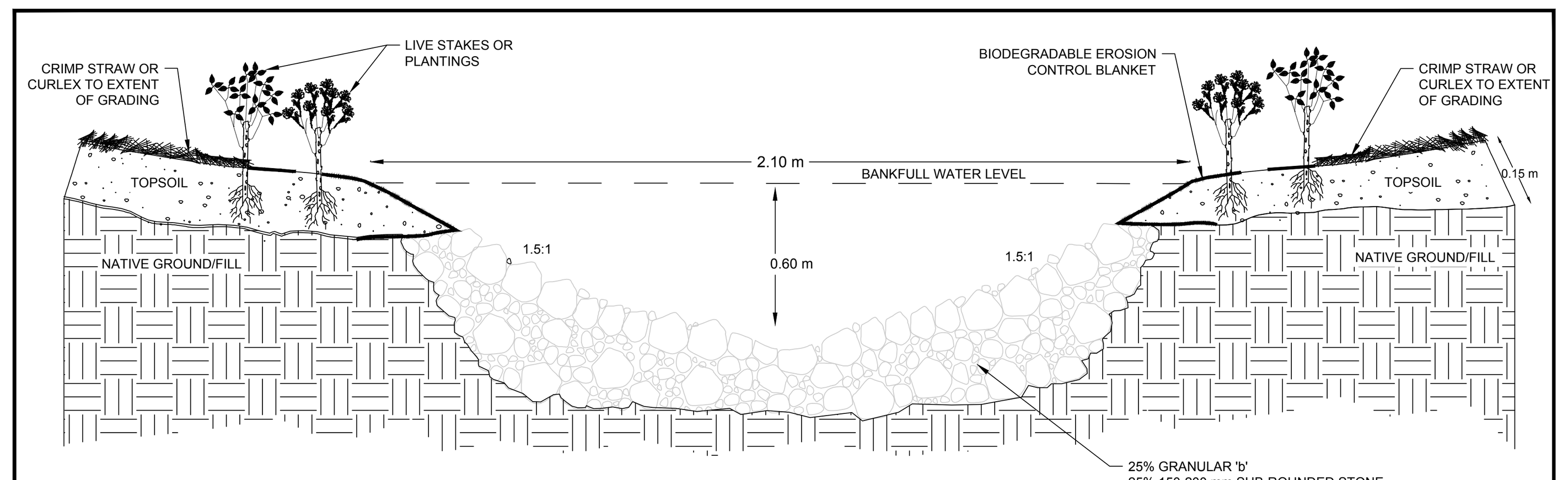


TYPICAL RIFFLE CROSS SECTION
(STA 0+000 TO 0+378)
N.T.S.



TYPICAL POOL CROSS SECTION
(STA. 0+000 TO 0+378)
N.T.S



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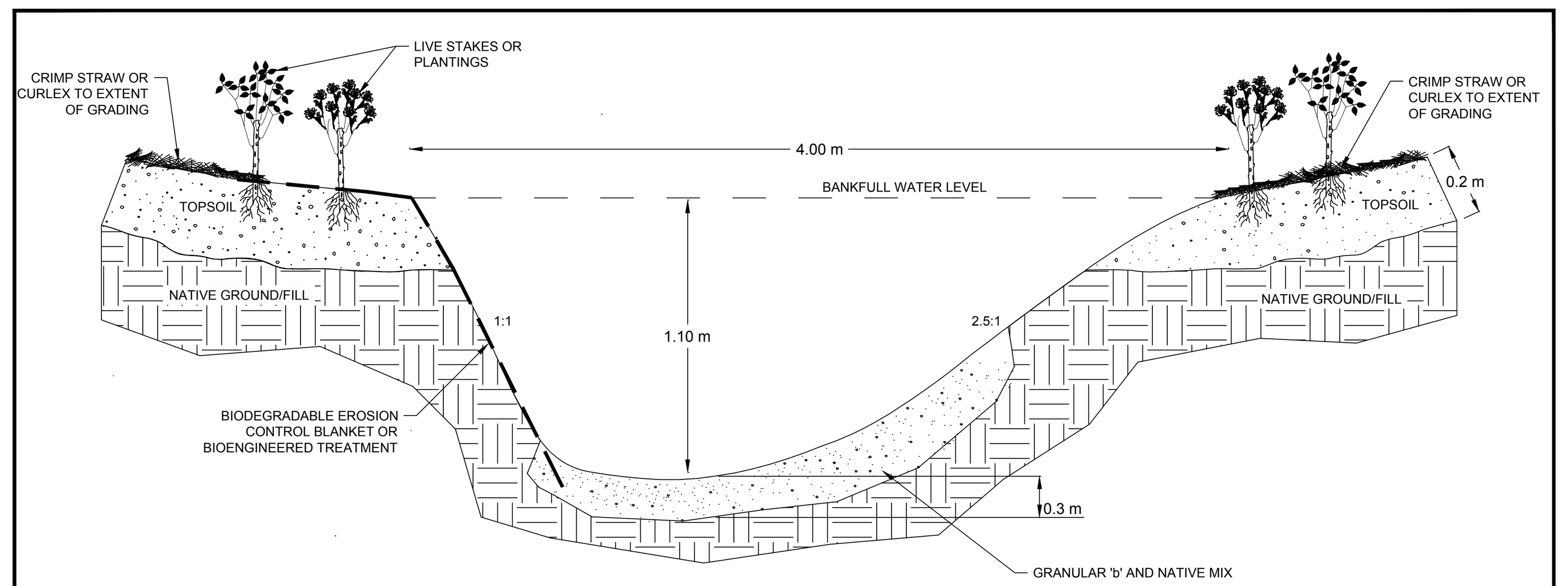

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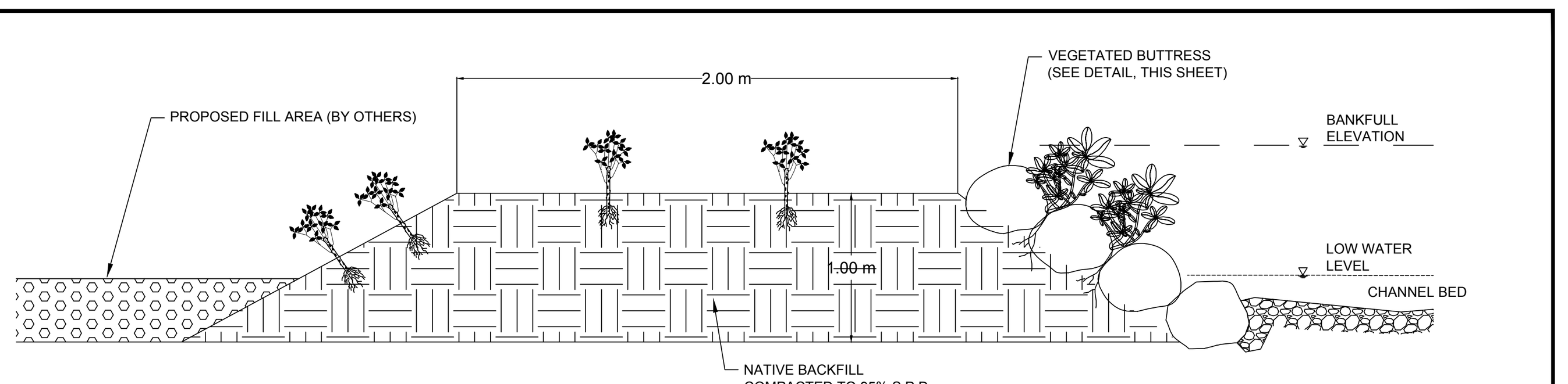
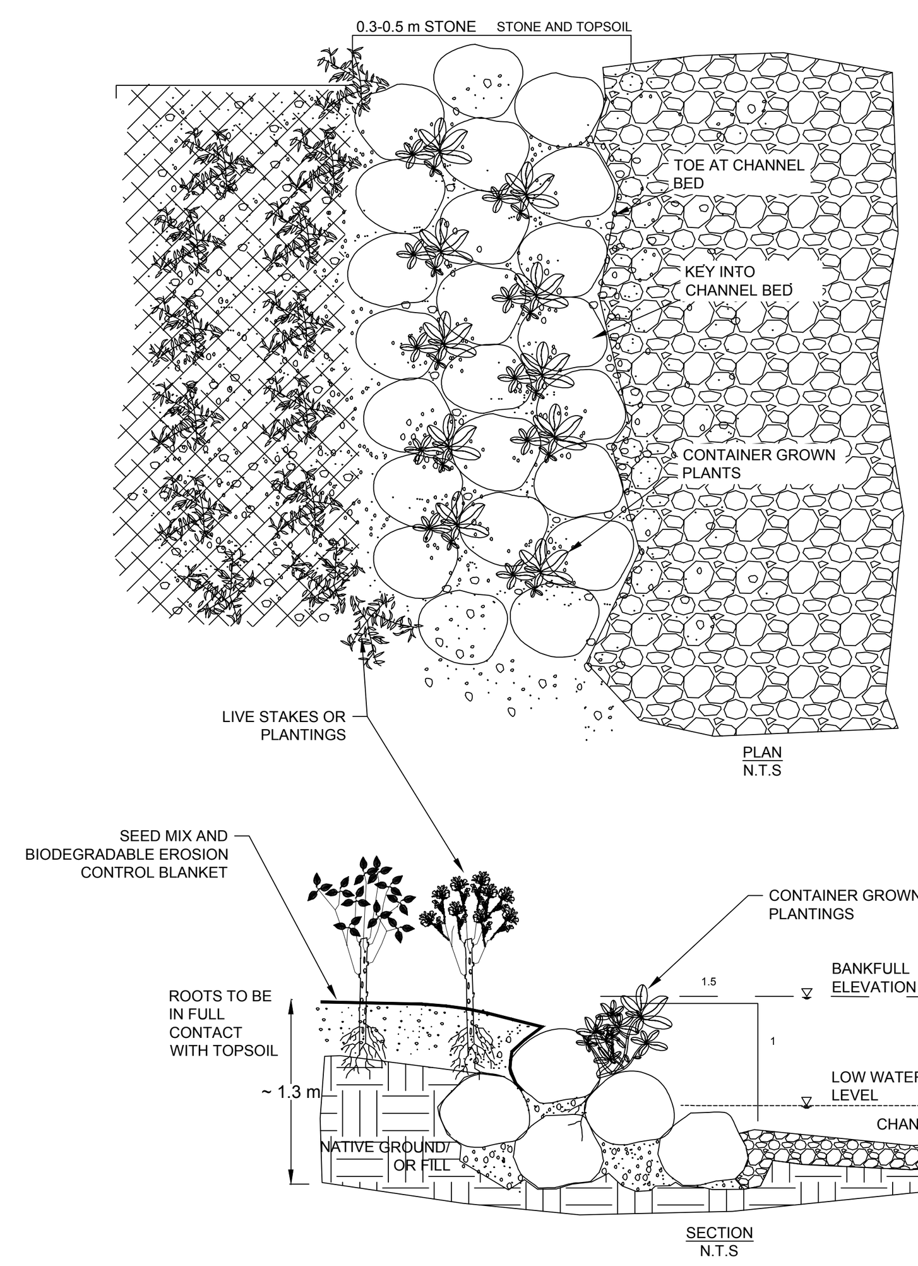


NOTES

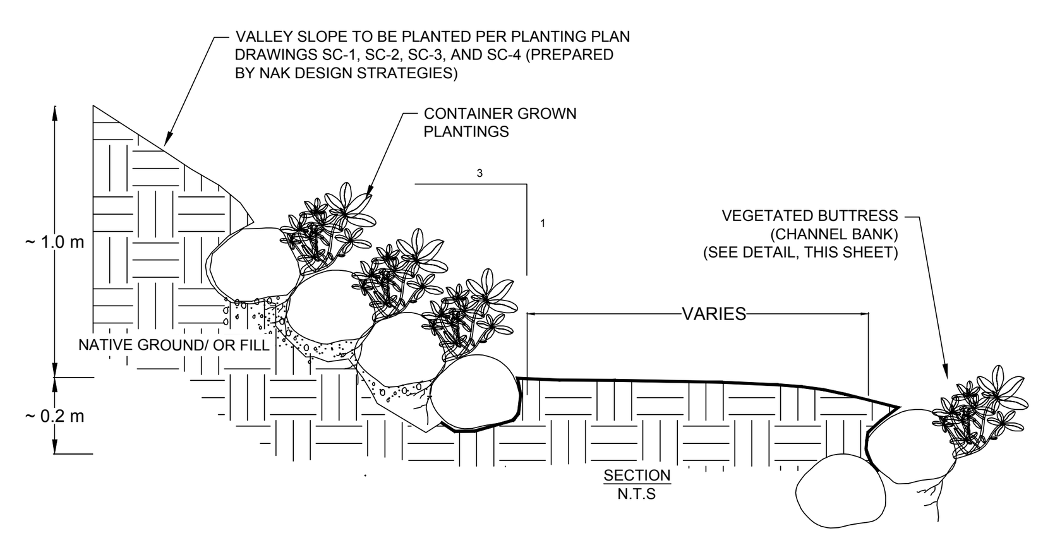
1. EARTH PLUG TO BE CONSTRUCTED IN LIFTS CONCURRENT WITH CONSTRUCTION OF VEGETATED BUTTRESS.
2. EARTH PLUG TO BE COMPACTED TO 95% S.P.D.
3. TOP OF EARTH PLUG TO BE SEEDED WITH NATIVE MIX, AS SPECIFIED IN PLANTING PLAN DRAWINGS SC-1, SC-2, SC-3, AND SC-4 PREPARED BY NAK DESIGN STRATEGIES.

EARTH PLUG TYPICAL
N.T.S.

