Matrix Solutions Inc.
A Montrose Environmental Company

HIDDEN VALLEY FLOOD RISK REDUCTION

SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT PROJECT FILE REPORT

Prepared for:
CITY OF KITCHENER

Prepared by:
MATRIX SOLUTIONS INC., A MONTROSE ENVIRONMENTAL COMPANY

Version 1.0
March 2024
Guelph, Ontario

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HIDDEN VALLEY FLOOD RISK REDUCTION

SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Prepared for the City of Kitchener, March 2024

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VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	12-Jan-2024	Draft	31809 Hidden Valley Flood Risk Reduction EA 2024-01-12 draft v0.1	Issued to client for review
V1.0	06-Mar-2024	Final	31809 Hidden Valley Flood Risk Reduction EA 2024-03-06 final V1.0.docx	Issued for public, Indigenous, and agency review.

EXECUTIVE SUMMARY

The City of Kitchener (City) retained Matrix Solutions Inc., a Montrose Environmental company, (Matrix) to complete a Flood Risk Reduction Environment Assessment (EA) for Hidden Valley Creek in Kitchener, Ontario. Hidden Valley Creek is a watercourse which runs from Wabanaki Drive in the west and King Street East in the north, through a wetland/woodland environmental complex, and outlets to the Grand River. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream reaches of the Hidden Valley Creek subwatershed close to Hidden Valley Road. The project is being carried out in accordance with the requirements of the Environmental Assessment Act and follows the process for Municipal Class EA Schedule B. The intent of this project is to identify alternative solutions to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed.

The Problem/Opportunity Statement is as follows:

> *"There are several flood vulnerable areas and erosion vulnerable reaches in the downstream reaches of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This Environmental Assessment is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community."*

Public, Indigenous, and agency consultation was completed as part of the project. A Notice of Study Commencement was mailed out to a list of potentially interested groups and agencies on June 13, 2023. A Public Information Centre was held on October 12, 2023, to introduce the project, summarize the alternative solutions, and provide an opportunity for interested parties to identify any concerns or local information that will support the EA process. A Notice of Completion will be advertised and circulated to the stakeholder list following approval by the City.

Four alternatives were assessed for potential to reduce flood risk within Hidden Valley Creek:

- Alternative 1 is a Do-Nothing scenario in which no changes are made.
- Alternative 2 considers flow attenuation upstream of the Hidden Valley ESPA/PSW through the use of oversized stormwater controls.

- Alternative 3 considers construction a flow control structure, such as a dam, within the Hidden Valley ESPA/PSW to provide engineered attenuation within the wetland.
- Alternative 4 proposes increasing conveyance downstream of the Hidden Valley ESPA/PSW.

Matrix completed a detailed assessment of each alternative solution and ranked each alternative across three categories:

- Technical Environment
- Cultural/Social Environment
- Natural Environment

Matrix considered each alternative's ability to address the project objectives with the greatest benefit and least negative impact toward each environmental category.

Based on the evaluation of Technical Environment, Social/Economic Environment, and Natural Environment, Alternative 4 is the preferred solution. Alternative 4 has the highest Technical, Cultural and Social-Economic, and Natural Environment score of all alternatives. This alternative reliably reduces Flood Risk, has minimal approval requirements, does not have an intensive construction cycle, and improves upon existing conditions by increasing the habitat connectivity of Hidden Valley Creek and adding native vegetation.

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1 INTRODUCTION

Hidden Valley Creek is a watercourse in southern Kitchener which runs from Wabanaki Drive in the west and King Street East in the north, through a wetland/woodland environmental complex, and outlets to the Grand River. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream reaches of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This Environmental Assessment (EA) is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community. The project is being carried out in accordance with the requirements of the *Environmental Assessment Act* and follows the process for Municipal Class EA Schedule B. The intent of this project is to identify alternative solutions to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed.

1.1 Problem and Opportunity Statement

There are several flood vulnerable areas and erosion vulnerable reaches in the downstream reaches of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.

1.2 Study Area

Hidden Valley Creek receives drainage from a catchment of approximately 190 ha. The western portions of the catchment are developed with medium to high density land use, the southern limits contain low-density residential land use, and the centre and northern portions of the catchment are undeveloped. The study area shown in Figure 1 encompasses the entire catchment area.

Development has resulted in greater impervious area within the upper limits of the catchment. Specifically, in 2008 there was development of the Kitchener Operations Facility and a commercial parking lot west of Wabanaki Drive. Further development is anticipated east of Wabanaki Drive and south of Hidden Valley Road. The City of Kitchener's Hidden Valley Land Use Master Plan (City of Kitchener 2019) describes the anticipated development for the 183 ha region. Areas contained within the bounds of Hidden Valley Road have works planned for the development of low-rise residential,

medium-rise residential, mixed-use, commercial, and high-rise residential land use. The limits of the proposed development plans are shown in Figures 1 and 2.

Easting (m)

545000 545500 546000 546500 547000 547500

Northing (m)

4809000 4808500 4808000 4807500 4807000 4806500

8TH AVE
9TH AVE
ST JEROME CRES
CONNAUGHT ST
CARROL ST
WOODHAVEN RD
MUNROE ST
CEDARWOODS CRES
KINGSWAY DR
WEBER ST E
HUBER ST
FLORENCE AVE
JANSEN AVE
FAIRWAY RD N
THALER AVE
WINDOM RD
SOUTHILL DR
MORRISON RD
ONEIDA PL
RIVER RD E
UNDERHILL CRES
GRAND RIVER BLVD
CHANDOS DR
MORGAN AVE
KING ST E
LEWIS CRES
MANOR DR
GREENFIELD AVE
WILSON AVE
TRAYNOR AVE
BALFOUR CRES
CAMEO DR
HOFSTETTER AVE
STONEGATE DR
Hofstetter Creek
Hidden Valley North Creek
HWY 8
FAIRWAY RD S
Hidden Valley West Creek
Freeport Creek
WEBSTER RD
CHANDARA PL
CRESS LANE
GOODRICH DR
Hidden Valley East Creek
HIDDEN VALLEY RD
Schneider Creek
RIVER VALLEY DR
RIVER BIRCH ST
HIDDEN VALLEY CRES
MANITOU DR
WABANAKI DR
Grand River

N

Legend

- Existing Watershed
- Provincially Significant Wetland
- Flood-prone Area
- Proposed Development
- Watercourse
- Flow Direction

1:11,000 Meters

250 0 250 500

NAD 1983 UTM Zone 17N

Reference: Contains information licensed under the Open Government Licence - Ontario and GRCA Open Data Licence v2. Imagery (2022) Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Flood EA Report

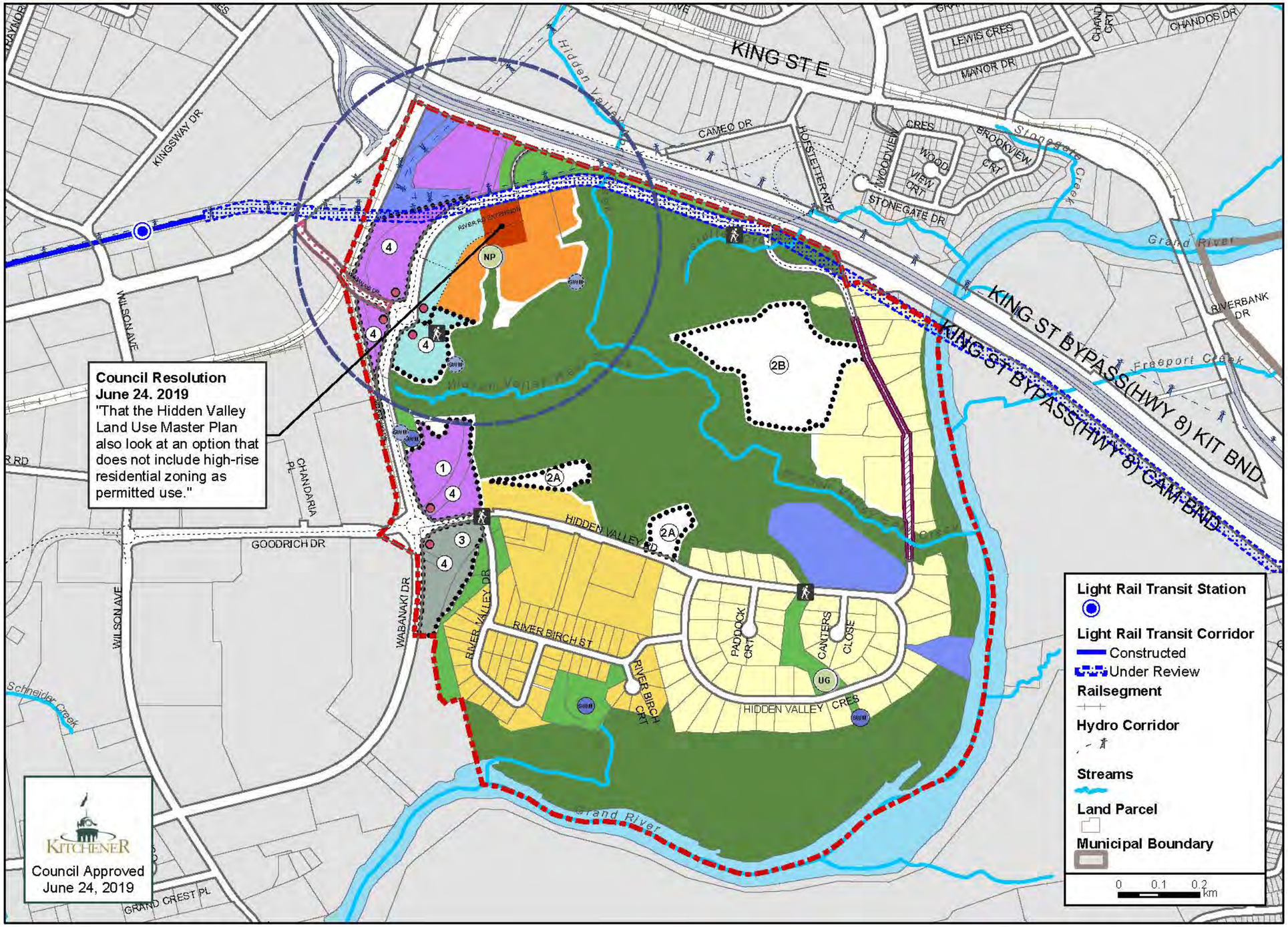
Study Area

Date:	Project:	Submitter:	Reviewer:
March 2024	31809	M. Legrand	S. Muscat

Figure 1

I:\Cityof\Kitchener\31809\Figures\And Tables\EA\2024\Rep\nFlood Section\Figure-1-Study_Area.mxd - Tabloid_L - 04-Mar-24, 03:32 PM - lmwright - TID005

Hidden Valley
Land Use Master Plan



Council Resolution
June 24. 2019
"That the Hidden Valley Land Use Master Plan also look at an option that does not include high-rise residential zoning as permitted use."

KITCHENER
Council Approved
June 24, 2019

Light Rail Transit Station

Light Rail Transit Corridor
- Constructed
- Under Review

Railsegment

Hydro Corridor

Streams

Land Parcel

Municipal Boundary

0 0.1 0.2 km

Land Use
- Low Rise Residential - Estate
- Low Rise Residential - Large Lot
- Medium Rise Residential
- High Rise Residential
- Mixed Use
- Commercial
- Business Park Employment
- Major Infrastructure & Utilities
- Natural Heritage Conservation
- Open Space

Site Specific Policy Area

1. Community and Institutional uses also allowed
2A. and 2B. Subject to regulation and further study
3. Some neighbourhood commercial uses also allowed
4. Compatibility of sensitive uses

Land Use Master Plan Boundary

Community Gateway

5 Minute Walking Distance from Centre
- 450m

Potential Trailhead Locations

Proposed Parkland
- NP Neighbourhood Park
- UG Urban Green

Proposed Roads
- Hidden Valley Road Realignment
- Local Street

Heritage Corridor

Priority Street

SWM Facility
- Existing
- Potential (Location to be determined)

Notes:
1. Portions of River Rd extension, Wabanaki Dr and Goodrich Dr may be renamed
2. Development limts and setbacks to be determined

There is a large woodland/wetland complex in the centre of the catchment, which holds classifications of a Provincially Significant Wetland (PSW), Environmentally Sensitive Policy Area (ESPA), and Core Environmental Feature (CEF). Within the study area there are regionally significant woodland and significant valley, species at risk habitat, and a warmwater fishery. In addition to being an environmentally sensitive area, the Hidden Valley ESPA/PSW is the hydrologically dominant landscape feature in the subwatershed.

The area downstream of the Hidden Valley ESPA/PSW has experienced flood and erosion impacts related to both specific rainfall-runoff events or the release of natural debris-blockages (e.g., beaver dams or natural debris jams) within the wetland feature. Two hydrologic investigations have been conducted for the Hidden Valley catchment:

- WalterFedy (2015) undertook a hydrologic and hydraulic analysis of the Hidden Valley Subwatershed and created hydrologic and hydraulic models.
- Wood (2019) conducted a hydrologic calibration study to better represent the Hidden Valley ESPA/PSW region with the WalterFedy hydrologic model. The study included a flow monitoring program upstream and downstream of the Hidden Valley ESPA/PSW.

Greater detail on the methodology and results of the two studies are presented in Section 2.1.

2 ENVIRONMENTAL ASSESSMENT AND PLANNING CONTEXT

2.1 Previous Studies

The existing hydrology and hydraulics of the Region have been studied in two previous assessments. In 2015 WalterFedy conducted a hydrologic and hydraulic study of the Hidden Valley Creek subwatershed which was followed up by a flow monitoring, calibration, and hydrologic study for the new secondary plan conducted by Wood PLC (Wood) in 2019. The goals, findings, and limitations of the two studies are outlined below.

2.1.1 WalterFedy 2015 - Hydrologic and Hydraulic Study

WalterFedy conducted a hydrologic and hydraulic study of the Hidden Valley Creek subwatershed in 2015, creating a hydrologic model for the entire catchment area using InfoSWMM and a localized hydraulic HEC-RAS model downstream of the wetland feature. The goals of their study were to investigate the root causes of the existing erosion and flooding of the creek and gain insight into the best mitigation options. The objectives outlined include:

- Develop a calibrated hydrologic model.
- Determine the causes of existing erosion and summarize inundation levels downstream of the wetland.
- Evaluate the possible impacts of the proposed River Road development on the wetland.
- Determine if specific techniques to reduce the quantity and rate of runoff from the proposed River Road development are warranted.
- Provide suggestions on stormwater criteria for future developments within the subwatershed.
- Examine the potential for collaborative channel erosion mitigation options that will address existing problems and future developments.
- Provide an analysis on the flow capacity of the existing culvert crossing at Hidden Valley Road.

In addition to hydrologic and hydraulic modelling of Hidden Valley Creek subwatershed, field monitoring was undertaken to measure flow at three locations in 2014. The flow monitoring stations were labelled SW1 (located downstream of Hidden Valley Road), SW2 (located along the west tributary) and SW3 (located along the north tributary; Figures 3 and 4).

2.1.1.1 Hydrologic Model

WalterFedy created a hydrologic model, using InfoSWMM, for both existing conditions and future conditions as outlined in the Class EA River Road Extension, River Road Stormwater Report (Stantec 2013). The existing model contained 60 subcatchments delineated through a combination of drainage infrastructure, site topography, field review and land use mapping (Figure 4). Topographic and aerial maps were used to

define catchment slope and imperviousness, respectively, and soil parameters were uniformly applied to all catchments based on the average soil class of “gravelly loam.” Catchments within the northwestern and southwestern areas of the study area were of primarily industrial and commercial land use, while catchments to the southeast were of low-density residential land use. Recent aerial photography indicates that additional development in the south and west areas of the catchment (south of Hidden Valley Road) have occurred since this study. The hydrology of the Region was modelled in response to the 25 mm, 1:2-year through 1:100-year return period synthetic storms, and the Regional storm.

Two storm pond facilities were included in this study and the wetland feature was represented as a storage node, with a stage-storage relationship developed through analysis of the topographic information. A beaver dam was noted in the wetland and assumed to be the primary hydraulic control for the wetland. WalterFedy questioned the stability and reliability of the dam to provide stormwater attenuation, speculating that the natural sedimentation process would reduce active storage volume over time. Inspection from aerial imagery indicates the dam may have drained since the investigation, with visual water recession observed post-2016.

Easting (m)

545750 546000 546250 546500 546750 547000

Northing (m)

4808000 4807750 4807500 4807250 4807000

FAIRWAY RD S
CAMEO DR
HOFSTETTER AVE
RIVER RD E
WOODVIEW
HWY 8
STONEGATE DR
HIDDEN VALLEY RD
WABANAKI DR
GOODRICH DR
RIVER VALLEY DR

SW1
SW2
SW3

N

Legend

- Watercourse
- Flow Direction
- Flow Monitoring Location (July to Nov. 2014)

1:5,000

125 0 125 250 Meters

NAD 1983 UTM Zone 17N

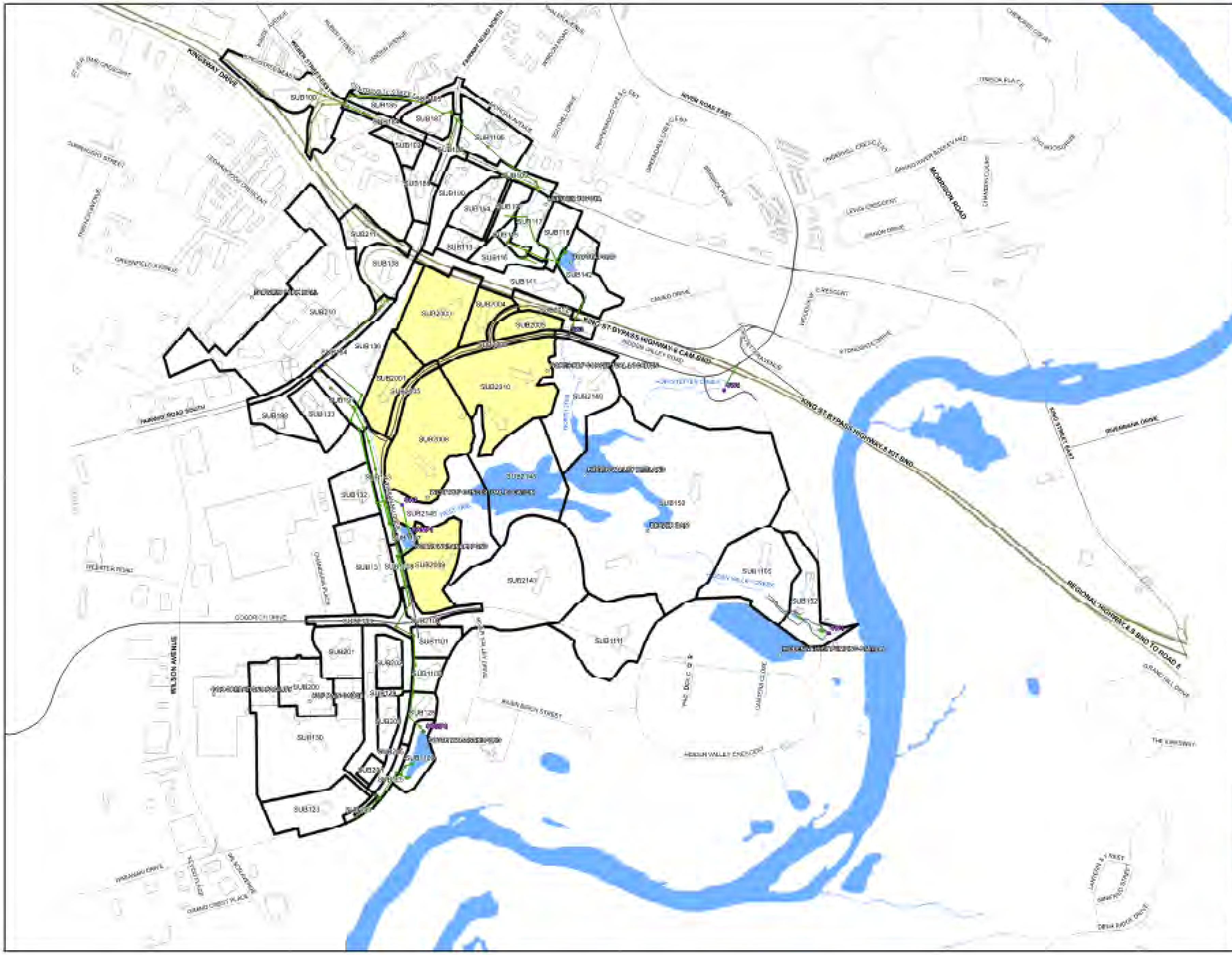
Matrix Solutions Inc.
A Montrose Environmental Company

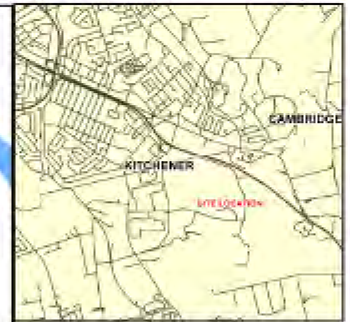
City of Kitchener
Hidden Valley Flood EA Report

Monitoring Locations

Date:	Project:	Submitter:	Reviewer:
March 2024	31809	M. Legrand	S. Muscat

Figure 3





Legend

- Proposed River Road Alignment
- Points of Interest
- Stormwater Manholes
- Stormwater Pipes
- Surface Water Monitoring Locations
- Regional Floodline
- Building Framework
- Future Land Use Changes
- Overland Flow
- Drainage Areas
- Surface Water Body
- Surface Water Creek

Roads

- Alleyway / Laneway
- Arterial
- Collector
- Freeway
- Local / Strata
- Local / Street
- Ramp

notes:
- Co-ordinate System: NAD 1983 UTM Zone 17N

customer:
CITY OF KITCHENER

project:
HIDDEN VALLEY WATERSHED HYDROLOGIC HYDRAULIC STUDY

title:
RIVER ROAD AND FUTURE DEVELOPMENTDRAINAGE AREAS

WALTERFEDY

scale:	1:5000
date:	2015.05.01
drawn by:	AZ
job number	2014-0226-10

FIG 13

Precise calibration of the wetland feature was not a goal of this study, and as such there is significant variability presented in the results downstream of the Hidden Valley ESPA/PSW. Further calibration of the model, specifically with regard to wetland inflow/outflow response, was conducted by Wood in 2019. Details on the calibration process is presented in Section 2.1.2.

Three proposed conditions scenarios were created by WalterFedy to assess the impacts of upstream development with and without stormwater control:

1. River Road development conditions
2. River Road and future development conditions with Regional pond control
3. River Road and future development conditions with Regional pond and Low Impact Development (LID) control

The results of the study indicated that implementation of the River Road Development without accompanying stormwater controls would increase peak flows entering the west and north tributaries of the creek. From an event-based water balance, the incremental increases in flow volumes are not expected to have detrimental impacts on the hydroperiod of the wetland. Minimal changes were expected to the water levels within the wetland, due to the large surface area available for storage.

In order to accommodate the increased flows (match existing flows), two new stormwater pond facilities were recommended and upsizing of the North Wabanki Pond was recommended. It was observed that implementing LID controls reduced the quality and quantity control strain on the pond facilities and increased the infiltration of stormwater, thus improving regional water balance.

2.1.1.2 Hydraulic Assessment

An existing conditions hydraulic model was established for the channel downstream of the wetland to the Grand River based on surveyed cross-sections. The purpose of the hydraulic modelling was to assess inundation and the hydraulic capacity of Hidden Valley Road. Both the driveway culverts and Hidden Valley Road culverts were observed to create a backwater effect in the model by restricting conveyance for all design storm events. It was determined that backwater at the Hidden Valley Road culvert does not

extend to the building at 735 Hidden Valley Road and is not the cause of the flooding. However, under the assumption of exiting development conditions and a beaver dam attenuating flows, a box culvert of span 2.5 m and rise 1.0 m was assessed to meet MTO criteria for an arterial road, conveying a maximum flow of 12.8 m^3/s. Without beaver dam attenuation, the maximum flow would be 14.8 m^3/s (based on the uncalibrated hydrology model) and would require a 3.8 m span box culvert to provide sufficient conveyance.

Varying scenarios of peak flow rates were also tested to determine if increased development upstream of the wetland complex have or will influence flooding downstream at Hidden Valley Road. Pre-existing flows, assuming conditions preceding the Kitchener Operations Facility and Best Buy development in 2008, were compared to existing conditions and it was determined that there was negligible difference to the flood extents within the Hidden Valley Corridor. These results indicated that flooding downstream of the wetland was not a result of increased upstream development. Additionally, a scenario of ultimate development considering the River Road Extension plans were tested and it was indicated that the proposed development does not influence inundation at Hidden Valley Road, as the proposed stormwater management controls would throttle post-development flows to pre-development magnitudes. Flooding downstream of the wetland was speculated to be a result of a failure of the beaver dams in the wetland, as removal of the dam attenuation results in a 16% increase of peak flow in the channel.

2.1.1.3 Erosion Hazards

During the survey of the site by WalterFedy in 2015 major bank erosion was identified along the channel and undercutting of both CSP culverts. The remains of a blown-out culvert were observed 50 m upstream of the property during the survey. The soil texture class (sandy and gravely loam) and steepness of the channel and bed slopes were remarked to promote high velocities and potential for further erosion.

Two potential solutions were evaluated to remediate erosion hazard, including protecting the creek bed and banks and creating a geomorphically stable system. Armour stone or riprap were suggested to harden the banks and prevent further erosion. Velocity dissipation devices such as grade control structures would reduce

velocity in the channel, slowing potential erosion. Alternatively, naturalization of the channel and widening the floodplain would mitigate erosion and stabilize the creek.

2.1.2 Wood 2019 - Flow Monitoring, Calibration, and Hydrologic Study for New Secondary Plan

Wood conducted a hydrologic investigation in 2019 with the goal of calibrating the Hidden Valley EPSA/PSW in the WalterFedy hydrology model and understanding the impact of the proposed development upstream of the feature.

2.1.2.1 Flow Monitoring

Flow monitoring data was collected by Wood at the same locations as the WalterFedy (2015) study and used to compliment the 2015 dataset. Water level data was collected using level-loggers with an acoustic doppler to allow for conversion to flow. As rating curve data was not available for the full range of monitored water levels, a rating curve was developed for each station in HEC-RAS by adjusting channel and bank roughness to match the measured stream stage and discharge.

Rainfall data from both the nearest rainfall gauging station (City of Kitchener's Operation Facility) and the nearest Environment Canada gauge (ID 6144239) were used to relate streamflow to precipitation events. The period in which streamflow was monitored (2017) was atypically dry compared to the climate normal for the Region. As such, the calibration process suffered for only measuring low flow events.

Data from the flow monitoring stations (refer to Figure 3 for locations) indicated that SW1 and SW3 show more muted responses to precipitation events than SW2 and SW2 exhibits the highest rate of baseflow. Oddities in the data, such as SW3 exhibiting dry weather diurnal flow, are unexplained. The rating curve fits for the three stations were good for low flows but lacked any high flow points to allow for proper calibration of a rating curve. Comparison between measured and modelled flow at SW2 showed a very poor fit, which attests to the limited reliability of the measured flows.

Due to the lack of high flow data, supplemental data from Stantec (2011-2017; refer to Section 2.1.3) was used to provide a more comprehensive dataset The location of the Stantec monitoring was close, but not at an exact location when compared to the Wood

installed sites (+/- 10 m). The Stantec data also only included low flow events and so did not improve the accuracy of the modelled high flow events.

2.1.2.2 Hydrologic Model Calibration

A total of 15 precipitation events were used to calibrate the existing condition hydrologic model. A storage-discharge relationship was developed for the wetland, but overestimated streamflow with a relatively low coefficient of determination between simulated and observed streamflow.

A sensitivity analysis was performed for various hydrologic parameters, including soil hydraulic conductivity, catchment directly connected imperviousness, wetland storage volume, and wetland discharge rate. Catchment width/length, overland flow roughness, and depression storage were excluded form the analysis. Changes to the soil parameters and directly connected imperviousness of the catchment increased the fit to the estimated runoff at flow locations SW2 and SW3.

Modifications to the wetland storage node, including the wetland feature and beaver dam, were less successful. The wetland node was calibrated solely against SW1 and with changes to initial depth, seepage rate, and outlet discharge relationships. Initial depth and seepage rate were calibrated according to the received model and information from the Stage 1 Hydrogeology Study, River Road Extension (Stantec 2013), and deemed to be relatively insensitive for long-term simulations. It is unclear whether the structures are based on empirical relationships or represent the physical outlet configuration of the wetland. While the wetland discharge relationship of the wetland had the greatest impact on results, given the absence of physical information on the outlet and minimal high flow calibration events Wood felt there was no justification to alter the relationship.

The results of the calibration process led to an improved model but maintained significant disparity towards measured flows. The Grand River Conservation Authority (GRCA) accepted the fit for the SW2 and SW3 stations, but expressed concern regarding the calibration fit for SW1. A revised effort was undertaken after talks with the GRCA to further calibrate the wetland using the SW1 rating data. Three large storm events were used to calibrate high flow events which resulted in a better fit for peak flow and

volume. While sufficient for the 2019 study, the updated calibration is advised to be further recalibrated if used for future works.

2.1.2.3 Hydrologic Results

The updated Wood hydrologic model was used to model existing and proposed development conditions. The inclusion and absence of stormwater controls, LIDs, and attenuation from the wetland were considered. The proposed development scenarios were created based on the Hidden Valley Master Land Use Plan (City of Kitchener 2019), the River Road Extension Environmental Assessment (IBI 2013), and the Hydrologic and Hydraulic Study (WalterFedy 2015). Due to the lack of detailed grading and lot information for the new developments and road alignments, Wood had considered the stormwater controls described by WalterFedy as adequate. Changes were made to catchment areas for the proposed development along Hidden Valley Road as well as the River Road alignment in accordance with the updated Land Use Plan and River Road Extension Report. Storm sewers along the River Road Extension were not included in the model. An overview of the modelled stormwater controls are shown in Figure 5.

Model results indicated that the wetland provides significant attenuation to flows, with 767% greater peak flows downstream when the storage node is removed from existing conditions. Due to the high degree of attenuation, a flow control structure placed downstream of the wetland feature was discussed with the GRCA to mitigate the impacts of a potential beaver dam break.

Legend

- Hidden Valley Wetland Node
- Reporting Nodes
- Outfall
- Stream
- Roads (Existing)
- Unchanged Subcatchments
- Refined Future Subcatchments
- Refined Future Subcatchments Containing Potential Development Areas

Future Land Use Plan

- Roads with Future River Road

N

SUB100 SUB185 SUB105 SUB184 SUB187 SUB1106 SUB102 SUB108 SUB109 SUB188 SUB190 SUB154 SUB191 SUB117 SUB118 SUB211 SUB115 SUB113 SUB116 SUB138 SUB142 SUB141 SUB210 SUB2000 SUB2004 SUB2012 SUB2005 SUB2195 SUB2006 SUB134 Future River Road SUB2001 SUB2007 SUB2010 SUB2149 SUB197 SUB198 SUB133 SUB2008 SUB2143 SUB2148 SUB132 SUB2150 SUB2145 STRG4 SUB1107 SUB2106 SUB2147 SUB131 SUB2108 SUB2009 SUB2153 SUB2105 SUB2146 Goodrich Drive SUB2103 SUB2104 Hidden Valley Road SUB2111 O100 SUB2152 SUB201 SUB2101 SUB202 SUB2100 SUB200 SUB203 SUB2128 SUB130 SUB205 SUB129 SUB1109 SUB125 SUB123 SUB199

AeroGRID, IGN, and the GIS User Community

HIDDEN VALLEY HYDROLOGIC STUDY

CITY OF KITCHENER

FUTURE CONDITIONS SUBCATCHMENT BOUNDARY PLAN AND LAND USE CHANGES

wood.

Scale **1:8,500**

0 50 100 200 300 400 Meters

Project No.	**TPB178083S**
Figure No.	**5-2**

2.1.3 Stantec, 2011 – 2022 - Flow Monitoring

Stantec conducted an Intake Protection Delineation (2010), Pre-Construction Groundwater and Surface Water Monitoring (2014), and a Stage 1 Hydrogeology Study (2013) in support of the proposed River Road Extension. on behalf of the Region of Waterloo. As part of these projects Stantec has captured water level surface data directly upstream of the Hidden Valley Road from December 2011 to December 2021 at a resolution of 1 measurement every 15 minutes, in support of the proposed River Road Extension project. This represents 10 years of monitoring data, including the period at which the Hidden Valley Road crossing was rehabilitated in September 2013. Low flow water levels remain unchanged following the road rehabilitation works, indicating that the pipe configuration and hydraulic conditions remained unchanged pre- and post-rehabilitation. Water surface elevations for the 10 years of monitoring range from 289.9 to 293.78 m.

Stantec collected instantaneous flow data 40 times at the location of the water level monitor, with a maximum observed flow rate of 0.389 m^3/s. The maximum observed flow rate corresponds to a water surface elevation of 290.86 m, as measured directly upstream of the Hidden Valley Road crossing. This water surface elevation is 3 m below the maximum observed water surface elevation from the 10-year monitoring period. Typically, observed instantaneous flow data is used to relate measured water surface elevations to a calculated flow rate using a "rating curve." The measured instantaneous flow does not capture high flow events; therefore, the rating curve developed by Stantec is not applicable to water surface elevations above 290.86 m. The flow data collected by Stantec was the primary source for the hydrologic analysis of the current project. Refer to Section 4.3.1 details on the use of this data.

2.2 Municipal Class Environmental Assessment

All municipalities in Ontario are subject to the provisions of the *Environmental Assessment Act* (EAA) and its requirements to prepare an Environmental Assessment (EA) for applicable public works projects. The Ontario MEA "Municipal Class Environmental Assessment" document (2023) provides municipalities with a five-phase planning procedure, approved under the EAA, to plan and undertake all municipal sewage, water, stormwater management, and transportation projects that occur

frequently, are limited in scale, and have a predictable range of environmental impacts and applicable mitigation measures.

In Ontario, infrastructure projects that require works for the purposes of flood or erosion control are subject to the Municipal Class EA process and must follow a series of mandatory steps as outlined in the Municipal Class EA document. The Class EA document identifies five project phases as summarized below:

- **Phase 1 – Problem or Opportunity:** Identify the problems or opportunities to be addressed and the needs and justification.
- **Phase 2 – Alternative Solutions:** Identify alternative solutions to the problems or opportunities by taking into consideration the existing environment, and establish the preferred solution considering public and agency review and input.
- **Phase 3 – Alternative Design Concepts for the Preferred Solution:** Examine alternative methods of implementing the preferred solution based upon the existing environment, public and agency input, anticipated environmental effects and methods of minimizing negative effects and maximizing positive effects.
- **Phase 4 – Environmental Study Report:** Document in an Environmental Study Report (ESR), a summary of the rationale, planning, design, and consultation process for the project as established through Phases 1 to 3 above and make such documentation available for scrutiny by review agencies and the public.
- **Phase 5 – Implementation:** Complete contract drawings and documents, proceed to construction and operation, and monitor construction for adherence to environmental provisions and commitments. Also, where special conditions dictate, monitor the operation of the completed facilities.

Depending on the anticipated level of environmental impact, and for some projects, the anticipated construction costs, the project does not necessarily have to undertake all the aforementioned phases. The Class EA defines three types of projects, referred to as Exempt, Schedule B, or Schedule C, which determine the required process. Projects are categorized according to their environmental significance and their effects on the surrounding environment. Planning methodologies are described within the Class EA and are different according to Class type, such as the following:

Exempt: Projects are limited in scale, have minimal adverse environmental effects, and include a number of municipal maintenance and operational activities. Some projects are exempt based on the results of an archaeological screening process or because of emergency response. These projects are pre-approved and may proceed to implementation without following the full Class EA planning process.

Schedule B: These projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process (Phases 1 and 2), involving mandatory contact with directly affected public, Indigenous communities, and with relevant review agencies to ensure that they are aware of the project and that their concerns are addressed. If there are no outstanding concerns, then the proponent may proceed to implementation (Phase 5). At the end of Phase 2, a project report documenting the planning process followed through Phases 1 and 2 shall be finalized and made available for public and agency review. If the screening process raises a concern which cannot be resolved, a request may be made to the Ontario Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study or that conditions be imposed only on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Alternatively, the proponent may elect voluntarily to plan the project as a Schedule C undertaking.

Schedule C: These projects have the potential for significant adverse environmental effects and must proceed under the full planning and documentation (Phases 1 to 5) procedures specified in the Class EA document. Schedule C projects require that an ESR be prepared and filed for review by the public and review agencies. If concerns are raised that cannot be resolved, a Part II Order may be requested.

2.2.1 Schedule Selection

For this study, Schedule B was considered applicable. This approach requires Phases 1 and 2 of the Municipal Class EA process to be addressed to satisfy the requirements for Schedule ‘B’ projects before proceeding with implementation (Phase 5). FIGURE 6Figure 6 illustrates the process followed in the planning and design of projects covered by Phases 1 and 2.

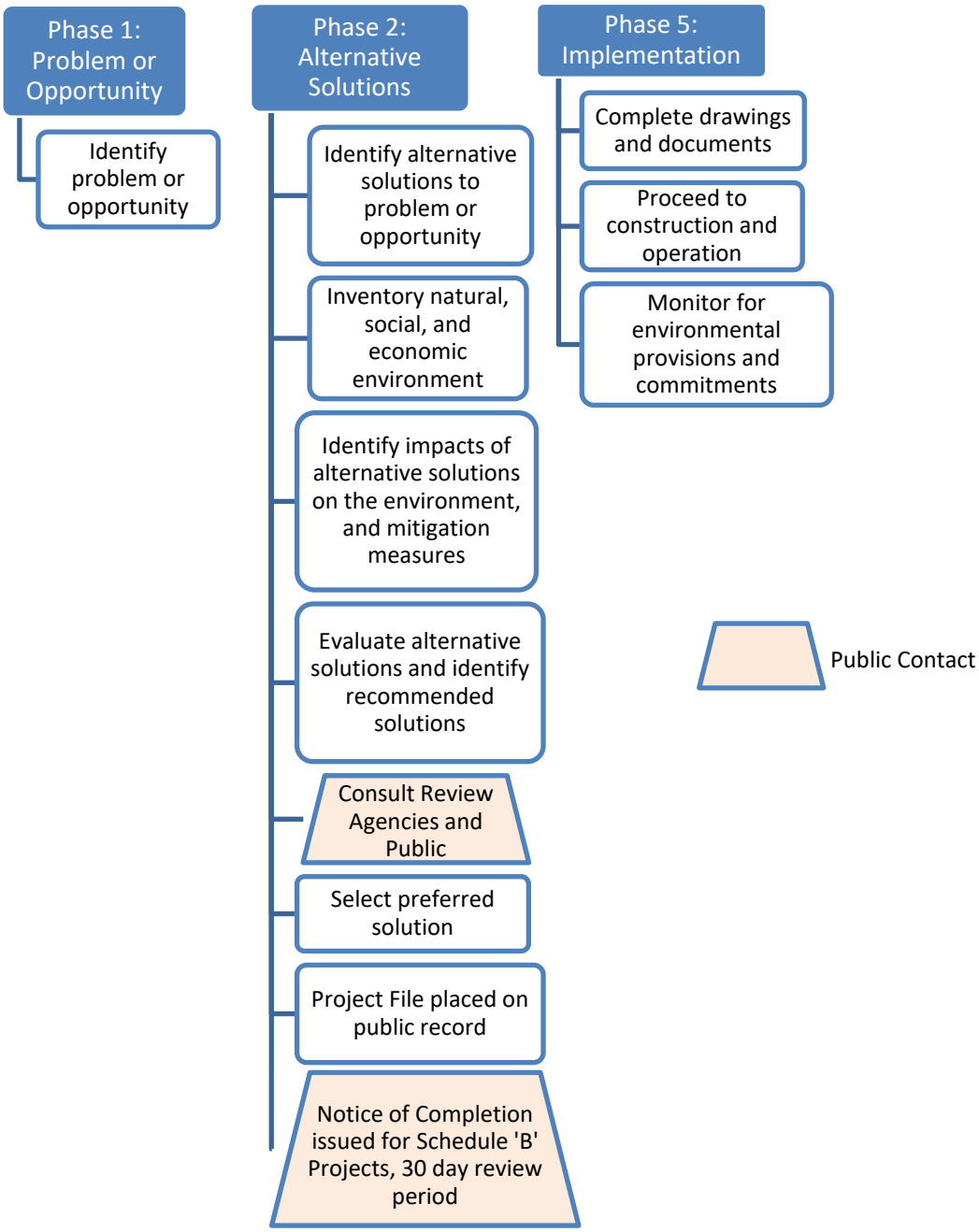


FIGURE 6 Class EA Process – Schedule B

2.3 Common Law and Riparian Rights

Common Law in Ontario establishes that “water flows naturally and should be permitted to thus flow” (Cameron 1979, Ontario 1993, Government of Ontario 2022), which in common terms means that natural watercourses should not be impeded. The definition of a natural watercourse has varied over the years but is defined by the Government of Ontario as “a channel where water flows between banks that are more of less defined” (Government of Ontario 2022).

Riparian rights concern landowners who own property fronting a natural watercourse. The rights of a riparian landowner include allowance to direct local drainage to the watercourse, regardless of downstream impacts, and the right to take water for domestic purposes. However, the riparian landowner cannot affect the natural conveyance of the watercourse. A riparian landowner must accept the natural flow from upstream riparian landowners regardless of the flood impacts. Altering the watercourse, such as damming a watercourse or redirecting flow, can make the riparian landowner liable for future damages. Beaver blockages and breaches, channel meandering, and erosion/sedimentation without human interaction are considered natural and are separate from riparian landowner liability.

The removal or change to woody debris and beaver blockages through human interaction can also be classified as an alternation to a natural watercourse if it impacts other riparian landowners. Unless a watercourse is located within municipal property, municipalities, conservation authorities or the Ministry of Natural Resources and Forestry have no authority to remove blockages. Common Law and Riparian Rights of the public and private riparian landowners along Hidden Valley Creek will be considered.

2.4 Provincial Policy Statement (2020)

The Province of Ontario is responsible for administering the *Planning Act,* 1990, as well as policy statements and plans related to a number of planning matters. In reviewing and assessing the existing and future conditions within the Scoped Study Area, it is essential to establish the provincial planning and policy context, considering both growth and sustainability objectives. The provincial policies that affect land uses within, and in proximity to the Scoped Study Area are summarized below. Given the scope and magnitude of the project, various provincial planning policy documents were reviewed

with a focus on the sensitivities and their significance which could influence the generation and evaluation of the appropriate alternative solutions.

The *Planning Act* is the Province of Ontario's legislated tool for ensuring that all land use planning throughout the province follows the same set of rules/guidelines. The Act outlines how decisions are to be made and the tools used to determine those decisions. Section 3 of the *Planning Act* grants the authority for the Government of Ontario to issue policy statements. The *Planning Act* requires that decisions affecting planning matters "shall be consistent with" policy statements issued under the Act.

The most recent Provincial Policy Statement (PPS; MMAH 2020) came into effect on May 1, 2020. The 2020 PPS provides policy direction on matters of provincial interest related to land use planning and development and intends to protect resources, public health and safety and the quality of the natural and built environment. Though the PPS informs land use planning decisions under the *Planning Act* in Ontario and requires that infrastructure be provided in a coordinated, efficient, and cost-effective manner, it is complemented by other provincial plans such as the Oak Ridges Moraine Conservation Plan (MMA 2017), and Greenbelt Plan (MMAH 2017). However, these were determined to not apply to this project.

The PPS recognizes the complex relationships between economic, environmental, and social factors in planning and embodies good planning principles. It includes enhanced policies on key issues that affect our communities, such as:

- creating healthy and active communities by facilitating active transportation and community connectivity
- the planning for, and protection of, corridors and rights-of-way for transportation infrastructure and transit to meet current and projected needs
- providing safe, efficient, cost-effective, and reliable multimodal transportation systems that facilitate the movement of people, that are integrated with adjacent systems and that are appropriate to address projected needs
- maintaining or restoring the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems;

and recognizing linkages between and among natural heritage features and areas, surface water features, and groundwater features

- restricting development and site alteration in, or adjacent to, significant wetlands, woodlands, valleylands, wildlife habitat, and Areas of Natural and Scientific Interest (ANSI) in Southern Ontario (Ecoregions 6E and 7E), unless it has been demonstrated that there will be no negative effects on the natural features or their ecological functions
- restricting development and site alteration in habitat of endangered or threatened species, except in accordance with provincial and federal requirements
- restricting development and site alteration in or near sensitive surface or groundwater features such that their features and related hydrological functions will be protected, improved, or restored
- protecting the overall health and safety of the population, including preparing for the impacts of a changing climate, and directing development away from areas of natural and human-made hazards
- conserving heritage and significant cultural heritage landscapes

The PPS focuses growth within settlement areas away from significant or sensitive resources and areas that may pose a risk to public health and safety. Furthermore, it recognizes that the wise use and management of resources may involve directing, promoting, or sustaining growth. It states that land uses must be carefully managed to accommodate appropriate development to meet the full range of current and future needs while achieving efficient development patterns.

The PPS highlights the importance of protecting the overall health and safety of the population and directs development away from areas of natural and human-made hazards. It includes policies to protect the population from hazards such as flooding and encourages the consideration of the potential effects of climate change that may increase the risk associated with natural hazards. The policies generally direct development to occur outside of areas that are identified as hazardous lands. The PPS

does, however, provide for the implementation of Special Policy Areas, which allows for the continued viability of existing uses that were historically present within flood plains.

2.5 A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2019)

The project is situated within the large regional area identified as the Greater Golden Horseshoe (GGH). On June 13, 2005, the *Places to Grow Act* received Royal Assent, providing a legal framework for the provincial government to designate any geographic area of the province as a growth plan area and to develop a growth plan in consultation with local officials and stakeholders (Ministry of Public Infrastructure Renewal [MPIR]; Government of Ontario 2006). The Act enables the government to plan for population growth, economic expansion, and the protection of the environment, agricultural lands and other valuable natural resources in a coordinated and strategic way within the GGH.

Known as the Growth Plan for the Greater Golden Horseshoe (Government of Ontario 2006), the Plan provided direction and policies for where and how growth is to occur within the GGH. The Growth Plan (2006) provided a strategy for managing growth and urban sprawl in the GGH to 2031, and specified density and intensification targets that must be met by GGH municipalities in developing Official plans.

The 2019 Growth Plan for the GGH was approved under the *Places to Grow Act*, 2005 to take effect on May 16, 2019. Known as "A Place to Grow," the new Plan builds upon the success of the initial Growth Plan (2006) and responds to the key challenges that the Region continues to face over the coming decades with enhanced policy directions. The Growth Plan (Government of Ontario 2019) was established by the Ontario government to provide a framework for municipalities to implement Ontario's vision for stronger communities and growth management throughout the GGH. The Growth Plan (2019) works in conjunction with other provincial policy and planning documents including the PPS 2020. The Growth Plan (2019) is intended to provide a framework for growth and development in the GGH that supports economic prosperity, protects the environment and helps communities achieve a high quality of life.

Within the GGH, the Growth Plan (2019) provides that the applicable time horizon for land use planning is 2041. The goals and policies of the Growth Plan (2019) pertain to important issues such as transportation, infrastructure, land use planning, urban form, affordable housing, natural heritage, resource protection, and resiliency against climate

change. The Growth Plan (2019) recognizes the differences between cities, suburbs, towns and villages, and how these areas will grow alongside one another. Built up areas, Urban Growth Centres, transit corridors and stations are outlined as key areas to concentrate growth.

In addition to outlining targets for growth, the Growth Plan (2019) prioritizes the protection of lands, features, and resources that are essential for long-term quality of life, economic prosperity, environmental health and ecological integrity of the Region. Included among these lands, features and resources to be protected are water resource systems and public open space.

The Growth Plan (2019) focuses on the compact, sustainable growth of healthy complete communities, which offer a variety of housing options and encourage mixed-use development. However, public safety must be prioritized within these developments and future flood risks shall be prevented. Accordingly, growth shall generally be directed away from hazardous areas, including those that have been identified as Special Policy Areas in accordance with the PPS 2020.

2.6 Grand River Conservation Authority

The GRCA regulates water and other natural resources within the Grand River watershed. For lands near or within watercourses, valleys, wetlands, or shorelines in the Grand River watershed, property owners, including the City of Kitchener, must obtain permission from the GRCA before beginning any development, site alteration, construction, or placement of fill within the area. Permits are also required for any wetland interference, or for altering, straightening, diverting or interfering in any way with the existing channel of a creek, stream or river. GRCA permits are required to complete any works along the Hidden Valley Creek which will impact the watercourse or wetland feature.

2.7 City of Kitchener Planning Context

The City of Kitchener's Hidden Valley Land Use Master Plan (2019) describes the anticipated development for the 183-ha region. Areas contained within the bounds of Hidden Valley Road have works planned for the development of low-rise residential,

medium-rise residential, mixed-use, commercial, and high-rise residential land use. The extents of the proposed development are indicated in Figure 2.

Development of the open space area within the subwatershed will have impacts on the hydrology and hydraulics of Hidden Valley Creek. The replacement of naturally pervious area with impervious area allows for less infiltration, transpiration, and attenuation of rainfall, which results in greater runoff volumes and higher peak flows. The effects of increased impervious area can be mitigated by using stormwater controls such as stormwater ponds and LID features. Stormwater ponds capture and slowly release runoff from a development catchment reducing flow rates. LID features such as grassy swales and pervious pavement allow greater initial infiltration of stormwater. Stormwater planning for the 2019 planned development is being carried out by Matrix under a separate cover and will work towards matching post-development flows to existing levels.

The City of Kitchener is in the process of reviewing and replacing the Hidden Valley Land Use Master Plan for the Hidden Valley Community with a new Secondary Plan. The current study will be integrated with the Secondary Plan. The natural environmental features in this area have been identified in the Regional Official Plan as “Regionally Significant Core Environmental Features.” Some of the land designations are subject to change through the City’s ongoing Secondary Planning process. Species at Risk (SAR) and SAR habitat have been identified through that project. It is anticipated that recommendations from the current study will help inform the Secondary Plan policies and zoning, e.g., holding provisions which would limit development until appropriate infrastructure is finally designed and constructed.

2.8 Regional Planning Context

2.8.1 Waterloo Region Official Plan (2015)

The Waterloo Region official plan is the Regional Municipality of Waterloo’s guiding document for directing growth and change for the next 20 years. The Plan describes the infrastructural, environmental, and social goals for the Region. One of the key objectives (5.2) of the Official Plan is to:

> "Plan and manage municipal drinking water supply systems using a comprehensive, integrated approach that reduces water demand, achieves efficiency of water use and protects, improves or restores the water quality and quantity."

The MCEA process is not directly subject to Official Plan policies but these policies were used to provide information as it relates to natural features within the study area. Toward this goal, the planned development upstream of the Hidden Valley ESPA/PSW will be controlled using quantity and quality stormwater controls, such as stormwater ponds.

Additionally, a roadway expansion and realignment project is underway along Hidden Valley Road and Wabanaki Drive, to the north and west of the Hidden Valley ESPA/PSW, respectively. This roadway expansion is in accordance with the Region's infrastructure development goals outlined in the Official Plan. The "River Road Extension" project is described in greater detail below.

2.8.2 River Road Extension

Waterloo Region is in the process of designing a roadway extension of River Road which includes expansion and realignment of several roadways within the study area, namely, Wabanki Drive, Hidden Valley Road, and Goodrich Drive. The River Road Extension scope and detail is outlined in Class Environmental Assessment River Road Extension River Road Stormwater Report (Stantec 2013) and the planned stormwater strategy is described in River Road Extension Stormwater Management and Hydraulics Report (WSP 2021). The project will include a road extension, realignment, culvert replacement, and regrading of Hidden Valley through the proposed development, and a redirection of additional flow to the North Wabanaki Stormwater Pond.

The implication of the proposed realignment is increased impervious area, to be compensated through the expansion of the North Wabanaki Stormwater Pond. Peak flow rates and volumes are to be controlled through a redesign of North Wabanaki Stormwater Pond to match existing volume and peak discharge rates of existing conditions.

2.9 Climate Change

MECP's guide "Consideration of Climate Change in Environmental Assessments in Ontario" was finalized in October 2017 (MOECC 2017). MECP requires that all Class EAs consider this within the scope of the project. Two approaches for consideration and addressing climate change in project planning include:

- reducing a project's effect on climate change (climate change mitigation)
- increasing the project's and local ecosystem's resilience to climate change (climate change adaptation)

This guide was considered in the development and evaluation of alternatives.

Climate change may cause the occurrence of larger and more frequent rainfall events. The Ontario PPS (refer to Section 2.4) recognizes that increased rainfall may lead to greater flooding, and it allows for municipalities and ministries to choose the most suitable approach to address this problem. The focus of this project is riverine flood mitigation and thus providing climate change resiliency to riverine flooding is the primary target. A flood remediation measure may be considered more favourable if it provides a greater resilience to these unanticipated future riverine flows. One of the key opportunities to be achieved through this project is to reduce flood risk. This will also provide resiliency to climate change for more frequent storm events.

2.10 Source Water Protection

Section A.2.10.6 of the MEA Municipal Class EA document directs proponents, including the City of Kitchener to consider Source Water Protection (SWP) in the context of the *Clean Water Act* (CWA). Projects proposed within a vulnerable area are required to consider policies in the applicable Source Protection Plan (SPP), including their impact with respect to the project. A watershed based SPP contains policies to reduce existing and future threats to drinking water in order to safeguard human health through addressing activities that have the potential to impact municipal drinking water systems. The City of Kitchener is located within the Lake Erie Source Protection Region, specifically the Grand River Source Protection Area (Region of Waterloo 2022). The Grand River SPP contains policies that address current and potential threats to

municipal drinking water supply. There are three types of vulnerable areas covered by the SPP:

- Intake protection zones (IPZs) – An IPZ is the area around a surface body of water where water is drawn in and conveyed for municipal drinking water.
- Wellhead protection areas (WHPAs) – WHPAs are areas of land around a municipal well where land use activities have the greatest potential to affect the quality of water flowing into the well.
- Issue Contributing Areas (ICAs) – An ICA is an area within a vulnerable area where activities could contribute to water quality issues.

The study area is located within the Surface Water Intake Protection Zone 2 (IPZ-2) of the Region of Waterloo's raw water intake on the Grand River immediately downstream. The IPZ-2 has an assigned vulnerability score of 7.2 out of 10. The Wellhead Protection Area "D" (WHPA-D) for the Fountain Street wellfield also extends onto the east limits of the study area and has a vulnerability score of 2. The only Prescribed Drinking Water Threat (PDWT) within the IPZ-2 and WHPA-D areas within the study area relates to the application of road salt but given the vulnerability scores, this PDWT cannot be defined as a significant drinking water threat. Construction in areas identified in the SPP require a screening or permit from GRCA.

It is acknowledged that the Region is currently completing a study that is, in part, reviewing and updating the WHPA zones for many wells and it is anticipated that the zone currently delineated may expand to encompass more of the study area. However, it is not anticipated that the vulnerability score will change to an extent where a significant drinking water threat could result.

3 PUBLIC, INDIGENOUS, AND AGENCY CONSULTATION

The involvement of the community – residents, agencies, stakeholders, Indigenous communities, and those who may be potentially affected by a project – is an integral part of the Class EA process. The purpose of the Class EA study consultation process is to provide an opportunity for stakeholder groups and the public to gain an understanding of the study process; contribute to the process for the development and selection of

alternatives; and provide feedback and advice at important stages in the Class EA process. Specifically, the objectives of the consultation effort are to:

- Generate awareness of the project and provide opportunities for involvement throughout the planning process.
- Facilitate constructive input from public and agency stakeholders at key points in the Class EA process, prior to decision-making.

A summary of the consultation activities undertaken for this Class EA is provided in this section.

3.1 Notice of Commencement

Public notices were issued throughout the course of the study to notify residents, agencies, stakeholders, and Indigenous communities of the status of the project and to invite feedback on the project.

At the beginning of the study, a Notice of Study Commencement was mailed or emailed to review agencies, Indigenous communities, and individual properties within the study area. The notice was also advertised on the City of Kitchener website at the address https://www.engagewr.ca/hidden-valley-flood-ea (the Notice of Study Commencement was originally posted to www.kitchener.ca/hiddenvalley). The notice presented an overview of the project and study area.

3.2 Indigenous Consultation

The Notice of Commencement was mailed to Nation Huronne-Wendat (HW), Mississaugas of the Credit First Nation (MCFN), and Six Nations of the Grand River (SNGR). Acknowledgement of the notice was received from MCFN, and SNGR. City staff held meetings with the SNGR and MCFN to present the Notice of Commencement. The Notice of Commencement was presented to SNGR on June 15, 2023, and presented to the MCFN on June 23, 2023. At these meetings City staff presented this project along with other ongoing initiatives within the City. The meetings also involved discussions on incorporating Indigenous knowledge into the EA process, such as integrating Rights-holder priorities and values with respect to the land and the waters into the evaluation criteria for selecting the preferred solution.

City of Kitchener staff held a second set of meetings with SNGR and MCFN to present alternative solutions and gather feedback on which solution is preferred, and to discuss how each Nation's priorities and values and have been incorporated into the evaluation criteria. These meetings were held with MCFN on September 25, 2023, and with SNGR on September 29, 2023. City staff presented a summary of this project including background and alternatives. Feedback was gathered from both MCFN and SNGR. A copy of the presentation and meeting minutes from each of these meetings are included in Appendix A.

3.3 Public Consultation

3.3.1 Public Information Centre

A Public Information Centre (PIC) was held on October 12, 2023, from 5:00 p.m. to 8:00 p.m. at the Centreville Chicopee Community Centre. Notice of the PIC was mailed to local property owners, posted on the City's website, and published in the Kitchener Record on September 29, 2023. A copy of this notice is included in Appendix A. The PIC provided attendees with information regarding:

- Background information regarding this study
- Municipal Class EA process
- Problem and Opportunity Statement
- An overview of work completed to date
- Description of the alternative solutions
- Proposed evaluation criteria for alternative solutions

The PIC was held in an open house format. The PIC was attended by approximately 11 local residents and their consultants, in addition to City and Matrix staff. Oen comment sheet was received. Materials from PIC #1 are included in Appendix A, including the poster boards, sign-in sheet, and comment sheets.

The majority of the questions and comments received during the open house were clarifications related to the project or technical questions. There was some concern regarding property or easement impacts downstream of Hidden Valley Road.

3.3.2 Project Specific Website

The City created a project specific website through its Engage Kitchener online platform. The website https://www.engagewr.ca/hidden-valley-flood-ea included copies of project notices and the presentation boards from the PIC. It also included project background, a newsfeed, and a 'live' timeline of the project status. A public question board is included with answers provided by the project team. Copies of the newsfeed and question board, at the time of publishing, are provided in Appendix A.

3.3.3 Project Specific Email Address

The City created a project specific email address to collect correspondence related to this study. The email address, hiddenvalley@kitchener.ca, was posted in notices and on the project specific website. Correspondence received through this email address is included in Appendix A.

3.4 Agency Consultation

Similar to the above notification process, review agencies were also contacted throughout the study. The following provides a summary of consultations with responding agencies.

3.4.1 Grand River Conservation Authority

Matrix and the City had open communication and dialogue with GRCA throughout the project, as well as a formal meeting on June 14, 2023. Early in the project, consultation with GRCA was undertaken to seek input on hydrologic methods and approach, hydraulic modelling updates, and natural heritage considerations.

3.4.2 Kitchener Climate Change and Environment Committee

Project staff presented the summary of the project to the City of Kitchener's Climate Change and Environment Committee on October 19, 2023. The meeting minutes indicate that the Climate Change and Environment Committee supports the preferred alternative solution for flood risk reduction in the Hidden Valley. Staff report and meeting minutes are provided in Appendix A.

3.5 Landowner Consultation

The following are a list of key landowner stakeholders within the study area:

- Pearl Valley Development Corporation (Pearl Valley)
- Owners of 691 – 748 Hidden Valley Road

Each of these landowners was personally emailed a copy of the project notices. Correspondence with these landowners is provided in Appendix A.

The Hidden Valley ESPA/PSW and the proposed development properties are within the lands owned by Pearl Valley. The Hidden Valley ESPA/PSW was investigated by Matrix on September 27, 2023, under the approval of Peal Valley. Observations are described in Section 4.1.

There are four properties downstream of the Hidden Valley ESPA/PSW which have expressed flood and erosion concerns in the past: 691, 730, 735, and 748 Hidden Valley Road. 691 and 735 Hidden Valley Road, upstream of the Hidden Valley Road crossing, were accessed on September 27, 2023.

3.6 Notice of Completion

To complete the Schedule B process, a Notice of Completion will be issued to Indigenous communities, review agencies, and the public and a period of at least 30 calendar days shall be allowed for comment and input. Following the adoption of this report by City Council, a Notice of Completion will be posted online, in the newspaper, and mailed to the stakeholder list advising that the project had been filed for the 30-day review period. The notice will invite interested parties to submit comments to the City within 30 calendar days of posting.

4 EXISTING CONDITIONS

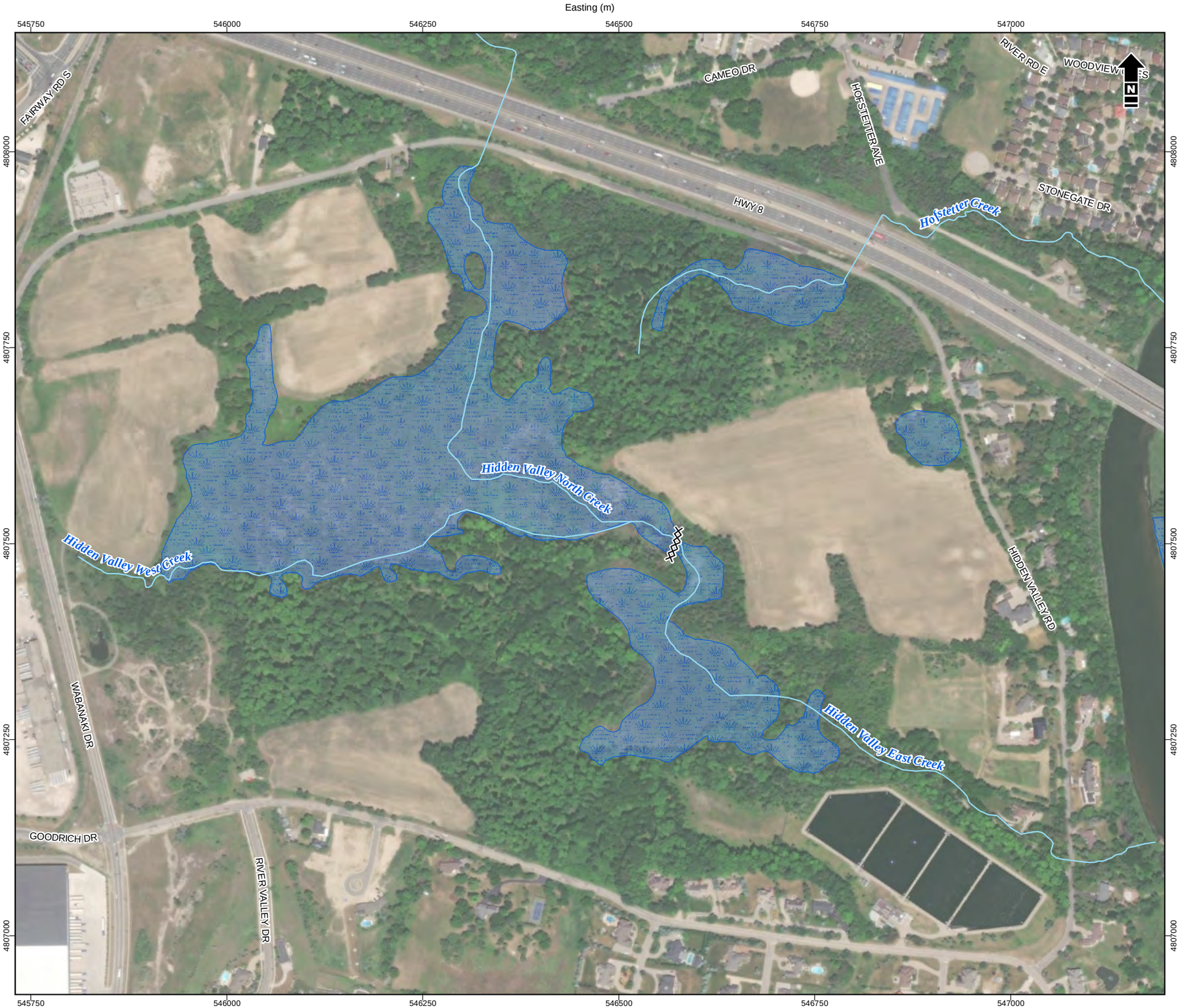
4.1 Field Investigation

Site walks were undertaken on April 18, 2023, at Hidden Valley Road and through the upstream property at 735 Hidden Valley Road, and on September 9, 2023, throughout the whole study area. The thorough field investigation on September 9, 2023,

investigated the Hidden Valley ESPA/PSW, North Wabanki Pond, and the North, West, and East Hidden Valley Creek Tributaries. Site photographs can be found in Appendix B. A summary of the findings is provided below.

The north and west tributaries to Hidden Valley Creek drain towards the Hidden Valley ESPA/PSW. Both watercourses are consistently shallow, with a bank height of 0.5 to 1.5 m, and a wide floodplain of tall grass. Minor erosion was noted along both tributaries but is of minimal concern because of the heavily vegetated banks.

A large beaver dam structure was noted in the field (Figure 7) with an approximate height of 2 m. The dam structure is comprised of woody material overlain with thick sedimentation. It is unknown when this dam was constructed.



Legend

- Provincially Significant Wetland
- Watercourse
- Beaver Dam

1:5,000 Meters

125 0 125 250

NAD 1983 UTM Zone 17N

Reference: Contains information licensed under the Open Government Licence - Ontario and GRCA Open Data Licence v2. Imagery (2022) Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Flood EA Report

Beaver Dam Location

Date:	Project:	Submitter:	Reviewer:
March 2024	31809	M. Legrand	S. Muscat

Figure 7

The east Hidden Valley Creek, which outlets from the Hidden ESPA/PSW, showed signs of greater erosion. The east Hidden Valley Creek runs through a heavily forested reach upstream of the properties at 691 and 735 Hidden Valley Road. There is a crossing with a circular concrete culvert located upstream of 735 Hidden Valley Road, which was described by the landowner of 691 Hidden Valley Road as rebuilt following a flooding event in the mid-2010s. Downstream of the driveway to 735 Hidden Valley Road is signs of significant erosion and undercutting along the left bank. The banks are topped by mowed grass which do not have significant root depths to reinforce the slopes.

Photographs 1 to 4 show the existing Hidden Valley Road crossing. The Hidden Valley Road crossing contains two culverts, a 600 mm diameter circular CSP conveying low flows, and a raised 900 mm diameter circular CSP to convey higher flow events. Rehabilitation works commenced in September 2013, following the road overtopping, to rebuild the crossing and widen the roadway. As part of the rehabilitation works, both culverts were extended and made to confluence at approximately ¾ the length of the existing road. The rebuilt design of Hidden Valley Road is shown in Appendix C (WalterFedy 2013). The low flow 600 mm diameter culvert at Hidden Valley Road was observed to be heavily blocked by sediment during the survey. As can be seen in Photograph 2, the low flow culvert was not visible beneath the sediment directly upstream of the crossing. Water was observed to be flowing under the armour stone headwall and can be seen to emerge from the 600 mm pipe at the under-road confluence (Photograph 3), which indicates that the 600 mm culvert is not entirely blocked. The heavy sedimentation upstream of the crossing and blockage of the 600 mm culvert is speculated to be related to the erosion noted downstream of the 735 Hidden Valley driveway. The soil eroded from the banks upstream have likely settled at the inlet of the Hidden Valley Road crossing where flow is constricted and slowed.

Continuous subsurface flow was observed to emerge from the ground both upstream and downstream of Hidden Valley Road. The majority of baseflow into the culvert during the survey date originated from a subsurface source upstream of Hidden Valley Road (Photograph 4), but the origin of this flow is not certain. The volume and rate of water resulting from this source do not impair the high flow capacity of the crossing.

	
Photograph 1: Upstream view of Hidden Valley Road Culverts. The low flow culvert cannot be seen below the sediment.	**Photograph 2:** Downstream view of the Hidden Valley Road culverts. Both culverts converge under the roadway so only a single pipe outlets downstream.
	
Photograph 3: View of pipe confluence under Hidden Valley Road.	**Photograph 4:** Flow from under asphalt, upstream of Hidden Valley Road.

4.2 Survey

The Hidden Valley Road culvert and upstream channel was surveyed by Matrix on September 9, 2023. The survey extended from approximately 15 m downstream of

Hidden Valley Road to 31 m upstream of the driveway crossing at 735 Hidden Valley Road. The survey also assessed the dimensions and conditions of the culvert crossings and erosion extents. Figure 8 presents the limits of the survey.

4.3 Flood Risk

Flood risk is the combination of flood hazard — determined by depth and velocity of flow — and vulnerability — determined based on land use and potential for impact. The lands upstream of the Hidden Valley ESPA/PSW are undeveloped and contain natural wetland, thus they have little vulnerability to flooding. There is a small portion of the Hidden Valley North Creek which runs parallel to a commercial development south of King Street East for approximately 70 m, which could be considered vulnerable. However, this is in the headwater of the catchment and is contained within the 2.5 m deep channel for the 1:2-year through Regulatory events, according to the detailed InfoSWMM model developed by WalterFedy (2015) and updated by Wood (2019). The only area of flood vulnerability within the study area is located downstream of the Hidden Valley EPSA/PSW, adjacent to Hidden Valley Road. The flood risk within the study area was assessed for this area along Hidden Valley Road.

The study area is within GRCA's estimated floodplain of Hidden Valley Creek, but outside the regulatory floodplain of the Grand River. The water surface elevations of the Grand River do not typically impact the hydraulics of Hidden Valley Creek.

The flood risk within the study area, downstream of the Hidden Valley ESPA/PSW and upstream of the Grand River, is analyzed as the intersection of flood hazard of Hidden Valley Creek and the vulnerability of the properties around Hidden Valley Road.

Easting (m)

546975 547000 547025 547050 547075 547100

Northing (m)

4807175 4807150 4807125 4807100 4807075

HIDDEN VALLEY RD

N

Legend

- Watercourse
- Culvert
- Observed Erosion
- Contour (0.5 m)
- Road
- Survey Location

1:500

Meters

10 0 10 20

NAD 1983 UTM Zone 17N

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Flood EA Report

Survey

Date:	Project:	Submitter:	Reviewer:
March 2024	31809	M. Legrand	S. Muscat

Figure 8

4.3.1 Hydrology

4.3.1.1 Flow Monitoring Analysis

Flow monitoring data at three sites was collected between 2011 and 2017. The sites are located at Hidden Valley Road downstream of the wetland (SW1), the west tributary upstream of the wetland (SW2), and the northern tributary upstream of the wetland (SW3). See Appendix D for a reference map of monitoring locations. Flow monitoring data was collected by the following:

TABLE 1 Flow Monitoring Data Collection Periods

Consultant	Data Collection Period
Stantec	2011-2017
WalterFedy	2014
Wood	2017

Matrix attempted to quantify an input-output relationship for the wetland based on the flow monitoring data. A consistent inflow-outflow relationship could not be found due to differences in initial storage levels within the wetland and complex surface water and groundwater relationships. Flow recorded at monitoring station SW1 was generally inconsistent with precipitation events and did not consistently align with peak flows at SW2 and SW3.

4.3.1.2 Flow Rates

As summarized in Section 2.1, previous studies aimed to develop a calibrated hydrologic model for Hidden Valley Creek based on the flow monitoring data. These projects were challenged due to the complexities of the ESPA/PSW.

The wetland is a complex attenuation feature, which has historically been difficult to calibrate. Accurate calibration of the wetland within a hydrologic model would require intensive groundwater modelling as well as detailed survey inspection of the area for each flow event. Access and time constraints limit the project team's ability to carry out a detailed groundwater-surface investigation into the wetland's complex hydrology. Additionally, the hydrologic model does not account for groundwater recharge/discharge and is not able to capture a dam break event. Therefore, further hydrologic modelling to estimate flows downstream of the wetland was not pursued.

Following discussions with the City and GRCA, it was determined that a statistical approach based on the monitored data is appropriate for the hydrologic assessment for this project. The flow monitoring data was used to perform a flood frequency analysis (FFA) to statistically estimate the peak flow rates at Hidden Valley Road from the monitored data. The flood frequency provides an advantage in that it uses observed peak flow measurements, which includes flow from groundwater discharge and dam breaks, to assess the empirical frequency of return period peak flows. However, as the available data set has a limited range of approximately 10 years, only flows up to the 1:50-year return period event can be estimated with reasonable confidence.

Monitored data included primarily water depths, with some flow measurements during low flow. Stantec was not able to perform in-field measurements of the flow rate at Hidden Valley Road during high flow events (above a water surface elevation of 290.86 m). Matrix developed a rating curve using known road overtopping and pipe flow relationships with upstream water depth. A site-specific model was created using PCSWMM software to relate water surface elevations upstream of Hidden Valley Road to flow through the road crossing. The rating curves were developed based on the surveyed conditions, including a 90% blockage of the 600 mm low flow culvert to represent existing conditions. The rating curve is provided in Appendix C. The surveyed crossing dimensions are shown in Table 2.

TABLE 2 Crossing Dimensions

	Hidden Valley Road		Driveway: 735 Hidden Valley Road	
	Overflow	**Low Flow**	**Overflow**	**Low Flow**
Diameter	900 mm	600 mm	Two 1,450 mm span by 870 mm rise	770 mm
Upstream invert (m)	290.77	289.94	294.686	293.74
Downstream Invert (m)	287.314	287.314	294.01	292.88

Matrix completed a FFA using the calculated flows from the 10-year monitoring dataset. The analysis was conducted across seven statistical distributions and evaluated

according to best-fit measures. The Log Person Type 3 distribution (WRC) was determined to provide the greatest fit for the data. Table 3 presents the resulting 1:2-year through 1:50-year peak flow rates. Storms above the 1:50-year frequency cannot be confidently extrapolated from 10 years of data.

TABLE 3 Peak Flow Rates

Return period	1:2-year	1:5-year	1:10-year	1:20-year	1:50-year
Peak flow (m^3/s)	0.31	1.33	3.08	6.43	15.4

4.3.2 Hydraulics

Matrix adopted and modified the Hidden Valley Creek hydraulic model provided by the City (WalterFedy 2014) for the flood risk analysis. Matrix updated the model based on in-field survey. Cross-sections 1 to 171, as shown in Figure 9, were updated based on 2023 survey data. Road crest elevations, and pipe inverts and dimensions were also updated to reflect existing conditions at both Hidden Valley Road and the 735 Hidden Valley Road driveway. The extent of the model is shown in Figure 9.

Matrix updated the HEC-RAS model at the Hidden Valley Road crossing to better represent the complex culvert structure, using the rating curve developed in PCSWMM described in Section 4.3.1.2.

Easting (m)

546900 546950 547000 547050 547100 547150

Northing (m)

4807250 4807200 4807150 4807100 4807050

Legend

- Watercourse
- Matrix Cross Section
- Contour (0.5 m)
- Road

1:1,000 Meters

25 0 25 50

NAD 1983 UTM Zone 17N

Reference: Contains information licensed under the Open Government Licence - Ontario and GRCA Open Data Licence v2. Imagery (2022) Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Flood EA Report

Matrix Updated Hydraulic Model

Date:	Project:	Submitter:	Reviewer:
March 2024	31809	M. Legrand	S. Muscat

Figure 9

4.3.2.1 Hidden Valley Road Hydraulic Capacity Assessment

The HEC-RAS model was used to assess the existing roadway configuration and the existing driveway configuration. Hidden Valley Road is classified as a local street according to the City's GIS data (Kitchener 2024), and as such has been assessed considering the required design criteria for a local road classification. The *City of Kitchener Development Manual* (2021) specifies that waterway openings for culverts and bridges be designed in accordance with MTO standards. Table 4 summarizes the design criteria for Hidden Valley Road as per the *MTO Highway Drainage Design Standards* (2008). The Design Freeboard is measured from the water surface upstream of the crossing, as generated by the Design Flow, to the edge of the pavement of the roadway. The Headwater/Diameter Ratio is measured as the depth of water upstream divided by the culvert diameter; in this case the lower 600 mm culvert was used.

TABLE 4 Design Criteria for Hidden Valley Road

Design Criteria	Site Requirement	MTO Highway Drainage Design Standard Reference
Design Flow Return Period	1:10-Year (Local Road) for a Span less than 6.0 m	WC-1 Design Flow
Design Freeboard	Greater or Equal to 0.3 m Measured from High Water Line to Low Edge of Pavement Elevation	WC-7 Culvert Crossings on a Watercourse Section 3.2
Headwater/ Diameter Ratio	HW/D Less than or Equal to 1.5	WC-7 Culvert Crossings on a Watercourse Section 3.5

Table 5 presents the results for Hidden Valley Road. Under existing conditions, the Hidden Valley Road culverts do not meet the Design Freeboard or the headwater/diameter (HW/D) ratio criteria. The roadway is overtopped for the 1:10-year through 1:50-year flows. The maximum road overtopping depth is 0.97 m during the 1:50-year flow. The hydraulic profile for the 1:2-year through 1:50-year flows is shown in Figure 10. The flood extents for the 1:2-year through 1:50-year flows are contained within the stream corridor downstream of Hidden Valley Road.

TABLE 5 Existing Conditions Hydraulic Results for Hidden Valley Road

Size	Cover to Road Centerline from Raised Culvert (m)	HW/D for Design Flow (Calculated from the Invert of the 600 mm Culvert)	Freeboard for Design Flow (m)	Are the Design Criteria Met?	
				HW/D ≤ 1.5	Freeboard ≥ 0.3 m
900 mm diameter Circular CSP and 600 mm diameter Circular CSP (blocked to 90% of depth)	1.68	5.82	-0.09	No	No

Notes:

Bold values indicate criteria not met.

