

Tributary of Reesor Creek Erosion Hazard Assessment

12811 Tenth Line

Whitchurch-Stouffville, ON



Prepared for:

Paul Tobia
Northcape Investments Inc.
8600 Dufferin St.
Vaughan, Ontario L4K 5P5

Submitted:

April 1, 2026

GEO Morphix Project No. 25157



Ver.	Purpose/Change	Authored by	Approved by	Date
1.0	First Submission	Nathan Beckner-Stetson, M.Sc., G.I.T. Suzanne St Onge, M.Sc.	Paul Villard, Ph.D., P.Geo., CAN-CISEC, EP, CERP	2026-04-01

Disclaimer

This report presents professional opinions and findings of a scientific and technical nature based on the knowledge and information available at the time of preparation. This document is prepared solely for the Client, and the data, interpretations, suggestions, recommendations, and opinions expressed in the report pertain only to the project being completed for the Client.

Table of Contents

1	Introduction	1
2	Desktop Assessment.....	1
	2.1 Physiography and Surficial Geology	1
	2.2 Historical Assessment	2
3	Watercourse Characteristics	2
	3.1 Reach Delineation.....	2
	3.2 Reach Observations	3
	3.3 Rapid Assessments	4
4	Erosion Hazard Assessment	5
5	Summary	6
6	References	7

List of Tables

Table 1: General reach characteristics	3
Table 2: Summary of rapid assessment results	4
Table 3: Toe erosion allowance guideline (adapted from MNR, 2002).....	6

Appendices

- Appendix A: Study Area and Reach Delineation
- Appendix B: Historical Aerial Imagery
- Appendix C: Photographic Record
- Appendix D: Rapid Assessment Field Sheets

1 Introduction

GEO Morphix Ltd. (GEO Morphix) was retained to complete an erosion hazard assessment in support of proposed residential development at 12811 Tenth Line in the Town of Whitchurch-Stouffville. The property, henceforth referred to as the subject lands, is bound by Tenth Line to the west, a woodlot to the east, and agricultural lands to the north and south (**Appendix A**). A tributary of Reesor Creek flows in a generally north to south orientation east of and within the southern extent of the subject lands.

Pre-consultation comments issued by the Town of Whitchurch-Stouffville on December 30, 2021, noted that a meander belt width analysis was required for the subject lands. The erosion hazard assessment documented herein informs, in part, the limit of development and should be reviewed in conjunction with assessments being undertaken by other disciplines such as geotechnical engineering and ecology.

The following activities were completed by GEO Morphix as part of the erosion hazard assessment:

- Review of available background reports and mapping (i.e., watershed/subwatershed studies, geology, topography, conceptual development plans)
- Review recent and historical aerial imagery to understand historical changes in channel form and function, land use and land cover
- Delineate watercourse reaches based on a desktop assessment
- Conduct field reconnaissance using standard, industry-accepted tools such as the rapid geomorphic assessment (RGA) and rapid stream assessment technique (RSAT) to evaluate existing instream and riparian conditions (i.e., evidence of ongoing channel processes, active erosion/deposition or potential channel instability)
- Delineate the erosion hazard on a reach basis using results of the desktop- and field-based assessments

2 Desktop Assessment

2.1 Physiography and Surficial Geology

Channel morphodynamics are governed by the flow regime and the availability and type of sediments (i.e., surficial geology) within the stream corridor. These factors are explored as they not only offer insight into existing conditions, but also potential changes that could be expected in the future as they relate to a proposed activity. Understanding local surficial geology is important for determining appropriate erosion hazard limits, as the stability of the channel banks and bed is dependent on the composition of soils, sediment, and underlying parent materials (MNR, 2002).

The subject lands are generally situated within the drumlinized till plains landform of the south slope physiographic region at the edge of the Oak Ridges Moraine (Chapman and Putnam, 2007). This region is generally located between Lake Ontario and the Oak Ridges Moraine and is the most southern slope extending from the Niagara Escarpment to the Trent River. It is characterized by long thin drumlins, large hills, and gently rolling till plains (Chapman and Putnam, 1984). Surficial geology in the subject lands is comprised of clay to silt-textured till (OGS, 2010).

A geotechnical investigation completed by Soil Engineers Ltd. (2026) and is summarized below. A total of 12 boreholes were drilled across the subject lands, revealing a 0.05 to 0.25 m layer of topsoil. This was underlain by ploughed soil, which generally extended from 0.7 to 1.1 m below grade. Earth fill was present below the topsoil at two borehole locations and consisted of silty clay with topsoil inclusions and rootlets, and extended to a depth of 1.4 m below grade. Sandy silt till/silt sand till extended between 4.0 and 5.6 m below grade for most boreholes and was generally dense. Silty clay/silty clay till was located below the sandy silt till within the eastern portion of the subject lands. Both the silty clay and silty clay till were generally very stiff in consistency. These findings were generally consistent with published mapping.

2.2 Historical Assessment

A series of historical aerial photographs were reviewed to determine changes to the channel and surrounding land use and land cover. This information, in part, provides an understanding of the historical factors that have contributed to current channel morphodynamics and potentially how past changes may affect channel planform in the future. Aerial photographs from 1970, 1978, 1988, 1999, 2005, 2009, 2015, 2020, and 2024 from the York Region online mapping tool were reviewed to understand site history. Copies of this imagery are provided in **Appendix B** for reference.

The corridor associated with the tributary of Reesor Creek east of the subject lands was partially forested in 1954. Sections of sinuous channel were visible where there were gaps in the canopy; although sections of channel upstream of the subject lands appeared to have been historically straightened to accommodate agricultural land uses and the road network. The existing ponds adjacent to the channel east and upstream of the subject lands were not present in the 1954 image. By 1970, the channel planform adjacent to the subject lands was largely obscured by the forest canopy; however, the three existing ponds had been constructed on the west side of the channel adjacent to and upstream of the subject lands. Only the northernmost pond, upstream of the subject lands, had a visible direct connection to the main channel in the 1970 image. A local channel realignment was visible adjacent to the northerly pond and was likely completed to accommodate the pond footprint. The southern pond adjacent to the subject lands had a formal access road and crossing over the channel in the 1970 image. These ponds likely have a limited impact on the flow and sediment transport regime in Reesor Creek as they are not online features. Woody vegetation was permitted to expand in the upstream portion of the corridor from 1970 onwards. Where the channel was visible in the years 1954, 1970, 1978 and 1988 upstream of the subject lands, there were no significant changes in channel planform. From 1988 to present, the channel planform was not visible in aerial imagery due to expanding woody vegetation in areas upstream of the subject lands and a dense forest canopy adjacent to the subject lands. There was no clear evidence of gaps in canopy cover due to slope processes or active channel migration during the period of available record.

3 Watercourse Characteristics

3.1 Reach Delineation

Reaches are homogeneous segments of channel used in geomorphological investigations. Reaches are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This method allows for a meaningful characterization of a watercourse as the aggregate of reaches, or an understanding of a reach, for example, as it relates to a proposed activity. Reaches are typically delineated based on changes in the following:

- Channel planform
- Channel gradient
- Physiography
- Land cover (land use or vegetation)
- Flow, due to tributary inputs
- Soil type and surficial geology
- Historical channel modifications

This follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997), and the Toronto and Region Conservation Authority (2004). Reaches are first delineated as a desktop exercise using available data and information such as aerial photography, topographic maps, geology information and physiography maps. The results are then verified in the field.

The reach breaks were determined based on changes in valley confinement, sinuosity, riparian vegetation and the presence of a farm crossing at 12811 Tenth Line. **Reach RCT2** was delineated adjacent to the parcel to the south (i.e., 12749 Tenth Line) and extended upstream into the subject lands, terminating at an existing farm crossing. **Reach RCT3** extended upstream of **RCT2** adjacent to the subject lands and had a lower channel sinuosity when compared to **Reach RCT2**. In addition, the

western valley slope was continuous along **Reach RCT3**. The upstream reach break for **Reach RCT3** was delineated at the upstream extent due to the change in confinement and riparian vegetation. Field work was conducted within Reaches **RCT2** and **RCT3** in support of the erosion hazard assessment. Reach delineation is graphically represented in **Appendix A**.

3.2 Reach Observations

Field investigations were completed on November 7th, and December 22nd, 2025, and included the following observations on a reach basis:

- Descriptions of riparian conditions
- Estimates of bankfull channel dimensions
- Determination of bed and bank material composition and structure
- Confirmation of valley form (i.e., unconfined, partially confined, confined)
- Observations of erosion, scour, or deposition
- Collection of photographs to document watercourses, riparian areas, adjacent land use, and channel disturbances such as crossing structures

These observations and measurements are summarized in **Table 1**. Field descriptions are supplemented and supported with representative photographs included in **Appendix C**. Field sheets, including those completed for reach characterization and rapid assessments, are provided in **Appendix D**.

Table 1: General reach characteristics

Reach	Average Bankfull Width (m)	Average Bankfull Depth (m)	Bed Substrate		Bank Materials	Dominant Riparian Vegetation	Notes
			Riffles	Pools			
RCT2	3.15	0.54	Clay/silt to boulders	Clay/silt to boulders	Clay/silt	Trees	High woody debris density with occasional woody debris jams; basal scour present through much of the reach
RCT3	5.09	0.51	Clay/silt to cobble	Clay/silt and minor sand	Clay/silt and minor sand	Trees and herbaceous vegetation	Reach was mostly frozen; one gravel/cobble riffle identified; sand was observed collecting on below-water ice.

