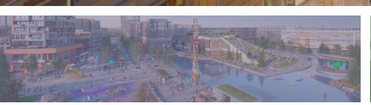
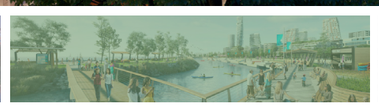

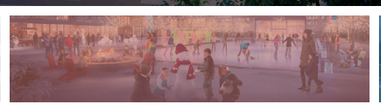


LAKEVIEW VILLAGE

SERSON CREEK DESIGN BRIEF

LAKEVIEW
COMMUNITY PARTNERS LIMITED

JULY 2020

LAKEVIEW

COMMUNITY PARTNERS LIMITED

TACC CONSTRUCTION

Greenpark

CCI DEVELOPMENT

BRANTHAVEN HOMES

ARGO DEVELOPMENT CORP

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Executive Summary

It has been a long-standing vision to rehabilitate Serson Creek on the Lakeview Village lands for the purposes of creating a new enhanced channel corridor that not only provides ecological benefits which are supportive to the Lakeview Waterfront Connection project but also addresses existing flooding and erosion issues.

Between 2012 and 2015, the Region of Peel, Credit Valley Conservation, City of Mississauga and Toronto and Region Conservation Authority initiated planning and design for the Lakeview Waterfront Connection (LWC) project on regional lands immediately to the east of the Lakeview Village site. The goal of the LWC project was to develop a large new natural park on the eastern Mississauga waterfront through extensive lake filling to create a diversity of natural habitats and enhance the public trail system.

The LWC project would result in the loss or alteration of 39 ha of open coast aquatic habitat and these losses were to be offset by creation of an equivalent area of terrestrial, wetland and aquatic habitat. Most of the new habitat would be created in the park, however some of the compensation was to be achieved through rehabilitation of the Serson Creek channel between its new outlet to the lake and Lakeshore Road, most of which is contained on the Lakeview Village or former Ontario Power Generation (OPG) lands. The LWC project had developed a rehabilitation plan for Serson Creek for the purposes of making the creek accessible to fish and increasing the availability of aquatic habitat by incorporating habitat features such as rocky ramps and improved riparian vegetation. These rehabilitation plans were approved by DFO and other agencies and permits were issued. Construction of the new channel was scheduled to commence in 2019.

In 2018, Lakeview Community Partners Limited (LCPL) purchased the former OPG lands and committed to redevelop the lands building upon the vision established though the City of Mississauga's Inspiration Lakeview Master Plan (2014). In 2018, LCPL engaged in extensive consultations with the Region, City, CVC and broader Mississauga community to update the master plan. Several Development Master Plans were prepared between 2018 and 2019, culminating in the Lakeview Village Development Master Plan 4.0 (October 2019) which has been endorsed by the municipality and its agency partners. LCPL is currently pursuing approval of a Draft Plan for the site.

The proposed Draft Plan accommodates a rehabilitated Serson Creek corridor on the Lakeview Village lands. The original LWC project design for the channel corridor was developed in the absence of any technical information for the future development on the Lakeview Village lands (i.e. finished grades, servicing connections, road crossings, etc.). As such, the LCPL consultant team was required to develop a modified design that better integrates with the future development while maintaining the original ecological objectives of improving fish habitat to satisfy the Department of Fisheries and Oceans (DFO) permitting requirements previously issued for the LWC project.

Executive Summary

The proposed channel corridor design includes a wider overall channel bottom, softer channel bank treatments, enhanced landscaping and habitat creation, and a trail system. Additionally, the channel has been sized to accommodate flooding and to provide flood relief to the adjacent G.E. Booth Waster Water Treatment Plant (WWTP). As such, the proposed channel design offers improved functionality over the original design.

A draft design brief for the Serson Creek channel was submitted to the Region, City and CVC in December 2019. Comments on the draft design brief were received in March to May 2020 from the various agencies. Through further consultation, the study team has further revised the channel corridor design to address any remaining technical concerns. Detailed responses to specific technical concerns are provided under separate cover.

Key changes to the design are as follows;

1. The current channel design brief is now limited only to Phase 1 and LCPL lands. The design for Phase 2 which includes the Plaster Form Inc. lands will be advanced separately in the future;
2. Channel slopes have been made less steep in some locations;
3. Channel banks softened and bottom width increased; and
4. Planting plans revised using a habitat-based approach and diversity of native species proposed significantly increased to be more consistent with those proposed for the LWC project.

