

Technical Memorandum

Date: March 4, 2019

Project #: 15881

To: Steve Burke, Town of Halton Hills

From: Dirk Janas & Michael Brierley

cc: Robin McKillop

Re: Vision Georgetown – Tributary C Realignment Alternative near 10512 8th Line

1. Introduction

Palmer Environmental Consulting Group Ltd. (PECG) has been involved in previous discussions with the Town of Halton Hills regarding the lower reaches of Tributary C (reaches C1 to C4) and the feasibility of realignment of C3. PECG has completed an additional assessment of these lower reaches to determine the potential for future realignment and refinement of the associated NHS corridor along reaches C3, C2 and C1. As part of this assessment, PECG has reviewed a memo completed by Wood (2019) entitled, *Review of Watercourse Constraint Ranking for Watercourse Reaches C-1 and C-2, Vision Georgetown Secondary Plan Area, Town of Halton Hills*, which includes a review of the catchment basin of reaches C1 and C2.

PECG has prepared a conceptual realignment of Reach C3 of Tributary C, within the Vision Georgetown Study Area, to create a naturalized environmental corridor and maintain Tributary C as an open channel from reach C4 to C1. This memorandum provides the results of our assessment. The potential for realignment will require engagement of Conservation Halton and the Regional Municipality of Halton.

2. Background

PECG has been retained on two separate occasions by the Town of Halton Hills to provide Fluvial Geomorphological guidance for the Vision Georgetown project. PECG was retained by the Town of Halton Hills to establish and/or refine the meander belt widths for seven reaches of Tributary A and Tributary C within the Vision Georgetown study area in order to inform development setback limits (PECG, 2018). The theoretical meander belts suggested for Tributary C were theoretical, conceptualized only in response to questions from Conservation Halton, but are not strictly applicable to such a drainage feature and thus should not dictate development setbacks. Following the completion of the Meander Belt Width Assessment for Tributary A and C, PECG was retained to complete a Peer Review (PECG, 2018) of the Geo Morphix Ltd. (2017) report, *Fluvial Geomorphological Assessment – Southwest Georgetown, Town of Halton*



Hills. For context and comparison, PEGG has also reviewed the Vision Georgetown Subwatershed Study completed for the Town of Halton Hills (AECOM, 2017). This background information has been used to inform the current assessment of proposed realignment of the C3 reach.

Appendix I of the Vision Georgetown Subwatershed Study (AECOM, May 2017) provides the Stream Characterization Tables. The aquatic habitat, vegetation, and linkage assessments, habitat classifications and drainage feature management recommendations for the lower reaches of Tributary C have been reviewed.

For the purposes of determining constraint rankings associated with flooding and conveyance characteristics of a watercourse, a contributing drainage area should typically be greater than 50 ha. As drainage features of this size are considered to have flooding hazards classified as medium or high, these watercourses are subject to regulation by Conservation Halton. Drainage features with catchments under 50 ha are classified as low constraint and not subject to regulation (Wood, 2019).

2.1 Tributary C

At the request of Conservation Halton, PEGG completed a cursory fluvial geomorphological assessment of Tributary C to establish the feasibility of creating an intermittent channel to replace a segment of drainage feature classified as a headwater drainage feature (HDF). As HDFs generally have smaller catchments, their flows are of insufficient frequency, magnitude and duration to fluvially erode and deposit sediments in a way that would form a sinuous planform.

Field reconnaissance for the PEGG geomorphological assessment was completed on March 13, 2018 to document and confirm field conditions in the Tributary C feature. During this assessment our geomorphologist walked the full length of the feature (reach C6 to C1). Within the Vision Georgetown property limits near 10512 8th Line, Georgetown, Ontario, Tributary C of Sixteen Mile Creek is considered to be an HDF, which flows intermittently following rain events and spring freshet. As part of the Vision Georgetown Subwatershed Study (AECOM, 2017), six (6) reaches along Tributary C were identified. The six reaches were classified as defined (discernible banks and bed) and undefined (no discernible banks and bed). Undefined reaches are within cultivated agriculture fields (reaches C3 and C5), and defined reaches are within woodlots or lawn vegetation (reaches C1, C2, C4 and C6).

Following is a summary of key considerations regarding HDF classification and constraints that were considered as part of the AECOM SWS (2017) for Tributary C and associated reaches:

- Tributary C is considered an HDF because it does not have permanently flowing water but does convey surface water periodically during the year, mainly during rainfall events.
- HDFs serve an important function to the overall watershed and need to be assessed prior to development to determine what existing functions need to be preserved
- The HDF assessment document provided by the Toronto Region Conservation Authority (TRCA 2014) and Credit Valley Conservation (CVC) considers several different aspects of function:
 - Hydrology – how frequently does the feature convey water? Does water remain in the feature during the driest time of the year?