Reach RCT2 was partially confined within a forested valley and surrounded by agricultural land uses. Irregular meanders were present along the reach. Riparian vegetation consisted of a continuous corridor of mature trees. Bank substrates were comprised of clay and silt, whereas bed substrate ranged from clay to occasional boulders. Basal scour was present in the majority of the reach. Riffles and pools, which were present in 15% and 30% of the reach respectively, also had a range of substrates, though smaller materials (silt/clay to gravel) were found in pools and larger materials (sand to cobble) were found in riffles. Fluvial entrainment and undercutting were present throughout the reach. One rooted knickpoint augmented by anthropogenic woody debris (e.g., plywood) was identified near the upstream extent of the reach and indicated that the channel was degrading to accommodate for a change in gradient. Bankfull width ranged from 2.89 to 3.87 m and bankfull depth ranged from 0.35 to 0.64 m.

Reach RCT3 was set within a forested valley, and a valley slope was present on the west side of the tributary alongside subject lands. Herbaceous vegetation and mature trees were the main forms of riparian vegetation, providing a moderately wide, continuous buffer along the reach. Riffle and pool

morphology could not be fully observed due to the presence of ice; however, one riffle was identified. Bank erosion was difficult to discern but appeared to occur in approximately 30-60% of the reach. The channel gradient was low. The channel bed substrate ranged from clay and silt to cobble, whereas the banks had clay, silt, and minor sand. Bankfull widths were 4.66 and 5.52 m and bankfull depths were 0.50 and 0.52 m.

3.3 Rapid Assessments

Rapid assessments were completed to identify dominant geomorphic processes, document stream health, and to identify any areas of concern regarding erosion or instability. Channel instability was objectively quantified through the application of the Ontario Ministry of the Environment (MOE) (2003) Rapid Geomorphic Assessment (RGA). Observations were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether a channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40), or adjusting (score >0.41).

The Rapid Stream Assessment Technique (RSAT) was also employed to provide a broader view of the system as it considers the ecological function of the watercourse (Galli, 1996). Observations were made of channel stability, channel scouring or sediment deposition, instream and riparian habitats, and water quality. The RSAT score ranks the channel as maintaining a poor (<13), fair (13-24), good (25-34), or excellent (35-42) degree of stream health.

The reaches were also classified according to a modified Downs (1995) Channel Evolution Model, which describes successional stages of a channel as a result of a perturbation, namely hydromodification. Understanding the current stage of the system is beneficial as this allows one to predict how the channel will continue to evolve or respond to an alteration to the system.

A summary of the reach classifications and rapid assessment scores is provided in **Table 2**.

Table 2: Summary of rapid assessment results

Reach	RGA (MOE, 2003)			RSAT (Galli, 1996)			Downs (1995) Model
	Score	Condition	Dominant Systematic Adjustment	Score	Condition	Limiting Feature(s)	
RCT2	0.36	In transition/stress	Evidence of Widening	29	Good	Channel stability	E
RCT3	0.32	In transition/stress	Evidence of Aggradation/ Evidence of Widening	33	Good	Channel stability	E

Reach RCT2 was in transition/stress, primarily due to widening, resulting in an RGA score of 0.36. Extensive basal scour, the presence of large organic debris, exposed tree roots, and fallen/leaning trees were the most common factors supporting the RGA score. Evidence of aggradation, such as poor longitudinal sorting of bed materials, was also present. Stream health was evaluated as good (RSAT score of 29). Channel stability was the limiting factor due to an unstable bank network and multiple large tree falls. The Downs (1995) classification indicated the reach was likely experiencing enlarging (E), evidenced by erosion of both banks, exposure of young tree roots, low channel embeddedness, and no alluvial terrace.

Reach RCT3 was in transition/stress (RGA score of 0.32). The main form of systematic adjustment was aggradation within the visible sections of the reach, though evidence of widening was also present. Siltation in pools, poor longitudinal sorting, basal scour, the presence of large organic debris, exposed

tree roots, and fallen/leaning trees were the most common factors supporting the RGA score. Stream health was good (scoring 33 on the RSAT), with limits to stream health due to channel stability such as an unstable bank network and multiple large tree falls. Applying the Downs (1995) classification to this channel indicated the reach was likely experiencing enlarging (E), evidenced by erosion along both banks exposing young tree roots, low embeddedness, and no alluvial terrace. The classification of compound (C) was also considered due to the combination of aggradation and widening occurring within the reach but was ultimately not applied due to the lack of alluvial terraces along the channel.

4 Erosion Hazard Assessment

Most watercourses in southern Ontario have a natural tendency to develop and maintain a meandering planform provided there are no topographical or spatial constraints. When defining the limits of an erosion hazard for a watercourse, unconfined and confined systems are assessed differently (TRCA, 2004 and MNR, 2002). Unconfined systems are those with streams in open areas (i.e., valleys not apparent) or with valley walls at a sufficient distance that the channel cannot reasonably be expected to contact due to migration under existing or future hydrologic scenarios. In this type of setting, the extent of the erosion hazard is delineated by the meander belt width, which is defined as the lateral extent that a channel has historically occupied and will likely occupy in the future.

Confined systems are those where a watercourse is contained within a defined valley where valley walls may constrain meander bend migration. Partially confined systems are those where meander bends are adjacent to only one valley wall and the watercourse is therefore restricted in migration and floodplain occupation on one side of the valley system. In these settings, where the channel is positioned within 15 m of a valley slope, the erosion hazard is generally defined by the toe erosion allowance, stable slope allowance, and erosion access allowance. In some instances, a meander belt width may also apply in partially confined systems.

The MNR (2002) outlines several approaches for establishing an appropriate toe erosion allowance where watercourses are confined by valley walls and located within 15 m of the toe of slope, which are as follows:

- 1) calculating the average annual recession rate based on a minimum of 25 years of record
- 2) applying a 15 m toe erosion allowance measured inland horizontally and perpendicular to the toe of the watercourse slope
- 3) soil types and hydraulic processes
- 4) use of a study that applies accepted geotechnical and engineering principles based on a minimum of 25 years of record

LiDAR and topographic survey data, as well as field observations, were used to evaluate the degree of reach confinement. **Reaches RCT3** and **RCT2** are partially confined, with a valley slope present adjacent to the subject lands. The erosion hazard is therefore comprised of the toe erosion allowance, slope stability allowance, and erosion access allowance. Regarding the toe erosion allowance, the forest canopy obscured a view of the channel planform and therefore meander migration rates could not be calculated. **Table 2**, below, provides toe erosion allowances based on MNR (2002). Field observations collected by GEO Morphix confirmed that the channel banks were comprised of clay and silt, and a minor amount of sand. Geotechnical boreholes indicate the subsurface is comprised of sandy silt till/silty sand till (generally dense) and silty clay/silty clay till (generally very stiff). Based on the above, evidence of active erosion observed in the field, and **Table 2**, an 8 m toe erosion allowance is recommended and should be applied from the channel bank where the channel is within 15 m of the toe of slope. This recommendation should be reviewed in conjunction with the geotechnical slope stability assessment prepared by others under separate cover.

Table 3: Toe erosion allowance guideline (adapted from MNR, 2002)

Material Type	Evidence of Active Erosion	No Evidence of Active Erosion		
		Bankfull Channel Width		
		< 5 m	30 m	> 30 m
1. Hard Rock (Granite)	0 – 2 m	0 m	0 m	1 m
2. Soft Rock (Shale, Limestone) Cobbles, Boulders	2 – 5 m	0 m	1 m	2 m
3. Stiff/Hard Cohesive Soils (Clays, Clay Silt), Coarse Granular (Gravels), Tills	5 – 8 m	1 m	2 m	4 m
4. Soft/Firm Cohesive Soil, loose granular, (sand, silt) Fill	8 – 15 m	1 – 2 m	5 m	7 m

5 Summary

GEO Morphix was retained to complete a fluvial geomorphology assessment for the property located at 12811 Tenth Line in the Town of Whitchurch-Stouffville. The study focused on the tributary of Reesor Creek adjacent to and within the southern extent of the subject lands (i.e., **Reaches RCT2 and RCT3**). The following provides a summary of key findings and recommendations:

- A rapid geomorphological assessment was completed along **Reaches RCT2 and RCT3** which indicated the reaches were in transition
- A meander belt width was not delineated as a valley slope is present along the west side of the tributary, which acts to limit channel migration
- Meander migration rates could not be measured due to the presence of a dense forest canopy, which obscured the channel planform in aerial imagery
- A toe erosion allowance of 8 m is recommended and should be applied from the channel bank where the reach is confined by a valley wall, and the channel is within 15 m of the valley slope toe
- The ultimate limit of the erosion hazard is based on the position of the long-term stable top of slope, which is delineated by others as part of the geotechnical slope stability assessment

We trust this report satisfies your requirements at this time. Should you have any questions or concerns, please contact the undersigned.