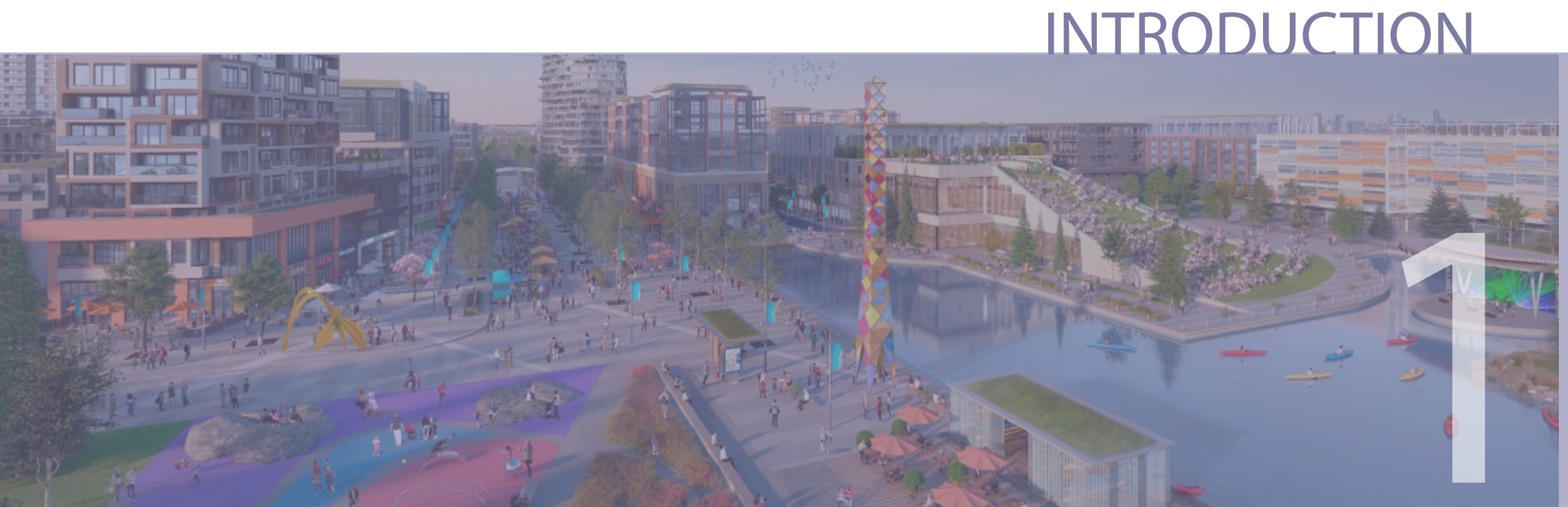
The updated design brief provides an overview of Serson Creek, including its historical and existing conditions. Biophysical conditions are described from a hydrologic, geomorphic and ecological perspective. The brief also describes the design in detail including ecological and stormwater design objectives, channel hydraulics and drainage diversions, natural channel designs, bioengineering treatments, landscaping and trails. The design is supported by drawings and technical appendices.

In terms of implementation, it is proposed that the channel rehabilitation work be undertaking in the summer / fall of 2020 and to be put online in 2021 once stabilized. Vegetation removal was completed in April 2020 and plans for a realigned haul road to service the LWC project have been reviewed by TRCA staff to ensure that works are not interrupted.

In summary, the proposed design improves greatly on the previously approved LWC design and provides a more natural channel and enhanced fish habitat. It also addresses the requirements of the fisheries habitat compensation plan as well as all the objectives identified in the CVC Living by the Lake Action Plan (2018). Additionally, the design offers flood relief to the adjacent regional lands.

Rendering of the Waterfront Trail

INTRODUCTION



1

Introduction

1.1 SERSON CREEK

Serson Creek was historically a small agricultural swale that flowed from Lakeshore Road southeast to through open fields and outlet to the lake slightly west of Applewood Creek. When the G.E. Booth Wastewater Treatment Plant (WWTP) and Ontario Power Generation Lakeview Generating Station were constructed in the late 1950's, a large drain was constructed between the two properties to convey most of the drainage directly south to the lake. Drainage from north of the WWTP continues to flow southeast but is piped under the WWTP and outlets slightly west of the original outlet.

Serson Creek is an engineered drain that currently functions primarily as a stormwater conveyance feature. Its ecological functions are very limited as a result of poor habitat structure and diversity, lack of hydraulic connectivity to lake for fish, poor water quality and poor vegetation cover. At present, the drain is dry and only receives flows under major storm events. It is disconnected from the lake and fish unable to migrate upstream. Most of the flows in the creek are currently being diverted into the pipe under the WWTP to facilitate construction of the lower channel and lake outlet as part of the LWC project.

The existing channel 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).

1.2 REHABILITATION

The LWC project proposed that Serson Creek be rehabilitated to provide compensation for the loss of aquatic habitat resulting from the park development. A rehabilitation plan for Serson Creek was developed by the LWC project team for the purposes of making the creek accessible to fish and increasing the availability of aquatic and riparian habitat. Most of the proposed rehabilitation would occur on the Lakeview Village lands. The rehabilitation plans were approved by DFO and other agencies and permits were issued. Work on the new channel was to be undertaken by TRCA and was scheduled to commence in 2019.

As the original rehabilitation plan was developed in the absence of technical information regarding the future development on the Lakeview Village lands (i.e. finished grades, servicing connections, road crossings, etc.), it was necessary to re-examine the feasibility of the original design. In response, the LCPL consultant team has prepared a modified design that better integrates with the future development while maintaining the original ecological objectives of improving fish habitat to satisfy the Department of Fisheries and Oceans (DFO) permitting requirements previously issued for the LWC project. The modified design also accommodates the Region's requirements related to proposed upgrades to the WWTP.