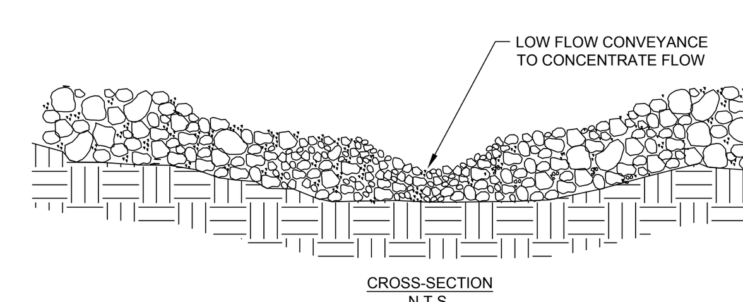


NOTES
1. LIVE STAKES MUST BE CUT FROM DORMANT MATERIALS.
2. LIVE STAKES SHALL BE PLANTED THE SAME DAY AS HARVESTED, OR STORED FOR A PERIOD NO LONGER THAN TWO (2) DAYS.
3. THE CONTRACTOR SHALL PROTECT PLANT MATERIALS FROM DRYING AND OVERHEATING AT THE TIME OF HARVEST, DURING TRANSPORT AND DURING THE CONSTRUCTION PROCESS.
4. LIVE STAKES TO BE 2-4 cm DIAMETER AND CUT TO A LENGTH OF 1.0-1.5 m
5. MAKE AN ANGLE CUT AT THE BASAL END, OR BOTTOM OF THE STAKE.
6. TRIM ALL SIDE BRANCHES, TAKING CARE NOT TO DAMAGE THE BARK.
7. DO NOT PLANT UPSIDE DOWN.
8. LIVE STAKES SHOULD BE INSTALLED USING A DEADBLOW HAMMER (LARGE RUBBER MALLET WITH THE HEAD FILLED WITH LEAD PELLETS).
9. 80 PERCENT OF STAKE TO BE BELOW SURFACE.
10. GENTLY TAMP THE LIVE STAKE INTO THE GROUND AT RIGHT ANGLES TO THE SLOPE.
11. IF THE SOIL IS COMPACT A PILOT HOLE MADE WITH A STEEL BAR SHOULD BE USED.
12. IF USING A PILOT HOLE REPACK SOIL AROUND THE STAKE.
13. DENSITY OF LIVE STAKES TO BE 4 PER SQUARE METRE.

VEGETATED ROCK BUTTRESS (CHANNEL BANK)
N.T.S

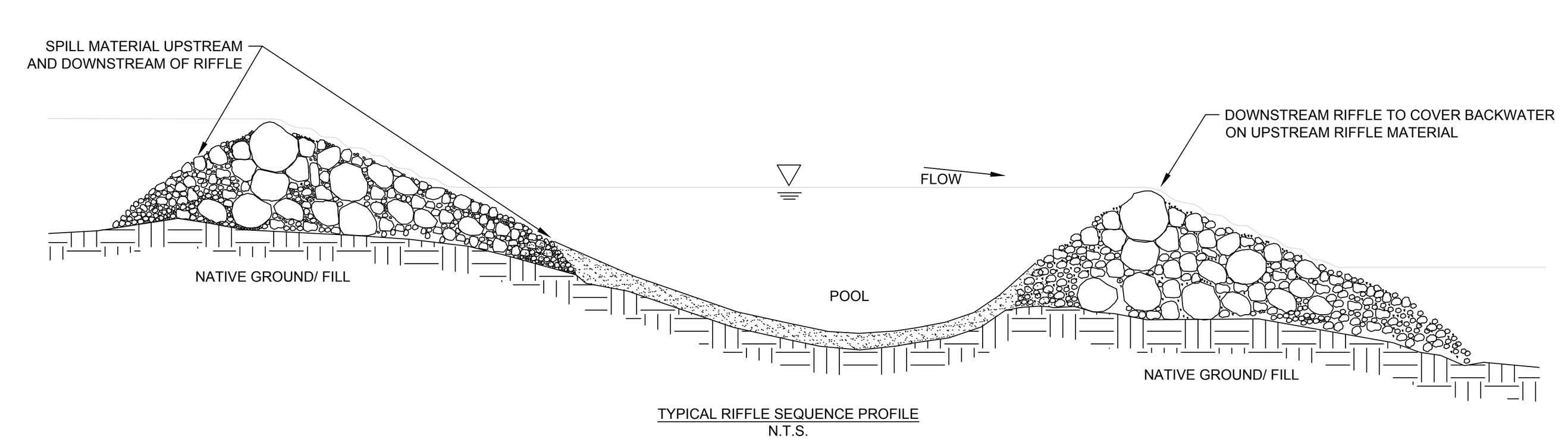


VEGETATED BUTTRESS (VALLEY SLOPE)
N.T.S

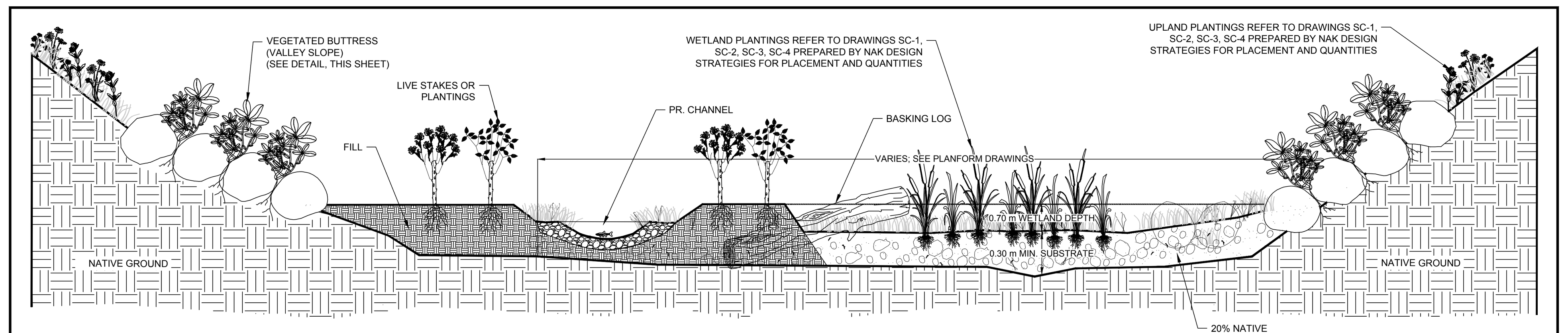


NOTES

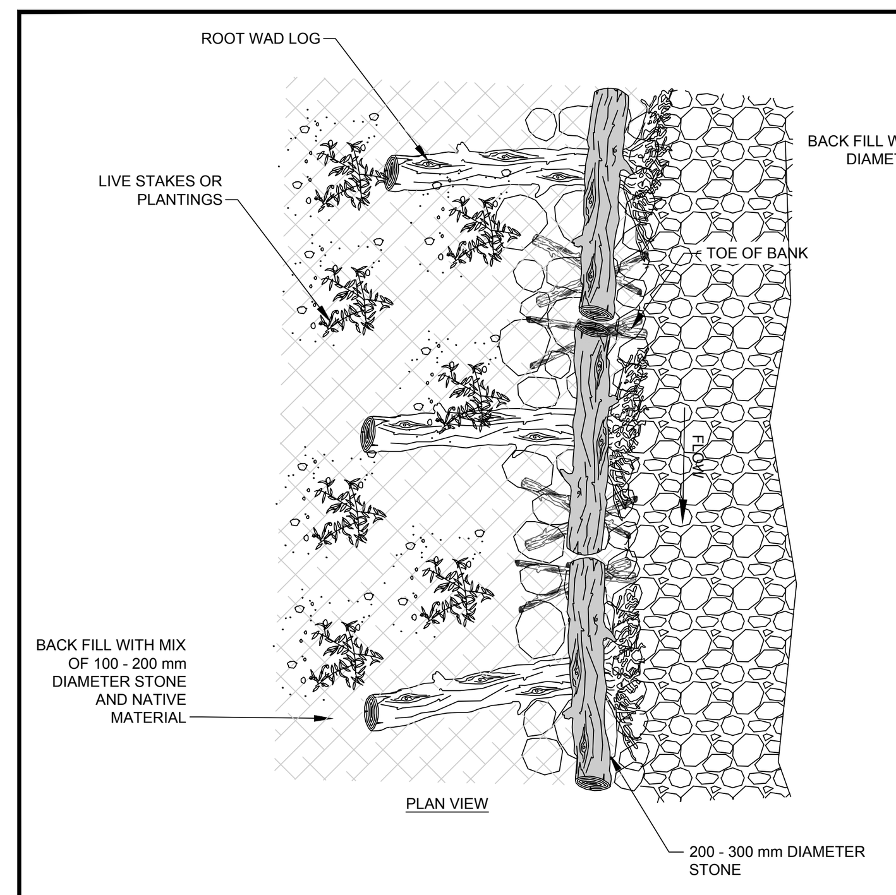
1. DIG DEPRESSIONS INTO THE BED TO STABILIZE RIFFLE MATERIALS.
2. PLACE LARGEST MATERIAL (KEY STONE) AT RIFFLE CREST (HIGHEST POINT).
3. ENSURE THAT LARGEST ROCKS PROTRUDE INTO FLOW.
4. THICKNESS OF RIFFLE SUBSTRATE AT CREST IS 2-3 TIMES THE LARGEST MATERIAL.
5. FILL VOIDS IN RIFFLE WITH PIT RUN AND/OR NATIVE MATERIALS.
6. TAPER GRAIN SIZE AND BED THICKNESS DOWNSTREAM AND UPSTREAM OF CREST.
7. RIFFLE MATERIALS SHOULD EXTEND OVER LIP OF THE DEPRESSION.
8. SPREAD REMAINING ROCK ON RIFFLE TO ATTAIN RIFFLE ANGLE.
9. RIFFLE LENGTH IS DETERMINED FROM PROFILE.
10. SUBSTRATE TO BE PLACED DIRECTLY ON NATURAL MATERIALS (DO NOT USE FILTER CLOTH, ETC.).
11. SUBSTRATE TO BE MECHANICALLY COMPACTED TO MINIMIZE INTERSTITIAL SPACING.

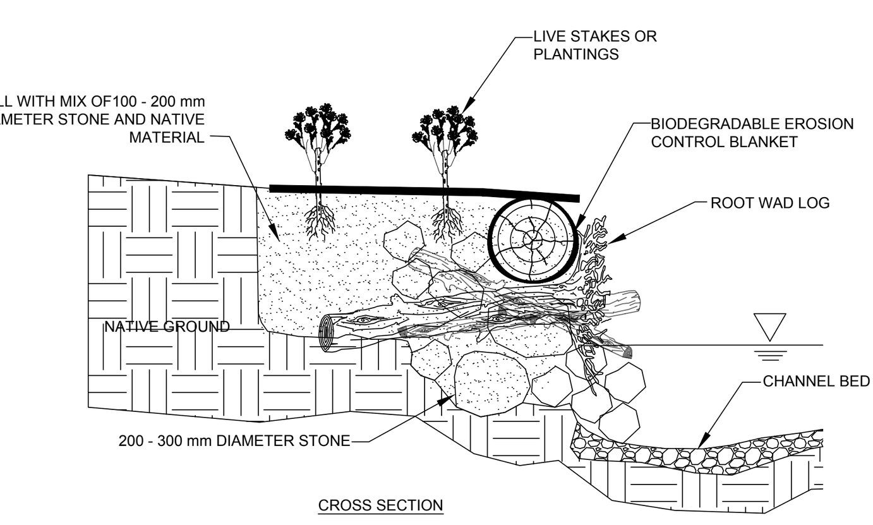


RIFFLE CONSTRUCTION DETAILS
N.T.S.



OFFLINE WETLAND DETAIL
N.T.S.



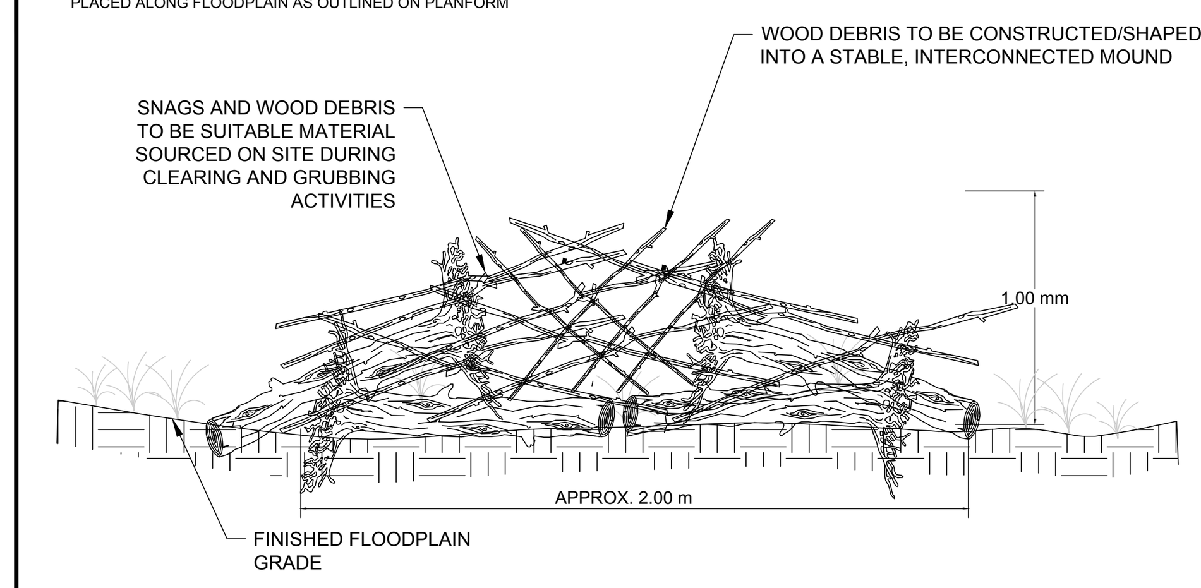


NOTES

1. ROOT WAD LOGS TO BE 1.50 TO 2.00 m IN LENGTH WITH A ~0.60 m DIAMETER ROOT BALL AND ~0.20 m DIAMETER TRUNK.
2. LOGS TO BE SOURCED ON SITE IF POSSIBLE.
3. KEY ~0.10 m OF ROOT BALL INTO CHANNEL BED.
4. END OF TRUNK TO BE AT GROUND ELEVATION.
5. STONES AT BANK TO BE 0.20 - 0.30 m DIAMETER.
6. BACKFILL WITH MIX OF 0.10 - 0.20 m DIAMETER STONES AND NATIVE MATERIAL.
7. INSTALL 2.00 m OF BIODEGRADABLE EROSION CONTROL BLANKET FROM CHANNEL BANK, AND LIVE STAKE.