Respectfully submitted,



Paul Villard Ph.D., P.Geo, CAN-CISEC, EP, CERP
Director, Principal Geomorphologist



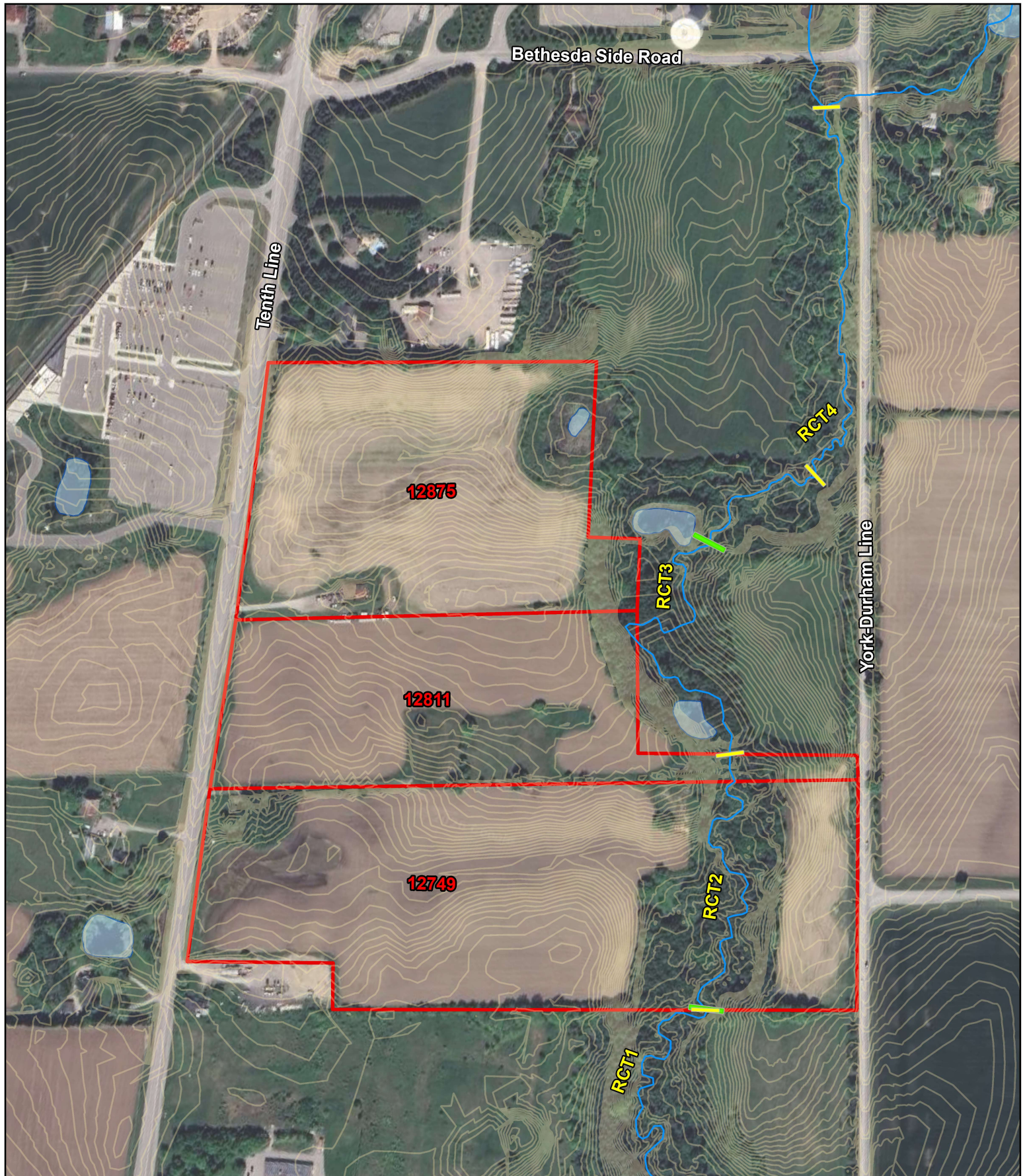
Suzanne St Onge, M.Sc.
Senior Environmental Scientist, Practice Lead

6 References

- Chapman, L.J., and Putnam, D.F. 1984: Physiography of Southern Ontario, Third Edition. Ontario Geological Survey, Toronto, ON.
- Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228.
- Downs, P.W. 1995. Estimating the probability of river channel adjustment. *Earth Surface Processes and Landforms*, 20: 687-705.
- Galli, J. 1996. Rapid Stream Assessment Technique, Field Methods. Metropolitan Washington Council of Governments.
- Ministry of the Environment (MOE). 2003. Ontario Ministry of the Environment. Stormwater Management Guidelines.
- Ministry of Natural Resources (MNR). 2002. Technical Guide – River & Stream Systems: Erosion Hazard Limit.
- Montgomery, D.R. and Buffington, J.M. 1997. Channel-reach morphology in mountain drainage basins. *Geological Society of America Bulletin* (109), 5: 596-611.
- Ontario Geological Survey (OGS). 2010. Surficial geology of Southern Ontario. Ontario Geological Survey. Miscellaneous Release – Data 128-REV.
- Richards, C., Haro, R.J., Johnson, L.B. and Host, G.E. 1997. Catchment and reach-scale properties as indicators of macroinvertebrate species traits. *Freshwater Biology*, 37: 219-230.
- Soil Engineers Ltd. 2026. A Geotechnical Investigation for Proposed Residential Development, 12811 Tenth Line, Town of Whitchurch Stouffville. Prepared for Northcape Investments Inc.
- Toronto and Region Conservation Authority (TRCA). 2004. Belt Width Delineation Procedures.

A vertical bar on the left side of the page with a gradient from light green at the top to dark blue at the bottom.

Appendix A: Study Area and Reach Delineation



- Legend**
- Reach Break and ID
 - Extent Field-Assessed
 - ~ Watercourse
 - 0.25 m Contour
 - Waterbody
 - Approximate Study Area

Reach Delineation
 Reesor Creek Tributary
 Whitchurch-Stouffville, Ontario

GEO MORPHIX™

N
 0 60 120
 Meters

Imagery: Google Earth Pro, 2025. Watercourse and Waterbody: MNR/2024. Approximate Study Area, Extent Field Assessed and Reach Break: GEO Morphix, 2025. 0.25 m Contour: SCS, 2025. Print Date: January, 2026. PN25155/56/57. Drawn By: S.S.O., N.B.S., G.U.

A vertical bar on the left side of the page with a gradient from light green at the top to dark blue at the bottom.