- Riparian vegetation – what type of vegetation surrounds the feature? How extensive is it?
- Fish habitat – how do fish use this feature? Year round or seasonally? Although there is no habitat in the feature, it contributes sediment and nutrients to fish habitat located downstream.
- Terrestrial habitat and linkage – does the feature provide terrestrial habitat? Is the feature a wetland? Is the HDF corridor used by wildlife to move to different habitat types?
- An HDF is assessed on these separate categories to determine a final management recommendation, which guides how the feature can or cannot be altered as part of land development.
- HDFs are broken into different segments as part of the assessment based on changes to these different functions, such as different surrounding vegetation or differences in flow.
- Management recommendations must maintain consistency progressing in a downstream direction. If a segment requires a certain level of protection, all segments located downstream should be considered for equal or higher level of protection.
- Based on the AECOM (2017) reporting, the following characterization was determined for the segments of Tributary C as outlined in the Stream Characterization Tables in Appendix I (excerpt for Tributary C attached to memo) of the SWS report:
 - Reaches C3, C2, and C1 were all classified as “mitigation” by AECOM based on hydrology as the dominant function. These features convey flow intermittently or during spring melt.
 - Reach C4 was classified as “conservation” by AECOM based on riparian vegetation as the dominant function. The feature is contained within a cultural thicket, which is considered important vegetation. The feature also had defined channel dimensions, which is indicative of function.
 - Because reaches C3, C2, C1 are located downstream of reach C4, they should also be managed as “conservation” to maintain function progressing downstream.
 - Conservation management requires a feature to remain open on the landscape and it therefore cannot be piped.
- Tributary C reaches C1 and C2 are located within private property at 10512 8th Line:
 - While the “conservation” management allows features to be relocated, the feature must maintain the open connection to the immediate downstream segment.
 - Reach C1 must connect to the culvert located at 8th Line in order to connect to the downstream watercourse.

2.2 Description of Existing Channel Conditions along Reaches C4 to C1

Reaches C1 and C2 are within a private residential property. Reach C-1 is poorly-defined and flows through shrub and graminoid vegetation with mowed lawn to the edges. Standing water was present during the PEGG assessment in a wide, backwatered pool at the inlet of the 8th Line culvert. The wetted depth of the backwater pool was 0.20 m. Coarse gravel was observed on the bed near the inlet.

Reach C2 consists of a defined channel that has been cut through a maintained lawn. Measured wetted depths of reach C2 ranged from 0.05 to 0.15 m and wetted width ranged from 0.30 to 0.80 m. Bed material consisted of small pebbles and sand. Minor erosion was observed along the banks. There is a distinct



change in the vegetation cover between reaches C1 and C2 as shown in the attached Stream Reach Photos from Appendix F of the SWS.

Reach C3 is located in an agricultural field. No standing water or defined channel morphology was observed as shown in the attached Stream Reach Photos from Appendix F of the SWS. A general flow path could be inferred based on the surrounding topography but there were no indicators of recent flow.

Reach C4 is located along the outer edge of a woodlot and thicket (see attached photo). The downstream end of the reach is marked by a wide (3.0 to 4.0 m), poorly-defined area where water presumably pools after draining from the woodlot. Cobbles, likely placed in the channel following removal from the surrounding agricultural field, were locally present in the channel. The bankfull cross-section dimensions ranged from 2.50 to 5.0 m wide and 0.30 to 0.45 m deep. The reach was dry during the assessment; however, garlic mustard was growing along the margins of the feature, indicative of wet conditions. The reach becomes less defined progressing upstream and is undefined at the upstream end of the reach.

3. Tributary C Design Considerations

Tributary C is a heavily fragmented HDF providing limited habitat connectivity upstream of 8th Line. As highlighted previously (Section 2.2), the defined channels of reaches C1, C2 and C4 are separated by an undefined flow path, reach C3. Vision Georgetown Subwatershed Report (AECOM, 2017) classified reach C4 as “conservation”. This classification of reach C4 indicates that reaches C1, C2 and C3 should also be managed as “conservation” to maintain function progressing downstream as an “open feature”. A review and confirmation of watercourse constraints ranking for reaches C1 and C2 was completed by Wood (2019). The constraints review confirmed the classification of reaches C1 and C2 as “Low constraint” by AECOM (2017) based on the relatively small subwatershed (56.1 ha), frequent disturbance to watercourse (lawn maintained across reach C2 and adjacent to C1) and short length of defined channel (100 m). Wood concluded that Tributary C provides limited benefit to the flooding and conveyance systems. Therefore, the realignment of reach C3 to establish a defined channel and environmental corridor connecting reaches C4 with C1 and C2 would be considered an enhancement to preserve naturalized habitat within the Vision Georgetown Study Area along the lower reaches of Tributary C.

