PARISH aquatic services

A Division of Matrix Solutions Inc.

December 4, 2015 Matrix 22585

Mr. Phil Sweetnam
RELOCATABLE HOMES LTD.
8 Sweetnam Drive
Stittsville, ON K2S 1G2

Subject: Poole Creek – Orchard Drive Meander Belt Width Assessment

Dear Mr. Phil Sweetnam:

1 INTRODUCTION

PARISH Aquatic Services (PARISH) was retained to complete a meander belt width (MBW) assessment of Poole Creek along the Orchard Drive Property. This work is being completed to provide an appropriate meander belt width which will serve as an update to the existing MBW delineated by Mississippi Valley Conservation Authority (MVCA). The study reach under investigation is shown on **Figure 1**.

In order to complete the assessment, the following work plan was undertaken:

- Collection and review of background information, including reports, mapping, and aerial imagery.
- Use of available mapping to confirm channel reach boundaries.
- Completion of rapid field assessments to determine channel geometry and active geomorphic processes.
- Desktop analysis to delineate meander belt widths and to provide an appropriate erosion setback.
- Provide discussion and recommendation for an updated MBW of the study reach.

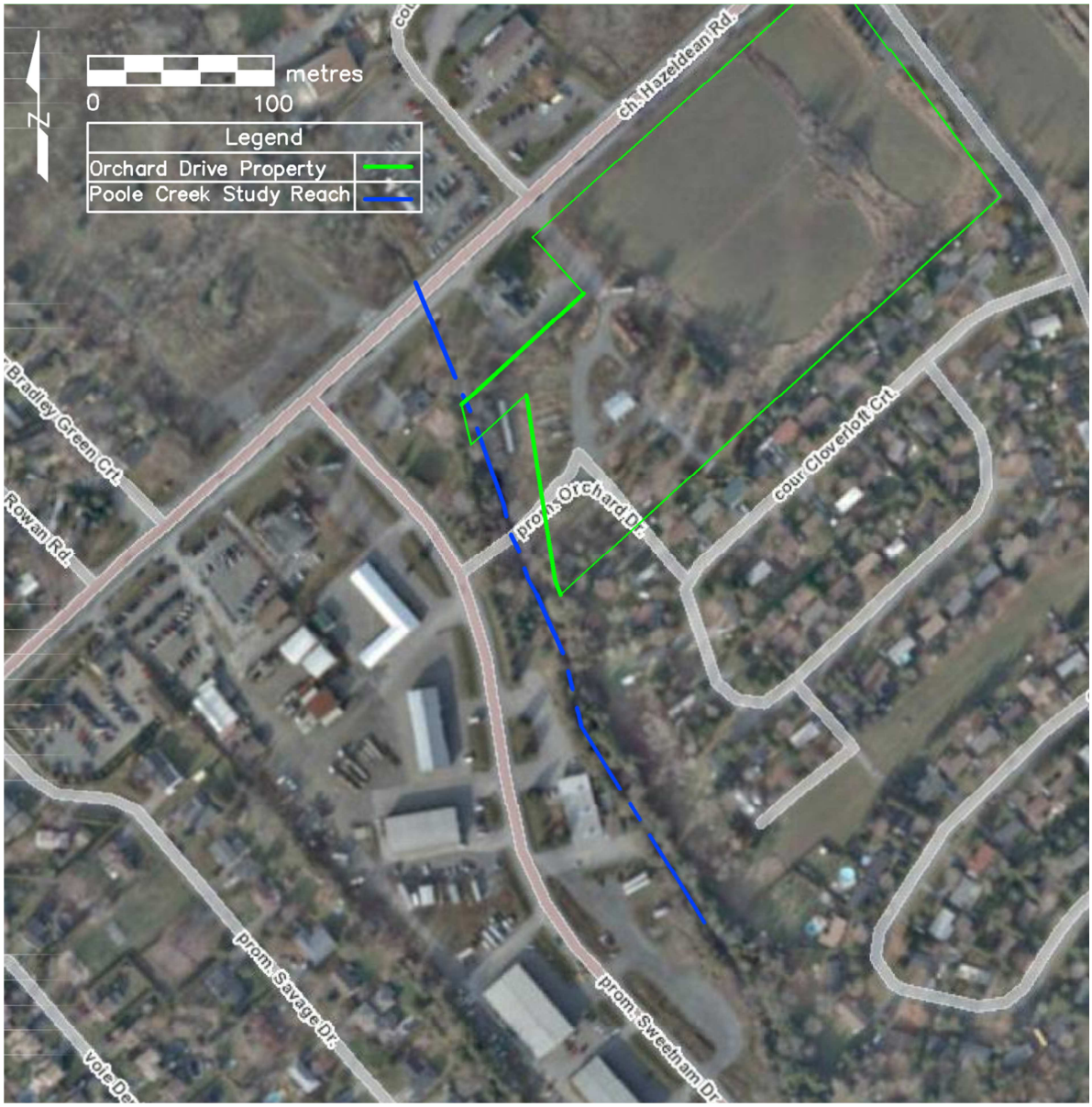


Figure 1 Study reach and adjacent property boundary.

2 FIELD INVESTIGATION

PARISH personnel were required to comply with legislated and PARISH health and safety standards. A field investigation was completed on December 2, 2015. The investigation provides an understanding of creek processes and the observations made can provide information regarding the appropriateness of the desktop analysis. A rapid stream assessment (RSAT) coupled with a rapid geomorphic assessment (RGA) were used to collect information regarding the stability and geomorphic processes occurring in the creek through the study reach.

The RGA was designed by the Ontario Ministry of Environment (MOE 2003) to assess reaches in rural and urban channels. This qualitative technique documents indicators of channel instability. Observations

are quantified using an index that identifies channel sensitivity based on the presence or absence of evidence of aggradation, degradation, channel widening, and planimetric adjustment. Examples of these include the presence of bar forms, exposed infrastructure, head cutting due to knickpoint migration, etc. Overall, the index produces values that indicate whether the channel is stable/in regime (score ≤0.20), stressed/transitional (score 0.21 to 0.40), or adjusting (score >0.41). Table 2 provides an explanation of the various classifications.