HW/D = Headwater elevation over Diameter

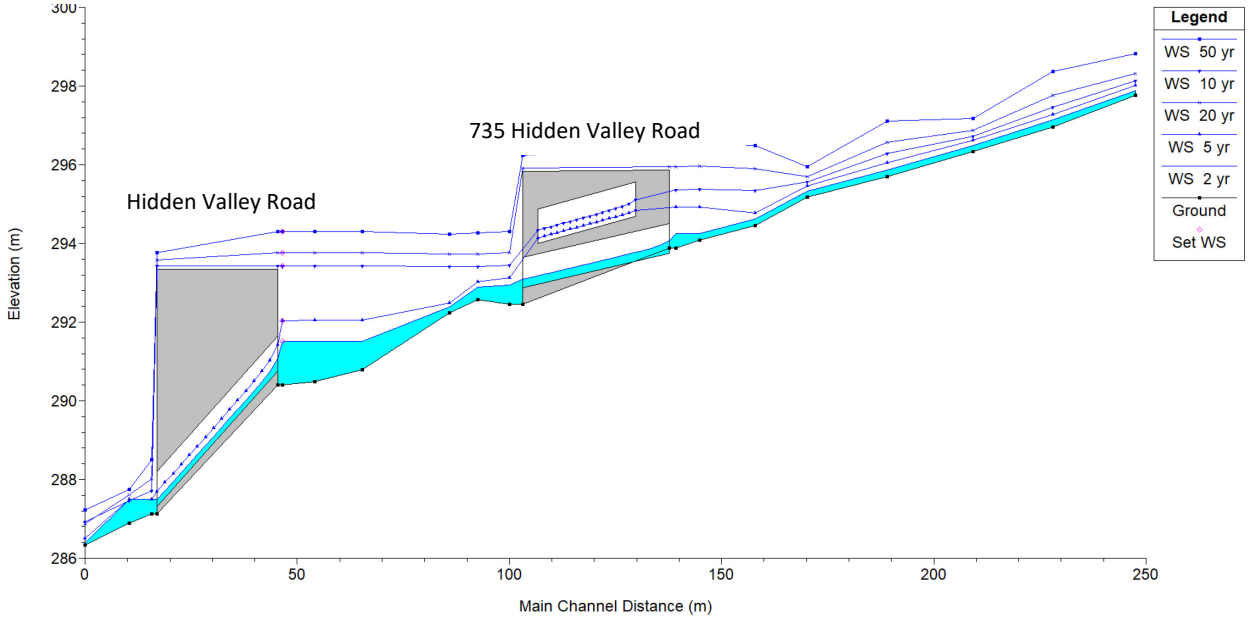


FIGURE 10 Hydraulic Profile – Existing Conditions

4.3.2.2 Hydraulics at Upstream Property

Flows equal to or greater than the 1:20 year flow spill out of the corridor upstream of the 735 Hidden Valley Road driveway due to the hydraulic restriction of the driveway culverts. The water surface elevation at 735 Hidden Valley Road resulting from the 1:20-

year flow is above the surveyed basement elevation (295.70 m). The wooded lands directly upstream of Hidden Valley Road are flooded during 1:20-year event due to the hydraulic restriction of the roadway culverts. However, the backwater effect from the Hidden Valley Road culvert does not impact the building at 735 Hidden Valley Road for any flows up to and including the 1:50-year flow, as the top of road elevation is lower than the ground elevation at the building.

4.4 Natural Environment

In compliment to the EA, a natural heritage document was prepared by Matrix to investigate and highlight the natural environmental features within the study area. Matrix staff conducted a brief reconnaissance site visit on September 27, 2023. Where Matrix had permission to access lands, a rapid vegetation assessment and a preliminary plant list was completed. Matrix walked the northern, central, and eastern portions of the study area, focusing on those areas that have been proposed to be impacted by the flood risk reduction EA and the stormwater management strategy. The full Natural Heritage Report can be found in Appendix E. Below is a summary of the findings.

4.4.1 Identified Features

The following natural heritage features, as identified in the City of Kitchener Official Plan and the Region of Waterloo Official Plan, have been identified within the study area:

- Environmentally Sensitive Policy Area: ESPA 27 Hidden Valley and ESPA 28 Petrifying Spring
- Locally Significant Valleylands: Along Hidden Valley Creek and Hofstetter Creek
- Provincially Significant Wetland: Hidden Valley Provincially Significant Wetland Complex
- Regionally and Locally Significant Woodlands: Along Hidden Valley Creek, extending north to Highway 8

The large PSW located within the central portion of the study area is approximately 19 ha in size and contains both swamp and marsh habitat types.

4.4.2 Aquatic Habitat and Fisheries

The study area contains three watercourses, the Grand River, Hofstetter Creek, and Hidden Valley Creek (North, East, and West). The Grand River and its tributaries are considered warmwater fish habitat. Extensive fish records are available within the Grand River, but there is no documented evidence of fish within Hidden Valley Creek. Within the Grand River, critical habitat for Black Redhorse and Silver Shiner has been identified by Fisheries and Oceans Canada (DFO). Any work within proximity to either watercourse would require a request for review from the DFO.

The Hidden Valley East Creek empties into the Grand River approximately 140 m downstream of the Hidden Valley Road Culvert. Although no fish were observed in the area surrounding the culvert, the area immediately downstream of the culvert is functionally connected to the Grand River and may support fish and fish habitat. The existing Hidden Valley culvert is heavily sedimented, with the low flow culvert being almost entirely buried. The condition of the culvert reduces the conveyance of the crossing and is currently a complete barrier to fish passage. Due to the presence of a *restricted species* and its critical habitat, upstream of the Hidden Valley culvert that could be impacted by the presence of fish the introduction of fish into this system is not recommended.

A seep is present immediately upstream of the Hidden Valley Road culvert, which appears to be originating from the southwest. Seeps are natural areas where there is shallow groundwater movement, which eventually rises to the surface through a porous substrate and contributes to the surface water features. Seeps provide an important contribution to the overall ecological function by providing habitat and a hydrological function of headwaters, recharge areas, and discharge areas within natural heritage systems.

4.4.3 Vegetation Communities and Plants

A total of 54 vegetation communities were identified within the study area by Matrix, LGL, and others. Fifty-three of these community types are both common and secure within Ontario. One rare vegetation community was observed within the study area by LGL (2023), a TPO1-1 Dry Tallgrass Prairie Type. No rare plant communities, SAR, Species of Conservation Concern (SCC), or locally rare plants were identified within the area

surrounding the Hidden Valley Road culvert. A full list of vegetation communities can be found in the full Natural Heritage Report (Appendix E).

4.4.4 Wildlife

Based on the background review, records for a total of 141 insect, 46 mammal, 173 bird, 71 fish, 6 mussel, and 24 reptile and amphibian species were noted to occur within the overall study area. Most of these species are common and secure within Ontario, though 24 SAR and 10 SCC have been identified as well. A full list of species can be found in the full Natural Heritage Report.

4.4.5 Significant Wildlife Habitat

The study area has the potential to contain candidate or confirmed Significant Wildlife Habitat (SWH) types, including habitat for SAR and SCC.

- Seasonal Concentration Areas of Animals: areas where wildlife species occur annually in aggregations at certain times.
- Rare Vegetation Communities: contain rare plant species communities.
- Specialized Habitats for Wildlife Considered SWH: contain rare habitats that wildlife populations depend on, especially for breeding and nesting.
- Habitats of SCC Considered SWH: includes SCC species, species that are locally or regionally rare and are declining, or other species with conservation concerns.
- Animal Movement Corridors: corridors that allow the movement of wildlife from one habitat type to another.

Using data from the background review and field visit, the SWH criteria were evaluated and 18 SWH types have potential to be present within the study area.

4.5 Social and Economic Environment

The social and economic sectors of the study area can be broken into two regions: upstream of the Hidden Valley ESPA/PSW and downstream of the Hidden Valley ESPA/PSW.

Upstream of the Hidden Valley ESPA/PSW there is planned development on property owned by Pearl Valley. The full extent and land use of the development can be seen in Figure 2. Development is planned along Hidden Valley Road and Wabanaki Drive, with stormwater facilities planned to control peak flow rates to match existing conditions. The proposed developments are not expected to change the flood risk conditions within the study area.

Downstream of the Hidden Valley ESPA/PSW there are several residential properties which lie adjacent to Hidden Valley Creek. There are concerns raised about flooding and erosion within this reach which has potential to impact the social and economic wellbeing of these property owners.

The Hidden Valley ESPA/PSW is not a public social feature, with no formal trails. During the investigation in September 2023, informal trails were noted along the south Hidden Valley Road leading into the Hidden Valley ESPA/PSW. These trails are not maintained and could be considered hazardous. The natural feature and informal trails are within the Pearl Valley lands and are thus privately owned and closed to the public.

4.6 Infrastructure and Utilities

Access to the study area is limited because the Hidden Valley ESPA/PSW and upstream development lands are privately owned. The proposed development lands and Hidden Valley ESPA/PSW are owned by Peal Valley. Flood hazard mitigation strategies within these lands should be coordinated with the land-owning stakeholders. Additionally, there are several crossings downstream of the Hidden Valley ESPA/PSW which are privately owned. The City does not have jurisdiction over the privately owned crossings.

Hidden Valley Creek at Hidden Valley Road is accessible from both the north and south, as the roadway circles around Wabanaki Drive. Access to properties around the Hidden Valley Creek crossing should not be impaired during roadworks, as detours to the north and south are available. There are no storm, sanitary or water main pipes restricting culvert design at this crossing.

5 DEVELOPMENT OF ALTERNATIVE SOLUTIONS

A series of alternatives have been developed for reducing flood and erosion risk in the Hidden Valley Road area and for supporting future development in the Hidden Valley community.

5.1 Alternative 1: Do-Nothing

Alternative 1 proposes a Do-Nothing scenario in which no changes are made. This scenario represents the most inexpensive solution, as there are no additional capital expenditures. Flood risk downstream of the wetland would remain as is.

5.2 Alternative 2: Reduce Flows Upstream of Wetland

Alternative 2 proposes that flow be attenuated upstream of the Hidden Valley ESPA/PSW using oversized stormwater controls. Several new developments are currently proposed upstream of the Hidden Valley ESPA/PSW with suggested outlet and source controls (see Section 4.5). While it is conventional to control flow rates and volumes from proposed new developments to match existing conditions, controlling the flows to lower than existing conditions may reduce flood risk downstream.

5.3 Alternative 3: Flow Control Structure in Wetland

Alternative 3 proposes constructing a flow control structure, such as a dam, within the Hidden Valley ESPA/PSW to provide engineered attenuation within the wetland. Under existing conditions, it is speculated that flooding downstream of the wetland is a result of beaver dam failures several times in the past decade. A constructed dam downstream of the existing beaver dam would preserve the current conditions of the wetland while increasing the reliability of attenuation. Engineered attenuation within the wetland would reduce the risks associated with failing beaver dams and mitigate the resulting flood risk.

Currently, the Hidden Valley ESPA/PSW lands are owned by Peal Valley. Within Ontario, riparian landowners are entitled to drain to and use water features within their property, but cannot dam or interfere with the feature in ways which will detriment downstream properties. Consultation with the GRCA and Ministry of Natural Resources

and Forestry would be required to approve plans for such works within a natural watercourse, such as Hidden Valley Creek and the Hidden Valley ESPA/PSW.

5.4 Alternative 4: Conveyance Improvements Downstream of the Wetland

Alternative 4 proposes increasing the conveyance capacity downstream of the Hidden Valley ESPA/PSW. Increasing conveyance at Hidden Valley Road would lower the water surface elevation upstream of the road and reduce the frequency of road overtopping. A reduction in roadway overtopping would also reduce erosion potential and improve long-term slope stability on both sides of Hidden Valley Road. Conveyance improvements through private properties adjacent to Hidden Valley Road have not been considered as part of this alternative because works on private property are not within the City's jurisdiction.

Erosion control and channel banks stabilization downstream of the 735 Hidden Valley Road driveway and upstream of Hidden Valley Road are also considered. Erosion control measures would reduce the sedimentation of the Hidden Valley Road culvert and provide greater bank stability within the City's right-of-way.

6 EVALUATION CRITERIA AND METHODOLOGY

The project team selected the following three categories for the evaluation of the alternative solutions:

- Technical Environment
- Cultural/Social Environment
- Natural Environment

Matrix considered each alternative's potential for benefits and negative impact towards each environmental category. Details of the aspects considered within each category are provided below.

Figure 11 provides a visual representation of the considerations within the three environmental categories.

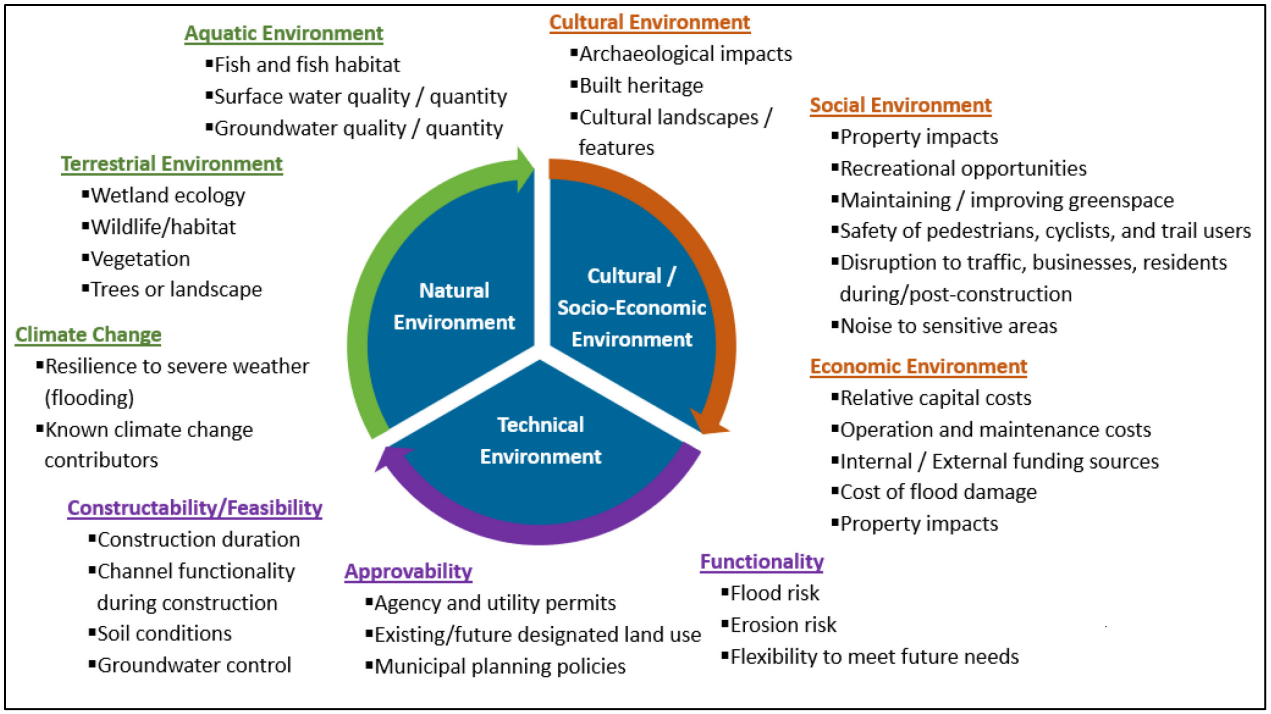


FIGURE 11 Evaluation Criteria

6.1 Technical Environment

The Technical Environment focuses on the alternative solution's ability to meet the project objectives. For this project, the functionality of the alternative was assessed through consideration of the alternative's potential to reduce flood risk and erosion risk within the study area. Also considered as part of functionality is the alternative's flexibility to meet future needs. Future needs could arise from changes in climate, land use, or other changes in the area.

The Technical Environment also includes the approvability, and constructability or feasibility of each alternative. The approvability includes considerations for municipal planning policies, coordination with existing and future designated land uses, and the potential requirements for agency and utility permits. The constructability and feasibility of an alterative includes consideration for things such as physical constraints such as topography or dimensions, construction duration, utility conflicts, channel function during construction, soil conditions and groundwater control.

6.2 Cultural/Social Environment

The cultural and social environment focuses on impacts to people and places of social and cultural relevance. Impacts to locations which are of social or cultural significance are evaluated, such as archaeological sites, built heritage, private properties, greenspace, and recreation facilities.

Impacts to the social wellbeing and safety of residents are also considered. Intangible factors such as noise disturbances due to construction, traffic disruptions, and temporary closures of public amenities impact the social environment. Safety concerns are assessed with greater consideration.

Economic impacts are also associated with the cultural and social environment. Relative capital costs of projects, operation and maintenance costs, flooding damages, and funding sources are considered in the evaluation of alternatives. Costs of a project are weighed against benefits, such as cost savings from the prevention of flooding damages, to provide a wholistic evaluation.

6.3 Natural Environment

The Natural Environment focuses on impacts to the ecology of the area. The ecologic analysis is broken into both the aquatic and terrestrial environments.

The aquatic environment includes consideration for fish and fish habitat, surface water quality, and groundwater quality. The study area includes a large ecologically significant and complex water feature, which increases the severity of environmental consideration. The long-term impacts towards water features, including the wetland and watercourses, as well as short term impacts during construction and operation and maintenance are considered.

The terrestrial environment includes both vegetative and wildlife communities in and around the study area. Wetland ecology, wildlife habitat, and tree/vegetation health are considered with respect to the short-term and long-term impacts of the proposed alternatives.

Climate change resilience is also considered when assessing the natural environment. The impacts of severe weather towards the study area, such as flooding, are assessed

with consideration of a changing climate. The evaluation also favours proactive mitigation, prioritizing alternatives which maintain or reduce the known climate change contributors.

7 EVALUATION OF ALTERNATIVES

In this section each alternative is described in detail with respect to considerations for each of the evaluation criteria. A summary of the evaluation is provided in Section 7.5.

7.1 Alternative 1

Technical Environment

Alternative 1 is a Do-Nothing scenario. Under Alternative 1, the flood and erosion hazard downstream of the Hidden Valley ESPA/PSW would remain unchanged and Hidden Valley Road would continue to overtop with a frequency of approximately once in 10 years. The erosion noted near Hidden Valley Road downstream of the wetland is likely to continue in the future, which will further increase sedimentation of the Hidden Valley culverts and reduce conveyance capacity.

The approvability and constructability of Alternative 1 is the highest ranked of all alternatives, as it is it the easiest to implement due to its simplistic nature.

Under existing conditions Hidden Valley Road is overtopped during the 1:10-year flow and a single property is flooded downstream of the wetland during the 1:20-year event. It is speculated that the prior flood instances downstream of the wetland were the result of beaver dam failure within the wetland. With Alternative 1 beaver dams within the wetland will remain at potential risk for failure.

Cultural and Social-Economic Environment

From a cultural and social-economic perspective, there will be no additional cultural or economic impacts, but the social impact of flooding and erosion around Hidden Valley Road will continue. Alternative 1 does not require any immediate capital costs for the City. However, the existing sedimentation and road overtopping potential at Hidden Valley Road will remain. These will require ongoing maintenance and potentially repair costs for the City.

Natural Environment

There will be no change to the Natural environment under Alternative 1. The risk of erosion related to overtopping of Hidden Valley Road will continue. Floods overtopping the road have potential to erode the road embankment and the valley wall with potential damages to existing vegetation and sedimentation in the creek. The existing culvert structure acts as a complete barrier to fish passage, providing protections to the population of a *restricted species* and its critical habitat upstream.

7.2 Alternative 2

Technical Environment

Alternative 2 is to overcontrol flows upstream of the Hidden Valley ESPA/PSW to reduce peak flow rates downstream. Approvals for the additional stormwater control measures in the proposed development lands could be provided through the planning process and could be agreed upon through cost sharing measures by the City and the developer (Pearl Valley).

This alternative is not expected to have a significant impact on reducing flows near Hidden Valley Road because the wetland complex already provides significant attenuation and flows are not driven strictly by a direct input and output response. The Hidden Valley ESPA/PSW provides between 9,000 to 14,600 m^3 of surface storage, granting greater peak flow attenuation than even an oversized stormwater management pond could provide. Although it is difficult to quantify due to the complexities of the wetland feature, the presence of the beaver dam and standing water below the dam elevation indicates that the wetland currently provides significant attenuation. The flow monitoring data indicates that peak flows downstream of the wetland are not driven solely by inputs to the wetland, but also by groundwater discharge and potential collapses in the beaver dam structures. Reduction in flow to the wetland would not affect the potential for beaver dam collapses, and thus would not guarantee a reduction in flood hazard downstream. Therefore, Alternative 2 is not preferred within the technical environment.

Cultural and Social-Economic Environment

The additional stormwater controls would require an archaeological assessment as they would be constructed on undeveloped lands. However, the locations for the proposed

controls are within the proposed development lands and will require an assessment regardless, so the required archaeology assessments would be minimal additional effort.

The upsizing of the proposed stormwater controls or placement of new stormwater controls would reduce the available area for property development, reducing the total effective developable land. The area impacted by this alternative will be dependent on the degree of additional attenuation provided by the facilities. The cost of the additional stormwater controls could be integrated into the development planning and financed through cost sharing programs. Therefore, the overall impact relative to the total development costs could be minimal. Ongoing costs for Alternative 2 include operation and maintenance of the additional area and volume in the stormwater management facilities. Additionally, if the flows at Hidden Valley Road are not reduced, the existing sedimentation and road overtopping potential at Hidden Valley Road will remain. These will require ongoing maintenance and potentially repair costs for the City.

Natural Environment

The Hidden Valley ESPA/PSW is located directly downstream of the proposed stormwater management controls, and thus could be impacted by changes to the flow rate and volume released by the stormwater controls. Water balance within a wetland is critical to maintaining it's health, and while changes to flow volume are expected to be minimal through this alternative, there may be long-term changes to the hydroperiod of the wetland which could negatively impact the overall function and viability of the wetland. The Hidden Valley PSW forms part of the critical habitat for a *restricted species* under the ESA. Any changes to hydraulics in the wetland, even minor, could have detrimental impacts to this species and their protected habitat. Similarly, any changes to groundwater and water balance have potential for short and long-term impacts on associated wetland features and functions. As no fish are present within the upstream reaches of Hidden Valley Creek, impacts to fish and fish habitat are not anticipated. This alternative also has the potential to impact confirmed SAR bat habitat and confirmed species at risk vegetation such as the Butternut.

7.3 Alternative 3

Technical Environment

Alternative 3 is a flow control structure, such as a dam, constructed in the Hidden Valley ESPA/PSW. This alternative has the potential to reduce flood risk at Hidden Valley Road through controlled outflow from the wetland. This alternative also reduces the uncertainty of beaver dam failures but does not eliminate the hazard.

Regional and provincial approvability of this alternative would be very difficult given the high potential for environmental harm. It is unlikely that Regulatory approval would be granted for such an endeavour given severity of ecological impact. Therefore, Alternative 3 is not preferred within the technical environment.

Cultural and Social-Economic Environment

This alternative would require construction in undisturbed lands and thus require an archaeological assessment. Construction within the wetland would require access be created, which could impact local traffic and access to the informal trailways. Construction within the wetland would be difficult, resulting in prolonged noise and traffic inconveniences caused by the construction.

Alternative 3 presents the highest capital cost of any alternative, due to the complexities involved in construction. The area where a dam would be constructed is privately owned. Therefore, capital costs would need to include property acquisition in addition to construction. The financial costs for Alternative 3 are substantially higher than the other alternatives. The design, permitting and approvals phase of this alternative could cost as much as construction of the other alternatives due to the complexities of working in a wetland. The capital construction costs of Alternative 3 would be significantly more expensive than the other alternatives, The operations and maintenance requirements for Alternative 3 would have to meeting provincial standards for dams. This include regular structural and safety inspections and regulated management programs. The financial implications of this are ongoing and substantially higher than the other alternatives.

Access to the wetland would have to be designed through highly sensitive environmental land, stabilized construction and staging areas would have to be

established on naturally saturated loose soil for heavy machinery, and intensive remediation controls and monitoring post-construction would have to be established. Monitoring for debris jams would be required following significant flow events, and structural inspection and maintenance would be required for the lifetime of the structure. Alternative 3 has the highest operation and maintenance requirements of all the alternatives.

In addition, removing a natural blockage and establishing a man-made flow control within the Hidden Valley ESPA/PSW would open the City to liability concerning future flood damages. A riparian landowner is not allowed to alter the natural flow of a watercourse in such a way that would impact other riparian landowners, and the removal or change to woody debris and beaver blockages can be classified as an alteration to a natural watercourse if it impacts other riparian landowners. By replacing a naturally occurring hydraulic control with a City-owned structure, the liability for future flooding would rest upon the City.

Natural Environment

Alternative 3 presents the greatest challenge in implementation from a natural environment perspective, as it would be highly intrusive to the Hidden Valley ESPA/PSW. Establishing an engineered structure within a PSW presents a high risk of potential impacts to the wetland caused by construction activities and ongoing access. Damage to the wetland during construction could impair or destroy the ecologically significant habitat communities within the feature. The proposed area provides critical habitat for a *restricted species*. It is anticipated that an Overall Benefit Permit from the MECP would be required and may be difficult to obtain.

Additional impacts include the potential for changes to water balance in the wetland, impacts to SAR bat habitat, impact to SAR vegetation, reptiles and amphibians, habitat fragmentation due to access road construction, and increased potential for debris jams. As no fish are present within the upstream reaches of Hidden Valley Creek, impacts to fish and fish habitat are not anticipated. It is anticipated that Alternative 3 has the most substantial impacts to the natural environment.

7.4 Alternative 4

Technical Environment

Alternative 4 is an increase in the conveyance capacity downstream of the wetland, specifically at Hidden Valley Road. Improving conveyance at Hidden Valley Road would improve flood risk upstream of Hidden Valley Road and reduce erosion risk downstream of Hidden Valley Road. Alternative 4 was assessed based on replacing the existing culverts at Hidden Valley Road with a single box culvert measuring 1,200 mm rise by 3,900 mm span.

Replacing the existing the roadway culvert with a concrete box culvert of 1,200 mm rise by 3,900 mm span would convey the 1:50 year flow without overtopping the roadway and therefore would meet the MTO design criteria. Conveyance improvements to the Hidden Valley Road culvert do not change the hydraulic conditions upstream of the 735 Hidden Valley Road driveway crossing. Table 6 presents the hydraulic results of this Alternative 4 culvert replacement and Figure 12 shows a comparison of flood extents for the 1:10- and 1:50-year events between Existing Conditions and the assessed Alternative 4 Conveyance Conditions. Figure 13 shows a profile comparison of the 1:50-year event.

TABLE 6 Alternative 4 Hydraulic Results for Hidden Valley Road for the 10-year Flow

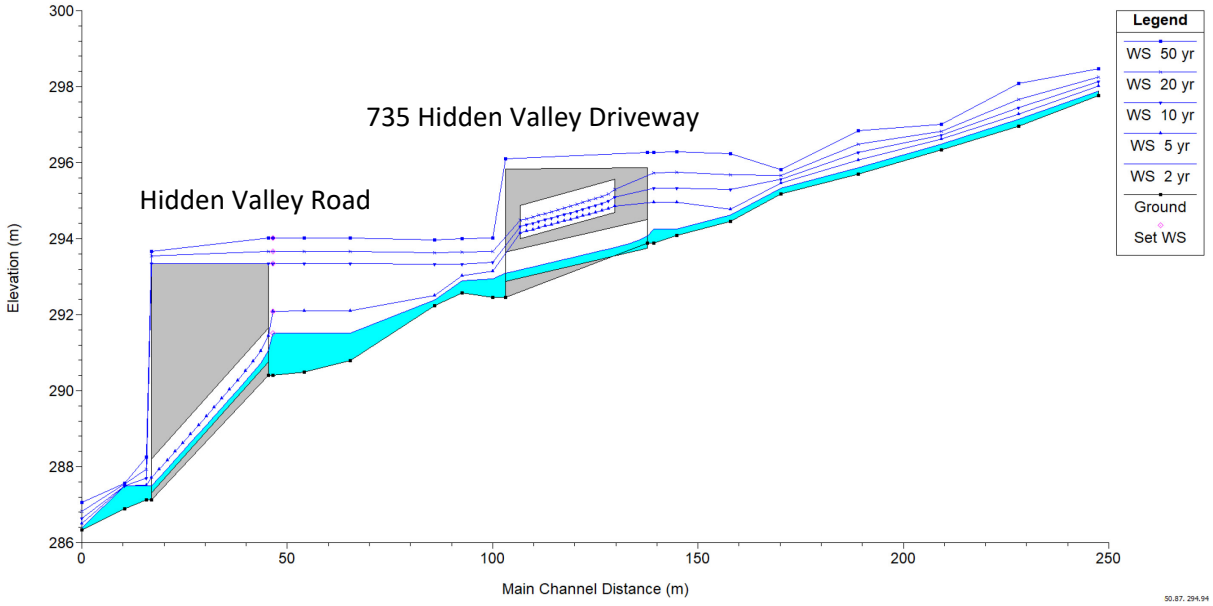
Size	Cover to Road Centerline (m)	HW/D for Design Flow	Freeboard for Design Flow (m)	Are the Design Criteria Met?	
				HW/D ≤ 1.5	Freeboard ≥ 0.3 m
3,900 mm span, 1,200 mm rise concrete box culvert	1.67	0.54	2.28	Yes	Yes

Notes:

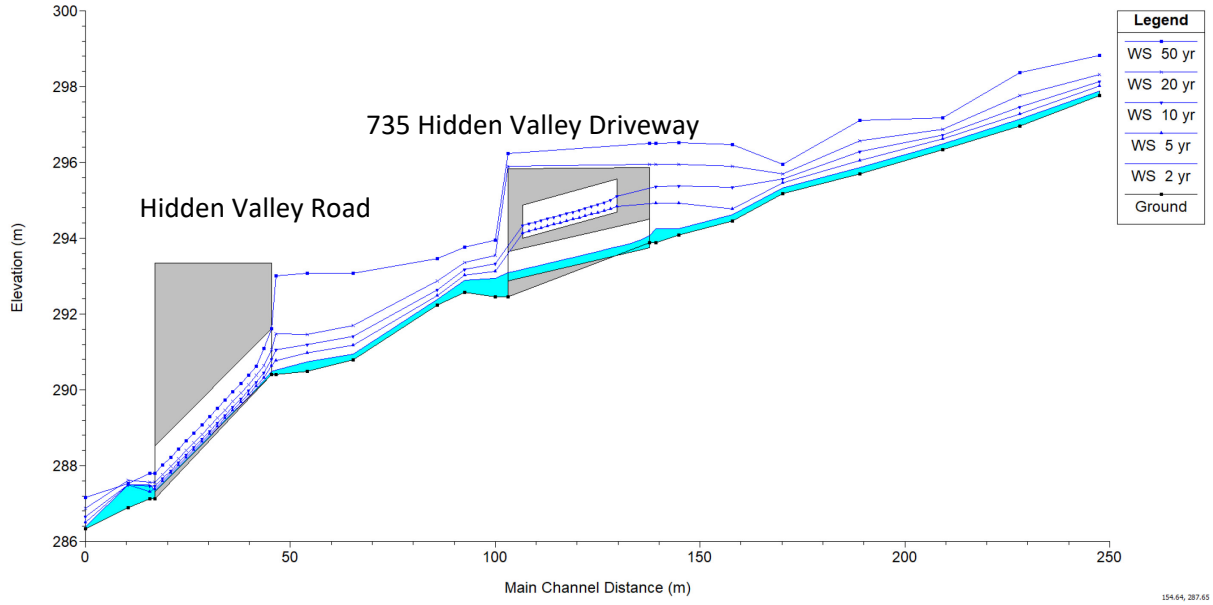
VxD = Velocity times depth over the roadway.

The MTO design standard for local roads such as Hidden Valley Road is to convey the 10-year flow through the culvert. The Alternative 4 Conveyance Conditions are shown to convey the 50-year flow without overtopping the road. By conveying more than the minimum required by the MTO standards, this alternative further reduces the risk of road overtopping and related erosion. This alternative also ensures that backwater conditions resulting from this crossing do not impact the driveway culverts at 735 Hidden Valley Road up to and including the 50-year flow.

Due to climate change, there is increased uncertainty and risk associated with extreme weather events. The resilience of infrastructure is of particular importance to ensure that sufficient flood protection is provided in the future as well as to current standards for critical infrastructure and flood prone locations. The Alternative 4 Conveyance Conditions provides climate change resilience by designing to a level of service well above the MTO design standard.



Existing Conditions Flood Levels



Proposed Conditions Flood Levels

FIGURE 12 Flood Level Comparison

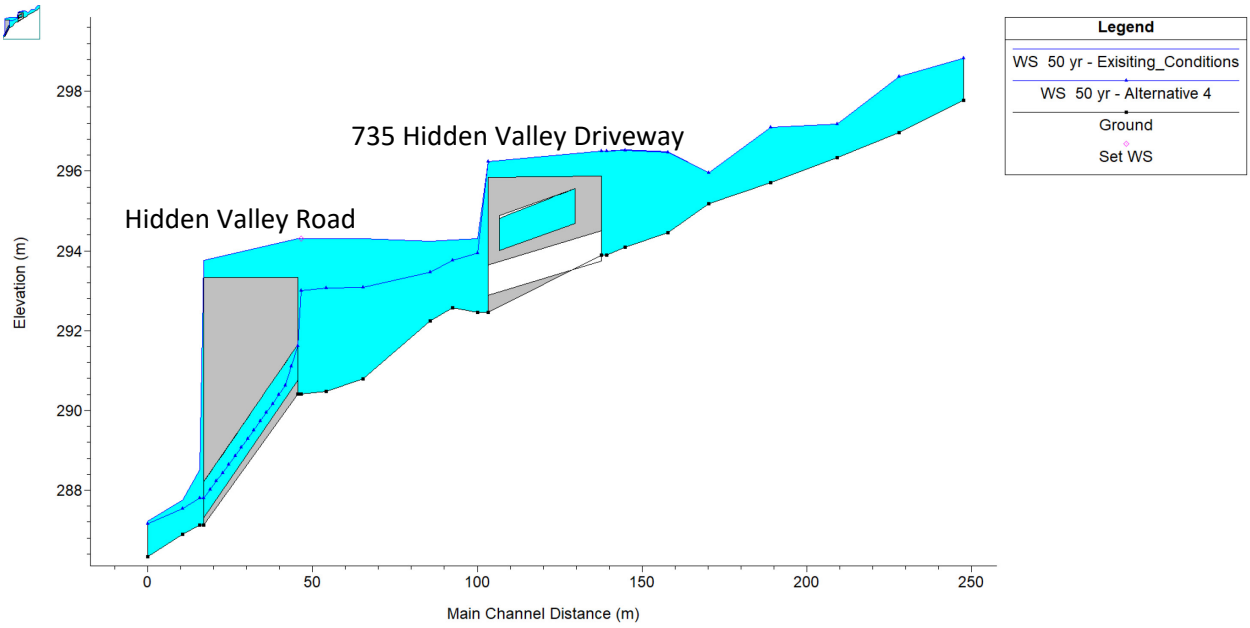


FIGURE 13 1:50-year Profile Comparison

The flood extent directly upstream of Hidden Valley Road would be greatly reduced under the assessed Alternative 4 conditions. Flood conditions further upstream at the driveway of 735 Hidden Valley Road would be unchanged due to the elevation of the Hidden Valley Road crest (293.34 m) being lower than the channel upstream of driveway culvert (293.74 m). Increases to conveyance capacity at Hidden Valley Road would not improve flood conditions at the buildings on the 735 Hidden Valley Road property. Water surface elevations at HEC-RAS station 140 (upstream of the driveway crossing) are consistent between existing conditions and the assessed Alternative 4 conditions.

The objectives of this project are to reduce flood risk, and not necessarily to change the Regulatory flood hazard limits as defined by GRCA. Alternative 4 will not change the Regulatory flood hazard limits as set by GRCA on either the downstream side of Hidden Valley Road, through the private property at 730 Hidden Valley Road or the upstream side of Hidden Valley Road, through the private property at 735 Hidden Valley Road.

Erosion control and channel banks stabilization downstream of the 735 Hidden Valley Road driveway would reduce the sediment volumes at the Hidden Valley Road culverts. This improvement would reduce operations and maintenance costs at the road culvert and improve slope stability at 735 Hidden Valley Road. This slope stability work on the

channel would be undertaken by the City on private property in order to protect the City's road crossing infrastructure from sedimentation. For the purposes of this EA, we have assumed this work would be mutually beneficial and therefore permissions and a temporary easement for the work would be easily obtained.

This alternative would require the standard roadworks approvals process, such as GRCA approval and a Departments of Fisheries and Oceans Request for Review. It is anticipated that the approvals process for this alternative will be straight forward.

Cultural and Social-Economic Environment

Construction activities for this alternative would be limited to previously disturbed lands, and thus would not require additional archaeological investigations. Construction for Alternative 4 would be limited to the roadway and would result in temporary traffic disruption to nearby residents and increased noise. This alternative presents the lowest capital cost and maintenance of all alternatives, except for Alternative 1.

Natural Environment

Alternative 4 proposes works within the vicinity of Hidden Valley East Creek. This area is located outside of the Hidden Valley PSW and outside of the critical habitat for the *restricted species*. The proposed impacts to the natural environment would be limited in duration and overall area, with most impacts occurring for the duration of construction only.

Although some bank and riparian vegetation would be removed during construction, the overall landscape could be improved by increasing native species cover through a site-specific restoration and planting plan. Hydraulic capacity upgrades to the system would increase the bank stability and decrease the erosion rate.

The Hidden Valley Road culvert is just one of the many barriers to fish within the Hidden Valley Creek system. It is heavily sedimented, with the low flow culvert being almost entirely buried. The area immediately downstream of the culvert is functionally connected to the Grand River and may support fish and fish habitat. The area isolated vernal ponds and wetlands upstream of the Hidden Valley Road culvert is fishless and supports a population of a *restricted species* and its critical habitat. The introduction of fish to this area through culvert improvements is not recommended. As part of the

detailed design phase of this project it is recommended to incorporate either passive or active fish exclusion measures as part of the culvert replacement. These exclusion measures shall ensure that the population and habitat of the *restricted species* are not negatively impacted.

7.5 Evaluation Table

Each alternative has been ranked for each subcategory. Success bubbles are shown across the screening results to give an easy visualization of each alternative's score. More advantageous alternatives have circles which are coloured in. A full summary of the evaluation shown in Table 7.

TABLE 7 Detailed Evaluation Table

Criteria	Criteria Description	Alternative 1 Do-Nothing		Alternative 2 Reduce Flows Upstream of Wetland		Alternative 3 Flow Control Structure in Wetland		Alternative 4 Conveyance Improvements Downstream of the Wetland	
		No mitigation solution. Existing conditions left to continue.		Provide stormwater management (SWM) peak flow control in the upper catchment, above the ESPA/PSW		Replace flow control functionality of existing beaver dam with engineered structure (berm/dam)		Culvert replacement at Hidden Valley Road	
Technical Environment									
Functionality	Flood risk Erosion risk Flexibility to meet future needs	Flood risk remains the same, overtopping risk of Hidden Valley Road remains the same.	○	Existing wetland provides vast amounts of stormwater storage. Minimal flood risk reduction expected by increased stormwater storage upstream.	◔	Potential to reduce flood risk from beaver dam failures at Hidden Valley Road and private property.	◑	Road overtopping eliminated up to and including the 1:50-year flow. Reduced flood risk upstream of Hidden Valley Road. Reduced erosion risk downstream of Hidden Valley Road.	●
Approvability	Agency and utility permits Existing/future designated land use Municipal planning policies.	No work to be approved. No changes to developable land.	●	Additional flow control to be provided at proposed development site(s). Approvals to be provided through planning process and cost sharing agreements. MECP registration (butternut) and Overall Benefit Permit (SAR bats) required. DFO RFR submission, and GRCA permit required.	◑	Complex and unique permitting process with multiple stakeholder's interest. MECP permit for bats and restricted species. Critical habitat has been identified for the restricted species. DFO authorization. MNRF Section 14 permit under the *Lakes and Rivers Improvement Act* (LRIA). GRCA permit.	○	Standard roadworks approvals process. Relatively simple permitting process. DFO RFR submission. MECP registration under Section 23.18 for SAR bats. GRCA permit.	◔
Constructability/Feasibility	Construction duration Channel functionality during construction Soil conditions Groundwater control	No construction required.	●	Medium construction efforts.	◑	Longest and most complex construction.	◔	Shortest and most straight forward construction.	◔
Summary of Technical Environment Screening		Alternative 4 has the highest technical score of all alternatives, as it reliably reduces flood risk, has minimal approval requirements and requires relatively straightforward construction. In comparison, Alternative 1 does not improve flood risk, and Alternatives 2 and 3 have unreliable potential for reducing flood risk. Alternative 3 would have a prolonged and difficult approval process, which further reduces its technical scoring.							

Criteria	Criteria Description	Alternative 1 Do-Nothing		Alternative 2 Reduce Flows Upstream of Wetland		Alternative 3 Flow Control Structure in Wetland		Alternative 4 Conveyance Improvements Downstream of the Wetland	
		No mitigation solution. Existing conditions left to continue.		Provide stormwater management (SWM) peak flow control in the upper catchment, above the ESPA/PSW		Replace flow control functionality of existing beaver dam with engineered structure (berm/dam)		Culvert replacement at Hidden Valley Road	
Technical Environment Screening Result		Alternative 1 is moderately preferred in the technical environment.		Alternative 2 is moderately preferred in the technical environment.		Alternative 3 is the least preferred in the technical environment.		Alternative 4 is the most preferred in the technical environment.	
Cultural/Social-Economic Environment									
Cultural Environment	Archaeological impacts Built heritage Cultural landscapes/features	No impacts		Works in undeveloped land that have been disturbed in recent past. Archaeology Assessment required but could be coordinated with development planning.		Works in the wetland. Would require Archaeology Assessment.		Works limited to previously disturbed road right-of-way. No anticipated impacts.	
Social Environment	Property impacts Recreational opportunities Maintaining/improving greenspace Safety of pedestrians, cyclists, and trail users Disruption to traffic, businesses, residents during/post-construction Noise to sensitive areas	Erosion and flooding left to continue – impacts to private property. Impacts to traffic and safety.		Reduced available development area in the upstream properties. Construction impacts part of overall development plan.		Impacts to wetland greenspace and informal trails. Noise and impacts during construction in the ESPA.		Noise and impacts during construction in the roadway. Temporary traffic disruption.	
Economic Environment	Relative capital costs Operation and maintenance costs Internal/External funding sources Cost of flood damage Property impacts	No capital costs. Periodic maintenance at erosions sites. Continued road washout potential. Sediment cleanout required at road.		Could be funded through cost sharing. Moderate capital costs. Ongoing maintenance – typical requirements.		Highest capital costs. Ongoing maintenance – specialized requirements. Monitoring for debris jams would be required following significant flow events.		Typical culvert crossing within existing roadway. Lowest capital cost. Minimal maintenance requirements.	
Summary of Cultural/Social-Economic Environment Screening		Alternative 4 has the highest Cultural and Social-Economic, as it will reduce flooding, maintain the existing land use, and not have an intensive construction cycle. The social-economic scores of Alternatives 1, 2, and 3 are reduced due to: continuation of flooding, occupation of additional land, and long/intensive construction window, respectively. Alternative 3 also increased the City's potential liability because of a City-owned structure in the watercourse. This further reduces Alternative 3's Social-Economic scores.							

Criteria	Criteria Description	Alternative 1 Do-Nothing		Alternative 2 Reduce Flows Upstream of Wetland		Alternative 3 Flow Control Structure in Wetland		Alternative 4 Conveyance Improvements Downstream of the Wetland	
		No mitigation solution. Existing conditions left to continue.		Provide stormwater management (SWM) peak flow control in the upper catchment, above the ESPA/PSW		Replace flow control functionality of existing beaver dam with engineered structure (berm/dam)		Culvert replacement at Hidden Valley Road	
Cultural/Social-Economic Environment Screening Result		Alternative 1 is moderately preferred in the cultural/social-economic environment.		Alternative 2 is moderately preferred in the cultural/social-economic environment.		Alternative 3 is the least preferred in the cultural/social-economic environment.		Alternative 4 is the most preferred in the cultural/social-economic environment.	
Natural Environment									
Aquatic Environment	Fish and fish habitat Surface water quality/quantity Groundwater quality/quantity	No changes to existing habitat.		No significant changes to existing habitat.		Permanent loss of aquatic habitat within construction footprint. Increased potential for debris jams.		Potential removal of one of the barriers to fish movement upstream. Installation of fish exclusion measures would be required to prevent impacts to a *restricted species*. Improved bank stability.	
Terrestrial Environment	Wetland ecology Wildlife/habitat Vegetation Trees or landscape	No changes to existing habitat.		Potential for changes to water balance in wetland. Potential impacts to SAR bat habitat or SAR vegetation (butternut) through woodlot or hedgerow removal.		Potential for changes to water balance in wetland. Potential impacts to SAR bat habitat or SAR vegetation (butternut) through woodlot or hedgerow removal. Potential impacts to SAR reptiles and amphibians and their habitat. Creation of new access roads, increasing habitat fragmentation and creating barriers to wildlife movement.		Removal of edge vegetation. Reduction in valley erosion and sedimentation. Increase in native species cover through restoration plans. Increased connectivity for wildlife.	
Climate Change	Resilience to severe weather (flooding) Known climate change contributors	No changes to existing climate resiliency.		Flows above design capacity could cause unexpected impacts to the wetland.		Flows above design capacity could cause unexpected flooding to downstream properties.		Increased conveyance provides additional climate change resiliency.	

Criteria	Criteria Description	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Do-Nothing		Reduce Flows Upstream of Wetland		Flow Control Structure in Wetland		Conveyance Improvements Downstream of the Wetland	
		No mitigation solution. Existing conditions left to continue.		Provide stormwater management (SWM) peak flow control in the upper catchment, above the ESPA/PSW		Replace flow control functionality of existing beaver dam with engineered structure (berm/dam)		Culvert replacement at Hidden Valley Road	
Summary of Natural Environment Screening		Alternative 4 improves upon the natural habitat of the area and has the highest Natural Environment scoring. Alternative 1 maintains the existing natural habitat, while Alternatives 2 and 3 have the potential to negatively impact species at risk habitat within the PSW/ESPA. Alternative 4 is the only alternative to improve upon existing conditions through restoring the landscape and adding native vegetation.							
Natural Environment Screening Result		Alternative 1 is moderately preferred in the natural environment		Alternative 2 is moderately preferred in the natural environment		Alternative 3 is the least preferred in the natural environment		Alternative 4 is the most preferred in the natural environment.	
Overall Screening		Alternative 4 is the preferred solution based on the evaluation of Technical Environment, Social/Economic Environment and Natural Environment.							
Overall Screening Result		Alternative 1 is moderately preferred overall.		Alternative 2 is moderately preferred overall.		Alternative 3 is the least preferred overall.		Alternative 4 is the most preferred overall.	

8 PREFERRED SOLUTION

Alternative 4 is the preferred solution based on the evaluation of Technical Environment, Social/Economic Environment and Natural Environment. Alternative 4 considers increased conveyance capacity at Hidden Valley Road and erosion protection upstream of Hidden Valley Road.

Alternative 4 has the highest technical score of all alternatives, as it reliably reduces flood risk, has minimal approval requirements, and requires relatively straightforward construction. Alternative 4 was assessed using a 3,900 mm span by 1,200 mm rise box culvert which was shown to meet the City and MTO roadway design criteria and reduce road overtopping to flows greater than the 1:50-year flow. Erosion control measures could be implemented upstream of the roadway. This would increase slope stability and reduce sedimentation at the road culvert. In comparison, Alternative 1 does not improve flood risk, and Alternatives 2 and 3 have unreliable potential for reducing flood risk. Alternative 3 would have a prolonged and difficult approval process, which further reduces its technical scoring.

Alternative 4 increases the conveyance capacity of Hidden Valley Road and reinforces the slopes upstream of Hidden Valley Road, reducing the water surface elevation and decreasing the potential for future erosion. Velocity dissipation within the culvert design also allows for decreased shear stress along the banks downstream of the road, improving long-term slope stability through 730 Hidden Valley Road. The preferred alternative must be designed so that there are no impacts to flood elevations for all storm events (2, 5, 10, 25, 50, 100, and Regional).

Alternative 4 has the highest Cultural/Social-Economic score, as it will reduce flooding, maintain the existing land use, and not have an intensive construction cycle. The social-economic scores of Alternatives 1, 2, and 3 are reduced due to: continuation of flooding, occupation of additional land, and long/intensive construction window, respectively. Alternative 3 also increased the City's potential liability because of a City-owned structure in the watercourse. This further reduces Alternative 3's social-economic scores.

Alternative 4 improves upon the natural habitat of the area and has the highest Natural Environment scoring. Alternative 1 maintains the existing natural habitat, while Alternatives 2 and 3 have the potential to negatively impact SAR habitat within the PSW/ESPA. Alternative 4 is the only alternative to improve upon existing conditions through restoring the landscape and native vegetation. Practical measures to restore or enhance sections of Hidden Valley Creek as well as adjacent riparian areas will be clearly outlined and implemented at the detailed design stage The use of native seed mixes, live-stakes, and appropriate bio-engineering measures is strongly encouraged for long-term erosion and sediment control. Natural channel design principles shall be followed to the extent possible.

9 PROJECT IMPLEMENTATION AND NEXT STEPS

9.1 Planning

It is recommended that the City proceed with implementation of the conveyance improvement works identified as detailed in the preferred solution (Section 8). Detailed design is required to develop engineering drawings for tender and construction.

In preparation for detailed design, the following is recommended:

- Tree Inventory and Cavity Tree Assessment - Once the extents of construction impacts are known a detailed tree inventory & cavity tree assessment should be completed to assess the potential for SAR vegetation and SAR bats within the proposed limits of construction. Any removal of trees with suitable cavities for SAR bats should consider the appropriate mitigation strategies as outlined in Appendix E.

- Construction Access and Laydown Areas - All areas selected for construction access routes and as laydown areas, should be confirmed and staked in the field in consultation with an ecologist prior to construction in order to avoid sensitive species and larger trees to the extent possible.

- Geotechnical investigation may be required during the detailed design.

- Survey - Legal and topographic surveys will be required for detailed design. Subsurface Utility Engineering surveys may be required at detailed design.

- Additional information will be required at detailed design to demonstrate that the following applicable policies outlined under Section 9.1.2 of the GRCA's consolidated policies will be met:
    - the risk of flood damage to upstream or downstream properties is reduced through site and infrastructure design, wherever possible
    - where unavoidable, intrusions on significant natural features or hydrologic or ecological functions are minimized and it can be demonstrated that best management practices including site and infrastructure design and appropriate remedial measures will adequately restore and enhance features and functions
    - physical realignments or alterations to the river, creek, stream or watercourse channel associated with a new crossing are avoided or are in accordance with the policies in Section 9.1.16
    - maintenance requirements are minimized

9.2 Environmental Mitigation Measures and Monitoring

Mitigation measures must be set in place to safeguard natural heritage features near the project area during construction. Design and construction plans will follow best management practices to minimize negative impacts, protect the environment, and encourage overall environmental improvements. Environmental monitoring will be conducted during construction and post-construction to ensure the design continues to serve as intended and does not negatively impact the surrounding area. Mitigation measures include, but are not limited to, the following:

- Notification to Agencies
    - A permit will be required from GRCA
- Respecting construction timing windows with respect to migrating birds and aquatic habitat/working in the dry
- Applying best construction practices
- Preventing wildlife mortality and disturbance
- Preventing terrestrial disturbance

- Implementing erosion and sediment controls during construction
- Protecting SAR

9.2.1 Temporary Flow Passage

MTO Drainage Design Standard TW-1 identifies the return periods for sizing of temporary drainage facilities (e.g., bridges, culverts, diversion channels, and diversion pipes) during construction. It also includes the return period associated with the design of temporary erosion control basins. The return period for the design of temporary drainage measures required during construction are assessed on a project specific basis. The contributing factors affecting the choice of return period depends on the length of the construction period and include consideration of potential consequences in terms of public safety, traffic delays, property damage due to flooding, and environmental impacts.

Whether a dam and pump or dam and divert temporary flow passage system is selected for flow bypass, an Ontario MECP Permit to take Water (PTTW) is not anticipated for construction activities related to this site. However, if there is active pumping at the site, such as damming the culvert and pumping around it or from within a cofferdam, the following conditions are required:

- discharge from the pumping operation contains no visible contaminants
- erosion and sediment control measures are installed and properly used
- water taking and discharge flow rate is controlled to ensure no downstream or upstream impacts on water quantity or quality (i.e., no storage or ponding of water onsite)
- refueling of pumps occurs at a distance of greater than 30 m from the water body

The noted requirements, including an erosion and sediment control plan for construction, will be incorporated into the contract documents and operational constraints for construction activities related to the project. In addition to the requirements noted above, the new MECP regulations also formally acknowledges that passive stream diversion (water managed through the site without pumping) does not require a PTTW but requires that the water levels upstream or downstream are note effected and that surface water remains on or is directly returned to the same water body.

MTO's *Highway Drainage Design Standards* (MTO 2008) Section TW-2 provides guidance on return period flow for sizing temporary drainage works during construction. The return period is based on the length of the construction period and the potential consequences of failure in terms of public safety, traffic delays, property damage due to flooding, and environmental impacts. The minimum return periods defined by MTO are presented in Table 8. Assuming a construction duration of less than 2 months, the return period for sizing bypass works is the 1:2-year event regardless of the level of consequence.

TABLE 8 Minimum Minor Return Period for Temporary Works (MTO 2008)

Duration of Construction	Return Period (years) Consequence		
	Low	Medium	High
Less than 2 months	1:2-year event	1:2-year event	1:2-year event
Up to 4 months	1:2-year event	1:5-year event	1:5-year event
Up to 8 months	1:5-year event	1:5-year event	1:10-year event
Up to 12 months	1:5-year event	1:5-year event	1:25-year event
Up to 18 months	1:5-year event	1:10-year event	1:25-year event
Greater than 18 months	1:10-year event	1:10-year event	1:25-year event

9.2.2 Notification

The GRCA should be notified of the scheduled initiation of work within the watercourse and on the watercourse banks. The contract administrator must be notified at the commencement of the excavation works to provide opportunity to inspect the watercourse bypass measures.

The contractor shall provide details and descriptions, working drawings, and schedules that detail the sequence of the in-water work and the provision of temporary water passage associated with the construction.

9.2.1 Isolation

All in-stream work must be completed in the dry by dewatering the work area and diverting or pumping the flows around the limits of the work area as follows:

- Existing stream flows must be maintained downstream of the dewatered work area.
- A flow dissipater such as clean slotted barrel or filter bags should be placed at water discharge points to prevent erosion and sediment release.
- Sediment laden dewatering discharge within work areas should be pumped to a settling basin well away from the watercourse and allowed to settle or filter through a minimum of 30 m of grassed vegetation before re-entering the watercourse.
- The work area should be stabilized against the impacts of high-flow events at the end of each workday.
- Work in the watercourse and floodplain should be suspended and the work area stabilized when there is a high probability of a convective rainfall event and during warm winter periods where there is a high likelihood of significant snow melt runoff.
- Materials used for coffer dam construction should be filled with clean pea gravel free of particulates.
- For additional guidance on staging and isolation, the Erosion and Sediment Control Guide for Urban Construction (TRCA 2019) should be consulted.

Seepage discharge upstream of the crossing, noted during the field reconnaissance, will have to be assessed and managed during the detailed design phase. Groundwater constraints and the potential for short and long-term impacts on associated wetland features and functions will need to be assessed and properly mitigated at the detailed design stage. A during construction dewatering plan will also be required.

9.2.2 Phasing

Prior to commencing construction, the isolation and bypass system should be established. The downstream coffer dam should be constructed first followed by the upstream coffer dam. A qualified aquatic biologist should then capture fish within the

work area. Fish should be relocated downstream. The work area should then be dewatered under supervision of the aquatic biologist.

Following the completion of the culvert construction, remove the downstream cofferdam and allow water to backflow into the construction area. Slowly remove the upstream cofferdam to allow water to enter the new culvert. If a bypass pumping system is used, disable the bypass pumping to progressively achieve full flow.

The contract must provide primary and back-up pumps with sufficient capacity to convey the baseflow of the channel if the dam and pump technique is used.

9.2.3 Fish Capture

The area immediately downstream of the Hidden Valley Road culvert may have fish present from the Grand River. Any in-water works should adhere to the construction timing windows for warmwater fisheries, identified as March 15 to July 15, and follow the best management practices for construction. Further details can be found in Appendix E. Prior to any works, it is anticipated that a DFO request for review (RFR) or a DFO Letter of Authorization (LOA) may be required. To support the fish rescue, a Scientific Fish Collection License for Scientific Purposes and a Wildlife Scientific Collectors Authorization from the MNRF would be required.

9.2.4 Weather Conditions

The contractor should monitor the weather forecast several days prior to commencing in-stream construction to ensure that works will be commenced during favourable weather conditions. Once construction has started, the contractor must continue to monitor the weather and prepare the site for any forecasted rainfall events. Preparations include provision of supplemental pumping capacity, backfilling or covering open excavations and exposed soil, securing any falsework, and ceasing any works or operations within the watercourse.

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APPENDIX A
Consultation Package

NOTICE OF STUDY COMMENCEMENT

Municipal Class Environmental Assessment
Hidden Valley Flood Risk Reduction

The Study

The City of Kitchener (the City) retained Matrix Solutions Inc. (Matrix) to provide a Municipal Class Environmental Assessment (EA) for flood risk reduction in the Hidden Valley Creek subwatershed. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.

The Process

The project is being carried out in accordance with the requirements of the Environmental Assessment Act and it is being planned under Schedule B. The intent of this project is to identify solutions and design alternatives to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed. A key component of the EA process will be consultation with interested stakeholders (public, landowners, and agencies).

Matrix will conduct a detailed background review and hydrologic/hydraulic analysis of the study area and identify potential solutions to reduce flood hazard. Upon completion of the analysis, Matrix will prepare a Project Report for the City and for submission to the Ministry of the Environment, Conservation and Parks (MECP), which will be available for public review for a period of 30 calendar days. All interested parties will have an opportunity to attend a Public Information Centre (PIC) meeting hosted prior to the final decisions on the proposed solutions. Notification of the PIC will be provided through email and postings on the City's website.

Study Area

The Hidden Valley Creek subwatershed is approximately 200 ha located in southeast Kitchener (see Figure 1). The Hidden Valley Creek subwatershed contains a large wetland/woodland environmental complex, which holds classifications of a Provincially Significant Wetland (PSW), Environmentally Sensitive Policy Area (ESPA), and Core Environmental Feature (CEF). Within the study area there are Regionally Significant Woodland and Significant Valley, species at risk habitat, and a warmwater fishery. In addition to being an environmentally sensitive area, the Hidden Valley ESPA/PSW is the hydrologically dominant landscape feature in the subwatershed.

The area downstream of the Hidden Valley ESPA/PSW has experienced past flood and erosion impacts related to both specific rainfall-runoff events and/or the release of natural debris-blockages (e.g., beaver dams or natural debris jams) within the wetland feature.

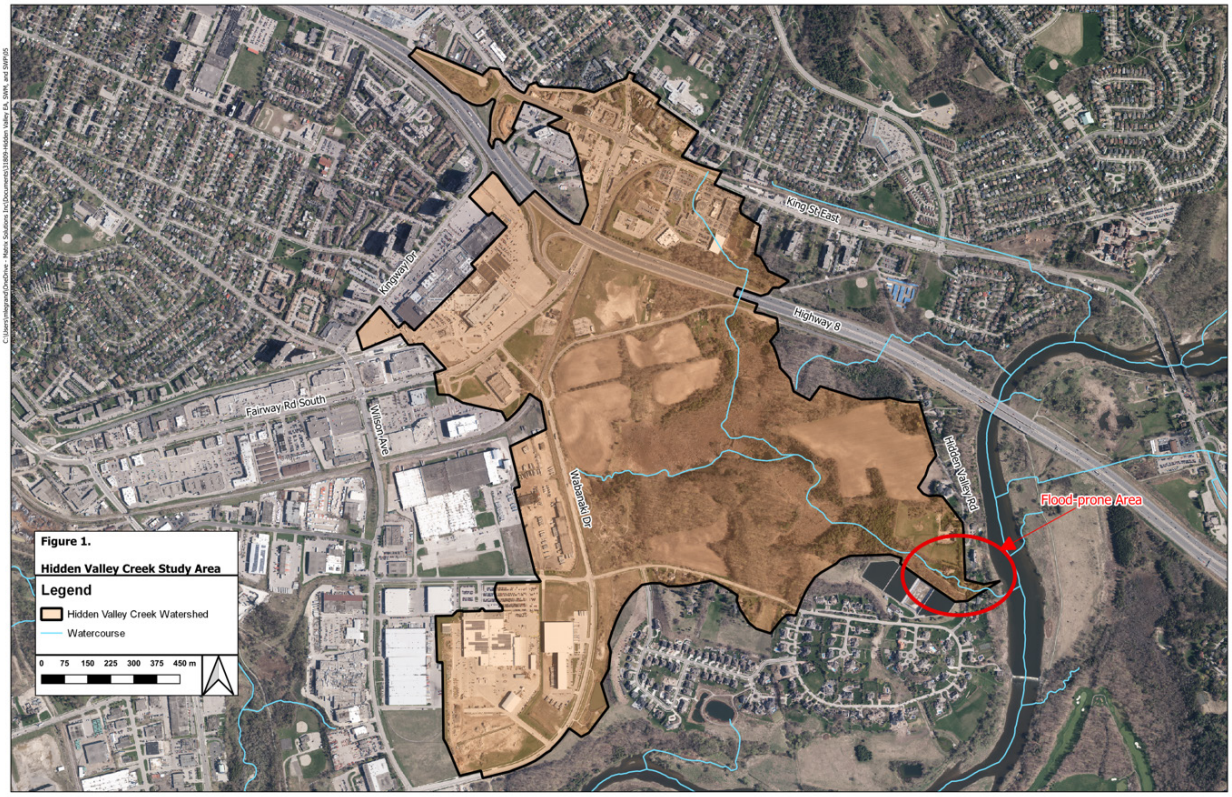


Figure 1

Public Feedback

Public, Indigenous, and agency consultation is a key component of the Class EA process, and Matrix is interested in hearing any comments or concerns that you may have about this study.

Your input is important!

To submit a comment or question via email, or if you have accessibility requirements to comment on the study, please contact one of the representatives below:

Monica Mazur, M.Sc., P.Eng.
Water Resources Analyst
Sanitary and Stormwater Utilities Division
City of Kitchener
Phone: 519-741-2600
Email: hiddenvalley@kitchener.ca

Karen Hofbauer, M.A.Sc., P.Eng.
Principal Water Resources Engineer
Matrix Solutions Inc.
Phone: 226-314-1932
Email: khofbauer@matrix-solutions.com

Please note that comments will be maintained for reference throughout the project and will become part of the public record. Under the Municipal Freedom of Information and Protection of Privacy Act and the Environmental Assessment Act, any personal information such as name, address, and telephone number included in a submission will become part of the public record unless the comments specifically request that such personal details not be included in the public record.

Project information will be made available on the City's website:

www.kitchener.ca/hiddenvalley

This notice was first issued on June 13, 2023.

July 21, 2023
Matrix File No. 31809

Conseil de la Nation Huronne-Wendat Consultation Team:

RE: City of Kitchener – Municipal Class Environmental Assessment
Hidden Valley Flood Risk Reduction

Please find attached a Notice of Study Commencement for the above noted project. This study is being carried out in accordance with the requirements of the *Environmental Assessment Act*, as a Schedule B Municipal Class Environmental Assessment. All notices related to this project can be found on the City of Kitchener's website at the following link:

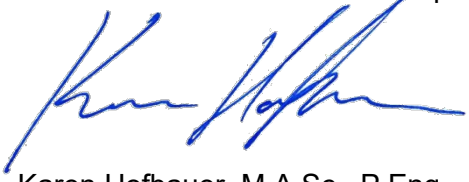
www.kitchener.ca/hiddenvalley

There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This Environmental Assessment is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.

Matrix is interested in hearing any comments or concerns that you may have about this study. Please feel free to call or email me using the contact details below should you require additional information. We look forward to hearing from you.

Yours truly,

MATRIX SOLUTIONS INC.
A Montrose Environmental Company



Karen Hofbauer, M.A.Sc., P.Eng.
Principal Water Resources Engineer
Phone: 226.314.1932
Email: khofbauer@matrix-solutions.com

KH/vc
Attachments

copy: Monica Mazur, Water Resources Analyst, Sanitary & Stormwater Utilities Division, City of Kitchener

July 21, 2023
Matrix File No. 31809

Mississaugas of the Credit First Nation Department of Consultation and Accommodation:

RE: City of Kitchener – Municipal Class Environmental Assessment
Hidden Valley Flood Risk Reduction

Please find attached a Notice of Study Commencement for the above noted project. This study is being carried out in accordance with the requirements of the *Environmental Assessment Act*, as a Schedule B Municipal Class Environmental Assessment. All notices related to this project can be found on the City of Kitchener's website at the following link:

www.kitchener.ca/hiddenvalley

There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This Environmental Assessment is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.

Matrix is interested in hearing any comments or concerns that you may have about this study. Please feel free to call or email me using the contact details below should you require additional information. We look forward to hearing from you.

Yours truly,

MATRIX SOLUTIONS INC.
A Montrose Environmental Company

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copy: Monica Mazur, Water Resources Analyst, Sanitary & Stormwater Utilities Division, City of Kitchener

July 21, 2023
Matrix File No. 31809

Six Nations of the Grand River Consultation and Accommodation Process Team:

RE: City of Kitchener – Municipal Class Environmental Assessment
Hidden Valley Flood Risk Reduction

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Phone: 226.314.1932
Email: khofbauer@matrix-solutions.com

KH/vc
Attachments

copy: Monica Mazur, Water Resources Analyst, Sanitary & Stormwater Utilities Division, City of Kitchener

Monica Mazur

Subject: Mississaugas of the Credit First Nation lunch & DMAF engagement meeting
Location: 72 Wilson Ave (72 Wilson Ave, Kitchener Ontario N2C 1G5, Canada)

Start: Fri 6/23/2023 12:00 PM
End: Fri 6/23/2023 3:00 PM

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Sarah Anderson

Here is a proposed agenda for our meeting and lunch on Friday.

Mark, Abby and Adam, please let us know if you would like to add to or change the agenda.

11:30 to 12 p.m. **Arrive at the park.** We will have coffee, tea and fruit set up at the covered shelter in Wilson Park.

12:00 p.m. to 12:30 p.m. **Welcoming remarks**

12:30 to 1:30 **Lunch provided by White Owl Native Ancestry**

1:30 to 2:30 **Engagement meeting** (presentation to be shared ahead)

- Schneider Creek and Shoemaker Creek EA alternative solutions review
- Hidden Valley Environmental Assessment Notice of Commencement (kitchener.ca)
    - Natalie Goss (Manager of Policy & Research – Planning Division) and Richard Kelly-Ruetz (Senior Planner) will be present to respond to questions from a Planning perspective.
- How we have begun incorporating Indigenous knowledge into EA processes (see attached document)

2:30 – 3:00 p.m. **Montgomery Creek restoration tour**

The lunch, meetings and tour will be held outside. Please dress for the weather and bring a water bottle.

NOTE: The park is across from Kingsdale Community Centre at 72 Wilson Avenue. The covered shelter is about 100 meters south of Wilson Ave, along the creek-side path.

Washrooms are available indoors at the community centre and at the 78 Wilson Avenue pool.

https://goo.gl/maps/5BupgHVbj7sC1K1q8

DMAF - Six Nations of the Grand River Consultation and Accommodation Process team

June 15, 2023

9:30 a.m. to 2:30 p.m.

131 Goodrich Drive, Kitchener, ON

Visit objectives: To engage in Nation-to-Nation relationship building and seek feedback on Sanitary & Stormwater Division and Parks & Cemeteries Division initiatives.

Six Nations of the Grand River Consultation and Accommodation Process Team Participants:

- Tanya Hill-Montour, Archaeology Supervisor
-
- Lonny Bomberry, Director of Lands and Resources
- SNGR to confirm other participants in June
- Dawn Russell, Consultation Administrative Assistant

City of Kitchener Participants

- Denise McGoldrick, General Manager Infrastructure Services
- Bu Lam, Director of Sanitary and Stormwater Utilities (SSU)
- Jeffery Silcox-Childs, Director Parks and Cemeteries (P&C)
- Sophia, Director of Equity, Anti-Racism and Indigenous Initiatives
- Nick Gollan, Manager of Planning and Programs (SSU)
- Ashley Visneski, Manager of Parks and Open Spaces Design and Development (P&C)
- Josh Shea, Manager, Forestry and Natural Areas (P&C)
- Samantha Brickman, Supervisor of Capital Programs (SSU)
- Bart Mazan, Project Manager (SSU)
- Chris Nechacov, Project Manager (SSU)
- Rachel Voros, Natural Areas Project Manager (P&C)
- Liz Christensen, Trails Project Manager (P&C)
- Rebecca Roy, Landscape Architect (P&C)
- Sabiha Syed, Park Engagement Liaison (P&C)
- Sarah Anderson, Engagement Associate (SSU)
- Colin Funk, Engagement Support Student (SSU)

Time	Discussion	Presenters	Participants
9:30 am-10:00 am	**Arrival** • Coffee, tea and snacks provided		
10:00 am-10:30 am	**Welcoming remarks**	Denise McGoldrick	SNGR team SSU team Jeffery Silcox-Childs Ashley Visneski Josh Shea Sophia Stanberry
10:30 am-11:15 am	**SSU engagement** • Schneider Creek and Shoemaker Creek EA alternative solutions review • Hidden Valley Environmental Assessment Notice of Assessment	Bu Lam Nick Gollan Samantha Brickman	SNGR team SSU team Denise McGoldrick Sophia Stanberry
	Short break		

11:20 am-12:00 pm	**Park and Cemeteries Engagement** • Permanent Indigenous Space • Wiijindamaan Project • Huron Natural Area Management Plan	Jeff Silcox-Childs Ashley Visneski Josh Shea	SNGR team P&C team Denise McGoldrick Sophia Stanberry SSU team
12:00 pm - 1:30 pm	**Lunch at 131 Goodrich followed by travel to Wilson Park** • Includes vegan and gluten-free options	SSU hosts lunch	SNGR team Denise McGoldrick Sophia Stanberry SSU team P&C team
1:30 pm-2:30 pm	**Tour of the Montgomery Creek restoration** • Park at Kingsdale Community Centre (see directions below) • Meet at the Wilson Avenue pedestrian bridge	Stantec Consulting R&M Construction SHIFT Rebecca Roy	SNGR team SSU team Denise McGoldrick Sophia Stanberry P&C team

Directions to Kingsdale Community Centre at 72 Wilson Avenue from 131 Goodrich Drive:

Turn left onto Goodrich Dr

350 m

Turn right onto Wilson Ave

2.2 km

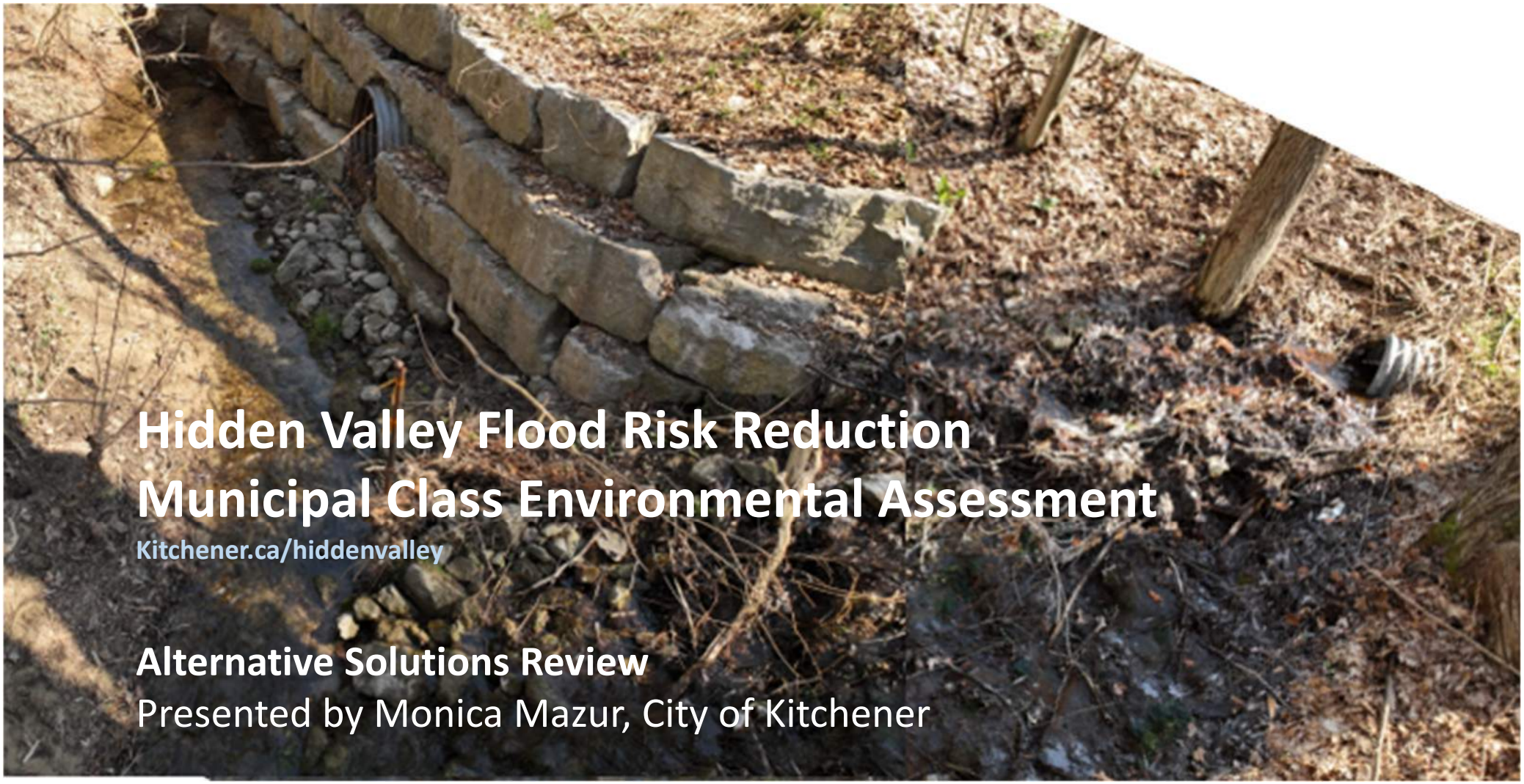
Turn right

Destination will be on the right

57 m

Kingsdale Community Centre

72 Wilson Ave, Kitchener, ON N2C 1G5



Hidden Valley Flood Risk Reduction
Municipal Class Environmental Assessment

Kitchener.ca/hiddenvalley

Alternative Solutions Review

Presented by Monica Mazur, City of Kitchener

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AGENDA

1. Background
2. Potential Alternative Solutions
3. Evaluation Criteria
4. Preliminary Evaluation of Alternatives
5. Discussion

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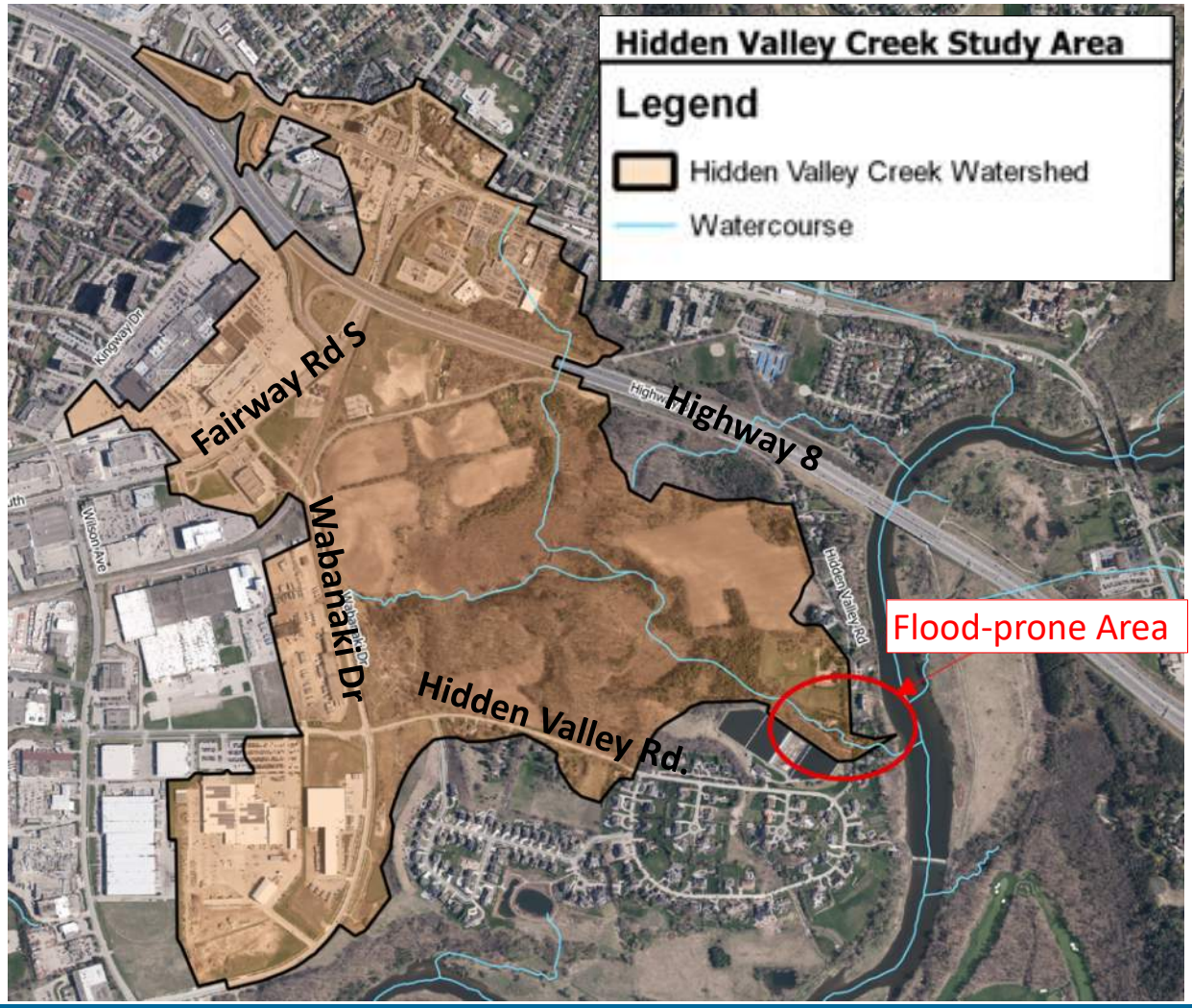
STUDY LOCATION



Southeast Kitchener

Hidden Valley Creek, 110 m upstream of Grand River

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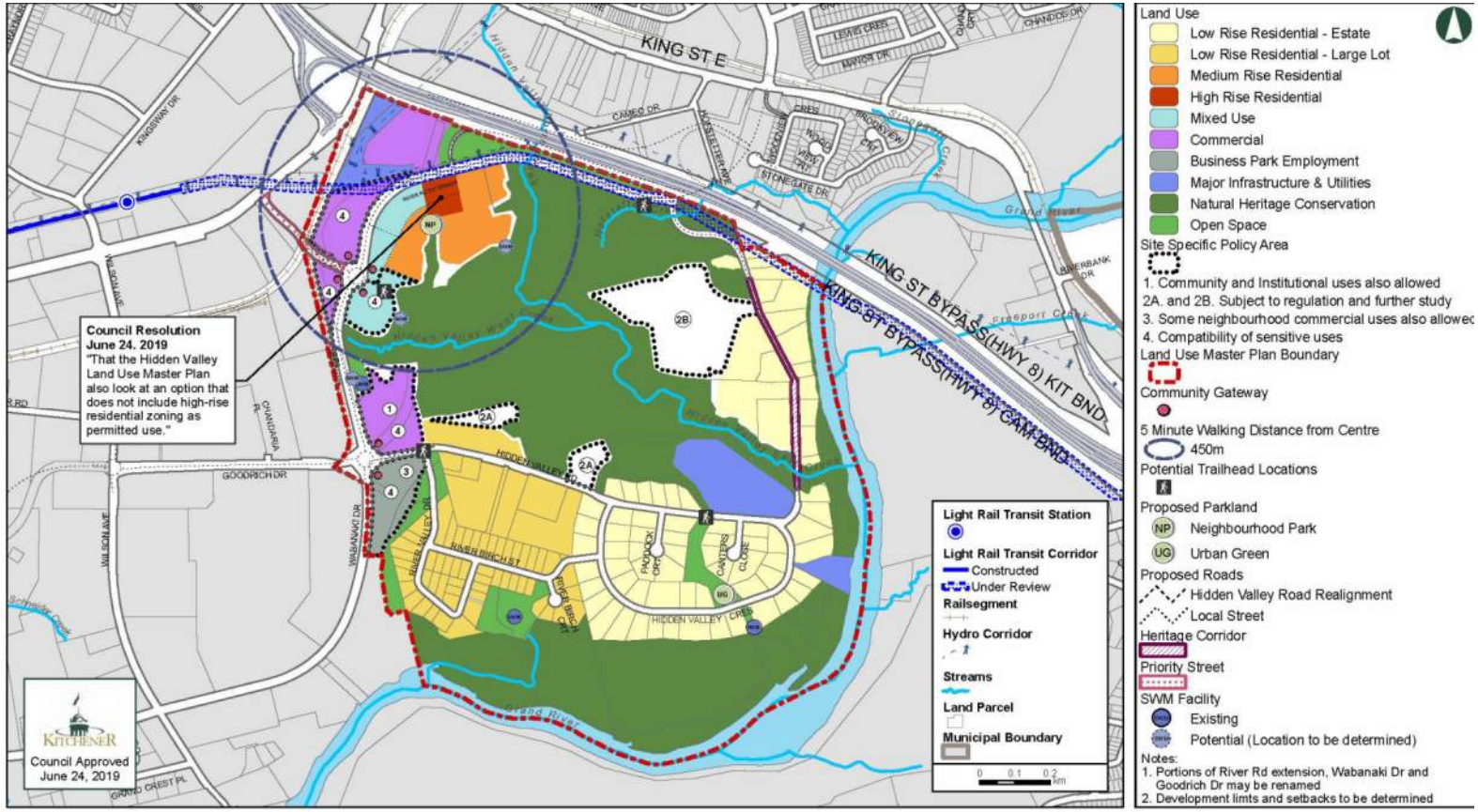
PROJECT BACKGROUND

Master Land Use Study



More Information on kitchener.ca/hiddenvalley

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PROJECT BACKGROUND

Q23-045 Engineering Studies

Study 1	Study 2	Study 3
Flood Risk Reduction Municipal Class Environmental Assessment	Stormwater Management Strategy	Source Protection / Intake Protection Zones

Schedule B Municipal Class Environmental Assessment Process for Study 1

Phase 1:	Phase 2:	
Problem or Opportunity	Evaluation of Alternative Solutions	Selection of preferred solution
Notice of Study Commencement	First Nations Consultation Public Information Center	Notice of Completion 30-Day Review
June 2023	Early Fall 2023	Late Fall 2023

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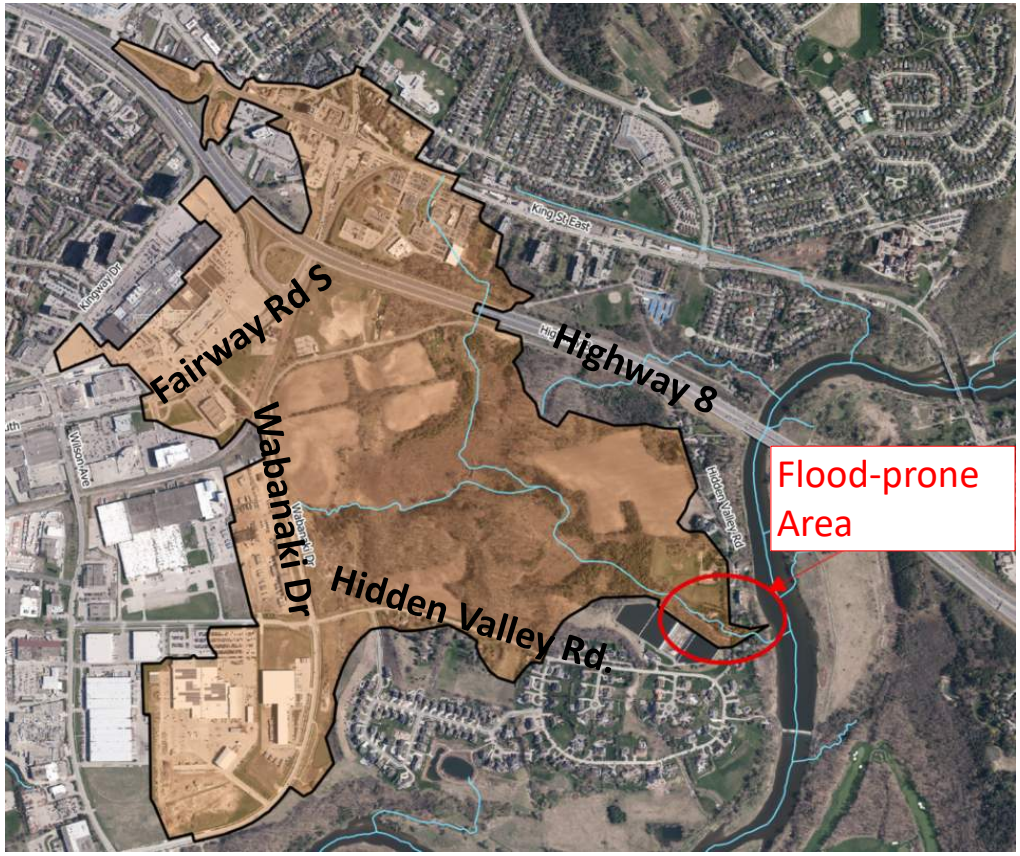
PROBLEM STATEMENT

There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road.