WOODY DEBRIS BANK TREATMENT
N.T.S.

** LOCATION OF WOODY DEBRIS HABITAT FEATURE TO BE SPORADICALLY PLACED ALONG FLOODPLAIN AS OUTLINED ON PLANFORM



NOTES

1. HEIGHT OF MOUND WILL BE DEPENDANT ON SIZE AND SHAPE OF MATERIALS. NOT TO EXCEED 1000 mm.
2. NO SPECIFIC SPECIES ARE REQUIRED, HOWEVER MOUND SHOULD BE EVEN MIX OF BOTH HARDWOOD AND SOFTWOOD SPECIES.
3. NO ADDITIONAL WOOD DEBRIS SHALL BE DEPOSITED ON TO FLOODPLAIN, UNLESS INTERCONNECT WITHIN THE HABITAT FEATURE.

FLOODPLAIN WOOD DEBRIS HABITAT FEATURE
N.T.S.

PROPOSED CONTAINER GROWN PLANTINGS

VALLEY SLOPE
SPECIES AND QUANTITIES

BOTANICAL NAME	COMMON NAME	QUANTITY
Salix discolor	PUSSY WILLOW	xx
Salix exigua	SANDBAR WILLOW	xx
Cornus stolonifera	RED OSIER DOGWOOD	xx

BANK TREATMENTS
SPECIES AND QUANTITIES

BOTANICAL NAME	COMMON NAME	QUANTITY
Salix discolor	PUSSY WILLOW	xx
Salix exigua	SANDBAR WILLOW	xx
Cornus stolonifera	RED OSIER DOGWOOD	xx

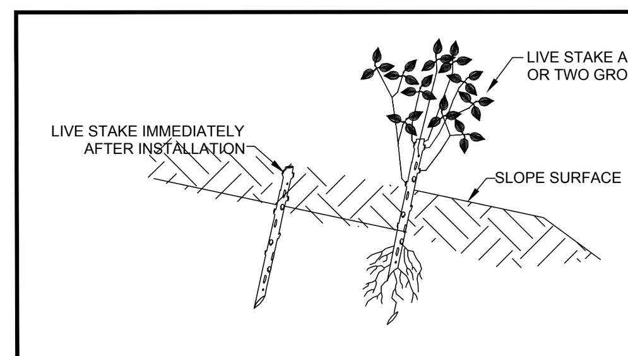
FLOODPLAIN/TOP OF CHANNEL
SPECIES AND QUANTITIES

BOTANICAL NAME	COMMON NAME	QUANTITY
Salix discolor	PUSSY WILLOW	xx
Salix exigua	SANDBAR WILLOW	xx
Cornus stolonifera	RED OSIER DOGWOOD	xx

TYPE: CONTAINER GROWN/BARE ROOT

PROPOSED SEED MIXES

REFER TO PLANTING PLAN DRAWINGS SC-1, SC-2, SC-3, AND SC-4 (PREPARED BY NAK DESIGN STRATEGIES) FOR SEED MIXES, QUANTITIES AND LOCATIONS TO BE APPLIED.



SPECIES

BOTANICAL NAME	COMMON NAME
Salix discolor	PUSSY WILLOW
Salix exigua	SANDBAR WILLOW
Cornus stolonifera	RED OSIER DOGWOOD

QUANTITIES SHALL BE AS REQUIRED; TYPICALLY REPLACE CONTAINER GROWN PLANTS AT A 3:1 RATE

NOTES
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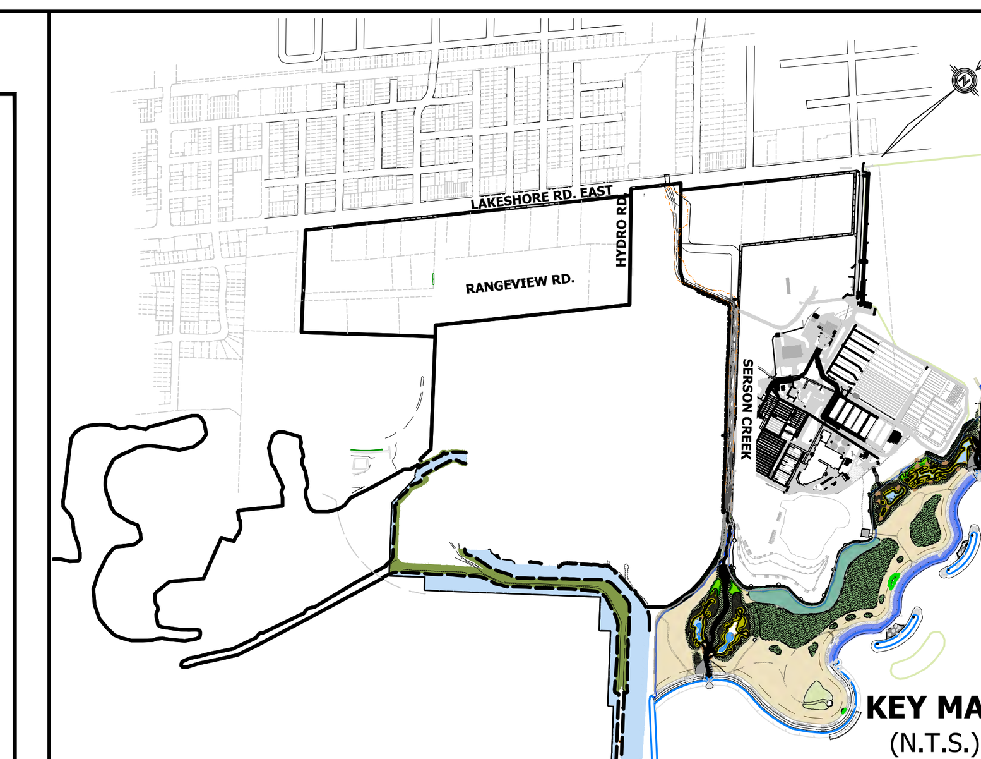
2. LIVE STAKES SHALL BE PLANTED THE SAME DAY AS HARVESTED, OR STORED FOR A PERIOD NO LONGER THAN TWO (2) DAYS.
3. THE CONTRACTOR SHALL PROTECT PLANT MATERIALS FROM DRYING AND OVERHEATING AT THE TIME OF HARVEST, DURING TRANSPORT AND DURING THE CONSTRUCTION PROCESS.
4. LIVE STAKES TO BE 2-4 cm DIAMETER AND CUT TO A LENGTH OF 1.0-1.5 m
5. MAKE AN ANGLE CUT AT THE BASAL END, OR BOTTOM OF THE STAKE.
6. TRIM ALL SIDE BRANCHES, TAKING CARE NOT TO DAMAGE THE BARK.
7. DO NOT PLANT UPSIDE DOWN.
8. LIVE STAKES SHOULD BE INSTALLED USING A DEADBLOW HAMMER (LARGE RUBBER MALLET WITH THE HEAD FILLED WITH LEAD PELLETS).
9. 80 PERCENT OF STAKE TO BE BELOW SURFACE.
10. GENTLY TAMP THE LIVE STAKE INTO THE GROUND AT RIGHT ANGLES TO THE SLOPE.
11. IF THE SOIL IS COMPACT A PILOT HOLE MADE WITH A STEEL BAR SHOULD BE USED.
12. IF USING A PILOT HOLE REPACK SOIL AROUND THE STAKE.
13. DENSITY OF LIVE STAKES TO BE 4 PER SQUARE METRE.

LIVE STAKE DETAIL (PROVISIONAL)
N.T.S.



KEY MAP
(N.T.S.)

GENERAL NOTES

1. A FULL SET OF DRAWINGS AND PERMITS WILL BE KEPT ON SITE DURING CONSTRUCTION.
2. ACTIVITIES WITHIN THE WATERCOURSE SHALL OCCUR FROM JULY 1 TO MARCH 31, OR AS OTHERWISE DIRECTED BY THE MNRF.
3. THE CONTRACTOR SHALL PROVIDE THE CONSERVATION AUTHORITY AND DESIGNER AT LEAST 48-HOURS OF NOTICE PRIOR TO COMMENCING WORK.
4. ALL DRAWINGS SHALL BE USED FOR CONSTRUCTION. DO NOT SCALE FROM PLANFORM DRAWINGS.
5. ALL MEASUREMENTS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE INDICATED.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATES OF ALL UTILITIES.
7. LAYOUT OF WORKS SHALL BE REVIEWED AND APPROVED BY THE DESIGNER OR REPRESENTATIVE.
8. ALL WORKS SHALL BE REVIEWED AND APPROVED BY THE DESIGNER OR REPRESENTATIVE.
9. ALL GENERAL BACKFILL/SOIL SHALL BE APPROVED MATERIAL COMPACTED TO 85% STANDARD PROCTOR DENSITY, UNLESS OTHERWISE STATED.
10. THE CONTRACTOR SHALL REMOVE ALL SEDIMENT CONTROLS AFTER VEGETATION HAS ESTABLISHED. WORKS WILL NOT BE CONSIDERED COMPLETE UNTIL SEDIMENT CONTROLS ARE REMOVED.

ENVIRONMENTAL MITIGATION NOTES

1. ALL MITIGATION AND ESC MEASURES SHALL BE INSTALLED PRIOR TO START OF CONSTRUCTION.
2. ALL EQUIPMENT SHALL BE CLEAN AND FREE OF PETROLEUM PRODUCTS.
3. ALL MAINTENANCE, REFUELING AND STORAGE OF EQUIPMENT SHALL BE CONTROLLED SO AS TO PREVENT AND DISCHARGE OF PETROLEUM PRODUCTS.
4. VEHICULAR MAINTENANCE AND REFUELING SHALL BE CONDUCTED AWAY FROM WATERCOURSES.
5. CONSTRUCTION MATERIALS SHALL BE STORED AWAY FROM WATERCOURSES.
6. DURING CONSTRUCTION ALL VEGETATION ADJACENT TO THE WORK AREA IS TO BE PROTECTED, WHERE IT IS DISTURBED IT SHALL BE RESTORED TO ORIGINAL CONDITION.
7. SEDIMENT CONTROLS SHALL BE INSPECTED DAILY TO ENSURE THAT THEY ARE IN GOOD REPAIR AND FUNCTIONING AS INTENDED.
8. EROSION AND SEDIMENT CONTROLS MUST BE MAINTAINED DURING AND AFTER CONSTRUCTION UNTIL THE SITE IS DEEMED TO BE STABLE BY THE CONTRACT ADMINISTRATOR.
9. ADDITIONAL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED IF PROPOSED CONTROLS ARE NOT ADEQUATELY PREVENTING EROSION AND RELEASE OF SEDIMENT OFF SITE.
10. RE-VEGETATE WORK SITE AS WORK PROGRESSES, OR SOON AS CONDITIONS ALLOW. APPLY A NURSE CROP OF ANNUAL RYE OR SIMILAR COVER IN AREAS TO BE EXPOSED FOR PROLONG PERIODS, PARTICULARLY WITHIN THE NEW CHANNEL CORRIDOR FOR EROSION CONTROL (RATE 30.0 KG/HA).
11. A QUALIFIED BIOLOGIST OR TECHNOLOGIST WITH A VALID PERMIT FROM MNRF SHALL BE AVAILABLE TO RELOCATE DOWNSTREAM STRANDED FISH AND AMPHIBIANS AS REQUIRED.
12. THE WEATHER SHALL BE MONITORED BY THE CONTRACTOR TO ENSURE THAT WORKS ARE COMPLETE DURING DRY OR FAVOURABLE FLOW CONDITIONS.
13. ALL WORK IN THE WATERCOURSE SHALL BE COMPLETED IN THE DRY WITHIN AN ISOLATED WORK AREA DURING LOW-FLOW CONDITIONS.
14. ALL DISTURBED AREAS SHALL BE GRADED, ORGANIC SOIL SHALL BE ADDED AND SEEDED WITH PERMITTED SEED MIX. DISTURBED AREAS SHALL BE COVERED BY COIR CLOTH, JUTE MAT OR STRAW CRIMPING.
15. THE CONTRACTOR SHALL REMOVE ALL SEDIMENT CONTROLS AFTER VEGETATION HAS ESTABLISHED. WORKS WILL NOT BE CONSIDERED COMPLETE UNTIL SEDIMENT CONTROLS ARE REMOVED.