1.3 SUPPORTING STUDIES

With input from the agencies, the LCPL project team has applied an integrated multi-disciplinary approach to the design of the final channel corridor for Phase 1. This updated channel design brief is supported by information contained in the flowing technical reports:

- Geotechnical Slope Stability Assessment - DS Consulting (July 2019)
- Serson Creek Geomorphic Assessment and Rehabilitation Design – Beacon Environmental Limited (October 2019)
- Hydraulics Memorandum- Urbantech Consulting (October 2019)

Copies of these studies are included in the appendices.

Introduction

1.4 OBJECTIVES

The proposal to rehabilitate Serson Creek originated through the environmental assessment process for the LWC project. The main objective for rehabilitating the creek was to restore fish habitat by improving connectivity of the channel with the lake and by creating improved riparian and aquatic habitat.

Additional objectives for Serson Creek were identified through the 2018 Action Plan prepared for CVC's Lake Ontario Integrated Shoreline Strategy (LOISS) and these are as follows:

- 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 (JTLCA) and Lakeview Village initiatives.
- R1-7 (Improve Habitat Quality)
  Increase cover of wetlands in the coastal reach through JTLCA. 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.

The LCPL project team has also identified the following additional objectives that can be achieved through the proposed channel corridor design:

- Creation of a wider and more natural creek corridor;
- Elimination/mitigation of existing flooding risks to the WWTP site;
- Elimination of bypass flow pipe under the WWTP site;
- Incorporation of pedestrian / cycling trail within the creek corridor connecting JTLCA to Lakeshore Road East;
- Provision of enhanced level of habitat creation and diversity; and
- Landscape screening of the WWTP property from the Lakeview Village.

Aerial view of the existing Lakeview Village lands

View from Lakefront Promenade Park with the Lakeview Village site across the water

EXISTING CONDITIONS

2

EXISTING CONDITIONS

2.1 EXISTING DRAINAGE

Serson Creek has a drainage area of 270 ha area comprised mainly of urbanized lands. South of Lakeshore Road East, the creek flows through an open channel to the former rail line. Flows are then split in two by a diversion berm installed to accommodate the LWC project works at the mouth of the creek. The diversion berm directs baseflows easterly to the WWTP site where it passes through a woodlot and is then piped underneath the WWTP to the lake. Under large storm events, flows top over the diversion berm and enter the main channel that runs along the easterly boundary of the LCPL property. This flow diversion is a temporary measure that is required until rehabilitation of the main channel is completed. The main channel is currently protected along the bed and banks with cobble and riprap. 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 considered depositional due to more shallow gradients. Drawing STM-1 illustrates the existing drainage area to Serson Creek.

2.2 REACH DELINEATION

Reach S1 includes the lower reach of the creek south of the LCPL property. This reach consists of the portion of creek that was historically 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 includes the long straight section of channel on the LCPL property and adjacent to the WWTP that represents Phase 1 of the proposed rehabilitation design. The channel 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 includes the main channel from Lakeshore Road East downstream to the former rail line at the WWTP property. This reach is characterized as 'in adjustment' based on the RGA and 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 corresponds with a 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.

Boreholes were drilled near the creek area. The borehole location plan and relevant borehole logs are attached in Appendix B. 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.

EXISTING CONDITIONS

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 the DS Consultants Ltd. reports for the West and East sides of the corridor (Appendix B).

2.5 ECOLOGICAL CONDITIONS

Ecological conditions along Serson Creek were characterized in the Environmental Impact Study (EIS) prepared in support of the Lakeview Village draft plan application (Beacon 2020). The EIS describes the existing and historical ecological conditions of Serson Creek, including the terrestrial and aquatic resources and ecological functions it supports. The EIS also provides recommendations for enhancement measures to create and diversify habitats within the new channel corridor.

Serson Creek is not a natural creek and is also not associated with a valley landform. Historically, this creek was a small agricultural swale that flowed southeast toward Applewood Creek and drained the surrounding fields. When the WWTP and LGS were constructed in the late 1950's the swale became piped under the WWTP and most of the upstream drainage was diverted to a large drainage ditch that was constructed along the eastern boundary of the former OPG lands.

Most of Serson Creek is treed and has been mapped as cultural woodland dominated by immature Manitoba Maple (Acer negundo), Norway Maple (Acer platanoides) and dead or dying Green Ash (Fraxinus pensylvanica) trees. The ecological quality of the vegetation resources is considered low due to the predominance of non-native and invasive trees species which are known to ecologically impair riparian ecosystems. All vegetation was removed from the Phase 1 channel in April 2020 under a City tree clearing permit to facilitate initiation of the rehabilitation works.

Serson Creek 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.

CVC fish collection records for Serson Creek at two stations south of Lakeshore Road East for the period between 1992 through to 2017 did not record any captured fishes. Serson Creek is considered to provide low quality fish habitat due to the enclosure of the low flow channel and blockage of the high flow channel. The Lakeshore Road East culvert crossing was recently upgraded and 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 new culvert allows for potential fish movement upstream in the future.