This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.



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POTENTIAL ALTERNATIVE SOLUTIONS - OVERVIEW

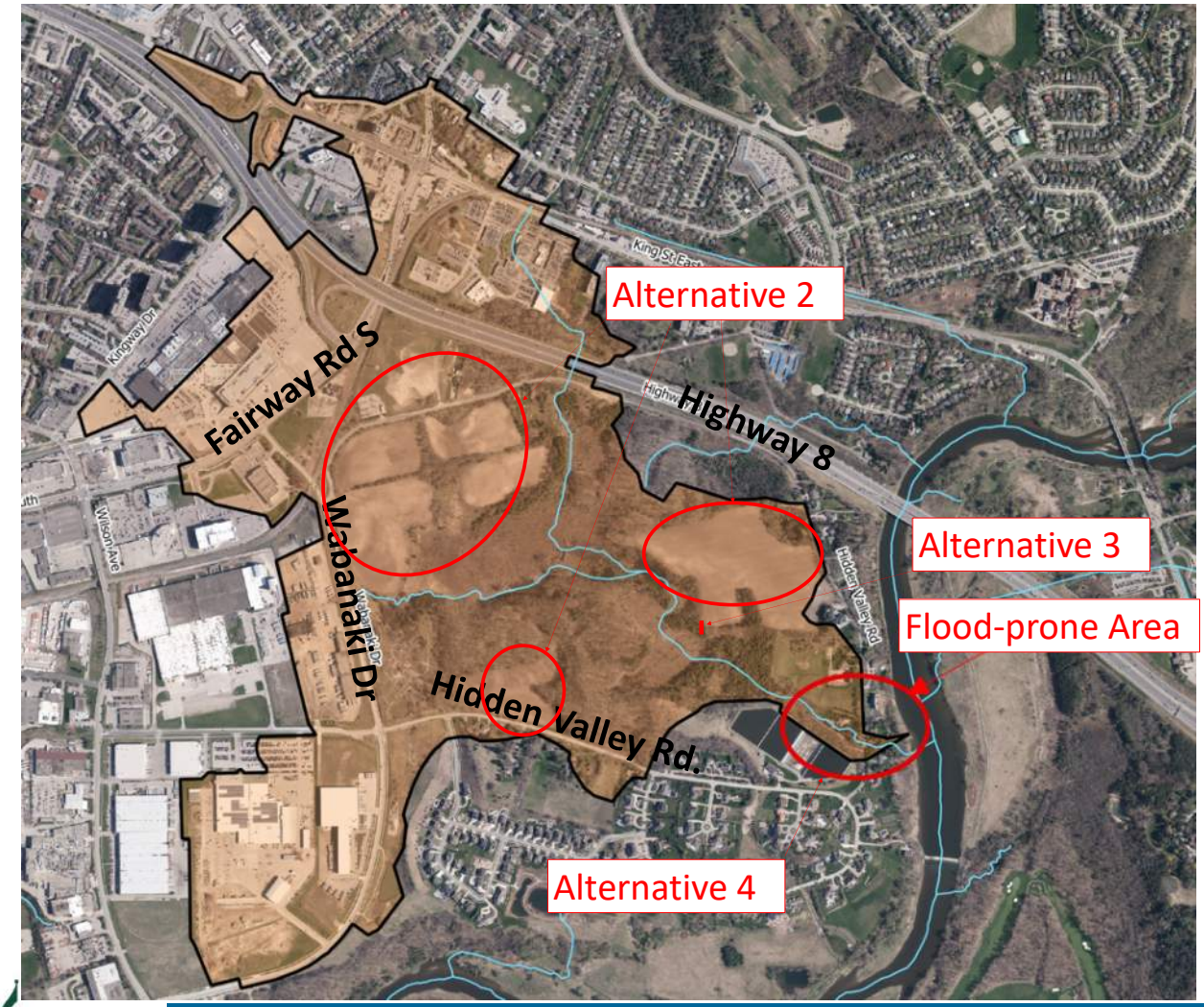
1. Do Nothing

2. Reduce Flows Upstream of Wetland

3. Flow Control Structure in Wetland

4. Conveyance Improvements Downstream of Wetland

POTENTIAL ALTERNATIVE SOLUTIONS - MAP



Hidden Valley Creek Study Area

Legend

- Hidden Valley Creek Watershed
- Watercourse

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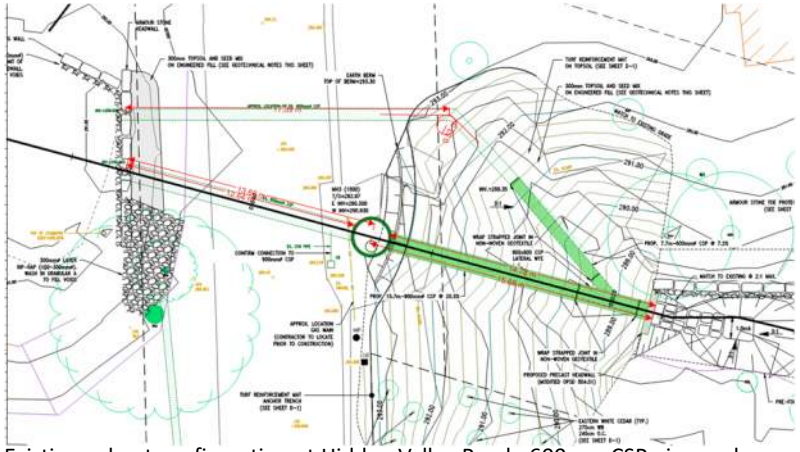
ALTERNATIVE #1 – DO NOTHING



Existing culvert configuration at Hidden Valley Road. 600mm CSP pipe and 900mm CSP pipe

Headway of Hidden Valley Road crossing; note almost complete submersion of easterly culvert by sedimentation

Erosion just upstream of Hidden Valley Road; potential source of material reducing capacity at road culverts

- No repairs or retrofits would be undertaken
- Hidden Valley Road would continue to overtop under large flow events exceeding current culvert capacity
- Washouts, flooding, and erosion would continue

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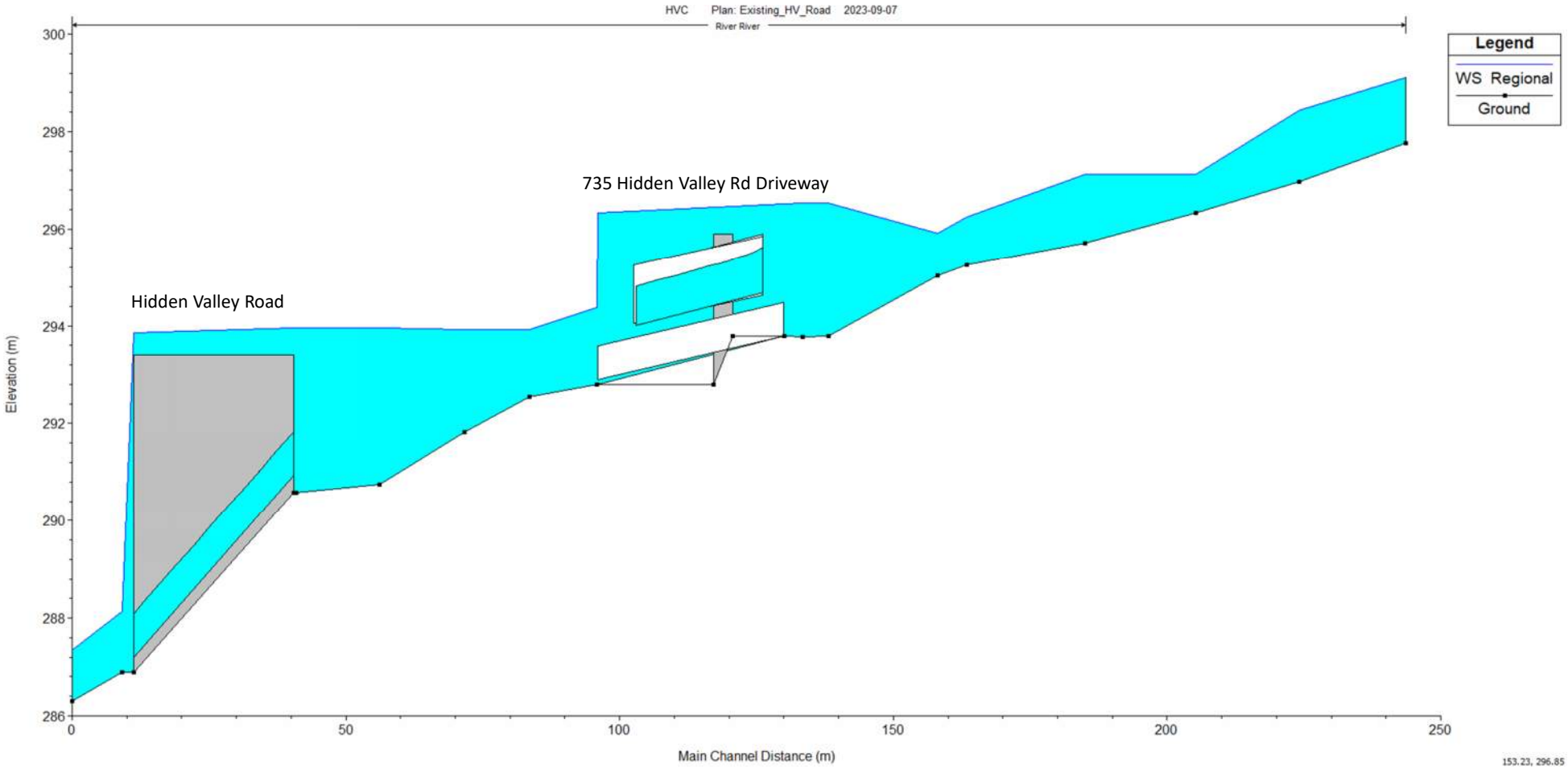
ALTERNATIVE #1 – DO NOTHING



Existing Hydraulic Profile for Regional Flow: Overtopping of private driveway and Hidden Valley Road

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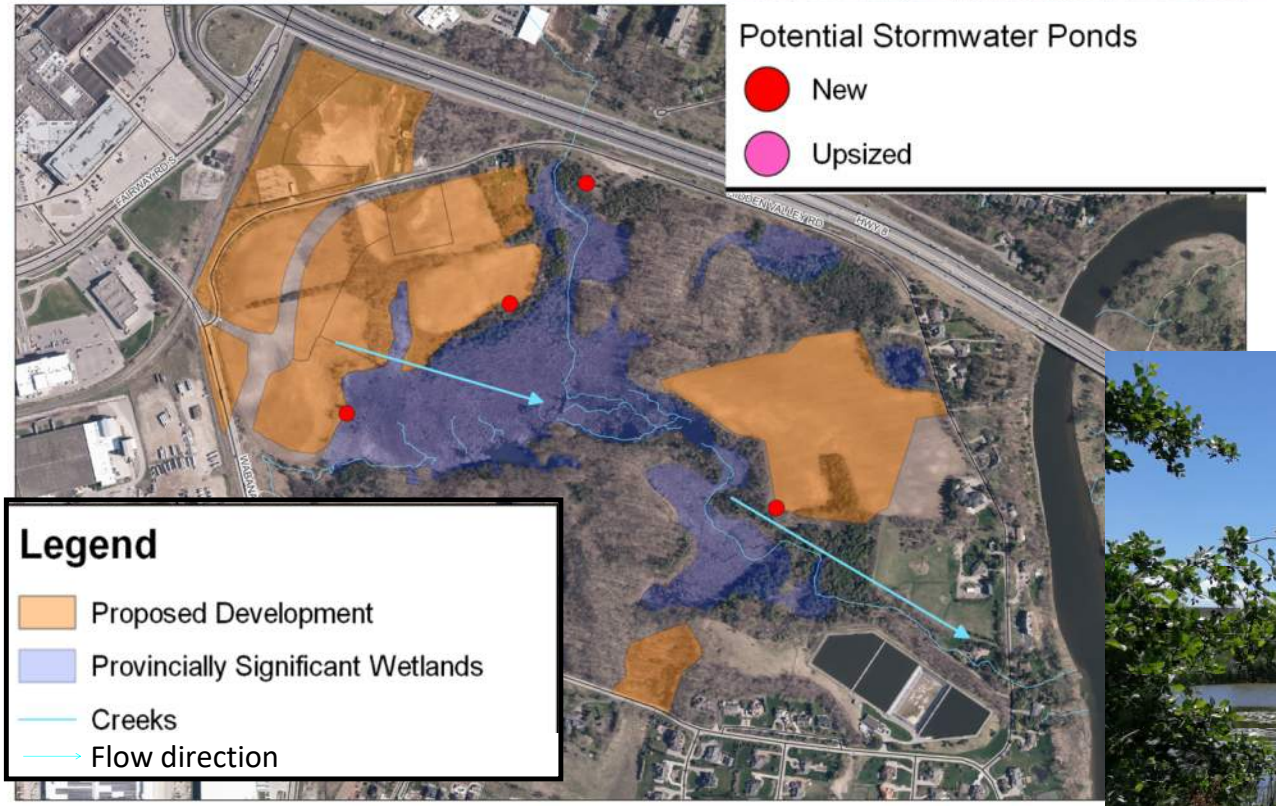
ALTERNATIVE #2 – REDUCE FLOWS UPSTREAM OF WETLAND



- Provide stormwater management (SWM) peak flow control in the upper catchment, above the ESPA / PSW

Example Stormwater Pond (Pond 17)(Kitchener, 2018)

- Could include new SWM for existing developed areas, or over-sized SWM for potential future development areas; multiple locations

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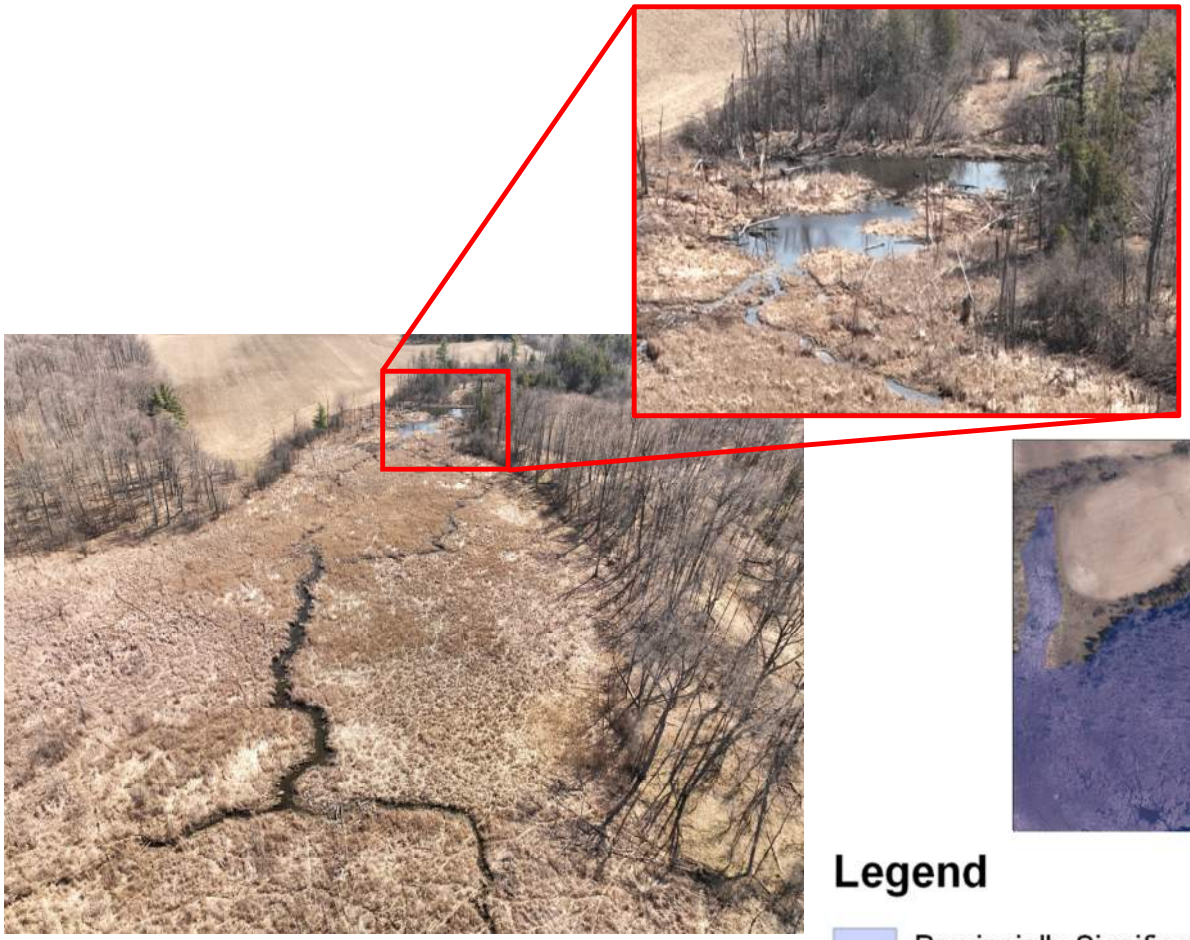
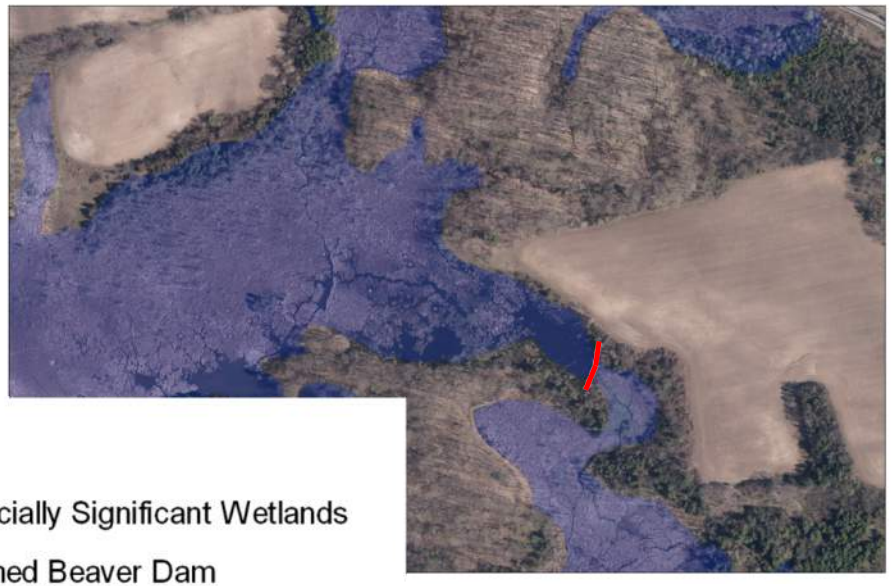
ALTERNATIVE #3 – FLOW CONTROL STRUCTURE IN WETLAND



- Replace flow control functionality of existing beaver dam with engineered structure (berm /dam)



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ALTERNATIVE #4 – CONVEYANCE IMPROVEMENTS DOWNSTREAM OF WETLAND

- Culvert replacement at Hidden Valley Road
- Watercourse stabilization efforts in immediate vicinity of road crossing
- Reduced erosion downstream of Hidden Valley Road because of new culvert

Example Box Culvert

Source: https://www.concastpipe.com/innovative-box-culvert-design-supports-critical-fish-habitat-barefoot-box-culvert/

Example Watercourse Stabilization

Source: https://trca.ca/conservation/restoration/streams-valley-lands//

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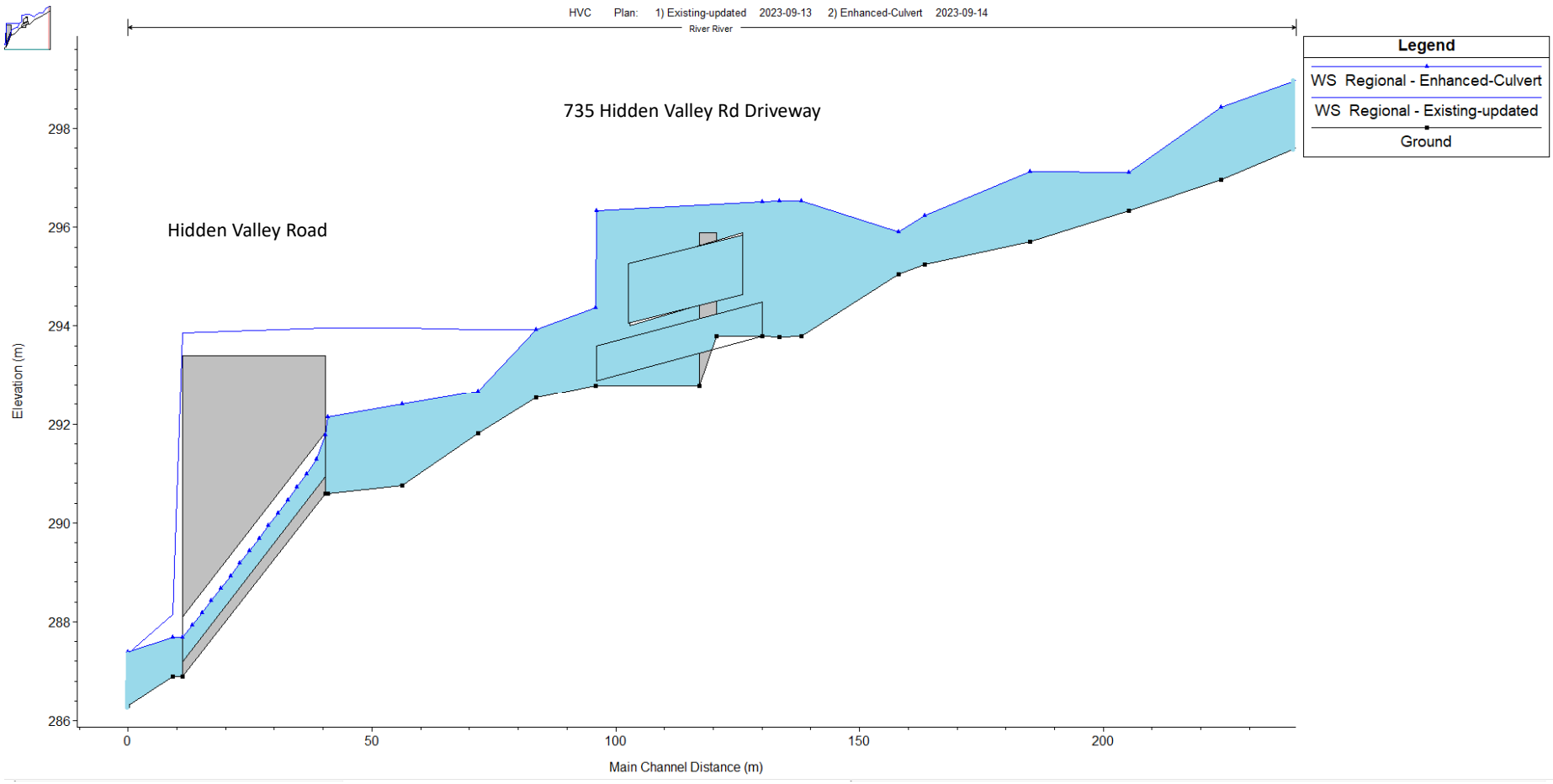
ALTERNATIVE #4 – CONVEYANCE IMPROVEMENTS DOWNSTREAM OF WETLAND



Potential Hydraulic Profile for Regional Flow: Overtopping of Hidden Valley Road eliminated

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EVALUATION CRITERIA ADOPTED FROM SCHNEIDER AND SHOEMAKER CREEKS NATURALIZATION ENVIRONMENTAL ASSESSMENT

SOCIO-ECONOMIC & CULTURAL ENVIRONMENT

TECHNICAL ENVIRONMENT

NATURAL ENVIRONMENT

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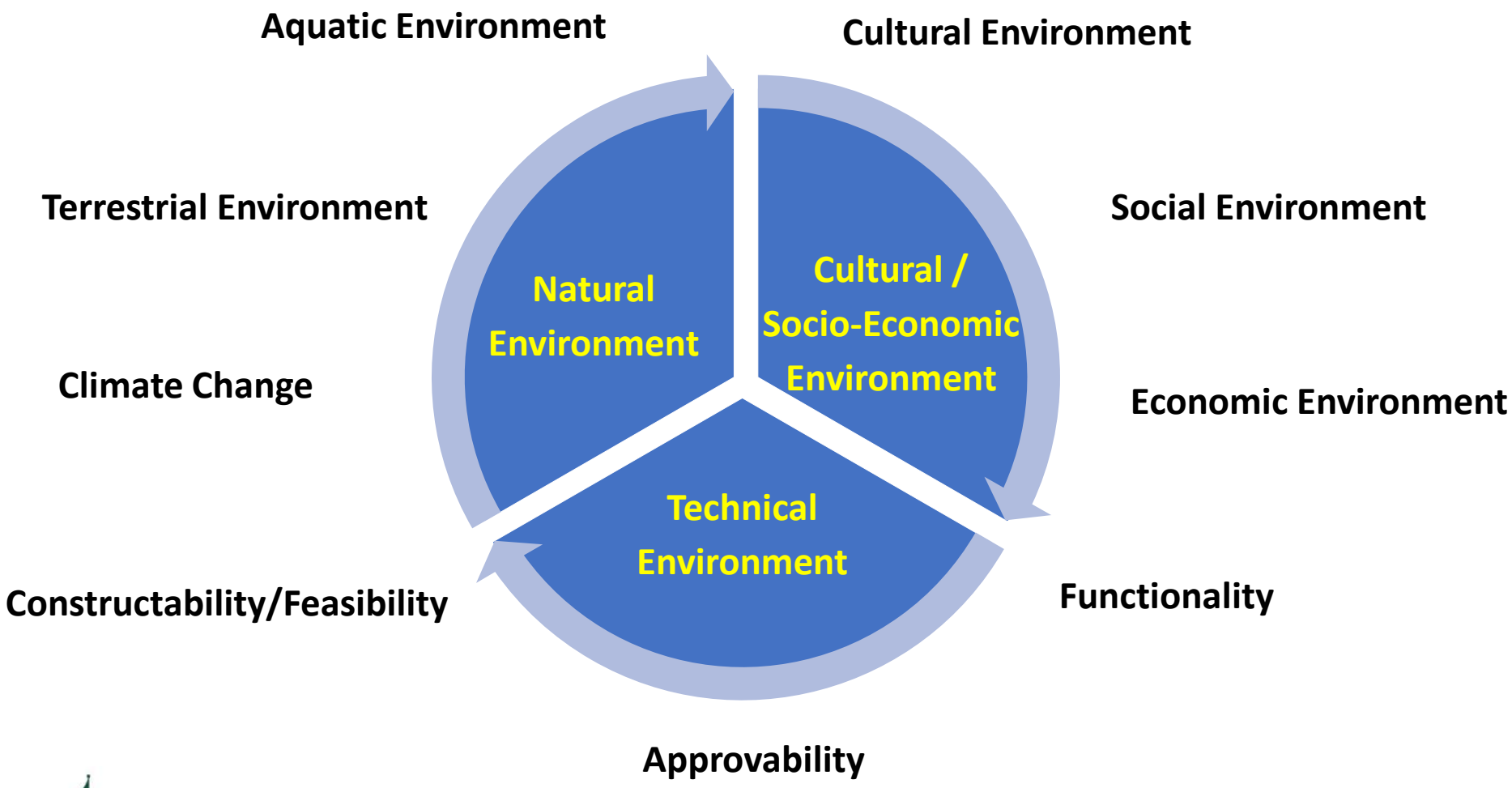
EVALUATION CRITERIA



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PRELIMINARY EVALUATION OF ALTERNATIVES

	Alternative 1: Do-Nothing	Alternative 2: Reduce Flows Upstream of Wetland	Alternative 3: Flow Control Structure in Wetland	Alternative 4: Conveyance Improvement Downstream of Wetland
Natural Environment				
Socio-economic and Cultural Environment				
Technical Environment				

Legend	Low Impact	Low-to-Moderate Impact	Moderate Impact	Moderate-to-High Impact	High Impact
					

The evaluation of alternatives progressed throughout the project lifespan. This slide shows the evaluation as presented to the SNGR. A slightly different Preliminary Evaluation of Alternatives slide was presented to MCFN. Both of these differed slightly from the Preliminary Evaluation of Alternatives slide included in the PIC.

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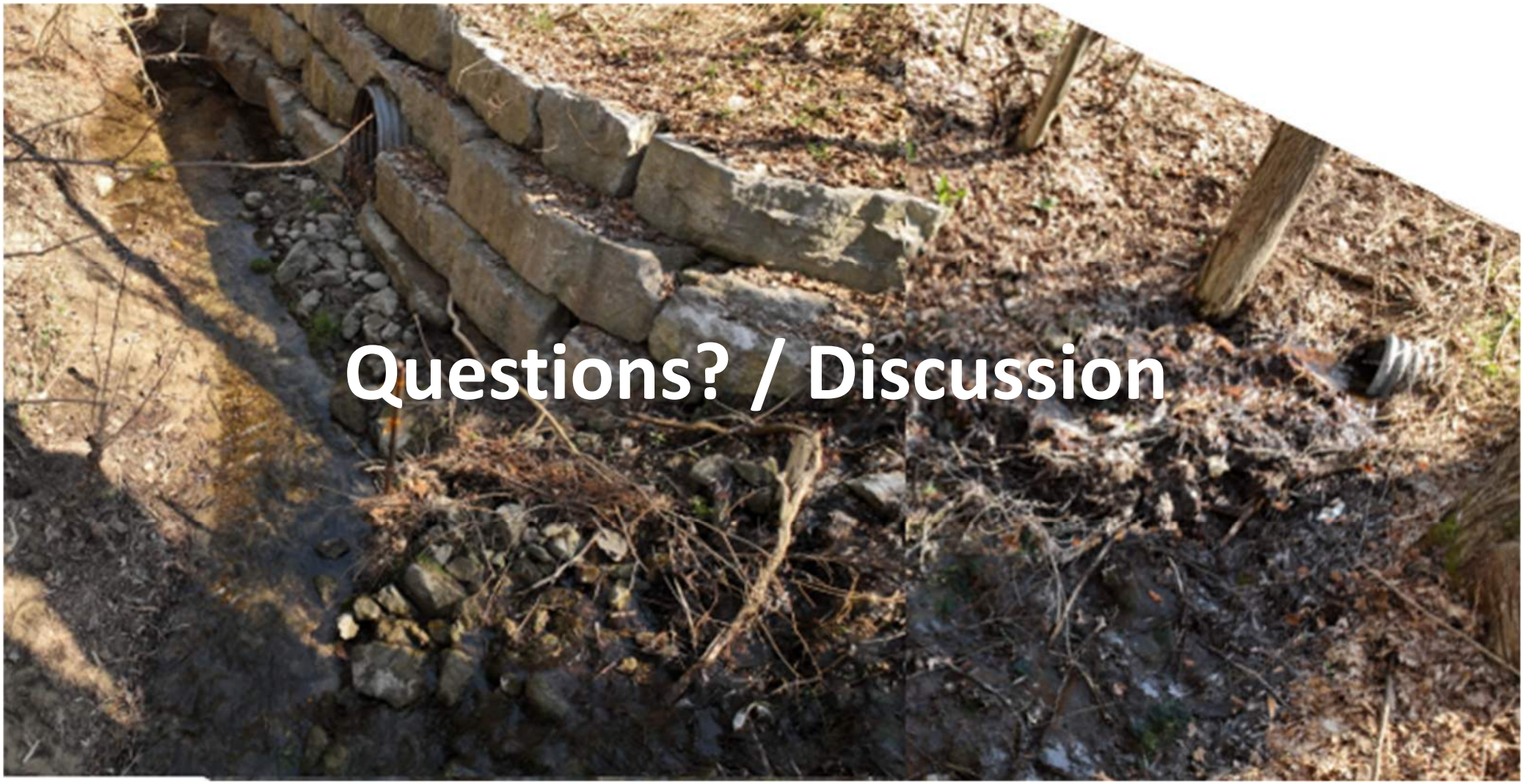

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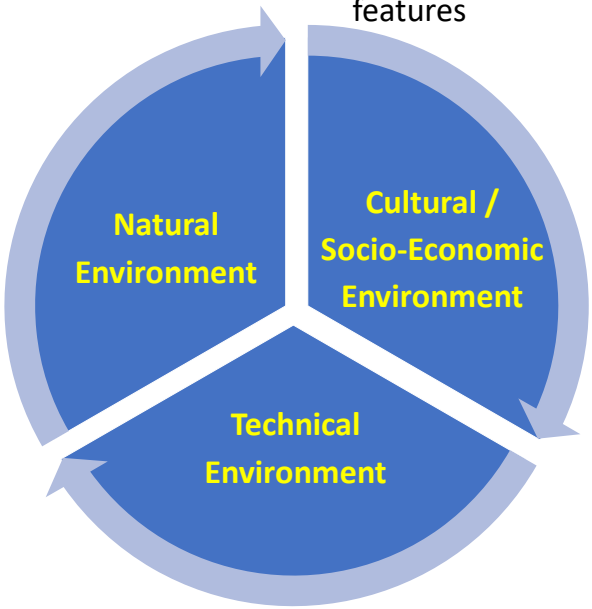
EVALUATION CRITERIA – A DEEPER DIVE

Aquatic Environment
- Fish and fish habitat
- Surface water quality / quantity
- Groundwater quality / quantity

Terrestrial Environment
- Wetland ecology
- Wildlife/habitat
- Vegetation
- Trees or landscape

Climate Change
- Resilience to severe weather (flooding)
- Known climate change contributors

Constructability/Feasibility
- Construction duration
- Channel functionality during construction
- Soil conditions
- Groundwater control



Cultural Environment
- Archaeological impacts
- Built heritage
- Cultural landscapes / features

Social Environment
- Property impacts
- Recreational opportunities
- Maintaining / improving greenspace
- Safety of pedestrians, cyclists, and trail users
- Disruption to traffic, businesses, residents during/post-construction
- Noise to sensitive areas

Economic Environment
- Relative capital costs
- Operation and maintenance costs
- Internal / External funding sources
- Cost of flood damage
- Property impacts

Approvability
- Agency and utility permits
- Existing/future designated land use
- Municipal planning policies

Functionality
- Flood risk
- Erosion risk
- Flexibility to meet future needs

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Meeting Notes

Date: September 25, 2023 from 2:00 p.m. to 4:00 p.m.

Meeting at: Microsoft Teams Meeting

Ref: City of Kitchener (City) stormwater management projects meeting with Mississaugas of the Credit First Nation Department of Consultation and Accommodation

Purpose

- To engage in Municipality-to-Nation relationship building and seek feedback on the Hidden Valley Flood Control EA alternative solutions.
- To answer questions and learn from the Mississaugas of the Credit First Nation

Attendees

Mississaugas of the Credit First Nation, Department of Consultation and Accommodation:
Abby LaForme, Consultation Manager

City of Kitchener, Planning:
Carrie Musselman, Senior Environmental Planner
Barbara Steiner, Senior Environmental Planner

Regrets
Bu Lam (Director, Sanitary & Stormwater Utilities)
Mark LaForme (Director, DOCA)
Adam LaForme (Supervisor, Archaeological Operations

City of Kitchener, Sanitary & Stormwater Utilities:
Nick Gollan, Manager of Planning and Programs
Samantha Brickman, Supervisor of Capital Programs
Sarah Anderson, Engagement Associate
Colin Funk, Engagement Support Student
Selah Woelk, Engagement Support Student

City of Kitchener, Development Engineering
Juan Carlos Reyes, Manager
Monica Mazur, Project Manager

Agenda

1. WELCOMING REMARKS

Sarah Anderson welcomed Abby LaForme to a more informal meeting and invited everyone to introduce themselves.

Abby said that there is nothing she wanted to add to the agenda. They are happy with everything that is being conducted. They are here to listen and hear the updates.

2. HIDDEN VALLEY FLOOD CONTROL ENVIRONMENTAL ASSESSMENT ALTERNATIVE SOLUTIONS

Monica Mazur presented the Alternative Solutions for the Hidden Valley Flood Control EA

Background (see attached slides for additional information)

a. The EA focuses on a subwatershed just upstream of the Grand River. The majority of the subwatershed is currently uninhabited. It contains a provincially significant

wetland, fish, deer, beavers, and other wildlife habitat. There is a flood and erosion vulnerable area at the downstream part of Hidden Valley Creek at Hidden Valley Road.

b. The Master Land Use Study was completed in 2019.
c. The EA is a part of the Secondary Planning Process. There are also a Stormwater Management Strategy and Source Protection/Intake Protection Zone study included in this Secondary Plan process

3. Phase 1 of the EA was completed in June 2023. The EA is meant to explore alternatives and select a preferred solution for flood risk reduction. Potential Alternative Solutions:
    a. Alternative 1: Do Nothing
        i. Required to be considered by provincial EA processes
        ii. Increased erosion and washouts and flooding would continue
    b. Alternative 2: Reduce flows upstream of wetland
        i. Implement stormwater management (SWM) facilities (e.g. ponds) upstream of the wetland
        ii. Create a SWM facility before development or require developers to implement SWM to overcontrol flows
        iii. Could negatively impact the wetland by reducing inflows to the wetland. Wetlands are complex systems, and this could have a negative impact on habitat.
    c. Alternative 3: Flow control structure in Wetland
        i. Adding an engineered concrete berm or dam downstream of the wetland
        ii. This solution is the least favourable for the City: it's very invasive, it would be difficult to get regulatory approval, and it would have negative impacts on the wetland habitat. We are moving away from hard engineering approaches towards naturalized solutions.
    d. Alternative 4: Conveyance improvements downstream of wetland
        i. Replacing culverts with infrastructure such as a bridge. Expanding and naturalizing the channel
        ii. This would be an opportunity to restore habitat connectivity, open up the channel as the current culvert is a barrier
        iii. This would prevent future road washouts and creek erosion at Hidden Valley Road.
4. Evaluation Criteria
    a. Integrating MCFN feedback into the EA criteria
        i. Integrating Indigenous knowledge and priorities
            1. Looking for ways to bring the wild back to developed areas (ex. Replacing the culvert and making the stream more naturalized)
            2. Showing reciprocity to the earth
5. Preliminary Evaluation of Alternatives presented in slides: Option 4 is preliminary preferred solution.
6. The City will share the preferred alternative report by email, likely in November [Delayed until winter 2024], and there will be a 30-day response period for feedback on the preferred alternative.

MCFN DOCA feedback:

Preference:

- Prefer the naturalization option on Option Four. Option Four does not help the residents at the other site, though. If it's anything like the Montgomery Creek restoration, I'm on board.
- Not at all in favour of alternative three.
- Alternative 4 is more geared toward natural species and habitat, and that's what we're all about. I have no questions, concerns, or problems with Alternative 4.

Request:

- Please share the EIS report once it's completed, so I have it on file. If we increase our staff capacity for reviewing environmental reports, we will have the new staff review it. I look for buffering, and species at risk is where it should be. That's all I can offer for involvement as far as environmental work at this point.
- Please remind the landowner/developer to contact MCFN about the stage 2 archaeological assessment.

Q: I thought you couldn't develop in provincially significant wetland areas?
A: None of the development will happen in the protected area. All of the land in green (on the map) is protected. The development is surrounding this area, but not within the provincially protected lands.

Q: What impact would Alternative 3 have on the beaver dam?
A: It would be very destructive. This is known as a "hard engineering approach". This would have been a common approach 50-60 years ago. Now we look for naturalized approaches. In theory, though this could be effective at reducing flows, it would have many other negative consequences on the natural environment. Also, since the wetland is so complex, it would be difficult to build and design.

Q: Regarding Alternative 4, is it basically the same idea that we saw in the park at our in-person meeting?
A: Yes. The idea is that we could renaturalize the culverts, recognizing that this would improve the flooding situation at the road, but not at the private driveway upstream.

Q: Do the property owners upstream of the public road have culverts in their area already, or would putting in culverts help their flooding?
A: Yes, the property owners upstream have culverts on their property. Due to the channel slope and distance from the private culvert crossings, the proposed culvert improvements at Hidden Valley Road presented in Alternative 4 would not impact flood levels at the private driveway/ culverts

Q: With the other studies that you are working for, what project is that for?
A: Stage 1 archaeological assessment was completed in the areas that are developable. This is the report we shared with Adam and the DOCA team. The Stage 2 assessment will not be completed until the development plans/designs are finalized.

Q: Usually when a project gets to a Stage 2 Archaeological Review, MCFN likes to be involved in the field work, so I wanted to ask when that was happening so I can inform Adam.
A: The Stage 2 Archaeology Review isn't within scope of this project. We are currently in the process of setting the rules for the development application through the secondary plan. The landowner will be responsible for the Stage 2 archaeological study, rather than the municipality. The landowner is awaiting the City's rules for development through the secondary plan.

Q: Has there been an EIS done for the development sites?

A: Yes, an EIS has been completed for the development sites. This is a very well-studied feature in the City with historical EIS's dating back to 1979. We are now waiting for the secondary plan to be completed. This will give us a set of rules for the landowner/developers. Then the landowner will be responsible for the Stage 2 study, rather than the city.

Q: Can you put a bird in the developers' ear about contacting MCFN when they want Stage 2 to begin? Does the city have a policy to inform rights holders when these processes begin, and do they tell consultants?

A: In recent years, it has become more habit or regular. As we transition to having more involvement by rightsholder's , the "birdie" often comes from the archaeological consultants themselves. They have usually encountered this request or worked on a similar project elsewhere. Kitchener Planning will likely be putting policies in the secondary plan that would help ensure accountability . We haven't done a secondary plan for greenfield development in 10 years, so we are re-evaluating our policies.

7. **QUESTIONS FOR KITCHENER'S CEMETERY TEAM**

There's no urgency around this, and we can add it to our agenda next time, when Adam can join us.

8. **ROUNDTABLE**

Sarah

- With DMAF projects we're noticing many of the stronger reactions from the community have been tempered as we show that we are committed to collaborating with the community on project outcomes. People are more on board with the environmental objectives for the project, now that we are also addressing the community's objectives.
- The change in engagement approach is changing people's perspectives of the projects

Q: Were they able to give their input and feel more comfortable?
A: Yes. We set up park pop-ups this summer, with ice cream and the engineering consultants available for questions and to provide context. We also asked kids questions of what their hopes are. Lots of them are very excited about aquatic habitat. We invited the neighbourhood to form a community resource group to work more closely in the design process.

Samantha

- As part of DMAF, 50% of the projects are related to road reconstructions. For these projects, we add Low Impact Development
- Within the road reconstructions, there are Planning and Engineering team's exploring placemaking adjacent to some of these projects. They are interested in involving rights holders. This is in the beginning stages, there's no budget set yet. At a high level, we're hoping to have some specific locations to talk about next meeting [Update: Sarah and Sam clarified subsequently that this process will be much slower than anticipated and may or may not move forward in 2024]. We want to know how you might be interested in this.
- Part of this development might have to do with installing low-impact development
- Many of the projects are also close to our projects, including the road that we parked on when you visited the park.

Q: Would this be road widening?
A: No, the width of the right of way doesn't change. As infrastructure ages it needs repairing, and now we are often installing low impact development.

Abby: I think our interest would be if there was any ground disturbance, ground impacts.

The placemaking would be installing signage, plaques, etc. Is that something you would be interested in for park areas? Including your perspective in park areas through historical signage, planting signage?

Abby: I can take that idea and see what Mark says. We have a traditional knowledge keeper, he could give you ideas about signage. For plantings, we could talk to the natural design team. I will take this idea with me and see if they want to go with it.
Is that something you're interested in, for parks areas, to have signage, historical signage, planting signage?

Sarah: Yes, we want to do that for projects moving forward. Integrating MCFN's voices, SNGR voices, and urban Indigenous perspectives through signs and plantings and art. Facilitating representation in those spaces.

We have some current road reconstruction projects where we are doing plantings, etc. We could share a photo of that, and a few sentences about that project.

ACTION ITEMS

2.1. City to send EIS report once completed.

2.2. City to review changes to secondary plan policies to address need for more accountability for developers to communicate with rights holders regarding the Stage 2 archaeology field work.

3.1. Add questions about cemeteries for Adam to next meeting agenda with MCFN. [Delayed until 2024]

4.1. City to send photo, project description of a road reconstruction with low-impact development plantings.

Meeting Notes

Date: September 29, 2023 from 10 a.m. to 12 p.m. **Meeting at:** Microsoft Teams Meeting

Ref: City of Kitchener (City) Stormwater and Sanitary Utilities meeting with Six Nations of the Grand River (SNGR) Consultation and Accommodation Process team

Purpose

- To engage in Municipality-to-Nation relationship building and seek feedback on Sanitary & Stormwater Utility projects and Developmental Services (Engineering and Planning) projects.
- To answer questions and learn from the SNGR Consultation and Accommodation Process team

Attendees

Six Nations of the Grand River, Consultation & Accommodations Process Team:
Lonny Bomberry, Director of Lands and Resources

Tanya Hill-Montour, Archaeology Supervisor
Dawn Russell, Consultation Administrative Assistant

Peter Graham, Consultation Supervisor
Daylon Gee, Land Use Officer
Tayler Hill, Director Trainee
Lauren Jones, Manager of the Wildlife and Stewardship Office
Lauren Vanderlingen, Wildlife Stewardship Assistant

City of Kitchener, Sanitary & Stormwater Utilities:
Samantha Brickman, Supervisor of Capital Program
Chris Nechacov, Project Manager
Sarah Anderson, Engagement Associate
Colin Funk, Engagement Support Student
Selah Woelk, Engagement Support Student

City of Kitchener, Development Engineering
Juan Carlos Reyes, Manager
Monica Mazur, Project Manager

City of Kitchener, Development Services
Natalie Goss, Manager of Policy and Research
Richard Kelly-Ruetz, Senior Planner

Agenda

1. **WELCOMING REMARKS**

Sarah Anderson welcomed all participants, and said that she always is remembering Six Nations' rights and relationship with the water, and noted how our work relates to the water. Lonny Bomberry, Tanya Hill-Montour, and Dawn Russel shared stories about the Grand River and how polluted the Grand River has become. They shared how extremely important the water is for the health and wellbeing of humans and non-human beings.

Sarah Anderson thanked all participants from Six Nations for joining the City on the day before National Day for Truth and Reconciliation. All participants introduced themselves, their roles in their organizations, and shared a personal connection to water.

1. **HIDDEN VALLEY FLOOD CONTROL ENVIRONMENTAL ASSESSMENT ALTERNATIVE SOLUTIONS**

- Monica Mazur presented the Alternative Solutions for the Hidden Valley Flood Control EA. Background (see attached slides for additional information)
    - The EA focuses on a subwatershed just upstream of the Grand River. The majority of the subwatershed is currently uninhabited. It contains a provincially significant wetland, fish, deer, beavers, and other wildlife habitat. There is a flood and erosion vulnerable area at the downstream part of Hidden Valley Creek at Hidden Valley Road.
    - The Master Land Use Study was completed in 2019.
    - The EA is a part of the Secondary Planning Process. There are also a Stormwater Management Strategy and Source Protection/Intake Protection Zone study included in this Secondary Plan process
- Phase 1 of the EA was completed in June 2023. The EA is meant to explore alternatives and select a preferred solution for flood risk reduction. Potential Alternative Solutions:
    - Alternative 1: Do Nothing
        - Required to be considered by provincial EA processes
        - Increased erosion and washouts and flooding would continue
    - Alternative 2: Reduce flows upstream of wetland
        - Implement stormwater management (SWM) facilities (e.g. ponds) upstream of the wetland
        - Create a SWM facility before development or require developers to implement SWM to overcontrol flows
        - Could negatively impact the wetland by reducing inflows to the wetland. Wetlands are complex systems, and reduced inflows could have a negative impact on habitat
    - Alternative 3: Flow control structure in Wetland
        - Adding an engineered concrete berm or dam downstream of the wetland
        - This solution is the least favourable for the City: it's very invasive, it would be difficult to get regulatory approval, and it would have negative impacts on the wetland habitat. We are moving away from hard engineering approaches towards naturalized solutions.
    - Alternative 4: Conveyance improvements downstream of wetland
        - Replacing culverts with infrastructure such as a bridge. Expanding and naturalizing the channel
        - This would be an opportunity to restore habitat connectivity, open up the channel as the current culvert is a barrier
        - This would prevent future road washouts and creek erosion at Hidden Valley Road.
- Evaluation Criteria
    - Integrating SNGR feedback into the EA criteria
        - Integrating Indigenous knowledge and priorities
            - Looking for ways to bring the wild back to developed areas (ex. Replacing the culvert and making the stream more naturalized)
            - Showing reciprocity to the earth

- Preliminary Evaluation of Alternatives presented in slides: Option 4 is preliminary preferred solution.
- The City will share the preferred alternative report by email, likely in November [Delayed until winter 2024], and there will be a 30-day response period for feedback on the preferred alternative.

SNGR CAP team feedback:

Recommendations

- Make sure that a strong baseline is taken, both for aquatic life and terrestrial life, so that you are making a decision based on all of the information
- If there is any spawning habitat nearby, that should be considered
- For restoration, reach out to Kayanase, the Six Nations nursery and greenhouse

Concerns

- Six Nations is generally against putting infrastructure into any wildlife corridors, which is involved in all of the options other than Alternative 4
- Initial thought was, "why not just replace the culvert." Major concern is how the culvert is designed to ensure that it can hold the bankfull width, and ensure the passage of both aquatic and terrestrial life
- It doesn't make sense to try and control the natural, healthy system - the Indigenous perspective would be to work around the river instead of trying to force the river

Preference

- We have a strong preference for Alternative Four

City staff clarified that the recommended design would include consideration of methods to enhance habitat connectively and fish passage, and ensuring the culvert would be wide enough to hold the bankfull width, if technically feasible.

Q: You mentioned that this supports future development. What is the development slated for this area?
A: The land is privately owned, and we don't know exactly what the property owner would propose to do on this area. This is more a higher-level land use project that allows a developer to bring forward a proposal for development. We as the City are currently trying to set a precedent for what we want to see there, likely middle-density development and some commercial with protection of the environmental feature in the middle.

Q: This is also a natural heritage area? How did this area get this designation?
A: The wetland in the area is a provincially significant wetland, a number of streams congregate there before unloading into the Grand River. The term "Natural Heritage" is a term that we use to describe the importance of this area as an environmentally valuable feature.

Next steps: The consultants will provide specifications for the design alternatives in the Preferred Alternatives Report to be shared by email in November [update: Delayed until winter 2024].

2. GATHERING ARCHAEOLOGY QUESTIONS FOR KITCHENER'S CEMETERY TEAM

- We have heard interest from rights holders in dialogue with cemetery teams. Does SNGR also have interest in connecting with Kitchener's cemetery team? We can meet directly with Tanya to find out what interest you have in this.
- SNGR used to meet with the old Parks director, but haven't met with the new Parks director yet

SNGR CAP team feedback:

- Tanya Hill-Montour would be interested in another meeting for specific context.
- SNGR likes to stay involved in conversations adjacent to cemeteries.
- There's a lot of Indigenous burials in the Kitchener area. SNGR keeps Indigenous burials in-situ, SNGR doesn't re-intern into a new burial ground.

Q: Have you had previous contact or discussion with the cemeteries team?
A: When an archaeological assessment is conducted, then Six Nations is reached out to in particular.

Q: When meeting with Niall and the Parks Team in the past, did this include discussions with the cemeteries team?
A: I don't think so. Members of the cemetery side did not come to a meeting in 2021.

Q: Inviting them into a meeting would be welcome and seeing what comes from the discussion?
A: Yes!

3. ROUNDTABLE OF UPDATES

Sarah shared that the City appreciated Lauren V's feedback on the Bundle D creek restoration projects. Lauren suggested study parameters that will strengthen the data collected and the chance to expand the impact of the study. Six Nations appreciates providing feedback and help setting the terms of EISs.

4. NEXT STEPS AND ACTION ITEMS

2.1. City to send Preferred Alternative Report for the Hidden Valley EA to SNGR likely in November [Delayed to winter 2024].

3.1. Next meeting will be in-person, and the City will take the SNGR CAP team out to lunch.

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Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

NOTICE OF PUBLIC INFORMATION CENTRE

Municipal Class Environmental Assessment
Hidden Valley Flood Risk Reduction

The Study: The City of Kitchener (the City) retained Matrix Solutions Inc. (Matrix) to provide a Municipal Class Environmental Assessment (EA) for flood risk reduction in the Hidden Valley Creek subwatershed. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community. The project is being carried out in accordance with the requirements of the Environmental Assessment Act and is planned under Schedule B. The intent of this project is to identify alternative solutions to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed.

Public Information Centre: A key component of the EA process is consultation with interested stakeholders (public, landowners, and agencies). As part of this study, consultation is being undertaken, and your participation is encouraged. A Public Information Centre (PIC) is planned to share the study background; explain the Environmental Assessment process; outline existing conditions; evaluation criteria; and the alternative solutions.

Public Information Centre
October 12, 2023
Drop-in format from 5 – 8 p.m.
Centreville Chicopee Community Center
141 Morgan Avenue, Kitchener
www.kitchener.ca/hiddenvalley
www.engagewr.ca/hidden-valley-flood-ea

We'd like to hear from you: Your input is important to us and can shape the project decision. We invite you to join our upcoming PIC to learn more about the alternative solutions, ask our team questions, and provide feedback. Listening to, and learning from, Indigenous Nations, residents and stakeholders is part of the process. If you are unable to attend the PIC, the presentation boards will be made available on the project website. To submit a comment or question via email, or if you have accessibility requirements to comment on the study, please contact one of the representatives below:

Monica Mazur, M.Sc., P.Eng.
Project Manager
Development Engineering
City of Kitchener
Phone: 519-741-2600 ext. 7135
hiddenvalley@kitchener.ca

Karen Hofbauer, M.A.Sc., P.Eng.
Principal Water Resources Engineer
Matrix Solutions Inc.
Phone: 226-314-1932
khofbauer@matrix-solutions.com

Please note that comments will be maintained for reference throughout the project and will become part of the public record. Under the Municipal Freedom of Information and Protection of Privacy Act and the Environmental Assessment Act, any personal information such as name, address, and telephone number included in a submission will become part of the public record unless the comments specifically request that such personal details not be included in the public record.
This notice was first issued on September 29, 2023.

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Matrix Solutions Inc.
A Montrose Environmental Company

Hidden Valley Flood Risk Reduction

Class Environmental Assessment

Sign-in Sheet

PUBLIC INFORMATION CENTRE 1

October 12, 2023

Name	Address	Contact Number
Scott	Country Lane Builders	
Steve	K. Smart Associates	
Jordon	Hofstetter Ave.	
Zaid	K. Smart Associates	
Peter		
Sidharth	Saddlebrook Court	
Jeff	MTE Consultants Inc	
Dora	Hidden Valley Road	
James	"	
Peter	Hidden Valley Rd.	
Amanda	Hidden Valley Rd.	

Disclaimer: Under the Freedom of Information and Protection of Privacy Act and the Environmental Assessment Act, unless otherwise stated in the submission, any personal information such as name, address, telephone number and property location included in a submission will become part of the public record files for this matter and will be released, if requested, to any person.

Hidden Valley Flood Risk Reduction
Municipal Class Environmental Assessment

October 12, 2023

Welcome to the Public Information Centre

- Please sign in to join our project email list
- Review the posters and displays
- You are encouraged to share your experiences and fill out a comment sheet
- Project staff are here to listen and answer your questions about this study
- Visit us at: www.engagewr.ca/hidden-valley-flood-ea

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A Montrose Environmental Company

Problem and Opportunity Statement

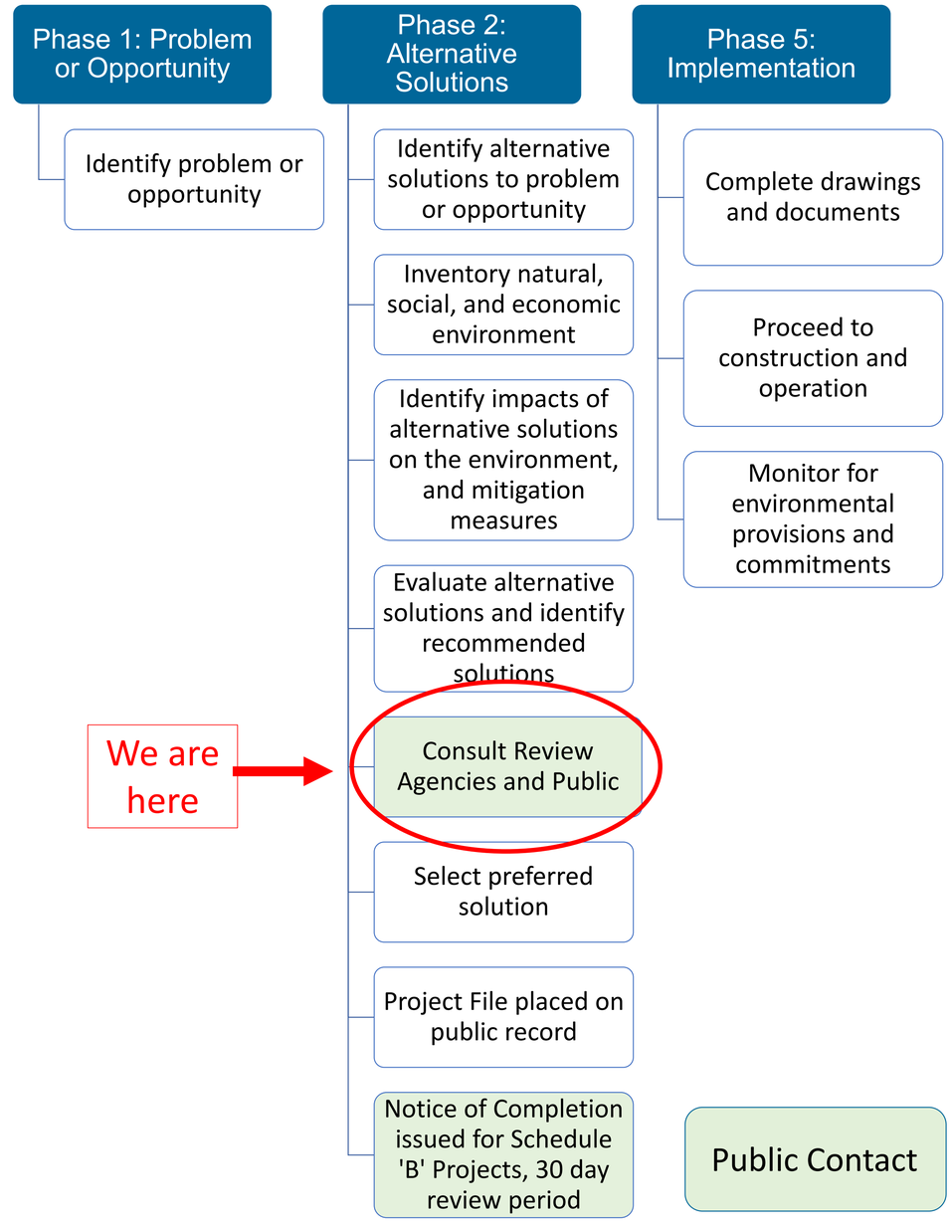
There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road.

This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.

Municipal Class Environmental Assessment Process

- This project is being completed following Schedule B of the Municipal Class Environmental Assessment Process

- Schedule B includes only Phases 1 and 2 of the assessment process before proceeding to Implementation.



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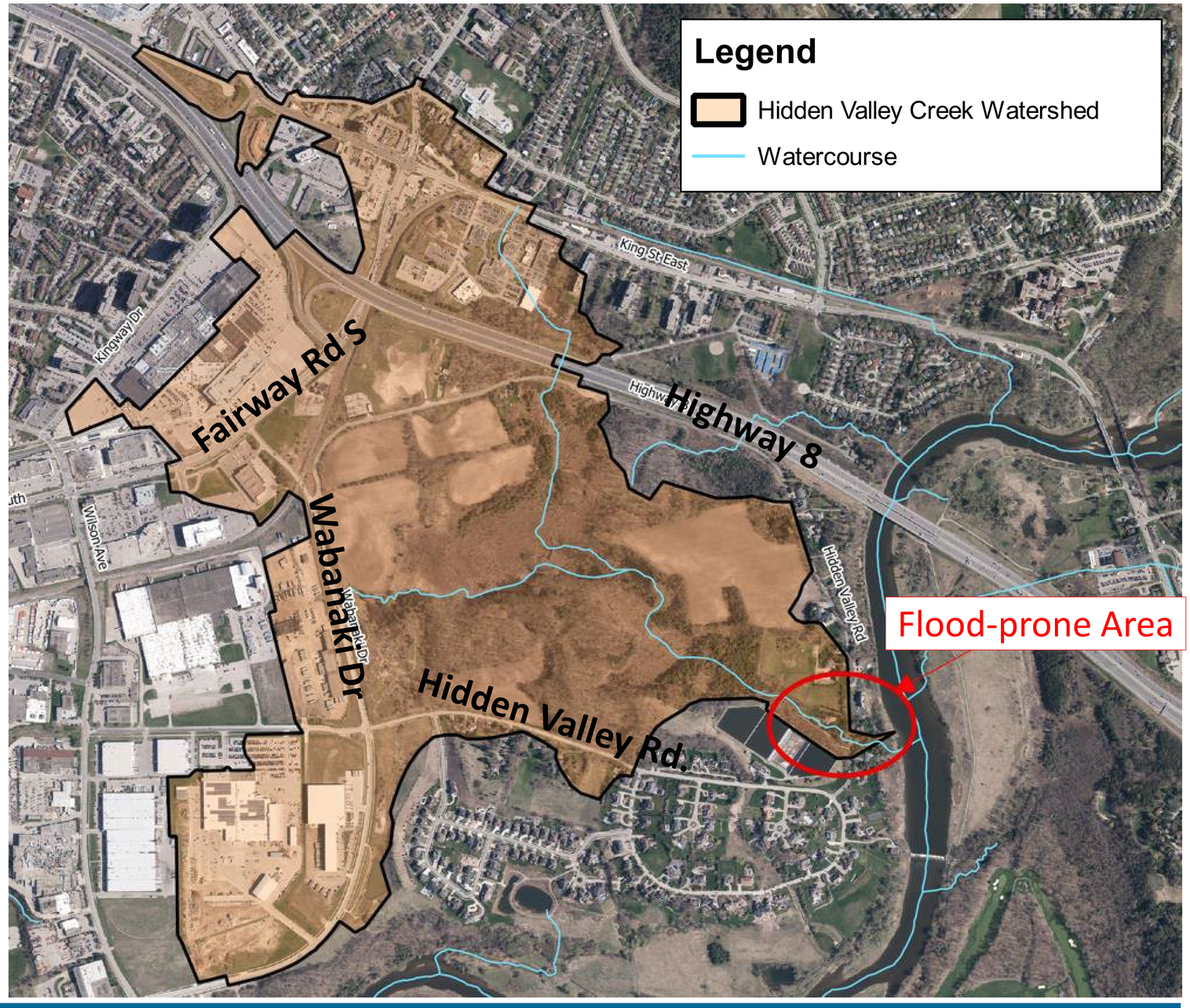
Study Area

- Hidden Valley Creek runs from Wabanaki Drive to the west and King Street East to the north, through a significant wetland / woodland complex, and outlets to the Grand River.
- Hidden Valley Creek receives drainage from a 190 ha catchment.
- The north and west headwaters of the catchment are developed with high density land use, the southeastern limits are low density residential. The remaining central portion of the catchment is undeveloped.



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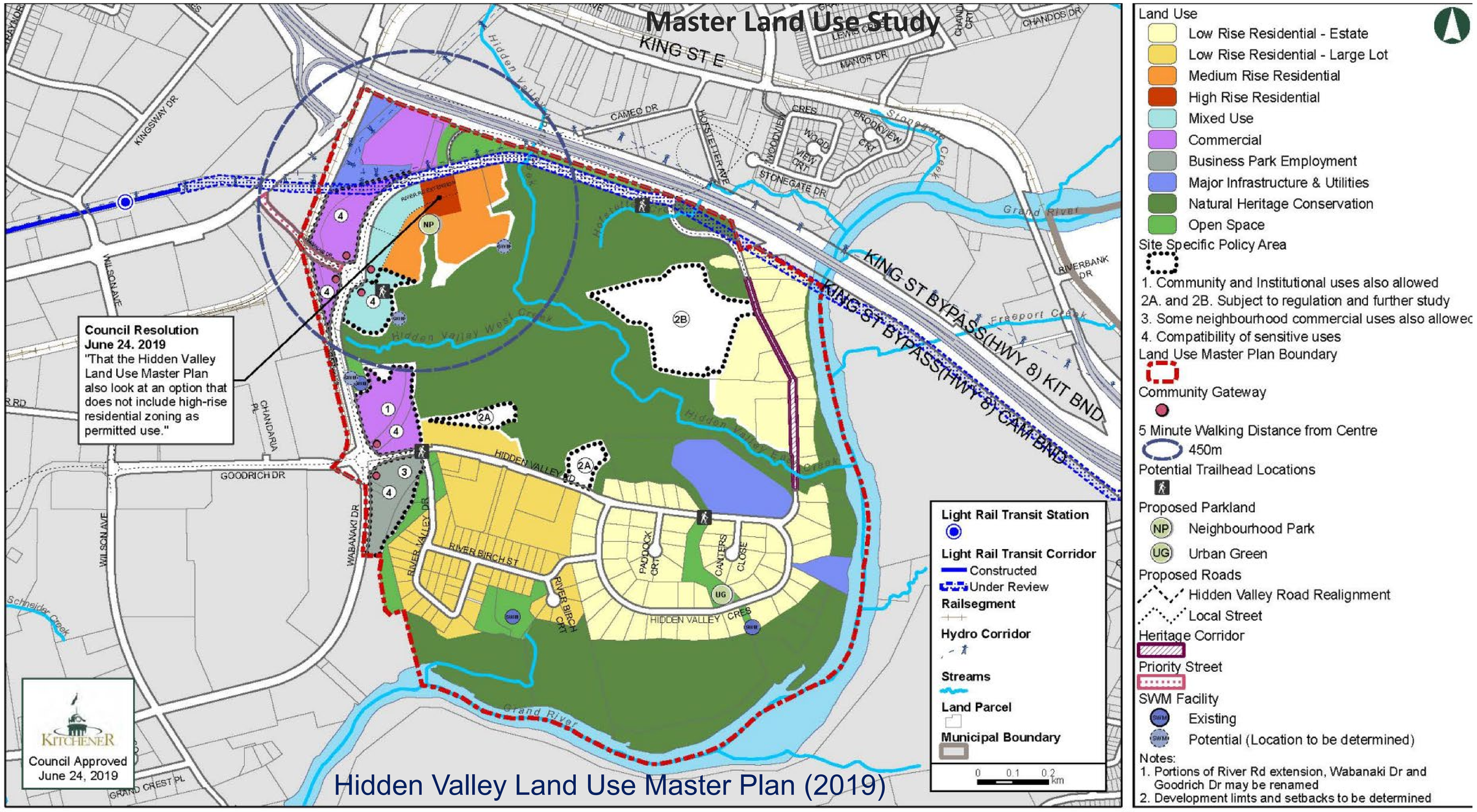
Planned Land Use within the Study Area



Hidden Valley Land Use Master Plan (2019)

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More Information on kitchener.ca/hiddenvalley

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Existing Conditions Understanding

- Hidden Valley Creek in southeast Kitchener has several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the subwatershed
- One of the Region's most significant environmental wetland complex is in the center of the subwatershed. This woodland/wetland complex holds classifications of a Provincially Significant Wetland (PSW), Environmentally Sensitive Policy Area (ESPA) and Core Environmental Feature (CEF).
- Areas in the downstream reaches of the subwatershed have experienced flood and erosion impacts related to both specific rainfall-runoff events and/or the release of natural debris-blockages (e.g., beaver dams or natural debris jams) within the wetland feature. Flooding and overtopping of Hidden Valley Road occurred in June 2013
- Future development is planned in the upstream reaches of the catchment which may impact flows to the wetland.
- The project objective is to define a solution to reduce existing flood risks and support future development in the Hidden Valley community.