BEACON ENVIRONMENTAL

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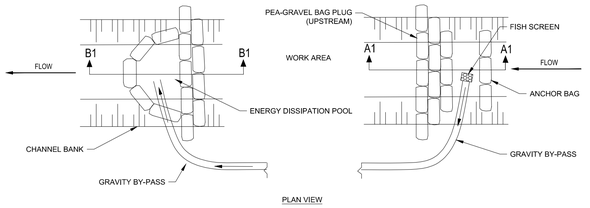
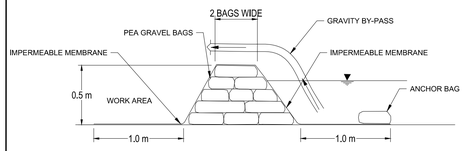
OPG LAKEVIEW COMMUNITY

SERSON CREEK PLAN & PROFILE

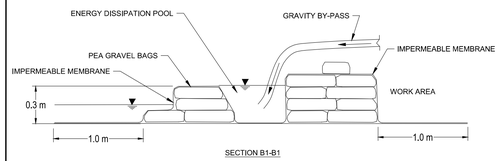
SURVEYED BY:	J.D.B.	DATE:	NOVEMBER, 2016	CONTRACT NO.	
DRAWN BY:	R.B.	CHECKED BY:	J.O.	PROJECT NUMBER	SHEET NO.
DESIGNED BY:	J.O.	CHECKED BY:	J.O.	17-549	DET-1
SCALE:	H: 500, V: 50	DATE:	OCTOBER, 2019		



PLAN VIEW



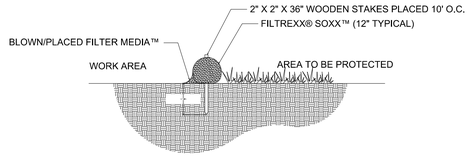
SECTION A1-A1



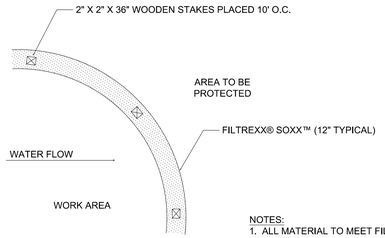
SECTION B1-B1

NOTES

1. METRE BAGS TO BE FILLED WITH PEA GRAVEL.
2. HEIGHT OF COFFERDAMS SHALL MATCH THE HEIGHT OF EITHER CHANNEL BANK, WHICHEVER IS LOWER.
3. IMPERVIOUS MEMBRANE SHALL COVER THE METRE BAGS TO LIMIT WATER ENTRY INTO WORK AREA.
4. PUMPING CAPACITY TO BE A MINIMUM, TO CARRY FLOWS AROUND WORK AREA.
5. SCREEN TO BE INSTALLED AT INTAKE END OF HOSE TO LIMIT FISH MORTALITY.
6. PUMPED WATER SHALL BE DISCHARGED INTO THE ENERGY DISSIPATION POOL.
7. A BACKUP PUMP AND HOSE SHALL BE KEPT ONSITE IN THE EVENT THAT INCREASED FLOWS CANNOT BE PUMPED IN THE PRIMARY SYSTEM.
8. THE CONTRACTOR SHALL MONITOR WEATHER CONDITIONS AND WILL NOT PROCEED WITH WORKS IN THE EVENT OF A STORM EVENT, OR IF IT IS ANTICIPATED THAT FLOWS CANNOT BE PUMPED AROUND AS REQUIRED.



SECTION NTS

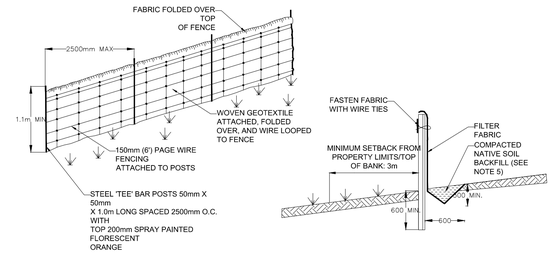


PLAN NTS

NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. FILTER MEDIA™ FILL TO MEET APPLICATION REQUIREMENTS.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.

FILTREXX® SEDIMENT CONTROL

NTS



NOTES

- SILT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW.
- SILT/SEDIMENT CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFORM TO MTO DRAINAGE MANUAL VOLUME 2 'CHART FA-3C TOPOGRAPHIC FACTOR (LS) BASED ON SLOPE LENGTH AND GRADIENT.'
- SILT/SEDIMENT CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL A MIN. OF 300mm BY EITHER STATIC SLICING OR TRENCH METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% STANDARD PROCTOR DENSITY.
- STEEL 'T' BAR POSTS ARE TO BE SPACED MAX. 2500mm ON CENTER.
- FROZEN GROUND CONDITIONS REQUIRE FILTER FABRIC TO BE BACKFILLED IN TRENCH WITH CLEAR STONE.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
- GEOTEXTILE FABRIC TO BE COMPRISED OF WOVEN OR NON-WOVEN U.V. STABILIZED MATERIAL.
- FABRIC TO BE FOLDED OVER TOP OF FENCE MIN. 300mm AND WIRE FASTENED.

SILTATION CONTROL FENCE

N.T.S.

PRE-CLEARING AND SITE PREPARATION

1. Prior to site disturbance the owner must confirm that no migratory birds are making use of the site for nesting.
2. The owner must ensure that the works are in conformance with the Migratory Bird Convention Act and that no migratory bird nests will be impacted by the proposed work.
3. Vegetation clearing work to be undertaken outside of the 'General Nesting Period' of breeding birds in Southern Ontario, between late March and the end of August. During the 'Peak Period' of bird nesting, between April 15th to July 31st, no vegetation clearing or disturbance to nesting bird habitat is permitted. In the 'Shoulder' seasons of April 1 to April 15 and August 1 to August 31, vegetation clearing can occur with clearance by an Ecologist with appropriate avian knowledge and the completion of a site survey to confirm lack of nesting.
4. The Contractor shall mark trees to be removed as specified on this drawing and he shall review this work with the project Arborist/Beacon's Landscape Architect prior to commencing any work on site.
5. The Contractor is required to install all tree protection hoarding first and obtain approval by the project Arborist and the City Forestry Department prior to undertaking any vegetation clearing, demolition, and grading works on site.
6. Trees identified for preservation are not to be damaged during tree removal operations. Where required, trees are to be pruned according to arboricultural standards.
7. Where possible, trees removed may be stored on site for re-use as habitat features in the channel or in wetlands. Wood chips can be re-used on site as part of planting works. All excess materials not identified for re-use shall be removed off site.

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3760 14th Ave, Suite 301, Markham, Ontario L3R 3T7
tel: 905.946.9461 fax: 905.946.9595
www.urbantech.com

LAKEVIEW COMMUNITY PARTNERS LTD.

CITY OF MISSISSAUGA

SERSON CREEK

CONSTRUCTION STAGING AND EROSION AND SEDIMENT CONTROL DETAILS

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	N.T.S.	**STG-2**

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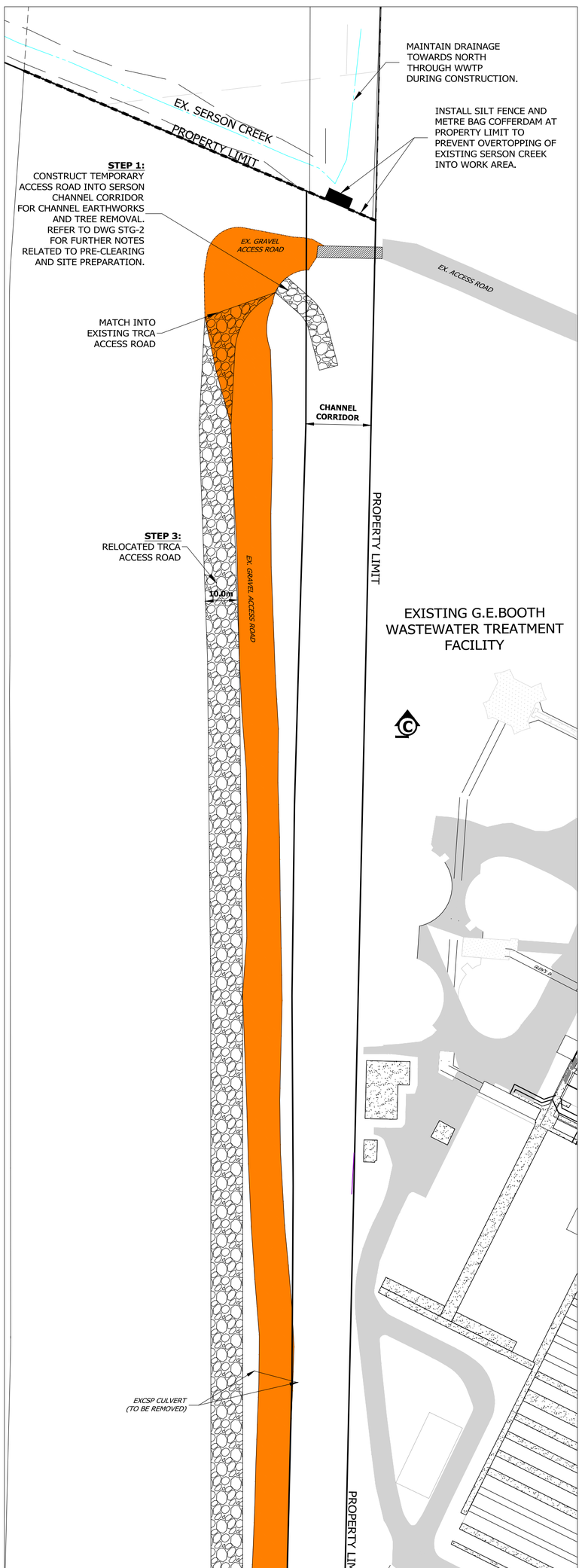
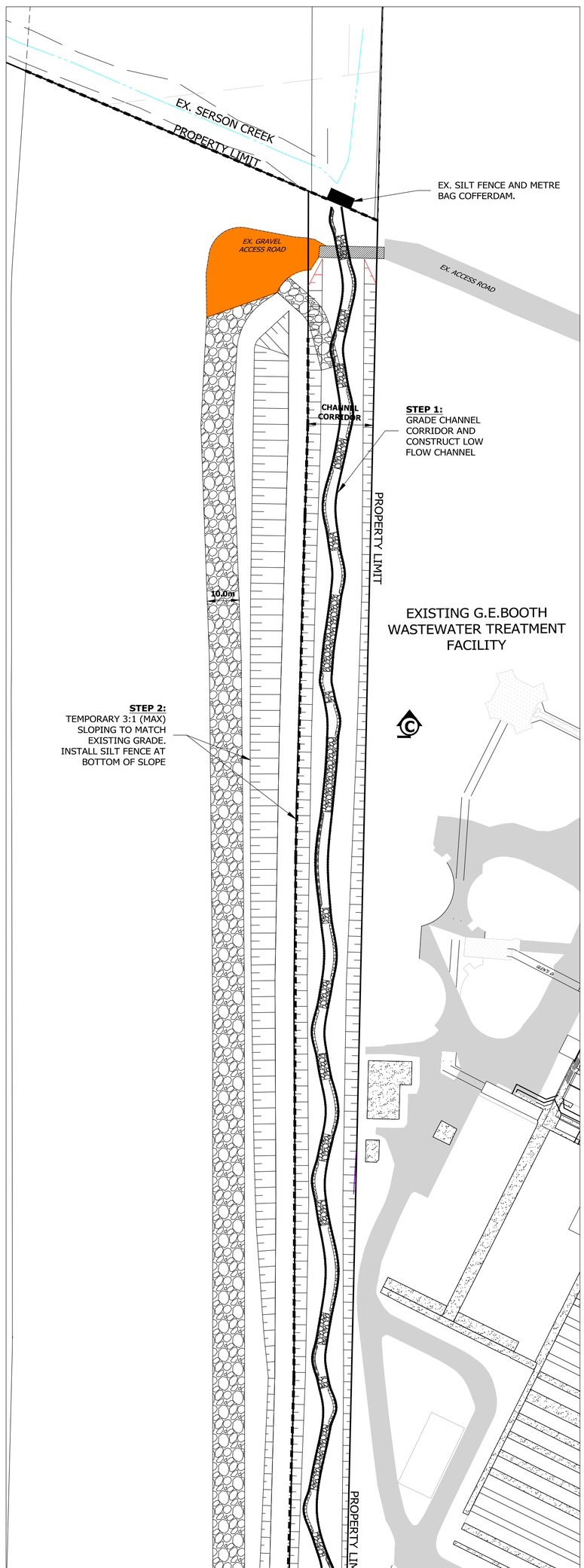
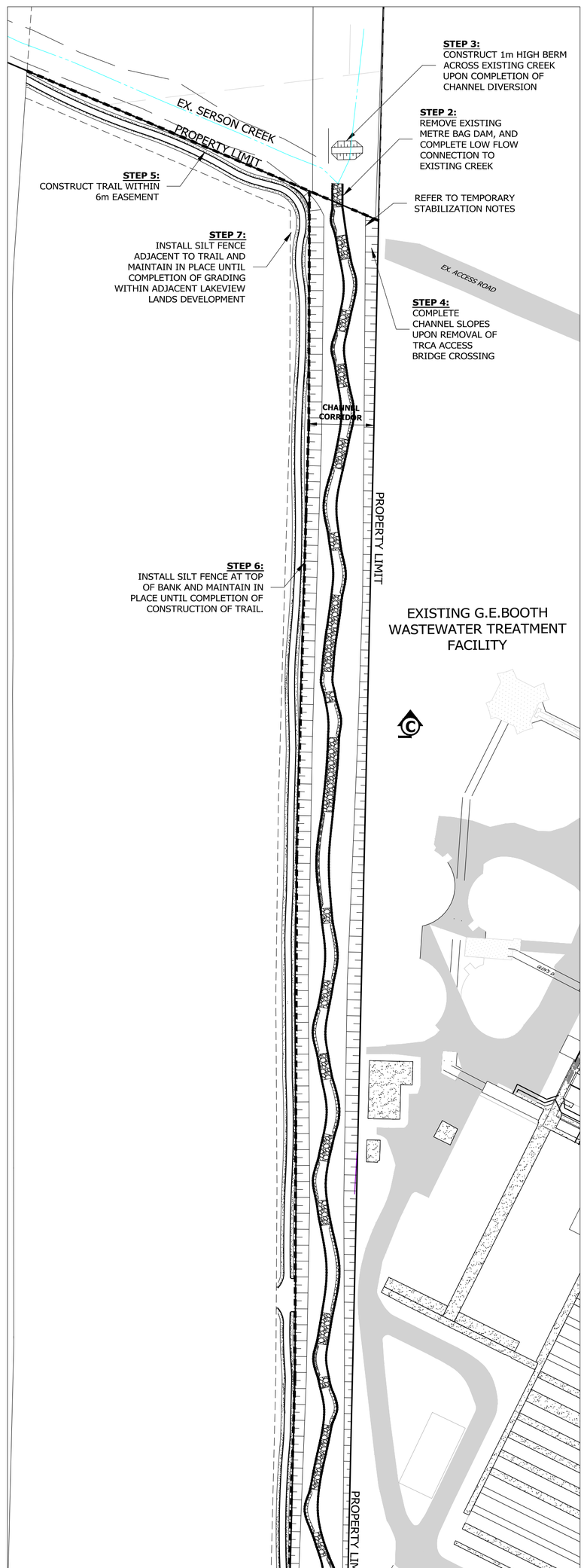