Table 1 Rapid Geomorphic Assessment Classification

Factor Value	Classification	Interpretation
≤0.20	In Regime or Stable (Least Sensitive)	The channel morphology is within a range of variance for streams of similar hydrographic characteristics – evidence of instability is isolated or associated with normal river meander propagation processes.
0.21-0.40	Transition or Stressed (Moderately Sensitive)	Channel morphology is within the range of variance for streams of similar hydrographic characteristics, but the evidence of instability is frequent.
≥0.41	In Adjustment (Most Sensitive)	Channel morphology is not within the range of variance, and evidence of instability is widespread.

The RSAT (COG 1996) provides a more qualitative and broader assessment of the overall health and functions of a reach. This system integrates visual estimates of channel conditions and numerical scoring of stream parameters using six categories: channel stability, erosion and deposition, instream habitat, water quality, riparian conditions, and biological indicators. Scores can be divided into three classes: low (<20), moderate (20 to 35), and high (>35).

The reach of Poole Creek adjacent to the Orchard Drive Property contains a riffle-pool complex at a steep gradient. The bankfull width of the channel averages 5.5 m with an average bankfull depth of 0.75 m. The banks are heavily armoured on both sides with boulders reaching 80 cm. Riffle material ranged from cobbles to boulders and gravels, sands and silts were found in pools. The underlying materials are mostly composed of silty sand.

The reach received a moderate stability ranking (RSAT = 35) with good channel stability and fair to poor riparian conditions. The reach was observed to be in transition or stressed (RGA = 0.26). The dominating process was found to be widening with fallen/leaning trees, the occurrence of large organic debris, exposed tree roots and steep bank angles through most of the reach. Although these observations indicate a widening channel, very little active erosion was noted throughout. It is expected that the large amount of placed boulders greatly enhance the stability of the channel.