With respect to water quality, Serson Creek itself is mainly composed of fine sediment such as silt, sand, and fine gravel. Benthic invertebrate sampling completed in 2011 support of the Environmental Assessment for the LWC project. The benthic community was indicative of poor to fairly poor water quality with significant levels of organic pollution (SENES 2014). Water quality is described as impaired with high nutrient loads that result in large algal blooms (CVC 2014). Water quality sampling and analysis were also completed as part of the LWC EA and identified that the creek exceeded the Provincial Water Quality Objectives PWQO for Total Phosphorus and E. Coli.

Aerial View of Preliminary Site Construction in 2018

CORRIDOR DESIGN

3

Rendering of Lakeview Square

Corridor Design

3.1 DESIGN APPROACH

The proposed channel corridor design presented in this design brief was developed in consultation with the regulatory agencies and has been prepared to achieve multiple objectives and satisfy existing permit requirements. The design balances these objective and requirements within the context of the future Lakeview Village development. The corridor width is constrained by the need to balance future land uses with typical natural channel design principals. Lakeview Village is not a typical greenfield development and Serson Creek is natural creek. Consequently, the design has been prepared to meet the various natural heritage, natural hazard, and socioeconomic objectives to the extent feasible.

The preceding sections describe the existing and historical conditions of the creek and identify the various objectives that can be achieved through rehabilitation of the creek. It is proposed that rehabilitation of Serson Creek occur in two phases as follows:

- Phase 1 - downstream from the flow diversion pipe to the JTLCA, and
- Phase 2 - upstream from the flow diversion pipe to Lakeshore Road East.

This channel corridor design brief is focused on Phase 1 only. Phase 2 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 the Serson Creek corridor to create a productive fishery by providing connectivity to the lake and creating terrestrial and wetland habitat that integrates with the habitat creation initiatives in the JTLCA. A secondary, but equally important objective is to consolidate the existing split flows into a single larger channel corridor that alleviates existing flooding issues on the WWTP site.

The following sections provide an overview of the proposed corridor hydraulics, low flow channel design considerations, bioengineering elements, and habitat enhancement details. The proposed corridor design improves upon the former design and meets the aquatic habitat compensation requirements for the LWC project. The design has also been modified to satisfy all the Serson Creek related objectives identified in the 2018 Action Plan prepared for CVC's Lake Ontario Integrated Shoreline Strategy (LOISS).

The proposed channel corridor design achieves 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 properties (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.

Channel grading is based on optimizing the available corridor width to match into existing / future grades at the upstream and downstream end of the system, as well as on either side of the corridor while achieving the flow conveyance and geomorphologic design requirements. See Drawings CH-1 to CH-3 in Appendix D for details. The stable slope has been determined to be 2.5:1 (see Appendix B).

3.2 NATURAL CHANNEL DESIGN ELEMENTS

The following section provides an overview of the natural channel design elements that have been incorporated into the proposed design.

The rehabilitation of Serson Creek provides an opportunity to restore a more natural planform to the creek. The corridor was sized primarily to provide flood storage and conveyance while also accommodating riparian habitat. The corridor width is defined on the east by the WWTP property and to the west by the limits of future development on the Lakeview Village site. As a result of the land use constraints, flood modelling, and slope design, the proposed corridor bottom width ranges from 11 to 15 m. From a geomorphic perspective, where the corridor bottom (i.e., lower floodplain) is not sufficiently wide to accommodate long-term natural migration tendencies of the channel (i.e., meander belt width), erosion protection measures have been incorporated into the design.

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 m^3/s estimated as part of the LWC 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.

Rendering of Town homes at Aviator Park

3.3 CHANNEL BIOENGINEERING TREATMENTS

The proposed design incorporates several bioengineering elements to provide the channel with a more natural and softer appearance.

Vegetated rock buttresses are proposed 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 and vegetation 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 planted vegetation provides enhanced stability while also providing riparian habitat.

Woody debris will be installed on banks not containing vegetated rock buttress. This treatment consists of embedding a tree root fan or ball and a portion of trunk into the toe of the channel bank. The bank is then backfilled with stone to provide further bank protection and stability. Plantings of native groundcover and shrubs are also integrated. This treatment functions to deflect erosive flows away from the channel bank and provide cover for fish. 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. Woody debris features provide micro-habitats for fish and wildlife. The features are located sporadically along the floodplain and will consist of mounds of locally sourced stable interconnected wood debris.

Several offline wetland features are proposed in the lower reach on the floodplain next to the channel to provide habitat diversity. These offline wetland features have been designed to provide flood attenuation and sediment storage and support shallow marsh communities.

Further information regarding habitat features is provided in Appendix A.

3.4 HABITAT CREATION

The proposed design will significantly improve the quality and function of the creek corridor by eliminating existing barriers to fish passage and redirecting flows to one channel to provide improved connectivity to the lake. The design will include a defined low flow and bankfull channel, a sequence of riffle and pool habitats and in-stream habitat structure. A series of offline wetlands and extensive plantings of native trees, shrubs and groundcovers will provide cover for fish and forage and habitat for wildlife.