STAGE 1
PRE-CONSTRUCTION



STAGE 2
CHANNEL CONSTRUCTION



STAGE 3
CHANNEL ACTIVATION

EROSION AND SEDIMENT CONTROLS GENERAL NOTES:

1. THIS DRAWING IS TO BE USED FOR ESC MEASURES DURING CONSTRUCTION OF SERSON CREEK.
2. ALL ESC MEASURES ARE TO BE MAINTAINED UNTIL CONSTRUCTION IS COMPLETE AND SITE IS STABILIZED.
3. THE CONTRACTOR SHALL ENDEAVOR TO PREVENT MUD TRACKING ONTO EXISTING ROADS AND SHALL PROVIDE FOR CLEAN UP AT HIS OWN EXPENSE AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE TO CONTROL DUST IN THE PROJECT AND HE SHALL PROVIDE, AT HIS OWN EXPENSE, CONTROLLING MEASURES AS DIRECTED BY THE ENGINEER AND THE CITY.
4. SHOULD EXCESSIVE MUD TRACKING BE NOTED ON THE CITY/REGION ROADS, IT MAY BE DIRECTED BY THE CITY/REGION ENGINEER TO INSTALL A WHEEL WASHING DEVICE WHICH WILL BE THE RESPONSIBILITY OF THE CONTRACTOR

E&SC NOTES (CREDIT VALLEY CONSERVATION):

a. GRANTING OF CVC PERMIT DOES NOT ABSOLVE THE PROPONENT/APPLICANT AND ITS ASSIGNED AGENTS FROM ITS/THEIR RESPONSIBILITIES TO COMPLY WITH ALL APPLICABLE MUNICIPAL BY-LAWS AND PART X (SPILLS) OF THE ENVIRONMENTAL PROTECTION ACT, R.S.O., 1990.
b. BE ADVISED THAT THE CREDIT VALLEY CONSERVATION AUTHORITY MAY, AT ANY TIME, WITHDRAW THIS PERMISSION, IF IN THE OPINION OF THE AUTHORITY, THE CONDITIONS OF THE PERMIT ARE NOT BEING COMPLIED WITH. THIS APPROVAL DOES NOT EXEMPT THE PROPERTY OWNER/APPLICANT/AGENT FROM THE PROVISIONS OF ANY FEDERAL, PROVINCIAL OR MUNICIPAL STATUTES, REGULATIONS OR BY-LAWS, OR ANY RIGHTS UNDER COMMON LAW.
c. EROSION AND SEDIMENT CONTROL (ESC) PLAN IS A DYNAMIC DOCUMENT, WHICH MAY BE SUBJECT TO CHANGE OR MODIFICATIONS AS A RESULT OF SITE DEVELOPMENTS OR CHANGES ON SITE. ANY DEVIATION FROM APPROVED PLANS MUST BE DESIGNED BY A QUALIFIED PROFESSIONAL.
d. IT IS EVERYONE'S RESPONSIBILITY TO PREVENT CONSTRUCTION RELATED SEDIMENT FROM IMPACTING AQUATIC RESOURCES AND OTHER NATURAL FEATURES.
e. PLEASE REFER TO ESC GUIDELINE FOR URBAN CONSTRUCTION (DECEMBER 2006) FOR THE DESIGN AND DESIGN ALTERATION OF ESC.
f. NO PUMPING OF SEDIMENT LADEN RUNOFF FROM TEMPORARY POND(S) TO THE CREEK IS ALLOWED AT ANY TIME.
g. AN AFTER HOURS CONTACT NUMBER IS TO BE VISIBLY POSTED ON SITE FOR EMERGENCIES. ALL THE PLANS SHOULD HAVE NAME AND CONTACT INFO OF THE PERSON RESPONSIBLE FOR ESC MEASURES.
h. ANY SEDIMENT SPILL FROM THE SITE SHOULD BE REPORTED TO MINISTRY OF ENVIRONMENT (SPILL ACTION CENTER) AT 1 800 268 6060.

TEMPORARY CHANNEL STABILIZATION

1. FOLLOWING COMPLETION AND STABILIZATION OF THE LOW FLOW CHANNEL SHOWN IN STAGE 2, THE CONTRACTOR IS TO PROCEED WITH RE-DIRECTION OF THE UPSTREAM FLOWS INTO THE ULTIMATE LOW FLOW CHANNEL AS PER STEPS LISTED IN STAGE 3.
2. IF REQUIRED, TEMPORARY MEASURES (EROSION BLANKETS OR APPROVED EQUAL) ARE TO BE IMPLEMENTED FOR QUICKER CHANNEL STABILIZATION PRIOR TO INTRODUCTION OF THE UPSTREAM FLOWS.
3. A SITE INSPECTION IS TO BE CONDUCTED WITH CVC STAFF PRIOR TO DETERMINING THE ACCEPTABLE METHOD OF MECHANICAL STABILIZATION, SPECIFICALLY AT THE AREAS THAT HAVE BEEN DISTURBED BY THE CONSTRUCTION ACTIVITY (LOW FLOW CHANNEL TIE IN POINTS, ETC...).

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3760 14th Ave, Suite 301, Markham, Ontario L3R 3T7
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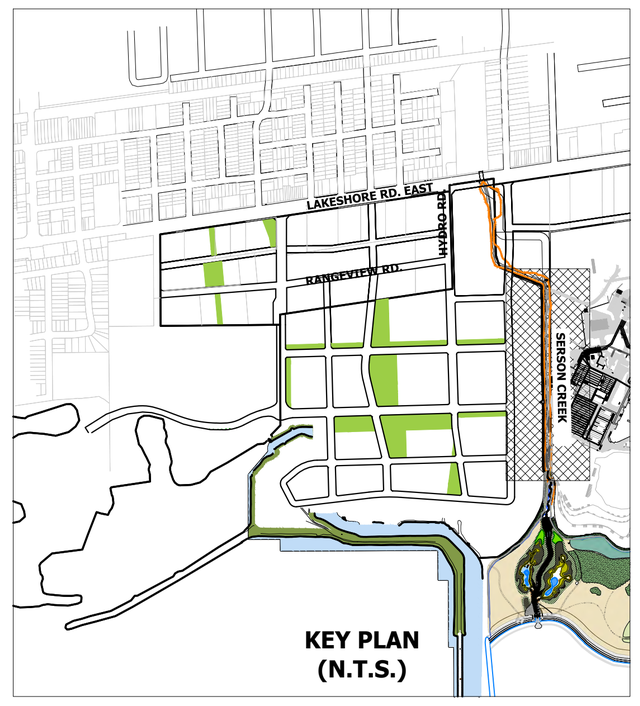
www.urbantech.com

LAKEVIEW COMMUNITY PARTNERS LTD.
CITY OF MISSISSAUGA

SERSON CREEK
CONSTRUCTION STAGING AND ESC PLAN

PROJECT No.	DATE	SCALE	DWG No.
17-549	NOV. 2019	1:1500	**STG-1**

File: P:\Projects\17-549-OPG Lakeview\Reports\NHS Design Brief\Drawings\17-549_Staging Plan.dwg - Revised by <JORMONDE> : Wed, Nov 27 2019 - 5:10pm



LAKESHORE ROAD EAST

83.59 / 11137

82.76 / 11096

82.60 / 11051

82.45 / 10998

Plaster Form Inc.

81.77 / 10850

81.61 / 10718

82.35 / 10997

OPEN CHANNEL LENGTH=1142m

81.85 / 10916

FUTURE ROAD CROSSING

81.82 / 10861

81.49 / 10591.4

81.40 / 10590.4

EXISTING CHANNEL

81.22 / 10589.4

81.01 / 10588.9

80.75 / 10588

EXISTING STORM SEWER

80.49 / 10465

EXISTING TRCA HAUL ROAD

80.24 / 10464

79.98 / 10350

LAKEVIEW VILLAGE

G.E.BOOTH WASTEWATER TREATMENT PLANT

79.63 / 10349

79.04 / 10211.6

78.60 / 10211

SERSON CREEK

76.80 / 10117

75.81 / 10037

RANGEVIEW RD.

HYDRO RD.

	EXISTING CONDITION		ULTIMATE CONDITION	
	LENGTH (m)	AREA (ha)	LENGTH (m)	AREA (ha)
OPEN CHANNEL	250	0.20	1142	2.39
OPEN DITCH	158	0.17	0	0
DISCONNECTED CHANNEL	520	0.72	0	0
CONNECTED CHANNEL	0	0	0	0

	EXISTING FLOODLINE AREA (ha)	ULTIMATE FLOODLINE AREA (ha)
Lakeview Village	1.29	1.17
Plaster Form Inc.	1.06	1.00
G.E.BOOTH WWTP	1.42+Spill	0.00
Total	3.77+Spill	2.17

LEGEND

- 247.00 EXISTING CONTOUR AND ELEVATION
- LAKEVIEW PROPERTY LIMIT
- PLASTER FORM PROPERTY LIMIT
- EXISTING OPEN CHANNEL C/L
- EXISTING OPEN DITCH C/L
- PROPOSED OPEN CHANNEL C/L
- ULTIMATE CONDITION FLOODLINE
- EXISTING FLOW SPILLS TO G.E.BOOTH W.W.T.P.
- EXISTING STORM SEWER
- FUTURE CHANNEL
- 78.15 / 10211 REGIONAL FLOODPLAIN ELEVATION (URBANTECH) / HEC-RAS STATION

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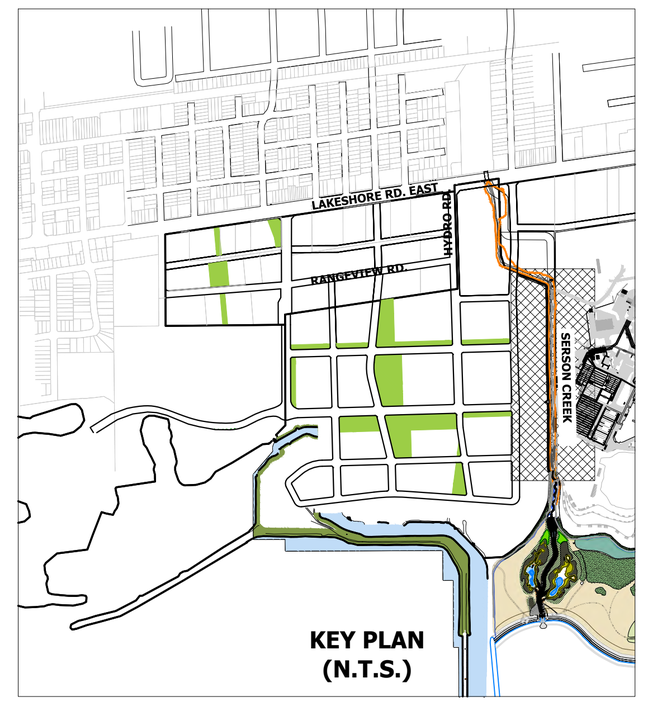
LAKEVIEW COMMUNITY PARTNERS LTD.

CITY OF MISSISSAUGA

ULTIMATE FLOODPLAIN MAPPING

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	1:1250	FP-3



LAKESHORE ROAD EAST

83.71
11137

83.33
11096

83.24
11051

Plaster Form Inc.

83.14
10998

82.54
10917

82.34
10861

82.11
10797

OPEN CHANNEL LENGTH=250m

HYDRO RD.

RANGEVIEW RD.

OPEN DITCH LENGTH=158m

EXISTING CHANNEL

81.50
10718

80.75
10588

EXISTING STORM SEWER

80.49
10465

EXISTING TRCA HAUL ROAD

80.24
10464

CONNECTED CHANNEL LENGTH=520m

79.98
10350

LAKEVIEW VILLAGE

G.E.BOOTH WASTEWATER TREATMENT PLANT

79.63
10349

79.04
10211.6

78.60
10211

SERSON CREEK

76.80
10117

75.81
10037

	EXISTING CONDITION		INTERIM CONDITION	
	LENGTH (m)	AREA (ha)	LENGTH (m)	AREA (ha)
OPEN CHANNEL	250	0.20	250	0.20
OPEN DITCH	158	0.17	158	0.17
DISCONNECTED CHANNEL	520	0.72	0	0
CONNECTED CHANNEL	0	0	561	1.08

	EXISTING FLOODLINE AREA (ha)	INTERIM FLOODLINE AREA (ha)
Lakeview Village	1.29	1.35
Plaster Form Inc.	1.06	0.47
G.E.BOOTH WWTP	1.42+Spill	0.00
Total	3.77+Spill	1.82

LEGEND

- 247.00 EXISTING CONTOUR AND ELEVATION
- LAKEVIEW PROPERTY LIMIT
- PLASTER FORM PROPERTY LIMIT
- OPEN CHANNEL C/L
- OPEN DITCH C/L
- PROPOSED OPEN CHANNEL C/L
- INTERIM CONDITION FLOODLINE
- EXISTING STORM SEWER
- FUTURE CHANNEL
- 78.15 / 10211 REGIONAL FLOODPLAIN ELEVATION
- HEC-RAS STATION

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LAKEVIEW COMMUNITY PARTNERS LTD.

CITY OF MISSISSAUGA

INTERIM FLOODPLAIN MAPPING

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	1:1250	FP-2

LAKESHORE ROAD EAST

83.71
11137

83.33
11096

83.25
11051

Plaster Form Inc.

83.14
10998

OPEN CHANNEL LENGTH=250m

82.62
10917

82.51
10861

HYDRO RD.

82.40
10797

RANGEVIEW RD.