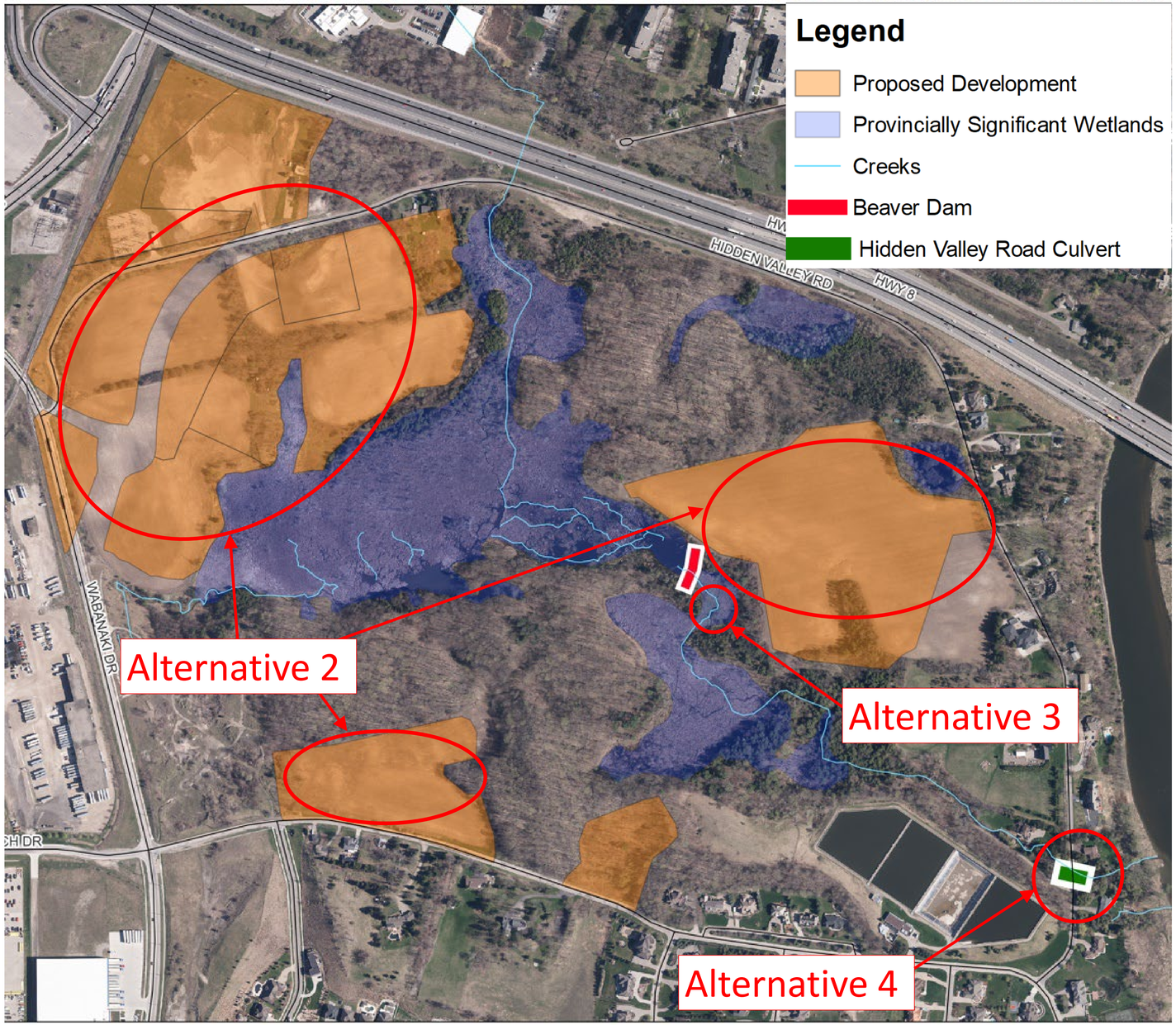
Alternative Solutions

Alternative 1
Do Nothing

Alternative 2
Reduce Flows Upstream of Wetland

Alternative 3
Flow Control Structure in Wetland

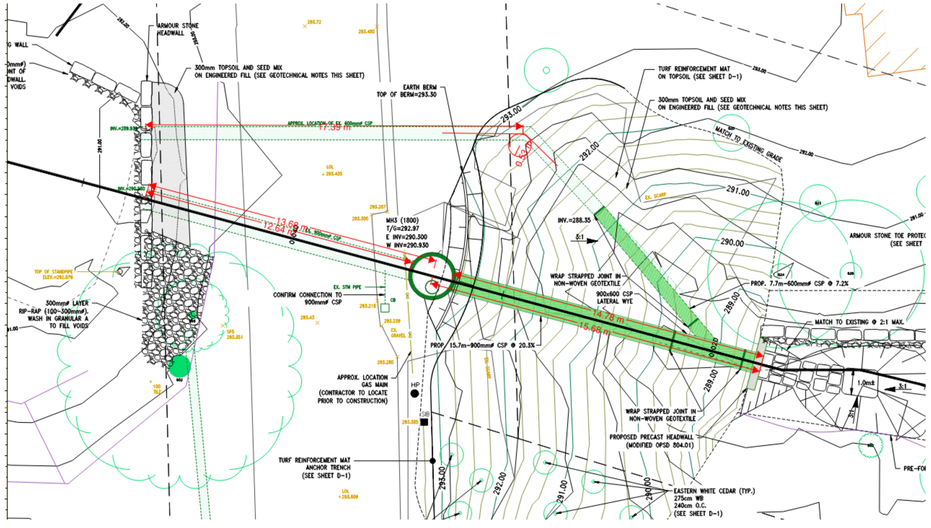
Alternative 4
Conveyance Improvements Downstream of the Wetland



Alternative 1 – Do Nothing

Erosion just upstream of Hidden Valley Road; potential source of material reducing capacity at road culverts

Headwall of Hidden Valley Road crossing; note almost complete submersion of northern culvert by sedimentation



Existing culvert configuration at Hidden Valley Road. 600 mm CSP pipe and 900 mm CSP pipe

- No repairs or retrofits would be undertaken
- Hidden Valley Road would continue to overtop under large flow events exceeding current culvert capacity
- Washouts, flooding, and erosion would continue

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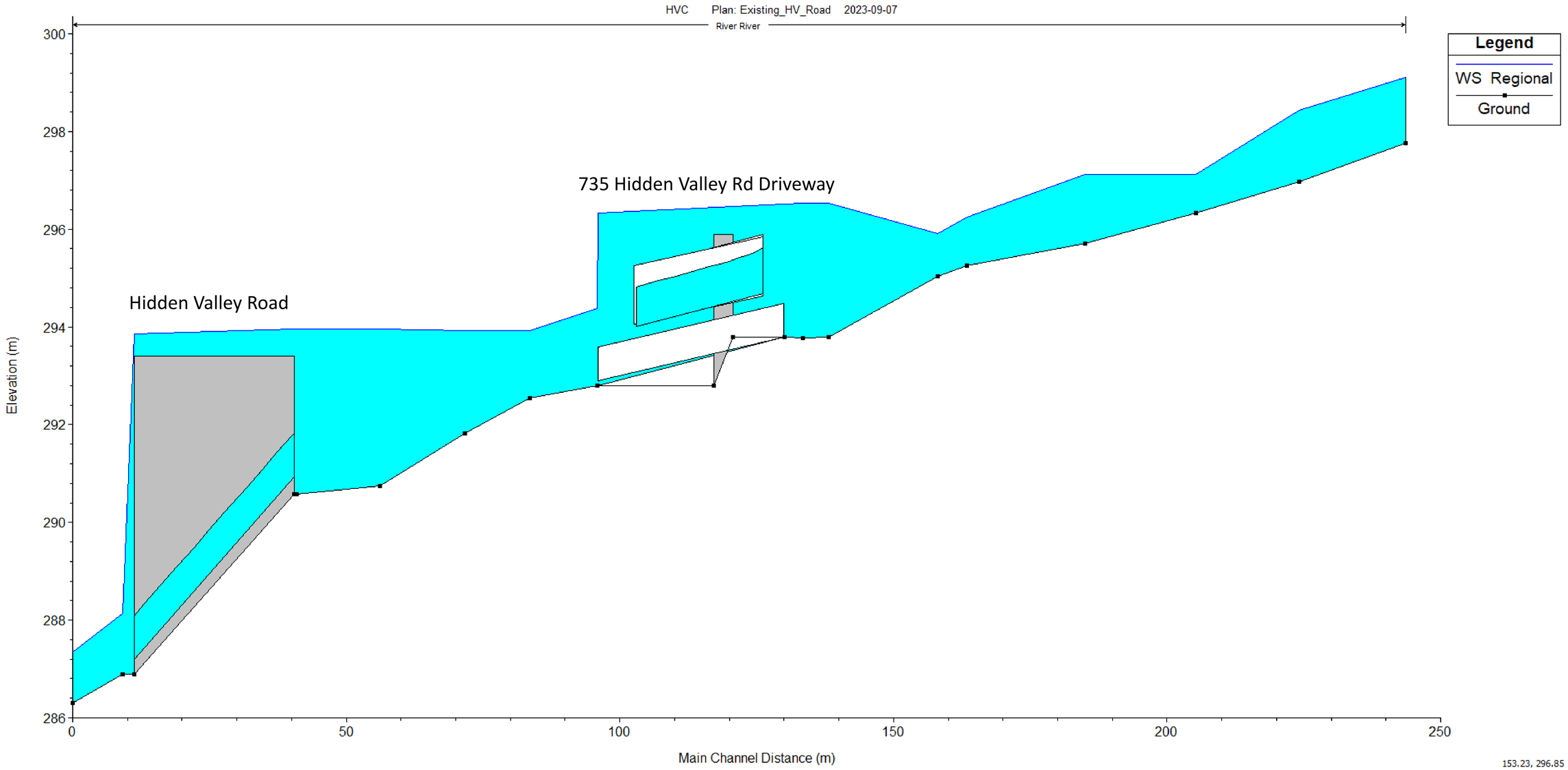
Alternative 1 – Do Nothing (continued)



Existing Hydraulic Profile for Regional Flow: Overtopping of Private Driveway and Hidden Valley Road

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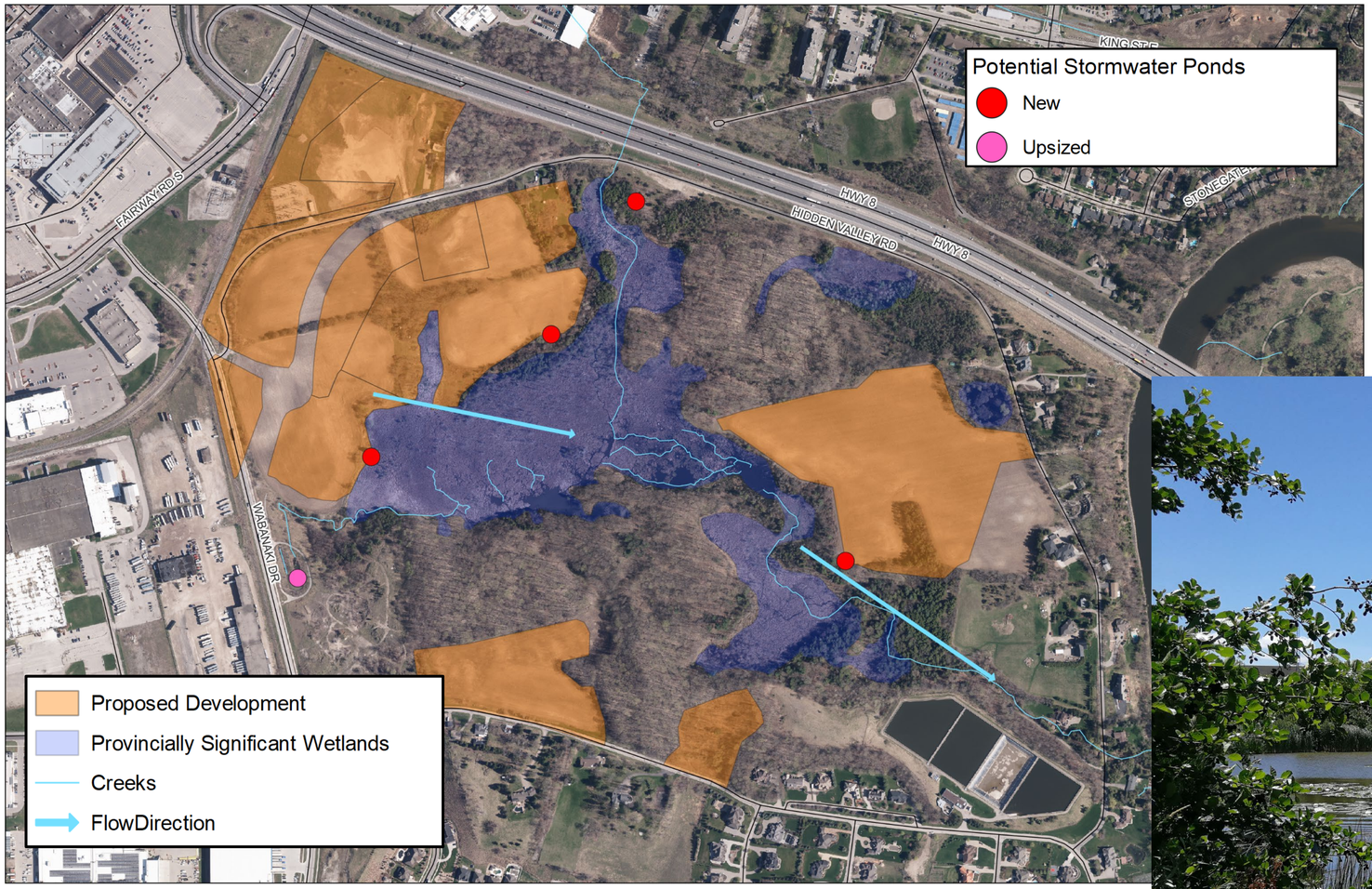
Alternative 2 – Reduce Flows Upstream of Wetland



Provide stormwater management (SWM) peak flow control in the upper catchment, above the ESPA/PSW

Could include new SWM for existing developed areas, or over-sized SWM for potential future development areas; multiple locations

Example Stormwater Pond (Pond 17)(Kitchener, 2018)

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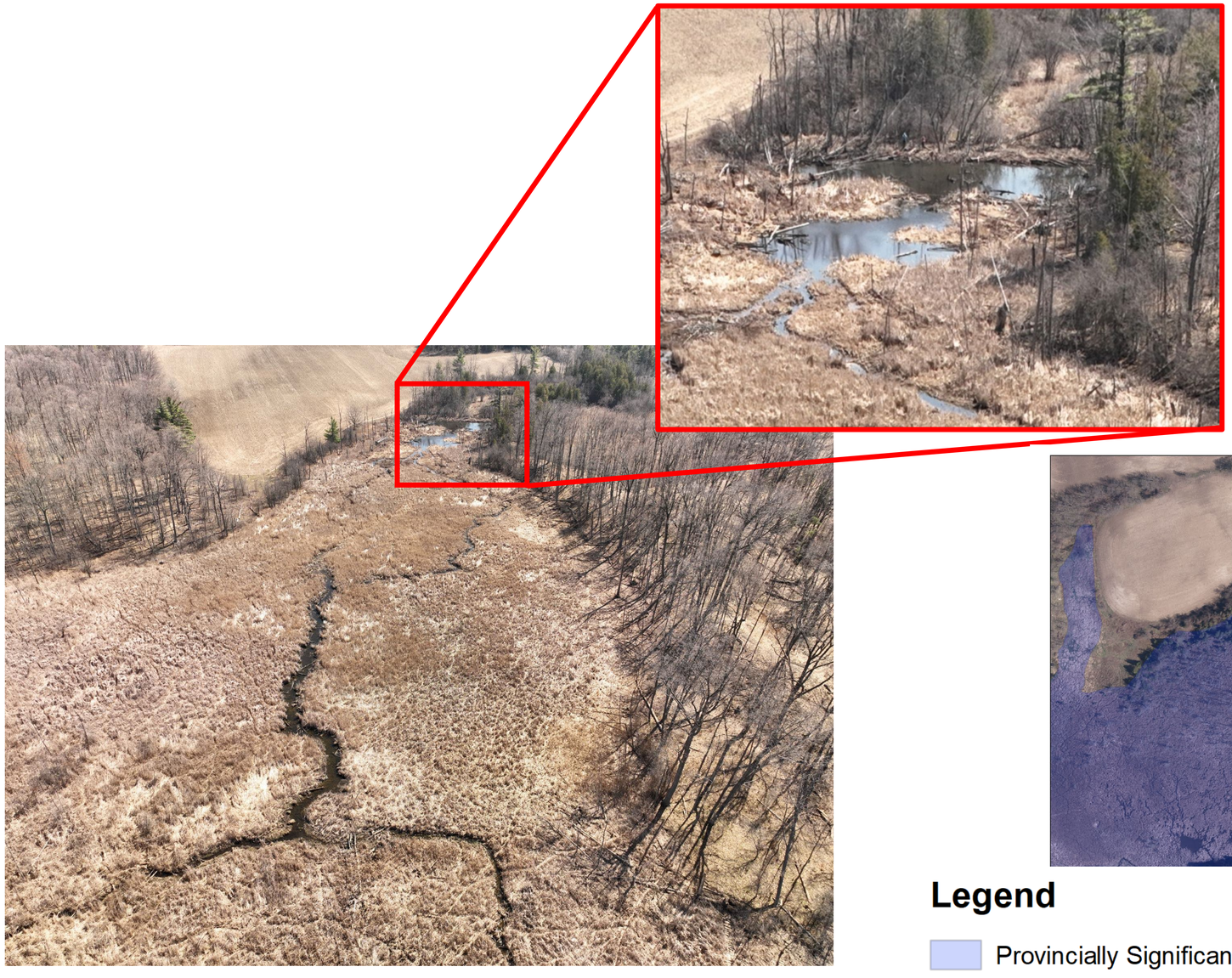
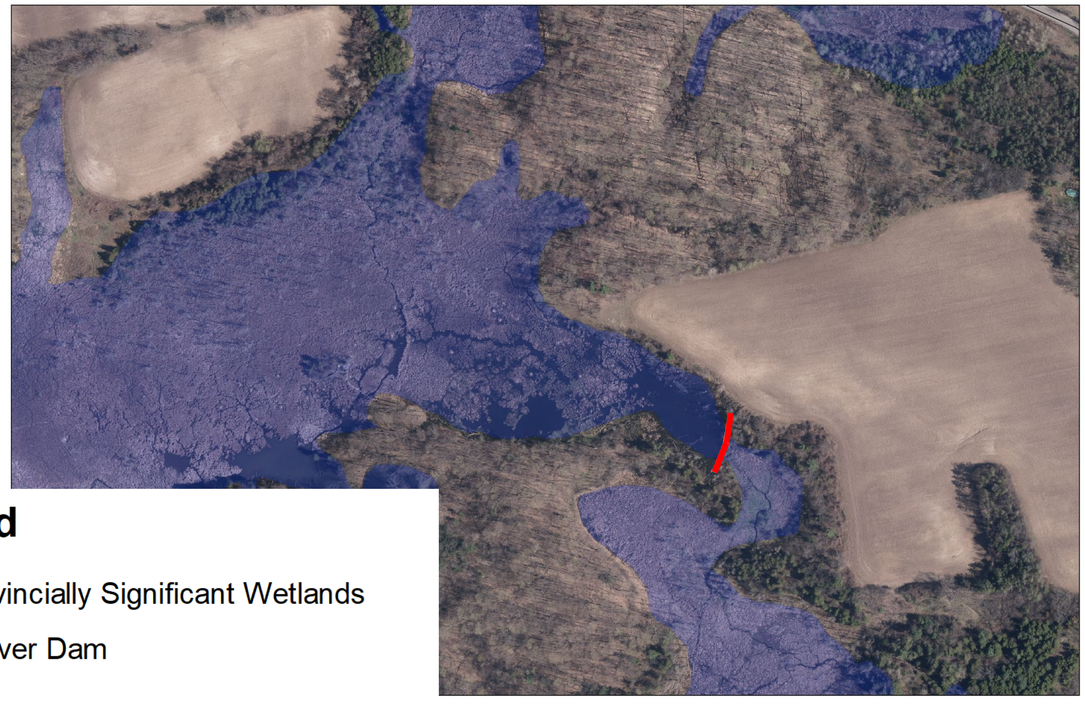
Alternative 3 – Flow Control Structure in Wetland



Replace flow control functionality of existing beaver dam with engineered structure (berm /dam)



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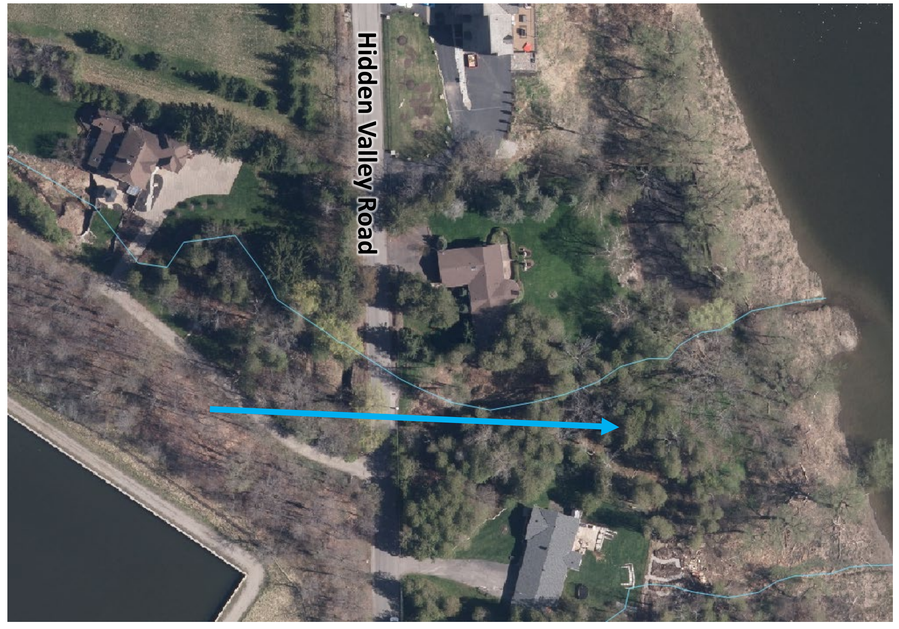
Alternative 4 – Conveyance Improvements Downstream of Wetland

- Culvert replacement at Hidden Valley Road
- Watercourse stabilization efforts in immediate vicinity of road crossing
- Reduced erosion downstream of Hidden Valley Road because of new culvert



Example Box Culvert

Source: https://www.concastpipe.com/innovative-box-culvert-design-supports-critical-fish-habitat-barefoot-box-culvert/

Example Watercourse Stabilization

Source: https://trca.ca/conservation/restoration/streams-valley-lands//

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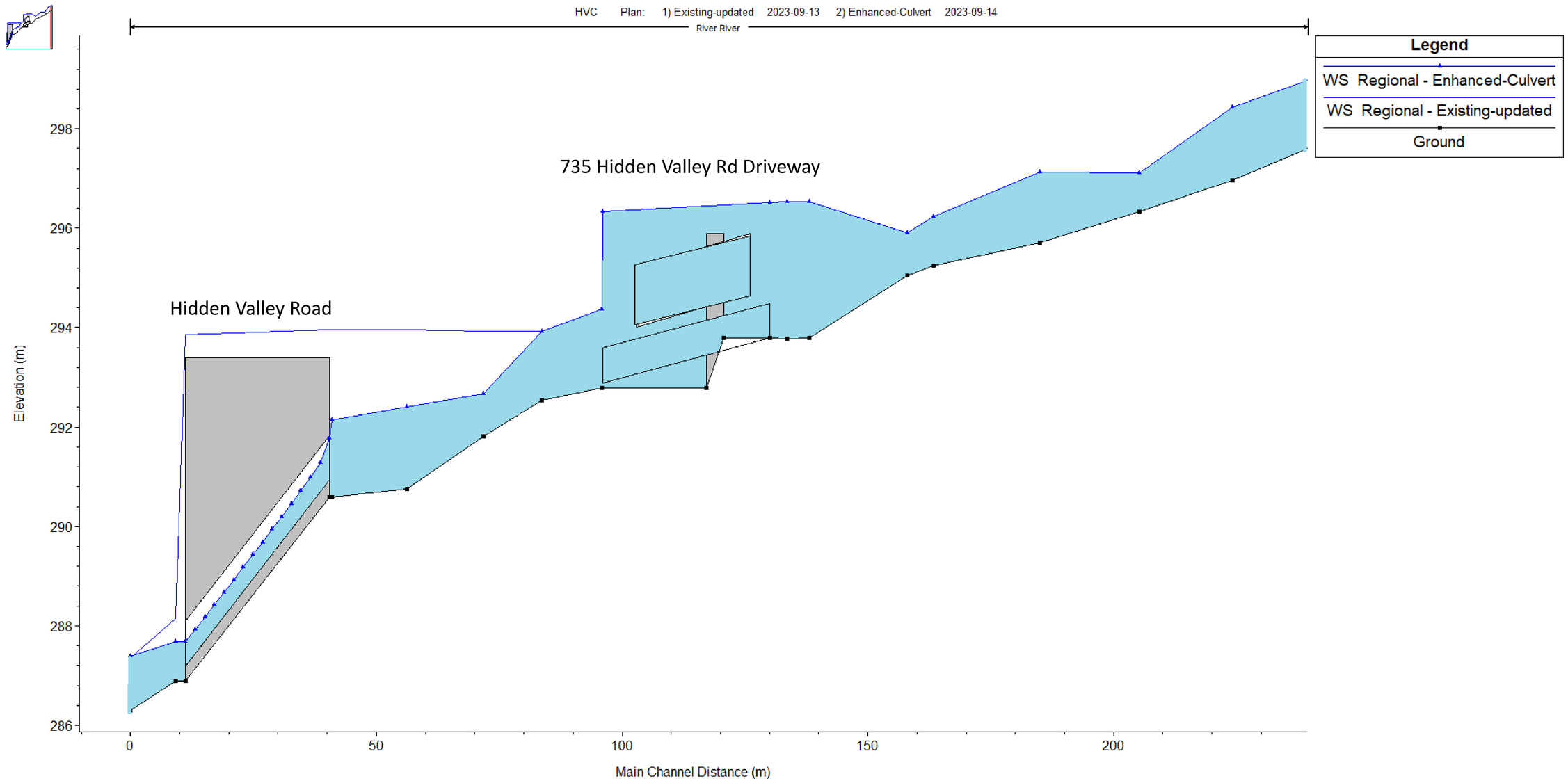
Alternative 4 – Conveyance Improvements (continued)



Potential Hydraulic Profile for Regional Flow: Overtopping of Hidden Valley Road Eliminated

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Evaluation Criteria

Aquatic Environment

- Fish and fish habitat
- Surface water quality / quantity
- Groundwater quality / quantity

Terrestrial Environment

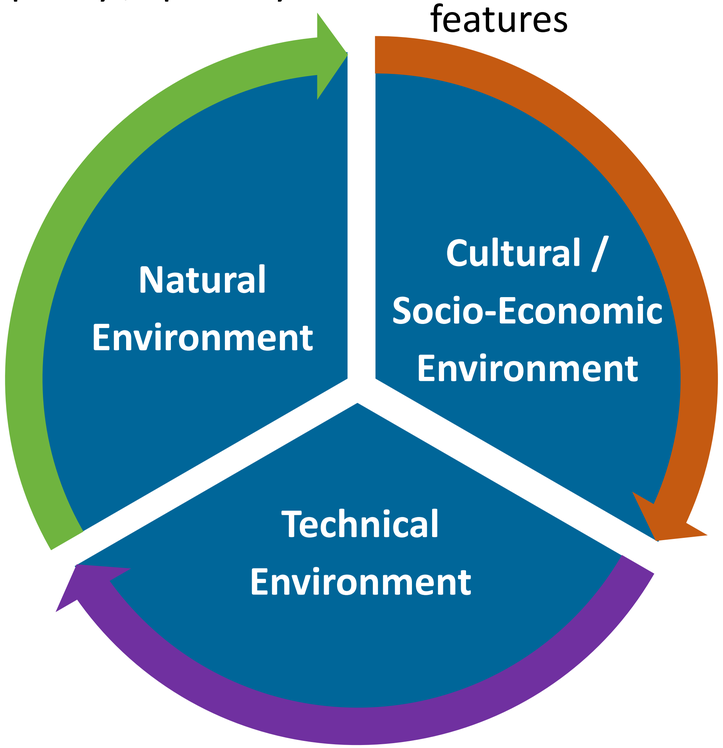
- Wetland ecology
- Wildlife/habitat
- Vegetation
- Trees or landscape

Climate Change

- Resilience to severe weather (flooding)
- Known climate change contributors

Constructability/Feasibility

- Construction duration
- Channel functionality during construction
- Soil conditions
- Groundwater control



Cultural Environment

- Archaeological impacts
- Built heritage
- Cultural landscapes / features

Approvability

- Agency and utility permits
- Existing/future designated land use
- Municipal planning policies

Social Environment

- Property impacts
- Recreational opportunities
- Maintaining / improving greenspace
- Safety of pedestrians, cyclists, and trail users
- Disruption to traffic, businesses, residents during/post-construction
- Noise to sensitive areas

Economic Environment

- Relative capital costs
- Operation and maintenance costs
- Internal / External funding sources
- Cost of flood damage
- Property impacts

Functionality

- Flood risk
- Erosion risk
- Flexibility to meet future needs

Preliminary Evaluation of Alternatives

	Alternative 1: Do-Nothing	Alternative 2: Reduce Flows Upstream of Wetland	Alternative 3: Flow Control Structure in Wetland	Alternative 4: Conveyance Improvement Downstream of Wetland
Natural Environment				
Socio-economic and Cultural Environment				
Technical Environment				

Legend

Low Impact	Low-to-Moderate Impact	Moderate Impact	Moderate-to-High Impact	High Impact
				

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Contact Information

Comments from this evening's PIC will be received until

October 27, 2023

Further ongoing study information is available at:

https://www.engagewr.ca/hidden-valley-flood-ea

If you would like to be included on the project mailing list please fill out a comment sheet.

Thank you for attending!

For questions and additional information, please contact:

Monica Mazur, M.Sc., P.Eng.

Project Manager

City of Kitchener

hiddenvalley@kitchener.ca

Phone: 519-741-2200 x 7135

Karen Hofbauer, M.A.Sc. P.Eng.

Project Manager

Matrix Solutions Inc.

khofbauer@matrix-solutions.com

Phone: 226-314-1932

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Matrix Solutions Inc.
A Montrose Environmental Company

Hidden Valley Flood Risk Reduction Class Environmental Assessment
Comment and Feedback Sheet – PIC – October 12, 2023

KITCHENER

Matrix Solutions Inc.
A Montrose Environmental Company

Your comments are appreciated. Please use this form to provide comments on any aspect of the project that you consider important. Please return your completed form to the front desk, or send by October 27, 2023 to:

Monica Mazur, M.Sc., P.Eng.
Project Manager
City of Kitchener
monica.mazur@kitchener.ca
Phone: 519-741-2200 x 7135

Karen Hofbauer, M.A.Sc. P.Eng.
Project Manager
Matrix Solutions Inc.
khofbauer@matrix-solutions.com
Phone: 226-314-1932

Please describe any flooding and/or erosion issues you are aware of related to Hidden Valley Creek. Please provide specific dates and locations if possible.

Do you have an opinion on relative weighting for each of the three main evaluation categories (natural, socio-economic / cultural, and technical)?

Please provide any additional comment on the study or information that may be useful for the study team.

K. Smart Associates has been retained by the owner of 730 Hidden Valley Road to assist with plans for a replacement home. The project team includes the home builder and geotechnical engineer.

At this time the preferred solution is Alternative 4, as this has the potential to reduce erosion risks along the creek downstream of Hidden Valley Road and adjacent to our client's property.

As discussed at the Information Centre, we have shared details about an existing easement in this section of the creek. We wish to have further discussions with the Class EA study team about stabilization efforts which may be appropriate downstream of the Hidden Valley Road culvert / crossing.

May we contact you to discuss the problems and/or information? Yes ☒ No ☐

Note: With the exception of personal information, comments provided above will become part of the public record and a copy of this document may be attached to future reports.

From: Karen Hofbauer
To: James [redacted], HiddenValley (SM)
Cc: Dora [redacted]
Subject: RE: [External] Questions Pertaining to the Hidden Valley Flood Risk Reduction EA
Date: Wednesday, October 4, 2023 4:31:56 PM
Attachments: image001.png

> You don't often get email from khofbauer@matrix-solutions.com. Learn why this is important

Hi James,
Thanks for reaching out, these are very good questions. I'm hoping that you will be able to attend our PIC next week as that will be the best opportunity to answer these questions and any others you may have. At the PIC we will have display boards and figures that we can use for speaking to your questions and concerns. Please connect with one of us at the PIC and we will be prepared for a personal conversation at that time.

If you are not able to attend the PIC let us know and we will make other arrangements.
Look forward to meeting you.
Karen

Karen Hofbauer, M.A.Sc., P.Eng. | Principal Water Resources Engineer

MATRIX SOLUTIONS INC. | A Montrose Environmental Company
7B, 650 Woodlawn Rd. W, Guelph, ON N1K 1B8
D 226.314.1932 | **C** 519.504.7517 | **T** 519.772.3777

From: James [redacted]
Sent: Sunday, October 1, 2023 10:36 AM
To: hiddenvalley@kitchener.ca; Karen Hofbauer <khofbauer@matrix-solutions.com>
Cc: Dora [redacted]
Subject: [External] Questions Pertaining to the Hidden Valley Flood Risk Reduction EA

Monica, Karen,

For background, Dora and I (James) are the owners of [redacted], one of the properties in the Flood-prone Area. Ours is the property the Hidden Valley East Creek runs through into the Grand River.

We are in the late planning stages of the development of a new home on the property. The floodplains on the property are probably the largest factor in our design process, so the study is both timely and likely of real consequence. I've attached a GRCA map of our property for reference.

Prior to the PIC on October 12, we thought we'd send some of our questions your way. We

appreciate that many of these questions you may not have answers to yet and some will be addressed at the PIC. Nonetheless, the questions are:

1. Do you have historical data on flooding events in the area? If so, can that be shared with us?
2. What data and modelling techniques are being used to assess flood risks and propose solutions?
3. Is climate change modelling factored into the flood risk assessments?
4. What are the alternative solutions being considered to mitigate flood risks?
5. How will these solutions affect the flood-prone properties specifically?
6. Is it possible the floodplain boundaries on our property could change?
7. What is the projected timeline for implementing the flood risk reduction measures?
8. What maintenance plans will be in place to ensure the effectiveness of the flood risk reduction measures?
9. What legal protections or responsibilities exist for property owners in the flood-prone area?
10. How will the effectiveness of the flood risk reduction measures be evaluated over time?

We appreciate that it may take many months (or years) to answer these questions fully. Nonetheless, we look forward to being involved in the process.

Regards,
James.

Sent via Superhuman

From:	robert
To:	HiddenValley (SM)
Subject:	Re: Feedback opinion.
Date:	Wednesday, October 25, 2023 6:40:16 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png image006.png image007.png image008.png

---

Thank you Monica for taking the time to read and reply to my input on this topic. Hope you have a wonderful day.

Get Outlook for Android

From: HiddenValley (SM) <HiddenValley@kitchener.ca>
Sent: Wednesday, October 25, 2023 2:24:28 PM
To: robert <[redacted]>
Subject: RE: Feedback opinion.

Hi Robert,

I am well, thank you. I hope you are enjoying the beautiful month of October.

Thank you for your input on the Hidden Valley area. In response to your question, while the Hidden Valley Flood Risk Reduction Municipal Class EA process will not be specifically exploring if biking or hiking trails would be permitted and how they might impact the natural features, other studies that are currently being undertaken to support the Hidden Valley Secondary Plan (zoning) will be considering trails and their potential environmental impact. Please follow www.kitchener.ca/hiddenvalley for more information. Although it's not something we're able to include in this particular project, we are taking your feedback into consideration, and I have passed on your feedback to the staff who are responsible for the Hidden Valley Secondary Plan.

Thanks,

Monica Mazur, M.Sc., P.Eng.

Project Manager| Development Engineering | City of Kitchener
519-741-2200 ext. 7135 | TTY 1-866-969-9994 | monica.mazur@kitchener.ca

From: robert <[redacted]>
Sent: Sunday, October 1, 2023 12:11 PM
To: HiddenValley (SM) <HiddenValley@kitchener.ca>

Subject: Feedback opinion.

> You don't often get email from [redacted] Learn why this is important

Hi Monica how are you, hope you had a great weekend. Would like to input on hidden valley area. I believe we should be focusing on making what is left of hidden valley into a natural park. Since city planning revolves around developers and profit gouging, there is very little consideration for future societal deprivation. Less greenspace with excessively increasing population equals a much less considerate society as many city's historic plans have proven. This should be an area for generations to enjoy and not just another little Oasis for the financially well off. Thank you and have a good day.

Monica Mazur

From: Karen Hofbauer <khofbauer@matrix-solutions.com>
Sent: Thursday, October 12, 2023 10:55 AM
To: Zaid Kashif Al Ghitta; HiddenValley (SM)
Cc: David [redacted] Steve [redacted], Scott [redacted], Gerald [redacted]
Subject: RE: [External] Public Information Centre - [redacted] Inquiry
Attachments: 2023-10-12 Hidden Valley Flood Control EA - PIC Boards.pdf

Hi Zaid,
Please find attached the PIC boards that will be shared tonight.
Regards,

Karen Hofbauer, M.A.Sc., P.Eng. | Principal Water Resources Engineer

MATRIX SOLUTIONS INC. | A Montrose Environmental Company
D 226.314.1932 | **C** 519.504.7517

2023 Canada's Greenest Employers

From: Zaid Kashif Al Ghitta <zkashif@ksmart.ca>
Sent: Wednesday, October 11, 2023 11:07 AM
To: hiddenvalley@kitchener.ca
Cc: Karen Hofbauer <khofbauer@matrix-solutions.com>; David Harsch <dharsch@ksmart.ca>; Steve Jefferson <steve@ksmart.ca>; Scott Brubacher <scott@clbuilders.ca>; Gerald Martin <gerald@clbuilders.ca>
Subject: [External] Public Information Centre - [redacted]

Greetings,

I hope this e-mail finds you well. My name is Zaid Kashif Al Ghitta, and I am a Planner with K. Smart Associates Limited. We are a Planning and Engineering Consulting firm in Kitchener. We have been retained by the landowner at [redacted] in Kitchener to attain a GRCA permit for potential development on the property. The lot is within your Municipal Class Environmental Assessment, and as such, we will be at tomorrow's Public Information Centre. Is there any documentation or materials that can be shared with us for our review prior to our attendance?

Best,

Zaid Kashif Al Ghitta, BES
Land Use Planner – K. Smart Associates Limited
85 McIntyre Dr. Kitchener ON N2R 1H6 | http://www.ksmart.ca
T: 519.748.1199 x231 | F: 519.748.6100 | zkashif@ksmart.ca

Monica Mazur

From: Jordon [redacted]
Sent: Tuesday, October 24, 2023 11:45 AM
To: Monica Mazur
Subject: Hidden Valley Flood Risk Reduction EA comments
Attachments: K-W Record newspaper October 21, 1993 page B1.pdf

[You don't often get email from [redacted]om. Learn why this is important at https://aka.ms/LearnAboutSenderIdentification]

As mentioned in conversation at the drop-in PIC, I distinctly remember personally witnessing one or more occurrences of the road washing out, rather spectacularly, in the low spot between [redacted], during summer rain events in the late 1980s. The common quick fix made by city crews at the time was to dump some extra rip rap as scour protection. Unfortunately, I cannot find any newspaper article or otherwise that documents a particular event. It probably happened sometime after the dirt road was first covered with an impervious tar & chip surface treatment in the mid-'80s, during the period when the city's own forces (not contractors) did all maintenance work themselves. Elderly family members of mine don't remember flooding or erosion happening further back in time, pre-1958, when it was part of rural Waterloo Township, outside of city limits. The only clue that corroborates my own memory of flooding is a columnist's remark about city crews replacing a culvert maybe around 1990; the clipping is attached to this message, with added highlighting.

Not sure of the relevance, but one should be mindful that the driveway to [redacted] was substantially realigned by its second homeowner around the late '80s or early '90s. Originally, it was a straight configuration, and had street frontage nearly opposite to 730 Hidden Valley Road. It was later changed to the curving gated entrance, about 200-feet further south, now crossing over the creek and facing 748 Hidden Valley Road.

The contribution of storm water runoff from the roadway's long, steep hill with essentially no curb/gutter system, and only a single catchbasin at the bottom, is likely substantial. The road surface elevation drops, say, 100 feet over a 1000 feet span, probably yielding a steep 10% grade. This collects and channels a lot of rain water, especially after the road received its first asphalt paving, sometime in the late 2000s or early 2010s.

Additional background information as recommended research:

Full engineering specifications for the two existing concrete box culverts beneath Hidden Valley Road (the segment designated a service road until MTO conveyed it to the city) including former CSPs that these replaced when Highway 8 was first built, are found in the original set of drawings for MTO contract 61-108, work project 35-56 & 112-58, undertaken by E & E Seegmiller Construction. Details therein were not all carried forward to recent documentation when the highway was reconstructed/widened in 2008.
Certified copies of said contract drawings can be obtained from MTO's engineering west divisional office in London, or through the Archives of Ontario library.

The University of Waterloo Library's Special Collections & Archives holds the K-W Record Photographic Negative Collection.
Reference code SCA98-GA68-1961-61-617 contained some historical pictures of concrete box culverts under construction for "north"
Hidden Valley Creek, showing placement of very long, narrow concrete cribbing/formwork in progress.
Images can be obtained using the form at
https://can01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fuwaterloo.ca%2Flibrary%2Fspecial-collections-archives%2Frequest-

reproduction&data=05%7C01%7Cmonica.mazur%40kitchener.ca%7Cd7d055ae3f9e4988079308dbd4a84dcb%7Cc703d79153f643a59255622eb33a1b0b%7C0%7C0%7C638337591698030153%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000%7C%7C%7C&sdata=LJ9b1StX%2BDTkzAG2UDdS7lP0HqLpccrHQQH03epO%2FWg%3D&reserved=0

Because Matrix Solutions was also working on city contract Q22-079, the consultant's study team ought to look for any characteristic similarities between the three different nearby creeks that all drain into the westerly side of the Grand River. In particular, retrieving engineering records from past city contract T96-103 would give a better understanding of historical context to watercourse erosion control measures previously implemented.

I hope this contributes resourceful local knowledge.

_____

Jordon [redacted]

Road care conspicuous in Kitchener's Hidden Valley

Kitchener-Waterloo Record newspaper | October 21, 1993 | page B1

Point of view

Jim Romahn

I used to think Hidden Valley Road was the best-maintained road in all of Kitchener.

That was about 20 years ago when road graders seemed to be out every second week. I'd never seen anything like this when I was growing up on the Huron Road in Wilmot Township.

Yet that was only the beginning. About 15 years ago, road crews began to spray the gravel with oil, presumably to keep the dust down. That, too, is something that road crews used to do on the Huron Road. But they were satisfied to do it once a year, and often only in front of homes.

On Hidden Valley Road, they did it at least twice a year, and for the whole length. And they were never satisfied to leave it as smooth and hard as pavement. No, they'd plough it up every spring, grade it and grade it and grade it again. Then oil it again. And again.

Not only was Hidden Valley graded and sprayed. It was checked. Oh, how it was checked.

Every noon, the team of Record reporters who jog around the four-kilometre road could count on passing at least one orange City of Kitchener truck.

And as we passed, we could usually see two, sometimes three, City of Kitchener employees snoozing in the cab.

To be fair, maybe it was their noon break. Whatever the reason, the works crews certainly kept a close watch on that road. I began to think this was not only the best-kept road in Kitchener, but in the whole Waterloo Region.

But even this standard has been surpassed.

A few years ago, works department crews replaced a culvert. They not only replaced it; they outdid themselves by stacking two metal culverts, one on top of the other. There's enough water-draining capacity there now to handle a triple Hurricane Hazel.

Then, when Waterloo Region built its major Grand River water recharge system, the city did a first-class job paving a portion of Hidden Valley Road. There are even sections with concrete curbs.

But they didn't pave the whole eight kilometres. Nor were they satisfied to complete the job last year. They came back this year, ripped out a curve and rebuilt it. And poured new concrete curbs — really nice ones — and laid new pavement. And — you guessed it — ripped a trench right across it only a few weeks later. And paved that again.

To be fair again, that work was done by utilities crews, not the city's roads department. And, nowadays, there are no more noon-hour snoozers on Hidden Valley Road. Maybe the traffic has become too heavy.

But that does not mean that maintenance is suffering. Heavens no!

Instead of grading gravel, the works crew has taken a liking to tar and chips. All of the gravelled portion now sports a wonderful coating of tar and chips. More accurately, several coatings of tar and chips.

Every year the crew adds more. Sometimes it's patching, especially in any area that shows the slightest sign of wear. And in July they added another coat over a whole kilometre-long section. And they came back in October and added yet another coat over the same kilometre.

Not that it needed it. But there isn't much that's been done to Hidden Valley Road over the last 20 years that waited until it actually needed doing.

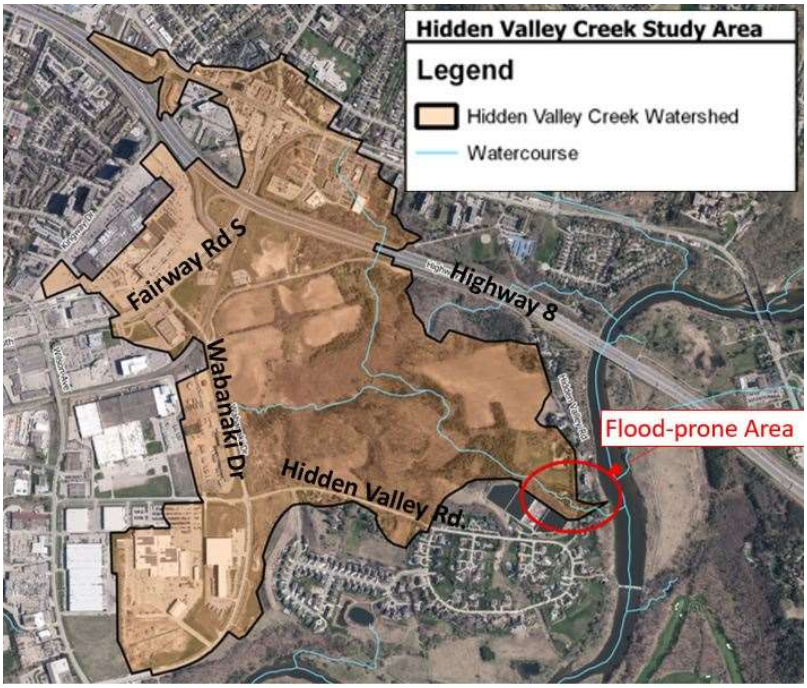
Now, I realize that all of this is anecdotal and isn't really fair to the foreman and crew that looks after Hidden Valley Road. And so, for the record, the books at the new city hall will show that, on average, Kitchener is spending $3,239 per lane per kilometre to maintain streets this year — $20,000 short of $4 million for 1,235 lane-kilometres of street.

That's for everything, including snow plowing and salting.

And the records further show that only about $8,000 has been spent on Hidden Valley Road, including those many days applying more layers of tar and chips, for an average of about $1,000 per kilometre per lane.

But despite those statistics, I still think it's the best-maintained road in all of Canada.

Hidden Valley Flood Risk Reduction Environmental Assessment



The intent of this project is to identify a preferred solution to reduce existing flood risks and support future development in the Hidden Valley community.

There will be opportunity to learn about and give feedback during the study process. We will host a public information centre that you can attend. You are also welcome to contact the consultant and/or project manager at any time.

We will include your comments on the following in the project file report:

- The criteria for evaluating the project and the preliminary alternatives
- The proposed flood mitigation alternatives, the final evaluation criteria, and the preferred solution

If you would like to receive updates about this project, please add your email to the Stay Informed box and click 'Subscribe'.

Background

The Hidden Valley Creek subwatershed includes both woodland and wetland areas. It is an environmentally sensitive area, home to species at risk habitats and a warmwater fishery.

There are several flood vulnerable areas and erosion vulnerable area in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. The area downstream has experienced past flood and erosion impacts. These are related to specific rainfall or runoff events and the release of natural debris (examples: beaver dams or natural debris jams).

This study is part of our secondary planning process. Future development in the area will follow both the current Hidden Valley Land Use Master Plan and our ongoing secondary planning process.

NEWS FEED | QUESTIONS

All unpublished Newsfeed items are shown as "Draft". Only admins will be able to see it in the preview mode.

Public Information Centre materials now available

19 Oct 2023

Thank you to everyone who joined us at our Public Information Centre earlier this month. If you were unable to make it, here are the materials we shared: Hidden Valley Flood Risk Reduction PIC boards.

Your input on this study is valuable and appreciated. Please review those materials and, if you have any feedback, email your comments to the project team. We are able to accept comments until October 30, 2023.

If you haven't already, subscribe to the project newsletter to get updates. Add your email to the Stay Informed box on this page and click 'Subscribe'.

Public Information Centre Oct. 12, 2023

27 Sep 2023

The City of Kitchener (the City) retained Matrix Solutions Inc. (Matrix) to provide a Municipal Class Environmental Assessment (EA) for flood risk reduction in the Hidden Valley Creek subwatershed. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community. The project is being carried out in accordance with the requirements of the Environmental Assessment Act and is planned under Schedule B. The intent of this project is to identify alternative solutions to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed.

Public Information Centre

October 12, 2023
Drop-in from 5 to 8 p.m.
Centreville Chicopee Community Center
(141 Morgan Avenue, Kitchener)

A key component of the EA process is consultation with interested stakeholders (public, landowners, and agencies). As part of this study, consultation is being undertaken, and your participation is encouraged. A Public Information Centre (PIC) is planned to:

- share the study background
- explain the Environmental Assessment process
- outline existing conditions
- evaluation criteria
- and the alternative solutions

We'd like to hear from you

Your input is important to us and can shape the project decision. We invite you to join our upcoming PIC to learn more about the alternative solutions, ask our team questions, and provide feedback. Listening to, and learning from First Nations, residents and stakeholders is part of the process. If you are unable to attend the PIC, the presentation boards will be made available on this webpage.

To submit a comment or question via email, or if you have accessibility requirements to comment on the study, please contact one of the representatives below:

Monica Mazur, M.Sc., P.Eng.

Project Manager (Development Engineering)

City of Kitchener

Phone: 519-741-2600 ext. 7135

hiddenvalley@kitchener.ca

Karen Hofbauer, M.A.Sc., P.Eng.

Principal Water Resources Engineer Matrix Solutions Inc.

Phone: 226-314-1932

Email: khofbauer@matrix-solutions.com

Please note that comments will be maintained for reference throughout the project and will become part of the public record. Under the Municipal Freedom of Information and Protection of Privacy Act and the Environmental Assessment Act, any personal information such as name, address, and telephone number included in a submission will become part of the public record unless the comments specifically request that such personal details not be included in the public record.

Notice of Commencement

13 Jun 2023

Municipal Class Environmental Assessment Hidden Valley Flood Risk Reduction

The City of Kitchener (the City) retained Matrix Solutions Inc. (Matrix) to provide a Municipal Class Environmental Assessment (EA) for flood risk reduction in the Hidden Valley Creek subwatershed. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community.

The Process

The project is being carried out in accordance with the requirements of the Environmental Assessment Act and it is being planned under Schedule B. The intent of this project is to identify solutions and design alternatives to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed. A key component of the EA process will be consultation with interested stakeholders (public, landowners, and agencies).

Matrix will conduct a detailed background review and hydrologic/hydraulic analysis of the study area and identify potential solutions to reduce flood hazard. Upon completion of the analysis, Matrix will prepare a Project Report for the City and for submission to the Ministry of the Environment, Conservation and Parks (MECP), which will be available for public review for a period of 30 calendar days. All interested parties will have an opportunity to attend a Public Information Centre (PIC) meeting hosted prior to the final decisions on the proposed solutions. Notification of the PIC will be provided through email and postings on the City's website.

Study Area

The Hidden Valley Creek subwatershed is approximately 200 ha located in southeast Kitchener (see Figure 1). The Hidden Valley Creek subwatershed contains a large wetland/woodland environmental complex, which holds classifications of a Provincially Significant Wetland (PSW), Environmentally Sensitive Policy Area (ESPA), and Core Environmental Feature (CEF). Within the study area there are Regionally Significant Woodland and Significant Valley, species at risk habitat, and a warmwater fishery. In addition to being an environmentally sensitive area, the Hidden Valley ESPA/PSW is the hydrologically dominant landscape feature in the subwatershed.

The area downstream of the Hidden Valley ESPA/PSW has experienced past flood and erosion impacts related to both specific rainfall-runoff events and/or the release of natural debris-blockages (e.g., beaver dams or natural debris jams) within the wetland feature.

Public Feedback

Public, Indigenous, and agency consultation is a key component of the Class EA process, and Matrix is interested in hearing any comments or concerns that you may have about this study.

To submit a comment or question via email, or if you have accessibility requirements to comment on the study, please contact one of the representatives below:

Monica Mazur, M.Sc., P.Eng.

Project Manager (Development Engineering)

City of Kitchener

Phone: 519-741-2600 ext. 7135

hiddenvalley@kitchener.ca

Karen Hofbauer, M.A.Sc., P.Eng.

Principal Water Resources Engineer Matrix Solutions Inc.

Phone: 226-314-1932

Email: khofbauer@matrix-solutions.com

Please note that comments will be maintained for reference throughout the project and will become part of the public record. Under the Municipal Freedom of Information and Protection of Privacy Act and the Environmental Assessment Act, any personal information such as name, address, and telephone number included in a submission will become part of the public record unless the comments specifically request that such personal details not be included in the public record.

Notice of Completion - Draft

27 Sep 2023

Report approved, public comment period open - Draft

27 Sep 2023

Page last updated: 19 Oct 2023, 04:44 PM

STAY INFORMED

Subscribe for project updates

Subscribe

10 members of your community are following this project

Lifecycle

Notice of study commencement

We are notifying the public, Indigenous communities and key stakeholders about this study

Evaluate alternatives and identify a preferred solution

We are considering a range of alternatives to identify a preferred solution

Open for feedback

Attend our public information centre to learn more about this project and give your feedback on the potential alternative solutions

Review and confirm solution

We are reviewing the feedback we received before selecting the preferred solution

Notice of Completion

We are notifying the public, Indigenous communities and stakeholders that the selection of the preferred alternative is complete

Report published

The planning process is documented in the Project File Report, now available for review for 30 calendar days.

Study complete

The public comment period has ended and the study is complete

Documents

Hidden Valley Flood Control EA - PIC Boards (8.48 MB) (pdf)

Who's Listening

Monica Mazur, M.Sc., P.Eng.

Project Manager (Development Engineering)

City of Kitchener

Phone 519-741-2200 x7135

Email hiddenvalley@kitchener.ca

Karen Hofbauer, M.A.Sc., P.Eng.

Principal Water Resources Engineer

Matrix Solutions Inc.

Phone 226-314-1932

Email khofbauer@matrix-solutions.com

Important Links

Hidden Valley (kitchener.ca)

Climate Change and Environment Committee

Committee Minutes

October 19, 2023, 4:00 p.m.
Electronic Meeting

Present:	Councillor A. Clancy, Member
	Councillor S. Davey, Member
	M. Garner, Vice-Chair
	K. Bockasten, Member
	J. Clary-Lemon, Member
	G. Johannesson, Member
	B. Kurczak, Member
	K. Loveless, Member
	V. Nhio-son, Member
	M. Shafii, Member
	F. Tohidi, Member
Staff:	A. Cipriani, Corporate Sustainability Officer
	N. Goss, Manager, Policy & Research
	S. Lodenquai, Committee Administrator
	M. Mazur, Project Manager Development Engineering
	C. Musselman, Senior Environmental Planner

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1. Commencement

The Climate Change and Environment Advisory Committee held a meeting this date commencing at 4:00 p.m. In the absence of the Chair, Kyle Loveless was elected as Chair Pro Tem for the October 19, 2023 meeting. The meeting began with a Land Acknowledgement given by the Chair.

2. Discussion Items

2.1 Q23-045 Hidden Valley Flood Risk Reduction Environmental Assessment, DSD-2023-453

The Committee considered Climate Change and Environment report DSD-2023-453, dated October 5, 2023 recommending preferred alternative solution #4 for flood risk reduction in the Hidden Valley Creek subwatershed, as presented by M. Mazur.

On motion by K.Loveless

That the Climate Change and Environment Committee supports the preferred alternative solution for flood risk reduction in the Hidden Valley Creek subwatershed.

Carried

2.2 Presentation of Impact Report to the Climate Change & Environment Committee - Reep Green Solutions

Patrick Gilbride and Lisa Truong (in place of Mary Jane Patterson) attended the meeting and presented the annual Reep Green Solutions Impact Report.

2.3 CCEC Sub-Committee Assignments and Updates

It was decided that B. Kurczak would step down from the Buildings and District Energy sub-committee and B. Unrau will step in. General sub-committees were provided as available.

3. Information Items

4. Adjournment

On motion, this meeting adjourned at 5:36 p.m.

Shannon Lodenquai
Committee Administrator

Staff Report

Development Services Department *www.kitchener.ca*

REPORT TO:	**Climate Change and Environment Committee**
DATE OF MEETING:	**October 19, 2023**
SUBMITTED BY:	**Natalie Goss, Manager Policy and Research 519-741-2200 ext. 7648**
PREPARED BY:	**Monica Mazur, Project Manager, 519-741-2200 ext. 7135**
WARD(S) INVOLVED:	**Ward 3**
DATE OF REPORT:	**October 5, 2023**
REPORT NO.:	**DSD-2023-453**
SUBJECT:	**Hidden Valley Flood Risk Reduction Municipal Class Environmental Assessment**

RECOMMENDATION:

That the Climate Change and Environment Committee supports the preferred alternative solution for flood risk reduction in the Hidden Valley Creek subwatershed.

REPORT HIGHLIGHTS:

- The purpose of this report is to present the preliminary alternatives considered for flood risk reduction in the Hidden Valley creek subwatershed.
- The key finding of this report is that implementing conveyance improvements downstream of the wetland is the preferred solution.
- The recommendation has no impact on the Capital or Operating Budget. Funds are currently available from Development Charges.
- Community engagement included is First Nations consultation, a Public Information Center on October 12, an Engage Page, and a page for Hidden Valley on the City of Kitchener website.
- This report supports **Cultivating a Green City Together: Focuses a sustainable path to a greener, healthier city; enhancing & protecting parks & natural environment while transitioning to a low-carbon future; supporting businesses & residents to make climate-positive choices.**

BACKGROUND:

The City of Kitchener (the City) retained Matrix Solutions Inc. (Matrix) to provide a Municipal Class Environmental Assessment (EA) for flood risk reduction in the Hidden Valley Creek subwatershed. There are several flood vulnerable areas and erosion vulnerable reaches in the downstream portion of the Hidden Valley Creek subwatershed close to Hidden Valley Road. This EA is being undertaken to define a flood risk reduction solution to reduce existing flood risks and support future development in the Hidden Valley community. The project is being carried out in accordance with the requirements of the Environmental Assessment Act and it is being planned under Schedule B. The intent of this project is to identify solutions

and design alternatives to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed.

The Hidden Valley Creek subwatershed is approximately 200 ha located in southeast Kitchener (see Figure 1). The Hidden Valley Creek subwatershed contains a large wetland/woodland environmental complex, which holds classifications of a Provincially Significant Wetland (PSW), Environmentally Sensitive Policy Area (ESPA), and Core Environmental Feature (CEF). Within the study area there are Regionally Significant Woodland and Significant Valley, species at risk habitat, and a warmwater fishery. In addition to being an environmentally sensitive area, the Hidden Valley ESPA/PSW is the hydrologically dominant landscape feature in the subwatershed. The area downstream of the Hidden Valley ESPA/PSW has experienced past flood and erosion impacts related to both specific rainfall-runoff events and/or the release of natural debris-blockages (e.g., beaver dams or natural debris jams) within the wetland feature.

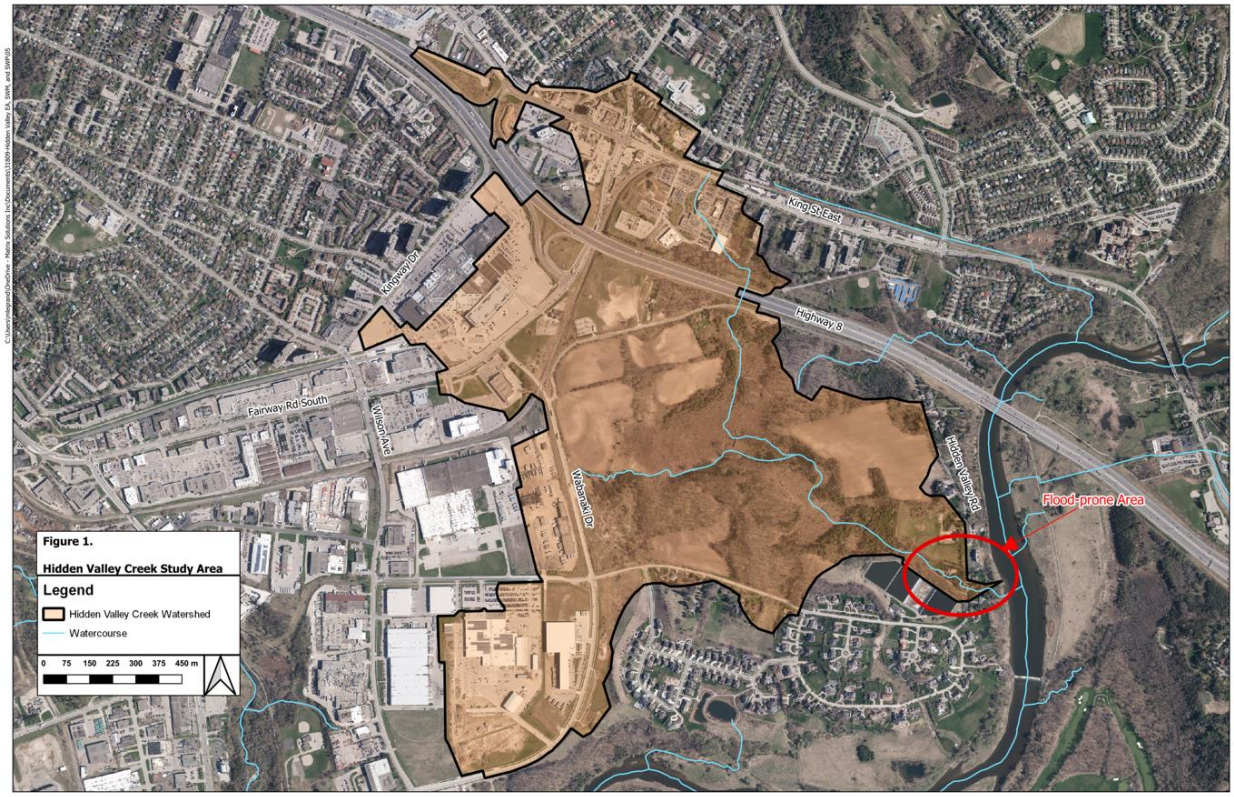


Figure 1

REPORT:

Four preliminary alternatives are considered to reduce the flood hazard in the vulnerable downstream reaches of the Hidden Valley Creek subwatershed.

Alternative 1: Do Nothing

Alternative 1 proposes a “Do Nothing” scenario in which no changes are made, as per requirements of the Municipal Class EA process. Based on available hydrologic modeling (flows) and hydraulic modeling (elevations), a property downstream of the wetland is flooded during the 1:25 year event and Hidden Valley Road is overtopped during the 1:10 year event under existing conditions. Prior occurrences of flooding at the subject locations are thought

to have been, at least in part, the result of beaver dam failure within the wetland. Beaver dams and other partial debris jams within the wetland are still at potential risk for failure under existing conditions.

Alternative 2: Reduce Flows Upstream of Wetland
Alternative 2 includes the potential implementation of flow attenuation measures upstream of the Hidden Valley wetland, such as stormwater controls to temporarily detain some runoff volume and release it at a reduced rate. Much of the existing development in the headwaters of the subwatershed occurred prior to the large-scale adoption of stormwater management practices; there may be some potential to retroactively implement flow reduction measures for these areas as either standalone facilities (i.e., new facilities to service existing development) or in conjunction with future development.

Several new developments are currently proposed upstream of the Hidden Valley wetland that will include stormwater management mitigation measures (e.g., control of post-development flows back to existing rates). These facilities could potentially be modified to "over-control" runoff from newly developing areas (e.g., control of post-development flows to below existing rates) to help reduce flood potential downstream.

Alternative 3: Flow Control Structure in Wetland
Alternative 3 includes constructing a flow control structure, such as a dam, within the Hidden Valley wetland to create / utilize storage volume above the normal wetland water levels to provide peak flow attenuation for surface water flows to / through the feature. Under existing conditions, it is speculated that naturally occurring beaver dams and/or vegetative debris jams (i.e., deadfall) have built up and subsequently, either partially or completely, at various times over the past decade, resulting in or exacerbating downstream flooding. Engineered flow control measures would replicate the naturally occurring conditions within the wetland while increasing the reliability of the structure. Attenuation within the wetland would reduce the peak flow rate downstream and mitigate future flooding.

Alternative 4: Conveyance Improvements Downstream of the Wetland (preferred alternative)
Alternative 4 would entail improving conveyance systems through the Hidden Valley Creek corridor downstream of the wetland to safely pass elevated flows across private property and Hidden Valley Road, reducing flooding. There are two intact engineered crossings constricting flow downstream of the Hidden Valley wetland, a driveway crossing on private property and the municipal road crossing under Hidden Valley Road.

Hidden Valley Road does not meet MTO drainage design standards for local roadway crossings under existing conditions, and frequent overtopping of the roadway increases the potential for channel erosion downstream of the crossing. This is of particular interest as the channel runs through or adjacent to other private properties downstream of Hidden Valley Road, and long-term erosion could impact these properties. Improving conveyance at Hidden Valley Road would also improve erosion and long-term slope stability around and immediately downstream of the crossing.

Evaluation Criteria
Based on positive collaborative experiences of recent City of Kitchener projects, this Study proposes to adopt the "Framework for incorporating First Nations rights holder priorities and

knowledge into an Environmental Assessment" (City of Kitchener and Stantec, 2023). The intent of using this framework is to incorporate rights holder priorities and knowledge into the EA process and achieve a balance of alternative evaluation criteria weighting between ecological, technical, socio-economic and cultural considerations. The integration of indigenous knowledge, lands, land claims, and treaty rights are not specifically identified as a stand-alone category, but rather woven into and throughout all of the considerations identified below. City staff met with the Six Nations of the Grand River and the Mississauga's of the Credit First Nation in September 2023 to present the alternative solutions and receive their input on their preferred solution. The preferred solution at the time of writing this report is Alternative 4. Input from the public at the Public Information Center on October 12th, 2023 will also be incorporated in the decision-making process when confirming the preferred solution. A preliminary evaluation of alternative solutions is presented in Table 1 below.

Table 1. Preliminary Evaluation of Alternative Solutions

	Alternative 1: Do-Nothing	Alternative 2: Reduce Flows Upstream of Wetland	Alternative 3: Flow Control Structure in Wetland	Alternative 4: Conveyance Improvement Downstream of Wetland
Natural Environment				
Socio-economic and Cultural Environment				
Technical Environment				

STRATEGIC PLAN ALIGNMENT:

This report supports **Cultivating a Green City Together: Focuses a sustainable path to a greener, healthier city; enhancing & protecting parks & natural environment while transitioning to a low-carbon future; supporting businesses & residents to make climate-positive choices.**

FINANCIAL IMPLICATIONS:

Capital Budget – The recommendation has no impact on the Capital Budget. Funds are currently available from Development Charges.

Operating Budget – The recommendation has no impact on the Operating Budget.

COMMUNITY ENGAGEMENT:

INFORM –

A Notice of Study Commencement and Notice of Public Information Center have been shared with the public, stakeholders, and rights holders. Project information can be found on www.kitchener.ca/hiddenvalley and www.engagewr.ca/hidden-valley-aood-ea.

CONSULT –

First Nations Consultation: City staff met with the Six Nations of the Grand River and the Mississauga's of the Credit First Nation in September 2023 to present the alternative solutions, receive input on their preferred solution, and incorporate rights holder priorities and knowledge into the EA process.

Public Information Centre: A key component of the EA process is consultation with interested stakeholders (public, landowners, and agencies). As part of this study, consultation is being undertaken. A Public Information Centre (PIC) is planned on October 12 to share the study background; explain the Environmental Assessment process; outline existing conditions; evaluation criteria; and the alternative solutions.

PREVIOUS REPORTS/AUTHORITIES:

- Hidden Valley Land Use Master Plan
- Ongoing Hidden Valley Secondary Plan
- Staff Report (No. DSD-19-133) to Planning & Strategic Initiative Committee on June 10, 2019 for the Neighbourhood Planning Review: Hidden Valley Land Use Master Plan.

REVIEWED BY: Carlos Reyes, Manager Development Engineering

ATTACHMENTS:

Attachment A – Notice of Study Commencement
Attachment B – Notice of Public Information Centre

APPENDIX B
Site Photographs

Photo 1. Inlet to Wabanaki Pond

Photo 2. Hidden Valley West Creek Outfall

Photo 3. Hidden Valley West Creek armour stone bank

Photo 4. Hidden Valley West Creek naturalized banks with undercutting

Photo 5. Hidden Valley North Creek typical cross section

Photo 6. Hidden Valley ESPA/PSW

Photo 7. Reservoir behind beaver dam.

Photo 8. Damaged crossing downstream of Hidden Valley ESPA/PSW

Photo 9. Hidden Valley Road Crossing, upstream view

Photo 10. Hidden Valley Road Crossing, downstream view

Photo 11. Erosion Noted upstream of Hidden Valley Road

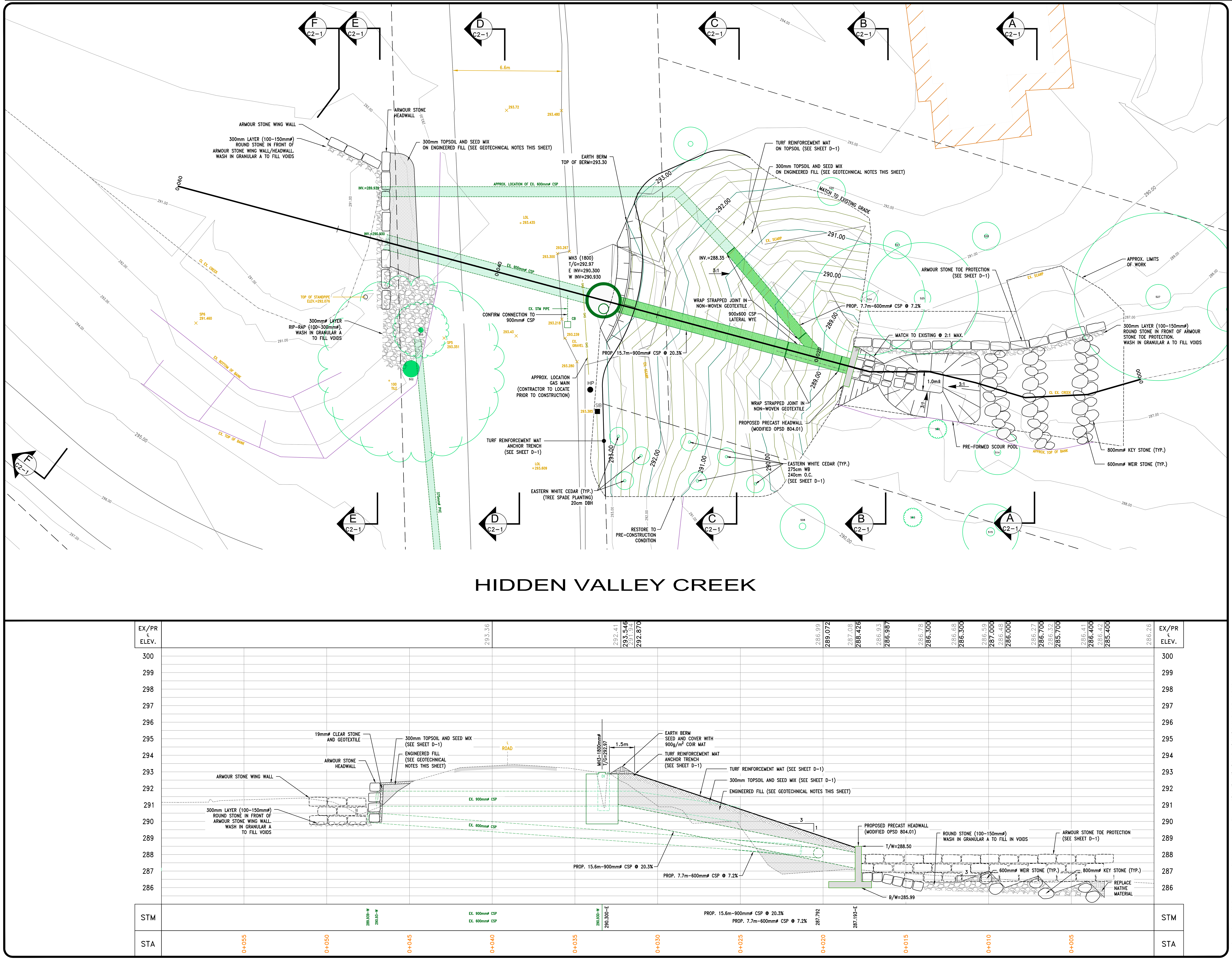
Photo 12. 735 Hidden Valley Road Driveway crossing, view downstream

Photo 13. 735 Hidden Valley Road Driveway bypass culverts, view upstream

Photo 14. 735 Hidden Valley Road Driveway low flow culvert, view upstream

APPENDIX C
Hydraulic Analysis

Existing Conditions



8.			
7.			
6.	ISSUED FOR TENDER	M.H.	09/16/2013
5.	ISSUED TO THE GRCA FOR PERMIT APPLICATION	M.H.	09/12/2013
4.	ISSUED FOR REVIEW BY THE GRCA	M.H.	08/20/2013
3.	ISSUED FOR REVIEW BY THE CITY	M.H.	08/16/2013
2.	ISSUED FOR REVIEW BY THE CITY	M.H.	08/14/2013
1.	ISSUED FOR REVIEW BY THE CITY	M.H.	08/09/2013
NO.	REVISION	BY	MM/DD/YY

construction NORTH — true NORTH

THE POSITION OF THE POLE LINES, CONDUITS, WATERMAINS, SEWERS, AND OTHER UTILITIES AND STRUCTURES ARE N O T NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED.

BEFORE STARTING WORK

THE CONTRACTOR SHALL CONFIRM THE POSITION AND EXACT LOCATION OF ALL SUCH UTILITIES, AND SHALL ASSUME ALL LIABILITY FOR ANY DAMAGE TO THEM MADE DURING THE COURSE OF THE CONTRACT WORK.

NOTES:

STORM SEWER SYSTEM

a. PIPE BEDDING – CLASS "B", SSMS E1-01
b. STORM MANHOLES – OPSD 701.010, 701.011, 701.012, 701.013, 701.014
c. ALL CATCHBASINS – OPSD 705.030
d. PRECAST DOUBLE CATCHBASIN – OPSD 705.040
e. SINGLE CATCHBASIN LEADS – 250mmø
f. DOUBLE CATCHBASIN LEADS – 300mmø
g. PIPE CLASS – STORM SEWERS PVC PVC DR 35(mm) OR CONCRETE

GEOTECHNICAL

REFER TO REPORT BY PETO MACCALLUM LTD., DATED SEPT 2013

ADDITIONAL LOCAL GEOTECHNICAL INFORMATION AVAILABLE:

- BRIDLE PATH ESTATES/HIDDEN VALLEY CRESCENT, CITY OF KITCHENER (1992)
- WATER TRANSMISSION MAIN/HIDDEN VALLEY ROAD, REGION OF WATERLOO (1989)

ENGINEERED FILL:

- ENGINEERED FILL IMPORTED TO THE SITE SHOULD MEET THE REQUIREMENTS OF SELECT SUBGRADE MATERIAL (OPSS 1010) AND SHALL MEET TABLE 1 O.REG. 153/04
- FILL SHOULD BE STEPPED/BENCHED INTO THE EXISTING SLOPES AFTER REMOVAL OF ALL TEMPORARY FILL
- FILL SHOULD BE PLACED IN MAXIMUM 200mm THICK HORIZONTAL LIFTS AND COMPACTED TO MINIMUM 95% SPMDD UNDER FULL-TIME ENGINEERING SUPERVISION

OTHER UTILITIES

TEMPORARY SUPPORT OF EXISTING UTILITY POLES MUST BE APPROVED BY KITCHENER-WILMOT HYDRO. ALL ASSOCIATED COSTS WILL BE THE RESPONSIBILITY OF CONTRACTOR.

EMERGENCY RESPONSE

THE CONTRACTOR SHALL NOTE AND RECORD THE FOLLOWING NUMBERS IN THEIR EMERGENCY CONTACT LIST TO BE RETAINED ON-SITE FOR REPSONSE TO EMERGENCY SPILLS AND/OR TESTING OF SUPSECTED CONTAMINATED MATERIALS WHICH MAY BE DISCOVERED ON-SITE.

THE CONTRACTOR SHALL PROVIDE AND MAINTAIN A SPILL KIT APPROPRIATE FOR THE SITE AND WORKING CONDITIONS.

IN THE EVENT THAT EITHER SHOULD OCCUR, THE CONTRACTOR SHALL AS A FIRST COURSE OF ACTION CONTAIN AND/OR SECURE THE MATERIALS, ADVISE THE CONTRACT ADMINISTRATOR, FULL-TIME ON-SITE REPRESENTATIVE (INSPECTOR) AND THE REGION REPRESENTATIVE(S) AND IMMEDIATELY CONTACT THE FOLLOWING:

- MINISTRY OF THE ENVIRONMENT: 1-800-268-6060 (SPILL)
- REGION OF WATERLOO: 519-650-8260 (DURING NORMAL BUSINESS HOURS) OR 519-650-8200 (AFTER HOURS) (SPILL)
- GUELPH DISTRICT OFFICE OF THE MINISTRY OF THE ENVIRONMENT: (CONTAMINATED MATERIALS ON-SITE): 1-800-265-8658

SURVEY

TOPO SURVEY BY AUTOMATED ENGINEERING TECHNOLOGIES LTD. JULY 2013

BENCHMARK

No. KI-85
TOPOGRAPHICAL SURVEY TABLET IN A CONCRETE PIER, 0.3m IN DIAMETER, AT GROUND LEVEL, 0.24 km NORTH ON HIDDEN VALLEY ROAD FROM THE INTERSECTION OF HIDDEN VALLEY ROAD AND GOODRICH DRIVE, APPROXIMATELY 0.2 km EAST FROM HIDDEN VALLEY ROAD, ON TOP OF A GRASSY HILL, 68.6m SOUTHEAST OF HYDRO POLE, 27.1m SOUTH OF FENCE LINE AND 21.0m SOUTHWEST OF SECOND HYDRO POLE.

ELEV. = 337.760m

KITCHENER — The Corporation Of The CITY OF KITCHENER

Infrastructure Services
Engineering Division

WALTERFEDY
675 Queen Street South, Suite 111
Kitchener, Ontario, Canada N2M 1A1
T 519.576.2150 F 519.576.5499
walterfedy.com

PROPOSED PLAN & PROFILE

HIDDEN VALLEY CREEK

DESIGNED BY: M.H.	APPROVED BY:	DRAWN BY: M.V.
		CHECKED BY: M.H.
		SCALE: HOR.-1:100 / VER.-1:100
		DATE: (MM.DD.YY) 07.22.13
CONSULTANT DWG. No. PR-1	SHEET No. 3 of 5	DWG. No.