3.1 Channel Realignment Considerations

Several opportunities to enhance the fluvial geomorphological form and function of Reach C3 are worth considering:

- *New Channel Corridor (Figure 1)* – The construction of a defined environmental corridor would create a functional development setback and establish terrestrial and hydrological connectivity from C4 to C1. The length of open channel would increase from approximately 200 m to approximately 425 m. The new channel would be roughly centred along the 30 m-wide corridor. The proposed open channel corridor would establish a restoration and enhancement area of approximately 6,000 m² that would be part of the NHS.
- *Sinuous planform* – The construction of a defined channel along reach C3 would increase longitudinal habitat connectivity from C4 to C1. A more sinuous planform would increase the



channel length (decrease channel gradient) and provide for improved aquatic and terrestrial habitat functions. The channel would be approximately centered along the environmental corridor, with a buffer of approximately 15 m on either side. Based on an investigation of surrogate reaches within the Sixteen Mile Creek watershed, meandering channels are not common within similarly sized headwater subwatersheds. The establishment of a 30 m environmental corridor would provide ample space for minor lateral adjustments to occur over the 100-year planning horizon.

- *Defined Channel* – Reach C3 has an identifiable general flow pattern within a cultivated agricultural field with no defined channel morphology. The construction of a low flow channel with a width:depth ratio >10 and floodplain accessed during higher flow events would maintain a sustainable sediment transport regime within the new channel corridor, which would reduce instability. As well, the minor erosive potential would be evenly distributed across a defined flood-prone area within the greater Vision Georgetown study area.
- *Enhanced Channel Habitat* – The use of Natural Channel Design (NCD) principles would reinstate natural form and function to the undefined channel, with subdued pool and riffle sequences and/or pocket wetlands to provide habitat diversity. Riparian planting would increase the shear strength of the channel banks and provide habitat benefits through increased shading, shelter and allochthonous food sources.
- *Restoration and Enhancement Plan* – A detailed plan would be developed providing for the planting of native trees, shrubs and herbaceous plants along reach C3 in place of the current agricultural field conditions. This would provide enhance terrestrial and aquatic habitat and wildlife connectivity.

3.2 Additional Realignment Option

- *Realignment of reaches C1 and C2* – This realignment scenario is presented with an understanding of a pending Environmental Assessment along 8th Line. The relocation of reaches C1 and C2, and the culvert beneath 8th Line, would position Tributary C south of the 10512 8th Line private property, thereby creating one continuous reach from reach C4 to downstream of 8th Line. In addition, the relocation of reaches C1 and C2 would limit the continued vegetation management (mowed/maintained lawn under current conditions) along this section of the channel. This realignment scenario faces considerable constraints/challenges. For example, topography of the realignment area would require substantial cut and fill to achieve the desired channel grade. Further, vegetation removal from the coniferous woodlot along the eastern embankment of 8th Line would be required. Evaluating the feasibility of this option would require agency consultation.
- *Replacement of 8th Line Culvert* – Reach C1 currently pools at the inlet of the CSP culvert beneath 8th Line. A replacement culvert would restore connectivity by widening and constructing of a defined low flow channel along its bed to reconnect a fragmented HDF upstream of 8th Line, thereby improving hydrological connectivity and reducing backwater conditions. The replacement of the culvert would allow it to be sized to improve conveyance of flood flows beneath 8th Line, which are expected to be augmented by discharging stormwater management ponds.

The channel enhancement opportunities identified above would not only improve the fluvial geomorphological form and function of the lower reach of Tributary C but would also improve the ecological function of the channel corridor.



Figure 1: Plan view of the proposed realignment of reach C3, centered along a 30 m-wide environmental corridor contiguous with an existing woodlot.

References

- AECOM, 2017. Southwest Georgetown Subwatershed Study: VISION GEORGETOWN Subwatershed Strategy Report. Final Report. Submitted to: Town of Halton Hills.
- Geo Morphix Ltd., 2017. Fluvial Geomorphological Assessment. Southwest Georgetown, Town of Halton Hills. Submitted to: Southwest Georgetown Landowners Group, November 16, 2017
- Palmer Environmental Consulting Group Inc., 2018. Vision Georgetown – Meander Belt Assessment for Select Reaches of Tributary A and Tributary C. Submitted to: Town of Halton Hills.
- Palmer Environmental Consulting Group Inc., 2018. Vision Georgetown - Peer Review of Southwest Georgetown Landowners Group Private OPA Submission – Fluvial Geomorphological Assessment. Submitted to: Town of Halton Hills.

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GROUP INC.

Wood., 2019. Review of Watercourse Constraints Ranking for Watercourse Reaches 'C-1' and 'C-2', Vision Georgetown Secondary Plan Area, Town of Halton Hills. Submitted to: Town of Halton Hills

TRCA and CVC, 2014: Evaluation, Classification and Management of Headwater Drainage Features Guidelines.