EXISTING CHANNEL

OPEN DITCH LENGTH=158m

82.34
10590

82.36
10718

81.74
10589

81.57
10588

EXISTING STORM SEWER

81.43
10588

EXISTING TRCA HAUL ROAD

81.22
10464

DISCONNECTED CHANNEL LENGTH=520m

80.55
10588

LAKEVIEW VILLAGE

G.E.BOOTH WASTEWATER TREATMENT PLANT

79.75
10349

SERSON CREEK

78.15
10211

76.97
10117

STARTING WATER LEVEL=74.8m

75.79
10037

KEY PLAN
(N.T.S.)

LAKESHORE RD. EAST
HYDRO RD.
RANGEVIEW RD.
SERSON CREEK

LEGEND

- 247.00 EXISTING CONTOUR AND ELEVATION
- LAKEVIEW PROPERTY LIMIT
- PLASTER FORM PROPERTY LIMIT
- CVC EXISTING REGIONAL FLOODLINE
- URBANTECH REGIONAL FLOODLINE
- SPILL TO G.E.BOOTH W.W.T.P.
- OPEN CHANNEL C/L
- OPEN DITCH C/L
- DISCONNECTED CHANNEL C/L
- EXISTING STORM SEWER
- 78.15 / 10211 REGIONAL FLOODPLAIN ELEVATION (URBANTECH) / HEC-RAS STATION

	LENGTH (m)	AREA (ha)
OPEN CHANNEL	250	0.20
OPEN DITCH	158	0.17
DISCONNECTED CHANNEL	520	0.72

EXISTING FLOODPLAIN AREA (ha)		
	CVC	URBANTECH
Lakeview Village	1.15	1.29
Plaster Form Inc.	0.79	1.06
WWTP	1.14+Spill	1.42+Spill
Total	3.08+Spill	3.77+Spill

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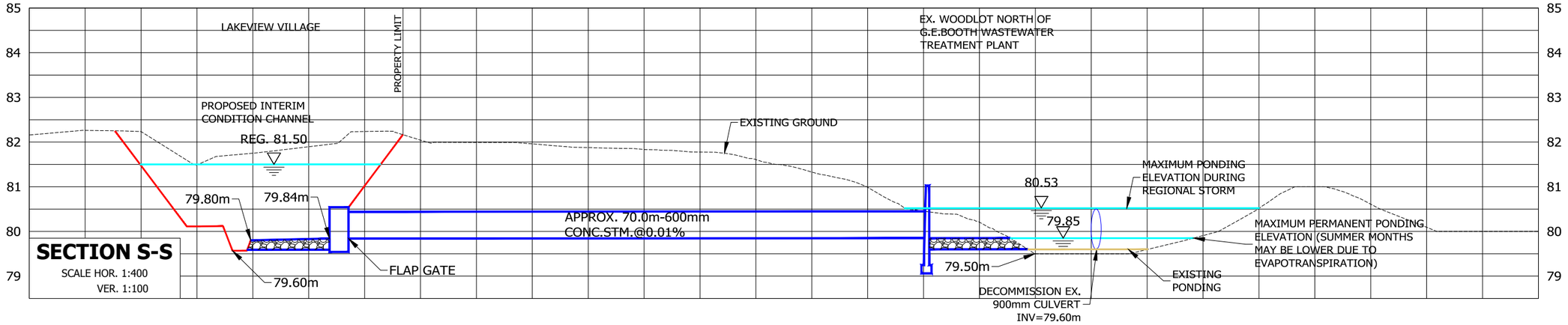
CITY OF MISSISSAUGA

EXISTING FLOODPLAIN MAPPING

PROJECT No.	DATE	SCALE	DWG No.
17-549	DEC. 2019	1:1250	FP-1



SECTION S-S

SCALE HOR. 1:400
VER. 1:100

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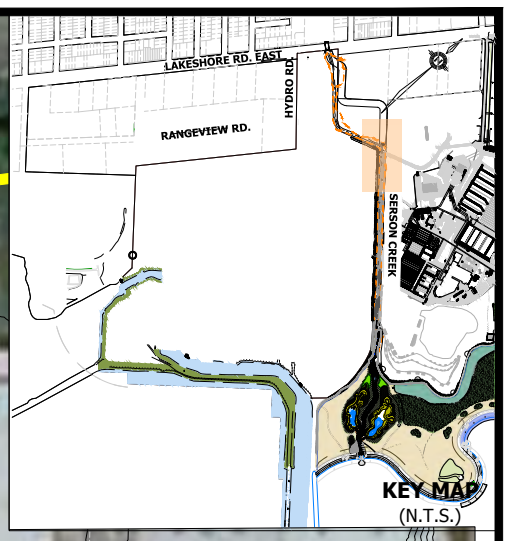
www.urbantech.com

LAKEVIEW COMMUNITY

SECTION S-S

PROJECT No.	DATE	SCALE	DWG No.
17-549	OCT 2019	H 1:400 V 1:100	SWM-2

LAKESHORE ROAD EAST



KEY MAP
(N.T.S.)

Plaster Form Inc.

DRAINAGE AREA = 8ha

EXISTING CVC. PONDING AREA DURING 100-year STORM
ELEVATION=80.54m
DEPTH=1.04m

EXISTING CHANNEL

MAX. PONDING AREA DURING REGIONAL STORM
ELEVATION=80.52m
DEPTH=1.02m

MAX. PERMANENT PONDING AREA (SUMMER MONTHS MAY BE LOWER DUE TO EVAPOTRANSPIRATION)
ELEVATION=79.85m
DEPTH=0.35m

EXISTING PONDING AREA
ELEVATION=79.60m
DEPTH=0.10m

EXISTING TRCA HAUL ROAD

PROPOSED 600mm PIPE WITH FLAP GATE TO PREVENT BACKWATER INTO WOODLOT

PROPOSED INTERIM CHANNEL

LAKEVIEW VILLAGE

DECOMMISSION EXISTING 900mm CULVERT INV=79.60m

EXISTING STORM SEWER

G.E.BOOTH WASTEWATER TREATMENT PLANT

LEGEND

- 247.00 EXISTING CONTOUR AND ELEVATION
- LAKEVIEW PROPERTY LIMIT
- PLASTER FORM PROPERTY LIMIT
- OPEN CHANNEL C/L
- PROPOSED OPEN CHANNEL C/L
- EXISTING FLOW TO WOODLOT
- EXISTING STORM SEWER
- EXISTING DRAINAGE AREA TO WOODLOT
- PROPOSED 600mm PIPE
- MAX. PERMANENT PONDING AREA
- MAX. PONDING AREA DURING REGIONAL STORM
- EXISTING PONDING AREA
- EXISTING CVC PO.DNING AREA DURING 100-year STORM

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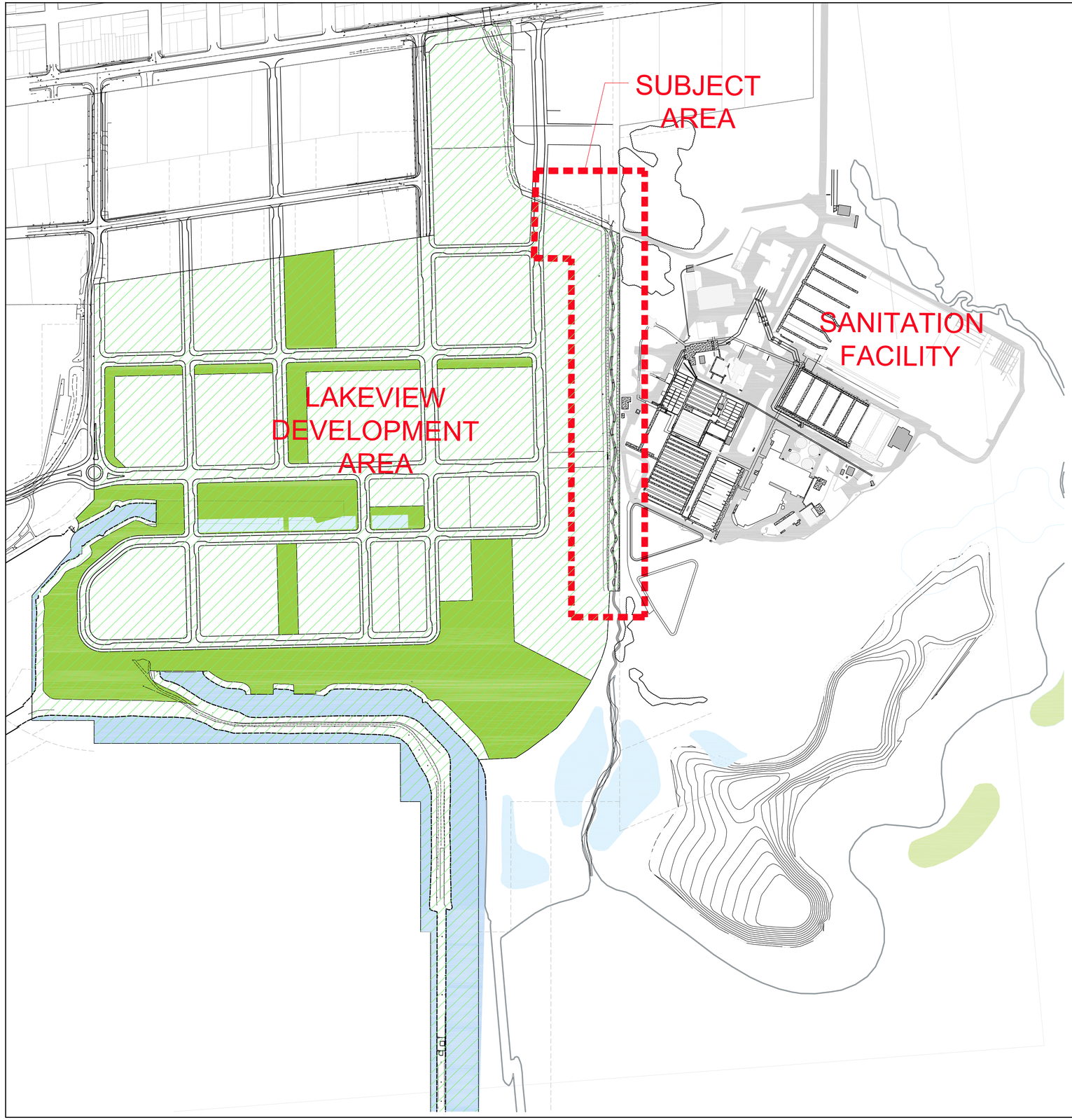
LAKEVIEW COMMUNITY PARTNERS LTD.

DIVERSION OF WOODLOT DRAINAGE AREA TO SERSON CREEK

PROJECT No.	DATE	SCALE	DWG No.
17-549	NOV. 2019	1:1500	SWM-1



MISSISSAUGA

SERSON CREEK
LAKEVIEW COMMUNITY
MODIFIED CHANNEL RECONSTRUCTION

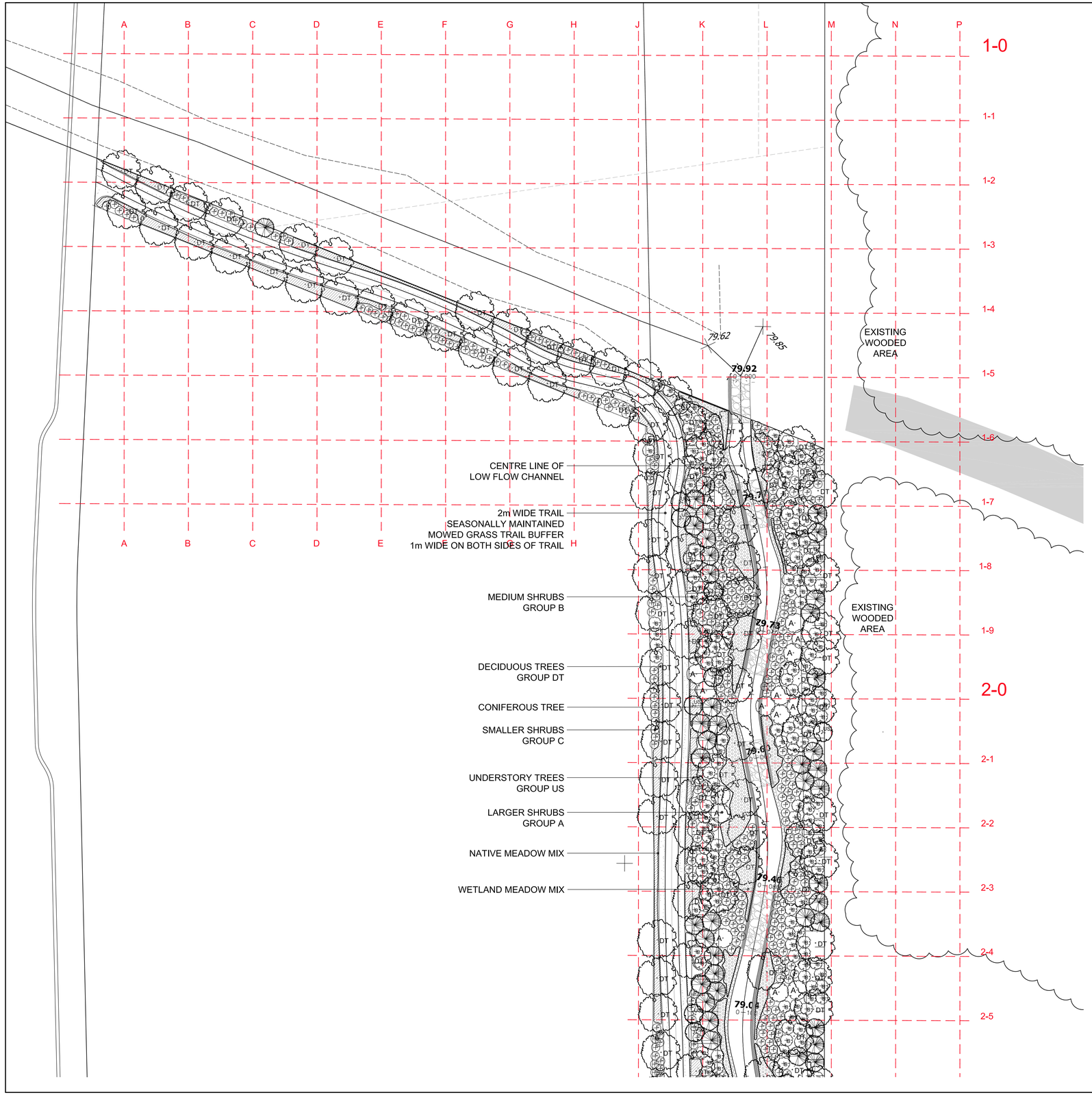
PLANTING PLAN

DRAWING LIST:

First Submission: November 29, 2019
Issued for Review: October 3, 2019
Issued for Review: September 9, 2019
Issued for Review: August 29, 2019
Issued for Review: August 21, 2019
Issued for First Review: July 21, 2019

NAK design strategies

421 RONCESVALLES AVENUE, TORONTO, ON M6R 2N1 CANADA
T 416.340.8700 F 416.340.7100 NAKDESIGNSTRATEGIES.COM



PLANT LISTS & KEYS
ALL PLANTS TO BE NATIVE

PLANT QUANITIES & GROUPINGS

PLANTS ARE TO BE MASSED IN GROUPS OF 3 TO 20 OF LIKE GENUS & SPECIES EXCEPT WHERE SINGLE OR DOUBLE GROUPINGS ARE SHOWN ON PLAN.