Appendix B: Historical Aerial Imagery



Location: Whitchurch-Stouffville, ON

Year: 1954

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



Location: Whitchurch-Stouffville, ON

Year: 1970

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



Location: Whitchurch-Stouffville, ON

Year: 1978

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



Location: Whitchurch-Stouffville, ON

Year: 1995

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



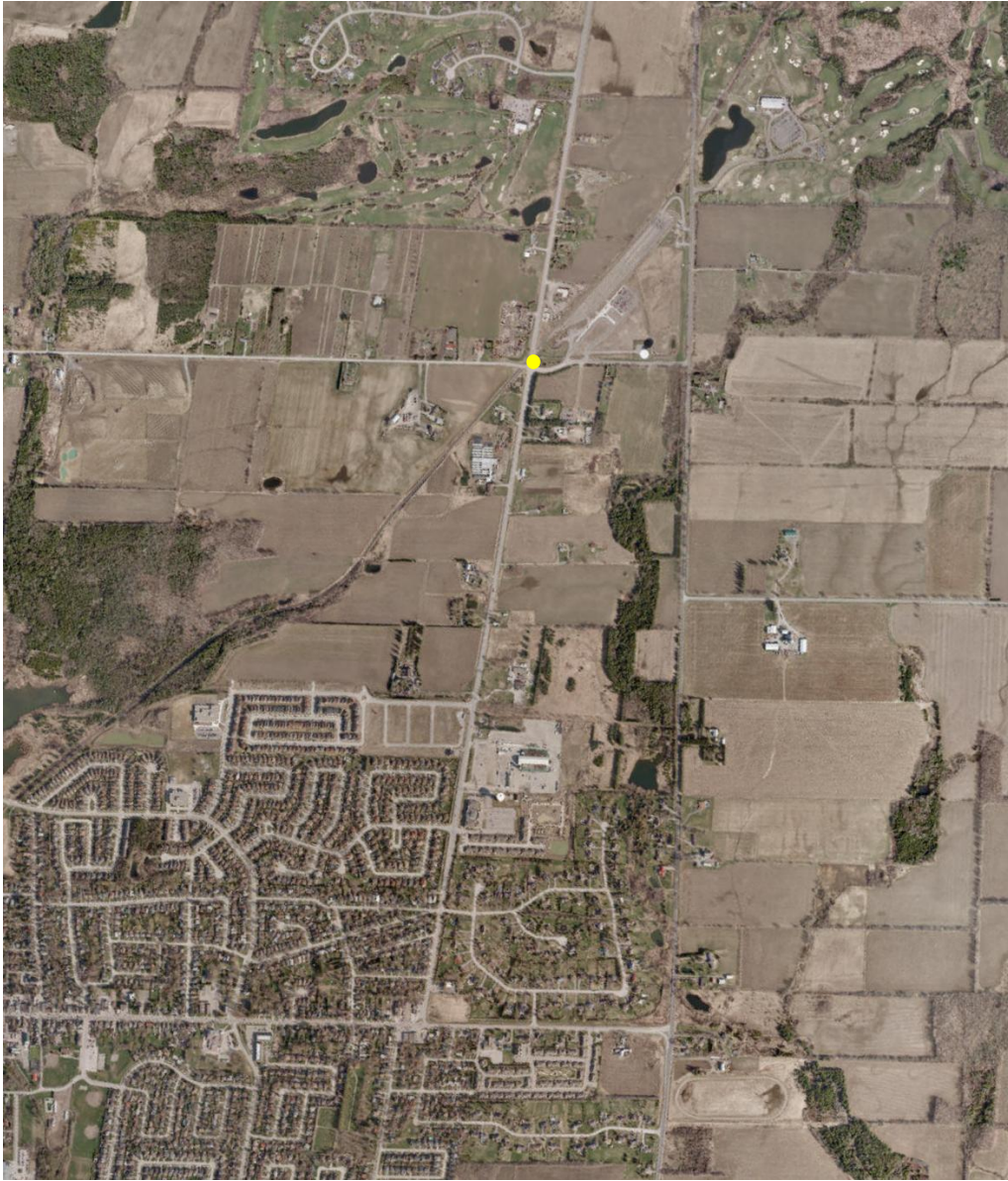
Location: Whitchurch-Stouffville, ON

Year: 2005

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



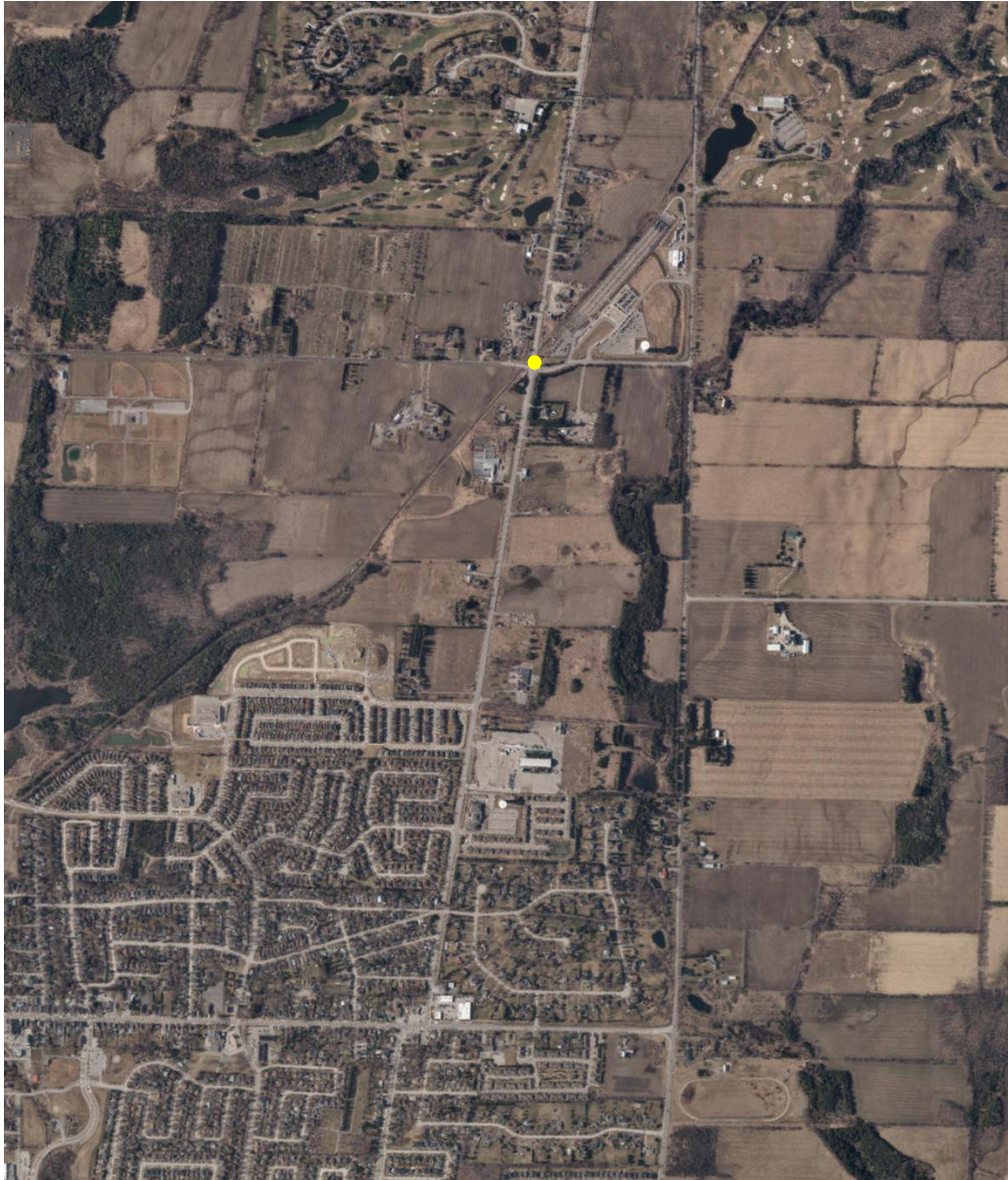
Location: Whitchurch-Stouffville, ON

Year: 2009

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



Location: Whitchurch-Stouffville, ON

Year: 2015

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



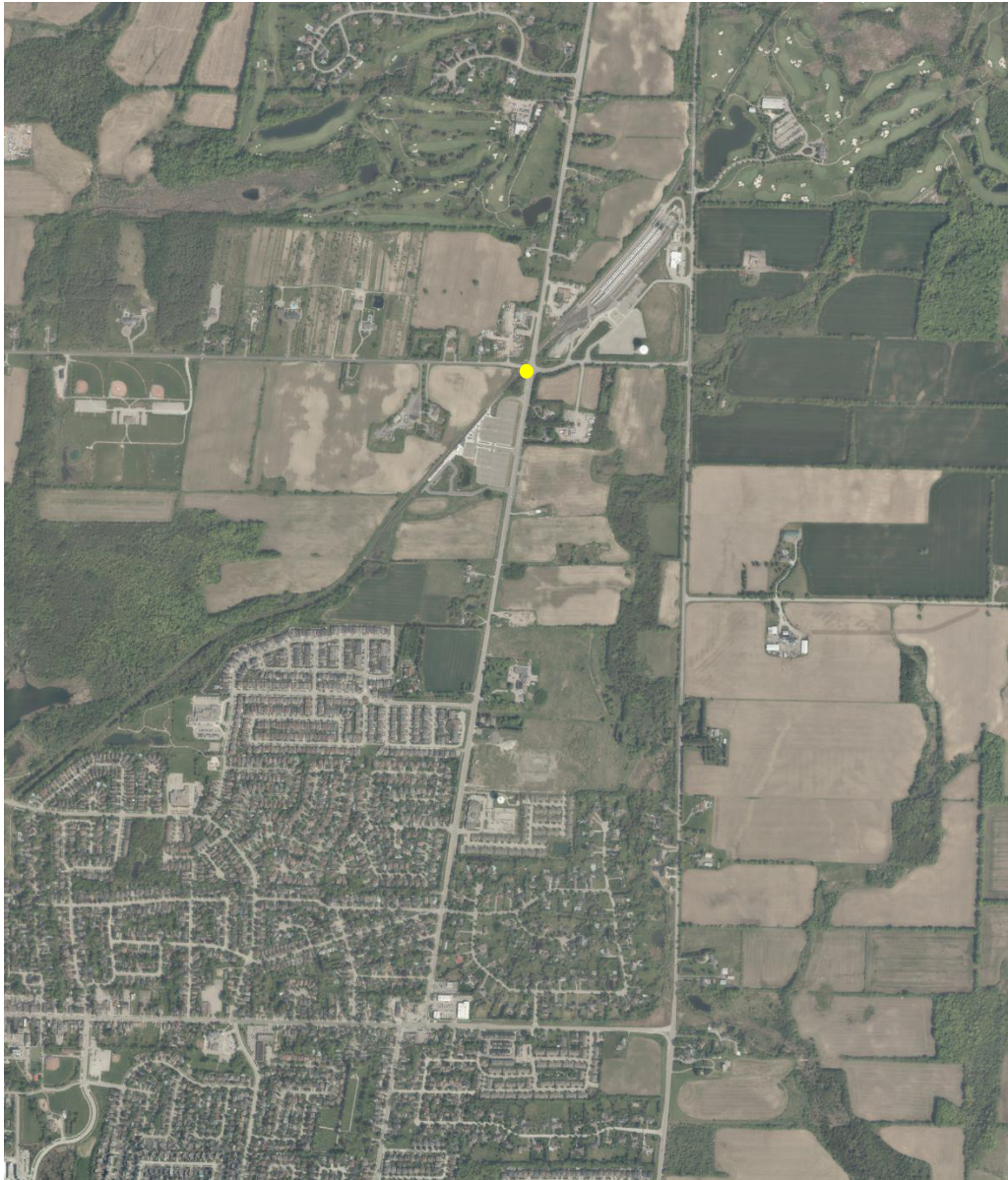
Location: Whitchurch-Stouffville, ON

Year: 2020

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road



Location: Whitchurch-Stouffville, ON

Year: 2024

Scale: Digital Orthoimagery

Source: York Region Imagery

Yellow Point: Intersection of Tenth Line and Bethesda Side Road

A vertical bar on the left side of the page with a gradient from light green at the top to dark blue at the bottom.

Appendix C: Photographic Record

Photo 1
Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2



Photograph taken facing upstream showing a riffle mostly composed of gravel, sand, and clay/silt.

Photo 2
Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2



Photograph of fallen trees that caused a woody debris jam (which was a common occurrence throughout **Reach RCT2**) over a cobble-dominated riffle.

Photo 3

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2

Undercuts (ranging from 0.16 to 0.32 m deep) were present throughout **Reach RCT2**. Basal scour was present in 60-100% of the reach. Exposed roots were common.

Photo 4

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2

One riffle-pool sequence occurred along the reach that was 6.9 m in length, though riffles and pools were both relatively common. Yellow arrow indicates a riffle, orange circle indicates a pool. Note the leaning trees, which were a common occurrence along the reach.

Photo 5
Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2



A knickpoint/woody debris jam was augmented by anthropogenic materials such as plywood (indicated by the arrow).

Photo 6
Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2



Photograph taken at the upstream extent of **Reach RCT2** of a culvert crossing in disrepair. Debris from the crossing and large cobbles were present downstream.

Photo 7

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT2



Photograph taken facing upstream along the section of reach within 12811 Tenth Line. Some woody debris was present in-stream, and basal scour was minimal through the upstream extent of the reach.

Photo 8

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT3



Photo of **Reach RCT3** facing upstream. The reach was frozen at the time of assessment. A minor woody debris jam/knickpoint is denoted by the arrow. Note the leaning trees.

Photo 9

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT3

The riparian vegetation along **Reach RCT3** was mostly comprised of trees. Woody debris density was moderate, and leaning trees were common.

Photo 10

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT3

Reach RCT3 had low sinuosity and irregular meanders. Basal scour (indicated by the steep banks on the outside of the meander) was visible in 30-60% of the reach.

Photo 11

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT3

Reach RCT3 was partially confined along the right bank. The slope substrate was primarily composed of clay and silt with minor sand.