A variety of habitats are proposed to be created within the corridor including wetlands, woodlands, shrub thickets, meadow and prairie. The range of habitats was developed by considering the types of naturally occurring communities that would occur in the watershed and more specifically in proximity to the lake. Many of the reference habitats and associated species selected for creation of these habitats are based on the approach utilized in the LWC project area, however the planting plan has been significantly diversified relative to the previous plan prepared for this section of Serson Creek. For example, the previous plan was comprised primarily of shrub plantings.

In developing the habitat types to be created, the corridor was subdivided into three general zones (top, slope and bottom) to separate the wet lowland floodplain from the drier slopes and top. Additionally, a hydraulic analysis was undertaken to identify portions of the corridor that would be subjected to more frequent flooding and inundation as well as area of higher or lower flow velocities. This information was used to assist with selection of habitat types and species to ensure the selected species were most suited to the site conditions.

It should be noted that restoration of most natural ecological communities requires many years of natural succession and cannot be easily replicated. Additionally, in the absence of similar habitats in the adjacent landscape efforts to replicate natural communities are typically unsuccessful. Furthermore, due to changes in edaphic and climatic conditions, it is no longer feasible to restore many types of natural communities, especially in highly urbanized landscapes. While it is possible plant similar assemblages of species as are found in natural analog communities, the result rarely exhibits the same structure, trophic levels and species inter-relationships observed in natural systems. Such restoration efforts are nevertheless still highly beneficial for conserving native biodiversity in urban areas.

Given the linear nature of the corridor, it was not possible to create certain community types such as forests which are typically greater than 40 m or more in width in the lower reaches of Phase 1. Instead, woodlands were proposed in the upper sections adjacent to the WWTP. Similarly, the channel corridor does not include aquatic habitats which are areas of open water greater than 2 m in depth. Instead shallow marsh wetlands have been proposed and will be planted with wetland and aquatic vegetation.

The following is a listing of the various habitats proposed.

1. Prairie – tableland along trail
2. Meadow – patches on valley slope
3. Woodland - tableland and valley slope at northern end of Phase 1.
4. Floodplain Forest/Swamp - floodplain at northern end of Phase 1.
5. Upland and Valley Slope Shrub Thicket – clusters and nodes throughout.
6. Shrub Thicket – patches on tableland and valley slope
7. Thicket Swamp – patches on floodplain
8. Meadow Marsh – on floodplain in middle sections
9. Shallow Marsh – on floodplain in online pools lower reach.

In addition to these habitats there will be screening plantings for the WWTP.

Three native seed mixes have been developed to be applied to the valley bottom, slope and tableland respectively. Seeded areas will be supplemented with plantings of trees, shrubs and groundcovers.

Further details are presented in the Landscaping Plan (Appendix D).

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

Corridor Design

3.5 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:

- Creation of a wider and more natural creek corridor;
- Elimination/mitigation of existing flooding risks to the WWTP site;
- Elimination of bypass flow pipe under the WWTP site;
- Incorporation of pedestrian / cycling trail within the creek corridor connecting JTLCA to Lakeshore Road East;
- Provision of enhanced level of habitat creation and diversity; and
- Landscape screening of the WWTP property from the Lakeview Village.

3.6 HYDRAULICS

Hydraulic modelling (HEC-RAS) was completed to evaluate and inform the proposed rehabiliation design. For the purposes of hydraulics modelling, the design is divided into interim and ultimate phases.

Phase 1A, (i.e., the current proposal under request for permit), 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. It is assumed that the existing TRCA haul road / bridge crossing is in place in this scenario.

Phase 1B (i.e., the current proposal under request for permit) is identical to Phase 1A, with the exception that the temporary haul road and bridge crossing are removed. This improves / reduces the floodplain upstream. The bridge crossing is expected to be removed in 2024, subject to TRCA's schedule.

Phase 2 represents the ultimate conditions in which the remaining portion of Serson Creek is realigned from Lakeshore Road East to the Phase 1A/1B channel limit. It is understood that CVC will not review this portion of the channel works at this time. The future channel alignment upstream of Phase 1 will have no hydraulic impacts on the Phase 1A/Phase 1B water levels. The ultimate channel block has been sized and conceptually shown in the preferred alignment on the plans, but this submission has been scoped to focus on the Phase 1A/1B portion of the channel. It is understood that the alignment of the Phase 2 channel is subject to CVC / City review; however, the Phase 1A/1B channel design is "fixed" baased on the downstream tie-in to the TRCA channel / Jim Tovey Lakeview Conservation Area and the upstream elevation of the existing channel at the property Lakeview Village property line.

The existing flow rates and boundary conditions in the May 2019 CVC model were used to simulate the Phase 1A/1B channel. 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. As shown on Figures STM-1 and STM-2, the proposed drainage area is slightly smaller than the existing drainage area. The proposed Serson Innovation Corridor blocks are proposed to drain to the subdivision sewers rather than to Serson Creek; this is consistent with the assumption that the flows will not increase beyond existing rates.

The drainage areas / flows are not expected to change for the ultimate (Phase 2) channel (i.e., the ultimate flows in the channel are assumed to be equivalent to the existing flows in the May 2019 CVC model. 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.