Tributary C

Reach C-1

June 20, 2013

Ditch form choked with vegetation.



Reach C-1

June 20, 2013

Locally exposed bed and bank undercutting.



Reach C-2
June 20, 2013

Small defined channel
through residential
property.



Reach C-3
June 20, 2013

No defined channel –
agricultural field very
recently cultivated.



Appendix F - Stream Reaches Photo Log

Reach C-3
April 24, 2013

Evidence of flow observed within the field.



Reach C-4
June 20, 2013

Defined channel adjacent to woodlot.



Appendix I – Tributary C Headwater Summary Table

Drainage Feature	Date of Field Work (date, weather, protocol used, surveyors etc.)	Soils		Flow Assessment		Aquatic Habitat Assessment		Vegetation/Wetland Assessment		Linkage		Channel Form			Channel Conditions		Habitat Classifications (Based on fish habitat and flow characteristics)	Drainage Feature Management Recommendations	Notes
		Catchment Size (km ²)	Surface Flows	Groundwater Flows	Attributes/Species/Abundance/Size	Life Cycle and Habitat Functions	Riparian	In-stream	Connections (up and downstream reaches)	Functions	Width (m)	Depth (m)	Bank slope (degrees)	Average channel slope (degrees)	Bed Form	Stability/channel condition			
Tributary C	Geomorph: 6/20/2013 Sunny 16°C	C-1: 0.706	C1: Intermittent	C1 (northeast of 8 th Line): downward	C1: Flow and nutrient conveyance	C1: Provides contribution to habitat	C1: Maintained lawn and tall grasses	C1: Trees, shrubs, and tall grasses	No significant connections for aquatic species or wildlife	-	-	-	C-1: 2.09	Poorly defined: C1	C-1: Poorly defined	surface runoff from agricultural field	C1, C3, C5: Simple contributing habitat	C1, C3, C5: Mitigation 2 (2009) Mitigation (2013)	- standing water at 8 th line culvert
	Reaches: 16°C	C-3: 0.407	C3: Ephemeral	hydraulic gradient at piezometer; groundwater flows not inferred.	C3: Flow conveyance	C3: Contribute flow to habitat downstream	C3: Cultivated field	C3: Cultivated field	Connection to floodplain depressions and downstream transport	-	-	-	C-3: 0.94	Not defined: C3, C5	Channel occupies topographic low point in landscape and is poorly defined or not defined.				
	C-5	C-5: 0.149	C5: Ephemeral	C1: Groundwater sheen observed	C5: None	C5: Contribute flow to habitat downstream	C5: field	C5: cultivated field	No significant connections for aquatic species or wildlife.	-	-	-	C-5: 0.89						
	Geomorph: 6/20/2013 Sunny 16°C			C1: Groundwater sheen observed															
	Hydrogeology: 6/21/2013, 27°C, Sunny, prior 72hrs precipitation free, AK/RBC			C3: saturated soil in depression															
Tributary C		C-2: 0.561	C2: Intermittent		C2, C4, C6: Flow and nutrient conveyance	C2, C4, C6: Provide contribution to habitat downstream	C2: Maintained lawn	C2: maintained lawn	Connection to floodplain depressions and downstream branch of channel	C2: 0.40	C2: 0.10	C4: 27-55	C-2: 0.36	Poorly defined: C2, C4	C-2, C-4 & C-6: Defined		C2: Simple contributing habitat	C2: Mitigation 2 (2009) Mitigation (2013)	-Drain tile outlet at top of C6
	Reaches: 16°C	C-4: 0.250	C4: Intermittent				C4: Dense tall grasses and shrubs, immature trees. Part of cultural thicket (unit 18b).	C4: choked with vegetation	downstream branch of channel for local movement of wildlife between Block B and C.	C2: 0.57	C2: 0.10	C6: 25-32	C-4: 1.66	C2, C4	Defined		C4, C6: Complex contributing habitat	C4, C6: Mitigation 1 (2009) Conservation (2013)	
	C-4	C-4: 0.037	C4: Intermittent							C4: 0.54	C4: 0.14	C6: 1.66	C-6: 1.4	Defined: C6 (moderate pool-riffle form, medial bar)	C4: obscured by vegetation, but defined in wooded area				
	Geomorph: 6/20/2013 Sunny 16°C									C6: 1.21	C6: 0.07	C6: 1.4	C-6: 1.4		C6: obscured by vegetation, but defined in wooded area				
	Hydrogeology: 6/21/2013, 27°C, Sunny, prior 72hrs precipitation free, AK/RBC									C6: 0.71	C6: 0.07	C6: 1.4	C-6: 1.4		C6: obscured by vegetation, but defined in wooded area				