PROPOSED SHADE TREES - CHANNEL
60mm Caliper B&B - 324 Total

CONTEMPLATED SHADE TREES - WWTP PROPERTY AREA (in blue)
60mm Caliper B&B - 67 Total
ACER RUBRUM
ACER SACCHARUM
BETULA PAPYRIFERA
CARYA OVATA
CELTIS OCCIDENTALIS
PLATANUS OCCIDENTALIS
QUERCUS ALBA
QUERCUS MACROCARPA
QUERCUS RUBRA
QUERCUS VELUTINA

PROPOSED UNDERSTORY TREES
900mm Height/B&B - 32 Total
AMELANCHIER LAEVIS
ACER SPICATUM
CARPINUS CAROLINIANA
CORNUS ALTERNIFOLIA

PROPOSED CONIFEROUS TREES - CHANNEL
60mm Caliper B&B - 220 Total

CONTEMPLATED CONIFEROUS TREES - WWTP PROPERTY AREA (in green)
60mm Caliper B&B - 22 Total
PICEA GLAUCA
PINUS STROBUS
THUJA OCCIDENTALIS
TSUGA CANADENSIS

PROPOSED LARGE SHRUBS - GROUP A
600mm Height/3 Gallon Container - 77 Total
HAMAMELIS VIRGIANA
RHUS TYPHINA
SALIX BEBBIANA
SALIX ERIOCEPHALA
SALIX LUCIDA
VIBURNUM LENTAGO
SAMBUCUS CANADENSIS

PROPOSED MEDIUM SHRUBS - GROUP B
600mm Height/3 Gallon Container - 772 Total
CEPHALANTHUS OCCIDENTALIS
CORNUS SERICEA
CORNUS AMOMUM
ILEX VERTICILLATA
PHYSOCARPUS OPULIFOLIUS
RUBUS ODORATUS
SALIX EXIGUA
SAMBUCUS CANADENSIS

PROPOSED SMALL SHRUBS - GROUP C
600mm Height/3 Gallon Container - 1993 Total
DIERVILLA LONICEERA
ROSA PALUSTRIS
RUBUS ODORATUS
SPIREA ALBA

NATIVE MEADOW MIX
See Specification
700square metres

WETLAND MEADOW MIX
See Specification
2360square metres

Contractor shall check all dimensions on the work and report any discrepancy to the Landscape Architect before proceeding. All drawings and specifications are the property of the Landscape Architect and must be returned at the completion of the work. This drawing is not to be used for construction until signed by the Landscape Architect.

No.	Description	Date
-		
-		
5	Issued for First Submission	Nov 29/19
4	Issued for Review	Oct 3/19
3	Issued for Review	Sept 9/19
2	Issued for Review	Aug 29/19
1	Issued for Review	Aug 21/19

Revision

City Approval Stamp

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO SILVANO TARBELLI OALA MEMBER

N

NAK design strategies

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Project

Serson Creek

Lakeview Community, Mississauga,Ontario

Title

Modified Channel Reconstruction
Planting Plan-Area 1-0 - 2-5

Date	August 2019
Scale	1:300
Drawn	jb
Checked	jr
Job No.	19-111

Sheet

SC1

Native Seed Mix A - To be applied to channel bottom and floodplain - Total Area 4,235 m^2

Application Timing for both seed mixes: November 10th to December 10th.

Seed Mix Name: CVC 3 - Lowland Restoration Mix

Seed Source: Ontario Seed Company

Application Rate: 35 kg/ha

Species Composition & Proportions:

Scientific Name	Common Name	Percentage
(based on No. of Pure Live Seed)		
Triticum aestivum	Winter Wheat (NURSE CROP)	40
Anemone canadensisCanada	Anemone	5
Bidens cernua	Nodding Beggarticks	5
Carex vulpinoidea	Fox Sedge	5
Elymus virginicus var.virginicus	Virginia Wildrye	5
Eutrochium maculatum var.maculatum	Spotted Joe Pye Weed	5
Juncus effusus ssp. solutus	Soft Rush	5
Juncus tenuis	Path Rush	5
Poa palustris Fowl	Bluegrass	5
Scirpus atrovirens Dark-green	Bulrush	5
Symphyotrichum novae-angliae	New England Aster	5
Symphyotrichum puniceum	Swamp Aster	5
Verbena hastata	Blue Vervain	5

Native Seed Mix B - To be applied to valley slopes - Total Area 6,000 m^2

Seed Mix Name: CVC 1 - Upland Mix

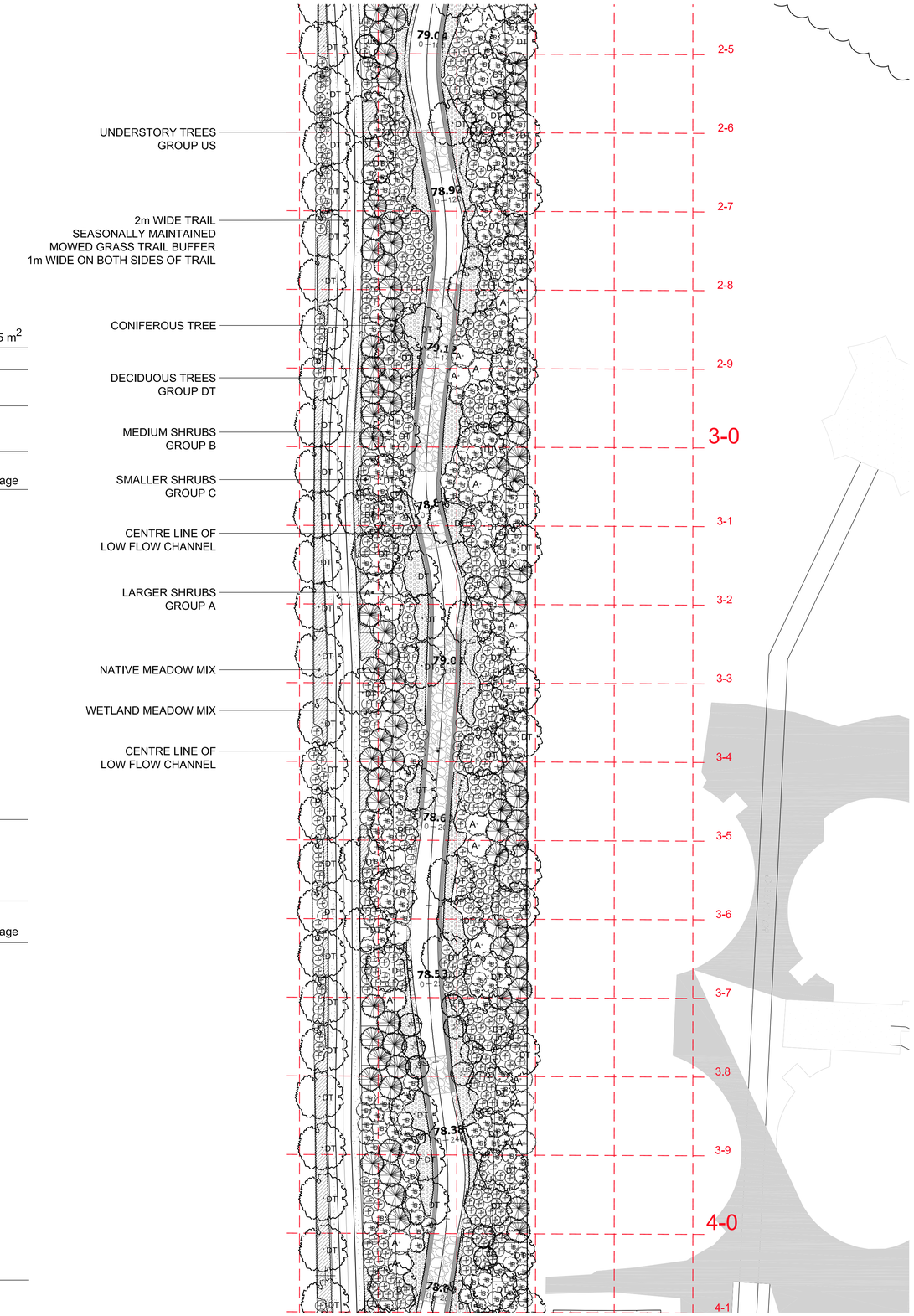
Seed Source: Ontario Seed Company

Application Rate: 35 kg/ha

Species Composition:

Scientific Name	Common Name	Percentage
(based on No. of Pure Live Seed)		
Triticum aestivum	Winter Wheat (NURSE CROP)	40
Anemone canadensis	Canada Anemone	5
Asclepias syriaca	Common Milkweed	5
Carex granularis	Limestone Meadow Sedge	1
Elymus virginicus var. virginicus	Virginia Wildrye	10
Euthamia graminifolia	Grass-leaved Goldenrod	5
Monarda fistulosa var. fistulosa	Wild Bergamot	5O
enothera biennis	Common Evening Primrose	1
Rudbeckia hirta	Black Eyed Susan	5
Solidago canadensis var. canadensis	Canada Goldenrod	5
Solidago juncea	Early Goldenrod	1
Solidago nemoralis ssp. nemoralis	Gray-stemmed Goldenrod	5
Symphyotrichum novae-angliae	New England Aster	1
Verbena urticifolia	White Vervain	1

PROPOSED LOWLAND & SLOPE TERRASEEDING PLANT SPECIFICATION



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ACER SACCHARUM
BETULA PAPYRIFERA
CARYA OVATA
CELTIS OCCIDENTALIS
PLATANUS OCCIDENTALIS
QUERCUS ALBA
QUERCUS MACROCARPA
QUERCUS RUBRA
QUERCUS VELUTINA

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CORNUS ALTERNIFOLIA

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PINUS STROBUS
THUJA OCCIDENTALIS
TSUGA CANADENSIS

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600mm Height/3 Gallon Container - 77 Total
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RHUS TYPHINA
SALIX BEBBIANA
SALIX ERIOCEPHALA
SALIX LUCIDA
VIBURNUM LENTAGO
SAMBUCUS CANADENSIS

PROPOSED MEDIUM SHRUBS - GROUP B
600mm Height/3 Gallon Container - 772 Total
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CORNUS SERICEA
CORNUS AMOMUM
ILEX VERTICILLATA
PHYSOCARPUS OPULIFOLIUS
RUBUS ODORATUS
SALIX EXIGUA
SAMBUCUS CANADENSIS

PROPOSED SMALL SHRUBS - GROUP C
600mm Height/3 Gallon Container - 1993 Total
DIERVILLA LONICEERA
ROSA PALUSTRIS
RUBUS ODORATUS
SPIREA ALBA

NATIVE MEADOW MIX
See Specification
700square metres

WETLAND MEADOW MIX
See Specification
2360square metres

No.	Description	Date
-		
-		
5	Issued for First Submission	Nov 29/19
4	Issued for Review	Oct 3/19
3	Issued for Review	Sept 9/19
2	Issued for Review	Aug 29/19
1	Issued for Review	Aug 21/19

Revision

City Approval Stamp

NAK design strategies
421 RONCESVALLES AVENUE, TORONTO, ON M6R 2N1 CANADA
T 416.340.8700 F 416.340.7100 NAKDESIGNSTRATEGIES.COM

