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Raisin River Conservation Authority
P.O. Box 429, 18045 County Road 42,
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K6H 5T2

Re: CP-16-0280 – Eastman Municipal Drain Floodplain

1.0 PURPOSE

McIntosh Perry has been retained by the Cornwall Gravel Company Limited to review and confirm the floodplain limit north of South Branch Road in the Township of South Stormont, County of Stormont, Dundas and Glengarry. This work was undertaken in support of a license application under the Aggregate Resources Act for a part of Lot 6, Concession 4, referred to as the MacLeod III property. The existing floodplain elevations developed in the 1980s by Crysler & Lathem Ltd. in this immediate area appeared to extend a significant distance from the watercourse, which based on the Owner's previous knowledge of the site, appeared to be conservative. A reduction in the floodplain elevation would provide the potential to expand their current application's extraction boundary south towards South Branch Road, providing an opportunity for additional resource material. Based on our discussions with the Raisin River Conservation Authority (RRCA), it was noted that any reduction in the floodplain should be accompanied by a brief report to detail our findings and reasoning for lowering the elevation.

2.0 LIMITATIONS AND ASSUMPTIONS

Based on the available material to review, there were several assumptions and limitations to the analysis below. The limitations of the report reflect primarily the information and material available at the time of the study, which results in McIntosh Perry implementing several assumptions to complete the analysis. These assumptions are as described below:

- Detailed topographic information was available for the proposed site (LIDAR) but, given the relatively large size of the upstream drainage area, Ontario Base Mapping (OBM) was used, in conjunction with the Ontario Flow Assessment Tool and the original Engineer's Report for the Eastman Municipal Drain to confirm its drainage boundaries (OBM topographical contours at 5m intervals)
- HEC-RAS data including cross-sections, culverts, ineffective areas etc. were reviewed from the existing model supplied by the Raisin River Conservation Authority;
- This letter assumes that this information is accurate and given that the reproduction of such a study would be extensive it is understood that the information within has been used in good faith and believed to be true;

- Runoff data within the HEC-RAS model was prepared by A.J. Robinson and Associates Inc. and imported into HEC-RAS by J.F. Sabourin and Associates Inc. for the use of the RRCA.
- Manning's roughness coefficients ("n") were copied from the existing cross-sections within the model (0.042 for grassed areas and 0.022 for within the channel banks). Based on our review, these appeared reasonable for this analysis.

3.0 BACKGROUND REVIEW

3.1 Eastman Drain – Watershed Management Study (A.J. Robinson & Associates Inc. – December, 1988)

The stormwater management review of the Eastman Municipal Drain was completed by A.J. Robinson and Associates in 1988. At that time, drainage areas upstream of the Raisin River were reviewed, given known urban expansion north of the City of Cornwall. The study reviewed both the proposed and existing conditions in terms of land uses and provided peak runoff flow rates for the 2- through 100-year storm events for various storm distributions (Chicago, SCS Type 2, AES).

The report used an OTTHYMO model to calculate the peak runoff flow rates for all upstream areas flowing towards the confluence of the Eastman Municipal Drain and the Raisin River. While OTTHYMO modelling programs are an industry standard software used for calculating peak flow rates, the programs do possess some limitations, one of which pertains to the size of the catchments. Generally speaking, OTTHYMO programs are limited to 1 km² catchments and are generally found to overestimate the peak flow rates as the catchment approach and exceed that size. The majority of catchments in this report exceeded that maximum, with the area of direct concern to our site (area 406 within the A.J. Robinson Report) being 3.29km². For catchments of that size, other methodologies exist that may have provided smaller peak flow rates. However, the original flow data have been used in order to provide a conservative design.

The report also does not take into consideration the extent of the now existing quarry on the land directly upstream of the crossing, which produces a significant portion of the flow to the culverts on South Branch Road. However, similar to the original flow data, we have continued the review based on the flows presented to provide a conservative design.

4.0 HEC-RAS MODEL PROVIDED BY RAISIN RIVER CONSERVATION AUTHORITY (RRCA)

The RRCA provided their existing HEC-RAS model for our review as part of this analysis. The existing stormwater flows and cross-sections had been input for various key areas throughout the catchment and along the Eastman Drain. The area of focus for this analysis is directly upstream of the South Branch Road. This area currently has two (2) 2.2m culverts located within the Municipal Drain, which flows south through South Branch Road. Upon running the model without any alterations to the cross-sections or flow rates, the

100-year elevation is reduced from the previously noted Floodplain analysis. The elevation change was from 58.22m to 57.90m.

Upon further review of the HEC-RAS model, several items were noted that were inconsistent with our understanding of the site. This included some of the cross-sections being incomplete or inconsistent with the property's topography based on our recent data and typical practices for performing this type of analysis in the HEC-RAS software. Additional details regarding these discrepancies are detailed below:

- The existing model shows the South Branch Road crossing as a bridge with relatively steep embankments and does not account for storage in the road side ditch or in relatively flat surrounding areas.
 - We have recomputed the road cross-section as a series of culverts rather than a bridge to confirm the 100-year floodplain elevation.
- The existing model shows the South Branch Road crossing having three openings (reflecting culverts) all within the Eastman Municipal Drain. This is incorrect, this crossing has two culverts and a third is located approximately 360m to the east. In major and minor events, the roadside ditch is expected to fill with water and flow from the Eastman Drain would reach the additional culvert, providing additional relief to the system.
 - As a function of revising the cross-sections based on the existing topography, the culverts have been realigned to their current existing locations.