The proposed interim Phase 1A and Phase 1B flood elevations are shown in Drawing FP-2. Along the length of the restored channel, the interim Regional floodplain is contained within the corridor.

In Phase 1A, the existing TRCA haul road / bridge crossing causes backwater that continues to result in flooding upstream, within the woodland area north of the haul road. A berm is proposed in the channel upstream of the tie-in point to eliminate flooding and to ensure the frequent flows are directed into the realigned corridor rather than the "remnant" channel through the woodlot. However, this berm has been disregarded as it relates to Regional flood mapping in accordance with CVC flood mapping protocol. The interim / Phase 1A flood elevations upstream of the tie-in point are lower than existing water levels as a result of the rehabilitated corridor widening and lowering.

For Phase 1B, the removal of the temporary haul road bridge further reduces the Regional floodplain by more than 80cm such that the backwater near the tie in point does not spill into the woodland even if the berm is not considered.

The proposed interim channel design contains the maximum design flows with sufficient freeboard to private property or structures (minimum 0.30m). Note that the proposed berm on the G.E. Booth WWTP property is not required to contain the floodplain and is situated above the Regional floodplain. This berm is provided for screening / landscaping purposes and has been agreed to by the Region of Peel staff.

Refer to Appendix C for detailed results and the digital hydraulic modelling files.

The proposed improvements to the flood hazard and elimination of the spill on the G.E. Booth WWTP lands satisfies Objective R1-1 (Manage Stormwater Quantity) - i.e., reduction of flooding of structures in Serson Creek through improved flow conveyance.

3.7 RESTORATION AND TRAILS

Landscaping plans for areas outside the immediate channel riparian zone have been prepared by NAK Design Strategies (see Appendix D), 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 (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 development setback is proposed on private property from the top of bank. The setback is proposed to be entirely within private property and will form part of the Serson Innovation Corridor "Campus" / trail system. Refer to Drawing D4 for the typical sections illustrating the development setback.
- 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 2.0m wide trail (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. The channel grading and landscaping design has been coordinated with the Region of Peel. Through this coordination, the Region has requested heightening and landscaping of the berms along the edge of their property. These berms will be constructed by the Region within the G.E. Booth property limit according to the proposed grading and landscaping design presented herein and will offer additional visual screening and corridor planting opportunities.

Additional Objectives Achieved: Creation of pedestrian / cycling links between the lake and Lakeshore Road Eastwater levels as a result of the rehabilitated corridor widening and lowering.

Corridor Design

3.8 CORRIDOR LIMITS

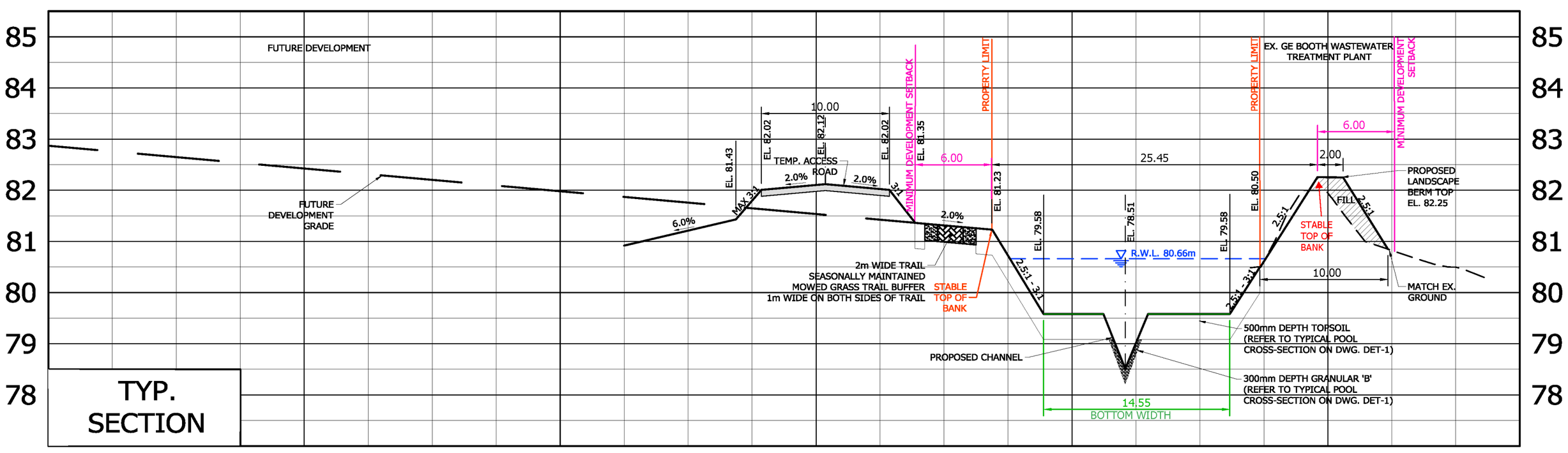
The overall channel corridor limits have been based on the overall fluvial, ecological, and hydraulic designs noted in the preceding sections.