3 DESKTOP ANALYSIS

As part of the desktop analysis, historical aerial photography of Poole Creek are compared. Typically historical planforms of the channel are overlaid, which allow for a direct comparison of lateral channel adjustment. From historical planforms, 100-year migration rates are estimated and preliminary meander belt widths are delineated. Once a preliminary meander belt width is completed, comparisons would be made to empirical relationships which estimate meander belt widths based on the bankfull characteristics of the channel. In heavily altered channels, such as the reach investigated in the current report, a surrogate reach of similar geometry and geology would be used to determine a preliminary meander belt width.

Once a preliminary belt width is delineated for a reach, a safety factor is applied. This safety factor is often the 100-year migration rate or the standard erosion setback of 10% the preliminary meander belt width on either side of the channel.

In the case of Poole Creek through the study reach, historical planform comparisons did not result in an adequate estimate of preliminary bankfull width. The creek is well sheltered in photographs due to the large amounts of trees and where comparisons can be made, the heavily armoured banks have prevented the channel from migrating naturally. Reaches downstream and upstream of the study reach were observed to be in different settings. Upstream, the channel is part of a wetland system and downstream reach gradients appear to be far more moderate than the steep riffle-pool complex of the study reach observed.

Due to the lack of information on the natural planform of the channel through the study reach, the meander belt width delineated relied on the results of empirical relations based on the bankfull width of the channel measured during the field investigation.

4 EMPIRICAL RELATIONSHIPS

Predicted planform metrics can be approximated using standard empirical relations developed by Williams (1986), which are based on an extended dataset of 194 sites from a large variety of physiographic environments in various countries. The equations relate natural average channel cross-section metrics (width, depth, and area) to watercourse wavelength, amplitude, and radius of curvature. Similar relations to the equations developed by Williams (1986) include ones developed by Ward et al. (2002) and Lorenz et al. (1985), and are contained in **Table 2**. These relations are based on measurements of real watercourses; however, their transferability to all watercourses is potentially limited due to possible differences in hydrologic regime, drainage area, and general controlling factors. In particular, in urbanized settings, classic alluvial forms are typically limited to headwater tributaries that have not yet undergone significant morphological change. These considerations should be kept in mind when applying the empirical relations; however, often they can provide the only approximation available.

Table 2 Empirical Meander Belt Width Equations

Source	Equation	Preliminary MBW (m)
Williams (1986) Bankfull width (m)	$4.3W^{1.12}$	29.0
Ward et al. (2002) Bankfull width (ft)	$4.8W^{1.08}$	33.3
Lorenz et al. (1985) Bankfull width (m)	$7.53W^{1.01}$	42.1
Average		**34.8**

The empirical relationships result in an average preliminary MBW of 34.8 m using an average bankfull width 5.5 m, as observed on site. A 10% erosion setback (3.5 m) should be applied to each side of this value for a final MBW of 41.8 m. Preliminary, final and MVCA meander belt widths are provided in **Figure 2**. A significant reduction compared to the MBW delineated by MVCA is shown using the

established empirical relationships above. This is due to a difference in methods used to establish a meander belt width.