HEC-RAS Plan: Exisiting_Conditions River: River Reach: River

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(N/m2)	(N/m s)
River	248	2 yr	0.31	297.77	297.89	297.89	297.92	0.029665	0.86	0.37	5.24	1.01	21.14	18.12
River	248	5 yr	1.33	297.77	298.01	298.01	298.10	0.020877	1.38	1.04	5.75	1.00	39.68	54.87
River	248	10 yr	3.08	297.77	298.14	298.15	298.31	0.020005	1.90	1.81	6.28	1.07	63.24	120.16
River	248	20 yr	6.43	297.77	298.31	298.36	298.62	0.020017	2.53	2.97	7.01	1.15	97.34	246.53
River	248	50 yr	15.40	297.77	298.83	298.77	299.19	0.009604	2.82	7.14	9.16	0.90	95.28	268.85
River	229	2 yr	0.31	296.97	297.15	297.16	297.22	0.045545	1.16	0.26	2.86	1.23	37.29	43.44
River	229	5 yr	1.33	296.97	297.28	297.33	297.49	0.049370	2.06	0.64	3.02	1.43	89.63	184.82
River	229	10 yr	3.08	296.97	297.46	297.54	297.78	0.036603	2.50	1.23	3.26	1.30	111.27	278.59
River	229	20 yr	6.43	296.97	297.77	297.82	298.17	0.025645	2.81	2.29	3.65	1.13	120.85	339.23
River	229	50 yr	15.40	296.97	298.37	298.37	298.92	0.019298	3.26	4.72	4.41	1.01	141.01	460.02
River	210	2 yr	0.31	296.34	296.48	296.50	296.56	0.060483	1.22	0.25	3.40	1.43	42.88	52.29
River	210	5 yr	1.33	296.34	296.62	296.64	296.76	0.030228	1.62	0.82	4.14	1.17	55.39	89.92
River	210	10 yr	3.08	296.34	296.72	296.81	297.04	0.043373	2.48	1.24	4.25	1.46	114.33	283.33
River	210	20 yr	6.43	296.34	296.87	297.05	297.48	0.054195	3.46	1.86	4.41	1.70	199.20	688.76
River	210	50 yr	15.40	296.34	297.18	297.54	298.29	0.055347	4.66	3.30	4.79	1.79	313.59	1462.19
River	190	2 yr	0.31	295.71	295.87	295.87	295.93	0.026179	1.09	0.28	2.36	1.00	29.19	31.68
River	190	5 yr	1.33	295.71	296.06	296.07	296.21	0.023843	1.75	0.76	2.76	1.07	58.52	102.53
River	190	10 yr	3.08	295.71	296.29	296.29	296.52	0.019107	2.11	1.46	3.25	1.01	73.34	154.99
River	190	20 yr	6.43	295.71	296.58	296.58	296.92	0.016982	2.60	2.49	3.90	1.00	96.98	251.81
River	190	50 yr	15.40	295.71	297.10	297.17	297.64	0.013104	3.33	5.38	7.30	0.97	132.16	440.38
River	171	2 yr	0.31	295.18	295.33	295.34	295.39	0.031435	1.07	0.29	2.92	1.09	29.88	31.93
River	171	5 yr	1.33	295.18	295.46	295.51	295.64	0.040368	1.86	0.72	3.80	1.37	73.01	135.80
River	171	10 yr	3.08	295.18	295.56	295.68	295.93	0.056054	2.67	1.15	4.54	1.69	136.34	364.07
River	171	20 yr	6.43	295.18	295.70	295.90	296.34	0.063968	3.53	1.82	5.17	1.90	214.10	755.57
River	171	50 yr	15.40	295.18	295.95	296.35	297.10	0.068264	4.75	3.24	6.08	2.08	339.70	1613.27
River	159	2 yr	0.31	294.46	294.62	294.66	294.75	0.098360	1.64	0.19	2.31	1.84	75.21	123.00
River	159	5 yr	1.33	294.46	294.77	294.85	295.04	0.056527	2.31	0.57	2.67	1.59	110.26	255.20
River	159	10 yr	3.08	294.46	295.34	295.07	295.43	0.005122	1.36	2.27	3.27	0.52	27.20	36.95
River	159	20 yr	6.43	294.46	295.91	295.38	296.02	0.003316	1.48	4.89	9.90	0.44	27.61	40.72
River	159	50 yr	15.40	294.46	296.48	296.15	296.59	0.002623	1.71	15.75	24.45	0.41	32.55	55.74
River	146	2 yr	0.31	294.09	294.25	294.25	294.31	0.026422	1.11	0.27	2.26	1.02	30.44	33.91
River	146	5 yr	1.33	294.09	294.93	294.45	294.94	0.000807	0.53	2.53	4.38	0.22	4.12	2.16
River	146	10 yr	3.08	294.09	295.37		295.39	0.000735	0.63	5.12	10.66	0.22	5.35	3.40
River	146	20 yr	6.43	294.09	295.96		295.98	0.000310	0.59	17.02	26.16	0.16	3.88	2.30
River	146	50 yr	15.40	294.09	296.53		296.55	0.000357	0.80	33.05	30.06	0.18	6.26	4.97
River	140	2 yr	0.31	293.89	294.25	294.10	294.26	0.002054	0.48	0.63	2.60	0.31	4.60	2.22
River	140	5 yr	1.33	293.89	294.93	294.31	294.94	0.000449	0.43	3.07	4.39	0.17	2.67	1.16
River	140	10 yr	3.08	293.89	295.37	294.54	295.39	0.000454	0.58	6.46	14.29	0.18	4.12	2.38
River	140	20 yr	6.43	293.89	295.95	294.82	295.97	0.000390	0.71	13.98	28.13	0.18	5.43	3.87
River	140	50 yr	15.40	293.89	296.51	295.39	296.55	0.000601	1.07	25.11	30.68	0.23	11.15	11.95
River	124		Culvert											
River	101	2 yr	0.31	292.45	292.94	292.61	292.94	0.000135	0.15	2.02	6.09	0.08	0.41	0.06
River	101	5 yr	1.33	292.45	293.13	292.76	293.14	0.000587	0.41	3.24	6.48	0.19	2.63	1.08
River	101	10 yr	3.08	292.45	293.44	292.90	293.46	0.000697	0.58	5.34	7.16	0.21	4.56	2.63
River	101	20 yr	6.43	292.45	293.76	293.10	293.80	0.001038	0.82	7.82	8.24	0.27	8.59	7.06
River	101	50 yr	15.40	292.45	294.30	293.48	294.38	0.001550	1.21	12.71	10.07	0.34	17.00	20.61
River	93	2 yr	0.31	292.57	292.89	292.89	292.93	0.032115	0.90	0.34	4.43	1.04	23.18	20.85
River	93	5 yr	1.33	292.57	293.02	293.02	293.12	0.023652	1.39	0.95	5.07	1.03	41.43	57.74
River	93	10 yr	3.08	292.57	293.41		293.45	0.002722	0.83	3.71	8.38	0.40	11.08	9.19
River	93	20 yr	6.43	292.57	293.74		293.79	0.002077	0.98	6.56	9.26	0.37	13.29	13.02
River	93	50 yr	15.40	292.57	294.28		294.36	0.001854	1.30	12.08	11.76	0.38	19.79	25.76
River	87	2 yr	0.31	292.24	292.39	292.43	292.54	0.126084	1.70	0.18	2.54	2.03	84.63	143.68
River	87	5 yr	1.33	292.24	292.49	292.59	292.81	0.100832	2.48	0.54	3.56	2.05	141.61	351.70
River	87	10 yr	3.08	292.24	293.42		293.44	0.000688	0.63	4.95	6.47	0.22	5.25	3.33
River	87	20 yr	6.43	292.24	293.73		293.78	0.001054	0.96	7.40	9.50	0.28	10.90	10.47
River	87	50 yr	15.40	292.24	294.24		294.35	0.001617	1.51	14.04	17.23	0.37	23.87	36.02
River	66	2 yr	0.31	290.79	291.51	290.98	291.51	0.000012	0.06	5.05	10.85	0.03	0.06	0.00
River	66	5 yr	1.33	290.79	292.04	291.08	292.05	0.000020	0.12	12.24	15.47	0.04	0.18	0.02
River	66	10 yr	3.08	290.79	293.43		293.43	0.000004	0.10	42.39	27.29	0.02	0.10	0.01
River	66	20 yr	6.43	290.79	293.76		293.76	0.000012	0.19	51.80	29.82	0.04	0.30	0.06
River	66	50 yr	15.40	290.79	294.31		294.32	0.000033	0.35	69.66	34.94	0.06	1.02	0.36
River	55	2 yr	0.31	290.48	291.51		291.51	0.000019	0.09	4.41	11.24	0.04	0.12	0.01
River	55	5 yr	1.33	290.48	292.04		292.05	0.000034	0.18	12.93	18.66	0.05	0.38	0.07
River	55	10 yr	3.08	290.48	293.43		293.43	0.000007	0.14	47.04	29.35	0.03	0.17	0.02
River	55	20 yr	6.43	290.48	293.76		293.76	0.000019	0.25	57.43	33.23	0.05	0.53	0.13
River	55	50 yr	15.40	290.48	294.31		294.32	0.000055	0.47	77.24	40.08	0.08	1.79	0.84
River	47	2 yr	0.31	290.41	291.51		291.51	0.000011	0.10	3.10	11.84	0.03	0.11	0.01
River	47	5 yr	1.33	290.41	292.04		292.04	0.000054	0.29	4.62	15.63	0.07	0.85	0.24
River	47	10 yr	3.08	290.41	293.43		293.43	0.000003	0.10	45.67	28.92	0.02	0.08	0.01
River	47	20 yr	6.43	290.41	293.76		293.76	0.000009	0.18	55.71	31.88	0.03	0.26	0.05
River	47	50 yr	15.40	290.41	294.31		294.31	0.000027	0.35	75.36	41.50	0.06	0.94	0.33
River	32		Culvert											
River	17	2 yr	0.31	287.12	287.50	287.31	287.50	0.001114	0.39	0.78	2.98	0.24	2.88	1.13
River	17	5 yr	1.33	287.12	287.50	287.50	287.64	0.019691	1.67	0.80	3.00	1.00	51.89	86.64
River	17	10 yr	3.08	287.12	287.72	287.72	287.96	0.016811	2.19	1.40	3.53	1.00	75.07	164.59
River	17	20 yr	6.43	287.12	288.02	288.02	288.43	0.014389	2.81	2.29	4.41	1.00	104.70	294.11
River	17	50 yr	15.40	287.12	288.51	288.51	288.96	0.015192	2.96	5.21	6.56	0.99	114.98	340.68
River	11	2 yr	0.31	286.89	287.50	287.50	287.50	0.000077	0.14	2.25	5.19	0.07	0.30	0.04
River	11	5 yr	1.33	286.89	287.50	287.50	287.52	0.001447	0.59	2.25	5.19	0.29	5.70	3.38
River	11	10 yr	3.08	286.89	287.47	287.50	6278514.00	99622980.000000	11096.69	0.00	5.13	37815.07	7498852000.00	83212450000000.00
River	11	20 yr	6.43	286.89	287.61	287.61	287.87	0.016769	2.26	2.84	5.42	1.00	78.70	178.14
River	11	50 yr	15.40	286.89	287.75	288.04	288.68	0.047766	4.28	3.60	5.70	1.72	265.37	1134.52
River	1	2 yr	0.31	286.34	286.39	286.49	287.40	1.813576	4.45	0.07	1.74	7.15	698.41	3104.71
River	1	5 yr	1.33	286.34	286.50	286.66	287.38	0.385576	4.15	0.32	2.79	3.92	428.39	1779.51
River	1	10 yr	3.08	286.34	286.92	286.84	287.04	0.010003	1.55	1.99	4.74	0.76	39.22	60.82

HEC-RAS Plan: Exisiting_Conditions River: River Reach: River (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(N/m2)	(N/m s)
River	1	20 yr	6.43	286.34	286.88	287.09	287.53	0.058207	3.58	1.80	4.59	1.83	213.58	764.50
River	1	50 yr	15.40	286.34	287.22	287.53	288.18	0.048210	4.33	3.55	5.81	1.77	271.38	1175.89

HEC-RAS Plan: Alternative 4 River: River Reach: River

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(N/m2)	(N/m s)
River	248	2 yr	0.31	297.77	297.89	297.89	297.92	0.029665	0.86	0.37	5.24	1.01	21.14	18.12
River	248	5 yr	1.33	297.77	298.01	298.01	298.10	0.020877	1.38	1.04	5.75	1.00	39.68	54.87
River	248	10 yr	3.08	297.77	298.14	298.15	298.31	0.020005	1.90	1.81	6.28	1.07	63.24	120.16
River	248	20 yr	6.43	297.77	298.31	298.36	298.62	0.020017	2.53	2.97	7.01	1.15	97.34	246.53
River	248	50 yr	15.40	297.77	298.83	298.77	299.19	0.009604	2.82	7.14	9.16	0.90	95.28	268.85
River	229	2 yr	0.31	296.97	297.15	297.16	297.22	0.045545	1.16	0.26	2.86	1.23	37.29	43.44
River	229	5 yr	1.33	296.97	297.28	297.33	297.49	0.049370	2.06	0.64	3.02	1.43	89.63	184.82
River	229	10 yr	3.08	296.97	297.46	297.54	297.78	0.036603	2.50	1.23	3.26	1.30	111.27	278.59
River	229	20 yr	6.43	296.97	297.77	297.82	298.17	0.025645	2.81	2.29	3.65	1.13	120.85	339.23
River	229	50 yr	15.40	296.97	298.37	298.37	298.92	0.019298	3.26	4.72	4.41	1.01	141.01	460.02
River	210	2 yr	0.31	296.34	296.48	296.50	296.56	0.060483	1.22	0.25	3.40	1.43	42.88	52.29
River	210	5 yr	1.33	296.34	296.62	296.64	296.76	0.030228	1.62	0.82	4.14	1.17	55.39	89.92
River	210	10 yr	3.08	296.34	296.72	296.81	297.04	0.043373	2.48	1.24	4.25	1.46	114.33	283.33
River	210	20 yr	6.43	296.34	296.87	297.05	297.48	0.054195	3.46	1.86	4.41	1.70	199.20	688.76
River	210	50 yr	15.40	296.34	297.18	297.54	298.29	0.055347	4.66	3.30	4.79	1.79	313.59	1462.19
River	190	2 yr	0.31	295.71	295.87	295.87	295.93	0.026179	1.09	0.28	2.36	1.00	29.19	31.68
River	190	5 yr	1.33	295.71	296.06	296.07	296.21	0.023843	1.75	0.76	2.76	1.07	58.52	102.53
River	190	10 yr	3.08	295.71	296.29	296.29	296.52	0.019107	2.11	1.46	3.25	1.01	73.34	154.99
River	190	20 yr	6.43	295.71	296.58	296.58	296.92	0.016982	2.60	2.49	3.90	1.00	96.98	251.81
River	190	50 yr	15.40	295.71	297.10	297.17	297.64	0.013104	3.33	5.38	7.30	0.97	132.16	440.38
River	171	2 yr	0.31	295.18	295.33	295.34	295.39	0.031435	1.07	0.29	2.92	1.09	29.88	31.93
River	171	5 yr	1.33	295.18	295.46	295.51	295.64	0.040368	1.86	0.72	3.80	1.37	73.01	135.80
River	171	10 yr	3.08	295.18	295.56	295.68	295.93	0.056054	2.67	1.15	4.54	1.69	136.34	364.07
River	171	20 yr	6.43	295.18	295.70	295.90	296.34	0.063968	3.53	1.82	5.17	1.90	214.10	755.57
River	171	50 yr	15.40	295.18	295.95	296.35	297.10	0.068264	4.75	3.24	6.08	2.08	339.70	1613.27
River	159	2 yr	0.31	294.46	294.62	294.66	294.75	0.098360	1.64	0.19	2.31	1.84	75.21	123.00
River	159	5 yr	1.33	294.46	294.77	294.85	295.04	0.056527	2.31	0.57	2.67	1.59	110.26	255.20
River	159	10 yr	3.08	294.46	295.34	295.07	295.43	0.005122	1.36	2.27	3.27	0.52	27.20	36.95
River	159	20 yr	6.43	294.46	295.90	295.38	296.01	0.003393	1.49	4.83	9.69	0.44	28.08	41.74
River	159	50 yr	15.40	294.46	296.47	296.15	296.59	0.002707	1.73	15.52	24.35	0.42	33.41	57.88
River	146	2 yr	0.31	294.09	294.25	294.25	294.31	0.026422	1.11	0.27	2.26	1.02	30.44	33.91
River	146	5 yr	1.33	294.09	294.93	294.45	294.94	0.000807	0.53	2.53	4.38	0.22	4.12	2.16
River	146	10 yr	3.08	294.09	295.37		295.39	0.000735	0.63	5.12	10.66	0.22	5.35	3.40
River	146	20 yr	6.43	294.09	295.96		295.97	0.000317	0.60	16.86	26.12	0.16	3.94	2.35
River	146	50 yr	15.40	294.09	296.53		296.55	0.000363	0.80	32.82	30.00	0.18	6.35	5.08
River	140	2 yr	0.31	293.89	294.25	294.10	294.26	0.002054	0.48	0.63	2.60	0.31	4.60	2.22
River	140	5 yr	1.33	293.89	294.93	294.31	294.94	0.000449	0.43	3.07	4.39	0.17	2.67	1.16
River	140	10 yr	3.08	293.89	295.37	294.54	295.39	0.000454	0.58	6.46	14.29	0.18	4.12	2.38
River	140	20 yr	6.43	293.89	295.95	294.82	295.97	0.000396	0.72	13.86	28.10	0.18	5.50	3.94
River	140	50 yr	15.40	293.89	296.50	295.39	296.54	0.000611	1.08	24.94	30.65	0.23	11.30	12.18
River	124		Culvert											
River	101	2 yr	0.31	292.45	292.94	292.61	292.94	0.000135	0.15	2.02	6.09	0.08	0.41	0.06
River	101	5 yr	1.33	292.45	293.13	292.76	293.14	0.000587	0.41	3.24	6.48	0.19	2.63	1.08
River	101	10 yr	3.08	292.45	293.33	292.90	293.36	0.001112	0.68	4.56	6.89	0.26	6.50	4.39
River	101	20 yr	6.43	292.45	293.55	293.10	293.61	0.002065	1.05	6.14	7.59	0.37	14.66	15.34
River	101	50 yr	15.40	292.45	293.94	293.48	294.08	0.003616	1.65	9.34	8.78	0.51	33.36	55.02
River	93	2 yr	0.31	292.57	292.89	292.89	292.93	0.032115	0.90	0.34	4.43	1.04	23.18	20.85
River	93	5 yr	1.33	292.57	293.02	293.02	293.12	0.023616	1.39	0.95	5.07	1.03	41.38	57.64
River	93	10 yr	3.08	292.57	293.18	293.18	293.32	0.020216	1.65	1.87	6.86	1.01	51.18	84.30
River	93	20 yr	6.43	292.57	293.36	293.36	293.56	0.018460	2.00	3.22	8.22	1.02	66.72	133.15
River	93	50 yr	15.40	292.57	293.76		294.03	0.010638	2.26	6.82	9.34	0.84	70.02	158.19
River	87	2 yr	0.31	292.24	292.39	292.43	292.54	0.126084	1.70	0.18	2.54	2.03	84.63	143.68
River	87	5 yr	1.33	292.24	292.49	292.59	292.81	0.100832	2.48	0.54	3.56	2.05	141.61	351.70
River	87	10 yr	3.08	292.24	292.63	292.76	293.07	0.065053	2.91	1.06	3.91	1.79	161.15	469.28
River	87	20 yr	6.43	292.24	292.88	293.01	293.36	0.036993	3.08	2.09	4.52	1.45	152.34	469.43
River	87	50 yr	15.40	292.24	293.47	293.47	293.92	0.014110	2.99	5.31	6.94	0.99	114.16	340.80
River	66	2 yr	0.31	290.79	290.94	290.98	291.03	0.047188	1.28	0.24	2.51	1.33	43.39	55.58
River	66	5 yr	1.33	290.79	291.18	291.08	291.21	0.004120	0.68	1.94	8.41	0.45	9.20	6.29
River	66	10 yr	3.08	290.79	291.42	291.19	291.45	0.002204	0.76	4.09	10.01	0.37	9.17	6.94
River	66	20 yr	6.43	290.79	291.70	291.34	291.74	0.001878	0.94	7.27	12.79	0.36	12.13	11.36
River	66	50 yr	15.40	290.79	293.08	291.64	293.10	0.000199	0.63	33.31	24.05	0.14	3.80	2.39
River	55	2 yr	0.31	290.48	290.73	290.73	290.81	0.024800	1.21	0.25	1.71	1.01	34.07	41.35
River	55	5 yr	1.33	290.48	290.97	290.97	291.11	0.020498	1.64	0.81	3.01	1.01	51.13	83.96
River	55	10 yr	3.08	290.48	291.19	291.19	291.38	0.018089	1.94	1.59	4.23	1.00	63.52	123.08
River	55	20 yr	6.43	290.48	291.46	291.46	291.68	0.011585	2.18	3.80	10.79	0.88	67.58	146.99
River	55	50 yr	15.40	290.48	293.07		293.09	0.000337	0.86	36.94	26.99	0.18	6.99	6.05
River	47	2 yr	0.31	290.41	290.53	290.52	290.56	0.017446	0.79	0.39	5.24	0.81	16.32	12.86
River	47	5 yr	1.33	290.41	290.78	290.66	290.82	0.004323	0.87	1.54	6.95	0.49	13.27	11.50
River	47	10 yr	3.08	290.41	291.07	290.81	291.12	0.002671	1.05	2.94	8.57	0.43	15.68	16.45
River	47	20 yr	6.43	290.41	291.49	291.02	291.57	0.001978	1.29	5.00	11.64	0.41	19.76	25.43
River	47	50 yr	15.40	290.41	293.01	291.47	293.08	0.000547	1.24	12.41	22.99	0.25	13.58	16.86
River	32		Culvert											
River	17	2 yr	0.31	287.12	287.50	287.31	287.50	0.001173	0.39	0.79	2.98	0.24	2.87	1.11
River	17	5 yr	1.33	287.12	287.32	287.51	288.34	0.390356	4.49	0.30	2.29	3.99	483.07	2169.52

HEC-RAS Plan: Alternative 4 River: River Reach: River (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(N/m2)	(N/m s)
River	17	10 yr	3.08	287.12	287.46	287.72	288.53	0.193216	4.59	0.67	2.88	3.04	419.14	1925.41
River	17	20 yr	6.43	287.12	287.56	287.99	289.70	0.264101	6.48	0.99	3.15	3.69	759.05	4917.48
River	17	50 yr	15.40	287.12	287.80	288.51	291.48	0.271138	8.50	1.81	3.77	3.91	1147.60	9750.82
River	11	2 yr	0.31	286.89	287.50	287.50	287.50	0.000077	0.14	2.25	5.19	0.07	0.30	0.04
River	11	5 yr	1.33	286.89	287.50	287.50	287.52	0.001447	0.59	2.25	5.19	0.29	5.70	3.38
River	11	10 yr	3.08	286.89	287.50	287.50	287.60	0.007758	1.37	2.25	5.19	0.67	30.58	41.92
River	11	20 yr	6.43	286.89	287.61	287.61	287.87	0.016769	2.26	2.84	5.42	1.00	78.70	178.14
River	11	50 yr	15.40	286.89	287.53	288.04	289.63	0.158895	6.41	2.40	5.25	3.03	658.54	4223.84
River	1	2 yr	0.31	286.34	286.39	286.49	287.40	1.813576	4.45	0.07	1.74	7.15	698.41	3104.71
River	1	5 yr	1.33	286.34	286.50	286.66	287.38	0.385576	4.15	0.32	2.79	3.92	428.39	1779.51
River	1	10 yr	3.08	286.34	286.65	286.84	287.33	0.123027	3.64	0.85	3.78	2.46	264.04	960.95
River	1	20 yr	6.43	286.34	286.88	287.09	287.54	0.058503	3.59	1.79	4.59	1.83	214.42	768.85
River	1	50 yr	15.40	286.34	287.16	287.53	288.34	0.064779	4.82	3.20	5.58	2.03	342.33	1648.54

Crossing Dimensions

	Hidden Valley Road		735 Diveway	
	Overflow	Low Flow	Overflow	Low Flow
Diameter	900 mm	600 mm	Two 1,450 mm span by 87	770 mm
Upstream invert (m)	290.77	289.94	294.69	293.74
Downstream Invert (m)	287.31	287.31	294.01	292.88

Hydraulic Results

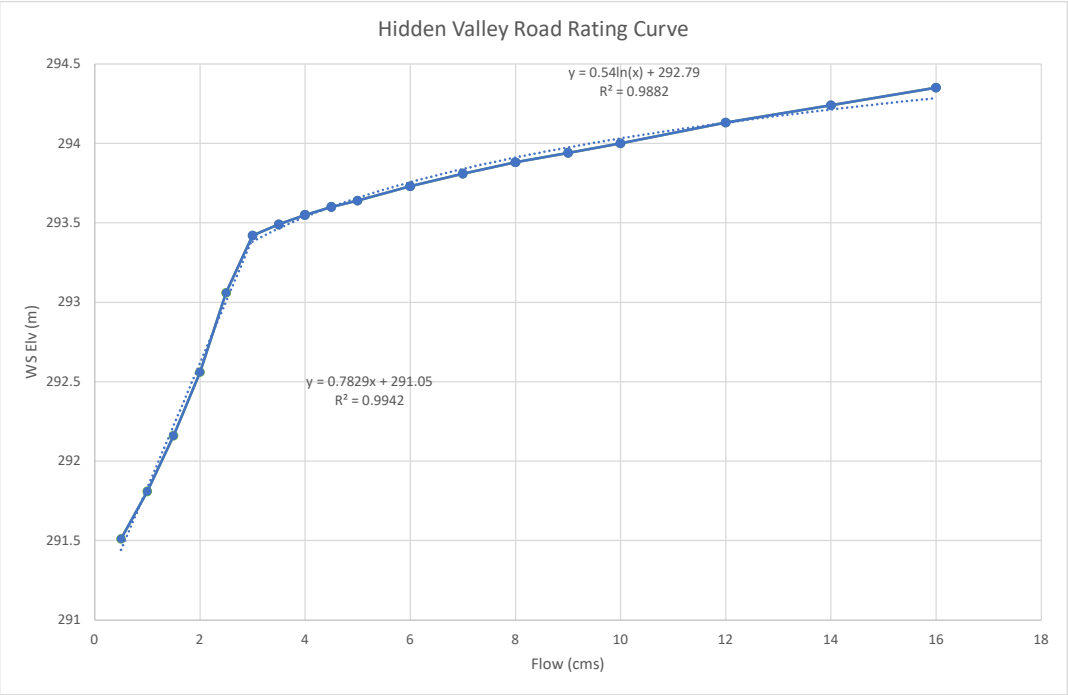
Existing Conditions Hidden Valley Road Results	
10-Year Walter Level (m)	293.43
HW/D (600 mm culvert)	5.82
Freeboard (m)	-0.09
Cover (m)	1.68

Alternative 4 Hidden Valley Road Results	
10-Year Walter Level (m)	291.06
HW/D	0.54
Freeboard (m)	2.28
Cover (m)	1.73

Flow (m3/s)	Water Surface Elevation Upstream of Road (m)	
0		
0.5	291.51	
1	291.81	
1.5	292.16	**Road Crest Elevation**
2	292.56	**293.34 m**
2.5	293.06	
3	293.42	
3.5	293.49	
4	293.55	
4.5	293.6	
5	293.64	
6	293.73	
7	293.81	
8	293.88	
9	293.94	
10	294	
12	294.13	
14	294.24	
16	294.35	

Water Level Upstream of Hidden Valley Road

Return Storm	Flow (m3/s)	Water Surface Upstream of Road
50-year	15.30	294.31
20-year	6.43	293.76
10-year	3.08	293.43
5-year	1.33	292.04
2-year	0.31	291.51


Hidden Valley Road Rating Curve
y = 0.54ln(x) + 292.79
R² = 0.9882
y = 0.7829x + 291.05
R² = 0.9942
WS Elv (m)
Flow (cms)
294.5
294
293.5
293
292.5
292
291.5
291
0
2
4
6
8
10
12
14
16
18

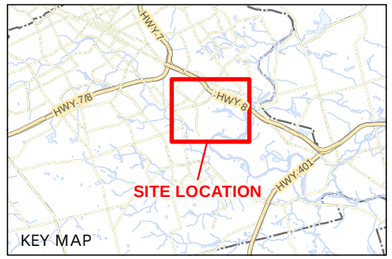
APPENDIX D
Flood Frequency Analysis

Stantec

Region of Waterloo

Legend

- Production Well
- Deep Monitoring Well (Stantec, 2012)
- Shallow Monitoring Well (Stantec, 2012)
- Drive-Point Piezometer (Stantec 2011/2012/2013)
- Guelph Permeameter (Stantec, 2012)
- Surface Water Monitoring Location (Stantec, 2011)
- Staff Gauge (Stantec, 2011)
- Observation Well
- Test Hole
- Water Supply Well
- Unknown Well Type
- Abandoned Well
- Beaver Dam
- Proposed Road Alignment
- Jefferson Salamander Regulated Habitat (MNR, 2011)
- Watercourse
- Ponded Area (Stantec, 2011)
- Vernal Pond (LGL, June 2009)
- Parcel Fabric



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © R egion of Waterloo, 2010.

February 2014
160900687

Client/Project
2013 Pre-Construction
Groundwater and Surface Water Monitoring
King Street to Manitou Drive, Kitchener, Ontario
Regional Municipality of Waterloo

Figure No.
1

Title
Site Plan & Monitoring Locations

0 250 500 m
1:10,000

\\Cd1004-f01\work_group\01609\active\160900687_River_Rd_Hydrogeo\planning\drawing\MXD\PreConstruction_MonProgram\160900687_PreConMonProg2013_Fig01_SitePlan.mxd
Revised: 2014-02-19 By: ccoghlan

Hidden Valley EA

Sample
Empirical probability formula : F[X(k)]=(k-0.40)/(n+0.20) (Cunnane)
Inactive data (in italic) are included in the empirical probability calculation.

Nr.	Observation	Identifier	Probability empirical	Code
1	0.34	2012	0.5490	
2	6.52	2013	0.9412	
3	2.9	2014	0.8431	
4	0.05	2015	0.0588	
5	0.4	2016	0.6471	
6	0.06	2017	0.2549	
7	0.27	2018	0.3529	
8	0.31	2019	0.4510	
9	0.05	2020	0.1569	
10	0.81	2021	0.7451	

Hidden Valley EA

Basic statistic	Active data
Number of observations	10
Minimum	0.0500
Maximum	6.52
Mean	1.17
Standard deviation	2.06
Median	0.325
Coefficient of variation (Cv)	1.76
Skewness coefficient (Cs)	2.40
Kurtosis coefficient (Ck)	4.60

HYFRANPLUS

Hidden Valley EA

Test for independence (Wald-Wolfowitz)

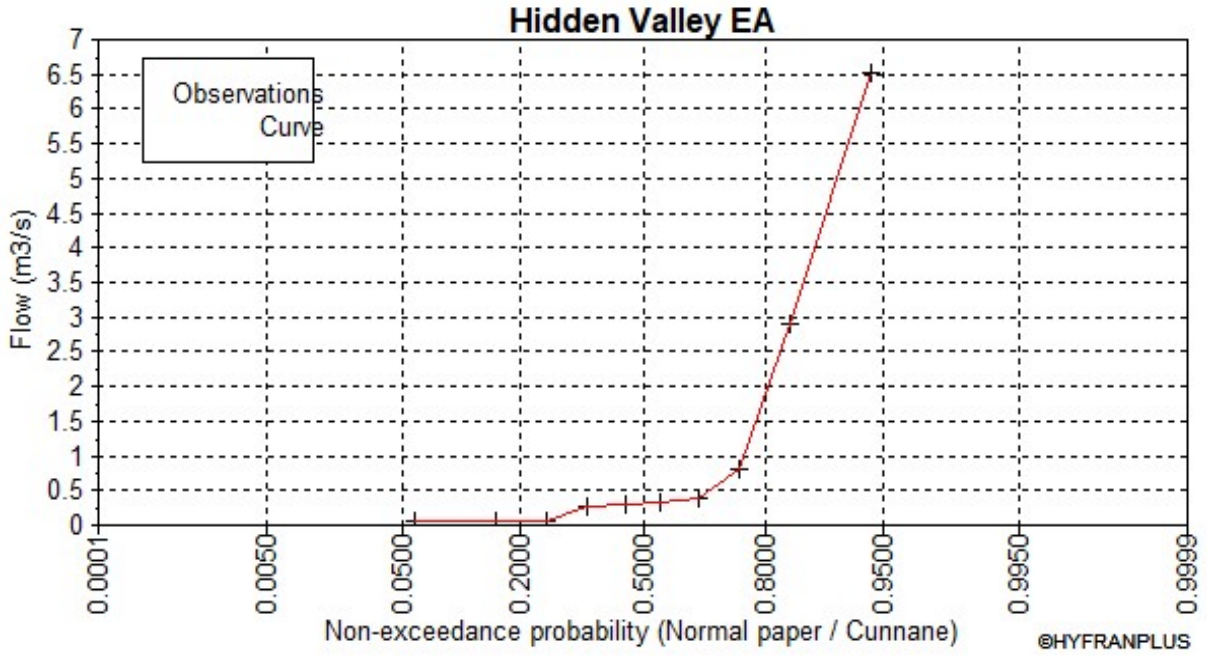
Hypotheses :
H0 : The observations are independent
H1 : Observations are dependent (autocorrelation of order 1)

Results :

Statistics value	|U| = 1.75
p-value :	p = 0.0807

Conclusion :
We accept H0 at a significance level of 5 %.

Hidden Valley EA



Hidden Valley EA

Comparison of characteristics between function and sample

	Charac. of the population	Charac. of the sample
Minimum	0.000311	0.0500
Maximum	None	6.52
Mean	2.25	1.17
Standard deviation	235	2.06
Median	0.306	0.325
Coefficient of variation (Cv)	105	1.76
Skewness coefficient (Cs)	N/D	2.40
Kurtosis coefficient (Ck)	N/D	4.60

HYFRANPLUS

Hidden Valley EA

Log-Pearson type 3 (WRC)

Results of the fitting

Number of observations : 10

Parameters

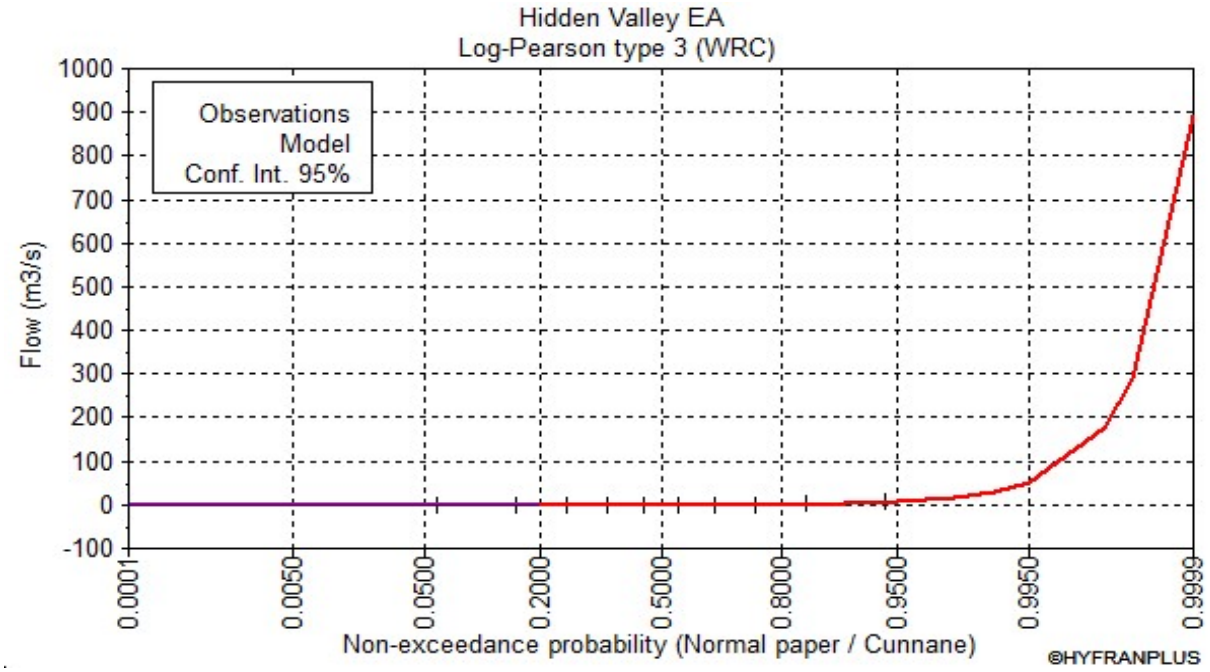
alpha	5.934830
lambda	18.094212
m	-3.507068

Quantiles

q = F(X) : non-exceedance probability
T = 1/(1-q)

T	q	XT	Standard deviation	Confidence interval (95%)
10000.0	0.9999	892	3980	N/D
2000.0	0.9995	290	1020	N/D
1000.0	0.9990	175	548	N/D
200.0	0.9950	50.3	113	N/D
100.0	0.9900	28.3	53.6	N/D
50.0	0.9800	15.4	23.9	N/D
20.0	0.9500	6.43	7.30	N/D
10.0	0.9000	3.08	2.69	N/D
5.0	0.8000	1.33	0.909	N/D
3.0	0.6667	0.644	0.390	N/D
2.0	0.5000	0.306	0.176	N/D
1.4286	0.3000	0.135	0.0731	N/D
1.2500	0.2000	0.0847	0.0452	-0.00387 - 0.173
1.1111	0.1000	0.0463	0.0265	-0.00572 - 0.0983
1.0526	0.0500	0.0291	0.0201	-0.0103 - 0.0685
1.0204	0.0200	0.0180	0.0166	-0.0146 - 0.0505
1.0101	0.0100	0.0133	0.0151	N/D
1.0050	0.0050	0.0103	0.0140	N/D
1.0010	0.0010	0.00635	0.0120	N/D
1.0005	0.0005	0.00534	0.0113	N/D
1.0001	0.0001	0.00379	0.00989	-0.0156 - 0.0232

Hidden Valley EA



Hidden Valley EA

Sample
Empirical probability formula : F[X(k)]=(k-0.40)/(n+0.20) (Cunnane)
Inactive data (in italic) are included in the empirical probability calculation.

Nr.	Observation	Identifier	Probability empirical	Code
1	0.34	2012	0.5490	
2	6.52	2013	0.9412	
3	2.9	2014	0.8431	
4	0.05	2015	0.0588	
5	0.4	2016	0.6471	
6	0.06	2017	0.2549	
7	0.27	2018	0.3529	
8	0.31	2019	0.4510	
9	0.05	2020	0.1569	
10	0.81	2021	0.7451	

Hidden Valley EA

Description

Hidden Valley EA

Basic statistic	Active data
Number of observations	10
Minimum	0.0500
Maximum	6.52
Mean	1.17
Standard deviation	2.06
Median	0.325
Coefficient of variation (Cv)	1.76
Skewness coefficient (Cs)	2.40
Kurtosis coefficient (Ck)	4.60

HYFRANPLUS

Hidden Valley EA

Test for independence (Wald-Wolfowitz)

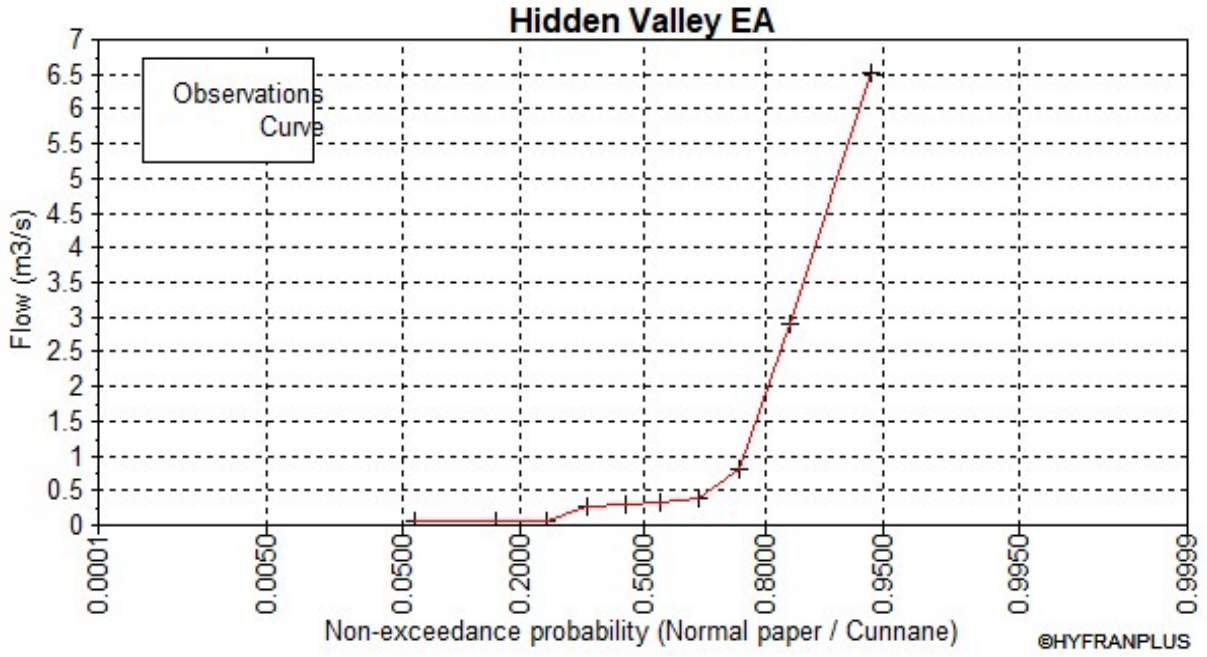
Hypotheses :
H0 : The observations are independent
H1 : Observations are dependent (autocorrelation of order 1)

Results :

Statistics value	|U| = 1.75
p-value :	p = 0.0807

Conclusion :
We accept H0 at a significance level of 5 %.

Hidden Valley EA



Hidden Valley EA

Comparison of characteristics between function and sample

	Charac. of the population	Charac. of the sample
Minimum	0.000311	0.0500
Maximum	None	6.52
Mean	2.25	1.17
Standard deviation	235	2.06
Median	0.306	0.325
Coefficient of variation (Cv)	105	1.76
Skewness coefficient (Cs)	N/D	2.40
Kurtosis coefficient (Ck)	N/D	4.60

HYFRANPLUS

Hidden Valley EA

Log-Pearson type 3 (WRC)

Results of the fitting

Number of observations : 10

Parameters

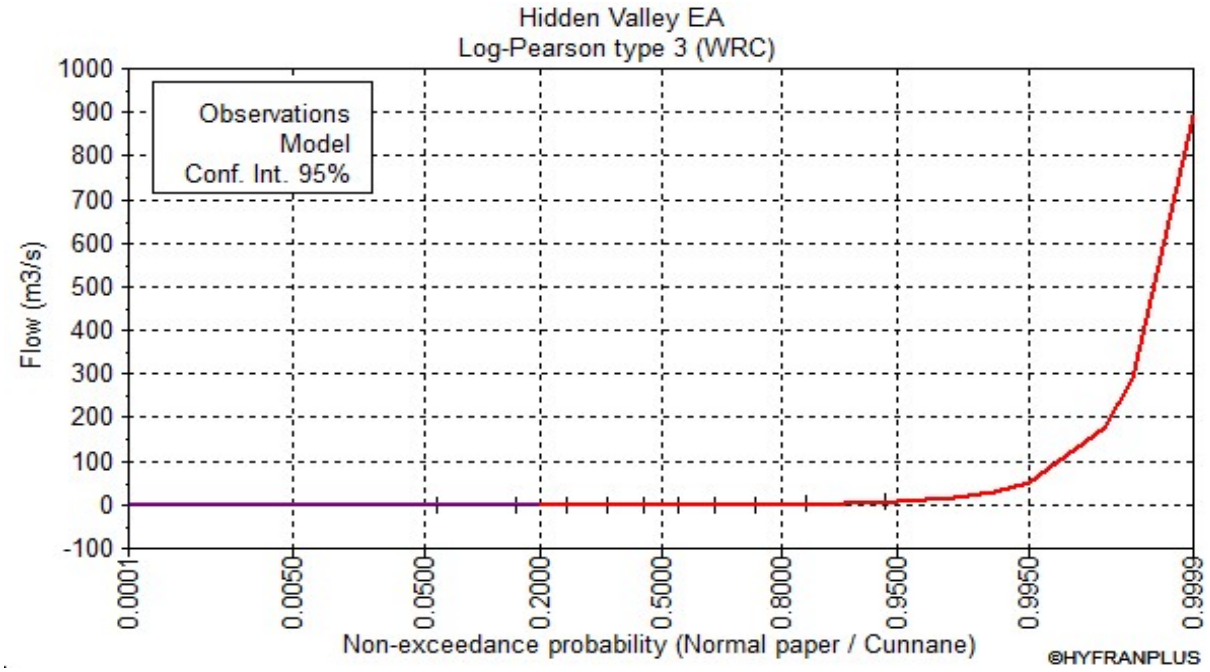
alpha	5.934830
lambda	18.094212
m	-3.507068

Quantiles

q = F(X) : non-exceedance probability
T = 1/(1-q)

T	q	XT	Standard deviation	Confidence interval (95%)
10000.0	0.9999	892	3980	N/D
2000.0	0.9995	290	1020	N/D
1000.0	0.9990	175	548	N/D
200.0	0.9950	50.3	113	N/D
100.0	0.9900	28.3	53.6	N/D
50.0	0.9800	15.4	23.9	N/D
20.0	0.9500	6.43	7.30	N/D
10.0	0.9000	3.08	2.69	N/D
5.0	0.8000	1.33	0.909	N/D
3.0	0.6667	0.644	0.390	N/D
2.0	0.5000	0.306	0.176	N/D
1.4286	0.3000	0.135	0.0731	N/D
1.2500	0.2000	0.0847	0.0452	-0.00387 - 0.173
1.1111	0.1000	0.0463	0.0265	-0.00572 - 0.0983
1.0526	0.0500	0.0291	0.0201	-0.0103 - 0.0685
1.0204	0.0200	0.0180	0.0166	-0.0146 - 0.0505
1.0101	0.0100	0.0133	0.0151	N/D
1.0050	0.0050	0.0103	0.0140	N/D
1.0010	0.0010	0.00635	0.0120	N/D
1.0005	0.0005	0.00534	0.0113	N/D
1.0001	0.0001	0.00379	0.00989	-0.0156 - 0.0232

Hidden Valley EA



APPENDIX E
Ecology Report

Matrix Solutions Inc.
A Montrose Environmental Company

NATURAL HERITAGE EXISTING CONDITIONS REPORT

HIDDEN VALLEY FLOOD RISK REDUCTION, SOURCE WATER PROTECTION, AND STORMWATER MANAGEMENT STRATEGY
KITCHENER, ONTARIO

Prepared for:
CITY OF KITCHENER

Prepared by:
MATRIX SOLUTIONS INC., A MONTROSE ENVIRONMENTAL COMPANY

Version 1.0
March 2024
Guelph, Ontario

Unit 7B, 650 Woodlawn Rd. West
Guelph, ON, Canada N1K 1B8
T 519.772.3777 F 226.314.1908
www.matrix-solutions.com

NATURAL HERITAGE EXISTING CONDITIONS REPORT

HIDDEN VALLEY FLOOD RISK REDUCTION, SOURCE WATER PROTECTION, AND STORMWATER MANAGEMENT STRATEGY

KITCHENER, ONTARIO

Report prepared for The City of Kitchener, March 2024

Bailey Cole, B.Sc., CAN-CISEC
Environmental Planner

reviewed by
Shari Muscat, B.E.S., B.A.
Senior Environmental Planner

reviewed by
Karen Hofbauer, M.A.Sc., P.Eng.
Principal Water Resources Engineer

VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	12-Jan-2024	Draft	31809 Hidden Valley NH 2024-01-12 draft v0.1.docx	Issued to client for review
V1.0	12-Mar-2024	Final	31809 Hidden Valley NH R 2024-03-12 Final V1.0.docx	Issued to client

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IN-TEXT FIGURES

IN-TEXT TABLES

APPENDICES

1 INTRODUCTION

The City of Kitchener (the City) has retained Matrix Solutions Inc., a Montrose Environmental company to complete a review of the natural heritage features to support a Municipal Class B Environmental Assessment for Flood Risk Management within the Hidden Valley Watershed. Congruent with the Class Environmental Assessment process, Matrix has also been retained to support the City with the development of a Stormwater Management Strategy, and Source Water Protection and Intake Protection Zones.

This report has been written to support the Flood Risk Reduction Environmental Assessment which is being undertaken to reduce existing flood risks and to support future development in the Hidden Valley community. Within the downstream reaches of Hidden Valley Creek, there are several flood and erosion vulnerable areas, as well as watercourse crossings which may not have capacity to pass current or proposed peak flows. This report provides a detailed description of the study area, and the extent of natural heritage features within it. Through a review of existing literature and databases, this report will help guide the selection of the long list of alternatives. This report should be read in conjunction with the Hidden Valley Flood Risk Reduction Schedule B Class Environmental Assessment (Matrix 2024).

1.1 Study Area

The subject lands include the lands that drain to Hidden Valley Creek in Kitchener (Ontario). The study area includes these lands, and an additional 120 m of adjacent lands. The subject lands are bound to the north by Morgan Avenue, by the Grand River to the east, 280 m south of Hidden Valley Road, and Wilson Avenue to the west. A map of the Hidden Valley subwatershed can be seen in, showing both the subject lands, and the study area boundaries. The Hidden Valley Creek subwatershed is approximately 183 hectares in size.

Current land uses within the study area include a broad range of residential, agricultural, employment, commercial, and major infrastructure uses. There is currently a stormwater management facility located in the southeast corner of the study area. Previous land uses have included an equine facility and a gravel pit which was located on the northeast corner of Hidden Valley Road and Wabanaki Drive.

The Hidden Valley area is considered one of the most significant environmental features within the City of Kitchener and the Region of Waterloo. The area contains an esker formation, provincially significant wetlands, large significant woodland and upland forest areas, rare and significant flora and fauna including regulated habitat for species at risk, habitat breeding areas, sourcewater protection areas and steep slopes along the Grand River. Each of these natural features and their constraints will help guide the selection of the long list of alternatives.

Easting (m)

545000 545500 546000 546500 547000 547500

Northing (m)

4809000 4808500 4808000 4807500 4807000 4806500

8TH AVE
9TH AVE
ST JEROME CRES
CONNAUGHT ST
CARROL ST
WOODHAVEN RD
MUNROE ST
CAIT AVE
GREENFIELD AVE
FAIRLAWN RD
TRAYNOR AVE
BELWOOD CRES
BALFOUR CRES
FAIRWAY RD S
KINGSWAY DR
FLORENCE AVE
JANSEN AVE
HUBER ST
THALER AVE
WINDOM RD
SOUTHILL DR
FAIRWAY RD N
RIVER RD E
QUINTE CRES
ONEIDA PL
MORRISON RD
UNDERHILL CRES
GRAND RIVER BLVD
CHANDOS DR
LEWIS CRES
MANOR DR
MORGAN AVE
BERWICK PL
KING ST E
CAMEO DR
HOFSTETTER AVE
WOODVIEW CRES
STONEGATE DR
HIDDEN VALLEY RD
HWY 8
WILSON AVE
WEBSTER RD
CHANDARIA PL
CRESS LANE
GOODRICH DR
WABANAKI DR
RIVER BIRCH ST
PADDOCK CRT
HIDDEN VALLEY CRES
MANITOU DR

N

Subject Lands
Study Area (120m Area of Investigation)

Reference: Contains information licensed under the Open Government Licence - Ontario. Imagery (2022) Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

1:11,000 metres
100 0 100 200
NAD 1983 UTM Zone 17N

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Natural Heritage Report

DRAFT

Study Area Overview

Date:	Project:	Submitter:	Reviewer:
January 2024	31809	B. Cole	S. Muscat

Figure 1

I:\City\Kitchener\31809\Figures\And Tables\Natural Heritage\2024\Figure-1-Study_Area_Overview.mxd - Tabloid_L - 11-Jan-24, 05:48 PM - lmwright - TID005

1.2 Background Review

A desktop background review of available online resources and wildlife atlases was conducted to collect information regarding natural features and wildlife within the study area. As part of this review, available aerial photography, and mapping was also compiled and reviewed. The sources used are outlined in Table 1 below.

Table 1 Background Sources

Source	Citation	Information Reviewed
Land Information Ontario (LIO)	MNR 2000	Natural heritage features data layers
Ontario GeoHub	MNRF 2023a	Natural heritage features data layers
Aquatic Species at Risk Map	DFO 2023	Aquatic species at risk map
Natural Heritage Information Centre (NHIC)	MNRF 2023b	Data records for the study area
Ontario Breeding Bird Atlas (OBBA)	Birds Canada et al. 2023	Species records for the study area
Ontario Butterfly Atlas	TEA 2023a	Species records for the study area
Ontario Moth Atlas	TEA 2023b	Species records for the study area
Ontario Reptile and Amphibian Atlas	Ontario Nature 2023	Species records for the study area
Important Bird Areas	Bird Studies Canada 2023	Data records for the study area
eBird	Cornell Lab of Ornithology 2023	Species records for the study area
Ontario Mammals, iNaturalist	CAS 2023b	Species records for the study area
iNaturalist	CAS 2023a	Species records for the study area

1.2.1 Previous Reports

Extensive natural heritage studies have been completed within the Hidden Valley area, from 1979 through to 2023. This has included landscape level studies as well as detailed species-specific surveys. The following reports were reviewed and incorporated into our assessment:

1. Hidden Valley Land Use Master Plan (City of Kitchener, 2019)
2. Class Environmental Assessment. River Road Extension from King Street East to Manitou Drive (IBI Group, 2013)
3. Planning and Works Committee. Agenda: Tuesday March 4th, 2014, 2pm (Regional Municipality of Waterloo, 2014)
4. Stage 2 ION LRT from Kitchener to Cambridge Transit Project Assessment Process (WSP 2021)
5. Schedule B Class Environmental Assessment. Upper Hidden Valley Sanitary Pump Station and Forcemain (MTE Consultants Inc., 2022)
6. Hidden Valley Inventory of Environmental Features and Functions (Ecologistics, 1979)
7. Hidden Valley Draft Characterization Report. Comprehensive Environmental Impact Study for the City of Kitchener (LGL, 2023. Draft)

2 POLICY CONTEXT

The community of Hidden Valley is located in southwestern Ontario, along the Grand River within the City of Kitchener, in the Region of Waterloo. As it is located within a two-tier municipality, the study area is subject to official plan policies from both the City of Kitchener and the Region of Waterloo.

Due to the recent passing of Bill 23, Bill 13, and Bill 109, there have been substantial changes to the planning policies within 2 tier municipalities, notably with the delegation of most planning powers to the lower tier municipalities. Although the City of Kitchener has updated their Official Plan since the passing of these bills, the Region of Waterloo Official Plan has not yet been updated, as such the current Region of Waterloo policies have been referred to. It should be noted that these policy changes are both dynamic and ongoing. At the time of writing this report, we have received notice from the Ministry of Municipal Affairs and Housing (MMAH) that additional changes and decisions regarding municipal plans can be expected in early 2024.

A portion of the study area is regulated by the Grand River Conservation Authority (GRCA), and the study area is also subject to legislation from the Ontario Ministry of Environment, Conservation and Parks (MECP), and the Ontario Ministry of Natural Resources and Forestry (MNRF). The following section provides a summary of the legislation and guidelines relevant to this project.

2.1 Policy Framework

Table 2 Applicable Federal, Provincial, and Municipal Policies

Legislation	Policies and Regulations	Guidelines	Summary of Contents
Federal Acts and Regulations			
Species at Risk Act (2002)	Critical Habitat of the Black Redhorse (Moxostoma duquesnei) (DFO, 2022) Critical Habitat of the Silver Shiner (*Notropis photogenis*) (DFO, 2023)	N/A	• SARA incorporates a number of prohibitions to protect SAR, providing recovery strategies for extirpated, endangered, or threatened species, as well as managing species of special concern (Government of Canada, 2016). On private or provincially-owned lands, only aquatic species listed as endangered, threatened, or extirpated and migratory birds listed on Schedule 1 are protected under SARA, unless ordered by the Governor in Council, or for those species that have critical habitat identified. Schedule 1 migratory birds where critical habitat has been identified require consideration under SARA. Should a species also be listed under SARA and the ESA, where the ESA provides equal or greater protection, the ESA takes precedence. • **Applicability to Project:** Both fish and mussel species at risk have been identified with the Grand River, which is located within the study area, and immediately downstream of the project area. Critical habitat for the Black Redhorse and the Silver Shiner has been identified within the Grand River through the DFO.
Fisheries Act (1985, amended 2019)	Fish Protection Policy Statement (2013)	N/A	• The *Fisheries Act* outlines the framework for the management and regulation of fisheries and the conservation and protection of fish and fish habitat within the fishing zones of Canada, all waters in the territorial sea of Canada, and all internal waters of Canada. • **Applicability to Project:** Any activities that may impact a watercourse, Hidden Valley Creek or the Grand River, would require a Request for Review from the DFO. It is anticipated that this project will require, at minimum a request for review from the DFO.
Migratory Birds Convention Act (1994, amended on 2017)	Migratory Birds Regulation (2022) Migratory Bird Sanctuary Regulations (2022)	N/A	• The MBCA affords protection to birds listed under Article 1 of the MBCA. General prohibitions protect migratory birds, their nests, and their eggs, and prohibits the deposition of harmful substances in waters and other areas frequented by them. • The MBR clarifies the nest protection timelines for 18 species that are listed on Schedule 1. These timelines include a waiting period until the nest can be deemed abandoned and subsequently removed. The waiting period for these 18 species remains in effect even if the nest is unoccupied. Nest protection for all other species which are not listed in Article 1 remains the same, with nest removal occurring once the young have fledged. • **Applicability to Project:** All vegetation removal shall occur outside of the migratory bird nesting window of April 1 to August 31 of any year to avoid disturbing active nests.

Legislation	Policies and Regulations	Guidelines	Summary of Contents
Provincial Acts and Regulations			
Planning Act (1990, amended 2022)	*Provincial Policy Statement, 2020* (MMAH 2020)	*Natural Heritage Reference Manual* (MNR 2010) *Significant Wildlife Habitat Technical Guide* (MNR 2000) *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E* (MNRF 2015)	• The PPS provides policy direction on provincial matters of interest related to land use planning and development. It sets the policy framework for regulating development and use of land and is issued under the authority of Section 3 of the *Planning Act*. • Section 2.1 of the PPS outlines policies that provide legislative protection for the natural environment. These policies include the exclusion of development and site alteration within PSWs, habitat of endangered or threatened species, fish habitat, as well as within SWH, significant woodlands, significant valleylands, ANSIs or adjacent lands "…unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions" (MMAH 2020). The NHRM was developed to provide technical guidance for implementing the natural heritage policies of the PPS. • The NHRM and SWHTG outline protection of natural heritage features within Ontario including significant wetlands, woodlands, and wildlife habitat. • **Applicability to Project:** A number of natural heritage features are found within the study area that may contain SWH which includes potential for species of conservation concern and special concern.
Places to Grow Act (2005)	*A Place to Grow. Growth Plan for the Greater Golden Horseshoe* (2020) O. Reg. 416/05: Growth Plan Areas	N/A	• The *Places to Grow Act* enables the development of regional growth plans that guide government investments and land use planning policies. • The Growth Plan for the Greater Golden Horseshoe provides a framework for long-term management of growth within the region. It builds upon the policies in the PPS 2020 provides direction on how and where the region will grow. • **Applicability to Project:** The Region of Waterloo has been designated as a Growth Plan Area. The project area is subject to policies under the Growth Plan for the Greater Golden Horseshoe (2020).
Endangered Species Act (2007, amended 2020)	O. Reg.'s: 230/08 242/08 829/21 830/21 832/21	N/A	• The ESA provides conservation and protection of species in Ontario. Species listed as endangered or threatened under the ESA are afforded legal protection from harm and harassment. The ESA also prohibits damage or destruction of habitat of endangered or threatened species. Habitat protection for a species can be general or subject to the specific provisions of a habitat regulation as set out in O. Reg. 832/21. • **Applicability to Project:** The ESA applies to all SAR species within provincial lands protected under the ESA. Any impacts to these species or their habitats protected under the ESA would require a permit. • Habitat for a *restricted species* has been identified within the project area. Consultation with the MECP would be required for any works within 300m of this area.

Legislation	Policies and Regulations	Guidelines	Summary of Contents
Fish and Wildlife Conservation Act (1997, amended 2021)	O. Reg.'s: 670/98 668/98 666/98 667/98 665/98 664/98 663/98 O. Reg. 669/98: Wildlife Schedules (1998)	N/A	• The *Fish and Wildlife Conservation Act* affords protection for some species of birds, amphibians, reptiles, and mammals in Ontario. • Some bird species which are not afforded protection under the MBCA are afforded protection under the *Fish and Wildlife Conservation Act*. • **Applicability to Project:** Suitable habitat for some of these species, including raptors and fur bearing mammals has been identified within the project area. Environmental management considerations should include timing windows for vegetation clearing and for construction.
Conservation Authorities Act (1990, amended 2022)	O. Reg. 150/06: Grand River Conservation Authority: Regulation of Development, Interference with Wetlands and Alteration to Shorelines and Watercourses (2006) Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (GRCA 2015) Wetland Policy (GRCA 2003)	N/A	• The *Conservation Authorities Act* empowers conservation authorities to regulate activities in natural and hazardous areas (such as streams, floodplains, wetlands, areas in and near rivers, slopes, and lake shoreline) through the Development, Interference with Wetlands, and Alterations to Shorelines and Watercourse Regulation. • **Applicability to Project:** A portion of the study area is located within the jurisdiction of the GRCA (regulated under O. Reg. 150/06). Any works within the regulatory limit may require a permit.
Municipal Acts and Regulations			
Regional Official Plan (Region of Waterloo, 2015)	N/A	Region of Waterloo Greenlands Network Implementation Guideline (2016)	• The Regional Official Plan was adopted by the Region of Waterloo on June 16, 2009, and has been amended through to June 18, 2015. • **Applicability to Project:** The ROW has identified a series of natural heritage features within their policies that includes The Greenlands Network, Environmentally Sensitive Landscapes (ESLs), and Environmentally Sensitive Policy Areas (ESPAs). Within the study area, the ROW has identified a regionally significant valley (the Grand River) and regionally significant woodlands. Both a portion of the study area and the project area have been identified as a Region Core Environmental Feature. The study area is located within ESPA 27 Hidden Valley/Bird Ridge and within ESPA 28 Petrifying Spring.

Legislation	Policies and Regulations	Guidelines	Summary of Contents
City of Kitchener Official Plan (2014, amended 2023)	Natural Heritage System Technical Background Report (City of Kitchener, 2014) Hidden Valley Land Use Master Plan (City of Kitchener, 2019) Hidden Valley Secondary Plan (in progress, 2023)	N/A	• The City of Kitchener Official Plan was adopted by City Council on November 19, 2014. A consolidated version of the official plan came into effect on August 23, 2023, which incorporates several amendments due to the implementation of Bill 13, 23, and 109. • **Applicability to Project:** Within the study area, a number of provincially, regionally, and locally significant features are present including wetlands, woodlots, valleylands are present. A portion of the study area and the project area have been identified as being part of the Kitchener Core Natural Heritage Features. • The Kitchener Official Plan outlines that infrastructure work shall avoid natural heritage features, where possible. Where avoidance is not feasible, the construction shall be designed to maintain, enhance, and restore ecological functions.

Notes:
ANSI - Area of Natural and Scientific Interest
DFO - Fisheries and Oceans Canada
ESA - *Endangered Species Act*
GRCA - Grand River Conservation Authority
HADD - harmful alteration, destruction, and displacement
MBCA - *Migratory Birds Convention Act*
MBR - Migratory Birds Regulation
NHRM - *Natural Heritage Reference Manual*
O. Reg. - Ontario Regulation
PPS - Provincial Policy Statement
SAR - species at risk
SARA - *Species at Risk Act*
SWH - significant wildlife habitat
SWHTG - *Significant Wildlife Habitat Technical Guide*

2.2 Agency Consultation

A request for information regarding the study area was submitted to the MECP and the MNRF (Aylmer District office) on May 9th, 2023. Wetland evaluation records and records of SAR and their critical habitat was requested. The MNRF provided wetland evaluation records on May 10th, 2023, and the MECP provided SAR critical habitat mapping on May 23, 2023. All information provided will be incorporated into the appropriate sections within this report. As these correspondences include confidential information, a copy of them will not be provided in this report.

3 NATURAL HERITAGE EXISTING CONDITIONS

Natural heritage information available for the site has been compiled as part of the background review. Species records, natural features, and habitat types were reviewed, and their results can be found in the following subsections. These findings will be used to evaluate and assess the short list of alternatives through the EA process. Once the preferred alternative has been identified, these findings will help inform the necessary mitigation measures and, if required, any additional studies.

3.1 Identified Features

The City of Kitchener Official Plan and the Region of Waterloo Official Plan were reviewed to identify any natural heritage features or Core Natural Areas that may be present.

Within the City of Kitchener, Core Natural Areas are designated as “Natural Heritage Conservation” and includes Provincially Significant Wetlands, Locally Significant Wetlands, significant valleys, environmentally significant valley features, locally significant valley features, environmentally sensitive policy areas, significant woodlands, locally significant woodlands, significant habitat of endangered or threatened species, and fish habitat.

The Region of Waterloo Greenlands Network is divided into Core Environmental Features and Landscape Level Systems. Landscape level systems include significant valleylands, environmentally sensitive landscapes, the provincial greenbelt natural heritage system, regional recharge areas, and the southwest Kitchener policy area. Core environmental features include PSWs, environmentally sensitive policy areas, regional forests, forests greater than 4 ha, and significant valley features.

The study area contains Kitchener Core Natural Heritage Features and Regional Core Environmental Features.

3.1.1 Environmentally Sensitive Policy Areas

Environmentally Sensitive Policy Areas (ESPA's) are core natural heritage features that have been designated through the Region of Waterloo Official Plan.

Two ESPA's are located within the study area:

- ESPA 27: Hidden Valley. Located within the central portion of the study area.
- ESPA 28: Petrifying Spring. Located to the southwest of the study area.

3.1.2 Valleylands

Valleylands are natural areas that occur in a valley or landform depression that has flowing or standing water for some period of the year. The Grand River flows from Wareham, Ontario, south through Brantford and Paris, before emptying into the north shore of Lake Erie, just south of Dunnville. A reach of the Grand River and its associated valleyland flows through the eastern portion of the study area. It is confined due to steep banks and slope erosion hazards and has been identified as a Regionally Significant Valley.

Hidden Valley Creek and Hoffstetter Creek and their associated valleylands which traverse the study area, have been identified as a Locally Significant Valleylands. To the immediate north of the study area, the upstream section of Hidden Valley East Creek (north of Highway 8) is listed as future restored locally significant valleyland.

3.1.3 Wetlands

The study area contains the Hidden Valley Provincially Significant Wetland (PSW). This PSW is located within the central portion of the property and is approximately 19 ha in size. It contains both swamp and marsh habitat types.

Both the Lower Freeport Creek Non-PSW Complex and the Grandview PSW are located just outside of the study area, on the eastern side of the Grand River, adjacent to Highway 8.

3.1.4 Areas of Natural and Scientific Interest

Areas of Natural and Scientific Interest (ANSIs) are areas of land or water that contain features identified as having life science or earth science values related to protection, scientific study, or education.

Based on the background review completed by Matrix, there are no ANSIs present within the study area. The Freeport Esker (an Earth Science ANSI) is located approximately 1.2km to the east of the project area. Additionally, the Homer Watson Park (an Earth Science ANSI) is located approximately 1.0km to the southwest of the project area.

3.1.5 Significant Woodlands

Woodlands are treed areas that provide environmental and economic benefits to the landowner as well as the general public. These woodlands provide benefits such as wildlife habitat, erosion prevention, hydrological and nutrient cycling, long-term storage of carbon, as well as recreational and harvesting opportunities. Woodlands vary in their level of significance at the local, regional, and the provincial levels.

Significant Woodlands within the City of Kitchener are those that are greater than 4 hectares, consist primarily of native tree species, and meet the criteria of a woodland under the Regional Woodland Conservation By-law. Locally Significant Woodlands are less than 4 ha in size, but are ecologically, functionally, or economically important.

Regionally Significant, Locally Significant, and other woodlands have been identified by the City of Kitchener Natural System Technical Background Report (2014) within the study area. A large portion of the central woodland has been identified as Regionally Significant. A small eastern portion of this woodland has been identified as Locally Significant, and small northwest portion of this woodland has been identified as other woodlands.

Easting (m)

545000 545500 546000 546500 547000 547500

Northing (m)

4809000 4808500 4808000 4807500 4807000 4806500

8TH AVE
9TH AVE
ST JÉROME CRES
CONNAUGHT ST
CARROL ST
WOODHAVEN RD
MUNROE ST
CAIT AVE
FAIRLAWN RD
TRAYNOR AVE
GREENFIELD AVE
BELWOOD CRES
BALFOUR CRES
FAIRWAY RD S
KINGSWAY DR
FLORENCE AVE
JANSEN AVE
HUBER ST
THALER AVE
WINDOM RD
SOUTHILL DR
FAIRWAY RD N
RIVER RD E
QUINTE CRES
ONEIDA PL
UNDERHILL CRES
MORRISON RD
CHANDOS DR
GRAND RIVER BLVD
LEWIS CRES
MANOR DR
MORGAN AVE
BERWICK PL
KING ST E
CAMEO DR
HOFSTETTER AVE
WOODVIEW CRES
STONEGATE DR
HWY 8
HIDDEN VALLEY RD
WILSON AVE
CHANDARIA PL
WEBSTER RD
CRESS LANE
GOODRICH DR
WABANAKI DR
RIVER BIRCH ST
PADDOCK CRT
HIDDEN VALLEY CRES
MANITOU DR

N

Subject Lands
Study Area (120m Area of Investigation)

Wooded Area
- Regionally Significant
- Locally Significant
- Other

Wetland (GRCA)
- Provincially Significant
- Non-Provincially Significant
- Unevaluated

Reference: Contains information from the City of Kitchener Natural Heritage Background Report and information licensed under the Open Government Licence - Ontario and GRCA Open Data Licence v2. Imagery (2022) Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

1:11,000 metres
100 0 100 200
NAD 1983 UTM Zone 17N

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Natural Heritage Report

Natural Heritage Features

DRAFT

Date:	Project:	Submitter:	Reviewer:
January 2024	31809	B. Cole	S. Muscat

Figure 2

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3.2 Aquatic Habitat and Fisheries

3.2.1 Background

Aquatic Habitat Assessments are used to identify impacts and to propose mitigation measures, with the goal of preventing or reducing impacts to fish and fish habitat. Under the Fisheries Act, fish habitat means the water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas (DFO).

3.2.2 Methods

A high-level aquatic habitat assessment was conducted by Matrix on September 27, 2023, to characterize aquatic features within the study area. LGL had previously sampled the area in 2009, 2012, and 2015. Matrix assessed the portion of Hidden Valley Creek approximately 40m downstream of the culvert crossing and approximately 55m upstream of the culvert. Detailed field notes and photos were recorded.

The following information was documented during this assessment:

- Substrate type and composition;
- Riparian and aquatic vegetation;
- Potential fish habitat or presence of fish;
- Flow conditions;
- Adjacent lands (vegetation community type, riparian habitat, canopy cover, land use, etc.);
- Channel morphology; and
- Instream habitat and cover.

As the area has already been extensively studied, no fish community assessment or detailed aquatic assessment were completed by Matrix as part of this Environmental Assessment.

3.2.3 Results and Discussion

The study area contains three watercourses, the Grand River, Hofstetter Creek, and Hidden Valley Creek (North, East, and West). Site conditions, as observed by Matrix during our field visit, were cross referenced with those outlined by LGL from their previous studies. No significant differences were observed. Characteristic photos of the site, including the areas assessed for aquatic habitat are found in Appendix A.

Grand River

The Grand River and its tributaries are considered warmwater fish habitat. Extensive fish records are available within the Grand River, but there is no documented evidence of fish within Hidden Valley Creek. Within the Grand River, critical habitat for Black Redhorse and Silver Shiner has been identified by

the DFO. Any work within proximity to either watercourse would require a request for review from the DFO.

The Hidden Valley East Creek empties into the Grand River approximately 140 m downstream of the Hidden Valley Road culvert. At the mouth of Hidden Valley East Creek, there is clear deposition of fine sediments into the Grand River, likely as a result of ongoing erosion in the Hidden Valley Creek system. Although no fish were observed in the area surrounding the culvert, the area immediately downstream of the culvert is functionally connected to the Grand River and may support fish and fish habitat.

Hidden Valley East Creek – Culvert Under Hidden Valley Road

The Hidden Valley Road culvert infrastructure includes two culverts on the west side that join into one culvert on the east side. This culvert crossing is a complete barrier to fish passage, even during spring run-off conditions. The lower (main) culvert is entirely filled with packed sediment and is completely buried on the west end. The upper (overflow) culvert is perched, by approximately 1.5 to 2 m in height on the upstream side. Water appears to be flowing underground, across Hidden Valley Road, bypassing both culverts entirely.

A high-level aquatic habitat assessment showed that the area within the vicinity of the Hidden Valley Road Culvert was overall poor fish habitat, and no fish were observed. Although a detailed benthic assessment was not completed, a visual survey of the water showed the substantial presence of scuds, which is an indicator of poor water quality. The dominant substrate type was rubble, with some gravel and sand. Instream cover for fish included undercut banks and boulders scattered throughout. Although the upper reaches of Hidden Valley Creek were experiencing significant instability concerns, the lower portion of the creek, where the culvert is located was generally stable. Adjacent land uses were residential with manicured grasses. Heavy disturbance was present upstream, as adjacent landowners have removed bank vegetation and replaced it with manicured rocks.

Seeps are natural areas where there is shallow groundwater movement, which eventually rises to the surface through a porous substrate and contributes to the surface water features. Seeps have an important contribution to the overall hydrological function of headwaters, recharge areas, and discharge areas within natural heritage systems. A seep was present immediately upstream of the Hidden Valley Road culvert. The seep appears to be originating from the southwest, near the wastewater management facility.

Easting (m)

545000 545500 546000 546500 547000 547500

Northing (m)

4809000 4808500 4808000 4807500 4807000 4806500

8TH AVE
9TH AVE
ST JEROME CRES
CONNAUGHT ST
CARROL ST
WOODHAVEN RD
MUNROE ST
TRAYNOR AVE
CAIT AVE
GREENFIELD AVE
FAIRLAWN RD
BELWOOD CRES
BALFOUR CRES
FAIRWAY RD S
WEBSTER RD
CRESS LANE
MANITOU DR
WILSON AVE
KINGSWAY DR
FLORENCE AVE
HUBER ST
JANSEN AVE
THALER AVE
WINDOM RD
SOUTHILL DR
FAIRWAY RD N
CHANDARIA PL
GOODRICH DR
WABANAKI DR
RIVER RD E
MORGAN AVE
BERWICK PL
QUINTE CRES
ONEIDA PL
UNDERHILL CRES
MORRISON RD
GRAND RIVER BLVD
CHANDOS DR
LEWIS CRES
MANOR DR
KING ST E
CAMEO DR
WOODVIEW CRES
STONEGATE DR
HIDDEN VALLEY RD
HWY 8
RIVER BIRCH ST
PADDOCK CRT
HIDDEN VALLEY CRES

Schneider Creek
Hidden Valley North Creek
Hofstetter Creek
Hidden Valley West Creek
Hidden Valley East Creek
Freeport Creek
Grand River

N

Subject Lands
Study Area (120m Area of Investigation)
Waterbody (GRCA)
Watercourse
Hidden Valley Road Culvert

1:11,000 metres
100 0 100 200
NAD 1983 UTM Zone 17N

Reference: Contains information licensed under the Open Government Licence - Ontario and GRCA Open Data Licence v2. Imagery (2022) Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Matrix Solutions Inc.
A Montrose Environmental Company

City of Kitchener
Hidden Valley Natural Heritage Report

DRAFT

Aquatic Reaches

Date:	Project:	Submitter:	Reviewer:
January 2024	31809	B. Cole	S. Muscat

Figure 3

I:\City\Kitchener\31809\Figures And Tables\EA\2024\Report\Natural Heritage\Figure 3-Aquatic_Reaches.mxd - Tabbed_L - 12-Jan-24, 10:51 AM - jmwright - TID005

3.3 Vegetation Communities and Plants

3.3.1 Background

Ecological Land Classification (ELC) of southern Ontario was established in 1994 to manage natural resources and the information about those resources. ELC provides a uniform and consistent way to identify, describe, name, map, manage, and conserve important landscape patterns and communities. Within southern Ontario and the Region of Waterloo, there are a number of rare or significant ELC communities. Rare vegetation communities with the potential to occur within the project area can be found in Section 3.3.3.

3.3.2 Methods

Matrix staff conducted a brief reconnaissance site visit on September 27, 2023. Where Matrix had permission to access lands, a rapid vegetation assessment and a preliminary plant list was completed. Matrix walked the northern, central, and eastern portions of the study area, focussing on those areas that have been proposed to be impacted by the flood risk reduction EA and the stormwater management strategy. A rapid ELC assessment was completed, and vegetation communities were delineated using the ELC system for southern Ontario (Lee et al. 1998). Data recorded for each vegetation community included species composition and the presence of dominant and uncommon species or features. No detailed inventories were completed by Matrix, as a comprehensive set of inventories was recently completed on the property. Site conditions were cross referenced with those outlined in previous reports. No significant differences were observed.

3.3.3 Results and Discussion – Rare Plant Communities

Based on the background review completed by Matrix, there is the potential for the presence of 4 rare vegetation communities within the Region of Waterloo, a list of these communities and whether they have been identified within the study area are summarized in Table 3 below.

LGL identified a small TPO1-1 community within the southwestern portion of the study area during their surveys in 2021. Given the extent of development within the area, they concluded that this community was likely anthropogenic in origin and was likely established because of an applied seed mix during construction. Matrix did not enter this portion of the property, nor did we observe any other rare plant communities during our site visit.

Table 3 Rare Ecological Land Classification Communities Potentially Present Within the Study Area

ELC Code	ELC Community Type	Region of Waterloo	Study Area	
		Number of Communities	NHIC Records	LGL Records
BOS2-1	Leatherleaf Shrub Kettle Peatland Type	X	No	No
SWT3-13	Poison Sumac Organic Thicket Swamp Type	X	No	No
TPO1-1	**Dry Tallgrass Prairie Type**	**3**	**No**	**Yes**
TPW1-1	Dry Black Oak – White Oak Tallgrass Woodland Type	3	No	No

Notes:
X denotes that the community is known to occur
ELC - Ecological Land Classification
NHIC - Natural Heritage Information Centre

3.3.4 Result and Discussion

A total of 54 vegetation communities were identified within the study area by Matrix, LGL, and others. Fifty-three of these community types are both common and secure within Ontario. One rare vegetation community was observed by LGL within the study area and has been described in Section 3.3.3 above.

As LGL has extensively studied the area, Matrix field surveys focused on verification on ELC community types and verification of community boundaries. Matrix observed no notable differences.