With the permission of the Region of Peel, the creation of a berm (not for flood containtment, but for screening) has been proposed. The top of this berm (designed at the stable slope of 2.5:1 to minimize impact to the Region's property) defines the stable top of bank hazard on the east side fo the corridor. Similarly, the west stable top of bank (based on Beacon and DS Consultants erosion and stability assessments) constitutes the west limit of the corridor.

All other hazards are contained within the corridor defined by the stable top of bank, including the flood hazard and the meander belt as shown in the typical section below.

The creek corridor has been designed to include a minimum 6.0 m Development Setback which is consistent with CVC's Slope Stability and Determination Guideline (CVC 2014) and CVC's Watershed Planning and Regulation Policies (CVC 2010). The Erosion Hazard is defined by the Stability Component and Erosion Component, not the Development Setback Component (CVC 2014). While Provincial guidance offered through the River & Stream Systems Technical Guide (MNR 2002) includes an erosion access allowance as part of the erosion hazard limit, the guide offers municipalities the flexibility to implement guidance specific to their regions and watersheds. In the case of Serson Creek, an erosion access allowance is not required as a development setback is already been integrated into the development and provides for access to the valleylands.

The 6.0 m Development Setback is not considered necessary to protect the the ecological functions of the creek or the stability of the slope as these are engineered and landscaped features. The purpose of the setback is to provide unincumbered access to the valley in the event that channel or slopes require repair or maintainence. Access will be provided via an easement on private property where requried. While CVC and City policies relating to buffers and setbacks encourage placement into public ownership, it is not a policy requirement. Retaining the Development Setback under private ownership with approporiate zoning or easements that allows for public trail uses and valley access offers the same level of protection and function as placement within public ownership. With respect to NHS Policy 6.3.24, the 6.0 m Development Setback is neither a natural feature nor a natural hazard and does not form part of the NHS.



STORMWATER MANAGEMENT / SERVICING

4

Rendering of Ogden Ground Level

Stormwater Management / Servicing

4

4.1 STORMWATER MANAGEMENT

As shown in Figure STM-2, the proposed drainage area to Serson Creek consists predominately of a large area north of Lakeshore Road. The lands adjacent to Serson Creek are proposed to drain to the subdivision sewer system rather than the creek, with the exception of some future lands adjacent to the Phase 2 (ultimate) channel.

Due to the proximity to the lake, quantity control is not required. However, any proposal to discharge stormwater directly into the channel as part of future phases of development 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 including provision of the 5mm retention target established by the City of Mississauga. Note that these considerations are not applicable to the Phase 1A/1B design as there are no direct outlets or new development areas proposed to drain to the Phase 1A/1B channel at this time.

4.2 WOODLAND DRAINAGE DIVERSION

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.

- In the interim conditions (Phase 1A / prior to haul road removal), a temporary storm sewer (600mm) 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. Drawings SWM-1A and 2A illustrate the proposed connection. This allows the Region's works to proceed without the requirement to manage the external drainage, but prior to removal of the haul road.

- Upon removal of the haul road (Phase 1B), the storm sewer shown in Drawing SWM-1A can be removed and the ultimate swale connection to the woodlot shown on Drawing SWM-1 and Drawing SWM-2 can be constructed on the Region's property.

It should be noted that these works are almost entirely on the Region's property and therefore the construction and maintenance obligations will be dealt with by the Region. Region staff have agreed to these measures.

4.3 WOODLAND BENEFITS

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 fl ows 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.

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 are dead or dying and the understorey is dominated by non-native invasive shrubs.

The City's NAI acknowledges that that Serson Woodland is in poor condition recommends that a Management Plan be prepared 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 along the future swale 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.

4.4 WATERMAIN CROSSING

The Lakeview Village lands are located within Pressure Zone 1 in the Region of Peel's water distri¬bution system, and are currently serviced via a 250/300 mm diameter watermain looped along East Avenue and Rangeview Road, which is connected to a recently installed 600 mm sub-transmission main on Lakeshore Road East. The 600mm sub-transmission main can be connected to for the proposed development.

There are also other surrounding existing watermains but as indicated by the region no connections to these watermains are permissible. These watermains include the existing 400 mm local distribution feedermain crossing the site south of Rangeview Road, providing direct water supply from the Lakeview Water Treatment Facility to the G.E. Booth Wastewater Treatment Facility.

This existing 400mm supply to the G.E. Booth WWTP is currently situated at a relatively shallow depth beneath Serson Creek. In order to acheive the proposed rehabilitation design described in Section 3, channel lowering in this area is required, which would conflict with the existing watermain crossing.

A new watermain crossing and connection has been coordinated with the Region staff as shown on Drawing WM-1 and detailed in the cross-sections on Drawing WM-2. This proposed connection will relocate / preserve the dedicated feed to the plant and will allow for realignment of the watermain within the LCPL lands as well as lowering of the channel while providing suitable cover. No service connections to this watermain will be permitted.

The watermain will be relocated within / north of the existing haul road and will tie into the existing watermain in the Region's property east of the channel. The watermain will be constructed by a combination of tunneling (to avoid disturbance to the access road / bridge footings) across the channel and open cut on the Region's property. The 400mm watermain will be placed in a 900mm liner and will be approximately 1.5m below the future channel invert.