Photo 12

Reesor Creek Tributary, Whitchurch-Stouffville
Reach RCT3

Photograph of valley wall contact along the right bank of the stream. The slope was gentle and heavily treed.

A vertical bar on the left side of the page with a gradient from light green at the top to dark blue at the bottom.

Appendix D: Rapid Assessment Field Sheets

General Site Characteristics

Project Number: 25156

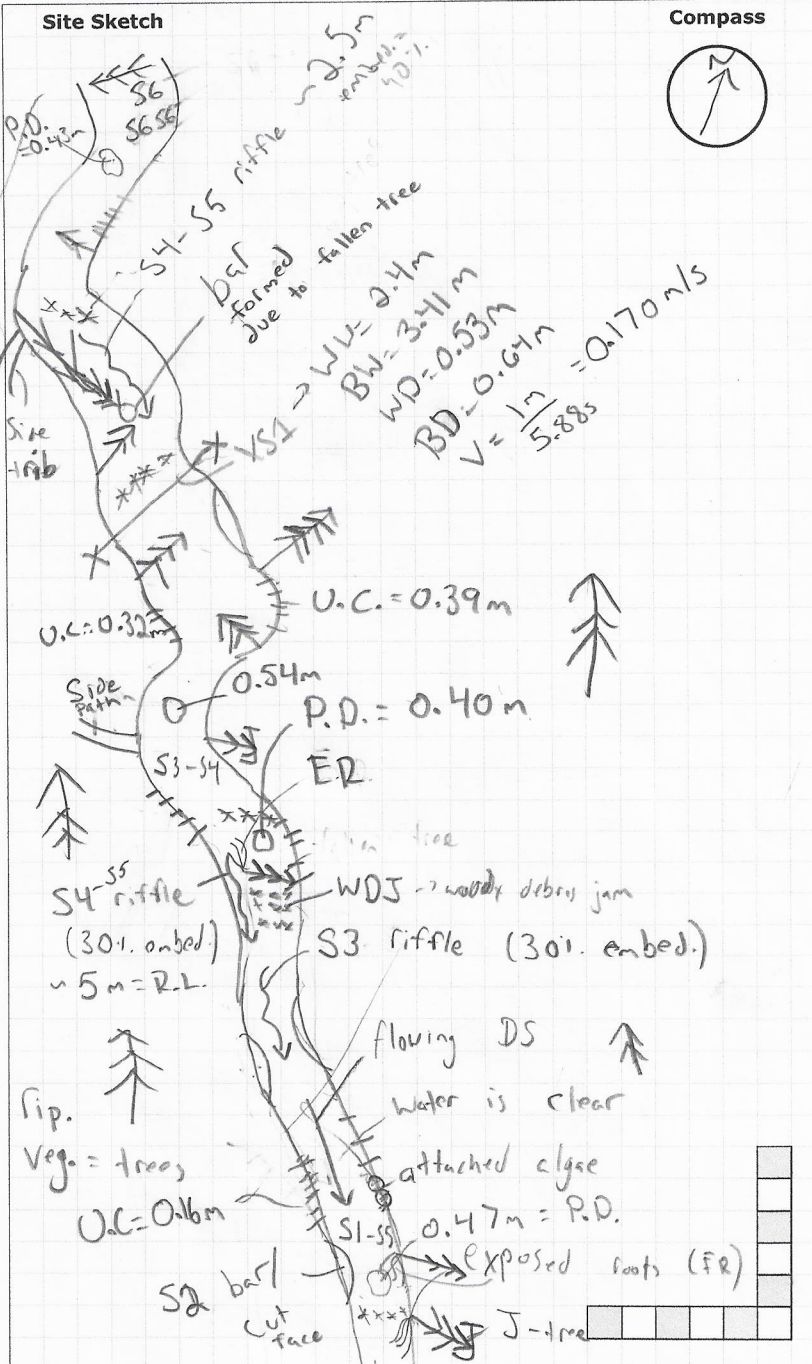
Date:	2025-11-07	Stream:	Reesor Creek
Time:	09:20	Reach:	RCT2
Weather:	Rain 11°C	Location:	Whitchurch-Stouffville, ON
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	
Undercut bank	
Bank stabilization	Additional Symbols
Leaning tree	ER
Fence	J-tree
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	

Flow Type	
H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

Substrate	
S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other	
BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point



Photos:

Notes:

General Site Characteristics

Project Number: 25156

Date:	2025-11-07	Stream:	Reesor Creek
Time:	09:20	Reach:	RCT2
Weather:	Rain, 11°C	Location:	Whitchurch-Stouffville, ON
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	
Undercut bank	
Bank stabilization	
Leaning tree	
Fence	
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	

Additional Symbols

$\pi = ER$

$\Rightarrow J = J + tree$

Flow Type

H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

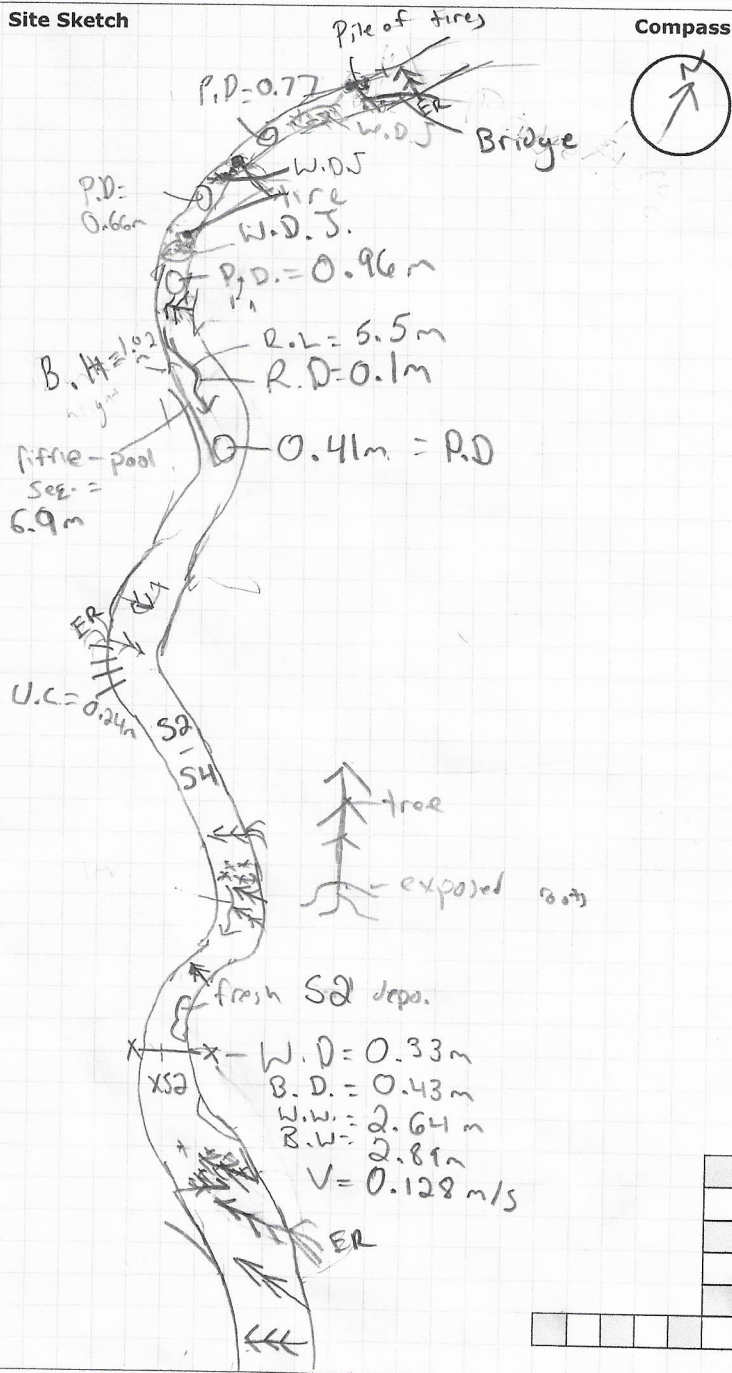
Substrate

S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other

BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point

Site Sketch



Photos:

Notes: Continued from father, tree

General Site Characteristics

Project Number: 25156

Date:	2025-11-07	Stream:	Reesor Creek
Time:	09:20	Reach:	RCT2
Weather:	Rain, 11°C	Location:	Whitchurch-Stouffville, ON
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Features	Monitoring
Reach break	Long-profile
Station location	Monumented XS
Cross-section	Monumented photo
Flow direction	Monumented photo direction
Riffle	Sediment sampling
Pool	Erosion pins
Sediment bar	Scour chains
Eroded bank/slope	
Undercut bank	
Bank stabilization	
Leaning tree	
Fence	
Culvert/outfall	
Swamp/wetland	
Grasses	
Tree	
Instream log/tree	
Woody debris	
Beaver dam	
Vegetated island	