Table 4 Ecological Land Classification Communities within the Study Area

ELC Code	ELC Community Type
AG	Agriculture
CUM1-1	Dry-Moist Old Field Meadow Type
CUP	Plantation
CUP1	Deciduous Plantations
CUP1-3	Black Walnut Deciduous Plantation Type
CUP2	Mixed Plantations
CUP3	Coniferous Plantations
CUP3-1	Red Pine Coniferous Plantation Type
CUP3-2	White Pine Coniferous Plantation Type
CUP3-3	Scotch Pine Coniferous Plantation Type
CUT1	Mineral Cultural Thicket Ecosite
CUT1-1	Sumac Cultural Thicket Type
CUW1	Mineral Cultural Woodland Ecosite
FOC2	Dry-Fresh Cedar Coniferous Forest Ecosite
FOC2-2	Dry-Fresh White Cedar Coniferous Forest Type
FOC3	Fresh-Moist Hemlock Coniferous Forest Ecosite
FOC3-1	Fresh-Moist Hemlock Coniferous Forest Type
FOC4-1	Fresh-Moist White Cedar Coniferous Forest Type
FOC4-2	Fresh-Moist White Cedar-Hemlock Coniferous Forest Type

ELC Code	ELC Community Type
FOD	Deciduous Forest
FOD3	Dry-Fresh Poplar-White Birch Deciduous Forest Ecosite
FOD3-1	Dry-Fresh Poplar Deciduous Forest Type
FOD4	Dry-Fresh Deciduous Forest Ecosite
FOD4-2	Dry-Fresh White Ash Deciduous Forest Type
FOD5	Dry-Fresh Sugar Maple Deciduous Forest Ecosite
FOD5-1	Dry-Fresh Sugar Maple Deciduous Forest Type
FOD5-2	Dry-Fresh Sugar Maple-Beech Deciduous Forest Type
FOD5-3	Dry-Fresh Sugar Maple-Oak Deciduous Forest Type
FOD5-6	Dry-Fresh Sugar Maple-Basswood Deciduous Forest Type
FOD5-7	Dry-Fresh Sugar Maple-Black Cherry Deciduous Forest Type
FOD5-8	Dry-Fresh Sugar Maple-White Ash Deciduous Forest Type
FOD7	Fresh-Moist Lowland Deciduous Forest Ecosite
FOD8-1	Fresh-Moist Poplar Deciduous Forest Type
FOM	Mixed Forest
FOM6-1	Fresh-Moist Sugar Maple-Hemlock Mixed Forest Type
FOM7-1	Fresh-Moist White Cedar-Sugar Maple Mixed Forest Type
H	Hedgerow
M	Manicured
MAM2	Mineral Meadow Marsh Ecosite
MAM2-2	Reed-canary Grass Mineral Meadow Marsh Type
MAM2-5	Narrow-leaved Sedge Mineral Meadow Marsh Type
MAM2-10	Forb Mineral Meadow Marsh Type
MAS2-1	Cattail Mineral Shallow Marsh Type
MAS3-1	Cattail Organic Shallow Marsh Type
OAO	Open Aquatic
SWC3-2	White Cedar-Conifer Organic Coniferous Swamp Type
SWD2-2	Green Ash Mineral Deciduous Swamp Type
SWD4	Mineral Deciduous Swamp Ecosite
SWD4-1	Willow Mineral Deciduous Swamp Type
SWD5-1	Black Ash Organic Deciduous Swamp Type
SWM1-1	White Cedar-Hardwood Mineral Mixed Swamp Type
SWM6-1	Birch-Conifer Organic Mixed Swamp Type
SWT2-5	Red-osier Mineral Thicket Swamp Type
TPO1[(1)]	**Dry Tallgrass Prairie Ecosite**

Notes:
ELC - Ecological Land Classification
1. Rare plant community

LEGEND

Study Area

ELC Communities

AG	Agriculture
CUM1-1	Dry-Moist Old Field Meadow Type
CUP	Plantation
CUP1	Deciduous Plantations
CUP1-3	Black Walnut Deciduous Plantation Type
CUP2	Mixed Plantations
CUP3	Coniferous Plantations
CUP3-1	Red Pine Coniferous Plantation Type
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CUW1	Mineral Cultural Woodland Ecosite
FOC2	Dry-Fresh Cedar Coniferous Forest Ecosite
FOC2-2	Dry-Fresh White Cedar Coniferous Forest Type
FOC3	Fresh-Moist Hemlock Coniferous Forest Ecosite
FOC3-1	Fresh-Moist Hemlock Coniferous Forest Type
FOC4-1	Fresh-Moist White Cedar Coniferous Forest Type
FOC4-2	Fresh-Moist White Cedar-Hemlock Coniferous Forest Type
FOD	Deciduous Forest
FOD3	Dry-Fresh Poplar-White Birch Deciduous Forest Ecosite
FOD3-1	Dry-Fresh Poplar Deciduous Forest Type
FOD4	Dry-Fresh Deciduous Forest Ecosite
FOD4-2	Dry-Fresh White Ash Deciduous Forest Type
FOD5	Dry-Fresh Sugar Maple Deciduous Forest Ecosite
FOD5-1	Dry-Fresh Sugar Maple Deciduous Forest Type
FOD5-2	Dry-Fresh Sugar Maple-Beech Deciduous Forest Type
FOD5-3	Dry-Fresh Sugar Maple-Oak Deciduous Forest Type
FOD5-6	Dry-Fresh Sugar Maple-Basswood Deciduous Forest Type
FOD5-7	Dry-Fresh Sugar Maple-Black Cherry Deciduous Forest Type
FOD5-8	Dry-Fresh Sugar Maple-White Ash Deciduous Forest Type
FOD7	Fresh-Moist Lowland Deciduous Forest Ecosite
FOD8-1	Fresh-Moist Poplar Deciduous Forest Type Type
FOM	Mixed Forest
FOM6-1	Fresh-Moist Sugar Maple-Hemlock Mixed Forest Type
FOM7-1	Fresh-Moist White Cedar-Sugar Maple Mixed Forest Type
H	Hedgerow
M	Manicured
MAM2	Mineral Meadow Marsh Ecosite
MAM2-2	Reed-canary Grass Mineral Meadow Marsh Type
MAM2-5	Narrow-leaved Sedge Mineral Meadow Marsh Type
MAM2-10	Forb Mineral Meadow Marsh Type
MAS2-1	Cattail Mineral Shallow Marsh Type
MAS3-1	Cattail Organic Shallow Marsh Type
OAO	Open Aquatic
SWC3-2	White Cedar-Conifer Organic Coniferous Swamp Type
SWD2-2	Green Ash Mineral Deciduous Swamp Type
SWD4	Mineral Deciduous Swamp Ecosite
SWD4-1	Willow Mineral Deciduous Swamp Type
SWD5-1	Black Ash Organic Deciduous Swamp Type
SWM1-1	White Cedar-Hardwood Mineral Mixed Swamp Type
SWM6-1	Birch-Conifer Organic Mixed Swamp Type
SWT2-5	Red-osier Mineral Thicket Swamp Type
TPO1	Dry Tallgrass Prairie Ecosite

Hidden Valley Secondary Plan

Ecological Land Classification

LGL LIMITED
environmental research associates

Project	TA9168	Figure	12a
Date	April 2023	Prepared By:	KC
Scale	1:8,000	Verified By:	AHF

3.4 Wetland Delineation

3.4.1 Background

The Ontario Wetland Evaluation System (OWES) was established in 1983 to aid in the identification of wetlands that have value at a provincial scale. The OWES for Southern Ontario manual is now on its 4th update (MNRF, 2022). OWES provides a uniform and consistent way to identify and measure the recognized values of wetlands, and the role that they play in maintaining critical ecosystem functions, providing social benefits, moderating storm flows, improving water quality, and protecting rare species. It was developed primarily to fill a need within Ontario's planning process: to determine whether a wetland has been identified as Provincially Significant Wetland (PSW).

3.4.2 Methods

As a wetland evaluation has already been completed for the Hidden Valley PSW (MNRF, 2012), Matrix did not repeat field efforts. Instead, these wetland boundaries were verified in the field, information was collected, and any areas where the wetland boundary may have changed were identified.

As part of our desktop review, satellite imagery was reviewed and analyzed. Any areas of potential differences were noted, and these areas were flagged for ground truthing. While onsite, Matrix staff completed vegetation inventories to aid in the completion of wetland boundary delineations. Wetland boundaries were drawn where 50% of the plant species observed consisted of upland species and 50% consisted of wetland species. Along with the vegetation inventory, site elevation changes and soil characteristics were assessed to aid in the delineation.

3.4.3 Results and Discussion

The study area contains the Hidden Valley Provincially Significant Wetland (PSW). This wetland was evaluated in 1993, and most recently updated in 2012 (according to the wetland evaluation record). This PSW is located within the central portion of the study area and is approximately 19 ha in size. It contains a variety of habitats, including swamp and marsh habitat types. Dominant soil types are clay/loam and sand. It consists of mostly palustrine wetlands, with some isolated wetlands. These wetlands eventually drain southeast to the Hidden Valley Creek. Adjacent land uses include agricultural, residential, and a stormwater storage facility.

Dominant vegetation forms within the Hidden Valley PSW include robust emergent, coniferous trees, ground cover or herbaceous, deciduous trees, free-floating plants, tall shrubs. Each wetland community present and their ELC code can be seen in Figure 4.

Matrix identified a single wetland community, a MAS2-1 in the northwestern portion of the subject lands, that was larger than identified in the LGL report. Based on the vegetation present during our site visit, and using the 50% vegetation rule, this community extends further west than identified in Figure 4 by LGL and

extends into a portion of the community that had been identified as a CUM1-1. Prior to any works within close proximity to the wetland, Matrix recommends that a wetland delineation be completed, to update the evaluation records from 2012.

3.5 Wildlife

Based on the background review completed by Matrix, records for a total of 151 insect, 46 mammal, 173 bird, 71 fish, 6 mussel, and 23 reptile and amphibian species were noted to occur within the overall study area. Most of these species are common and secure within Ontario, though 26 SAR and 12 SCC have been identified as well. A full list of species at risk can be found in Appendices B.

3.5.1 Background

Extensive field surveys have been completed by environmental consultants, including LGL, within the Hidden Valley area. These surveys date from 1979 through to 2023 and include detailed vegetation community assessments, wildlife habitat assessments, breeding bird surveys, breeding amphibian surveys, fish community assessments, and fish habitat assessments. Through these detailed surveys, several species at risk, species of conservation concern and significant wildlife habitat have been identified. The following sections will outline these findings.

Species at risk (SAR) are floral or faunal species where populations have declined (or are at risk of declining) to such an extent that the species is at risk of extinction or extirpation. Throughout this study, SAR collectively refers to species listed as threatened or endangered under the *Endangered Species Act* (ESA).

Species of conservation concern (SCC) are floral or faunal species where decline is apparent, but not to the extent where a listing of threatened or endangered under the ESA or *Species at Risk Act* (SARA) are warranted. Throughout this study, SCC collectively refers to species that are listed as special concern under the ESA; species listed as special concern, threatened, or endangered under SARA where the corresponding species status under the ESA is less protective; and species with a subnational conservation rank between S1 and S3. Where critical habitat has been defined for species listed under SARA, SCC may be afforded additional protection within provincial jurisdiction.

3.5.2 Methods

A desktop background review of available online resources and previous reports for the study area was completed. Data was collected from a variety of resources, as outlined in Section 1.2 Background Review. This included online public databases like iNaturalist with verifiable records, as well as previous reports for the area.

3.5.3 Results and Discussion – Matrix Incidental Wildlife Observations

While completing vegetation and ELC assessments, Matrix field staff recorded any incidental wildlife encountered. Four species of wildlife were observed during their site visit on September 27, 2023. These species are summarized in Table 5.

Table 5 Wildlife Observed by Matrix on September 27, 2023

Common Name	Latin Name	ESA Status	SARA Status
Avian			
Red-tailed Hawk	*Buteo jamaicensis*	-	-
Herpetofauna			
Eastern Gartersnake	*Thamnophis sirtalis sirtalis*	-	-
Mammals			
White-tailed Deer	*Odocoileus virginianus*	-	-
Coyote	*Canis latrans*	-	-

Notes:
ESA – *Endangered Species Act*
SARA – *Species at Risk Act*

3.5.4 Results and Discussion – SAR and SCC

Twenty-Six (26) SAR listed under the ESA as either threatened or endangered and 12 SCC listed as special concern have been identified as potentially present within the study area through Matrix's background review. A full list of SAR and SCC can be found in Appendix C and Appendix D. Species without suitable habitat within the study area, or those who the site falls outside of their native breeding range, were immediately ruled out. The remaining species can be found in Table 6 and Table 7.

A probability ranking of the species occurring within the study area has been assigned to each species including:

- **Low Probability:** A site lacking either sufficient size, geographic location, or required characteristics to be considered suitable habitat using aerial interpretation and field visits.
- **Moderate Probability**: A site containing candidate habitat features using aerial interpretation although evidence of the SAR itself was not found on site during a field visit.
- **High Probability:** A site containing both candidate habitat using aerial interpretation as well as evidence of the SAR identified during a field visit or known to occur on the site through background information. Any species that was observed by LGL during their studies is listed as high probability.

Table 6 Species at Risk Potentially Present Within the Study Area

Common Name	Latin Name	ESA Status	SARA Status	Probability
Aquatic				
Black Redhorse	*Moxostoma duquesnei*	THR	THR	High
Silver Shiner	*Notropis photogenis*	THR	THR	Moderate
Wavy-rayed Lampmussel	*Lampsilis fasciola*	THR	SC	Moderate
Avian				
Bank Swallow	*Riparia riparia*	THR	THR	High
Bobolink	*Dolichonyx oryzivorus*	THR	THR	Low
Chimney Swift	*Chaetura pelagica*	THR	THR	High
Eastern Meadowlark	*Sturnella magna*	THR	THR	Low
Flora				
Black Ash	*Fraxinus nigra*	END	No Status	High
Butternut	*Juglans cinerea*	END	END	High
Herpetofauna				
Restricted species	*Restricted species*	END	END	High
Mammals				
Eastern Small-footed Myotis	*Myotis leibii*	END	N/A	High
Little Brown Myotis	*Myotis lucifugus*	END	END	High
Northern Myotis	*Myotis septentrionalis*	END	END	High
Tri-colored Bat	*Perimyotis subflavus*	END	END	High

Notes:
END – endangered; ESA – *Endangered Species Act*
SARA – *Species at Risk Act;* SC – special concern
THR – threatened

Table 7 Species of Conservation Concern Potentially Present Within the Study Area

Common Name	Latin Name	ESA Status	SARA Status	Probability
Aquatic				
Rainbow Mussel	*Villosa iris*	SC	SC	Moderate
Avian				
Bald Eagle	*Haliaeetus leucocephalus*	SC	No Status	Moderate
Barn Swallow	*Hirundo rustica*	SC	SC	High
Eastern Wood-pewee	*Contopus virens*	SC	SC	High
Wood Thrush	*Hylocichla mustelina*	SC	THR	High
Herpetofauna				
Snapping Turtle	*Chelydra serpentina*	SC	SC	High
Invertebrates				
Monarch	*Danaus plexippus*	SC	SC	High

Notes:
END – endangered; ESA – *Endangered Species Act*
SARA – *Species at Risk Act;* SC – special concern
THR – threatened

Aquatic

The Department of Fisheries and Oceans Canada (DFO) has identified critical habitat for two species at risk within the Grand River. This includes Black Redhorse (Moxostoma duquesnei) and Silver Shiner (*Notropis photogenis*), both listed as Threatened under the ESA and SARA. The Wavy-rayed Lampmussel (*Lampsilis Fasciola*) (THR, SC) and Rainbow Mussel (*Vilosa iris*) (SC, SC) have also been identified within the Grand River. Although these SAR are present within the Grand River, given the barriers at Hidden Valley Road, and the lack of suitable aquatic habitat, there is no evidence that Hidden Valley Creek currently supports these species.

Avian

Of the bird species noted through the background review, most are dependent on large grasslands or woodlands with mature trees and swamps. Through breeding bird surveys on the property, and several verifiable naturalist observations, most of these species are confirmed to be present within the overall Hidden Valley Community. Along Hidden Valley West Creek, there was significant bank erosion observed by Matrix, which could be suitable habitat for Bank Swallows, as they prefer to nest within vertical banks with loose soils lacking vegetation.

Flora

LGL (2023) identified two SAR trees, and a number of locally significant plant species within the study area. Both butternut (*Juglans cinerea*) and black ash (*Fraxinus nigra*) are listed as Endangered under the ESA and are afforded additional protections. Both species occur within wetlands or moist forest habitats and can be found within these respective areas within the study area. These features are generally located outside of the proposed development limit.

LGL observed an additional 18 species of locally rare plants within the study area. These results can be found in Table 8 below. Thirteen (13) of these species have been identified as locally rare on the current Region of Waterloo Plant List (2006), and an additional 5 have been identified under the proposed Region of Waterloo Plant List (2020) that is currently in draft form.

Table 8 Locally Rare Plant Species Observed within the Study Area by LGL

Species		Local Status		Observations by LGL	
Common Name	Latin Name	Waterloo, 2006	Waterloo, 2020*	Prior to 2021	2021
Flora					
black walnut	*Juglans nigra*	X	X	X	X
bristle-stalked sedge	*Carex leptalea ssp. Leptalea*	X	X	X	
burred sedge	*Carex sparganioides*	X	X	X	
common hackberry	*Celtis occidentalis*	X	X	X	X
common juniper	*Juniperus communis*	X	X		X
fringed gentian	*Centianopsis crinite*	X	X	X	
james' sedge	*Carex jamesii*	X	X	X	

Species		Local Status		Observations by LGL	
Common Name	Latin Name	Waterloo, 2006	Waterloo, 2020*	Prior to 2021	2021
purple joe-pye-weed	*Eupatorium purpureum var. purpureum*	X	X	X	
sand dropseed	*Sporobolus cryptandrus*	X	X	X	
stoneroot	*Collinsonia canadensis*	X	X	X	X
white spruce	*Picea glauca*	X	X	X	X
white wild licorice	*Galium circaezans*	X	X	X	
wood's sedge	*Carex woodii*	X	X	X	
Cottonwood(1)	*Populus deltoides*		X(1)	X	X
European beggar-ticks(1)	*Bidens vulgate*		X(1)	X	
tall beggar-ticks(1)	*Bidens vulgate*		X(1)	X	
thin-leaved sedge(1)	*Carex cephaloidea*		X(1)	X	X
wooly sedge(1)	*Carex pellita*		X(1)	X	
Count		**13**	**18**	**17**	**7**

Notes:
* The Region of Waterloo's Locally Rare Plant List for 2020 is currently in draft form.
1. Species that have only been identified as locally rare within the draft 2020 document

Herpetofauna

LGL observed Snapping Turtles (*Chelydra serpentina*) nesting in the area adjacent to the Hidden Valley Provincial Significant Wetland, in the summer of 2013. Snapping turtles are listed as special concern under the ESA but may be given additional protections as their nesting areas may be considered Significant Wildlife Habitat (SWH).

Restricted Species

A *restricted species* has been confirmed within Hidden Valley, and within the study area, through studies that were completed by LGL in 2008. As a result of these studies, Regulated Habitat has been mapped within the study area, with the most recent update being in 2018 by the MNRF. Due to recent changes in provincial government, Regulated Habitat for species at risk is now under the jurisdiction of the MECP, and no longer the MNRF. Additional surveys have been completed by landowner and their consultants; however, these results are not yet available.

Invertebrates

Monarchs (*Danaus plexippus)* (Special Concern) was identified within the study area by LGL in 2021 and WSP in 2020. Monarchs generally occur within tallgrass or meadow habitats and prefer areas dominated by milkweed. Some small milkweed patches and sparse areas of suitable habitat were observed within the study area by Matrix.

Mammals

Four species at risk bats have been identified as potentially occurring within the study area. This includes the Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*) and Tri-coloured Bat (*Perimyotis subflavus*), which are all listed as Endangered under the ESA. Generally, there are few records of bat roosting habitat in Ontario; however, it is known that they were widespread and abundant prior to the outbreak of white-nose syndrome.

Bat acoustic monitoring was completed within portions of the study area in 2018 (WSP 2020). Although they were unable to determine the exact species of bats that were present, they identified that these individuals were presumed to be a Myotis or Perimyotis species. Although there are no general habitat descriptions, the recovery strategies for each species provides guidance on sensitivity of habitats for SAR bat use. These species can form roosts in woodlands with abundant trees that support cavities, cracks, and loose bark. Little Brown Myotis particularly relies on man-made structures that provide a range of microclimates, such as attics, barns and sheds, while Northern Myotis is primarily reliant on treed habitats for roosting.

Three additional species of bats including the Red Bat (*Lasiurus borealis*), the Hoary Bat (*Lasiurus cinereus*), and the Silver-haired Bat (*Lasionycteris noctivagans*) have recently been listed by COSEWIC as Endangered. Although they are not currently listed under the ESA, it should be noted that regulations and protections are subject to change over time.

3.6 Significant Wildlife Habitat

3.6.1 Background and Methods

Significant natural heritage features include those listed in the *Provincial Policy Statement, 2020* (PPS; MMAH 2020), the *Natural Heritage Reference Manual* (NHRM; MNR 2010), the S*ignificant Wildlife Habitat Technical Guide* (SWHTG; MNR 2000), the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E* (the Ecoregion 6E Schedules; MNRF 2015), the City of Kitchener Official Plan (2023), and the Region of Waterloo Official Plan (2015). The findings of the background review and of our brief site investigation were cross referenced with the criteria provided in these documents to identify the potential presence of significant natural heritage features and functions.

3.6.2 Results and Discussion

The study area has the potential to contain candidate or confirmed SWH habitat types, including habitat for SAR or SCC. The Ecoregion 6E Schedules describe five categories of SWH for Ecoregion 6E:

- Seasonal Concentration Areas of Animals: areas where wildlife species occur annually in aggregations at certain times.

- Rare Vegetation Communities: contain rare plant species communities.

- Specialized Habitats for Wildlife Considered SWH: contain rare habitats that wildlife populations depend on, especially for breeding and nesting.

- Habitats of SCC Considered SWH: includes SCC species, species that are locally or regionally rare and are declining, or other species with conservation concerns.

- Animal Movement Corridors: corridors that allow the movement of wildlife from one habitat type to another.

Using data from the background review and field visit, the SWH criteria were evaluated and 18 SWH types have potential to be present within the study area, these are summarized in Table 9. Field investigations, completed by Matrix, LGL, and others, have confirmed a number of these SWH types within the area. The full screening can be found in Appendix E.

Table 9 Significant Wildlife Habitats Potentially Present within the Study Area

Significant Wildlife Habitat Type	Associated Habitat
Seasonal Concentration Areas of Animals	
Raptor Wintering Area	**Candidate:** SWH type is present within the project area. Suitable forest and upland habitats are present and within proximity to the Grand River.
Bat Maternity Colonies	**Confirmed:** SWH type is present within the study area. Confirmed habitat for SAR bats identified by WSP (2020) within the northwest portion of the study area. Suitable forested areas with large diameter trees are present.
Turtle Wintering Areas	**Confirmed:** SWH type is present within the study area. Confirmed basking observations of a Snapping Turtle during an emergent period (LGL, 2023). Suitable swamp and open water habitat are present.
Reptile Hibernaculum	**Candidate:** SWH type may be present within the study area.
Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)	**Candidate:** SWH type is present within the study area. Portions of Hidden Valley creek are experiencing significant bank erosion. The upper reaches of Hidden Valley West Creek contain steep and eroded slopes adjacent to meadow communities.
Deer Yarding Areas	**Confirmed:** A deer yarding and congregation area has been identified by the Kitchener Natural Heritage System Technical Background Report (City of Kitchener, 2014).
Deer Winter Congregation Areas	**Confirmed:** A deer yarding and congregation area has been identified by the Kitchener Natural Heritage System Technical Background Report (City of Kitchener, 2014).
Rare Vegetation Communities	
Tallgrass Prairie	**Confirmed:** SWH type is present within the study area but not within the project area. Tallgrass prairie community is located in the southwest portion of the study area, as seen in Figure 4. LGL noted that this area was planted as part of construction restoration.
Specialized Habitats for Wildlife Considered SWH	
Waterfowl Nesting Area	**Candidate:** SWH type present within the study area. Area contains suitable upland habitats adjacent to wetlands.

Significant Wildlife Habitat Type	Associated Habitat
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	**Candidate:** SWH type present within the study area. Suitable nesting habitat is located adjacent to the Grand River.
Turtle Nesting Areas	**Confirmed:** SWH present within the study area. Suitable shallow marsh habitat with exposed soils. LGL (2023) confirmed turtle nesting within the agricultural field within the northern portion of the study area.
Seeps and Springs	**Confirmed:** SWH present within the project area. A seep was identified near the culvert structure at 735 Hidden Valley Road.
Amphibian Breeding Habitat (Woodland)	**Confirmed:** SWH present within the project area. Suitable wetland habitat within close proximity to a woodland habitat. LGL (2023) Confirmed breeding of amphibians.
Habitats of Species of Conservation Concern Considered Significant Wildlife Habitat	
Marsh Breeding Bird Habitat	**Candidate:** SWH type is present within the project area. Suitable meadow marsh ecotype is present.
Shrub/Early Successional Bird Breeding Habitat	**Candidate:** SWH type is present within the study area but not within the project area. There is a field to the southeast of the project site that is >10ha of cultural thicket that is actively naturalizing.
Special Concern and Rare Wildlife Species	**Candidate:** SWH type is present within the project area. Several SCC have been confirmed within the project area.
Animal Movement Corridors	
Amphibian Movement Corridors	**Confirmed:** SWH type is present within the study area. Suitable wetland habitat within close proximity to a woodland habitat. Confirmed by LGL (2023).
Deer Movement Corridors	**Confirmed:** SWH type is present within the study area. LGL (2023) has identified a movement corridor along the Grand River, and along Wabanaki Road.

The potential for 3 additional SWH communities to occur within the project area have been identified by Matrix that were not previously identified by LGL. This includes Colonially-Nesting Bird Breeding Habitat (Bank and Cliff), Reptile Hibernaculum, and Seeps and Springs.

4 IDENTIFICATION OF ALTERNATIVE SOLUTIONS

A series of alternatives have been developed to reduce the flood risk and to support future development in the Hidden Valley community. The following sections are meant to provide an overview of the environmental impacts of each alternative, meanwhile the complementing Flood Risk Reduction EA (Matrix 2024) will provide a more detailed description of these alternatives.

Alternative 1: Do Nothing

Alternative 1 proposes a do-nothing scenario in which no changes are made. Flood risk downstream of the wetland would remain as is.

Alternative 2: Reduce Flows Upstream of the Wetland

Alternative 2 proposes that flow be attenuated upstream of the Hidden Valley ESPA/PSW using oversized stormwater controls.

Alternative 3: Flow Control Structure in the Wetland

Alternative 3 proposes the construction of a flow control structure, such as a dam, within the Hidden Valley ESPA/PSW to provide engineered attenuation within the wetland. This alternative would mimic the flood protections that were previously provided by beavers in the area.

Alternative 4: Conveyance Improvements Downstream of the Wetland

Alternative 4 proposes to increase the conveyance downstream of the Hidden Valley ESPA/PSW through modifications in the Hidden Valley Road culvert infrastructure.

5 EVALUATION OF PROPOSED ALTERNATIVES

The following section identifies, describes, and discusses the existing and potential impacts to the natural environment that may occur due to each of the proposed alternatives.

- ***Existing Impacts*** are the existing stressors or other factors contributing to the site's current state.
- ***Short Term (indirect) impacts*** are generally those associated with the construction stage of the project and are typically temporary and preventable through the application of proper construction practices & mitigation and site inspection.
- ***Long Term (direct) impacts*** are those related to actual development plan and post-construction activities; however, these can also be mitigated or minimized through careful planning, construction design and the implementation of environmental best management practices.

Based on Matrix site investigations, the following impacts are relevant to the flood mitigation strategy and should be considered for future management of natural heritage features and functions within the subject lands. These impacts have been outlined in Table 10 below.

Table 10 Impact Assessment of Proposed Alternatives

Alternative	Impacts	Aquatic Habitat and Fisheries	Terrestrial Habitat and Features	Regulatory and Permitting	Ranking
Alternative 1 (Do nothing)	Existing Impacts	• Accumulation of sediment (aggradation) • Degraded aquatic habitat • Continued debris jams • Continued erosion • Substantial flooding (more than what naturally occurs)	• Edge effects on vegetation communities • Unmaintained trails • Loss of riparian vegetation • Loss of trees and damage to existing rooting systems • Loss of wildlife habitat for riparian species • Barrier to amphibious species (amphibians and reptiles)	Status quo: • No permitting required	
Alternative 2 (Reduce Flows Upstream of Wetland)	Short-term	• Sediment and Erosion Control (construction run-off, deposition, HADD)	• Sediment and dust deposition • Light and noise pollution	Standard SWM facility construction works: • MECP Butternut registration • MECP Overall benefit permit for bats (12+ months) • DFO Request for Review • GRCA permit	
	Long-term	• Quality and quantity control of water upstream	• Changes in water balance to wetland (loss of surface water inputs to the wetland) • Removal of hedgerows • Soil compaction or contamination • Introduction of invasive species • Potential impacts to bat habitat • Potential impacts to SAR vegetation (butternut) via removal • Increased native species cover through planting and restoration plans		
Alternative 3 (Flow Control Structure in Wetland)	Short-term	• Dewatering • Sediment and erosion control	• Sediment and dust deposition • Light and noise pollution	Complex and unique permitting process: • Multiple stakeholders interest • First Nations buy-in • MECP Overall benefit permit for bats (12+ months) • MECP SAR critical habitat identified for a restricted species • DFO authorization • MNRF Section 14 permit under the *Lakes*	
	Long-term	• Additional barrier to fish movement • Debris jams • Permanent loss of aquatic habitat within construction footprint	• Changes to water balance to wetland • Soil compaction or contamination • Introduction of invasive species • Potential impacts to bat habitat • Removal of SAR vegetation (butternut) • Potential impacts to SAR reptiles and amphibians and their habitat • Creation of new access roads increasing habitat fragmentation • Barrier to wildlife movement • Ongoing maintenance activities		

Alternative	Impacts	Aquatic Habitat and Fisheries	Terrestrial Habitat and Features	Regulatory and Permitting	Ranking
			• Increased native species cover	*and Rivers Improvement Act* (LRIA) • GRCA permit	
Alternative 4 (Conveyance Improvements Downstream)	Short-term	• Dewatering • Sediment and erosion control • Temporary fish relocation	• Sediment and dust deposition	Standard culvert replacement works: • Simple permitting process • DFO RFR submission • MECP registration under Section 23.18 for SAR bats • GRCA permit	
	Long-term	• Increased connectivity for terrestrial and amphibious species • Potential removal of one of the barriers to fish movement upstream and introduction of fish to the areas upstream of the culvert. • Potential impact to a restricted species due to the removal of the fish barrier. • Improved bank stability	• Removal of edge vegetation • Soil compaction or contamination • Introduction of invasive species • Increased native species cover through planting and restoration plans		
Note: Success bubbles are shown across the screening results to provide an easy visualization of an alternative's score. More advantageous alternatives have circles which are coloured in.					

6 PREFERRED SOLUTION

Based on the evaluation of Technical Environment, Social/Economic Environment and Natural Environment, Alternative 4 is the preferred solution. Alternative 4 also has the highest environmental score of all alternatives. With a suitable restoration plan developed, alternative 4 has the potential to improve upon the existing natural environment conditions. Alternative 1 maintains the existing natural environment, while Alternatives 2 and 3 have the most potential to negatively impact the natural environment as well as SAR habitat in the area.

The existing Hidden Valley Road culvert is heavily sedimented, with the low flow culvert being almost entirely buried. The existing blockage reduces the conveyance of the crossing and is currently a complete barrier to fish and wildlife passage.

As there are currently no fish upstream of the Hidden Valley culvert, and due to the presence of a *restricted species* and its critical habitat, the introduction of fish into this system is not recommended. The proposed design shall incorporate fish exclusion measures, while still providing connection opportunities for amphibious and terrestrial species such as Snapping Turtle.

Within the Hidden Valley Creek, the terrestrial ecosystem has experienced significant erosion, and the introduction of non-native and invasive species. Through the development of a comprehensive restoration plan, the natural banks could be restored, removing any non-native species and planting with native vegetation.

6.1 Identified Natural Heritage Features

The following natural heritage features, as identified in the City of Kitchener Official Plan and the Region of Waterloo Official Plan, have been identified within the vicinity of the proposed area for Alternative 4:

- ESPA 27: Hidden Valley. Along Hidden Valley Creek.
- Locally Significant Valleyland. Along Hidden Valley Creek.
- Located within the adjacent lands (<120 m) to Hidden Valley PSW.
- Regionally Significant Woodland. Along Hidden Valley Creek.

6.2 Aquatic Habitat and Fisheries

- The Grand River and its tributaries are identified as warmwater fish habitat.

- Extensive field surveys have been completed within the area, and there is no documented evidence of fish upstream of the Hidden Valley Culvert (LGL, 2023).

- A seep is present immediately upstream of the Hidden Valley Road culvert and appears to be originating from the southwest direction.

6.3 Vegetation Communities and Plants

- No rare plant communities, SAR, SCC, or locally rare plants were identified within the area surrounding the Hidden Valley Road culvert.

- The ELC communities within this area are forested and include FOD5-2 and CUP on the west side of the culvert, and FOC3 on the east side of the culvert.

6.4 Wildlife

- Seven species at risk and five species of conservation concern have been identified as potentially occurring within the area of the preferred alternative.

- A *restricted species* and its critical habitat has been previously confirmed within the Hidden Valley Wetland Complex. This species is sensitive to predation by fish and may be currently benefiting from the absence of any fish within the Hidden Valley Creek system.

Table 11 SAR and SCC Potentially Present Within the Vicinity of Alternative 4

Common Name	Latin Name	ESA Status	SARA Status	Probability of Occurrence
Avian				
Bald Eagle	*Haliaeetus leucocephalus*	SC	No Status	Low
Barn Swallow	*Hirundo rustica*	SC	SC	Moderate
Eastern Wood-pewee	*Contopus virens*	SC	SC	Low
Wood Thrush	*Hylocichla mustelina*	SC	THR	Low
Flora				
Black Ash	*Fraxinus nigra*	END	No Status	Low
Butternut	*Juglans cinerea*	END	END	Low
Herpetofauna				
Restricted species	*Restricted species*	END	END	Low
Snapping Turtle	*Chelydra serpentina*	SC	SC	Moderate
Mammals				
Eastern Small-footed Myotis	*Myotis leibii*	END	N/A	Moderate
Little Brown Myotis	*Myotis lucifugus*	END	END	Moderate
Northern Myotis	*Myotis septentrionalis*	END	END	Moderate
Tri-colored Bat	*Perimyotis subflavus*	END	END	Moderate

Notes:
END - endangered
ESA - *Endangered Species Act*
SARA - *Species at Risk Act*
SC - special concern
THR - threatened

6.5 Significant Wildlife Habitat

The following SWH types are potentially present within the proposed area for Alternative 4:

- Raptor Wintering Area
- Bat Maternity Colonies
- Turtle Wintering Areas
- Bald Eagle and Osprey Nesting, Foraging, and Perching Habitat
- Turtle Nesting Areas
- Seeps and Springs
- Habitat for Special Concern and Rare Wildlife Species

7 PROJECT IMPLEMENTATION AND NEXT STEPS

The following sections outline the anticipated permitting and approvals required for the construction of the preferred alternative, the recommended studies to be completed during the detailed design phase and provides a list of suitable best management practices for construction. These recommendations should be carried forward, and updated where additional information is received.

7.1 Permitting and Approvals

It is anticipated that the construction of Alternative 4 would require consultation with the DFO, the City of Kitchener, and the MECP. The following subsections will outline each of the approvals or reviews that may be required for this project.

Department of Fisheries and Oceans Canada

The preferred solution, which is the replacement and expansion of the culvert system under Hidden Valley Road, would require the submission of a request for review (RFR) to the DFO. During the submission process, information on aquatic habitat and the proposed impacts of the works would be provided to the DFO. If it is determined that the project will cause the death of fish and/or harmful alteration, disruption, or destruction of fish habitat, then a letter of approval (LOA) or full authorization under the Fisheries Act may be required.

Due to the presence of fish downstream of the Hidden Valley Culvert, it is anticipated that an RFR and/or a LOA may be required. Any in water works should be completed according to the timing windows for warmwater fisheries, with any fish being relocated prior to these works occurring. To support the fish rescue, a Scientific Fish Collection License for Scientific Purposes, and a Wildlife Scientific Collectors Authorization from the MNRF would be required.

As the repairs to the Hidden Valley Culvert will involve the removal of one of the fish barriers, additional fish exclusion measures would be required to continue protecting the *restricted species* upstream. Fish exclusion measures shall be regularly monitored to ensure that they are functioning correctly.

City of Kitchener

Both the upstream and downstream portions of the Hidden Valley Road culvert are located within forested areas. It is anticipated that at least some trees will be damaged, destroyed, or slated for removal as part of the preferred solution. A tree inventory and arborist report should be completed during the detailed design phase of this project. The tree inventory will identify and assess the condition of each tree within the vicinity of the proposed works. The arborist report will compile this information and provide an assessment of each individual tree and whether it shall be retained, injured, or removed. The arborist report shall meet the necessary requirements to apply for a tree removal permit from the City of Kitchener, should they request that one be completed.

Ministry of Environment, Conservation, and Parks

Through the construction of the preferred solution, it is expected that at least some trees will require trimming or removal. To date, no bat cavity assessments or acoustic monitoring has been completed within the vicinity of the preferred solution. Prior to the removal of any trees, Matrix recommends that a bat cavity assessment be completed within the area. This assessment will identify whether any snag trees are present and whether they are considered high- or low-quality bat habitat. Following this assessment, an Information Gathering Form (IGF) and/or Notice of Assessment should be submitted to the MECP for review. Should only a few cavity trees be identified for removal, the preferred solution would satisfy the requirements under the General Regulations (O. Reg. 242/08) of the ESA for threats to health and safety, not imminent (Section 23.18). The proposed works would include repairs and upgrades to existing infrastructure under Hidden Valley Road, with the goal of protecting municipal infrastructure from future flooding.

Although the area of impact for the preferred alternative is located outside of the Regulated Habitat for the *restricted species*, it is still located within the 300 m of adjacent lands. It is anticipated that a single IGF can be submitted for all of the impacted SAR, and that obtaining a C-permit would not be required.

7.2 Construction Mitigation Measures

The recommendations and general best management practices described below are intended to limit potential impacts within the subject lands and to adjacent natural heritage features. Emphasis should be placed on confining construction access, construction equipment, stockpiles, and re-fueling to lawns, paved surfaces, and other existing disturbed areas where available. The following recommendations are designed to mitigate and minimize potential impacts on the aquatic environment.

Wildlife Timing Windows

- **Breeding Birds:** Any vegetation removal must adhere to the Migratory Birds Convention Act timing windows. The *Migratory Birds Convention Act* protects migratory birds, their eggs, and their nests from being harmed or destroyed during the breeding bird window. The core breeding period for Zone C2 is early April 1 to August 25 (ECCC 2023). Any woody vegetation removal required to facilitate the proposed works should be undertaken outside of this window. Should any vegetation clearing be required within the nesting season, a qualified avian biologist shall undertake nest sweeps prior to tree removal to ensure that no nests are present.

- **Fisheries:** Any in-water works should adhere to Fisheries and Oceans Canada (DFO) in-water works timing restrictions for a warmwater system, identified as March 15 to July 15 or as directed by MNRF or DFO (DFO 2019).

Construction Best Management Practices

- **Avoidance of Sensitive Areas:** Equipment or materials storage, vehicle parking and soil storage should be kept 30 m away from sensitive natural heritage features such as watercourses, wetlands, and woodlots. Should space limitations create the need for stockpiling equipment or parking vehicles within the buffer to the forest, a certified arborist should provide recommendations to avoid impacts to edge trees.

- **Site Delineation:** The extent of the work area shall be clearly delineated, visible to all workers on site, and maintained regularly. Suitable delineation measures can include but are not limited to sediment fencing, reptile exclusion fencing, tree protection fencing or hoarding, and/or wooden stakes. No construction activities, including the storage of materials, are to occur outside of these delineated areas.

- **Maintenance and Refueling:** All equipment maintenance and refuelling shall be conducted a minimum of 30 m from any sensitive natural heritage features including but not limited to wetlands, watercourses, and woodlots. A suitable secondary containment method is required for all refuelling to prevent the accidental discharge of petroleum products to the environment.

- **Contaminant and Spill Response Plan:** An emergency spill response and management plan shall be developed and followed throughout the duration of construction. An emergency spill kit, suitable for the type of work, shall be kept on site at all times.

- **Erosion and Sediment Control (ESC):** An ESC plan shall be developed and implemented throughout the duration of construction and restoration of the site. This plan shall effectively control sedimentation and erosion within and adjacent to the work areas. The primary principles associated with sedimentation and erosion protection measures are to:
    - minimize the duration of soil exposure
    - retain existing vegetation, where feasible

- encourage revegetation
- divert runoff away from exposed soils
- keep runoff velocities low
- trap sediment as close to the source as possible

- **Traffic Limits:** Implement speed or traffic limits within and adjacent to natural areas. For areas with loose or dry soils, a dust management or suppression plan may be required.

- **Worker Education:** All workers on site shall be aware of potential wildlife occurrences and educated on measures to take to minimize potential for injury or incidental take. A log to record and report incidents of injury and/or mortality shall be maintained by the prime contractor.

- **Restoration:** A restoration plan shall be developed in consultation with a qualified ecologist and implemented throughout the duration of the project. Restoration of the site should be completed as soon as possible, immediately after each phase of construction is complete. Exposed soils should be seeded during the growing season. Should any soils be left exposed after November 15, erosion control blankets, or a similar material, shall be used to stabilize the soils until vegetation has regrown.

Prevention of Terrestrial Disturbance

- **Incidental Wildlife Occurrences:** No wildlife shall be handled or relocated without a Wildlife Scientific Collectors Permit from the MNRF. If sensitive or SAR species are suspected, a qualified ecologist should be contacted immediately to inquire about next steps. A setback shall be established by the qualified ecologist to protect the species until guidance has been received from the MECP. Details regarding the size and implementation of the setback should be determined in consultation with the MECP. Should the species be identified within the construction footprint, a relocation plan may be drafted in consultation with the appropriate agencies.

- **Breeding Birds:** Should an avian nest be identified within proximity to the work locations, all work within the vicinity shall be stopped immediately and a qualified biologist shall be contacted. A qualified biologist shall attend site to identify the species present and to provide a suitable setback for this species. Setbacks are conservatively determined based on the individual species, their tolerance to disturbance, and the type of works occurring within the area. Should a SAR, SCC, or Schedule 1 bird be observed, further consultation with the MECP is required, and consultation or permitting through the Migratory Birds Convention Act (MBCA) may be required.

- **Removal of Trees:** A tree inventory and arborist report shall be completed by a qualified biologist prior to the removal, damage, or destruction of any trees. This report will identify whether any SAR trees are present, and will provide guidance, recommendations, and next steps for consultation with the MECP.

- **Exclusion Fencing:** Suitable exclusion fencing shall be installed and maintained throughout the duration of the construction period. The fencing plan shall be developed in consultation with a qualified biologist and shall ensure that no species at risk reptiles or amphibians are able to enter the construction site. Exclusion fencing shall be monitored regularly to ensure that it is functioning well and has not deteriorated. Shall any individuals be found within the work area, all work shall immediately be halted, and a qualified biologist will be contacted. The individual will be relocated outside of the work zone by the qualified biologist, as approved under the Wildlife Scientific Collectors Permit from the MNRF.

- **Invasive Species:** Construction shall follow the clean equipment protocol (Halloran et al. 2016) to prevent the further spread of invasive species. Removal of all invasive species within the construction limits shall occur, including root systems, where feasible. Disposal of invasive species shall be administered in an appropriate manner following accepted and approved disposal guidelines from governing agencies.

Prevention of Aquatic Disturbance

- **Riparian Vegetation Removals:** Clearing of riparian trees and/or shrubs should be minimized where possible, such that physical and biological functional attributes of the terrestrial vegetation can be maintained as they relate to aquatic ecological function. Removals should be completed through consultation with an ecologist to avoid any sensitive species.

- **Fish Salvage:** If disturbance to the watercourse is anticipated during periods of high flows and/or when fish could potentially occur, the watercourse should be surveyed to determine if fish are present. If fish are present, in-water works and nearby construction should adhere to Fisheries and Oceans Canada (DFO) in-water works timing restrictions for a warmwater system, identified as March 15 to July 15 or as directed by MNRF or DFO (DFO 2019). Should fish be present, a fish salvage would be required. Prior to this, a qualified biologist will need to obtain a Scientific Fish Collection License for Scientific Purposes, and a Wildlife Scientific Collectors Authorization from the MNRF.

- **Fish Exclusion:** The design of the preferred alternative shall include permanent fish exclusion measures to ensure that no fish are able to pass upstream of the Hidden Valley Culvert. These exclusion measures shall be regularly monitored, to ensure that they are functioning correctly.

7.3 Recommended Studies

The following studies are recommended to be completed as part of the detailed design phase of the project:

Tree Inventory and Arborist Report

A high-level vegetation inventory was completed by Matrix within the area surrounding the preferred alternative as part of this report. Although no species at risk or locally rare species were observed by

Matrix within the vicinity of the preferred alternative, both butternut and black ash have the potential to occur. As part of the detailed design phase of this project, a tree inventory and arborist report should be completed. The tree inventory will identify the species and assess the condition of each tree within the vicinity of the proposed works. The arborist report will compile this information and provide an assessment of each individual tree and whether it shall be retained, injured, or removed.

Bat Cavity Assessment

Although a bat cavity assessment and acoustic monitoring has been completed on the northwestern portion of the subject lands, no studies have been completed within the vicinity of the preferred alternative. A bat cavity assessment should be completed early on in the detailed design phase of the project, to determine whether any high-quality bat cavity trees are present, and whether these trees may require removal as part of the design.

Fisheries Assessment

A high-level aquatic assessment was completed by Matrix within the area surrounding the preferred alternative as part of this report. Although a DFO request for review would be required for this project, it is not anticipated that a full DFO authorization or a detailed fisheries assessment would be required.

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APPENDIX A
Site Photographs

1. Hidden Valley west tributary.

2. Edge of the MAS2-1 community within the northwestern portion of the subject lands.

3. Hidden Valley road culvert. West side of Hidden Valley Road, looking north.

4. Hidden Valley road culvert. West side of Hidden Valley Road, looking south. Showing the location of the seep located immediately downstream of the culvert.

5. Hidden Valley creek. Immediately upstream of the Hidden Valley Road culvert, looking west.

6. Hidden Valley creek. Approximately 38 meters upstream of the Hidden Valley Road culvert, looking west.

7. Hidden Valley Creek. Immediately downstream of the Hidden Valley Road culvert.

8. Woody debris located within Hidden Valley Creek.

APPENDIX B

Desktop Wildlife Species Results

TABLE B1 Bird Species

Species		Conservation Rank				Source				
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC [1]	OBBA [2]	eBird [3]	iNaturalist [4]	Other Studies [4, 5, 6]
Accipitridae	**Hawks, Kites, Eagles & Allies**									
Accipiter cooperii	Cooper's Hawk	S4					x	x	x	x
Accipiter gentilis	Northern Goshawk	S4								x
Accipiter striatus	Sharp-shinned Hawk	S5					x	x		
Buteo jamaicensis	Red-tailed Hawk	S5					x	x	x	x
Buteo lagopus	Rough-legged Hawk	S1B/S4N						x		
Buteo platypterus	Broad-winged Hawk	S5B						x		
Circus cyaneus	Northern Harrier	S4B					x	x		
Haliaeetus leucocephalus	Bald Eagle	S2N/S4B	SC				x	x	x	
Alaudidae	**Larks**									
Eremophila alpestris	Horned Lark	S5B					x			x
Alcedinidae	**Kingfishers**									
Megaceryle alcyon	Belted Kingfisher	S4B/S5B					x	x		x
Apodidae	**Swifts**									
Chaetura pelagica	Chimney Swift	S4B/S4N	THR	THR	THR		x	x		x
Anatidae	**Ducks, Geese & Swans**									
Aix sponsa	Wood Duck	S5					x	x		x
Anas acuta	Northern Pintail	S5						x		
Anas clypeata	Northern Shoveler	S4						x		
Anas crecca	Green-winged Teal	S4						x		
Anas discors	Blue-winged Teal	S4					x	x		x
Anas platyrhynchos	Mallard	S5					x	x	x	x
Anas rubripes	American Black Duck	S4					x	x		
Branta canadensis	Canada Goose	S5					x	x	x	x
Branta hutchiinsii	Cackling Goose	S4M						x		
Bucephala albeola	Bufflehead	S4						x		
Bucephala clangula	Common Goldeneye	S5						x	x	
Clangula hyemalis	Long-tailed Duck	S3B						x		
Lophodytes cucullatus	Hooded Merganser	S5B, S5N					x	x	x	
Melanitta fusca	White-winged Scoter	S4B/S4N								x
Aythya collaris	Ring-necked Duck	S5						x		
Cygnus columbianus	Tundra Swan	S4								x
Mergus merganser	Common Merganser	S5B,S5N					x	x	x	x
Ardeidae	**Herons and Bitterns**									
Ardea alba	Great Egret	S2B						x	x	
Ardea herodias	Great Blue Heron	S4					x	x	x	x
Butorides virescens	Green Heron	S4B					x	x	x	x
Bombycillidae	**Waxwings**									
Bombycilla cedrorum	Cedar Waxwing	S5B					x	x	x	x
Caprimulgidae	**Nightjars**									
Chordeiles minor	Common Nighthawk	S4B	SC	SC	THR		x	x		
Cardinalidae	**Cardinals, Grosbeaks & Allies**									
Cardinalis cardinalis	Northern Cardinal	S5					x	x	x	x
Passerina cyanea	Indigo Bunting	S4B					x	x		x
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B					x	x	x	x
Piranga olivacea	Scarlet Tanager	S4B					x	x		x
Cathartidae	**Vultures**									
Cathartes aura	Turkey Vulture	S5B					x	x	x	x
Certhiidae	**Creepers**									
Certhia americana	Brown Creeper	S5B					x	x		x
Charadriidae	**Plovers**									
Charadrius semipalmatus	Semipalmated Plover	S4B,S4N						x		
Charadrius vociferus	Killdeer	S5B/S5N					x	x	x	x
Columbidae	**Pigeons & Doves**									
Columba livia	Rock Pigeon	SNA					x	x	x	x
Zenaida macroura	Mourning Dove	S5					x	x	x	x

Species		Conservation Rank				Source				
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC [1]	OBBA [2]	eBird [3]	iNaturalist [4]	Other Studies [4, 5, 6]
Corvidae	**Crows & Jays**									
Corvus brachyrhynchos	American Crow	S5B/S4N					x	x	x	x
Corvus corax	Common Raven	S5					x	x		
Cyanpcitta cristata	Blue Jay	S5					x	x	x	x
Cuculidae	**Cuckoo & Anis**									
Coccyzus americanus	Yellow-billed Cuckoo	S4B					x	x		x
Coccyzus erythropthalmus	Black-billed Cuckoo	S5B					x	x		x
Emberizidae	**New World Sparrows & Allies**									
Ammodramus henslowii	Henslow's Sparrow	SHB	END	END	END	x				
Junco hyemalis	Dark-eyed Junco	S5B						x		x
Melospiza georgiana	Swamp Sparrow	S5B					x	x		x
Melospiza melodia	Song Sparrow	S5B/S4N					x	x	x	x
Passerculus sandwichensis	Savannah Sparrow	S4B					x	x		x
Passerella iliaca	Fox Sparrow	S4B						x		
Pipilo erythrophthalmus	Eastern Towhee	S4B					x	x		x
Pooecetes gramineus	Vesper Sparrow	S4B					x	x		
Spizella arborea	American Tree Sparrow	S4B						x		x
Spizella pallida	Clay-colored Sparrow	S4B					x	x		
Spizella passerina	Chipping Sparrow	S5B/S4N					x	x		x
Zonotrichia albicollis	White-throated Sparrow	S5B					x	x		
Zonotrichia leucophrys	White-crowned Sparrow	S4B						x		x
Spizella pusilla	Field Sparrow	S4B					x	x		x
Falconidae	**Carcaras & Falcons**									
Falco columbarius	Merlin	S5B					x	x		
Falco peregrinus	Peregrine Falcon	S3B	SC				x			
Falco sparverius	American Kestrel	S4					x	x		x
Fringillidae	**Finches & Allies**									
Acanthis flammea	Common Redpoll	S4B						x		
Haemorhous mexicanus	House Finch	SNA					x	x	x	x
Haemorhous purpureus	Purple Finch	S4B						x		
Loxia leucoptera	White-winged Crossbill	S5B						x		
Spinus pinus	Pine Siskin	S4B					x	x		
Spinus tritis	American Goldfinch	S5B/S4N					x	x		x
Gruidae	**Cranes**									
Grus canadensis	Sandhill Crane	S5B					x			
Hirundinidae	**Swallows**									
Hirundo rustica	Barn Swallow	S4B	SC	SC			x	x		x
Petrochelidon pyrrhonota	Cliff Swallow	S4B					x	x		x
Progne subis	Purple Martin	S3/S4B					x			
Riparia riparia	Bank Swallow	S4B	THR	THR	THR	x	x	x		x
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B					x	x		x
Tachycineta bicolor	Tree Swallow	S4B					x	x		x
Icteridae	**New World Blackbird**									
Agelaius phoeniceus	Red-winged Blackbird	S4/S5					x	x	x	x
Dolichonyx oryzivorus	Bobolink	S4B	THR	SC		x	x			x
Euphagus carolinus	Rusty Blackbird	S4B	SC	SC	SC			x		
Icterus galbula	Baltimore Oriole	S4B					x	x	x	x
Icterus spurius	Orchard Oriole	S4B					x			
Molothrus ater	Brown-headed Cowbird	S4B					x	x		x
Quiscalus quiscula	Common Grackle	S5B/S4N					x	x		x
Sturnella magna	Eastern Meadowlark	S4B	THR	THR	THR	x		x		x
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	S2B						x		
Laniidae	**Shrikes**									
Lanius ludovicianus	Loggerhead Shrike	S2B	END	END	END	x				
Laridae	**Gulls, Terns & Skimmers**									
Hydroprogne caspia	Caspian Tern	S3B						x		
Larus argentatus	Herring Gull	S5B,S5N						x		
Larus delawarensis	Ring-billed Gull	S5B/S4N						x	x	x

Species		Conservation Rank				Source				
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC [1]	OBBA [2]	eBird [3]	iNaturalist [4]	Other Studies [4, 5, 6]
Mimidae	**Mockingbirds, Thrashers & Allies**									
Dumetella carolinsis	Gray Catbird	S4B					x	x		x
Toxostoma rufum	Brown Thrasher	S4B					x	x		x
Pandionidae	**Osprey**									x
Pandion haliaetus	Osprey	S5B					x	x	x	x
Paridae	**Chickadees and Titmice**									
Poecile atricapillus	Black-capped Chickadee	S5					x	x		x
Parulidae	**Wood Warblers**									
Cardellina pusilla	Wilson's Warbler	S4B								x
Geothlypis philadelphia	Mourning Warbler	S4B								x
Geothylupis trichas	Common Yellowthroat	S5B					x	x	x	x
Mniotilta varia	Black-and-white Warbler	S5B					x	x		x
Oreothlypis peregrina	Tennessee Warbler	S5B						x		x
Oreothlypis ruficapilla	Nashville Warbler	S5B					x	x		x
Parkesia motacilla	Louisiana Waterthrush	S3B	THR	THR	THR	x		x		
Parkesia noveboracensis	Northern Waterthrush	S5B						x		x
Seiurus aurocapilla	Ovenbird	S4B					x	x		x
Setophaga caerulescens	Black-throated Blue Warbler	S5B						x		x
Setophaga castanea	Bay-breasted Warbler	S5B						x		
Setophaga cerulea	Cerulean Warbler	S3B	THR	END	END	x				
Setophaga coronata	Yellow Rumped Warbler	S5B						x		x
Setophaga fusca	Blackburnian Warbler	S5B						x		
Setophaga magnolia	Magnolia Warbler	S5B						x		x
Setophaga pensylvanica	Chestnut-sided warbler	S5B						x		x
Setophaga petechai	Yellow Warbler	S5B					x	x		x
Setophaga pinus	Pine Warbler	S5B					x	x	x	x
Setophaga ruticilla	American Redstart	S5B					x	x		x
Setophaga striata	Blackpoll Warbler	S4B						x		x
Setophaga virens	Black-throated Green Warbler	S5B						x		x
Vermivora chrysoptera	Golden-winged Warbler	S4B	SC	THR	THR			x		
Vermivora cyanoptera	Blue-winged Warbler	S4B						x		
Passeridae	**Sparrows**									
Passer domesticus	House Sparrow	SNA					x	x	x	x
Phalacrocoracidae	**Cormorants**									
Phalacrocorax auritus	Double-crested Cormorant	S5B						x	x	x
Phasianidae	**Patridges, Grouse, Turkeys**									
Meleagris gallopavo	Wild Turkey	S5					x	x	x	x
Bonasa umbellus	Ruffed Grouse	S4						x		x
Picidae	**Woodpeckers**									
Colaptes auratus	Northern Flicker	S4B					x	x	x	x
Dryocopus pileatus	Pileated Woodpecker	S5					x	x	x	x
Leuconotopicus villosus	Hairy Woodpecker	S5					x	x		x
Melanerpes carolinus	Red-bellied Woodpecker	S4					x	x	x	x
Melanerpes erythrocephalus	Red-headed Woodpecker	S4B	END	END	END	x	x	x		
Picoides pubescens	Downy Woodpecker	S5					x	x	x	x
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B					x	x	x	x
Podicipedidae	**Grebes**									
Podilymbus podiceps	Pied-billed Grebe	S4B,S4N					x			x
Polioptilidae	**Gnatcatchers**									
Polioptila caerulea	Blue-gray Gnatcatcher	S4B					x	x		x
Rallidae	**Railes, Gallinules & Coots**									
Porzana carolina	Sora	S4B					x			x
Rallus limicola	Virginia Rail	S5B						x		x

Species		Conservation Rank				Source				
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC [1]	OBBA [2]	eBird [3]	iNaturalist [4]	Other Studies [4, 5, 6]
Regulidae	**Kinglets**									
Regulus calendula	Ruby-crowned Kinglet	S4B						x		x
Regulus satrapa	Golden-crowned Kinglet	S5B					x	x		
Scolopacidae	**Sandpipers, Phalaropes &Allies**									
Actitis macularius	Spotted Sandpiper	S5					x	x		x
Calidris fuscicollis	White-rumped Sandpiper	S5N						x		
Gallinago delicata	Wilson's Snipe	S5B						x		
Scolopax minor	American Woodcock	S4B					x	x		x
Tringa flavipes	Lesser Yellowlegs	S4B,S4N	THR					x	x	
Tringa melanoleuca	Greater Yellowlegs	S4B,S4N						x	x	
Sittidae	**Nutchatches**									
Sitta canadensis	Red-breasted Nuthatch	S5					x	x		x
Sitta carolinensis	White-breasted Nuthatch	S5					x	x	x	x
Stercorariidae	**Skuas**									
Asio flammeus	Short-eared Owl	S2N,S4B	THR							x
Asio otus	Long-eared Owl	S4						x		
Bubo virginianus	Great Horned Owl	S5					x	x	x	x
Megascops asio	Screech Owl	S4					x			x
Sturnidae	**Starlings**									
Sturnus vulgaris	European Starling	SNA					x	x	x	x
Trochillidae	**Hummingbirds**									
Archilochus colubris	Ruby-throated Hummingbird	S5B					x	x		
Troglodytidae	**Wrens**									
Cistothorus palustris	Marsh Wren	S4B					x	x		
Thyrothorus ludovicianus	Carolina Wren	S4					x	x		
Troglodytes aedon	House Wren	S5B					x	x		x
Troglodytes hiemalis	Winter Wren	S5B					x	x		
Turdidae	**Thrushes**									
Catharus fuscescens	Veery	S4B					x	x		x
Catharus guttatus	Hermit Thrush	S5B						x		
Catharus ustulatus	Swainson's Thrush	S4B						x		x
Hylocichla mustelina	Wood Thrush	S4B	SC	THR	THR	x	x	x		x
Sialia sialis	Eastern Bluebird	S5B					x			x
Turdus migratorius	American Robin	S5B					x	x	x	x
Tyrannidae	**Tyrant Flycatchers**									
Contopus virens	Eastern Wood-pewee	S4B	SC	SC	SC		x	x		x
Empidonax alnorum	Alder Flycatcher	S5B					x			
Empidonax flaviventris	Yellow-bellied Flycatcher	S5B						x		
Empidonax minimus	Least Flycatcher	S4B					x	x		x
Empidonax traillii	Willow Flycatcher	S5B					x	x		x
Empidonax virescens	Acadian Flycatcher	S2S3B	END	END	END	x		x		
Myiarchus crinitus	Great Crested Flycatcher	S4B					x	x		x
Sayornis phoebe	Eastern Phoebe	S5B/S4N					x	x		x
Tyrannus tyrannus	Eastern Kingbird	S4B					x	x		x

Species		Conservation Rank				Source				
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC [1]	OBBA [2]	eBird [3]	iNaturalist [4]	Other Studies [4, 5, 6]
Vireonidae	**Vireos**									
Vireo gilvus	Warbling Vireo	S5B					x	x		x
Vireo olivaceus	Red-eyed Vireo	S5B					x	x		x
Vireo solitarius	Blue-headed Vireo	S5B						x		
Vireo flavifrons	Yellow-throated Vireo	S4B					x	x		x
Vireo philadelphicus	Philadelphia Vireo	S5B						x		x
Total:						**10**	**111**	**153**	**42**	**114**

Notes:

S-rank
S1 - Critically Imperiled
S2 - Imperiled
S3 - Vulnerable
S4 - Apparently Secure
S5 - Secure
SU - Unrankable
SNA - Unranked
SX - Presumed Extirpated
SH - Possibly Extirpated
S#? - Rank Uncertain

ESA
SC - Special Concern
THR - Threatened
END - Endangered
EXT - Extinct
EXP - Extirpated

Additional Notes
ESA - *Endangered Species Act*
COSEWIC - Committee on the Status of Endangered Wildlife in Canada
SARA - *Species at Risk Act*
NHIC - Natural Heritage Information Centre
OBBA - Ontario Breeding Bird Atlas

COSEWIC
NAR - Not at Risk
SC - Special Concern
THR - Threatened
END - Endangered
EXT - Extinct
EXP - Extirpated
DD - Data Deficient

SARA Schedule
Schedule 1 - Officially protected under SARA
Schedule 2 - threatened/endangered; may be reassessed for consideration for inclusion to Schedule 1
Schedule 3 - special concern; may be reassessed for consideration for inclusion to Schedule 1

COSSARO
NAR - Not at Risk
SC - Special Concern
THR - Threatened
END - Endangered
EXP - Extirpated
DD - Data Deficient

Sources:

1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Make a Map: Natural Heritage Areas* . Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

2 Birds Canada et al. 2023. *Ontario Breeding Bird Atlas Data Summary Tool.* NatureCounts platform. Accessed MAY 2023. https://naturecounts.ca/nc/onatlas/findsquare.jsp

3 Cornell Lab of Ornithology. 2023. *eBird* . Accessed MAY 2023. https://ebird.org/home

4 iNaturalist. 2023. *Observations* . Accessed MAY 2023. https://www.inaturalist.org/observations

5 Hidden Valley Draft Characterization Report. Comprehensive Environmental Impact Study for the City of Kitchener (LGL, 2023. Draft)

6 Schedule B Class Environmental Assessment. Upper Hidden Valley Sanitary Pump Station and Forcemain (MTE Consultants Inc., 2022)

7 Stage 2 ION LRT from Kitchener to Cambridge Transit Project Assessment Process (WSP, 2021)

TABLE 2 Reptile and Amphibian Species

Species		Conservation Rank				Source			
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC[1]	ORAA	iNaturalist[2]	Other Studies[3, 4, 5]
Cryptodeira	**Turtles**								
Chelydra serpentina	Snapping Turtle	S3	SC	SC	SC	x	x	x	x
Chrysemys picta marginata	Midland Painted Turtle	S4				x	x	x	x
Emydoidea blandingii	Blanding's Turtle	S3	THR	END	THR	x	x		
Trachemys scripta elegans	Red-eared Slider	SNA					x		
Squamata	**Snakes**								
Lampropeltis triangulum	Milksnake	S4		SC	SC	x	x		x
Nerodia sipedon sipedon	Northern Watersnake	S5					x		
Opheodrys vernalis	Smooth Greensnake	S4					x		
Storeria dekayi	DeKay's Brownsnake	S5					x	x	
Storeria occipitomaculata	Red-bellied snake	S5					x		
Thamnophis sauritus	Eastern Ribbonsnake	S4	SC	SC	SC		x		
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5					x	x	x
Caudata	**Salamanders**								
Ambystoma laterale	Blue-spotted Salamander	S4							x
Ambystoma maculatum	Spotted Salamander	S4					x	x	x
Notophthalmus viridescens viridescens	Eastern Newt	S4?						x	
Notophthalmus viridescens viridescens	Red-spotted Newt	S5					x	x	
Plethodon cinereus	Eastern Red-backed Salamander	S5					x	x	x
Anura	**Frogs and Toads**								
Anaxyrus americanus	American Toad	S5					x	x	x
Hyla versicolor	Gray Treefrog	S5					x	x	x
Lithobates catesbeianus	American Bullfrog	S4					x		x
Lithobates clamitans	Green Frog	S5					x	x	x
Lithobates pipiens	Northern Leopard Frog	S5					x	x	x
Lithobates sylvaticus	Wood Frog	S5					x		x
Pseudacris crucifer	Spring Peeper	S5					x	x	x
Total:						**4**	**21**	**13**	**14**

Sources:

1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Make a Map: Natural Heritage Areas* . Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

2 iNaturalist. 2023. *Observations* . Accessed MAY 2023. https://www.inaturalist.org/observations

3 Hidden Valley Draft Characterization Report. Comprehensive Environmental Impact Study for the City of Kitchener (LGL, 2023. Draft)

4 Schedule B Class Environmental Assessment. Upper Hidden Valley Sanitary Pump Station and Forcemain (MTE Consultants Inc., 2022)

5 Stage 2 ION LRT from Kitchener to Cambridge Transit Project Assessment Process (WSP, 2021)

TABLE B3 Fish Species

Species Name		Conservation Rank				Source				
Scientific Name	Common Name	Provincial (S-rank)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC [1]	iNaturalist [2]	DFO [3]	LIO [4]	Other Studies [5, 6, 7]
Cypriniformes										
Campostoma anomalum	Central Stoneroller	S4							x	
Carassius auratus	Goldfish	SNA							x	
Cyprinus carpio	Common Carp	SNA					x		x	
Nocomis micropogon	River Chub	S4							x	
Notropis atherinoides	Emerald Shiner	S5							x	
Notropis photogenis	Silver Shiner	S2S3	THR	THR	THR	x		x		x
Notropis rubellus	Rosyface Shiner	S4							x	
Pimephales notatus	Bluntnose Minnow	S5							x	
Pimephales promelas	Fathead Minnow	S5							x	
Rhinichthys cataractae	Longnose Dace	S5							x	
Semotilus atromaculatus	Creek Chub	S5							x	
Luxilus cornutus	Common Shiner	S5							x	
Catostomus commersonii	White Sucker	S5							x	
Hypentelium nigricans	Northern Hog Sucker	S4							x	
Moxostoma duquesnei	Black Redhorse	S2	THR	THR	THR			x	x	x
Moxostoma macrolepidotum	Shorthead Redhorse	S5							x	
Moxostoma valenciennesi	Greater Redhorse	S3				x			x	
Gasterosteiformes										
Culaea inconstans	Brook Stickleback	S5							x	
Perciformes										
Ambloplites rupestris	Rock Bass	S5							x	
Lepomis cyanellus	Green Sunfish	S4							x	
Lepomis gibbosus	Pumpkinseed	S5							x	
Micropterus dolomieu	Smallmouth Bass	S5							x	
Pomoxis annularis	White Crappie	S4							x	
Pomoxis nigromaculatus	Black Crappie	S4							x	
Etheostoma blennioides	Greenside Darter	S4							x	
Etheostoma caeruleum	Rainbow Darter	S4							x	
Etheostoma exile	Iowa Darter	S5							x	
Etheostoma flabellare	Fantail Darter	S4							x	
Etheostoma nigrum	Johnny Darter	S5							x	
Percina maculata	Blackside Darter	S4							x	
Petromyzontiformes										
Lethenteron appendix	American Brook Lamprey	S3							x	
Salmoniformes										
Oncorhynchus mykiss	Rainbow Trout	SNA							x	
Siluriformes										
Noturus flavus	Stonecat	S4							x	
Ameiurus nebulosus	Brown Bullhead	S5							x	
Total						**2**	**1**	**2**	**33**	**2**
Total	**176**	**176**	**33**	**45**	**30**					

Notes:

S-rank
S1 - Critically Imperiled
S2 - Imperiled
S3 - Vulnerable
S4 - Apparently Secure
S5 - Secure
SU - Unrankable
SNA - Unranked
SX - Presumed Extirpated
SH - Possibly Extirpated
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ESA
SC - Special Concern
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ESA - *Endangered Species Act*
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SARA Schedule
Schedule 1 - Officially protected under SARA
Schedule 2 - threatened/endangered; may be reassessed for consideration for inclusion to Schedule 1
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Sources:

1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Make a Map: Natural Heritage Areas* . Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

2 iNaturalist. 2023. *Observations* . Accessed MAY 2023. https://www.inaturalist.org/observations

3 Fisheries and Oceans Canada (DFO). 2023. *Aquatic Species at Risk Map* . Accessed MAY 2023. https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

4 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Ontario GeoHub* . Open data resource through Land Information Ontario. Accessed MAY 2023. https://geohub.lio.gov.on.ca/

5 Hidden Valley Draft Characterization Report. Comprehensive Environmental Impact Study for the City of Kitchener (LGL, 2023. Draft)

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7 Stage 2 ION LRT from Kitchener to Cambridge Transit Project Assessment Process (WSP, 2021)

Table 4 Insect Species

Species Name		Conservation Ranking					Source				
Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC[1]	Ontario Butterfly Atlas [2]	iNaturalist[3]	Ontario Moth Atlas[4]	Other Studies[5, 6, 7]
Coleoptera	**Beetles**										
Anatis mali	Eye-spotted Ladybird Beetle	SNR							x		
Capnochroa fuliginosa	Darkling Beetle	SNR							x		
Carabus nemoralis	European Ground Beetle	SNA							x		
Cicindela duodecimguttata	Tiger Beetle	S5							x		
Cicindela formosa	Tiger Beetle	S4							x		
Cicindela limbalis	Tiger Beetle	S4S5							x		
Cicindela longilabris	Tiger Beetle	S5							x		
Cicindela punctulata	Tiger Beetle	S5							x		
Cicindela purpurea	Tiger Beetle	S4							x		
Cicindela repanda	Tiger Beetle	S5							x		
Cicindela scutellaris	Tiger Beetle	S5							x		
Cicindela sexguttata	Tiger Beetle	S5							x		
Cicindela tranquebarica	Tiger Beetle	S5							x		
Coleomegilla maculata	Spotted Ladybird Beetle	S5							x		
Crioceris asparagi	Common Asparagus Beetle	SNA							x		
Lilioceris lilii	Leaf Beetle	SNA							x		
Plagiodera versicolora	Leaf Beetle	SNA							x		
Polydrusus formosus	Green Immigrant Leaf Weevil								x		
Popillia japonica	Scarab Beetle	SNA							x		
Sitona hispidulus	Weevil species	SNR							x		
Diptera	**Flies**										
Xenox tigrinus	Tiger Bee Fly	S3S4							x		
Ephemeroptera	**Mayflies**										
Stenacron interpunctatum	Common Flat-headed Mayfly	S4S5							x		
Homoptera	**Sucking Insects**										
Athysanella longicauda	Leafhopper	SNR							x		
Athysanella terebrans	Leafhopper	SNR							x		
Chlorotettix attenuatus	Leafhopper	SNR							x		
Hymenoptera	**Sawflies, Wasps, Bees, and Ants**										
Apis mellifera	European Honey Bee	SNA							x		
Bombus bimaculatus	Two-spotted Bumble Bee	S5							x		
Tetramorium caespitum	Pavement Ant	SNA							x		
Xylocopa virginica	Virginia Carpenter Bee	S4S5							x		
Lepidoptera	**Butterflies**										
Aglais milberti	Milbert's Tortoiseshell	S5						x	x		
Amphion floridensis	Nessus Sphinx	S4								x	
Anatrytone logan	Delaware Skipper	S4						x			
Ancyloxypha numitor	Least Skipper	S5						x			
Antheraea polyphemus	Polyphemus Moth	S5								x	
Asterocampa celtis	Hackberry Emperor	S3						x			
Asterocampa clyton	Tawny Emperor	S3						x			
Boloria bellona	Meadow Fritillary	S5						x			
Boloria selene	Silver-bordered Fritillary	S5						x			
Callophrys niphon	Eastern Pine Elfin	S5						x			
Campaea perlata	Pale Beauty Moth	S5							x		
Carterocephalus palaemon	Arctic Skipper	S5						x			
Catocala blandula	Charming Underwing	S5								x	
Celastrina lucia	Northern Spring Azure	S5						x			
Celastrina neglecta	Summer Azure	S5						x			
Ceratomia undulosa	Waved Sphinx Moth	S5								x	
Cercyonis pegala	Common Wood-Nymph	S5						x			
Chlosyne nycteis	Silvery Checkerspot	S5						x			
Cisseps fulvicollis	Yellow-collared Scape Moth	SNR								x	
Coenonympha tullia	Common Ringlet	S5						x	x		
Colias eurytheme	Orange Sulphur	S5						x	x		
Colias philodice	Clouded Sulphur	S5						x	x		
Ctenucha virginica	Virginia Ctenucha Moth	S5							x	x	
Cucullia convexipennis	Brown-bordered Cucullia	S4							x		
Cupido comyntas	Eastern Tailed Blue	S5						x			
Danaus plexippus	Monarch	S2N,S4B	SC	END	SC			x	x		x
Darapsa myron	Hog Sphinx	SU								x	
Epargyreus clarus	Silver-spotted Skipper	S4						x			
Erynnis baptisiae	Wild Indigo Duskywing	S4						x	x		
Erynnis icelus	Dreamy Duskywing	S5						x			
Erynnis juvenalis	Juvenal's Duskywing	S5						x			
Estigmene acrea	Salt Marsh Moth	S5								x	
Euchaetes egle	Milkweed Tussock Moth	S4?								x	
Eumorpha pandorus	Pandorus Sphinx	S4								x	
Euphydryas phaeton	Baltimore Checkerspot	S4						x	x		
Euphyes bimacula	Two-spotted Skipper	S4						x			
Euphyes conspicua	Black Dash	S3						x			
Euphyes dion	Dion Skipper	S4						x			
Euphyes vestris	Dun Skipper	S5						x			
Feltia subgothica	Subgothic Dart	S5							x		
Feniseca tarquinius	Harvester	S4						x			
Glaucopsyche lygdamus	Silvery Blue	S5						x			
Grammia virgo	Virgin Tiger Moth	S5								x	
Halysidota tessellaris	Banded Tussock Moth	S5								x	
Haploa clymene	Clymene Moth	SNR								x	
Haploa lecontei	LeConte's Haploa	S4?								x	

Species Name		Conservation Ranking					Source				
Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC[1]	Ontario Butterfly Atlas [2]	iNaturalist[3]	Ontario Moth Atlas[4]	Other Studies[5, 6, 7]
Hemaris diffinis	Snowberry Clearwing Moth	S4S5								x	
Hemaris thysbe	Hummingbird Clearwing	S5								x	
Hyalophora cecropia	Cecropia Moth	S5							x	x	
Hyles gallii	Galium Sphinx	S5?								x	
Hypercompe scribonia	Giant Leopard Moth	SNR								x	
Hyphantria cunea	Fall Webworm Moth	S5							x	x	
Hypoprepia fucosa	Painted Lichen Moth	S5								x	
Junonia coenia	Common Buckeye	SNA						x			
Lethe anthedon	Northern Pearly-Eye	S5						x			
Lethe appalachia	Appalachian Brown	S4						x			
Lethe eurydice	Eyed Brown	S5						x			
Libytheana carinenta	American Snout	SNA						x			
Limenitis archippus	Viceroy	S5						x	x		
Limenitis arthemis arthemis	White Admiral	S5						x			
Limenitis arthemis astyanax	Red-spotted Purple	S5						x	x		
Lophocampa caryae	Hickory Tussock Moth	SNR							x	x	
Lophocampa maculata	Spotted Tussock Moth	S4								x	
Lycaena hyllus	Bronze Copper	S5						x			
Lymantria dispar	Gypsy Moth	SNA							x		
Malacosoma americana	Eastern Tent Caterpillar Moth	S5							x	x	
Manduca quinquemaculata	Five-spotted Sphinx Moth	S5								x	
Megisto cymela	Little Wood-Satyr	S5						x			
Nymphalis antiopa	Mourning Cloak	S5						x	x		
Nymphalis l-album	Compton Tortoiseshell	S5						x	x		
Operophtera bruceata	Bruce Spanworm	SNR							x		
Paonias excaecata	Blinded Sphinx	S5								x	
Paonias myops	Small-eyed Sphinx	S5								x	
Papilio cresphontes	Giant Swallowtail	S4						x	x		
Papilio glaucus	Eastern Tiger Swallowtail	S5						x			
Papilio polyxenes	Black Swallowtail	S5						x	x		
Papilio troilus	Spicebush Swallowtail	S4						x			
Pholisora catullus	Common Sootywing	S4						x			
Phragmatobia fuliginosa	Ruby Tiger Moth	S4?								x	
Phyciodes cocyta	Northern Crescent	S5						x			
Phyciodes tharos	Pearl Crescent	S4						x			
Pieris oleracea	Mustard White	S4						x			
Pieris rapae	Cabbage White	SNA						x	x		
Poanes hobomok	Hobomok Skipper	S5						x			
Poanes massasoit	Mulberry Wing	S4						x			
Polites mystic	Long Dash Skipper	S5						x			
Polites origenes	Crossline Skipper	S4						x			
Polites peckius	Peck's Skipper	S5						x			
Polites themistocles	Tawny-edged Skipper	S5						x			
Polygonia comma	Eastern Comma	S5						x	x		
Polygonia interrogationis	Question Mark	S5						x			
Polygonia progne	Gray Comma	S5						x			
Pompeius verna	Little Glassywing	S4						x			
Pontia protodice	Checkered White	SNA						x			
Pyrisitia lisa	Little Yellow	SNA						x			
Pyrrharctia isabella	Isabella Tiger Moth	S5								x	
Satyrium acadica	Acadian Hairstreak	S4						x			
Satyrium calanus	Banded Hairstreak	S4						x			
Satyrium caryaevorus	Hickory Hairstreak	S4						x			
Satyrium liparops	Striped Hairstreak	S5						x			
Satyrium titus	Coral Hairstreak	S5						x			
Smerinthus cerisyi	One-eyed Sphinx	S5								x	
Smerinthus jamaicensis	Twin-spotted Sphinx	S5								x	
Speyeria atlantis	Atlantis Fritillary	S5						x			
Speyeria cybele	Great Spangled Fritillary	S5						x			
Sphecodina abbottii	Abbott's Sphinx	S4								x	
Sphinx kalmiae	Laurel Sphinx	S5								x	
Spilosoma virginica	Virginian Tiger Moth	S5							x	x	
Thymelicus lineola	European Skipper	SNA						x			
Vanessa atalanta	Red Admiral	S5						x	x		
Vanessa cardui	Painted Lady	S5						x			
Vanessa virginiensis	American Lady	S5						x	x		
Wallengrenia egeremet	Northern Broken-Dash	S5						x			
Mantodea	**Mantises**										
Mantis religiosa	Praying Mantis	SNA							x		
Odonata	**Damselflies and Dragonflies**										
Aeshna umbrosa	Shadow Darner	S5							x		
Argia moesta	Powdered Dancer	S5							x		
Calopteryx maculata	Ebony Jewelwing	S5							x		
Libellula pulchella	Twelve-spotted Skimmer	S5							x		

Species Name		Conservation Ranking					Source				
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Orthoptera	Grasshoppers, Katydids, Crickets, and related insects										
Conocephalus fasciatus	Slender Meadow Katydid	S4S5							x		
Dissosteira carolina	Carolina Grasshopper	S4S5							x		
Gryllus pennsylvanicus	Fall Field Cricket	S5							x		
Orchelimum nigripes	Black-legged Meadow Katydid	S4							x		
TOTAL:							0	74	66	34	1
		9090	29	26	19	0					

Notes:

S-rank
S1 - Critically Imperiled
S2 - Imperiled
S3 - Vulnerable
S4 - Apparently Secure
S5 - Secure
SU - Unrankable
SNA - Unranked
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1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Make a Map: Natural Heritage Areas* . Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA
2 Toronto Entomologists' Association (TEA). 2023. *Ontario Butterfly Atlas* . Accessed MAY 2023. https://www.ontarioinsects.org/atlas/
3 iNaturalist (iNaturalist). 2023. *Observations* . Accessed MAY 2023. https://www.inaturalist.org/observations
4 Toronto Entomologists' Association (TEA). 2023. *Ontario Butterfly Atlas* . Accessed MAY 2023. https://www.ontarioinsects.org/moth/index.html
5 Hidden Valley Draft Characterization Report. Comprehensive Environmental Impact Study for the City of Kitchener (LGL, 2023. Draft)
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TABLE Mollusc Species

Species		Conservation Rank				Source			
Scientific Name	Common Name	Provincial (S-RANK)	Provincial (ESA)	National (COSEWIC)	National (SARA)	NHIC[1]	iNaturalist[2]	DFO[3]	Other Studies[4, 5, 6]
Unionidae									
Lampsilis fasciola	Wavy-rayed Lampmussel	S2	THR	SC	SC	x		x	x
Lasmigona costata	Fluted-shell	S5					x		
Strophitus undulatus	Creeper	S5					x		
Villosa iris	Rainbow Mussel	S1	SC	SC	SC	x			x
Viviparidae									
Cipangopaludina chinensis	Chinese Mysterysnail	SNA					x		
Helicidae									
Cepaea nemoralis	Grovesnail	SNA					x		
TOTAL:						**2**	**4**	**1**	**3**
	312	**312**	**19**	**21**	**16**				