4.5 DISTRICT ENERGY CROSSING

As part of the sustainability initiatives currently pursued by LCPL, district heating and cooling is proposed. This involves the use of a centralized plant (within the Serson Innovation Corridor lands) to supply hot and cold water to a series of pipes distributed throughout the community and used by individual buildings in lieu of traditional boilers and chillers.

For Lakeview, one option currently in discussion with the Region of Peel involves leveraging the waste heat available at the G.E. Booth Wastewater Treatment Plant o heat and cool water for distribution throughout the community.

This requires a distributed network of pipes within the street corridors to service the community, which must be coordinated with and respect the other demands on the street corridor. The pipe network is typically comprised of a 4-pipe system ranging in diameter from 150mm to 500mm. A connection would be required to the plant via a utility crossing of the channel. Preliminary locations have been discussed with the Region staff and a conceptual alignment and depth is illustrated on Drawing CH-3. While the crossing details including construction alignment, timing and installation method are yet to be determined, the approximate locatinos of the crossing is included on the plans to ensure the agencies are aware that there may be additional crossings of Serson Creek in the future.

Existing site conditions of Lakeview Village

IMPLEMENTATION

5

View looking towards Lakeshore Retail

Implementation

5.1 Channel Staging

The following is a high-level list of the works that will occur as part of the Phase 1A/Phase 1B channel implementation and the anticipated timing. Note that the channel works in Items 1 to 5 are generally considered to be "urgent" / critical path, as the Region of Peel relies on the proposed diversion of flows to the rehabilitated channel to proceed with the G.E. Booth WWTP expansion. Drawings STG-1 and STG-2 illustrate the erosion and sediment control considerations and the staging details.

1. Installation of erosion and sediment controls upon receipt of permits from approval agencies. It is proposed to apply for a single permit to cover the following works including those on the Region's property.

2. Haul road relocation - the current / temporary TRCA haul road is anticipated to be in use until 2024. In the interim, the haul road must be shifted further west to allow for the existing corridor to be widened / re-graded to match the proposed design. Timing - Summer 2020.

3. Watermain crossing - as described in Section 4.4, the proposed 400mm watermain relocation can commence upon Region approval of the connection request. Timing - Fall 2020

4. Majority of Phase 1A channel construction, stabilization, and landscaping up to connection at Plasterform Inc. property line / existing temporary haul road bridge. Construction within LCPL property only (no berming on WWTP property). Trail construction on west side. This work will be completed in the dry. Timing - Fall 2020

5. 600mm storm sewer stub connection for woodland drainage as per Drawings SWM-1A/SWM-2A; berming / low flow channel connection to rehabilitated channel (i.e., "flipping flows" into new corridor). Timing: late fall / early winter 2020.

6. District energy crossings - if location agreed to with agencies, can proceed with channel construction; as open cut; however, additional coordination is required. Timing - TBD. Can be tunneled if location will be confirmed following Phase 1A construction.

7. The above construction works result in the "interim with bridge" floodplain conditions noted in Drawing FP-2.

8. Creation of berm / landscaping on Region's property (east side of channel). Timing - anticipated 2021; TBD by Region.

9. Removal of haul road (TRCA). Results in Phase 1B channel / "interim with no bridge" floodplain on Drawing FP-2. Timing - anticipated 2024.

10. Grading of swale connection from woodland to Phase 1B as per Drawings SWM-1/SWM-2 and removal of 600mm storm sewer from Drawings SWM-1A/SWM-2A. Works by Region. Timing - post-2024.

11. Ultimate channel through Plasterform Inc. and LCPL lands. Timing - to be determined.

5.2 Erosion & 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. Genrally, the Phase 1A 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 measuremens must be taken to prevent downstream impacts to the lake / connection to the Jim Tovey Lakeview Conservation Area.

The following meausres are recmomneded for the channel construction as shown in Drawings STG-1 and STG-1:

- Natural features, property lines, and fill regulation limits to be staked where applicable.
- Seimdnt control fence and snow fence placed priort o earthworks / channel construction.
- Placemcent of filter socks and other measures at connectino to lake.
- All temporary E&SC measures will be routinely inspected/monitored and repaired during construction as required. Controls will not be removed until the areas they serve are restored and stable.
- All reasonable measures will be taken to ensure that sediment loading into the lake is minimied both

5.3 Operations and Maintenance

The Beacon design brief (Appendix A) outlines the following operations and maintenance recommendations including a monitoring protocol. In general, the channel has been designed to require minimal maintenance and will remain accessible at all times. No designated access points have been provided for in the design., although the proposed slopes (2.5:! / 3:1 are generally accessible. There is a flatter section (~ 5:1) at the south limit of channel which can be used to facilitate access.

The landscaping plans in Appendix D include gaps between plantings along the length of the channel that will provide access should it be necessary. An easement is proposed on the 6.0 m private development setback which will provide for access to the valleylands, should it be necessary to undertake repairs in the future. Access may also be provided through the Region's property on the east side of the channel; however, it is anticipated that the City will prefer access from the west side.