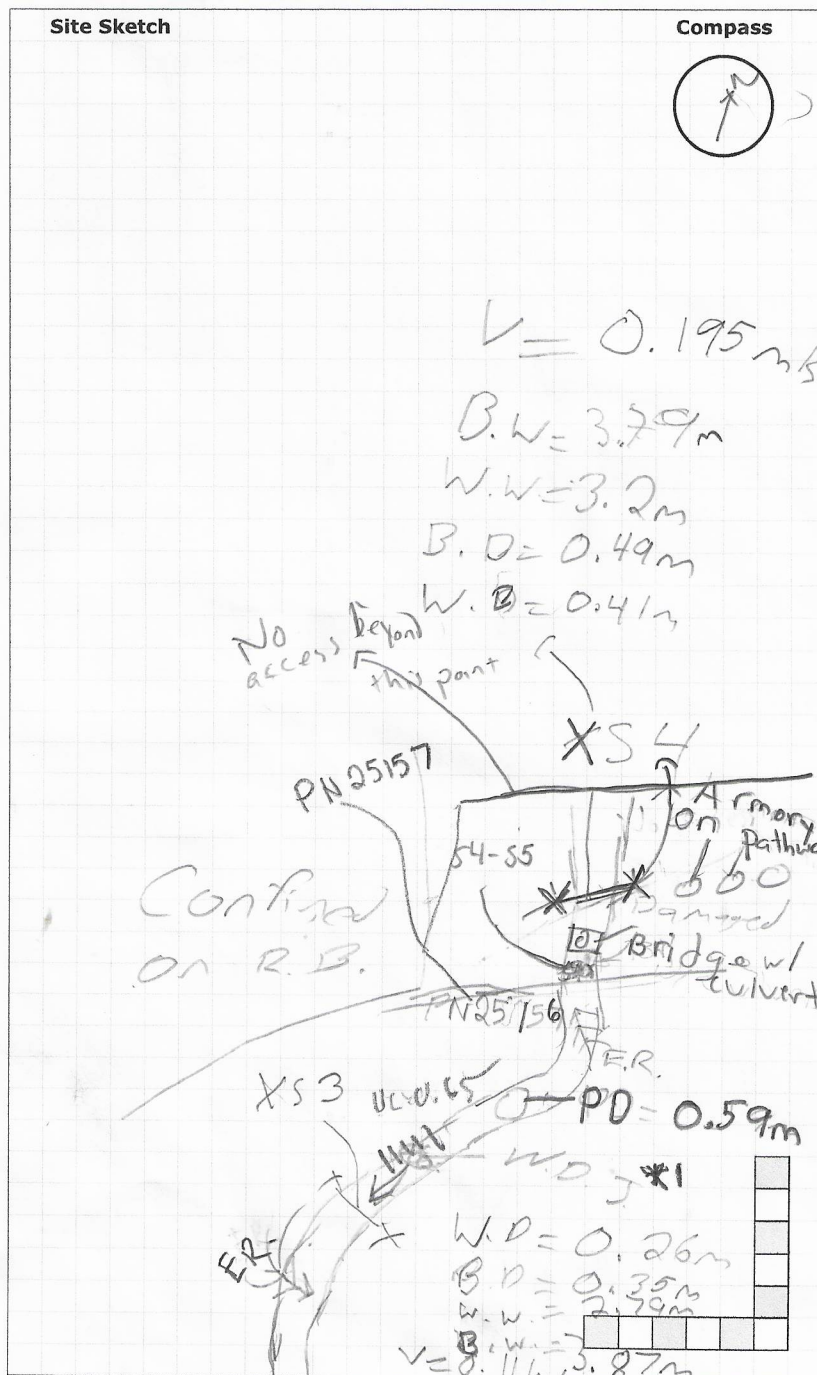
Additional Symbols

= ER

= J-tree

Site Sketch

Compass



Photos:

Notes: #1 2025-12-22 NBS JS returned

Flow Type	
H1 Standing water	H1A Back water
H2 Scarcely perceptible flow	
H3 Smooth surface flow	
H4 Upwelling	
H5 Rippled	
H6 Unbroken standing wave	
H7 Broken standing wave	
H8 Chute	
H9 Free fall	H9A Dissipates below free fall

Substrate	
S1 Silt	S6 Small boulder
S2 Sand	S7 Large boulder
S3 Gravel	S8 Bimodal
S4 Small cobble	S9 Bedrock/till
S5 Large cobble	

Other	
BM Benchmark	EP Erosion pin
BS Backsight	RB Rebar
DS Downstream	US Upstream
WDJ Woody debris jam	TR Terrace
VWC Valley wall contact	FC Flood chute
BOS Bottom of slope	FP Flood plain
TOS Top of slope	KP Knick point

to investigate pass. WDS / top. Anthrop. debris (wood planks & sticks) creates a small WDS / top. Pool depth = 0.50. Water top to' lower top = 0.18m

Reach Characteristics

Project Number: 25156

Date:	2025-11-07	Field Staff:	NBS JS	Watershed/Subwatershed:	West Number River
Time:	09:00	Stream:	Reesor Creek	UTM (Upstream):	
Weather:	Rain, 11°C	Reach:	RCJ2	UTM (Downstream):	

Land Use (Table 1)	1/3	Valley Type (Table 2)	3	Channel Type (Table 3)	7	Channel Zone (Table 4)	2	Flow Type (Table 5)	1	☐ Evidence of Groundwater Location: _____ Photo: _____
-----------------------	-----	--------------------------	---	---------------------------	---	---------------------------	---	------------------------	---	---

Riparian Vegetation			
Dominant Type (Table 6)	1	Coverage	Channel Widths
Encroachment (Table 7)	1	☐ None ☐ Fragmented ☒ Continuous	☐ 1 - 4 ☒ 4 - 10 ☐ > 10
		Age (yrs) ☐ Immature (<5) ☐ Established (5-30) ☒ Mature (>30)	

Aquatic & Instream Vegetation			
Type (Table 8)	6	Woody Debris	WD Density
Reach Coverage %	10	☒ In Cutbank ☒ In Channel ☐ Not Present	☐ Low ☐ Mod ☒ High

Water Quality	
Odour (Table 16)	Turbidity (Table 17)
1	1

Channel Characteristics

Sinuosity Type (Table 9)	2	Sinuosity Degree (Table 10)	3	Bank Angle	Bank Erosion (Table 19)	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Gradient (Table 11)	1	# of Channels (Table 12)	1	☐ 0 - 30 ☒ 30 - 60 ☒ 60 - 90 ☐ Undercut	☐ < 5% ☒ 5 - 30% ☐ 30 - 60% ☒ 60 - 100%	☒	☒	☒	☒	☐	☐	☐
Entrenchment (Table 13)	1	Bank Failure (Table 14)	1/2	Runs Bed (if no riffle-pool morphology)		☒	☒	☒	☒	☒	☐	☐
Down's Model (Table 15)	E	Bankfull Indicators (Table 18)	3/5/7	Bankfull Width (m)	3.41	2.89	3.87	Wetted Width (m)	2.4	2.64	2.79	
Sed Sorting (Table 20)	PS	Sediment Transport Observed? ☐ Yes ☒ No ☐ Not Visible		Bankfull Depth (m)	0.64	0.43	0.35	Wetted Depth (m)	0.53	0.33	0.26	
Transport Mode (Table 21)	1-3	% of Bed Active	0	Undercuts (m)	0.32	0.16	0.24	Velocity (m/s)	0.176	0.128	0.111	
Geomorphic Units (Table 22)	5-8	Mass Movement (Table 23)		Pool Depth (m)	0.47	0.66	0.77	Velocity Estimate Method	WB	WB	WB	
Riffle-Pool Spacing (m):	6.9	% Riffles:	15	% Pools:	30	Riffle Length (m)	5	2.5	5.5	Meander Amplitude (m)		

Notes:

Photos:

Rapid Geomorphic Assessment

Project Number: 25156

Date:	2025-11-07	Stream:	Reesor Creek
Time:	09:20	Reach:	RCT2
Weather:	Rain, 11°C	Location:	Whitchurch-Stouffville, ON
Field Staff:	NBS SS	Watershed/Subwatershed:	West Humber River

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		X	3 7
	2	Coarse materials in riffles embedded	X		
	3	Siltation in pools		X	
	4	Medial bars		X	
	5	Accretion on point bars	X		
	6	Poor longitudinal sorting of bed materials	X		
	7	Deposition in the overbank zone		X	
Sum of indices =			3	4	0.43
Evidence of Degradation (DI)	1	Exposed bridge footing(s)		X	0 6
	2	Exposed sanitary / storm sewer / pipeline / etc.			
	3	Elevated storm sewer outfall(s)			
	4	Undermined gabion baskets / concrete aprons / etc.			
	5	Scour pools downstream of culverts / storm sewer outlets			
	6	Cut face on bar forms → only once		X	
	7	Head cutting due to knickpoint migration		X	
	8	Terrace cut through older bar material		X	
	9	Suspended armour layer visible in bank		X	
	10	Channel worn into undisturbed overburden / bedrock		X	
Sum of indices =			0	6	0
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	X		6 7
	2	Occurrence of large organic debris	X		
	3	Exposed tree roots	X		
	4	Basal scour on inside meander bends	X		
	5	Basal scour on both sides of channel through riffle	X		
	6	Outflanked gabion baskets / concrete walls / etc.			
	7	Length of basal scour > 50% through subject reach	X		
	8	Exposed length of previously buried pipe / cable / etc.			
	9	Fracture lines along top of bank		X	
	10	Exposed building foundation			
Sum of indices =			6	1	0.86
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		X	1 7
	2	Single thread channel to multiple channel		X	
	3	Evolution of pool-riffle form to low bed relief form		X	
	4	Cut-off channel(s)		X	
	5	Formation of island(s)		X	
	6	Thalweg alignment out of phase with meander form		X	
	7	Bar forms poorly formed / reworked / removed	X		
Sum of indices =			1	6	0.14

Notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.3575

In Regime	In Transition/Stress	In Adjustment
☐ 0.00 - 0.20	☒ 0.21 - 0.40	☐ 0.41

Rapid Stream Assessment Technique

Project Number: 25156

Date:	2025-11-07	Stream:	Reesor Creek
Time:	09:20	Reach:	RCT2
Weather:	Rain, 11°C	Location:	Whitchurch-Stouffville, ON
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Category	Poor	Fair	Good	Excellent
Channel Stability	< 50% of bank network stable - Recent bank sloughing, slumping or failure frequently observed	50-70% of bank network stable - Recent signs of bank sloughing, slumping or failure fairly common	71-80% of bank network stable - Infrequent signs of bank sloughing, slumping or failure	> 80% of bank network stable - No evidence of bank sloughing, slumping or failure
	- Stream bend areas highly unstable - Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) - Bank overhang > 0.8-1.0 m	- Stream bend areas unstable - Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) - Bank overhang 0.8-0.9m	- Stream bend areas stable - Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) - Bank overhang 0.6-0.8 m	- Stream bend areas very stable - Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) - Bank overhang < 0.6 m
	- Young exposed tree roots abundant > 6 recent large tree falls per stream mile	- Young exposed tree roots common 4-5 recent large tree falls per stream mile	- Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile	- Exposed tree roots old, large and woody - Generally 0-1 recent large tree falls per stream mile
	- Bottom 1/3 of bank is highly erodible material - Plant/soil matrix severely compromised	- Bottom 1/3 of bank is generally highly erodible material - Plant/soil matrix compromised	Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	Channel cross-section is generally trapezoidally-shaped	Channel cross-section is generally trapezoidally-shaped	Channel cross-section is generally V- or U-shaped	Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11
Channel Scouring/ Sediment Deposition	> 75% embedded (> 85% embedded for large mainstem areas)	50-75% embedded (60-85% embedded for large mainstem areas)	25-49% embedded (35-59% embedded for large mainstem areas)	Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	- Few, if any, deep pools - Pool substrate composition >81% sand-silt	- Low to moderate number of deep pools - Pool substrate composition 60-80% sand-silt	- Moderate number of deep pools - Pool substrate composition 30-59% sand-silt	- High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) - Pool substrate composition < 30% sand-silt
	Streambed streak marks and/or "banana"-shaped sediment deposits common	Streambed streak marks and/or "banana"-shaped sediment deposits common	Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	Streambed streak marks and/or "banana"-shaped sediment deposits absent
	- Fresh, large sand deposits very common in channel - Moderate to heavy sand deposition along major portion of overbank area	- Fresh, large sand deposits common in channel - Small localized areas of fresh sand deposits along top of low banks	- Fresh, large sand deposits uncommon in channel - Small localized areas of fresh sand deposits along top of low banks	- Fresh, large sand deposits rare or absent from channel - No evidence of fresh sediment deposition on overbank
	Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	Point bars common, moderate to large and unstable with high amount of fresh sand	Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Date:	2025-11-07		PN:	25156		Location:	Whitchurch Stouffville, ON				
Category	Poor	Fair	Good	Excellent							
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)							
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. • Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)							
	• Riffle substrate composition: predominantly gravel with high amount of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble							
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas							
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure							
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement							
	• Riffle/Pool ratio 0.49:1 ; ≥1.51:1	• Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1							
	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C							
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☒ 6	☐ 7 ☐ 8							
Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)							
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L							
	• Objects visible to depth < 0.15m below surface	• Objects visible to depth 0.15-0.5m below surface	• Objects visible to depth 0.5-1.0m below surface	• Objects visible to depth > 1.0m below surface							
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour							
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8							
Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks							
	• Canopy coverage: <50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: >80% shading (> 60% for large mainstem areas)							
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7							
Total overall score (0-42) =		29		Poor (<13)		Fair (13-24)		Good (25-34)		Excellent (>35)	

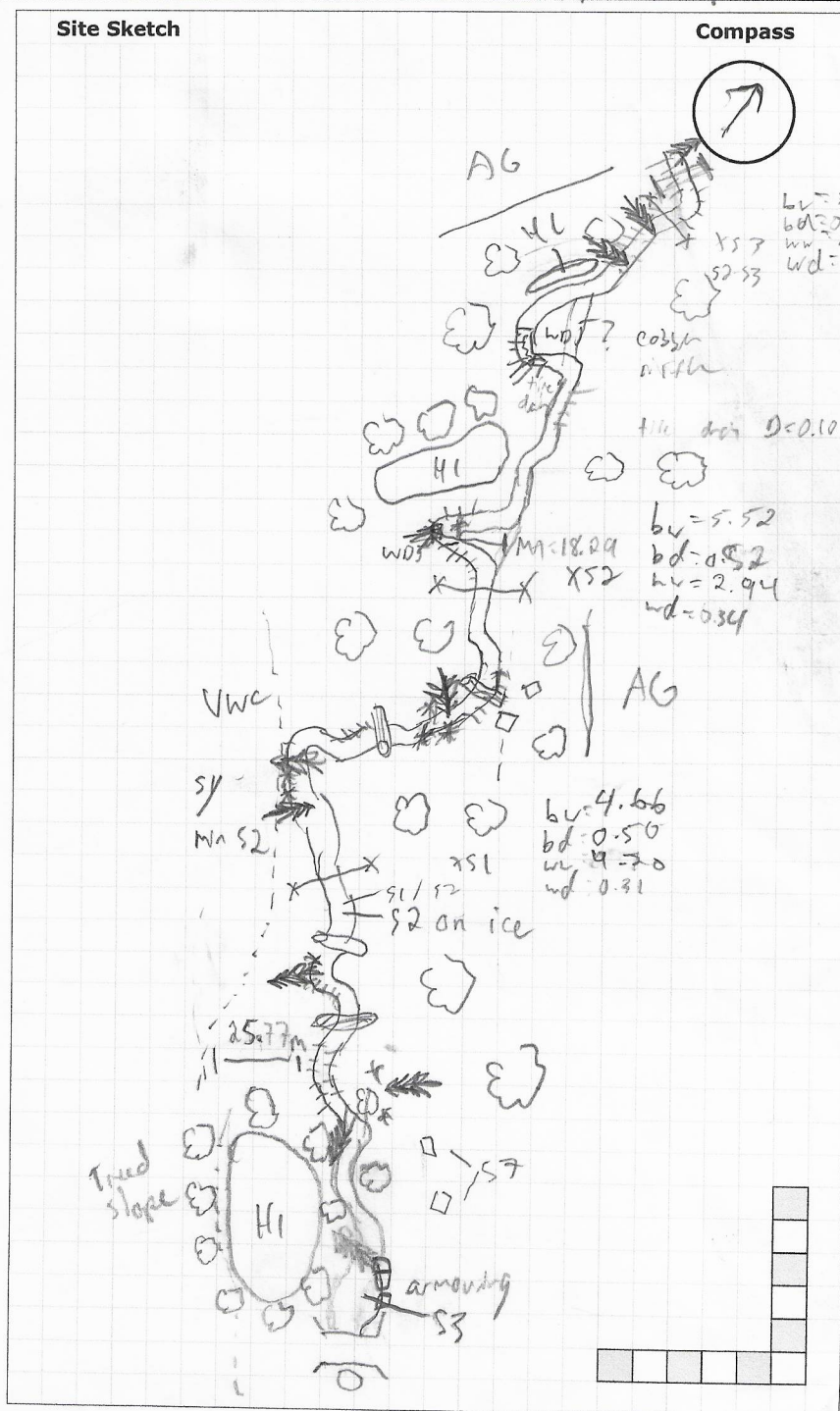
Date:	2025-12-22	Stream:	Reaser Creek
Time:	9:42	Reach:	RCT3
Weather:	Sunny & Cloud	Location:	Whit Church - stone falls
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Features	Monitoring
 Reach break	 Long-profile
 Station location	 Monumented XS
 Cross-section	 Monumented photo
 Flow direction	 Monumented photo direction
 Riffle	 Sediment sampling
 Pool	 Erosion pins
 Sediment bar	 Scour chains
 Eroded bank/slope	
 Undercut bank	Additional Symbols
 Bank stabilization	
 Leaning tree	
 Fence	
 Culvert/outfall	
 Swamp/wetland	
 Grasses	
 Tree	
 Instream log/tree	
 Woody debris	
 Beaver dam	
 Vegetated island	

Flow Type	
H1	Standing water H1A Back water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall H9A Dissipates below free fall

Substrate	
S1	Silt
S2	Sand
S3	Gravel
S4	Small cobble
S5	Large cobble
S6	Small boulder
S7	Large boulder
S8	Bimodal
S9	Bedrock/till

Other			
BM	Benchmark	EP	Erosion pin
BS	Backsight	RB	Rebar
DS	Downstream	US	Upstream
WDJ	Woody debris jam	TR	Terrace
VWC	Valley wall contact	FC	Flood chute
BOS	Bottom of slope	FP	Flood plain
TOS	Top of slope	KP	Knick point

**Photos:**

Notes: Berm btm WC & Pond

Reach Characteristics Project Number: 25157

Date:	2025-12-22	Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River
Time:	9:42	Stream:	Reesor Creek	UTM (Upstream):	
Weather:	Sun & Cloud	Reach:	RCT3	UTM (Downstream):	

Land Use (Table 1)	1/3	Valley Type (Table 2)	3	Channel Type (Table 3)	7	Channel Zone (Table 4)	2	Flow Type (Table 5)	1	☐ Evidence of Groundwater Location: _____ Photo: _____
-----------------------	-----	--------------------------	---	---------------------------	---	---------------------------	---	------------------------	---	---

Riparian Vegetation

Dominant Type (Table 6)	1/4	Coverage	Channel Widths	Age (yrs)
Encroachment (Table 7)	1	☐ None ☐ Fragmented ☒ Continuous	☐ 1 - 4 ☒ 4 - 10 ☐ > 10	☐ Immature (<5) ☒ Established (5-30) ☒ Mature (>30)

Aquatic & Instream Vegetation

Type (Table 8)	☒	Woody Debris	WD Density	WDJ/50m:
Reach Coverage %	5	☐ In Cutbank ☐ In Channel ☐ Not Present	☐ Low ☒ Mod ☐ High	51

Water Quality

Odour (Table 16)	1	Turbidity (Table 17)	1
---------------------	---	-------------------------	---