Sources:

1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Make a Map: Natural Heritage Areas* . Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

2 iNaturalist. 2023. *Observations* . Accessed MAY 2023. https://www.inaturalist.org/observations

3 Fisheries and Oceans Canada (DFO). 2023. *Aquatic Species at Risk Map* . Accessed MAY 2023. https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

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Table 6 Mammal Species

Species Name		Conservation Ranking				Source			
Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	NHIC[1]	Ontario Mammals[2]	iNaturalist[3]	Other Studies[4, 5, 6]
Artiodactyla	**Deer and Bison**								
Odocoileus virginianus	White-tailed Deer	S5					x	x	x
Carnivora	**Carnivores**								
Canis latrans	Coyote	S5					x		x
Lontra canadensis	North American River Otter	S5					x		
Martes americana	American Marten	S5					x		
Mephitis mephitis	Striped Skunk	S5					x	x	x
Mustela erminea	Ermine	S5							x
Mustela frenata	Long-tailed Weasel	S4					x		x
Mustela nivalis	Least Weasel	SU					x		x
Neogale vison	American Mink	S4					x	x	x
Pekania pennanti	Fisher	S5							x
Procyon lotor	Northern Raccoon	S5					x	x	x
Taxidea taxus	American Badger	S2	END	SC, END	SC, END		x		
Ursus americanus	American Black Bear	S5					x		
Vulpes vulpes	Red Fox	S5					x		x
Chiroptera	**Bats**								
Eptesicus fuscus	Big Brown Bat	S4					x		
Lasionycteris noctivagans	Silver-haired Bat	S4					x		
Lasiurus borealis	Red Bat	S4					x		
Lasiurus cinereus	Hoary Bat	S4					x		
Myotis leibii	Eastern Small-footed Myotis	S2/S3	END				x		
Myotis lucifugus	Little Brown Myotis	S4	END	END	END		x		
Myotis septentrionalis	Northern Myotis	S3	END	END	END		x		
Perimyotis subflavus	Tricolored Bat	S3	END	END	END		x		
Didelphimorphia	**Oppossums**								
Didelphis virginiana	Virginia Opossum	S4					x		
Lagomorphia	**Rabbits and Hares**								
Lepus europaeus	European Hare	SNA							x
Sylvilagus floridanus	Eastern Cottontail	S5					x	x	x
Rodentia	**Rodents**								
Castor canadensis	Beaver	S5					x	x	x
Glaucomys sabrinus	Northern Flying Squirrel	S5					x		x
Glaucomys volans	Southern Flying Squirrel	S4					x		
Marmota monax	Woodchuck	S5					x	x	x
Microtus pennsylvanicus	Meadow Vole	S5					x		x
Mus musculus	House Mouse	SNA					x		
Myodes gapperi	Southern Red-backed Vole	S5					x		
Napaeozapus insignis	Woodland Jumping Mouse	S5					x		
Ondatra zibethicus	Muskrat	S5					x		x
Peromyscus leucopus	White-footed Mouse	S5					x		x
Peromyscus maniculatus	Deer Mouse	S5					x		x
Sciurus carolinensis	Grey Squirrel	S5					x	x	x
Synaptomys cooperi	Southern Bog Lemming	S4					x		
Tamias striatus	Eastern Chipmunk	S5					x	x	x
Tamiasciurus hudsonicus	Red Squirrel	S5					x	x	x
Zapus hudsonius	Meadow Jumping Mouse	S5							x
Soricomorpha									
Blarina brevicauda	Northern Short-tailed Shrew	S5					x		x
Condylura cristata	Star-nosed Mole	S5					x		
Parascalops breweri	Hairy-tailed Mole	S4					x		
Sorex cinereus	Masked Shrew	S5					x		
Sorex hoyi	Pygmy Shrew	S4					x		
TOTAL:						**0**	**42**	**10**	**24**

Sources:

1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. *Make a Map: Natural Heritage Areas* . Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

2 iNaturalist. 2023. Ontario Mammals. Accessed MAY 2023. https://www.inaturalist.org/guides/1327?view=card

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6 Stage 2 ION LRT from Kitchener to Cambridge Transit Project Assessment Process (WSP, 2021)

TABLE 7 Vegetation

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	LOCAL STATUS - WATERLOO 2020	LOCAL STATUS WATERLOO 1999	LOCAL STATUS WATERLOO 2009	All Species	NHIC[1]	iNaturalist[2]	Other Studies(3, 4, 5)
	Reference										Region of Waterloo. 2020.	Region of Waterloo. 1999.	Oldham & Brinker, 2009				
FERNS & ALLIES	**PTERIDOPHYTES**													x		o	o
Bracken Fern Family	**Dennstaedtiaceae**													x			o
Bracken Fern	*Pteridium aquilinum*	2	3			S5				G5				x			x
Wood Fern Family	**Dryopteridaceae**													x		o	o
Northwestern Lady Fern	*Athyrium filix-femina*													x		x	x
Northeastern Lady Fern	*Athyrium filix-femina var. angustum*	4	0			S5				G5T5				x			x
Bulblet Fern	*Cystopteris bulbifera*	5	-3			S5				G5				x		x	x
Narrow-leaved Glade Fern	*Homalosorus pycnocarpos*	10	0			S4				G5	R			x		x	
Spinulose Wood Fern	*Dryopteris carthusiana*	5	-3			S5				G5				x			x
Clinton's Wood Fern	*Dryopteris clintoniana*	7	-3			S4				G5				x		x	x
Crested Wood Fern	*Dryopteris cristata*	7	-5			S5				G5				x		x	x
Evergreen Wood Fern	*Dryopteris intermedia*	5	0			S5				G5				x		x	x
Marginal Wood Fern	*Dryopteris marginalis*	5	3			S5				G5				x		x	x
Western Oak Fern	*Gymnocarpium dryopteris*	7	3			S5				G5				x		x	
Ostrich Fern	*Matteuccia struthiopteris*	5	0			S5				G5				x		x	x
Sensitive Fern	*Onoclea sensibilis*	4	-3			S5				G5				x		x	x
Christmas Fern	*Polystichum acrostichoides*	5	3			S5				G5				x		x	x
Horsetail Family	**Equisetaceae**													x		o	o
Field Horsetail	*Equisetum arvense*	0	0			S5				G5				x		x	x
Common Scouring-rush	*Equisetum hyemale*	2	0			S5				G5T5				x			x
Woodland Horsetail	*Equisetum sylvaticum*	7	-3			S5				G5				x			x
Adder's Tongue Family	**Ophioglossaceae**													x		o	o
Rattlesnake Fern	*Botrychium virginianum*	5	3			S5				G5				x		x	
Royal Fern Family	**Osmundaceae**													x		o	o
Cinnamon Fern	*Osmundastrum cinnamomeum*	7	-3			S5				G5				x		x	
Maidenhair Fern Family	**Pteridaceae**													x		o	o
Northern Maidenhair Fern	*Adiantum pedatum*	7	3			S5				G5				x		x	x
Selaginella Family	**Selaginellaceae**													x		o	o
Hidden Spike-moss	*Selaginella eclipes*	7	-3			S4				G4				x			x
Marsh Fern Family	**Thelypteridaceae**													x		o	o
Eastern Marsh Fern	*Thelypteris palustris*	5	-3			S5				G5				x		x	x
CONIFERS	**GYMNOSPERMS**													x		o	o
Cedar Family	**Cupressaceae**													x		o	o
Common Juniper	*Juniperus communis*	4	3			S5				G5	R+	R+		x			x
Eastern Red Cedar	*Juniperus virginiana*	4	3			S5				G5				x			x
Eastern White Cedar	*Thuja occidentalis*	4	-3			S5				G5				x		x	x
Pine Family	**Pinaceae**													x		o	o
European Larch	*Larix decidua*		5	-1		SNA				G5				x			x
Tamarack	*Larix laricina*	7	-3			S5				G5				x			x
Norway Spruce	*Picea abies*		5	-1		SNA				G5				x			x
White Spruce	*Picea glauca*	6	3			S5				G5	R+	R+		x		x	x
Blue Spruce	*Picea pungens*		3			SNA				G5				x			x
Mugo Pine	*Pinus mugo*					SNA				GNR				x			x
Austrian Pine	*Pinus nigra*		5	-1		SNA				GNR				x			x
Red Pine	*Pinus resinosa*	8	3			S5				G5				x			x
Eastern White Pine	*Pinus strobus*	4	3			S5				G5				x		x	x
Scots Pine	*Pinus sylvestris*		3	-3	2	SNA				GNR				x			x
Eastern Hemlock	*Tsuga canadensis*	7	3			S5				G5				x		x	x
DICOTS	**DICOTYLEDONS**													x		o	o
Maple Family	**Aceraceae**													x		o	o
Amur Maple	*Acer ginnala*		5	-2	4	SNA				G--TNR				x			x
Manitoba Maple	*Acer negundo*	0	0		1	S5				G5				x		x	x
Japanese Maple	*Acer palmatum*													x			x
Norway Maple	*Acer platanoides*		5	-3	2	SNA				GNR				x		x	x
Red Maple	*Acer rubrum*	4	0			S5				G5				x		x	x
Silver Maple	*Acer saccharinum*	5	-3			S5				G5				x			x
Sugar Maple	*Acer saccharum*	4	3			S5				G5				x		x	x

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Sugar Maple	*Acer saccharum var. saccharum*													x		x	x
Mountain Maple	*Acer spicatum*	6	3			S5				G5				x		x	
Freeman's Maple	*Acer X freemanii*	6	-5			SNA				GNA				x			x
Sumac or Cashew Family	**Anacardiaceae**													x		o	o
European Smoke-tree	*Cotinus coggygria*		5			SNA				GNR				x			x
Western Poison-ivy	*Toxicodendron rydbergii*	2	0			S5				G--T5				x		x	x
Staghorn Sumac	*Rhus typhina*	1	3			S5				G5				x		x	
Carrot or Parsley Family	**Apiaceae**													x		o	o
Bishop's Goutweed	*Aegopodium podagraria*		0	-3	1	SNA				GNR				x		x	
Purplestem Angelica	*Angelica atropurpurea*	6	-5			S5				G5				x		x	
Spotted Water-hemlock	*Cicuta maculata*	6	-5			S5				G5				x			x
Canadian Honewort	*Cryptotaenia canadensis*	5	0			S5				G5				x		x	x
Wild Carrot	*Daucus carota*		5	-2		SNA				GNR				x		x	x
Giant Hogweed	*Heracleum mantegazzianum*		0		1	SNA				GNR	R			x		x	
American Marsh-pennywort	*Hydrocotyle americana*	7	-5			S4S5				G5				x		x	x
Woolly Sweet-cicely	*Osmorhiza claytonii*	5	0			S5				G5				x		x	
Wild Parsnip	*Pastinaca sativa*		5	-3		SNA				GNR				x			x
Black Snakeroot	*Sanicula marilandica*	5	3			S5				G5				x		x	x
Water Parsnip	*Sium suave*	4	-5		3	S5				G5				x			x
Dogbane Family	**Apocynaceae**													x		o	o
Spreading Dogbane	*Apocynum androsaemifolium*	3	5			S5				G5				x			x
Common Periwinkle	*Vinca minor*		5	-2	2	SNA				GNR				x		x	x
Holly Family	**Aquifoliaceae**													x		o	o
Winterberry	*Ilex verticillata*	5	-3			S5				G5				x			x
Ginseng Family	**Araliaceae**													x		o	o
Wild Sarsaparilla	*Aralia nudicaulis*	4	3			S5				G5				x		x	x
Spikenard	*Aralia racemosa*													x		x	
American Ginseng	*Panax quinquefolius*	9	5			S2	END	END	END	G3G4	R	R	R	x			x
Duchman's-pipe Family	**Aristolochiaceae**													x		o	o
Wild Ginger	*Asarum canadense*	6	5			S5				G5				x		x	x
Milkweed Family	**Asclepiadaceae**													x		o	o
Poke Milkweed	*Asclepias exaltata*	8	5			S4				G5				x		x	x
Swamp Milkweed	*Asclepias incarnata*	6	-5			S5				G5				x		x	x
Swamp Milkweed	*Asclepias incarnata ssp. Incarnata*													x		x	x
Common Milkweed	*Asclepias syriaca*	0	5			S5				G5				x		x	x
European Swallow-wort	*Vincetoxicum rossicum*		5	-3	1	SNA				GNR				x		x	
Composite or Aster Family	**Asteraceae**													x		o	o
Common Yarrow	*Achillea millefolium*		3	-1		SE				G5				x			x
Common Ragweed	*Ambrosia artemisiifolia*	0	3			S5				G5				x		x	x
Giant Ragweed	*Ambrosia trifida*	0	0			S5				G5				x		x	x
Western Pearly Everlasting	*Anaphalis margaritacea*	3	3			S5				G5				x			x
Field Pussytoes	*Antennaria neglecta*	3	5			S5				G5				x			x
Common Burdock	*Arctium minus*		3	-2		SNA				GNR				x			x
Biennial Wormwood	*Artemisia biennis*		-3	-1		SNA				G5	R			x			x
Common Mugwort	*Artemisia vulgaris*		5	-1	4	SNA				GU				x		x	
Heart-leaved Aster	*Symphyotrichum cordifolium*	5	5			S5				G5				x		x	x
Heath Aster	*Symphyotrichum ericoides*	4	3			S5				G5				x			x
White Panicled Aster	*Symphyotrichum lanceolatum*	3	-3			S5				G5				x		x	
Calico Aster	*Symphyotrichum lateriflorum*	3	0			S5				G5				x		x	
Large-leaved Aster	*Eurybia macrophylla*	5	5			S5				G5				x		x	x
New England Aster	*Symphyotrichum novae-angliae*	2	-3			S5				G5				x		x	x
Purple-stemmed Aster	*Symphyotrichum puniceum*													x			x
Purple-stemmed Aster	*Symphyotrichum puniceum var. puniceum*	6	-5			S5				G5T5				x			x
Flat-top White Aster	*Doellingeria umbellata*	6	-3			S5				G5		R*		x		x	
Flat-top White Aster	*Doellingeria umbellata var. umbellata*													x		x	
Arrow-leaved Aster	*Symphyotrichum urophyllum*	6	5			S4				G4G5				x			x
Nodding Beggar-ticks	*Bidens cernua*	2	-5			S5				G5				x			x
Devil's Beggar-ticks	*Bidens frondosa*	3	-3			S5				G5				x		x	x
Threelobe Beggar-ticks	*Bidens tripartita*	5	-3			S5				G5				x			x
Tall Beggar-ticks	*Bidens vulgata*	5	0			S5				G5				x			x
Brown Knapweed	*Centaurea jacea*		5	-1		SNA				GNR				x		x	x
Bighead Knapweed	*Centaurea macrocephala*		5	-1		SNA				GNR				x			x

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Jersey Knapweed	*Centaurea paniculata*					SNA				GNR				x			x
Ox-eye Daisy	*Leucanthemum vulgare*		5	-1		SNA				GNR				x			x
Chicory	*Cichorium intybus*		5	-1		SNA				GNR				x		x	x
Canada Thistle	*Cirsium arvense*		3	-1	1	SNA				GNR	R			x		x	x
Bull Thistle	*Cirsium vulgare*		3	-1		SNA				GNR				x		x	x
Canadian Horseweed	*Conyza canadensis*	0	1			S5				G5				x			x
Lance-leaved Tickseed	*Coreopsis lanceolata*	5	3			S4				G5				x			x
American Burnweed	*Erechtites hieraciifolius*	2	3			S5				G5		R		x		x	
Eastern Daisy Fleabane	*Erigeron annuus*	0	3			S5				G5				x		x	x
Philadelphia Fleabane	*Erigeron philadelphicus*	1	-3			S5				G5				x		x	x
Rough Fleabane	*Erigeron strigosus*	4	3			S5				G5				x			x
Boneset	*Eupatorium perfoliatum*	2	-3			S5				G5				x			x
White Snakeroot	*Ageratina altissima*													x		x	x
White Snakeroot	*Ageratina altissima var. altissima*	5	3			S5				G5T5				x		x	x
Spotted Joe-pye-weed	*Eutrochium maculatum*	3	-5			S5				G5				x		x	
Grass-leaved Goldenrod	*Euthamia graminifolia*	2	0			S5				G5				x			x
Jerusalem Artichoke	*Helianthus tuberosus*	1	0	-2		SU				G5	R			x		x	x
Common Hawkweed	*Hieracium vulgatum*		5	-1	3	SNA?				GNR				x		x	
Elecampane	*Inula helenium*		3	-2	4	SNA				GNR				x		x	
Nipplewort	*Lapsana communis*		3	-2	4	SNA				GNR				x		x	
White Rattlesnake-root	*Prenanthes alba*	6	3			S5				G5				x			x
Tall Rattlesnake-root	*Prenanthes altissima*	5	3			S5				G5				x			x
Black-eyed Susan	*Rudbeckia hirta*	0	3			S5				G5				x		x	x
Cut-leaved Coneflower	*Rudbeckia laciniata*	7	-3			S5				G5				x		x	
Brown-eyed Susan	*Rudbeckia triloba*		3	-1		SNA				G5				x			x
Tall Goldenrod	*Solidago altissima*	1	3			S5				G5				x		x	
Wreath Goldenrod	*Solidago caesia*	5	3			S5				G5				x		x	x
Zig-zag Goldenrod	*Solidago flexicaulis*	6	3			S5				G5				x		x	x
Giant Goldenrod	*Solidago gigantea*	4	-3			S5				G5				x		x	x
Early Goldenrod	*Solidago juncea*	3	5			S5				G5				x			x
Gray Goldenrod	*Solidago nemoralis*	2	5											x			x
Round-leaved Goldenrod	*Solidago patula*	8	-5			S4				G5				x			x
Wrinkle-leaf Goldenrod	*Solidago rugosa*													x			x
Wrinkle-leaf Goldenrod	*Solidago rugosa ssp. rugosa*	4	0			S5				G5T5				x			x
Field Sow-thistle	*Sonchus arvensis*													x			x
Field Sow-thistle	*Sonchus arvensis ssp. arvensis*		3	-1		SNA				GNRTNR				x			x
Common Tansy	*Tanacetum vulgare*		5	-1		SNA				GNR				x		x	x
Common Dandelion	*Taraxacum officinale*		3	-2		SNA				G5				x			x
Yellow Salsify	*Tragopogon dubius*		5	-1		SNA				GNR				x			x
Jack go to bed at noon	*Tragopogon pratensis*		5	-1		SNA				GNR				x		x	
Coltsfoot	*Tussilago farfara*		3	-2		SNA				GNR				x		x	x
Rough Cocklebur	*Xanthium strumarium*	2	0			S5				G5				x		x	
Touch-me-not Family	**Balsaminaceae**													x		o	o
Jewelweed	*Impatiens capensis*	4	-3			S5				G5				x		x	x
Ornamental Jewelweed	*Impatiens glandulifera*		-3	-2	1	SNA				GNR				x		x	
Pale Touch-me-not	*Impatiens pallida*	7	-3			S4				G5				x		x	
Barberry Family	**Berberidaceae**													x		o	o
Common Barberry	*Berberis vulgaris*		3	-2	3	SNA				GNR				x		x	x
Giant Blue Cohosh	*Caulophyllum giganteum*	6	5			S4S5				G4G5				x		x	
Blue Cohosh	*Caulophyllum thalictroides*	6	5			S5				G5				x			x
May-apple	*Podophyllum peltatum*	5	3			S5				G5				x		x	x
Birch Family	**Betulaceae**													x		o	o
Yellow Birch	*Betula alleghaniensis*	6	0			S5				G5				x		x	x
Paper Birch	*Betula papyrifera*	2	2			S5				G5				x			x
European Weeping Birch	*Betula pendula*		-4	-3	1	SNA				GNR				x		x	x
Blue Beech	*Carpinus caroliniana*													x		x	x
Blue Beech	*Carpinus caroliniana ssp. virginiana*	6	0			S5				G5T5	R			x			x
Ironwood	*Ostrya virginiana*	4	4			S5				G5				x		x	x
Bignonia Family	**Bignoniaceae**													x		o	o
Northern Catalpa	*Catalpa speciosa*		3	-1		SNA				G4?				x		x	x
Borage Family	**Boraginaceae**													x		o	o
Hound's-tongue	*Cynoglossum officinale*		5	-1		SNA				GNR				x		x	
Viper's Bugloss	*Echium vulgare*		5	-2		SNA				GNR				x		x	x
Virginia Stickweed	*Hackelia virginiana*	5	1			S5				G5		R*		x		x	

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Bay Forget-me-not	*Myosotis laxa*	6	-5			S5				G5				x			x
Field Forget-me-not	*Myosotis arvensis*		0	-1		SNA				GNR				x		x	
True Forget-me-not	*Myosotis scorpioides*		-5	-1	4	SNA				G5	R			x		x	
Woodland Forget-me-not	*Myosotis sylvatica*		5	-1		SNA				G5				x		x	
Common Comfrey	*Symphytum officinale*		5	-1		SNA				GNR				x		x	
Mustard Family	**Brassicaceae**													x		o	o
Garlic Mustard	*Alliaria petiolata*		0	-3	1	SNA				GNR				x		x	x
Garden Yellowrocket	*Barbarea vulgaris*		0	-1	3	SNA				GNR				x		x	x
Hoary Alyssum	*Berteroa incana*		5	-3		SNA				GNR				x		x	
Cut-leaved Toothwort	*Cardamine concatenata*	6	3			S5				G5				x		x	x
Crinkleroot	*Cardamine diphylla*	7	5			S5				G5				x		x	x
Pensylvania Bitter-cress	*Cardamine pensylvanica*	6	-4			S5				G5	R			x			x
Wormseed Wallflower	*Erysimum cheiranthoides*		3	-1		SNA				G5				x		x	
Dame's Rocket	*Hesperis matronalis*		5	-3	1	SNA				G4G5				x		x	x
Field Penny-cress	*Thlaspi arvense*		5	-1		SNA				GNR				x		x	
Bellflower Family	**Lobelia**													x		o	o
Indian Tobacco	*Lobelia inflata*	3	4			S5				G5				x		x	x
Great Blue Lobelia	*Lobelia siphilitica*	6	-4			S5				G5				x		x	
Honeysuckle Family	**Caprifoliaceae**													x		o	o
Northern Bush Honeysuckle	*Diervilla lonicera*	5	5			S5				G5				x			x
Twinflower	*Linnaea borealis*	7	0			S5				G5				x			x
American Fly Honeysuckle	*Lonicera canadensis*	6	3			S5				G5				x		x	
Limber Honeysuckle	*Lonicera dioica*	5	3			S5				G5				x		x	x
Douglas Honeysuckle	*Lonicera dioica*													x			x
Tartarian Honeysuckle	*Lonicera tatarica*		3	-3	1	SNA				GNR				x			x
American Black Elderberry	*Sambucus nigra ssp. canadensis*	5	-2			S5				G5T5				x			x
Black Elderberry	*Sambucus nigra*					SNA				G5				x			x
Red Elderberry	*Sambucus racemosa*	5	2		4	S5				G5				x		x	x
Orangefruit Horse-gentian	*Triosteum aurantiacum*	7	5			S4S5				G5				x			x
Maple-leaved Viburnum	*Viburnum acerifolium*	6	5			S5				G5				x		x	
Nannyberry	*Viburnum lentago*	4	-1			S5				G5				x		x	
European Cranberrybush	*Viburnum opulus*		0	-1		SNA				G5				x		x	x
Pink Family	**Caryophyllaceae**													x		o	o
Deptford Pink	*Dianthus armeria*		5	-1		SNA				GNR				x		x	x
Sweet William	*Dianthus barbatus*		5	-1		SNA				GNR				x		x	
Bouncing-bet	*Saponaria officinalis*		3	-3	3	SNA				GNR				x		x	x
Bladder Campion	*Silene latifolia*		5	-2		SNA				GNR				x		x	
Maidenstears	*Silene vulgaris*		5	-1		SNA				GNR				x			x
Staff-tree Family	**Celastraceae**													x		o	o
American Bittersweet	*Celastrus scandens*	3	3			S5				G5				x		x	x
Winged Spindle Tree	*Euonymus alatus*		5	-1	3	SNA				GNR				x		x	
Winter Creeper	*Euonymus fortunei*		5	-1		SNA				GNR				x		x	
Running Strawberry-bush	*Euonymus obovatus*	6	5			S4				G5				x		x	
Morning-glory Family	**Convolvulaceae**													x		o	o
Field Bindweed	*Convolvulus arvensis*		5	-1	3	SNA				GNR				x		x	
Scaldweed	*Cuscuta gronovii*	4	-3			S5?				G5				x		x	x
Dogwood Family	**Cornaceae**													x		o	o
Alternate-leaved Dogwood	*Cornus alternifolia*	6	5			S5				G5				x			x
Silky Dogwood	*Cornus amomum*	5	-4			S5				G5				x			x
Gray Dogwood	*Cornus racemosa*	2	-2			S5				G5				x			x
Round-leaved Dogwood	*Cornus rugosa*	6	5			S5				G5				x		x	x
Red-osier Dogwood	*Cornus sericea*	2	-3			S5				G5				x		x	x
Tatarian Dogwood	*Cornus sericea ssp. sericea*													x			x
Stonecrop Family	**Crassulaceae**													x		o	o
Stringy Stonecrop	*Sedum sarmentosum*		5	-2		SNA				GNR				x		x	
Gourd Family	**Cucurbitaceae**													x		o	o
Wild Cucumber	*Echinocystis lobata*	3	-2			S5				G5				x		x	
One-seeded Bur-cucumber	*Sicyos angulatus*	5	-2			S4S5				G5	R	R		x		x	
Teasel Family	**Dipsacaceae**													x		o	o
Fuller's Teasel	*Dipsacus fullonum*		5	-1	3	SNA				GNR				x		x	x
Oleaster Family	**Elaeagnaceae**													x			o
Russian Olive	*Elaeagnus angustifolia*		4	-1	3	SNA				GNR				x			x
Spurge Family	**Euphorbiaceae**													x		o	o
Three-seeded Mercury	*Acalypha rhomboidea*	0	3			S5				G5				x			x

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Pea Family	**Fabaceae**													x		o	o
Hog Peanut	*Amphicarpaea bracteata*	4	0			S5				G5				x			x
Crown-vetch	*Securigera varia*		5	-2	1	SNA				GNR				x		x	
Pointed-leaved Tick-trefoil	*Desmodium glutinosum*	6	5			S4				G5				x		x	
Honey Locust	*Gleditsia triacanthos*	3	0			S2?				G5				x		x	x
Bird's-foot Trefoil	*Lotus corniculatus*		1	-2	2	SNA				GNR				x		x	x
Black Medick	*Medicago lupulina*		1	-1	4	SNA				GNR				x		x	x
Alfalfa	*Medicago sativa ssp. sativa*		5	-1	4	SNA				GNRTNR				x			x
White Sweet-clover	*Melilotus albus*		3	-3	2	SNA				G5				x		x	
Black Locust	*Robinia pseudoacacia*		4	-3	2	SNA				G5				x		x	
Red Clover	*Trifolium pratense*		2	-2	4	SNA				GNR				x		x	x
White Clover	*Trifolium repens*		2	-1	4	SNA				GNR				x		x	
Cow Vetch	*Vicia cracca*		5	-1	2	SNA				GNR				x		x	x
Winter Vetch	*Vicia villosa*		5	-1		SNA				G5				x		x	
Beech Family	**Fagaceae**													x		o	o
American Beech	*Fagus grandifolia*	6	3			S4				G5				x		x	x
White Oak	*Quercus alba*	6	3			S5				G5				x		x	x
Bur Oak	*Quercus macrocarpa*	5	1			S5				G5				x			x
English Oak	*Quercus robur*					SNA				GNR				x		x	x
Red Oak	*Quercus rubra*	6	3			S5				G5				x		x	x
Fumitory Family	**Fumariaceae**													x		o	o
Dutchman's-breeches	*Dicentra cucullaria*	6	5			S5				G5				x		x	
Gentian Family	**Gentianaceae**													x		o	o
Greater Fringed Gentian	*Gentianopsis crinita*	8	-4			S5				G5	R	R		x			x
Geranium Family	**Geraniaceae**													x		o	o
Herb-robert	*Geranium robertianum*		5	-2		S5				G5				x		x	x
Currant Family	**Grossulariaceae**													x		o	o
American Black Currant	*Ribes americanum*	4	-3			S5				G5				x			x
Eastern Prickly Gooseberry	*Ribes cynosbati*	4	5			S5				G5				x		x	x
Swamp Red Currant	*Ribes triste*	6	-5			S5				G5				x		x	x
St. John's-wort Family	**Guttiferae**													x		o	o
Common St. John's-wort	*Hypericum perforatum*		5	-3	4	SNA				GNR				x			x
Witch-hazel Family	**Hamamelidaceae**													x		o	
Witch-hazel	*Hamamelis virginiana*	6	3			S4S5				G5				x		x	
Water-leaf Family	**Hydrophyllaceae**													x		o	o
Blunt-leaf Water-leaf	*Hydrophyllum canadense*	8	-2			S4				G5				x		x	x
Virginia Water-leaf	*Hydrophyllum virginianum*	6	-2			S5				G5				x		x	x
Walnut Family	**Juglandaceae**													x		o	o
Bitternut Hickory	*Carya cordiformis*	6	0			S5				G5				x		x	x
Shagbark Hickory	*Carya ovata*	6	3			S5				G5				x			x
Butternut	*Juglans cinerea*	6	2			S2?	END	END	END	G4			R	x		x	x
Black Walnut	*Juglans nigra*	5	3			S4?				G5	R+*	R+*		x		x	x
Mint Family	**Lamiaceae**													x		o	o
Blue Giant Hyssop	*Agastache foeniculum*	2	5			S4				G5	R+	R+		x			x
Wild Basil	*Clinopodium vulgare*	4	5			S5				G5				x		x	x
Canada Horsebalm	*Collinsonia canadensis*	8	0			S4				G5	R*	R*		x		x	x
Ground Ivy	*Glechoma hederacea*		5	-2	4	SNA				GNR				x		x	x
Common Hemp-nettle	*Galeopsis tetrahit*		5	-1		SNA				GNR				x		x	
Purple Dead-nettle	*Lamium purpureum*		5	-2		SNA				GNR				x		x	
Common Motherwort	*Leonurus cardiaca*													x		x	x
Common Motherwort	*Leonurus cardiaca ssp. cardiaca*		5	-2		SNA				GNRTNR				x		x	x
American Water-horehound	*Lycopus americanus*	4	-5			S5				G5				x			x
European Water-horehound	*Lycopus europaeus*		-5	-2	3	SNA				GNR				x		x	
Northern Water-horehound	*Lycopus uniflorus*	5	-5			S5				G5				x			x
American Wild Mint	*Mentha arvensis*	3	-3			S5				G5				x			x
Wild Bergamot	*Monarda fistulosa*													x			x
Catnip	*Nepeta cataria*		1	-2	4	SNA				GNR				x		x	x
Obedient Plant	*Physostegia virginiana*													x		x	
Obedient Plant	*Physostegia virginiana ssp. virginiana*	8	-3			S4				G5T5				x		x	
Common Heal-all	*Prunella vulgaris ssp. vulgaris*		0	-1		SNA				G5TU				x			x
Blue Skullcap	*Scutellaria lateriflora*	5	-5			S5				G5				x			x

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Marsh Hedge-nettle	*Stachys palustris*		-5	-1		SNA				G5				x		x	
Laurel Family	**Lauraceae**													x		o	o
Northern Spicebush	*Lindera benzoin*	6	-2			S4				G5				x		x	x
Loosestrife Family	**Lythraceae**													x		o	o
Purple Loosestrife	*Lythrum salicaria*		-5	-3	1	SNA				G5				x		x	x
Mallow Family	**Malvaceae**													x		o	o
Velvet-leaf	*Abutilon theophrasti*		4	-1	3	SNA				GNR				x		x	
Common Mallow	*Malva neglecta*		5	-1		SNA				GNR				x			x
Mulberry Family	**Moraceae**													x		o	o
White Mulberry	*Morus alba*		0	-3	1	SNA				GNR				x		x	x
Water-lily Family	**Nymphaeaceae**													x		o	o
Large Yellow Pond-lily	*Nuphar advena*	7	-5			S3				G5	R	R		x		x	
Olive Family	**Oleaceae**													x		o	o
White Ash	*Fraxinus americana*	4	3			S4				G5				x			x
European Ash	*Fraxinus excelsior*				4	SNA				GNR				x			x
Black Ash	*Fraxinus nigra*	7	-4			S4				G5				x		x	x
Green Ash	*Fraxinus pennsylvanica*	3	-3			S4				G5				x			x
European Privet	*Ligustrum vulgare*		1	-2	4	SNA				GNR				x			x
Common Lilac	*Syringa vulgaris*		5	-2	2	SNA				GNR				x			x
Evening-primrose Family	**Onagraceae**													x		o	o
Great Hairy Willow-herb	*Epilobium hirsutum*		-4	-2		SNA				GNR				x		x	x
Small-flowered Willow-herb	*Epilobium parviflorum*		3	-1		SNA				GNR				x			x
Marsh Seedbox	*Ludwigia palustris*	5	-5			S5				G5				x		x	x
Narrow-leaf Evening-primrose	*Oenothera fruticosa*													x			x
Narrow-leaf Evening-primrose	*Oenothera fruticosa ssp. glauca*		2	-1		SX				G5				x			x
Broom-rape Family	**Orobanchaceae**													x		o	o
Beechdrops	*Epifagus virginiana*	6	5			S5				G5				x		x	
Wood Sorrel Family	**Oxalidaceae**													x		o	o
Common Yellow Oxalis	*Oxalis stricta*	0	3			S5				G5				x		x	x
Poppy Family	**Papaveraceae**													x		o	o
Celandine	*Chelidonium majus*		5	-3		SNA				GNR				x		x	x
Bloodroot	*Sanguinaria canadensis*	5	4			S5				G5				x		x	x
Lopseed Family	**Phrymaceae**													x		o	
American Lopseed	*Phryma leptostachya*	6	5			S4S5				G5				x		x	
Plantain Family	**Plantaginaceae**													x		o	o
English Plantain	*Plantago lanceolata*		0	-1		SNA				G5				x		x	x
Common Plantain	*Plantago major*		-1	-1		SNA				G5				x		x	x
Rugel's Plaintain	*Plantago rugelii*	1	0			S5				G5				x		x	
Phlox Family	**Polemoniaceae**													x		o	o
Wild Blue Phlox	*Phlox divaricata*	7	3			S4				G5				x			x
Smartweed Family	**Polygonaceae**													x		o	o
Marsh Hydro-pepper	*Persicaria hydropiper*	4	-5			SNA				GNR				x		x	
Curlytop Smartweed	*Persicaria lapathifolia*	2	-4			S5				G5				x		x	
Pennsylvania Smartweed	*Persicaria pensylvanica*	3	-4			S5				G5				x		x	
Lady's-thumb	*Persicaria maculosa*		-3	-1		SNA				G3G5				x		x	
Dotted Smartweed	*Persicaria punctata*	4	-5			S5				G5	R*	R*		x		x	
Curly-leaf Dock	*Rumex crispus*		-1	-2		SNA				GNR				x			x
Bitter Dock	*Rumex obtusifolius*		-3	-1		SNA				GNR				x		x	
Purslane Family	**Portulacaceae**													x		o	o
Carolina Spring Beauty	*Claytonia caroliniana*	7	3			S5				G5				x		x	
Virginia Spring Beauty	*Claytonia virginica*	5	3			S5				G5				x			x
Primrose Family	**Primulaceae**													x		o	o
Fringed Loosestrife	*Lysimachia ciliata*	4	-3			S5				G5				x		x	x
Creeping Jenny	*Lysimachia nummularia*		-4	-3	2	SNA				GNR				x		x	x
Tufted Loosestrife	*Lysimachia thyrsiflora*	7	-5			S5				G5				x			x
Buttercup Family	**Ranunculaceae**													x		o	o
White Baneberry	*Actaea pachypoda*	6	5			S5				G5				x		x	x
Red Baneberry	*Actaea rubra*	5	5			S5				G5				x		x	x
Sharp-lobed Hepatica	*Anemone acutiloba*	6	5			S5				G5				x		x	x
Wood Anemone	*Anemone quinquefolia*													x		x	
Wood Anemone	*Anemone quinquefolia var. quinquefolia*	7	0			S5				G5T5				x		x	

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Virginia Anemone	*Anemone virginiana*													x		x	x
Tall Thimbleweed	*Anemone virginiana var. virginiana*	4	5			S5				G5T5				x		x	
Wild Columbine	*Aquilegia canadensis*	5	1			S5				G5				x		x	x
European Columbine	*Aquilegia vulgaris*		3	-1		SNA				GNR				x		x	
Yellow Marsh-marigold	*Caltha palustris*	5	-5			S5				G5				x		x	x
Littleleaf Buttercup	*Ranunculus abortivus*	2	-2			S5				G5				x		x	x
Tall Buttercup	*Ranunculus acris*		-2	-2		SNA				G5				x		x	x
Bristly Buttercup	*Ranunculus hispidus var. nitidus*					S5				G5T5			R	x		x	
Bristly Buttercup	*Ranunculus hispidus var. caricetorum*	5	-5			S5				G5T5				x		x	
Hooked Buttercup	*Ranunculus recurvatus*													x		x	x
Blisterwort	*Ranunculus recurvatus var. recurvatus*	4	-3			S5				G5T5				x			x
Creeping Buttercup	*Ranunculus repens*		-1	-1	3	SNA				GNR				x		x	
Early Meadow-rue	*Thalictrum dioicum*	5	2			S5				G5				x		x	x
Tall Meadow-rue	*Thalictrum pubescens*	5	-2			S5				G5				x		x	x
Buckthorn Family	**Rhamnaceae**													x		o	o
Alder-leaved Buckthorn	*Rhamnus alnifolia*	7	-5			S5				G5				x			x
Common Buckthorn	*Rhamnus cathartica*		3	-3	1	SNA				GNR				x		x	x
Glossy Buckthorn	*Frangula alnus*		-1	-3		SNA				GNR				x		x	
Rose Family	**Rosaceae**													x		o	o
Tall Hairy Agrimony	*Agrimonia gryposepala*	2	2			S5				G5				x			x
Dotted Hawthorn	*Crataegus punctata*	4	5			S5				G5				x		x	x
Mock Strawberry	*Potentilla indica*		4	-1		SNA				G5				x		x	
Woodland Strawberry	*Fragaria vesca*													x		x	x
Woodland Strawberry	*Fragaria vesca ssp. americana*	4	4			S5				G5T5				x		x	x
Wild Strawberry	*Fragaria virginiana*	2	1			S5				G5				x			x
Yellow Avens	*Geum aleppicum*	2	-1			S5				G5				x		x	x
White Avens	*Geum canadense*	3	0			S5				G5				x		x	x
Wood Avens	*Geum urbanum*		5	-1		SNA				G5				x		x	
Sweet Crabapple	*Malus coronaria*	5	5			S4				G5				x			x
Common Apple	*Malus pumila*		5	-1		SNA				G5				x			x
Norwegian Cinquefoil	*Potentilla norvegica*	0	0			S5				G5				x			x
Rough-fruited Cinquefoil	*Potentilla recta*		5	-2		SNA				GNR				x			x
Creeping Cinquefoil	*Potentilla reptans*					SNA				GNR				x		x	
Wild Plum	*Prunus americana*	6	5			S4				G5	R	R		x		x	
Sweet Cherry	*Prunus avium*		5	-2	4	SNA				GNR				x			x
Black Cherry	*Prunus serotina*	3	3			S5				G5				x		x	x
Choke Cherry	*Prunus virginiana*	2	1			S5				G5				x			x
Common Pear	*Pyrus communis*		5	-1		SNA				G5				x			x
Smooth Rose	*Rosa blanda*	3	3			S5				G5				x			x
Multiflora Rose	*Rosa multiflora*		3	-3	1	SNA				GNR				x		x	x
Rugosa Rose	*Rosa rugosa*		3	-1		SNA				GNR				x		x	
Dwarf Raspberry	*Rubus arcticus ssp. acaulis*					S5				G5				x		x	
Common Blackberry	*Rubus allegheniensis*	2	2			S5				G5				x			x
American Red Raspberry	*Rubus idaeus*	0	-2			SNA				G5				x		x	x
American Red Raspberry	*Rubus idaeus var. idaeus*	0	-2											x		x	
Black Raspberry	*Rubus occidentalis*	2	5			S5				G5				x		x	x
Pennsylvania Blackberry	*Rubus pensilvanicus*	6	1			SU				G5				x			x
Dwarf Red Blackberry	*Rubus pubescens*	4	-4			S5				G5				x		x	x
European Mountain-ash	*Sorbus aucuparia*		5	-2	4	SNA				G5				x		x	
Madder Family	**Rubiaceae**													x		o	o
Rough Bedstraw	*Galium asprellum*	6	-5			S5				G5				x			x
Licorice Bedstraw	*Galium circaezans*	7	4			S5				G5	R	R		x		x	x
Smooth Bedstraw	*Galium mollugo*		5	-2	2	SNA				GNR				x			x
Marsh Bedstraw	*Galium palustre*	5	-5			S5				G5				x			x
Three-petal Bedstraw	*Galium trifidum*													x			x
Three-petal Bedstraw	*Galium trifidum ssp. trifidum*	5	-4			S5				G5T5				x			x
Yellow Spring Bedstraw	*Galium verum*		5	-1	3	SNA				GNR				x			x
Rue Family	**Rutaceae**													x		o	o
American Prickly-ash	*Zanthoxylum americanum*	3	5			S5				G5	R*	R*		x		x	
Willow Family	**Salicaceae**													x		o	o
Balsam Poplar	*Populus balsamifera*	4	-3			S5				G5				x		x	x
Eastern Cottonwood	*Populus deltoides*											R+		x			x
Large-tooth Aspen	*Populus grandidentata*	5	3			S5				G5				x		x	x

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Trembling Aspen	*Populus tremuloides*	2	0			S5				G5				x			x
Bebb's Willow	*Salix bebbiana*	4	-4			S5				G5				x		x	
Missouri River Willow	*Salix eriocephala*	4	-3			S5				G5				x		x	x
Sandbar Willow	*Salix interior*													x		x	
Meadow Willow	*Salix petiolaris*	3	-4			S5				G5				x			x
Hybrid Crack Willow	*Salix X rubens*		-4	-3		hyb				HYB				x			x
Weeping Willow	*Salix X sepulcralis*					hyb				GNA				x			x
Saxifrage Family	**Saxifragaceae**													x		o	o
Two-leaved Bishop's Cap	*Mitella diphylla*	5	2			S5				G5				x		x	x
Heartleaf Foamflower	*Tiarella cordifolia*	6	1			S5				G5				x			x
Figwort Family	**Scrophulariaceae**													x		o	o
White Turtlehead	*Chelone glabra*	7	-5			S5				G5				x		x	x
Butter-and-eggs	*Linaria vulgaris*		5	-1	4	SNA				GNR				x		x	x
Canada Lousewort	*Pedicularis canadensis*	7	2			S5				G5				x		x	x
Common Mullein	*Verbascum thapsus*		5	-2		SNA				GNR				x		x	x
American Speedwell	*Veronica americana*	6	-5			S5				G5				x		x	
Water Speedwell	*Veronica anagallis-aquatica*		-5	-1		SE				G5				x		x	
Common Gypsyweed	*Veronica officinalis*		5	-2		SNA				G5				x		x	x
Ailanthus Family	**Simaroubaceae**													x		o	
Tree-of-heaven	*Ailanthus altissima*		5	-1	2	SNA				GNR				x		x	
Nightshade Family	**Solanaceae**													x		o	o
Clammy Ground-cherry	*Physalis heterophylla*	3	5			S4				G5				x			x
Bittersweet Nightshade	*Solanum dulcamara*		0	-2	3	SNA				GNR				x			x
Bladder-nut Family	**Staphyleaceae**													x		o	
American Bladder-nut	*Staphylea trifolia*	7	0			S4				G5	R	R		x		x	
Mezereum Family	**Thymelaeaceae**													x		o	o
Eastern Leatherwood	*Dirca palustris*	7	0			S4				G4				x		x	x
Linden Family	**Tiliaceae**													x		o	o
American Basswood	*Tilia americana*	4	3			S5				G5				x		x	x
Little Leaf Linden	*Tilia cordata*				4	SNA				GNR				x		x	
Elm Family	**Ulmaceae**													x		o	o
Common Hackberry	*Celtis occidentalis*	8	1			S4				G5	R*	R*		x		x	x
American Elm	*Ulmus americana*	3	-2			S5				G5				x			x
Siberian Elm	*Ulmus pumila*		5	-1	2	SNA				GNR				x			x
Nettle Family	**Urticaceae**													x		o	o
Smallspike False Nettle	*Boehmeria cylindrica*	4	-5			S5				G5				x		x	x
Canadian Wood Nettle	*Laportea canadensis*	6	-3			S5				G5				x			x
Lesser Clearweed	*Pilea fontana*	5	-3			S4				G5	R	R		x		x	
Canadian Clearweed	*Pilea pumila*	5	-3			S5				G5				x		x	x
Stinging Nettle	*Urtica dioica ssp. dioica*		-1	-1	3	SNA				G5T5?				x			x
Garden Valerian	*Valeriana officinalis*		2	-1		SNA				GNR				x		x	x
Vervain Family	**Verbenaceae**													x		o	o
Blue Vervain	*Verbena hastata*	4	-4			S5				G5				x		x	x
White Vervain	*Verbena urticifolia*	4	-1			S5				G5				x		x	x
Violet Family	**Violaceae**													x		o	o
Canadian White Violet	*Viola canadensis*	6	5			S5				G5				x		x	x
Marsh Blue Violet	*Viola cucullata*	5	-5			S5				G5				x			x
Alpine Violet	*Viola labradorica*					S5				G5				x		x	
Downy Yellow Violet	*Viola pubescens*	5	4			S5				G5				x		x	x
Long-spurred Violet	*Viola rostrata*	6	3			S5				G5				x		x	
Woolly Blue Violet	*Viola sororia*	4	1			S5				G5				x		x	x
Grape Family	**Vitaceae**													x		o	o
Thicket-creeper	*Parthenocissus vitacea*	3	3			S5				G5				x			x
Virginia Creeper	*Parthenocissus quinquefolia*	6	1			S4?				G5	R+	R+		x		x	
Riverbank Grape	*Vitis riparia*	0	-2			S5				G5				x		x	x
MONOCOTS	**MONOCOTYLEDONS**													x		o	o
Water-plantain Family	**Alismataceae**													x		o	o
Southern Water-plantain	*Alisma subcordatum*													x		x	
Northern Water-plantain	*Alisma triviale*													x		x	
Broad-leaved Arrowhead	*Sagittaria latifolia*	4	-5			S5				G5				x		x	x
Asparagus Family	**Asparagaceae**													x		o	o
Garden Asparagus	*Asparagus officinalis*		3	-1		SNA				G5?				x			x
Arum Family	**Araceae**													x		o	o
Jack-in-the-pulpit	*Arisaema triphyllum*	5	-2			S5				G5				x		x	x

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Flowering Rush Family	**Butomaceae**													x		o	
Flowering-rush	*Butomus umbellatus*		-5	-2	1	SNA				G5				x		x	
Sedge Family	**Cyperaceae**													x		o	o
White Bear Sedge	*Carex albursina*	7	5			S5				G5				x		x	x
Northern Clustered Sedge	*Carex arcta*					S4S5				G5	R	R		x		x	x
Drooping Wood Sedge	*Carex arctata*	5	5			S5				G5				x		x	x
Bebb's Sedge	*Carex bebbii*	3	-5			S5				G5				x			x
Eastern Woodland Sedge	*Carex blanda*	3	0			S5				G5?				x			x
Bromelike Sedge	*Carex bromoides*	7	-4			S5				G5				x		x	x
Thin-leaved Sedge	*Carex cephaloidea*	6	2			S5				G5				x			x
Fibrous Rooted Sedge	*Carex communis*	6	5			S5				G5				x		x	x
Bristly Sedge	*Carex comosa*	5	-5			S5				G5				x			x
Dewey's Sedge	*Carex deweyana*	6	4			S5				G5				x		x	x
Yellow Sedge	*Carex flava*	5	-5			S5				G5				x			x
Graceful Sedge	*Carex gracillima*	4	3			S5				G5				x		x	x
Limestone Meadow Sedge	*Carex granularis*	3	-4			S5				G5				x			x
Inflated Narrow-leaved Sedge	*Carex grisea*	8	1			S4				G5?	R	R		x		x	
Hammer Sedge	*Carex hirta*		4	-1		SNA				GNR				x		x	
Hitchcock's Sedge	*Carex hitchcockiana*	6	5			S5				G5				x			x
Porcupine Sedge	*Carex hystericina*	5	-5			S5				G5				x			x
Inland Sedge	*Carex interior*	6	-5			S5				G5				x		x	x
Greater Bladder Sedge	*Carex intumescens*	6	-4			S5				G5				x		x	
James' Sedge	*Carex jamesii*	8	5			S4				G5	R	R		x			x
Broad Loose-flowered Sedge	*Carex laxiflora*	5	0			S5				G5				x			x
Bristle-stalked Sedge	*Carex leptalea*	8	-5			S5				G5T?	R	R		x			x
Nerveless Woodland Sedge	*Carex leptonervia*	5	0			S4				G4				x		x	
Peck's Sedge	*Carex peckii*	6	5			S5				G5				x		x	
Long-stalked Sedge	*Carex pedunculata*	5	5			S5				G5				x		x	x
Woolly Sedge	*Carex pellita*	4	-5			S5				G5				x			x
Pennsylvania Sedge	*Carex pensylvanica*	5	5			S5				G5				x			x
Plantain-leaved Sedge	*Carex plantaginea*	7	5			S5				G5				x		x	x
Eastern Star Sedge	*Carex radiata*	4	5			S4				G4				x			x
Retrorse Sedge	*Carex retrorsa*	5	-5			S5				G5				x		x	x
Rosy Sedge	*Carex rosea*	5	5			S5				G5				x		x	x
Eastern Rough Sedge	*Carex scabrata*	8	-5			S5				G5	R	R		x		x	
Burreed Sedge	*Carex sparganioides*	5	0			S5				G5	R*	R*		x			x
Awl-fruited Sedge	*Carex stipata*	3	-5			S5				G5				x		x	x
Tussock Sedge	*Carex stricta*	4	-5			S5				G5				x			x
Parachute Sedge	*Carex tonsa var. rugosperma*	8	4			S5				G5T5				x			x
Blunt Broom Sedge	*Carex tribuloides*	5	-4			S4S5				G5				x		x	
Fox Sedge	*Carex vulpinoidea*	3	-5			S5				G5				x		x	x
Pretty Sedge	*Carex woodii*	6	0			S4				G4	R*	R*		x		x	x
Yellow Nutsedge	*Cyperus esculentus*	1	-3			S5				G5				x		x	
Brown Flatsedge	*Cyperus fuscus*		-5	-1		SNA				GNR				x		x	
Green Bulrush	*Scirpus atrovirens*	3	-5			S5				G5?				x			x
Wool-grass	*Scirpus cyperinus*	4	-5			S5				G5				x			x
Common Three-square	*Schoenoplectus pungens*													x		x	
Soft-stem Bulrush	*Schoenoplectus tabernaemontani*	5	-5			S5				G5				x		x	x
Frog's-bit Family	**Hydrocharitaceae**													x		o	o
Canadian Waterweed	*Elodea canadensis*	4	-5			S5				G5				x		x	
Iris Family	**Iridaceae**													x		o	o
Yellow Iris	*Iris pseudacorus*		-5	-2	4	SNA				GNR				x		x	
Harlequin Blue-flag	*Iris versicolor*	5	-5			S5				G5				x			x
Rush Family	**Juncaceae**													x		o	o
Arctic Rush	*Juncus arcticus*					S2S3				G5				x			x
Toad Rush	*Juncus bufonius*	1	-4			S5				GNR				x			x
Dudley's Rush	*Juncus dudleyi*	1	0			S5				G5				x			x
Soft Rush	*Juncus effusus*													x			x
Lamp Rush	*Juncus effusus ssp. solutus*	4	-5			S5				G5				x			x
Knotted Rush	*Juncus nodosus*	5	-5			S5				G5				x			x
Path Rush	*Juncus tenuis*	0	0			S5				G5				x		x	x
Hairy Woodrush	*Luzula acuminata*	6	1			S5				G5				x			x
Common Woodrush	*Luzula multiflora*													x			x

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Common Woodrush	*Luzula multiflora ssp. frigida*					S4S5				G5T5				x			x
Duckweed Family	**Lemnaceae**													x		o	o
Lesser Duckweed	*Lemna minor*	2	-5			S5				G5				x			x
Lily Family	**Liliaceae**													x		o	o
Wild Leek	*Allium tricoccum*	7	2			S4				G5				x		x	x
Wild Leek	*Allium tricoccum var. tricoccum*													x			x
Bluebead Lily	*Clintonia borealis*	7	-1			S5				G5				x		x	
European Lily-of-the-valley	*Convallaria majalis*		5	-2	3	SNA				G5				x		x	x
White Trout-lily	*Erythronium albidum*	8	5			S4				G5	R	R		x		x	
Yellow Trout-lily	*Erythronium americanum*	5	5			S5				G5				x		x	x
Orange Day-lily	*Hemerocallis fulva*		5	-3		SNA				GNA				x			x
Michigan Lily	*Lilium michiganense*	7	-1			S5				G5				x		x	x
Canada Mayflower	*Maianthemum canadense*	5	0			S5				G5				x			x
Large False Solomon's Seal	*Maianthemum racemosum*	4	3			S5				G5				x		x	x
Starry False Solomon's Seal	*Maianthemum stellatum*	6	1			S5				G5				x		x	x
Indian Cucumber-root	*Medeola virginiana*	7	5			S5				G5				x		x	
Eurasian Solomon's Seal	*Polygonatum multiflorum*			-1		SNA				GNR				x		x	
Hairy Solomon's Seal	*Polygonatum pubescens*	5	5			S5				G5				x		x	x
Rose Twisted-stalk	*Streptopus lanceolatus*	7	0			S5?				G5T5				x		x	x
Red Trillium	*Trillium erectum*	6	1			S5				G5				x		x	x
White Trillium	*Trillium grandiflorum*	5	5			S5				G5				x		x	x
Large-flowered Bellwort	*Uvularia grandiflora*	6	5			S5				G5				x		x	x
Orchid Family	**Orchidaceae**													x		o	o
Yellow Lady's Slipper	*Cypripedium calceolus*											R		x		x	
Small Yellow Lady's Slipper	*Cypripedium parviflorum*	7	-1			S4S5				G5T5				x		x	
Broadleaf Helleborine	*Epipactis helleborine*		5	-2		SNA				GNR				x		x	x
Yellow Widelip Orchid	*Liparis loeselii*	5	-4			S4S5				G5				x			x
Grass Family	**Poaceae**													x		o	o
Redtop	*Agrostis gigantea*		0	-2		SNA				G4G5				x		x	x
Creeping Bent Grass	*Agrostis stolonifera*	0	-3			SNA				G5				x			x
Fringed Brome	*Bromus ciliatus*	6	-3			S5				G5				x			x
Smooth Brome	*Bromus inermis*		5	-3	4	SNA				G5TNR				x			x
Orchard Grass	*Dactylis glomerata*		3	-1	3	SNA				GNR				x		x	x
Poverty Oat Grass	*Danthonia spicata*	5	5			S5				G5				x			x
Eastern Bottle-brush Grass	*Elymus hystrix*	5	5			S5				G5				x			x
Quack Grass	*Elymus repens*		3	-3	3	SNA				GNR				x			x
Virginia Wild Rye	*Elymus virginicus*													x		x	x
Virginia Wild Rye	*Elymus virginicus var. virginicus*	5	-2			S5				G5T5				x			x
Low Love Grass	*Eragrostis minor*		5	-1		SNA				GNR				x		x	
Giant Fescue	*Schedonorus giganteus*					SNA				G?				x		x	
Red Fescue	*Festuca rubra*													x			x
Red Fescue	*Festuca rubra ssp. rubra*		1	-1		SNA				G5T5				x			x
Nodding Fescue	*Festuca subverticillata*	6	2			S4				G5				x		x	x
Sheep Fescue	*Festuca trachyphylla*					SNA				GNR				x		x	
American Manna Grass	*Glyceria grandis*	5	-5			S4S5				G5				x			x
Fowl Manna Grass	*Glyceria striata*	3	-5			S5				G5				x		x	x
Rice Cut Grass	*Leersia oryzoides*	3	-5			S5				G5				x			x
Amur Silver Grass	*Miscanthus sacchariflorus*		5	-1		SNA				GNR				x		x	x
Wirestem Muhly	*Muhlenbergia frondosa*	5	-3			S4				G5	R*	R*		x		x	
White-grained Mountain-rice	*Oryzopsis asperifolia*	6	5			S5				G5				x		x	x
Acuminate Panic Grass	*Dichanthelium acuminatum*	2	0			S5				G5T				x			x
Witch Grass	*Panicum capillare*	0	0			S5				G5				x			x
Matted Panic Grass	*Dichanthelium acuminatum var. acuminatum*	10	5			S1				G5		R		x			x
Switch Grass	*Panicum virgatum*	6	-1			S4				G5				x		x	
Reed Canary Grass	*Phalaris arundinacea*	0	-4			S5				G5				x		x	x
Timothy	*Phleum pratense*		3	-1		SNA				GNR				x			x
Common Reed	*Phragmites australis*	0	-4			SNA				G5T5				x		x	x
European Reed	*Phragmites australis ssp. australis*		-4	-3	1									x		x	
Grove Blue Grass	*Poa alsodes*	7	-2			S4				G4G5				x		x	
Canada Blue Grass	*Poa compressa*	0	2			SNA				GNR				x		x	x
Wood Blue Grass	*Poa nemoralis*		0	-1		SNA				G5				x		x	
Fowl Blue Grass	*Poa palustris*	5	-4			S5				G5				x		x	
Kentucky Blue Grass	*Poa pratensis ssp. pratensis*	0	1		2	S5				G5T				x			x

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Purple False Melic	*Schizachne purpurascens*													x		x	x
False Melic Grass	*Schizachne purpurascens ssp. purpurascens*	6	2			S5				G5				x			x
Slender Wedgescale	*Sphenopholis intermedia*	6	0			S4S5				G5				x			x
Sand Dropseed	*Sporobolus cryptandrus*	2	4			S4				G5	R*	R*		x		x	x
Puffsheath Dropseed	*Sporobolus neglectus*	1	5			S4				G5				x			x
Pondweed Family	**Potamogetonaceae**													x		o	o
Curly-leaved Pondweed	*Potamogeton crispus*		-5	-3	1	SNA				G5				x		x	
Leafy Pondweed	*Potamogeton foliosus*	4	-5			S5				G5				x		x	
Fennel-leaved Pondweed	*Stuckenia pectinata*	4	-5			S5				G5				x		x	
Catbrier Family	**Smilacaceae**													x		o	o
Smooth Carrion Flower	*Smilax herbacea*	5	0			S4				G5				x		x	x
Bristly Greenbrier	*Smilax tamnoides*	6	0			S4				G5Q				x		x	
Cattail Family	**Typhaceae**													x		o	o
Narrow-leaved Cattail	*Typha angustifolia*	3	-5			SNA				G5				x			x
Broad-leaved Cattail	*Typha latifolia*	3	-5			S5				G5				x		x	x

Sources:

1 Ontario Ministry of Natural Resources and Forestry (MNRF). 2023. Make a Map: Natural Heritage Areas. Mapping application. Accessed MAY 2023. https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

2 iNaturalist. 2023. *Observations* . Accessed MAY 2023. https://www.inaturalist.org/observations

3 Hidden Valley Draft Characterization Report. Comprehensive Environmental Impact Study for the City of Kitchener (LGL, 2023. Draft)

4 Schedule B Class Environmental Assessment. Upper Hidden Valley Sanitary Pump Station and Forcemain (MTE Consultants Inc., 2022)

5 Stage 2 ION LRT from Kitchener to Cambridge Transit Project Assessment Process (WSP, 2021)

APPENDIX C

Species at Risk (SAR) Habitat Screening

TABLE C1 Species At Risk

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Source Identifying Species Record	Probability of Occurrence within Study Area	Conclusions/ Recommendations
Aquatics	Black Redhorse *Moxostoma duquesnei*	THR	THR Schedule 1	THR	- Watercourses with aquatic plants and moderate to fast current; typically less than two metres deep, with a sandy or gravel bottom.	- North shore of Lake Erie including selection locations in the Bayfield River, Maitland River, Ausable River, Grand River, Thames River, and Spencer Creek watersheds.	DFO, LGL (2015)	Confirmed: Critical Habitat identified by the DFO within the Grand River. LGL caught during electrofishing surveys in May 2015. Suitable habitat is present within the Grand River, which is located within the study area.	No work is proposed within the Grand River. An ESC plan should be prepared an implemented to avoid any sediment entering the watercourse.
Aquatics	Silver Shiner *Notropis photogenis*	THR	THR Schedule 1	THR	- Moderate to large sized streams with swift currents and moderate to high gradients. - Streams should be free of weeds and have clean gravel or boulder bottoms. - **OAO characterized as moderate to large streams with swift currents, no weeds, and gravel or boulder substrates**.	- Thames and Grand Rivers, and in Bronte Creek and Sixteen Mile Creek, which flow into Lake Ontario.	NHIC, DFO	Candidate: Critical Habitat identified by the DFO within the Grand River. Suitable habitat is present within the Grand River, which is located within the study area.	No work is proposed within the Grand River. An ESC plan should be prepared an implemented to avoid any sediment entering the watercourse.
Aquatics	Wavy-rayed Lampmussel *Lampsilis fasciola*	THR	SC Schedule 1	SC	- Small to medium rivers with clear water, and clean gravel or sandy bottoms. - Larvae require largemouth bass or smallmouth bass for hosts. - **OAO characterized as small to medium rivers with clean water and riffles with gravel or sandy substrates**.	- Southerwestern Ontario; the Grand, upper Thames, Maitland, Ausable, and St. Clair rivers, and the Lake St. Clair delta.	NHIC, DFO, LGL	Candidate: LGL did not observe any during their passive surveys in 2016 & 2018. Suitable habitat is present within the Grand River, which is located within the study area.	No work is proposed within the Grand River. An ESC plan should be prepared an implemented to avoid any sediment entering the watercourse.
Avian	Acadian Flycatcher *Empidonax virescens*	END	END Schedule 1	END	- Large, mature, undisturbed forests, usually 40 ha or greater. - Preferably near forest centres; nests usually built 100+ m from the forest edge, hanging over water (swamps and ravines with maple and beech trees). - Primarily found in forested ravines near Lake Erie shoreline. - **SWD, FOD communities that are mature, have a closed canopy, and are of sufficient size**.	- Occurs in low numbers in the Carolinian area of Southern Ontario.	NHIC (1974), eBird	Low: NHIC record is dated from 1974. SWD and FOD habitat are present within the project area, and are of sufficient size.	Records are dated, no further action is required.
Avian	Bank Swallow *Riparia riparia*	THR	THR Schedule 1	THR	- Requires vertical faces in sand or silt deposits; river and lake banks, active/inactive sand and gravel pits, road cuts, soil stockpiles. - Breeding sites are located close to aerial foraging areas such as grasslands, meadows, pastures, and cropland. - Large wetlands used for nocturnal roost sites during post-breeding, migration and wintering periods.	- Common across southern Ontario, especially along Lake Erie and Lake Ontario shorelines and the Saugeen River. - Sparse populations scattered across northern Ontario.	NHIC, OBBA, eBird, LGL (2020)	Confirmed: LGL observations in 2020 over the Highway 8/Grand River Bridge. Suitable nesting habitat is present within the project area, but no nests were observed.	Considerations should be made during the construction period to avoid creating vertical slope faces.
Avian	Bobolink *Dolichonyx oryzivorus*	THR	THR Schedule 1	SC	- Hayfields, pastures, wet prairie, graminoid peatlands, abandoned farm fields dominated by tall grasses, no-till cropland, small-grain fields, restored surface mining sites. - Small nests are often built on the ground in dense grasses. - Typically not abundant in short-grass prairie, alfalfa, or in row crop monocultures (corn, soybean, wheat). - **TPO, TPS, CUM1**.	- Southern Ontario north to James Bay.	NHIC, OBBA, LGL	Low: LGL notes that the fields were planted with soy during 2020/2021 field visits. Suitable nesting habitat is present within the project area.	Consideration during construction should be made to clear grasslands and wheat crops after breeding season has completed. Planting of non-suitable crops such as soy or corn is preferred.
Avian	Cerulean Warbler *Setophaga cerulea*	THR	END Schedule 1	END	- Mature deciduous forests with large, tall trees and an open understory. - Both wet bottomland forests and upland areas. - **FOD and SWD that are mature and contain an open understory**.	- Southern Lake Huron to Western Lake Ontario, and Georgian Bay to the Ottawa River.	NHIC (1900s)	Low: NHIC record is dated from 1900. Suitable habitat is present within the project area.	Records are dated. No further action is required.
Avian	Chimney Swift *Chaetura pelagica*	THR	THR Schedule 1	THR	- Historically included hollow trees. - More commonly found in and around urban settlements, including chimneys and other manmade structures. - Typically close to water. - **TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, SAF1 adjacent to suitable nesting habitat**.	- Southern Ontario north to Timmins.	OBBA, eBird, LGL (2020, 2021)	Confirmed: LGL observations in 2020 and 2021. FOD, CUM and MAM habitat is present within the project area.	Within heavily urbanized settings, Chimney Swifts prefer to nest within man-made structures.
Avian	Eastern Meadowlark *Sturnella magna*	THR	THR Schedule 1	THR	- Moderately tall grasslands; prairies, savannahs, pastures and hayfields, alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, overgrown fields. - Small trees, shrubs, or fence posts used as elevated song perches. - **TPO, TPS, CUM1, CUS, and MAM2**.	- Southern Ontario north to Timmins, as well as Lake of the Woods area.	NHIC (2010), eBird	Low: LGL notes that the fields were planted with soy during 2020/2021 field visits. Suitable nesting habitat (CUM and MAM) is present within the project area.	Consideration during construction should be made to clear grasslands and wheat crops after breeding season has completed. Planting of non-suitable crops such as soy or corn is preferred.
Avian	Lesser Yellowlegs *(Tringa flavipes)*	THR	Status Pending	THR	- Typically boreal forest areas and taiga. Frequents coastal salt marshes, freshwater wetlands, and anthropogenic wetlands such as sewage lagoons. - Nests on dry ground neat peatlands, marshes, ponds, and other wetlands	- Extreme northern Ontario (boreal forest) - Migration routes and stopover grounds are located within wetlands of southern Ontario	eBird, iNaturalist (2020)	Low: A verifiable observation was recorded on iNaturalist from July 2020, likely an individual passing through during migration. Suitable breeding habitat is not present within the study area.	Study area is not located within their known range. No further action is required.
Avian	Henslow's Sparrow *Centronyx henslowii*	END	END Schedule 1	END	- Open fields with tall grasses, flowering plants, and scattered shrubs; abandoned farm fields, pastures, and wet meadows. - Prefers undisturbed, extensive, dense, tall grasslands. - Avoids grazed, harvested, burned fields, or those crowded with trees and shrubs. - **TPO, CUM, and MAM that are a minimum of 30 ha in size with vegetation over 30 cm in height, a thick thatch layer, and absence of woody vegetation**.	- From Windsor northeast to Ottawa Valley/Montreal area.	NHIC (1948)	Low: NHIC record is dated from 1948. Suitable habitat is not present within the study area.	Records are dated. No further action is required.
Avian	Loggerhead Shrike *Lanius ludovicianus* Loggerhead Shrike (migrans subspecies; Eastern Loggerhead Shrike) *Lanius ludovicianus mi arans*	END	END Schedule 1	Non-active	- Fields or alvars with short grass; pasture, grasslands with scattered low trees and shrubs. - Small trees or shrubs are used for nesting and hunting perches. - **SWT, CUM, CUT, ALO and ALS**.	- From Kincardine northeast to Ottawa.	NHIC	Low: Habitat is not present within the study area.	No further action is required.
Avian	Louisiana Waterthrush *Parkesia motacilla*	THR	THR Schedule 1	THR	- Steep, forested ravines with fast flowing, pristine headwater streams. - Wetlands in large tracts of mature forest. - Heavily wooded swamps with vernal or semi-permanent pools. - Nests often built in niches in steep stream banks or near water in roots of uprooted trees or mossy logs and stumps.	- Prince Edward County, the central Niagara Escarpment between Hamilton and Owen Sound, and the Norfolk sand plain bordering the north shore of Lake Erie.	NHIC, eBird	Low: NHIC record is data from 1953. Suitable habitat is present within the study area, but not within the project area.	No further action is required.

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Source Identifying Species Record	Probability of Occurrence within Study Area	Conclusions/ Recommendations
Avian	Short-eared Owl *Asio flammeus*	THR	SC Schedule 1	THR	- Tundra, dense grasslands, peat bogs, marshes, sand-sage concentrations, old pastures, and agricultural fields. - Nests are built on the ground.	- All of Ontario.	LGL (local naturalist observation)	Low: LGL notes that a local naturalist had observed winter habitat use by a single individual. LGL notes that habitat is not ideal. Suitable habitat is not present within the study area.	No further action is required.
Avian	Red-headed Woodpecker *Melanerpes erythrocephalus*	END	THR Schedule 1	END	- Woodlands and woodland edges, including oak and beech forests, grasslands, orchards, riparian forests, beaver ponds, burns, parks, golf courses, and cemeteries. - Dead trees used for nesting and perching. **- TPS, TPW, CUW, FOD1, FOD2, FOD4-1, FOD6, FOD7, and FOD9 that are open with an abundance of dead**	- Woodland Caribou Provincial Park southeast to Cornwall.	NHIC, OBBA, eBird	Low: Suitable habitat is present within the project area.	The study area is not located within the known range. No further action required.
Flora	American Ginseng *Panax quinquefolius*	END	END Schedule 1	END	- Rich, moist, well-drained and relatively mature deciduous woods, typically dominated by sugar maple, white ash, bitternut hickory, and basswood. - Typically grows in deep, nutrient-rich soil over limestone or marble bedrock.	- Ontario south of Gravenhurst.	LGL (Ecologistics, 1979)	Low: A single plant was reported by Ecologistics Limited (1979) in the South Central portion of the study area. LGL conducted extensive searches based on Ecologistics mapping but did not observe any individuals. Suitable habitat is present within the project area.	Species is likely extirpated from the area. No further action is required.
Flora	Black Ash *Fraxinus nigra*	END	No Status	THR	- Commonly in mixed deciduous-conifer or conifer dominated swamps, with poorly drained soil ph of 4.4 to 8.2; Frequently in very wet, seasonally flooded, habitats including floodplain forests, basins, seepage and lacustrine swamp forests, shoreline forest margins, fens and bogs. - Moderatelv share-tolerant.	- Northern limit in western Ontario near 53°N with a Southern limit in southwestern Virginia.	LGL	Confirmed: LGL documents individuals within several ELC ecosites.	Protections for Black Ash have been temporarily suspended by the MECP until January 2024. Further consultation may be required.
Flora	Butternut *Juglans cinerea*	END	END Schedule 1	END	- Deciduous forests with moist, well-drained soil of pH 5.5 to 8; commonly found along streams. - Often grows alone in sunny openings and near forest edges. **- FOD and mature hedgerows**.	- South of Pembroke to Port Elgin.	iNaturalist, LGL	Confirmed: LGL documents 18 individuals in 2007, 2012, 2013, and 2021.	The study area is not located within the historic range, individuals may be planted.
Herpetofaunas	Blanding's Turtle (Great Lakes / St. Lawrence population) *Emydoidea blandingii*	THR	THR Schedule 1	END	- Shallow, nutrient-rich habitats; typically large wetlands and shallow lakes with lots of water plants. - Nesting occurs in sand, organic soil, gravel, cobblestone, and soil-filled crevices of rock outcrops. - Overwintering occurs in pools about 1 metre in depth. **- SWT2, SWT3, SWD, SWM, MAS2, SAS1, SAM1, where open water is present**.	- Southern Ontario north to Sudbury, with isolated reports as far north as Timmins.	NHIC, ORAA	Low: Known populations to the west (>3km). Suitable habitat is present within the study area. Substantial barriers to movement are present due to development within the Hidden Valley area.	Species unlikely to be present. Substantial barriers to movement are present.
Herpetofaunas	Common Five-lined Skink (Five-lined Skink; Carolinian population) *Plestiodon fasciatus*	END	END Schedule 1	END	- Clearings such as stabilized sand dunes, open forest areas, and wetlands. - Natural or artifical items used for shelter include construction materials, utility poles, logs, boardwalks or tree trunks. - Hibernation occurs in rock crevices or underneath the soil. **- SDO, SDS, SDT, TPS, CUS, CUW, FOM, FOD and MAM with suitable cover and basking habitat**.	- Near Lake Erie, Lake St. Clair, and Lake Huron; Point Pelee, Rondeau Provincial Park, Oxley Poison Sumac Swamp, Pinery Provincial Park, and Walpole Island. - Southern edge of the Canadian Shield; from Georgian Bay to Leeds and Greenville County.	LGL (Ecologistics, 1979)	Low: A single observation by Ecologistics in 1979. LGL conducted targetted surveys within the Esker in 2004 and did not observed any. Suitable habitat is no longer present within the study area.	Species has likley been extirpated from the area. No futher action is required.
restricted species	*restricted species*	END	END Schedule 1	END	- Mature deciduous or mixed upland forest containing, or adjacent to, breeding ponds. - Terrestrial habitat must include small mammal burrows or rock fissures for over-wintering below the frost line. - Breeding ponds are normally ephemeral or vernal woodland pools that dry in late summer.	- Most commonly found within the Niagara Escarpment and Carolinian forest regions.	NHIC, ORAA, LGL	Confirmed: LGL observations in 2007 and 2008. Confirmed habitat is present within the study area but not within the project area.	Consultation with the MECP is required to determine suitable mitigation measures for construction and stormwater management.
Mammals	American Badger (Southwestern population) *Taxidea taxus* (*Taxidea taxus jacksoni*)	END	END Schedule 1	END	- Tallgrass prairie, sand barrens, farmland, shrublands, alpine areas and wetlands. - Require coherent soils that can be burrowed into without collapsing. **- TPS1, CUM1, CUS, SBO with dry sandy soil**.	- Windsor to Dunnville and north to Owen Sound.	Ontario Mammals	Low: No suitable habitat is present within the study area. The portion of lands adjacent to the Grand River are built up with a significant slope.	No further action is required.
Mammals	Eastern Small-footed Myotis (Eastern Small-footed Bat) *Myotis leibii*	END	N/A	N/A	- Summer habitat includes rock outcrops, in buildings, under bridges, or in caves, mines or hollow trees. - Roosting locations are typically changed every night. - Winter hibernation occurs in caves or mines, typically drier and colder than sites selected by other bats.	- South of Georgian Bay to Lake Erie and east to the Pembroke area, the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park.	Ontario Mammals, WSP (2018)	Candidate: Suitable habitat is present within the project area. An unidentified SAR Bat (presumed Myotis or Perimyotis species) was recorded during acoustic surveys in 2018 by WSP.	Work to be completed outside of the bat maternity window. Should any bat cavity trees require removal, consultatiton with the MECP is required.
Mammals	Little Brown Myotis (Little Brown Bat) *Myotis lucifugus*	END	END Schedule 1	END	- Large-diameter trees, attics, abandoned buildings, and barns often used for summer colonies. - Foraging occurs over water, along waterways, and forest edges, while open areas such as clearcuts or fields are typically avoided. - Hibernacula used in winter include mines and caves that are humid and remain above freezing.	- All across Ontario; concentrated in southern Ontario.	Ontario Mammals, WSP (2018)	Candidate: Suitable habitat is present within the project area. An unidentified SAR Bat (presumed Myotis or Perimyotis species) was recorded during acoustic surveys in 2018 by WSP.	Work to be completed outside of the bat maternity window. Should any bat cavity trees require removal, consultatiton with the MECP is required.
Mammals	Northern Myotis (Northern Long-eared Bat) *Myotis septentrionalis*	END	END Schedule 1	END	- Typically within the boreal forest, under loose bark or in the cavities of trees. - Foraging occurs over water, along waterways, and forest edges, while open areas such as clearcuts or fields are typically avoided. - Overwintering occurs in cold and humid sites such as caves or mines. **- FOC, FOM, FOD, SWC, SWM, and SWD where suitable roosting (i.e. cavity trees and trees with loose bark) habitat is available**.	- Forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.	Ontario Mammals, WSP (2018)	Candidate: Suitable habitat is present within the project area. An unidentified SAR Bat (presumed Myotis or Perimyotis species) was recorded during acoustic surveys in 2018 by WSP.	Work to be completed outside of the bat maternity window. Should any bat cavity trees require removal, consultatiton with the MECP is required.
Mammals	Tri-colored Bat *Perimyotis subflavus*	END	END Schedule 1	END	- Day roost and maternity colonies are formed in older forests with large-diameter trees, barns, or other structures. - Foraging occurs over water or along streams in a forest. - Winter hibernacula include caves and mines.	- Southern Ontario north to Sudbury.	Ontario Mammals, WSP (2018)	Candidate: Suitable habitat is present within the project area. An unidentified SAR Bat (presumed Myotis or Perimyotis species) was recorded during acoustic surveys in 2018 by WSP.	Work to be completed outside of the bat maternity window. Should any bat cavity trees require removal, consultatiton with the MECP is required.