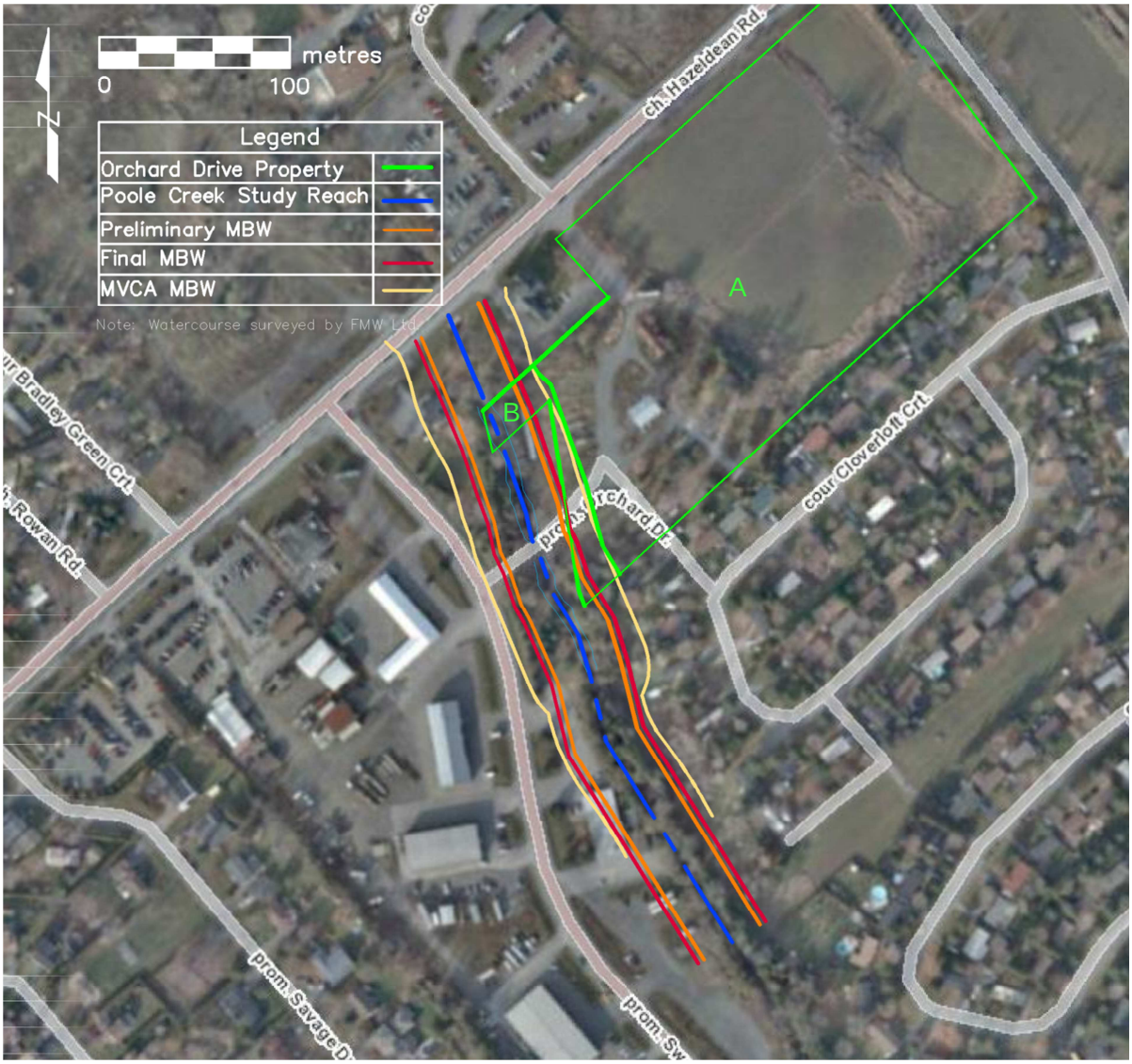


Figure 2 Preliminary and final MBWs.

In Figure 2, the thin blue lines represent bankfull as identified by Fairhall Moffatt Woodland Ltd. It is our understanding that Parcel B is to be transferred to the adjacent land owner, while Parcel A is intended for sale.

5 CONCLUSION

PARISH Aquatic Services (PARISH) was retained to complete a MBW assessment of Poole Creek along the Orchard Drive Property. Using empirical relationships a preliminary MBW of 34.8 m was established. A 10% erosion setback was added on each side of the reach for a final MBW of 41.8 m. The final MBW results in a reduction in the previously established MBW by MVCA.

6 CLOSURE

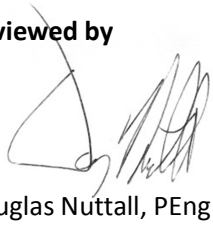
We trust that this letter report suits your present requirements. If you have any questions or comments, please call either of the undersigned at 613.686.5492.

Yours truly,

PARISH AQUATIC SERVICES

Matthew McCombs, EIT, MASc
Water Resources EIT

Reviewed by



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