Channel Characteristics

Sinuosity Type (Table 9)	2	Sinuosity Degree (Table 10)	1-2	Bank Angle	Bank Erosion	(Table 19)	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Gradient (Table 11)	1	# of Channels (Table 12)	1	☐ 0 - 30 ☒ 30 - 60 ☒ 60 - 90 ☐ Undercut	☐ < 5% ☐ 5 - 30% ☒ 30 - 60% ☐ 60 - 100%	Bank Riffle Pool Bed (if no riffle-pool morphology)	☒ ☐ ☐ ☒	☒ ☐ ☐ ☒	☐ ☒ ☐ ☒	☐ ☒ ☐ ☒	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Entrenchment (Table 13)	1	Bank Failure (Table 14)	1										
Down's Model (Table 15)	E	Bankfull Indicators (Table 18)	3		Bankfull Width (m)	4.66	5.52	3.41	Wetted Width (m)	4.20	2.94	2.75	
*Bed Sorting (Table 20)	MS-PS	Sediment Transport Observed?	☐ Yes ☒ No ☐ Not Visible		Bankfull Depth (m)	0.50	0.52	0.51	Wetted Depth (m)	0.31	0.34	0.36	
Transport Mode (Table 21)	1-3	% of Bed Active	0		Undercuts (m)	/	/	/	Velocity (m/s)	/	/	/	
*Geomorphic Units (Table 22)	G/8	Mass Movement (Table 23)	N/A		Pool Depth (m)	/	/	/	Velocity Estimate Method	/	/	/	
Riffle-Pool Spacing (m):	N/A	*% Riffles:	/	*% Pools:	/	/	/	/	Meander Amplitude (m)	18.79	/	/	

Notes: Reach was mostly frozen. Unable to observe bed for majority of reach.

Photos:

Rapid Geomorphic Assessment

Project Number: 25157

Date:	2025-12-24	Stream:	Reaser Creek
Time:	9:42	Reach:	R1C3
Weather:	sun & cloud	Location:	Whitchurch-Stouffville
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Process	Geomorphological Indicator		Present?		Factor Value
	No.	Description	Yes	No	
Evidence of Aggradation (AI)	1	Lobate bar		/	2/3
	2	Coarse materials in riffles embedded N/A			
	3	Siltation in pools	/		
	4	Medial bars N/A			
	5	Accretion on point bars N/A			
	6	Poor longitudinal sorting of bed materials	/		
	7	Deposition in the overbank zone N/A			
Sum of indices =			0	1	0.67

Evidence of Degradation (DI)	1	Exposed bridge footing(s)		/	9/5
	2	Exposed sanitary / storm sewer / pipeline / etc. N/A			
	3	Elevated storm sewer outfall(s) N/A			
	4	Undermined gabion baskets / concrete aprons / etc. N/A			
	5	Scour pools downstream of culverts / storm sewer outlets N/A			
	6	Cut face on bar forms N/A			
	7	Head cutting due to knickpoint migration		/	
	8	Terrace cut through older bar material		/	
	9	Suspended armour layer visible in bank		/	
	10	Channel worn into undisturbed overburden / bedrock		/	
Sum of indices =			0	5	0

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.	/		3/7
	2	Occurrence of large organic debris	/		
	3	Exposed tree roots	/		
	4	Basal scour on inside meander bends		/	
	5	Basal scour on both sides of channel through riffle		/	
	6	Outflanked gabion baskets / concrete walls / etc. N/A		/	
	7	Length of basal scour >50% through subject reach		/	
	8	Exposed length of previously buried pipe / cable / etc. N/A		/	
	9	Fracture lines along top of bank		/	
	10	Exposed building foundation N/A		/	
Sum of indices =			3	3	0.43

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)	/		1/6
	2	Single thread channel to multiple channel		/	
	3	Evolution of pool-riffle form to low bed relief form		/	
	4	Cut-off channel(s)		/	
	5	Formation of island(s)		/	
	6	Thalweg alignment out of phase with meander form		/	
	7	Bar forms poorly formed / reworked / removed N/A		/	
Sum of indices =			1	5	0.167

Notes: Reach from & snail count.

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.32

In Regime	In Transition/Stress	In Adjustment
☐ 0.00 - 0.20	☒ 0.21 - 0.40	☐ 0.41

Rapid Stream Assessment Technique Project Number: 25157

Date:	2025-12-22	Stream:	Reese Creek
Time:	9:42	Reach:	BCTB
Weather:	Sun & cloud	Location:	Whitelych - Staffville
Field Staff:	NBS JS	Watershed/Subwatershed:	West Humber River

Category	Poor	Fair	Good	Excellent
Channel Stability	< 50% of bank network stable - Recent bank sloughing, slumping or failure frequently observed - Stream bend areas highly unstable - Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) - Bank overhang > 0.8-1.0 m - Young exposed tree roots abundant > 6 recent large tree falls per stream mile - Bottom 1/3 of bank is highly erodible material - Plant/soil matrix severely compromised - Channel cross-section is generally trapezoidally-shaped	50-70% of bank network stable - Recent signs of bank sloughing, slumping or failure fairly common - Stream bend areas unstable - Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) - Bank overhang 0.8-0.9m - Young exposed tree roots common 4-5 recent large tree falls per stream mile - Bottom 1/3 of bank is generally highly erodible material - Plant/soil matrix compromised - Channel cross-section is generally trapezoidally-shaped	71-80% of bank network stable - Infrequent signs of bank sloughing, slumping or failure - Stream bend areas stable - Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) - Bank overhang 0.6-0.8 m - Exposed tree roots predominantly old and large, smaller young roots scarce 2-3 recent large tree falls per stream mile - Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material - Channel cross-section is generally V- or U-shaped	> 80% of bank network stable - No evidence of bank sloughing, slumping or failure - Stream bend areas very stable - Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) - Bank overhang < 0.6 m - Exposed tree roots old, large and woody - Generally 0-1 recent large tree falls per stream mile - Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material - Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☒ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11
Channel Scouring/ Sediment Deposition	> 75% embedded (> 85% embedded for large mainstem areas) - Few, if any, deep pools - Pool substrate composition >81% sand-silt - Streambed streak marks and/or "banana"-shaped sediment deposits common - Fresh, large sand deposits very common in channel - Moderate to heavy sand deposition along major portion of overbank area - Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	50-75% embedded (60-85% embedded for large mainstem areas) - Low to moderate number of deep pools - Pool substrate composition 60-80% sand-silt - Streambed streak marks and/or "banana"-shaped sediment deposits common - Fresh, large sand deposits common in channel - Small localized areas of fresh sand deposits along top of low banks - Point bars common, moderate to large and unstable with high amount of fresh sand	25-49% embedded (35-59% embedded for large mainstem areas) - Moderate number of deep pools - Pool substrate composition 30-59% sand-silt - Streambed streak marks and/or "banana"-shaped sediment deposits uncommon - Fresh, large sand deposits uncommon in channel - Small localized areas of fresh sand deposits along top of low banks - Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	- Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas) - High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) - Pool substrate composition <30% sand-silt - Streambed streak marks and/or "banana"-shaped sediment deposits absent - Fresh, large sand deposits rare or absent from channel - No evidence of fresh sediment deposition on overbank - Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☒ 7 ☐ 8

Version #2

Last edited: 10/02/2023

Senior staff sign-off (if required): _____ Checked by: SSO Completed by: NBS

Date: 2025-12-22		PN: 25157		Location: Witschuch - S4064ville	
Category	Poor	Fair	Good	Excellent	
Physical Instream Habitat	Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)	
	Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	Few pools present, riffles and runs dominant. Velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	Good mix between riffles, runs and pools. Relatively diverse velocity and depth of flow	Riffles, runs and pool habitat present. Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)	
	Riffle substrate composition: predominantly gravel with high amount of sand < 5% cobble	Riffle substrate composition: predominantly small cobble, gravel and sand 5-24% cobble	Riffle substrate composition: good mix of gravel, cobble, and rubble material 25-49% cobble	Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand > 50% cobble	
	Riffle depth < 10 cm for large mainstem areas	Riffle depth 10-15 cm for large mainstem areas	Riffle depth 15-20 cm for large mainstem areas	Riffle depth > 20 cm for large mainstem areas	
	Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure	
	Extensive channel alteration and/or point bar formation/enlargement	Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	No channel alteration or significant point bar formation/enlargement	
	Riffle/Pool ratio 0.49:1 ; ≥1.51:1	Riffle/Pool ratio 0.5-0.69:1 ; 1.31-1.5:1	Riffle/Pool ratio 0.7-0.89:1 ; 1.11-1.3:1	Riffle/Pool ratio 0.9-1.1:1	
	Summer afternoon water temperature > 27°C	Summer afternoon water temperature 24-27°C	Summer afternoon water temperature 20-24°C	Summer afternoon water temperature < 20°C	
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☒ 7 ☐ 8	
Water Quality	Substrate fouling level: High (> 50%)	Substrate fouling level: Moderate (21-50%)	Substrate fouling level: Very light (11-20%)	Substrate fouling level: Rock underside (0-10%)	
	Brown colour	Grey colour	Slightly grey colour	Clear flow	
	TDS: > 150 mg/L	TDS: 101-150 mg/L	TDS: 50-100 mg/L	TDS: < 50 mg/L	
	Objects visible to depth < 0.15m below surface	Objects visible to depth 0.15-0.5m below surface	Objects visible to depth 0.5-1.0m below surface	Objects visible to depth > 1.0m below surface	
	Moderate to strong organic odour	Slight to moderate organic odour	Slight organic odour	No odour	
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☒ 8	
Riparian Habitat Conditions	Narrow riparian area of mostly non-woody vegetation	Riparian area predominantly wooded but with major localized gaps	Forested buffer generally > 31 m wide along major portion of both banks	Wide (> 60 m) mature forested buffer along both banks	
	Canopy coverage: < 50% shading (30% for large mainstem areas)	Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	Canopy coverage: > 80% shading (> 60% for large mainstem areas)	
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☒ 6 ☐ 7	
Total overall score (0-42) = 33		Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)