TOTAL	26
Herpetofaunas	2
Avian	12
Aquatics	3
Invertebrates	0
Flora	3
Mammals	5

ESA Status	
END	14
THR	12
TOTAL SAR	26

APPENDIX D

Species of Conservation Concern (SCC) Habitat Screening

TABLE D1 Species of Conservation Concern

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Source Identifying Species Record	Probability of Occurrence within Study Area	Conclusions/ Recommendations
Aquatics	Rainbow Mussel *Villosa iris*	SC	SC Schedule 1	SC	- Small to medium sized rivers with a moderate to strong current, well-oxygenated water, and sandy, rocky, cobble or gravel bottoms. - Often found in riffle areas and along edges of vegetation in water less than 1 m deep. - Larvae require Striped Shiner, Smallmouth Bass, Largemouth Bass, Green Sunfish, Rainbow Darter, and Yellow Perch.	- South of Gravenhurst the Ausable, Bayfield, Detroit, Grand, Maitland, Moira, Niagara, Salmon, Saugeen, Sydenham, Thames, and Trent rivers and in Lake St. Clair.	NHIC	Candidate: LGL did not observe any during their passive surveys in 2016 & 2018. Suitable habitat is present within the Grand River, which is located within the study area.	No work is proposed within the Grand River. An ESC plan should be prepared an implemented to avoid any sediment entering the watercourse.
Avian	Bald Eagle *Haliaeetus leucocephalus*	SC	No Status	Not at Risk	- Wide variety of habitats near major lakes or rivers. - Tall trees (ie, pine or poplar) typically used for nesting. - Diet consists of fish and dead animals (ie, white-tailed deer). - **FOC, FOM, FOD, SWC, SWM and SWD**.	- Can be found across Ontario, from US border north to Lake of the Woods.	OBBA, eBird, iNaturalist, LGL	Confirmed: Several recent sightings along the Grand River. Suitable habitat is present within the project area.	No stick nests were observed by Matrix within the study area. Nest searches should be conducted prior to removing any trees.
Avian	Barn Swallow *Hirundo rustica*	SC	SC Schedule 1	SC	- Cup-shaped mud nests are built on human-made structures such as open barns, under bridges, and in culverts. - Preferably constructed on rough-cut wood surfaces with right angles. - Foraging habitat includes grassy fields, pastures, cropland, lake and river shorelines, cottage areas and farmyards, islands, wetlands, and tundra. - **TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, and SAF1, adjacent to suitable nesting structures**.	- From southern Ontario north to Hudson Bay.	OBBA, eBird, LGL (2021)	Confirmed: LGL observations in 2014, 2015, 2020, and 2021. Suitable habitat is present within the project area. Species is abundant in the region.	Vegetation and structure removal should be conducted outside of the breeding bird window of April 1 to August 31 of any given year.
Avian	Common Nighthawk *Chordeiles minor*	SC	THR Schedule 1	SC	- Open areas with little to no ground vegetation; logged or burned areas, rock barrens, peat bogs, lakeshores, dunes, beaches, and mine tailings. - Less commonly found in cultivated fields, orchards, mine tailings, and along gravel roads and railways. - Nesting habitat is typically open and vegetation free; may include grasslands, pastures, marshes, and riverbanks. - May also include mixed and coniferous forests. - **SD, BB, RB, CUM, BO, FOM, FOX and FOD with sparsely vegetated openings**.	- All of Ontario except for coastal regions of James Bay and Hudson Bay.	OBBA (2001-2005), eBird, LGL	Low: OBBA indicates possible breeding evidence within the region (2001-2005). No suitable habitat is present within the study area	No further action is required.
Avian	Eastern Wood-pewee *Contopus virens*	SC	SC Schedule 1	SC	- Mid-canopy layer of forest clearings, edges of deciduous and mixed forests, early successional clearings. - **FOC, FOM, FOD, SWD, SWM and CUW**.	- Southern Ontario north to Sudbury.	OBBA, eBird, LGL (2020)	Confirmed: LGL observations in 2020 at Schneider Park. Suitable habitat is present within the study area.	Vegetation removal should be conducted outside of the breeding bird window of April 1 to August 31 of any given year.
Avian	Golden-winged Warbler *Vermivora chrysoptera*	SC	THR Schedule 1	THR	- Areas with young shrubs surrounded by mature, spread out forests; field edges, hydro or utility right of ways, logged areas, dry uplands, swamp forests, marshes, beaver ponds, burned-out or intermittently cultivated areas. - Nests often placed near clusters of herbaceous plants and low bushes.	- Southern Ontario north to Sudbury.	eBird	Low: Suitable habitat is present within the study area.	Vegetation removal should be conducted outside of the breeding bird window of April 1 to August 31 of any given year.
Avian	Peregrine Falcon *Falco peregrinus*	SC	No Status	Not At Risk	- Tall, steep cliff ledges or tall buildings from 50 m to 200 m in height, close to large bodies of water. - Can be found in tundra, coastal, prairie or urban areas. - **CLO**.	- Breeding population centered around Lake Superior in northwest Ontario. - May be found migrating across rest of the province.	OBBA	Low: Suitable habitat is not present within the study area.	Vegetation removal should be conducted outside of the breeding bird window of April 1 to August 31 of any given year.
Avian	Rusty Blackbird *Euphagus carolinus*	SC	SC Schedule 1	SC	- Wet woodlands, swamps, pond edges. - Agricultural land is used for foraging. - Boreal forest is used for breeding; conifer-dominated forests adjacent to wetlands, peat bogs, sedge meadows, marshes, swamps, and beaver ponds.	- Breeding habitat spans Hudson Bay south to Orillia. - May be seen in southern Ontario during migration.	eBird	Low: Suitable habitat is present within the study area.	Study area is not located within the known breeding range. No further action is required.
Avian	Wood Thrush *Hylocichla mustelina*	SC	THR Schedule 1	THR	- Mature deciduous and mixed forests; moist stands of trees with well-developed undergrowth. - Tall trees are used for singing perches. - Nests are built in live saplings, trees, or shrubs, especially sugar maple or American beech. - Preferably large forest mosaics. - **FOD and FOM greater than 1 ha**.	- Southern Ontario north to Hearst.	NHIC, OBBA, eBird, LGL (2000)	Confirmed: LGL observation in Riverside Park (before 2000). Suitable habitat is present within the project area.	Vegetation removal should be conducted outside of the breeding bird window of April 1 to August 31 of any given year.
Herpetofaunas	Eastern Ribbonsnake (Great Lakes population; Northern Ribbonsnake) *Thamnophis sauritus*	SC	SC Schedule 1	SC	- Marshes, bogs, fens, ponds, lake shorelines, wet meadows, or other wetland habitats with both flowing and standing water. - Hibernacula consist of underground burrows or rock crevices; may be well-drained, close to water, or completely submerged. - **FOC, FOM, FOD, SWC, SWM, SWD, MAM, MAS, OAO, SAS, SAM and SAF containing standing or flowing water near year-round**.	- Southern Ontario north to Sudbury, including Manitoulin Island.	NHIC (1977), ORAA	Low: NHIC records from Fairway Road S & Highway 8 (1977). Suitable habitat is present within the study area.	Records are dated. No further action is required.
Herpetofaunas	Snapping Turtle *Chelydra serpentina*	SC	SC Schedule 1	SC	- Shallow wetland habitats with slow-moving water and soft bottoms; ponds, sloughs, shallow bays, river edges, or slow streams. - Nesting occurs on sandy or gravel banks or man-made structures such as roads, dams, and aggregate pits. - Overwintering occurs underwater, underneath logs, sticks, or overhanging banks, deep in mud in marshy areas, or underneath floating mats of vegetation. - **OAO, SA near gravelly or sandy areas**.	- Primarily southern Ontario north to Timmins; also found near Thunder Bay and Kenora.	NHIC, ORAA, iNaturalist, LGL (2021)	Confirmed: LGL observations in 2014, 2015, 2020, and 2021. Suitable habitat is present within the study area. Species abundant within the region.	Reptile exclusion fencing shall be installed for the duration of works.
Invertebrates	Monarch *Danaus plexippus*	SC	SC Schedule 1	END	- Open or disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests. - Trees along the north shore of the Great Lakes are used for roosting before migrating across open water. - Caterpillars are confined to meadows and open areas where milkweed grows. - **AL, TP, and CUM where milkweed is present**.	- South of 50° of latitude.	OBBA, iNaturalist, LGL	Confirmed: LGL (2021) and WSP (2020) observations. Small and sparse habitat is present within the study area.	Grubbing should be conducted outside of growing season. Restoration and planting plans to consider planting additional host species (i.e. milkweed)

TOTAL	12
Herpetofaunas	2
Avian	8
Aquatics	1
Invertebrates	1
Flora	0
Mammals	0

ESA Status	
SC	12
No Status	0
EXP	0
TOTAL SCC	12

APPENDIX E

Significant Wildlife Habitat Screening

TABLE E1 Seasonal Concentration Areas of Animals

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Waterfowl Stopover and Staging Areas (Terrestrial) Rationale: habitat important for migrating waterfowl	• American black duck • wood duck • green-winged teal • blue-winged teal • mallard • northern shoveler • American wigeon • northern pintail • gadwall	• CUM1 • CUT1 • plus, evidence of annual spring flooding from melt water or runoff within these ecosites	• fields with sheet water during spring (mid March to May) • field flooding during spring melt and runoff provides important invertebrate foraging habitat for migrating waterfowl • agricultural fields with waste grains are commonly used by waterfowl; these are not considered SWH unless they have spring sheet water available Information Sources: • reports and other information available from conservation authorities • sites documented through waterfowl planning processes (e.g., EHJV Implementation Plan) • field naturalists clubs • Ducks Unlimited Canada • NHIC Waterfowl Concentration Area • anecdotal information from the landowners, adjacent landowners, or local naturalist clubs may be good information in determining occurrence	Studies carried out and verified presence of an annual concentration of any listed species; evaluation methods to follow *Bird and Bird Habitats: Guidelines for Wind Power Projects* • any mixed aggregations of 100 or more individuals required • SWHMiST Index #7 provides development effects and mitigation measures • annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates) • the flooded field ecosite habitat plus a 100 to 300 m radius, dependant on local site conditions and adjacent land use is the SWH	**Candidate:** SWH type present within the project area. Contains CUM1 and CUT1 with sheet water flow during spring melt.
Waterfowl Stopover and Staging Areas (Aquatic) Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the ecodistrict.	• Canada Goose • Cackling Goose • Snow Goose • American Black Duck • Northern Pintail • Northern Shoveler • American Wigeon • Gadwall • Green-winged Teal • Blue-winged Teal • Hooded Merganser • Common Merganser • Lesser Scaup • Greater Scaup • Long-tailed Duck • Surf Scoter • White-winged Scoter • Black Scoter • Ring-necked duck • Common Goldeneye • Bufflehead • Redhead • Ruddy Duck • Red-breasted • Merganser • Brant • Canvasback • Ruddy Duck	• MAS1 • MAS2 • MAS3 • SAS1 • SAM1 • SAF1 • SWD1 • SWD2 • SWD3 • SWD4 • SWD5 • SWD6 • SWD7	• ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration • sewage treatment ponds and storm water ponds do not qualify as a SWH; however, a reservoir managed as a large wetland or pond/lake does qualify • these habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water) Information Sources: • Environment and Climate Change Canada • naturalist clubs often are aware of staging/stopover areas • MNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging • sites documented through waterfowl planning processes (e.g., EHJV implementation plan) • Ducks Unlimited Canada projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • NHIC Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100 or more of listed species for 7 days results in >700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH. • The combined area of the ELC ecosites and a 100 m radius area is the SWH. • Wetland area and shorelines associated with sites identified within the SWHTG Appendix K [cxlix] are significant wildlife habitat. • Evaluation methods to follow *Bird and Bird Habitats: Guidelines for Wind Power Projects*. • Annual use of habitat is documented from information sources or field studies (annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWH MiST Index #7 provides development effects and mitigation measures.	**Candidate:** SWH type present within the project area. Contains suitable shallow marsh, and deciduous swamp ecosites.

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Shorebird Migratory Stopover Area Rationale: High-quality shorebird stopover habitat is extremely rare and typically has a long history of use.	• Greater Yellowlegs • Lesser Yellowlegs • Marbled Godwit • Hudsonian Godwit • Black-bellied Plover • American Golden • Plover • Semipalmated Plover • Solitary Sandpiper • Spotted Sandpiper • Semipalmated • Sandpiper • Pectoral Sandpiper • White-rumped • Sandpiper • Baird's Sandpiper • Least Sandpiper • Purple Sandpiper • Stilt Sandpiper • Short-billed Dowitcher • Red-necked Phalarope • Whimbrel • Ruddy Turnstone • Sanderling • Dunlin	• BBO1 • BBO2 • BBS1 • BBS2 • BBT1 • BBT2 • SDO1 • SDS2 • SDT1 • MAM1 • MAM2 • MAM3 • MAM4 • MAM5	• Shorelines of lakes, rivers, and wetlands, including beach areas, bars, and seasonally flooded, muddy, and unvegetated shoreline habitats. • Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid June and early July to October. • Sewage treatment ponds and storm water ponds do not qualify as a SWH. Information Sources: • Western Hemisphere shorebird reserve network • CWS Ontario Shorebird Survey • Bird Studies Canada • Ontario Nature • local birders and naturalist clubs • NHIC Shorebird Migratory Concentration Area	Studies confirming: • Presence of three or more of listed species and >1,000 shorebird use days during spring or fall migration period (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period). • Whimbrel stop briefly (<24 hours) during spring migration, any site with >100 Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC Shoreline Ecosites plus a 100 m radius area. • Evaluation methods to follow *Bird and Bird Habitats: Guidelines for Wind Power Projects*. • SWH MiST Index #8 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the study area, along the shoreline of the Grand River, but is not present within the project area.
Raptor Wintering Area Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant.	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks / Owls: Combination of ELC Community Series; need to have present one Community Series from each land class. • Forest: FOD, FOM, FOC. • Upland: CUM, CUT, CUS, CUW. Bald Eagle: Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or lakes with open water (hunting area).	• The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. • Raptor wintering (hawk/owl) sites need to be >20 ha with a combination of forest and upland. • Least disturbed sites, idle/fallow, or lightly grazed field/meadow (>15 ha) with adjacent woodlands. • Field area of the habitat is to be wind swept with limited snow depth or accumulation. • Eagle sites have open water and large trees and snags available for roosting. Information Sources: • OMNRF Ecologist or Biologist. • Naturalist clubs. • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area. • Data from Bird Studies Canada. • Results of Christmas Bird Counts. • Reports and other information available from Conservation Authorities.	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One of more Bald Eagles or; At least10 individuals and two of the listed hawk / owl species[E]. • To be significant a site must be used regularly (3 in 5 years) [cxlix] for a minimum of 20 days by the above number of birds[E]. • The habitat area for an Eagle winter site is the Shoreline Forest Ecosites directly adjacent to the prime hunting area[E]. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #10 and #11 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. Suitable forest and upland habitats are present and within proximity to the Grand River.

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Bat Hibernacula Rationale: Bat hibernacula are rare habitats in all Ontario landscapes.	Big Brown Bat Tri-coloured Bat	Bat Hibernacula may be found in these Ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	• Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. • Active mine sites should not be considered as SWH. • The locations of bat hibernacula are relatively poorly known. Information Sources • OMNRF for possible locations and contact for local experts. • Natural Heritage Information Centre (NHIC) Bat Hibernaculum. • Ministry of Northern Development and Mines for location of mine shafts. • Clubs that explore caves (eg. Sierra Club). • University Biology Departments with bat experts.	All sites with confirmed hibernating bats are SWH Ⓔ. • The area includes 200 m radius around the entrance of the hibernaculum [cxlviii, ccvii, Ⓔ] for most development types and 1000 m for wind farms [ccv]. • Studies are to be conducted during the peak swarming period (Aug. - Sept.). • Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv]. • SWH MIST [cxlix] Index #1 provides development effects and mitigation measures.	SWH type not present within the study area.
Bat Maternity Colonies Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	• Maternity colonies can be found in tree cavities, vegetation and often in buildings [xxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario [xxii]. • Maternity colonies located in Mature deciduous or mixed forest stands [ccix, ccx, ccv] with > 10 / ha large diameter (> 25 cm dbh) wildlife trees [ccvii]. • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 [ccxiv] or class 1 or 2 [ccxii]. • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags / ha are preferred [ccx, lxiv]. Information Sources: • OMNRF for possible locations and contact for local experts. • University Biology Departments with bat experts.	Maternity Colonies with confirmed use by; • > 10 Big Brown Bats Ⓔ • > 5 Adult Female Silver haired Bats Ⓔ. • The area of the habitat includes the entire woodland or a forest stand ELC Ecosite or an Ecoelement containing the maternity colonies Ⓔ. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv]. • SWH MIST [cxlix] Index #12 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. Suitable forested areas with large diameter trees are present.
Turtle Wintering Areas Rationale: Generally, sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Blanding's Turtle Midland Painted Turtle Spiny Softshell Spotted Turtle Wood Turtle Special Concern: Eastern Musk Turtle Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles: SW MA OA SA FEO BOO Northern Map Turtle: Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen [cix, cx, cxi, cxii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. Information Sources: • EIS studies carried out by Conservation Authorities. • Field Naturalists Clubs. • OMNRF Ecologist or Biologist. • Natural Heritage Information Centre (NHIC).	• Presence of 5 over-wintering Midland Painted Turtles is significant Ⓔ. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant Ⓔ. • The mapped ELC Ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. - Oct.) or spring (Mar- May) [cvii]. • Congregation of turtles is more common where wintering areas are limited and therefore significant [cix, cx, cxi, cxii]. • SWH MIST [cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	**Candidate:** SWH type is present within the project area. Suitable swamp and open water habitat.

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Reptile Hibernaculum Rationale: Generally, sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Snakes: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brown snake Smooth Green Snake Northern Ring-necked Snake Special Concern: Milk snake Eastern Ribbonsnake Lizard: Special Concern: (Southern Shield population): Five-lined Skink	All snakes: Habitat may be found in any Ecosite other than very wet ones. Talus, Rock Barren, Crevice, Cave, and Alvar sites may be directly related to these habitats. Observations or congregations of snakes on sunny warm days in the spring or fall is a good indicator. Five-lined Skink: FOD FOM FOC1 FOC3	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line [xliv, l, li, lii, cxii]. • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. • Five-lined Skink prefer mixed forests with rock outcrop openings providing cover rock overlaying granite bedrock with fissure [cciii]. Information Sources: • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs. • University herpetologists. • Natural Heritage Information Centre (NHIC). • OMNRF ecologist or biologist may be aware of locations on wintering skinks.	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr / May) and Fall (Sept / Oct)(E). • Note: If there are Special Concern Species present, then site is SWH. • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (e.g. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m radius area is the SWH(E). • SWH MIST [cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula. • Presence of any active hibernaculum for skink is significant. SWH MIST [cxlix] Index #37 provides development effects and mitigation measures for Five-linked Skink wintering habitat.	**Candidate:** SWH type is present within the project area.
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff) Rationale: Historical use and number of colony nests make this habitat significant. An identified colony can be important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns. Habitat found in the following Ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed / permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed / permitted Mineral Aggregate Operation. Information Sources: • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas. • Bird Studies Canada; NatureCounts http://www.birdscanada.org/birdmon/ • Field Naturalist Clubs.	Studies confirming: • Presence of 1 or more nesting sites with 8 [cxlix] or more cliff swallow pairs and / or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50 m radius habitat area from the peripheral nests [ccvii]. • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #4 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. Portions of Hidden Valley creek are experiencing significant bank erosion.

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Colonially- Nesting Bird Breeding Habitat (Trees and Shrubs) <u>Rationale:</u> Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. <u>Information Sources:</u> • Ontario Breeding Bird Atlas ccv, colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony. • Aerial photographs can help identify large heronries. • Reports and other information available from Conservation Authorities. • MNRF District Offices. • Local Naturalist Clubs.	Studies confirming: • Presence of 5Ⓔ or more active nests of Great Blue Heron or other listed species. • The habitat extends from the edge of the colony and a minimum 300 m radius or extent of the Forest Ecosite containing the colony or any island < 15.0 ha with a colony is the SWH [cc, ccvii]. • Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and / or eggshells. SWH MIST [cxlix] Index #5 provides development effects and mitigation measures.	SWH type not present within the study area.
Colonially- Nesting Bird Breeding Habitat (Ground) <u>Rationale:</u> Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird). MAM1 - 6 MAS1 - 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. <u>Information Sources:</u> • Ontario Breeding Bird Atlas, rare / colonial species records. • Canadian Wildlife Service. • Reports and other information available from Conservation Authorities. • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area. • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, > 5 active nests for Common Tern or > 2 active nests for Caspian TernⒺ. • Presence of 5 or more pairs for Brewer's BlackbirdⒺ. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significantⒺ. • The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC Ecosites containing the colony or any island < 3.0 ha with a colony is the SWH [cc, ccvii]. • Studies would be done during May / June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi] • SWH MIST [cxlix] Index #6 provides development effects and mitigation measures.	SWH type not present within the study area.

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Migratory Butterfly Stopover Areas Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral Special Concern: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	• A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present and will be located within 5 km of Lake Erie or Lake Ontario [cxlix]. • The habitat is typically a combination of field and forest and provides the butterflies with a location to rest prior to their long migration south [xxxii, xxxiii, xxxiv, xxxv, xxxvi]. • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat [cxlviii, cxlix]. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes [xxxvii, xxxviii, xxxix, xl, xli]. Information Sources: • MNRF District Offices. • Natural Heritage Information Centre (NHIC). • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs. • Toronto Entomologists Association. • Conservation Authorities.	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug / Oct) [xliii]. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500 / day [xxxvii], significant variation can occur between years and multiple years of sampling should occur [xl, xlii]. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD. • MUD of > 5000 or > 3000 with the presence of Painted Ladies or Red Admiral's is to be considered significant(E). • SWH MIST [cxlix] Index #16 provides development effects and mitigation measures.	SWH type not present within the study area.
Landbird Migratory Stopover Rationale: Sites with a high diversity of species as well as high numbers are most significant.	All migratory songbirds. Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&n=421B7A9D-1 All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors).	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Woodlots > 5 ha (E) in size and within 5 km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Erie and Lake Ontario. If woodlands are rare in an area of shoreline, woodland fragments 2 - 5 ha can be considered for this habitat(E). • Woodlots need to be > 10 ha (E) in size and within 5 km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario. • If multiple woodlands are located along the shoreline those Woodlands < 2 km from Lake Ontario are more significant [cxlix]. • Sites have a variety of habitats; forest, grassland and wetland complexes [cxlix]. • The largest sites are more significant [cxlix]. • Woodlots and forest fragments are important habitats to migrating birds [ccxviii], these features located along the shore and located within 5 km of Lake Ontario are Candidate SWH [cxlviii]. Information Sources: • Bird Studies Canada. • Ontario Nature. • Local birders and field naturalist clubs. • Ontario Important Bird Areas (IBA) Program.	Studies confirm: • Use of the habitat by > 200 birds / day and with > 35 spp with at least 10 bird spp. recorded on at least 5 different survey dates(E). This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (Mar to May) and fall (Aug to Oct) migration using standardized assessment techniques. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #9 provides development effects and mitigation measures.	SWH type not present within the study area.

Wildlife Habitat	Wildlife Species	Candidate Significant Wildlife Habitat		Confirmed Significant Wildlife Habitat Defining Criteria	Study Area Assessment Details
		Ecological Land Classification Ecosite Codes	Habitat Criteria and Information Sources		
Deer Yarding Areas <u>Rationale:</u> Winter habitat for deer is considered to be the main limiting factor for northern deer populations. In winter, deer congregate in "yards" to survive severe winter conditions. Deer yards typically have a long history of annual use by deer, yards typically represent 10 - 15% of an areas summer range.	White-tailed Deer	Note: OMNRF to determine this habitat. ELC Community Series providing a thermal cover component for a deer yard would include: FOM FOC SWM SWC Or these ELC Ecosites: CUP2 CUP3 FOD3 CUT	• Deer yarding areas or winter concentration areas (yards) are areas deer move to in response to the onset of winter snow and cold. This is a behavioural response and deer will establish traditional use areas. The yard is composed for two areas referred to as Stratum I and Stratum II. Stratum II covers the entire winter yard area and is usually a mixed or deciduous forest with plenty of browse available for food. Agricultural lands can also be included in this area. Deer move to these areas in early winter and generally, when snow depths reach 20 cm, most of the deer will have moved here. If the snow is light and fluffy, deer may continue to use this area until 30 cm snow depth. In mild winters, deer may remain in the Stratum II area the entire winter. • The Core of a deer yard (Stratum I) is located within the Stratum II area and is critical for deer survival in areas where winters become severe. It is primarily composed of coniferous trees (pine, hemlock, cedar, spruce) with a canopy cover of more than 60% [cxciv]. • OMNRF determines deer yards following methods outlined in "Selected Wildlife and Habitat Features: Inventory Manual" [cxcv]. • Woodlots with high densities of deer due to artificial feeding are not significant [E].	No studies required: • Snow depth and temperature are the greatest influence on deer use of winter yards. Snow depth > 40 cm for more than 60 days in a typical winter are minimum criteria for a deer yard to be considered as SWH [lvi, lvii, lviii, lix, lx, E]. • Deer yards are mapped by OMNRF District offices. Locations of Core or Stratum I and Stratum II deer yards considered significant by OMNRF will be available at local MNRF offices or via Land Information Ontario (LIO). • Field investigations that record deer tracks in winter are done to confirm use (best done from an aircraft). Preferably, this is done over a series of winters to establish the boundary of the Stratum I and Stratum II yard in an "average" winter. MNRF will complete these field investigations [cxcv]. • If a SWH is determined for Deer Wintering Area or if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #2 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. A deer yarding and congregation area has been identified by the Kitchener Natural Heritage System Technical Background Report (City of Kitchener, 2014).
Deer Winter Congregation Areas <u>Rationale</u>: Deer movement during winter in the southern areas of EcoRegion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions [cxlviii].	White-tailed Deer	All Forested Ecosites with these ELC Community Series; FOC FOM FOD SWC SWM SWD Conifer plantations much smaller than 50 ha may also be used.	• Woodlots will typically be > 100 [E] ha in size. Woodlots < 100 ha may be considered as significant based on MNRF studies or assessment. • Deer movement during winter in the southern areas of EcoRegion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands [cxlviii]. • If deer are constrained by snow depth refer to the Deer Yarding Area habitat within Table 1.1 of this Schedule. • Large woodlots > 100 ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer / ha [ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[E]. <u>Information Sources:</u> • MNRF District Offices. • LIO/NRVIS.	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF [cxlviii]. • Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF [E]. • Studies should be completed during winter (Jan / Feb) when > 20 cm of snow is on the ground using aerial survey techniques [ccxxiv], ground or road surveys or a pellet count deer density survey [ccxxv]. • If a SWH is determined for Deer Wintering Area or if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #2 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. A deer yarding and congregation area has been identified by the Kitchener Natural Heritage System Technical Background Report (City of Kitchener, 2014).

Notes:
EHJV - Eastern Habitat Joint Venture

TABLE E2 Rare Vegetation Communities

Rare Vegetation Community	Candidate SWH			Confirmed SWH Defining Criteria	Study Area Assessment Details
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources		
Cliffs and Talus Slopes Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock > 3 m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	• Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources: • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs. • Conservation Authorities.	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes [lxxviii]. • SWH MIST [cxlix] Index #21 provides development effects and mitigation measures.	SWH type not present within the study area.
Sand Barren Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always < or equals to 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered, but less than 60%.	• A sand barren area > 0.5 ha in size[E]. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs. • Conservation Authorities.	• Confirm any ELC Vegetation Type for Sand Barrens [lxxviii]. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.)[E]. • SWH MIST [cxlix] Index #20 provides development effects and mitigation measures.	SWH type not present within the study area.
Alvar Rationale: Alvars are extremely rare habitats in EcoRegion 6E. Most alvars in Ontario are in EcoRegions 6E and 7E. alvars in 6E are small and highly localized just north of the Palaeozoic-Precambrian contact.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) *Carex crawei* 2) *Panicum philadelphicum* 3) *Eleocharis compressa* 4) *Scutellaria parvula* 5) *Trichostema brachiatum* These indicator species are very specific to Alvars within EcoRegion 6E [E cxlix].	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plants. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover [lxxviii].	• An Alvar site > 0.5 ha in size [lxxv]. Information Sources: • Alvars of Ontario (2000). • Federation of Ontario Naturalists [lxxvi]. • Ontario Nature - Conserving Great Lakes Alvars [ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Staff. • Field Naturalist Clubs. • Conservation Authorities.	• Field studies that identify four of the five [E] **Alvar Indicator Species** [lxxv, cxlix] at a Candidate Alvar site is Significant. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses [lxxv]. • SWH MIST [cxlix] Index #17 provides development effects and mitigation measures.	SWH type not present within the study area.

Rare Vegetation Community	Candidate SWH			Confirmed SWH Defining Criteria	Study Area Assessment Details
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources		
Old Growth Forest Rationale: Due to historic logging practices, extensive old growth forest is rare in the EcoRegion. Interior habitat provided by old growth forest is required by many wildlife species.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old Growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	• Woodland area 30 ha or greater in size or with at least 10 ha interior habitat assuming 100 m buffer at edge of forest [E]. Information Sources: • OMNRF Forest Resource Inventory mapping. • OMNRF Districts. • Field Naturalist Clubs. • Conservation Authorities. • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments.	Field Studies will determine: • If dominant trees species of the are > 140 years old, then the area containing these trees is Significant Wildlife Habitat [cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present). • The area of Forest Ecosites combined or an Ecoelement within an Ecosite that contain the old growth characteristics is the SWH. • Determine ELC vegetation types for the forest area containing the old growth characteristics [lxxviii]. • SWH MIST [cxlix] Index #23 provides development effects and mitigation measures.	**Candidate:** SWH type present within the project and study area. Forest is approximately 41 ha, with 12.5 ha of interior habitat.
Savannah Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 - 60% [lxxix, lxxx, lxxxi, lxxxii, lxxxiii].	• No minimum size to site [E]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources: • Natural Heritage Information Centre (NHIC) has location data available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	• Field studies confirm one or more of the Savannah indicator species listed in [cxlix] Appendix N should be present [E]. Note: Savannah plant spp. list from EcoRegion 6E should be used [cxlviii]. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (< 50% vegetation cover are exotic sp.). • SWH MIST [cxlix] Index #18 provides development effects and mitigation measures.	SWH type not present within the study area.
Tallgrass Prairie Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover [lxxix, lxxx, lxxxi, lxxxii, lxxxiii].	• No minimum size to site [E]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm one or more of the Prairie indicator species listed in [cxlix] Appendix N should be present [E]. Note: Prairie plant spp. list from EcoRegion 6E should be used [cxlviii]. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.). • SWH MIST [cxlix] Index #19 provides development effects and mitigation measures.	SWH type is present within the study area but not within the project area. LGL noted that this area was planted as part of construction restoration.
Other Rare Vegetation Communities Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG [cxlviii]. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	• ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M [cxlviii]. • The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources: • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm: • if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG [cxlviii]. • Area of the ELC Vegetation Type polygon is the SWH. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures.	SWH type not present within the study area.

TABLE E3 Specialized Habitats of Wildlife Considered SWH

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite Codes	Habitat Criteria and Information Sources		
Waterfowl Nesting Area <u>Rationale:</u> Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands.	• A waterfowl nesting area extends 120 m [cxlix] from a wetland (> 0.5 ha) or a wetland (> 0.5 ha) and any small wetlands (0.5 ha) within 120m or a cluster of 3 or more small (< 0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur [cxlix]. • Upland areas should be at least 120 m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (40 cm dbh) in woodlands for cavity nest sites. <u>Information Sources</u>: • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from Conservation Authorities.	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[Ⓔ], or; • Presence of 10 or more nesting pairs for listed species including Mallards[Ⓔ]. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m [cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWH MIST [cxlix] Index #25 provides development effects and mitigation measures.	**Candidate:** SWH type present within the project area. Area contains suitable upland habitats adjacent to wetlands.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite Codes	Habitat Criteria and Information Sources		
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat <u>Rationale:</u> Nest sites are fairly uncommon in EcoRegion 6E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey **<u>Special Concern:</u>** Bald Eagle	ELC Forest Community Series: FOD FOM FOC SWD SWM SWC Directly adjacent to riparian areas - rivers, lakes, ponds and wetlands.	• Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. • Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. • Nests located on man-made objects are not to be included as SWH (e.g., telephone poles and constructed nesting platforms). <u>Information Sources:</u> • Natural Heritage Information Centre (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. • MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point and does not represent all the habitat. • Nature Counts, Ontario Nest Records Scheme data. • OMNRF District. • Check the Ontario Breeding Bird Atlas [ccv] or Rare Breeding Birds in Ontario for species documented. • Reports and other information available from Conservation Authorities. • Field Naturalists Clubs.	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area [cxlviii] • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH [ccvii], maintaining undisturbed shorelines with large trees within this area is important [cxlviii]. • For a Bald Eagle the active nest and a 400 - 800 m radius around the nest is the SWH [cvi, ccvii]. Area of the habitat from 400 - 800m is dependent on site lines from the nest to the development and inclusion of perching and foraging habitat • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for equal or > 3 years or suspected of not being used for > 5 years before being considered not significant [ccvii]. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from early March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #26 provides development effects and mitigation measures.	**Candidate:** SWH type present within the project area. Suitable nesting habitat is located adjacent to the Grand River.
Woodland Raptor Nesting Habitat <u>Rationale:</u> Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in: SWC SWM SWD CUP3	• All natural or conifer plantation woodland / forest stands > 30 ha with > 10 ha of interior habitat [lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv, xcvi, cxxxiii]. Interior habitat determined with a 200 m buffer [cxlviii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. • • <u>Information Sources:</u> • OMNRF Districts. • Check the Ontario Breeding Bird Atlas [ccv] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of 1 or more active nests from species list is considered significant [cxlviii]. • Red-shouldered Hawk and Northern Goshawk - A 400 m radius around the nest or 28 ha area of habitat is the SWH [ccvii] (the 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest). • Barred Owl - A 200 m radius around the nest is the SWH [ccvii]. • Broad-winged Hawk and Coopers Hawk - A 100 m radius around the nest is the SWH [ccvii]. • Sharp-Shinned Hawk - A 50 m radius around the nest is the SWH [ccvii]. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting / nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWH MIST [cxlix] Index #27 provides development effects and mitigation measures.	SWH type not present within the study area. Not enough internal habitat with a 200m buffer.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite Codes	Habitat Criteria and Information Sources		
Turtle Nesting Areas <u>Rationale:</u> These habitats are rare and when identified will often be the only breeding site for local populations for turtles.	Midland Painted Turtle **<u>Special Concern:</u>** Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (< 100 m) [cxlviii] or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons, or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes and rivers are most frequently used. <u>Information Sources:</u> • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Centre (NHIC). • Field Naturalist Clubs.	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[Ⓔ]. • One or more Northern Map Turtles or Snapping Turtle nesting is a SWH[Ⓔ]. • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30 - 100 m around the nesting area dependant on slope, riparian vegetation and adjacent land use in the SWH [cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30 - 100 m area of habitat [cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting is a recommended method. • SWH MIST [cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	**Candidate:** SWH present within the project area. Suitable shallow marsh habitat with exposed soils.
Seeps and Springs <u>Rationale:</u> Seeps / Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps / Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps / springs.	• Any forested area (with < 25 % meadow / field / pasture) within headwaters of a stream or river system [cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species [cxix, cxx, cxxi, cxxii, cxiii, cxiv]. <u>Information Sources:</u> • Topographical Map. • Thermography. • Hydrological surveys conducted by Conservation Authorities and MOE. • Field Naturalists Clubs and landowners. • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	Field Studies confirm: • Presence of a site with 2 or more[Ⓔ] seeps / springs should be considered SWH. • The area of an ELC Forest Ecosite or an Ecoelement within Ecosite containing the seeps / springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat [cxlviii]. • SWH MIST [cxlix] Index #30 provides development effects and mitigation measures.	**Confirmed:** SWH present within the project area. A seep was identified near the culvert structure at 735 Hidden Valley Road.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite Codes	Habitat Criteria and Information Sources		
Amphibian Breeding Habitat (Woodland) <u>Rationale:</u> These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations.	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or shortest distance from forest habitat are more significant because they are more likely to be used due to educed risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) > 500 m^2 (about 25 m diameter) [ccvii] within or adjacent (within 120 m) to a woodland (no minimum size) [clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat [cxlviii]. <u>Information Sources</u>: • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records. • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations. • Field Naturalist Clubs. • Canadian Wildlife Service Amphibian Road Call Survey. • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt / salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or eggs masses) [lxxi] or 2 or more of the listed frog species with Call Level Codes of 3Ⓔ. • A combination of observational study and call count surveys [cviii] will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland / wetlands. • The habitat is the wetland area plus a 230 m radius of woodland area [lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWH MIST [cxlix] Index #14 provides development effects and mitigation measures.	**Candidate:** SWH present within the project area. Suitable wetland habitat within close proximity to a woodland habitat.
Amphibian Breeding Habitat (Wetland) <u>Rationale</u>: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario landscapes.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these Wetland Ecosites will be isolated (> 120 m) from Woodland Ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) maybe adjacent to woodlands.	• Wetlands > 500 m^2 (about 25 m diameter) [ccvii], supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats [clxxxii]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. <u>Information Sources:</u> • Ontario Herpetofaunal Summary Atlas (or other similar atlases). • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of breeding population of 1 or more of the listed newt / salamander species or 2 or more of the listed frog / toad species with at least 20 individuals (adults or eggs masses) [lxxi] or 2 or more of the listed frog / toad species with Call Level Codes of 3Ⓔ. or; Wetland with confirmed breeding Bullfrogs are significantⒺ. • The ELC Ecosite Wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys [cviii] will be required during the spring (March - June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #15 provides development effects and mitigation measure	**Candidate:** SWH present within the project area.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite Codes	Habitat Criteria and Information Sources		
Woodland Area-Sensitive Bird Breeding Habitat <u>Rationale:</u> Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager **<u>Special Concern</u>**: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (> 60 yrs old) forest stands or woodlots > 30 ha [cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200 m from forest edge habitat [clxiv]. <u>Information Sources:</u> • Local birder clubs. • Canadian Wildlife Service (CWS) for the location of forest bird monitoring. • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species [E]. • Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH [E]. • Conduct field investigations in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #34 provides development effects and mitigation measures.	SWH type not present within the study area.

TABLE E4 Habitats of Species of Conservation Concern Considered SWH

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite	Habitat Criteria and Information Sources		
Marsh Breeding Bird Habitat <u>Rationale:</u> Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan **<u>Special Concern:</u>** Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	• Nesting occurs in wetlands. • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present [cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it many be found in upland shrubs or forest a considerable distance from water. <u>Information Source:</u> • OMNRF District and wetland evaluations. • Field Naturalists Clubs. • Natural Heritage Information Centre (NHIC) Records. • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas.	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren **or** 1 pair of Sandhill Cranes **or** breeding by any combination of 5 or more of the listed species [E]. • Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH [E]. • Area of the ELC Ecosite is the SWH. • Breeding surveys should be done May / June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #35 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. Suitable meadow marsh ecotype is present.
Open Country Bird Breeding Habitat <u>Rationale:</u> This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow **<u>Special Concern:</u>** Short-eared Owl	CUM1 CUM2	• Large grassland areas (includes natural and cultural fields and meadows > 30 ha [clx, clxi, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. • Grassland not Class 1 or 2 agricultural lands, and not being actively used for farming (e.g. no row cropping or intensive hay or livestock pasturing in the last 5 years) [E]. • Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. • The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. <u>Information Sources:</u> • Agricultural land classification maps, Ministry of Agriculture. • Local Bird Clubs. • Ontario Breeding Bird Atlas. • Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species [E]. • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC Ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #32 provides development effects and mitigation measures.	SWH type not present within the study area.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite	Habitat Criteria and Information Sources		
Shrub / Early Successional Bird Breeding Habitat <u>Rationale:</u> This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	<u>Indicator Spp:</u> Brown Thrasher Clay-coloured Sparrow <u>Common Spp:</u> Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher **<u>Special Concern:</u>** Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of Shrub Ecosites can be complexed into a larger habitat for some bird species.	• Large field areas succeeding to shrub and thicket habitats > 10 ha [clxiv] in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (e.g. no row-cropping, haying or live-stock pasturing in the last 5 years) [E]. • Shrub thicket habitats (> 10 ha) are most likely to support and sustain a diversity of these species [clxxiii]. • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. <u>Information Sources:</u> • Agricultural land classifications maps, Ministry of Agriculture. • Local Bird Clubs. • Ontario Breeding Bird Atlas. • Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species [E]. • A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as SWH [E]. • The area of the SWH is the contiguous ELC Ecosite field / thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #33 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the study area but not within the project area. There is a field to the southeast of the project site that is >10ha of cultural thicket that is actively naturalizing.
Terrestrial Crayfish <u>Rationale:</u> Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare [ccii].	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crayfish or Meadow Crayfish (*Cambarus diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above Meadow Marsh Ecosites can be used by terrestrial crayfish.	• Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground cannot be too moist. Can often be found far from water. • Both species are semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. <u>Information Sources:</u> • Information sources from “Conservation Status of Freshwater Crayfishes” by Dr. Premek Hamr for the WWF and CNF March 1998.	Studies confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites [cci]. • Area of ELC Ecosite or an Eco-element area of meadow marsh or swamp within the larger Ecosite area is the SWH. • Surveys should be done in April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals in very difficult [cci]. • SWH MIST [cxlix] Index #36 provides development effects and mitigation measures.	SWH type not present within the study area.
Special Concern and Rare Wildlife Species <u>Rationale:</u> These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10 km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	• When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or Provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites [lxxviii]. <u>Information Sources:</u> • Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species list with element occurrences data. • NHIC Website “Get Information” - http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas. • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Field studies confirm: • Assessment / inventory of the site for the identified Special Concern or rare species needs to be completed during the time of the year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the project area. Several SCC have been confirmed within the project area.

TABLE E5 Animal Movement Corridors

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH Defining Criteria	Study Area Assessment Details
		ELC Ecosite	Habitat Criteria and Information Sources		
Amphibian Movement Corridors Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all Ecosites associated with water. Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	• Movement corridors between breeding habitat and summer habitat [clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi]. • Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat -Wetland) of this Schedule [E]. Information Sources: • MNRF District Office. • Natural Heritage Information Centre (NHIC). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs.	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant [cxlix]. • Corridors should have at least 15 m of vegetation on both sides of waterway [cxlix] or be up to 200 m [cxlix] wide of woodland habitat and with gaps < 20 m [cxlix]. • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat [cxlix]. • SWH MIST [cxlix] Index #40 provides development effects and mitigation measures	**Candidate:** SWH type is present within the project area. Suitable wetland habitat within close proximity to a woodland habitat.
Deer Movement Corridors Rationale: Corridors important for all species to be able to access seasonally important life-cycle habitats or to access new habitat for dispersing individuals by minimizing their vulnerability while traveling.	White-tailed Deer	Corridoes may be found in all forested Ecosites. A Project Proposal in Stratum II Deer Winter Area has potential to contain corridors.	• Movement corridor must be determined when Deer Wintering Habitat is confirmed as SWH from Table 1.1 of this schedule [E]. • A deer wintering habitat identified by the OMNRF as SWH Table 1.1 of this Schedule will have corridors that the deer use during fall migration and spring dispersion [clxxxii, clxxxiii, cxlix, cxciv]. • Corridors typically follow riparian areas, woodlots, areas of physical geography (ravines or ridges). Information Sources: • MNRF District Office. • Natural Heritage Information Center (NHIC). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs.	• Studies must be conducted at the time of year when deer are migrating or moving to and from winter concentration areas. • Corridors that lead to a deer wintering habitat should be unbroken by roads and residential areas. • Corridors should be at least 200 m wide [cxlix] with gaps < 20 m [cxlix] and if following riparian area with at least 15 m of vegetation on both sides of waterway [cxlix]. Shorter corridors are more significant than longer corridors [cxlix]. • SWM MIST [cxlix] Index #39 provides development effects and mitigation measures.	**Candidate:** SWH type is present within the study area. LGL (2023) has identified a movement corridor along the Grand River, and along Wabanaki Road.

TABLE E6 Significant Wildlife Habitat Exceptions for EcoDistricts within EcoRegion 6E

EcoDistrict	Wildlife Habitat and Species	Candidate SWH			Confirmed SWH Defining Criteria	Study Area Assessment Details
		Ecosite	Habitat Description	Habitat Criteria and Information Sources		
6E-14 Rationale: The Bruce Peninsula has an isolated and distinct population of black bears. Maintenance of large woodland tracts with mast-producing tree species is important for bears [clxxxvi, ccxvii].	**Mast Producing Areas** Black Bear	All Forested habitat represented by ELC Community Series: FOM FOD	• Black Bears require forested habitat that provides cover, winter hibernation sites, and mast-producing tree species [clxxxv, clxxxvii, clxxxviii, clxxxix, cxc, cxci, cxcii, cxciii, ccxvii]. • Forested habitats need to be large enough to provide cover and protection for black bears [ccxvii].	• Woodland Ecosites > 30 ha with mast-producing tree species, either soft (cherry) or hard (oak and beech). Information Sources: • Important forest habitat for black bears may be identified by OMNRF.	• All woodlands > 30 ha with a 50% composition of these ELC Vegetation (E) Types are considered significant: ○ FOM1-1 ○ FOM2-1 ○ FOM3-1 ○ FOD1-1 ○ FOD1-2 ○ FOD2-1 ○ FOD2-2 ○ FOD2-3 ○ FOD2-4 ○ FOD4-1 ○ FOD5-2 ○ FOD5-3 ○ FOD5-7 ○ FOD6-5 • SWM MIST [cxlix] Index #3 provides development effects and mitigation measures.	SWH type not present within the study area.
6E-17 Rationale: Sharp-tailed Grouse only occur on Manitoulin Island in EcoRegion 6E, Leks are an important habitat to maintain their population.	**Lek** Sharp-tailed Grouse	CUM CUS CUT	• The lek or dancing ground consists of bare, grassy or spare shrubland. There is often a hill or rise in topography [ccxix]. • Leks are typically a grassy field / meadow > 15 ha with adjacent shrublands and > 30 ha with adjacent deciduous woodland. Conifer trees within 500 m are not tolerated [ccxix].	• Grasslands (field / meadow) are to be > 15 ha when adjacent to shrubland and > 30 ha when adjacent to deciduous woodland [ccxix]. • Grasslands are to be undisturbed with low intensities of agriculture (light grazing or late haying). • Leks will be used annually if not destroyed by cultivation or invasion by woody plants or tree planting [ccxix]. Information Sources: • OMNRF district office. • Bird watching clubs. • Local landowners. • Ontario Breeding Bird Atlas.	• Studies confirming lek habitat are to be completed from late March to June. • Any site confirmed with Sharp-tailed Grouse courtship activities in considered significant (E). • The field / meadow ELC Ecosites plus a 200 m radius area with shrub or deciduous woodland is the lek habitat (E). • SWM MIST [cxlix] Index #32 provides development effects and mitigation measures.	SWH type not present within the study area.

APPENDIX F

Hidden Valley Land Use Master Plan (2019)

City of Kitchener
Planning Division

Hidden Valley Land Use Master Plan

KITCHENER

Approved by Kitchener Council: June 24th, 2019

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Context

The “Hidden Valley” area comprises approximately 183 hectares of land bounded by the Grand River, Highway 8, Wabanaki Drive and the rail corridor near Fairway Road. The area is characterized primarily by rolling topography, including several agricultural fields, with large lot estate residential dwellings towards the river. Previous equine facilities, fields and original dwellings have evolved over time with two new subdivisions and other infill lots. A gravel pit existed at the northeasterly corner of Hidden Valley Road and Wabanaki Drive. Currently, Hidden Valley Road forms a ring-road system within Hidden Valley and a new regional road, the River Road extension, is approved along the northern and western edges of the area. There are steep slopes and grade changes that, along with the limited road access and limited views into the area contribute to the name, “Hidden Valley”.

By far, one of the greatest and most noteworthy features of this area is the significant natural environmental system and the Grand River. Two branches of a creek flow through the area and connects to the Grand River with a third tributary creek that flows under the highway to the river. The features include an esker formation, provincially significant wetlands, large significant woodland and upland forest areas, rare and significant flora and fauna including regulated habitat for species at risk, habitat breeding areas, sourcewater protection areas and steep slopes along the Grand River. The natural environment is very significant and has been referred to as the “jewel”.

From a land use planning perspective, the Hidden Valley area includes a ‘Residential Community Plan’ that was approved in 1989-90 which helped guide and stage development in the late 1990s/early 2000s to now following the creation of a second road access/egress (Wabanaki Drive) and some servicing infrastructure. That plan includes land from the old alignment of River Road extension to the river and contains much of the area that was, and still is, on limited services (i.e. sanitary, water, etc.). The area generally north of the old River Road extension alignment to the rail corridor and highway is within the ‘Secondary Plan for the Hidden Valley Community’, which was approved in 1981 and holds the same status as a ‘Community Plan’. That plan envisioned business park land uses, which includes industrial and commercial uses, along the old alignment of the River Road extension and a planned internal road system. Development did not occur in this area as the River Road extension and services were never constructed (which are reflected in special policies and zoning holding regulations).

Following more than a decade of study and environmental assessment, a new alignment for the River Road extension is now approved. Provincial, regional and city policies and directions have also changed along with the context of growth and development in Waterloo Region. The existing land use plans and zoning for the Hidden Valley area are clearly out-of-date and will be replaced through recommendations of this Land Use Master Plan process.

Neighbourhood Planning Review – Hidden Valley Area (2018/19)

Issues and Opportunities

Given the context of the area, including its limited access and services, the existing land use is almost entirely low rise, large lot/estate residential. Along the future development areas of the River Road extension, there is definitely an opportunity to establish a range of other land uses to support a more "complete community" (an area that one could live, work, shop and play). The adjacency of the Grand River and the presence of the significant environment features, coupled with the existing rural character of the area lends itself to opportunities for preserving and accessing open green spaces. With any new development, active parkland will be needed. Centrally-located parks, well-designed public spaces and a network of trails can enhance new development and contribute to health and livability.

The City is in the process of essentially overhauling the entire local level planning framework to respond to and implement changes in provincial, regional and city policy. The old land uses from the Official Plan, the existing Community Plans and the outdated zoning from 1985-1994 need to be replaced. The Region has decided on the revised River Road extension alignment and is proceeding with the design and construction phases. This establishes new knowns and new opportunities for parcels of land adjacent to the new road alignment. A significant body of technical work prepared through an extensive public process was completed through the various regional studies and environmental assessment, including on the natural environment, transportation, geotechnical, heritage, water, species at risk, economics, design options, lighting, noise, etc.

Hidden Valley is a special character area with some unique attributes (including the significant environmental features and limited service areas) that deserves specific policies within the City's Official Plan via a Secondary Plan to provide certainty for the existing residential area and guidance for any new development. The intent is to create a plan so that new development is a positive addition to the community rather than through an ad-hoc reaction to any new development. From a land use policy standpoint, other considerations, include:

- There is currently no transit-service within the area (potential for River Road though). Typically, Kitchener land use planning occurs based on existing or planned transit routes.
- A portion of the land is within the 'Built-Up Area' and a portion is within the 'Designated Greenfield Area'. This provides different policy directions and some challenges.
- A small portion of the northeastern most edge of the plan is within the 'Influence Area' of the Fairway Major Transit Station Area (i.e. within 800m of ION stop at the mall).
- This area is currently a 'Special Policy Area' within the Official Plan that provides direction for this master plan, servicing considerations and existing land uses.
- All of the existing 'Business Park' lands, save and except for the City-owned parcel at the southeasterly corner of Hidden Valley Road and Wabanaki Drive, were identified in the City's Comprehensive Review of Employment Lands Study (2010) as 'lands under review' and were not included within the 'protected employment' category.
- Lands immediately to the west are one of the last remaining Heavy Industrial areas and are currently considered 'protected employment'.
- There are numerous environmental layers that must be considered and confirmed as part of the natural heritage system and conservation thereof.
- Hidden Valley Road is a significant 'Cultural Heritage Landscape' and under consideration as a 'Heritage Corridor'.
- A large portion of the area needs a wastewater/sanitary servicing solution. Also, there is no watermain for some of the area and limited other utility infrastructure.

Community members identified that environmental, transportation and streetscape/placemaking issues are of top concern. The protection of the natural environment is of critical importance along with the need for active park space. The methods of managing water (including flooding) requires solutions. There is also an opportunity to improve the conditions of roads, add sidewalks, and improve the existing streetscapes (including the remnant industrial/rail area along existing Wabanaki). The limited movement access/egress at Fairway Road/Wabanaki Drive is often noted as an issue and there are many commercial businesses on Fairway Road to drive to but there are not many neighbourhood-oriented uses in close proximity or walking distance. There is also a lack of community space and institutional uses close by (although the Kitchener Operations Facility is in the immediate vicinity).

Respect and Enhance Existing Areas

A More "Complete" Community

Sustainability

Protect the "Jewel"

Mix of Uses along River Rd extension

Policy Directions

The following is a summary of the key directions for the Land Use Master Plan. These reflect internal and external directions and feedback and are intended to guide the next steps.

Urban Structure and Community Design

1. Identify a new “Urban Corridor” on River Road extension from existing Goodrich/Hidden Valley Rd to Highway 8. Revise the existing urban structure elements accordingly.
2. At this time, the parcel at southeasterly corner of Wabanki Dr./Hidden Valley Rd. remains within the “Industrial Employment Area”.
3. The remainder of the land within the master plan is part of the “Community Area”.
4. Review and work with the Region of Waterloo on the River Road extension as a “Planned Transit Corridor”. Plan for transit-supportive densities along that route and in proximity to the nearby Fairway LRT Station. Provide transit-oriented design policies and guidelines for future development in that area.
5. The Land Use Master Plan requires approximately 2-3 hectares of new parkland. Provide a new, suitably-sized (~2ha) neighbourhood park using a 5-minute walking distance (approximately 450m) within the Urban Corridor along the River Road extension with connections to a trail system. Where possible, identify new and upgrade existing Urban Greens (small parkettes) in areas that are not served by a neighbourhood park within a 5-minute walk.

Natural Environment

1. Ensure that the form and function of the significant environmental features is conserved (protected and enhanced). Update the land use designations and zoning accordingly.
2. Undertake a formal Environmental Impact Study of the land use plan. Utilize water management background work and modelling as an input to that assessment.
    a. Determine appropriate development limits, setbacks (i.e. buffers), zoning and assess potential trail network/crossing implications.
3. Any future development should prepare an Environmental Impact Report.

Water Management

1. Utilize water management background work and modelling as an input to the secondary plan, technical studies and future development.
2. Establish a formal Stormwater Management Strategy and further investigate hydrogeological implications.
    a. This would include further confirmation of stormwater management facility locations (shown as ‘proposed’ on the Land Use Master Plan)

Transportation

1. Establish transit and active transportation routes. Consider any revised Stage 2 ION route using a portion of River Road extension.
2. Create a Transportation Demand Management Plan for the lands within the Urban Corridor.
3. Incorporate a local road system within the Urban Corridor area that has access/egress to River Road extension.
4. Plan for improvements to the portion of existing Hidden Valley Road from Wabanki Drive to just before Hidden Valley (East) Creek.
5. Plan for shared parking arrangements between land uses and developments, parking within the hydro corridor, zero-emission vehicles, ride-share and automated vehicle drop-offs.
6. Define clear pedestrian and cyclist crossing points of River Road extension and existing Wabanki Drive.

Infrastructure

1. With the exception of land that can utilize the existing sanitary pumping station on River Birch Street, the remainder of the area requires a wastewater servicing solution. Formal options are to be explored and analyzed through a Municipal Class Environmental Assessment that is informed by the Land Use Master Plan. Consideration is to be given to environmental, economic, social, infrastructure and other appropriate criteria.
2. Confirm the requirements and extent for water servicing, utilities and flood control measures.
3. With the construction of the River Road extension, formally close portions of existing Hidden Valley Road no longer required, retain easement(s) where necessary and consolidate with adjacent lands where possible. Consolidate former River Road extension alignment parcel as well.

Cultural Heritage

1. The portion of Hidden Valley Road from approximately just south of Hidden Valley Creek to the location of the start of the new access arrangement to River Road extension near Highway 8 is the only portion of the road that would be the significant Cultural Heritage Landscape (CHL).
    a. Conserve this significant CHL via several methods, such as identification in the Official Plan and as a Heritage Corridor, inform the land use and zoning of the adjacent area, and prepare a Corridor Enhancement Plan that would include cross-section(s) of the road top guide the maintenance and enhancement of the rural, cultural heritage character.
2. Find opportunities to acknowledge and celebrate the Grand River, Indigenous Culture and the historical context of the area. This could be connected with future park and open space features, wayfinding, interpretive panels, views and vistas or other opportunities.

Streetscapes and Placemaking

1. Establish a “Community Gateway” to the existing residential area on the easterly side of Wabanaki/Goodrich/River Rd extension on either side of Hidden Valley Road at the corner. This should include well-defined, visible and decorative entry features.
2. Consider as part of any future plans for road or lighting improvements along Hidden Valley Road to include streetscape enhancements, such as banner poles and landscaping.
3. With the River Road extension by the Region of Waterloo it will replace some of the existing Wabanaki Dr. Investigate opportunities to improve the landscaping and streetscape. Eventually work with lands on the west side of Wabanaki Dr./River Road extension to enhance the streetscape.
4. Work with the community in the Estate and Large Lot Residential areas for placemaking/sense of place opportunities. This could include recognition of historical use of the land, including indigenous culture, equine stables and operations or other placemaking features regarding the prior use of the land and that could enhance the character of the area.
5. Establish the existing portion of Wabanaki Drive between the River Road extension intersection and Fairway Road as a “Priority Street” and a “Community Gateway”. This could be an important connection, including to the Fairway ION stop. Prepare a Streetscape Master Plan, incorporate specific features to define the area with its own unique sense of place and carry that through via a promenade style to the future development southeast of River Road extension. Establish views, vistas and potential access of the environmental area.
6. Prepare any urban design guidelines for the existing residential portion of the community and the future development areas to establish clear expectations for any development.

Sustainable Development

1. Any new development in the Hidden Valley area should achieve a high standard of environmental sustainability in terms of energy, water and waste conservation/generation; transportation demand management, air quality, etc. to assist with achieving greenhouse gas emission reduction targets and to help mitigate an adapt to climate change.
2. Target net-zero energy development for the Urban Corridor area along the River Road extension. Study opportunities for distributed/district energy systems/shared infrastructure.

Hidden Valley Land Use Master Plan – Typologies

Low Rise Residential - Estate

- Single detached dwellings on estate sized lots that are privately/partially serviced
- Minimum lot width: 30metres. Min. lot area: 0.4 ha
- Home businesses allowed
- Maximum lot coverage: 55%
- Maximum building height: 11 metres

Low Rise Residential - Large Lot

- Predominantly single detached dwellings on large sized lots. Second and Secondary dwelling units permitted.
- Minimum lot width: 24m. Minimum lot area: 929m²
- Home businesses allowed
- Maximum lot coverage: 55%
- Maximum building height: 11 metres

Medium Rise Residential

- Permits multiple dwellings (apartments), cluster townhouses, lodging houses, residential care facilities
- Apartments would allow complementary uses on the ground floor such as artisan's establishment, studio, community facility, day care, convenience retail, office
- Minimum 20% landscaped area
- Floor Space Ratio (FSR): min. 0.6 to max. 2.0
- Building height: min. 7.5m to max 25 m (8 storeys)

High Rise Residential

- Permits multiple dwelling (apartments), residential care facilities
- Includes complementary non-residential uses: convenience retail, office, health office, daycare, studio, personal services, community facility, etc.
- Minimum 20% landscaped
- FSR = min. 2.0 to max. 4.0
- Building height: min. 11m to no max. but base/stepbacks

Mixed Use (Urban Corridor)

- A mix of commercial services, office, retail, multiple dwellings (apartments), institutional, etc.
- More "urban"-style development with active uses like shops and restaurants at street level and parking is accommodated underground or behind buildings
- Minimum 15% landscaped
- FSR: min. 0.6 - max. 2.0
- Building height: min. 11m - max. 25m or 50% greater if mixed use

Commercial (Urban Corridor)

- Typically commercial services, retail stores, offices and light employment businesses
- Also allows for uses such as banks, brewpubs, catering business, commercial schools, commercial entertainment, fitness centre, gas station, health clinic, personal services, veterinary, etc.
- Minimum 20% landscaped
- FSR: N/A
- Building height: up to max. 15m or 25m if mixed use building

Business Park Employment (General & Service)

- Land set aside for employment uses such as manufacturing, research and development, light industrial uses, contractor's establishments, biotech, etc.
- Allows for some complementary commercial such as fitness centre, craftsperson shop, personal services, restaurants
- Office allowed 450m from transit
- Visual barrier for residential zone
- FSR: N/A. Building height: N/A (max. 11m near residential)

Site Specific Policy Areas

1. Community and Institutional Uses – in addition to Commercial, other uses such as community facility, cultural facility, stand-alone place of worship, and other institutional uses would also be permitted.

2. Subject to Regulation and Further Study – this area is within a provincial ministry regulated area. The future land use is subject to further study or permitting.

3. Neighbourhood Commercial Uses – in addition to Business Park Employment, convenience retail and personal services would also be permitted.

4. Compatibility of Sensitive Uses – notwithstanding any of the land use categories, sensitive uses such as residential, day care facilities and places of worship may not be permitted within 70-300m of an Industrial zone and may require compatibility studies.

Major Infrastructure and Utility

- Large scale infrastructure and utilities for public uses
- Includes electrical transformer stations, public works yards, transportation or waste facility

Natural Heritage Conservation

- Protection of natural heritage (environmental) features and their ecological function
- May include wetlands, woodlands, valleylands, species habitat, etc
- No development permitted (only 'existing' agriculture allowed)

Open Space

- Typically "green" areas that may have steep slopes or opportunities for outdoor passive recreation as part of a connected open space, natural, trail or park system
- Provides a "buffer" between land uses
- No development permitted (except related to recreation)

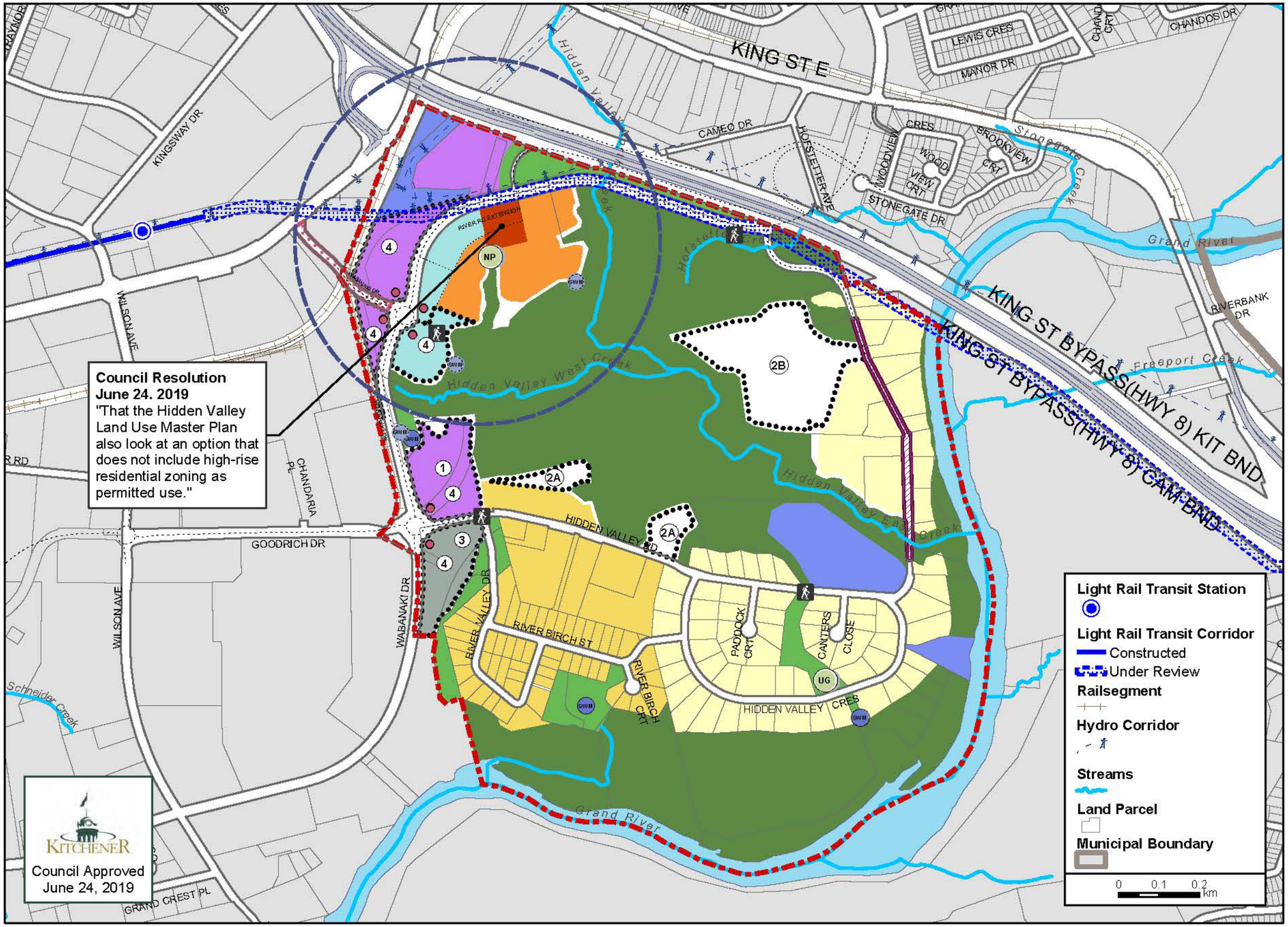
NP Neighbourhood Park – provide locations for active and passive recreation, playgrounds, field, etc.

UG Urban Green - provide small, walkable amenity spaces for the immediately surrounding area. May include seating, small playground or other

SWM SWM Existing / Proposed SWM Facilities - provide quantity and/or quality control for water run-off

Community Gateway – main entrances to the community or neighbourhood that are opportunities for placemaking features (enhanced landscaping, signage)

Hidden Valley
Land Use Master Plan



Council Resolution
June 24. 2019
"That the Hidden Valley Land Use Master Plan also look at an option that does not include high-rise residential zoning as permitted use."

KITCHENER
Council Approved
June 24, 2019

Light Rail Transit Station

Light Rail Transit Corridor
- Constructed
- Under Review

Railsegment

Hydro Corridor

Streams

Land Parcel

Municipal Boundary

0 0.1 0.2 km

Land Use
- Low Rise Residential - Estate
- Low Rise Residential - Large Lot
- Medium Rise Residential
- High Rise Residential
- Mixed Use
- Commercial
- Business Park Employment
- Major Infrastructure & Utilities
- Natural Heritage Conservation
- Open Space

Site Specific Policy Area

1. Community and Institutional uses also allowed
2A. and 2B. Subject to regulation and further study
3. Some neighbourhood commercial uses also allowed
4. Compatibility of sensitive uses

Land Use Master Plan Boundary

Community Gateway

5 Minute Walking Distance from Centre
- 450m

Potential Trailhead Locations

Proposed Parkland
- NP Neighbourhood Park
- UG Urban Green

Proposed Roads
- Hidden Valley Road Realignment
- Local Street

Heritage Corridor

Priority Street

SWM Facility
- Existing
- Potential (Location to be determined)

Notes:
1. Portions of River Rd extension, Wabanaki Dr and Goodrich Dr may be renamed
2. Development limts and setbacks to be determined

Implementation

The following aspects will help implement this Land Use Master Plan. Utilize an integrated and public process.

Official Plan Implications

- Prepare a draft amendment to Map 2 – Urban Structure to reflect the policy directions of this plan, including:
  - Identify a new 'Urban Corridor' along the River Road extension within the plan area instead of Industrial Employment Area and Major Transit Station Area.
  - Identify River Road extension as a 'Planned Transit Corridor'. Revise the 'Light Rail Transit Corridor' to reflect any approved Stage 2 ION updated route.
- Prepare a draft amendment to Map 3 – Land Use to identify that the Hidden Valley area should 'Refer to Secondary Plan for Detail'
- Prepare a draft amendment to Map 5 – Specific Policy Areas to remove #2 Hidden Valley (since it will be replaced with Secondary Plan maps and specific policies)
- Prepare a draft amendment to Map 6 – Natural Heritage System to reflect some minor adjustments
- Prepare a draft amendment to Map 9- Cultural Heritage Resources to indicate Hidden Valley Road from approximately Hidden Valley Creek to near Highway 8 as a Heritage Corridor
- Prepare a draft amendment to Map 11 – Integrated Transportation System to:
  - Illustrate the River Road extension as 'Planned' (or if any phase is built prior to the Official Plan Amendment then as 'Existing')
  - Illustrate Hidden Valley Road from approximately Hidden Valley Creek to near Highway 8 as a 'Heritage Corridor'
  - Update the 'Planned – Secondary Multi-use Pathway/Connection (Type 2)'

Secondary Plan and Supporting Technical Studies

- Prepare a draft Secondary Plan that would be incorporated into the Official Plan via an amendment to Section 16.D. At minimum, the Secondary Plan should include:
  - A Land Use Plan; a Natural Heritage System, Environmental and Water Management Map, Source Water Protection; and any other map/plan deemed appropriate for showing Secondary Plan details.
  - Objectives, general and topic-specific (natural environment, water management, parks, transportation, etc.) policies where required to identify directions for this community, and land use policies. Where possible, utilize the parent Official Plan and land use designation policies. Remove the density policy for Large Lot Residential where serviced.
- As part of the Secondary Plan process, complete the following technical studies: Environmental Impact Assessment, Stormwater Management Strategy, Transportation Analysis and TDM Action Plan, Sustainable Development/Net-Zero Energy Business Case, Community-specific Urban Design Guidelines, Corridor Enhancement Plan (Heritage Corridor), Park & Trail Analysis, Compatibility/Preliminary Noise Assessment, Preliminary Servicing Strategy, and Health Impact Assessment. Undertake a joint, integrated Wastewater Servicing Class Environmental Assessment.
- The Official Plan Amendments, Secondary Plan and supporting technical studies should provide guidance for zoning, development applications and implementation.

Wastewater Servicing EA

- Proceed with a City-led Municipal Class Environmental Assessment for wastewater (sanitary) servicing that, at minimum, includes:
  - Utilization of the Land Use Master Plan
  - Assessment of options to service new development areas, particularly the urban corridor area along the River Road extension.
    - Confirm whether or not it is feasible that, if it is determined that there could be future development within Site Specific Policy Area 2B, that there may be a servicing solution to the north near the new Hidden Valley Road access and River Road extension.
  - Reduce, minimize, eliminate or improve potential impacts to the natural environment
  - Considers the life-cycle costs of any resultant municipal assets within the option analysis

Zoning

- Prepare a draft Zoning By-law Amendment concurrently with, and that would conform to, the Secondary Plan and Official Plan Amendment.
  - Utilize the base zones from the new Zoning By-law (CRoZBy project).
  - Provide context and site-specific provisions to achieve the Land Use Master Plan, Secondary Plan/OP policies and Urban Design Guidelines.
  - Update the zoning for the existing developed residential area.
  - Consider if new development areas should be pre-zoned, zoned with holding provisions or zoning deferred until development application stage.

Urban Design

- Prepare and utilize 3D modeling, visualizations and testing of urban design principles to inform the policies, zoning and preparation of any neighbourhood-specific design guidelines. Specific attention should be paid to building heights and massing, building relationship to the street, setbacks and stepbacks. A transit and active transportation-oriented ground floor environment is important for the Urban Corridor area along with appropriate building base and features of mid-rise and tall buildings within the mixed use, medium rise residential and high rise residential areas.
- Identify (existing) Wabanaki Drive from Fairway Road to the intersection with River Road extension as a Priority Street with a Community Gateway function. Prepare a Streetscape Master Plan and accompanying design guidelines and standards.
- Incorporate the above into the Urban Design Manual (UDM)

Natural Heritage System and Trails

- Management Plans should be prepared for significant natural heritage features within the Land Use Master Plan area. This may occur as a condition of a development application and/or with decisions on ownership and operation.
- Confirm future access rights to any of the natural heritage system, open space, parks and trails within the Land Use Master Plan area.
- Any trail system that is identified within the Natural Heritage System of this Land Use Master Plan area should undertake further environmental study. Incorporate trail-heads and wayfinding signage.

Streets and Roads

- A new local road should be considered within future development applications for lands in the Urban Corridor with access to River Road extension.
- With the construction of the River Road extension, existing streets in the area should be appropriately renamed (i.e. portion of Wabanaki Drive).
- Prepare a cross section(s) and guidelines for Hidden Valley Road from Goodrich/Wabanaki to Hidden Valley (East) Creek that has a more urban condition. Include in the appropriate manual.
- As part of the Corridor Enhancement Plan, prepare a cross section(s) and guidelines for Hidden Valley Road from the creek to Highway 8 that respects and enhances the character and significance of the significant Cultural Heritage Landscape/Heritage Corridor. Include in the appropriate manual.
- Work with the Region of Waterloo and Ministry of Transportation on any future improvements and enhancements that could be made to the intersection of Fairway/Wabanaki.

Community Plans

With the consideration of the Official Plan Amendments and Secondary Plan, the existing Hidden Valley Industrial and Residential Community Plans should be repealed.

Appendix - Neighbourhood Planning Review Summary

The Hidden Valley Land Use Master Plan project process was formally initiated in early 2018 and is the first step of a multi-year process to update the planning framework.

Project Process

The project was divided into two major phases. The first phase involved internal project team discussions to study and apply technical information/reports available through the Region, GRCA and MNRF in preparation of the land use and zoning maps. In addition, the draft maps were circulated to the City, Region and GRCA experts for their professional opinion before presenting the maps at the public information centres.

Project Team

Hidden Valley project has an internal team of various experts from the City, Region and Provincial level governments. The internal project team representation is shown in the table below. In addition to the technical expertise, a significant number and wide range of technical studies were completed by the Region as part of the South Kitchener Transportation Corridor Study and subsequent Class Environmental Assessment for the River Road extension. Any further technical work conducted as part of the detail design for River Road extension, or from any related City-initiative is being utilized in the consideration of the land use master plan and secondary plan. At the next stage, additional technical assessments will be conducted in response to the land use plan which will accompany the formal Secondary Plan and provide direction for the land use, zoning, design guidelines, heritage implementation and for any subsequent development applications to follow.

Table 1: Hidden Valley Land Use Master Plan Project Team

	Business Unit	Review Area/Expertise
City of Kitchener	Planning	Long Range & Policy Planning, Urban Design
		Development Review
		Natural Environment
		Cultural Heritage
	Engineering	Development, Servicing & Utilities
		Stormwater Management
	Transportation	Active Transportation, Traffic
	Operations (Design & Development)	Parks, Open Space and Trails
	Technology Innovation & Services	Geospatial Data and Analytics
	Communications & Marketing	Communication and Engagement
Region of Waterloo	Planning	Community Planning, Land Use Compatibility
		Natural Environment
		Transportation Planning/Traffic, Active Transportation, Regional Roads
Grand River Conservation Authority	Resource Planning	Natural environment, natural hazards (floodplain and slopes), hydrology and hydraulics
Ministry of Natural Resources & Forestry	Guelph Office	Endangered Species Act/Species at Risk

Public Process

The Project team solicited feedback from public, developers and other stakeholders on the conceptual land use and zoning maps. For this purpose, two public information centres were arranged in the area. These public open houses provided opportunities to review proposed land use, zoning and other relevant documents and discuss these proposed changes with professionals from the City, Region and Grand River Conservation Authority. Stakeholders were given various options to provide feedback that included completing a feedback form, emailing comments, and have one to one meeting with project manager.

The first public information center was in June 2018. Background information was presented along with some of the considerations and potential guiding principles. Feedback was solicited from the community about the important characteristics of the area and suggestions moving forward. The information presented at the meeting included:

1. What are secondary plans
2. Existing land use and zoning maps
3. Supporting technical information
4. Key aspects of City land use review and considerations
5. Final outcome/deliverables of the project

Four themes, Figure 1, emerged from the feedback received during the first public information centre. These themes were Engineering and Stormwater, Transportation, Land Use and Character, and Environment. The project team incorporated the feedback into the process.

The second public information centre occurred in November 2018. City staff presented a draft land use plan for the area informed by the project team's work and stakeholder feedback. The information presented at the meeting included:

1. Land use consideration
2. Land Use typology for both residential and non-residential uses
3. Preliminary technical review information on:
    a. Environment, Transportation, Engineering & Water Management, Planning, Cultural Heritage, Parks & Trails
4. Master Plan guiding principles

The feedback, Figure 2, received from the second public information centre had some similiarities; however, the top three area of concerns were flooding, traffic and environment

Figure 1: Feedback PIC#1

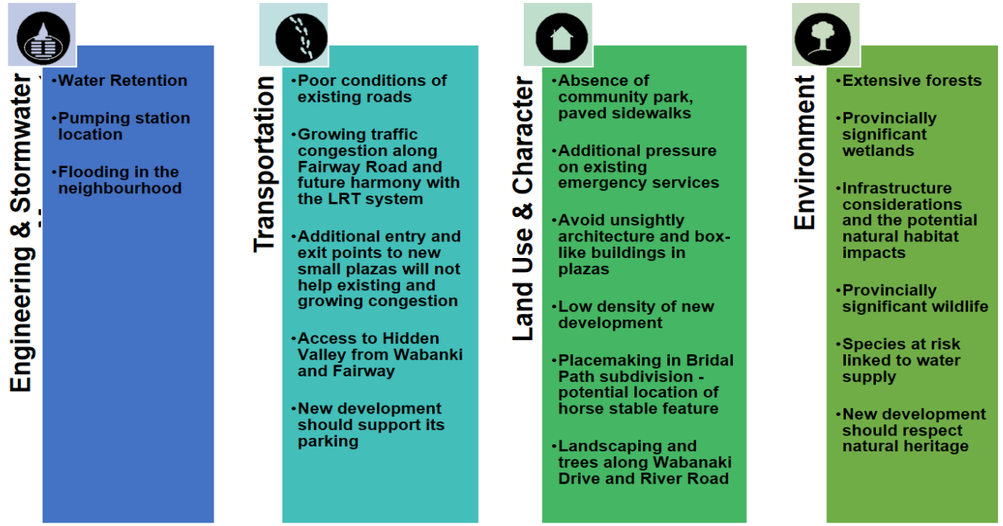
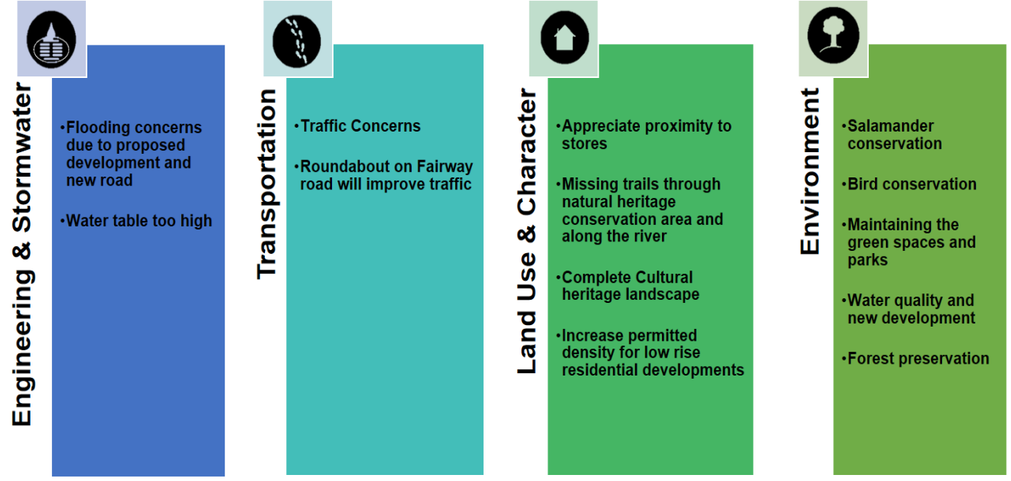


Figure 2: Feedback PIC#2



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