Project

Serson Creek
Lakeview Community, Mississauga,Ontario

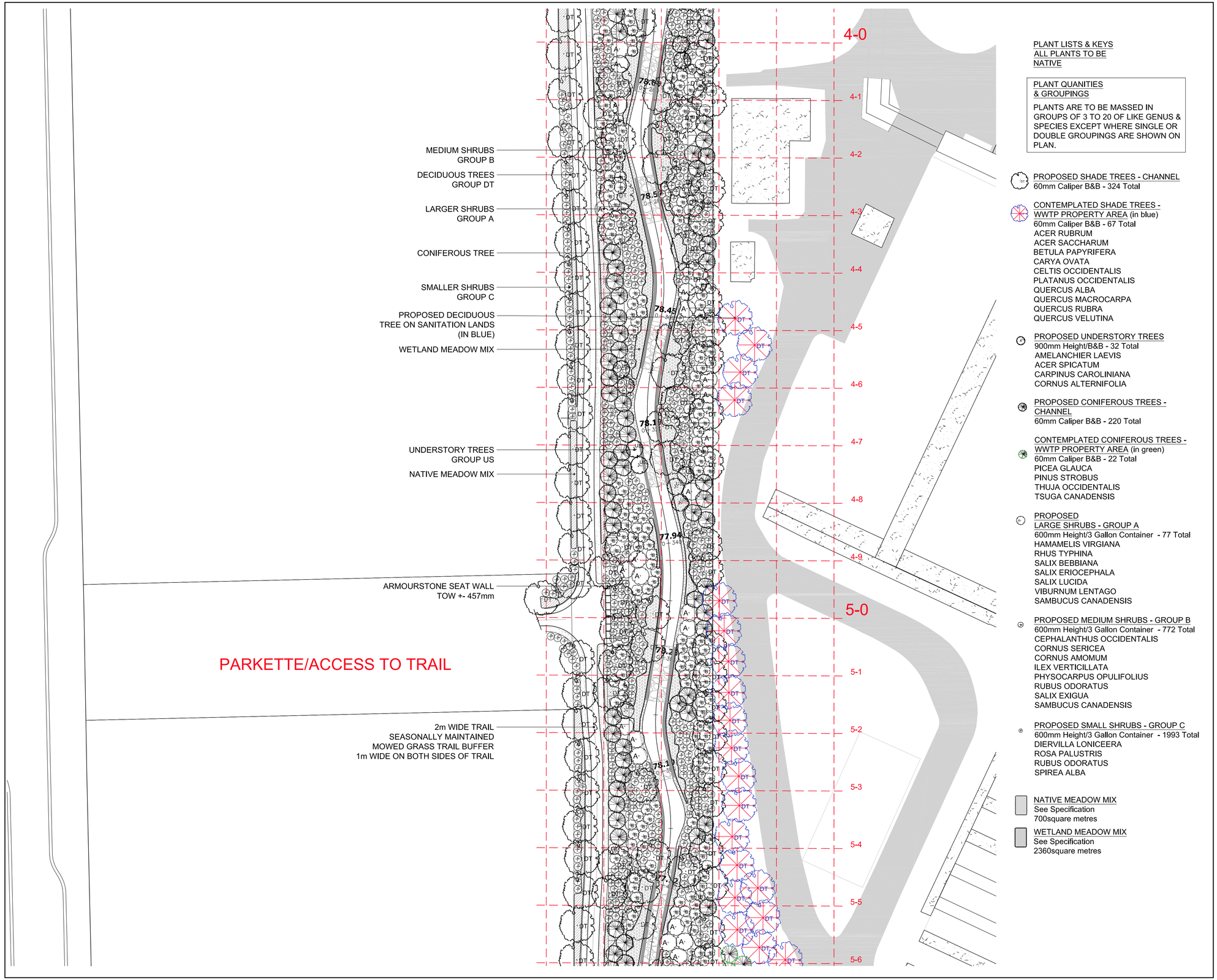
Title

Modified Channel Reconstruction
Planting Plan-Area 2-5 to 4-0

Date	August 2019
Scale	1:300
Drawn	jb
Checked	jr
Job No.	19-111

Sheet

SC2



PLANT LISTS & KEYS
ALL PLANTS TO BE NATIVE

PLANT QUANITIES & GROUPINGS

PLANTS ARE TO BE MASSED IN GROUPS OF 3 TO 20 OF LIKE GENUS & SPECIES EXCEPT WHERE SINGLE OR DOUBLE GROUPINGS ARE SHOWN ON PLAN.

PROPOSED SHADE TREES - CHANNEL
60mm Caliper B&B - 324 Total

CONTEMPLATED SHADE TREES - WWTP PROPERTY AREA (in blue)
60mm Caliper B&B - 67 Total
ACER RUBRUM
ACER SACCHARUM
BETULA PAPYRIFERA
CARYA OVATA
CELTIS OCCIDENTALIS
PLATANUS OCCIDENTALIS
QUERCUS ALBA
QUERCUS MACROCARPA
QUERCUS RUBRA
QUERCUS VELUTINA

PROPOSED UNDERSTORY TREES
900mm Height/B&B - 32 Total
AMELANCHIER LAEVIS
ACER SPICATUM
CARPINUS CAROLINIANA
CORNUS ALTERNIFOLIA

PROPOSED CONIFEROUS TREES - CHANNEL
60mm Caliper B&B - 220 Total

CONTEMPLATED CONIFEROUS TREES - WWTP PROPERTY AREA (in green)
60mm Caliper B&B - 22 Total
PICEA GLAUCA
PINUS STROBUS
THUJA OCCIDENTALIS
TSUGA CANADENSIS

PROPOSED
LARGE SHRUBS - GROUP A
600mm Height/3 Gallon Container - 77 Total
HAMAMELIS VIRGIANA
RHUS TYPHINA
SALIX BEBBIANA
SALIX ERIOCEPHALA
SALIX LUCIDA
VIBURNUM LENTAGO
SAMBUCUS CANADENSIS

PROPOSED MEDIUM SHRUBS - GROUP B
600mm Height/3 Gallon Container - 772 Total
CEPHALANTHUS OCCIDENTALIS
CORNUS SERICEA
CORNUS AMOMUM
ILEX VERTICILLATA
PHYSOCARPUS OPULIFOLIUS
RUBUS ODORATUS
SALIX EXIGUA
SAMBUCUS CANADENSIS

PROPOSED SMALL SHRUBS - GROUP C
600mm Height/3 Gallon Container - 1993 Total
DIERVILLA LONICEERA
ROSA PALUSTRIS
RUBUS ODORATUS
SPIREA ALBA

NATIVE MEADOW MIX
See Specification
700square metres

WETLAND MEADOW MIX
See Specification
2360square metres

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ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO — SYLVAND TARGET — OALA MEMBER

N

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Project

Serson Creek
Lakeview Community, Mississauga,Ontario

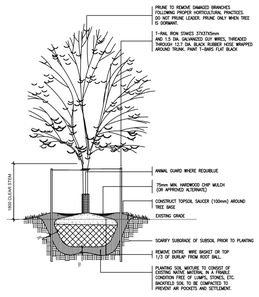
Title

Modified Channel Reconstruction
Planting Plan-Area 4-0 to 5-6

Date	August 2019
Scale	1:300
Drawn	jb
Checked	jr
Job No.	19-111

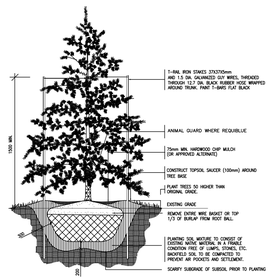
Sheet

SC3



NOTE:
1. STEEL T-BARS TO BE REMOVED AT THE COMPLETION OF THE TWO YEAR WARRANTY PERIOD.
2. REMOVE TREE WRAP PRIOR TO INSPECTION BY CITY OF MISSISSAUGA REPRESENTATIVE.
3. CALIPER TO BE MEASURABLE 305 mm ABOVE GRADE
4. TREES UNDER 70mm CALIPER REQUIRE 2 STAKES. TREES 70mm AND OVER REQUIRE 3 STAKES
5. SET TREE 50mm HIGHER THAN SURROUNDING GRADE TO ALLOW FOR SETTLEMENT.
6. IF SOIL TESTING IS REQUIRELIE AND SHOWS A DEFICIENCY IN NUTRIENTS — PREPARE PLANTING SOIL BY EVENLY MIXING FOUR PARTS SANDY TOPSOIL, ONE PART ORGANIC SOIL AMENDMENT WITH 5000 BONE MEAL AND 7500 COMMERCIAL FERTILIZER PER M3 OF TOPSOIL – TO THE SATISFACTION OF THE CITY OF MISSISSAUGA.

1 DECIDUOUS TREE PLANTING DETAIL



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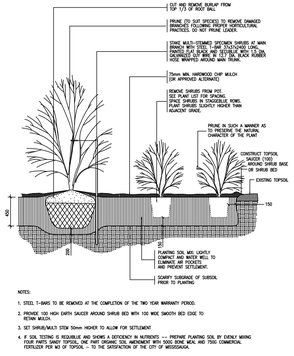
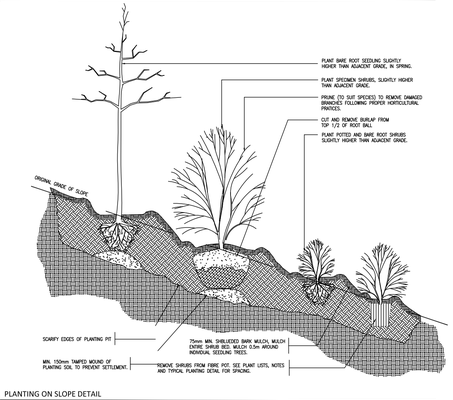
2 CONIFEROUS TREE PLANTING DETAIL

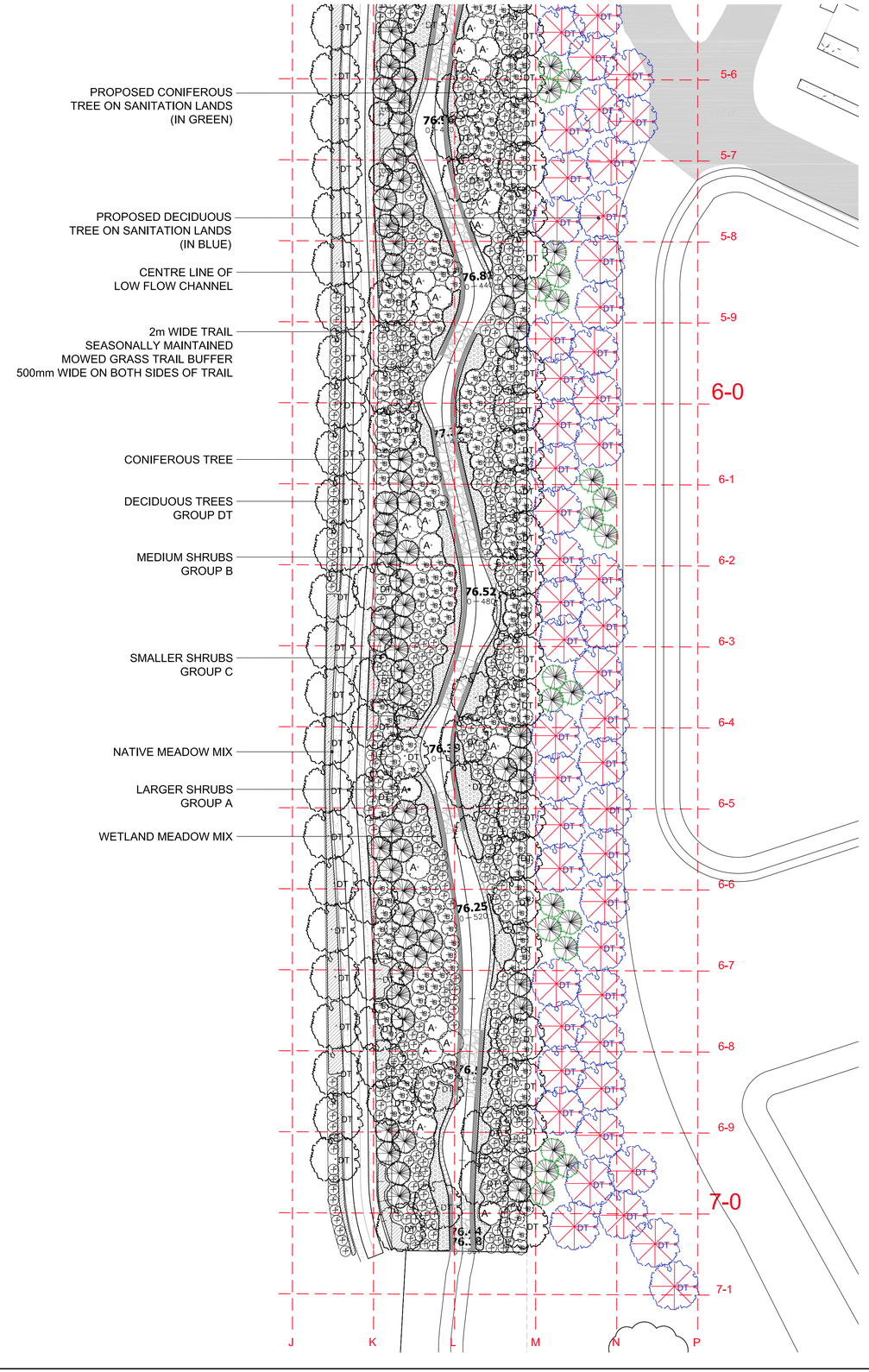


NOTES:
1. STEEL T-BARS TO BE REMOVED AT THE COMPLETION OF THE TWO YEAR WARRANTY PERIOD.
2. PROVIDE 100 HIGH EARTH SAUCER AROUND SHRUB BED WITH 100 WIDE SMOOTH BED EDGE TO RETAIN MULCH.
3. SET SHRUB/MULCH STEM 50mm HIGHER TO ALLOW FOR SETTLEMENT
4. IF SOIL TESTING IS REQUIRELIE AND SHOWS A DEFICIENCY IN NUTRIENTS — PREPARE PLANTING SOIL BY EVENLY MIXING FOUR PARTS SANDY TOPSOIL, ONE PART ORGANIC SOIL AMENDMENT WITH 5000 BONE MEAL AND 7500 COMMERCIAL FERTILIZER PER M3 OF TOPSOIL – TO THE SATISFACTION OF THE CITY OF MISSISSAUGA.

3 SHRUB PLANTING DETAIL



4 PLANTING ON SLOPE DETAIL



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RUBUS ODORATUS
SPIREA ALBA

NATIVE MEADOW MIX
See Specification
700square metres

WETLAND MEADOW MIX
See Specification
2360square metres

Contractor shall check all dimensions on the work and report any discrepancy to the Landscape Architect before proceeding. All drawings and specifications are the property of the Landscape Architect and must be returned at the completion of the work. This drawing is not to be used for construction until signed by the Landscape Architect.

No.	Description	Date
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Serson Creek

Lakeview Community, Mississauga,Ontario

Title

Modified Channel Reconstruction
Planting Plan-Area 5-6 to 7-1

Date	September 23.2019
Scale	1:300
Drawn	jb
Checked	jr
Job No.	19-111

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SC4