5.0 SOUTH BRANCH ROAD CROSSING

The HEC-RAS model as noted above was modified to account for the three culverts that would act in the major and minor events, as well as the capacity of the roadside ditch. The modelled cross-section was also extended upstream to correct minor discrepancies with the topographic data, which would result in less storage. With the cross-section and culvert data corrected, the flow rates were again confirmed in the model. The drainage area from the report by A.J. Robinson, provides a peak runoff from Area 406 at the confluence with the Raisin River of 26.64m³/s, while at the crossing specifically, the 100-year used within the RRCA's model was 23.82m³/s. This aligns with our expectations based on the drainage areas and the original designer's flow rates, but again appears to be conservative based on the methodology used. With these modifications, while continuing to use the original designer's flow rates, the resulting 100-year elevation was determined to be 57.92m, which has been illustrated in the attached revised floodplain sketch. It is our belief that this sketch provides a more realistic elevation with regards to the floodplain in comparison to that of the 1980 study and the 1988 report.

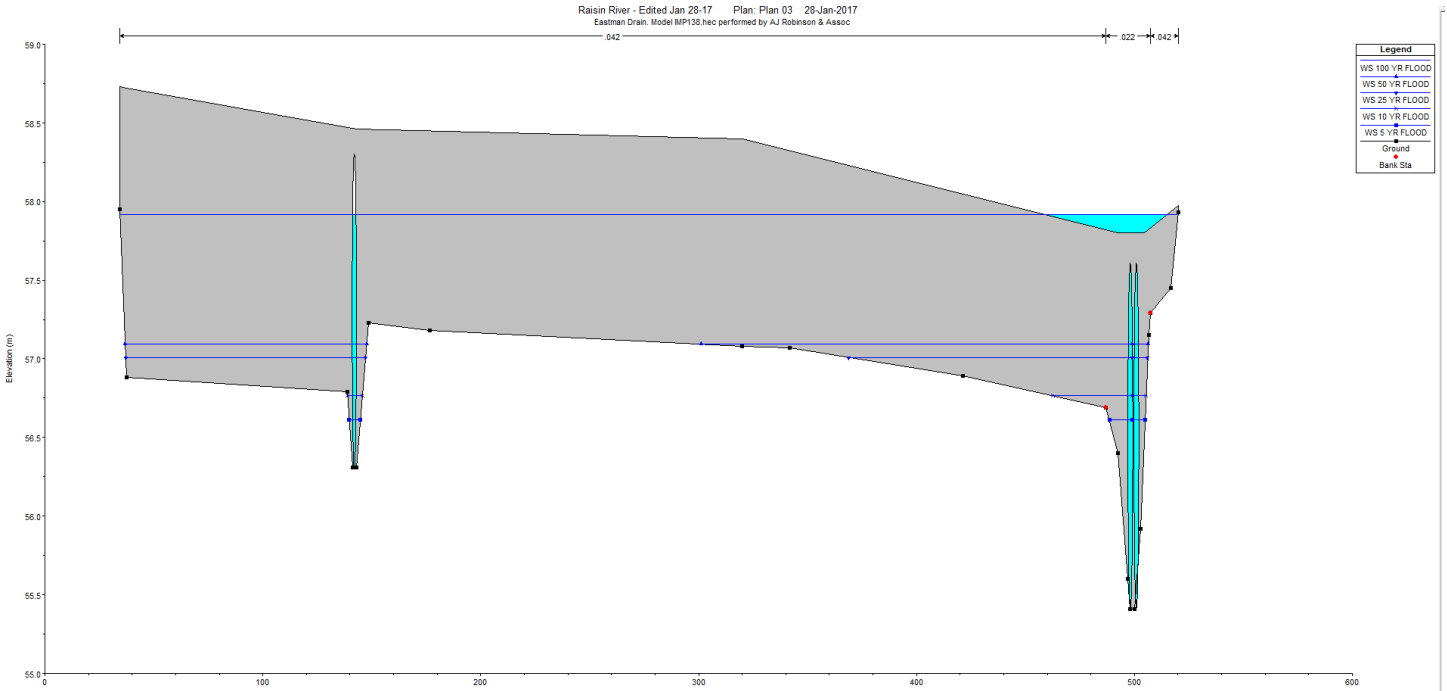


Figure 1: Cross-section South Branch Road

6.0 CONCLUSION / RECOMMENDATIONS

Given the information provided by others and assumptions used, it must be stressed that the findings cannot be guaranteed but are considered to provide a reasonable conservative estimate of the 100-year floodplain limits in the immediate area upstream of South Branch Road. The revised elevation (57.92m), was determined to be lower than that specified within the 1980s study performed by Chrysler and Lathem Ltd. (58.22m) and appears to be slightly higher than that of the original HEC-RAS model provided by the RRCA (57.90m) prior to any modification.

Based on the information above, it is recommended that the floodplain immediately upstream of the South Branch Road be adjusted to the calculated value of 57.92m and the limits of the proposed expansion of the Cornwall Gravel quarry be adjusted to reflect this new elevation and to ensure development remains outside of the 100-year floodplain. The revised floodplain limit sketch has been enclosed for information purposes.

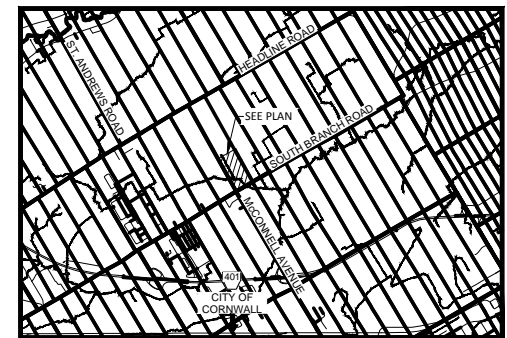
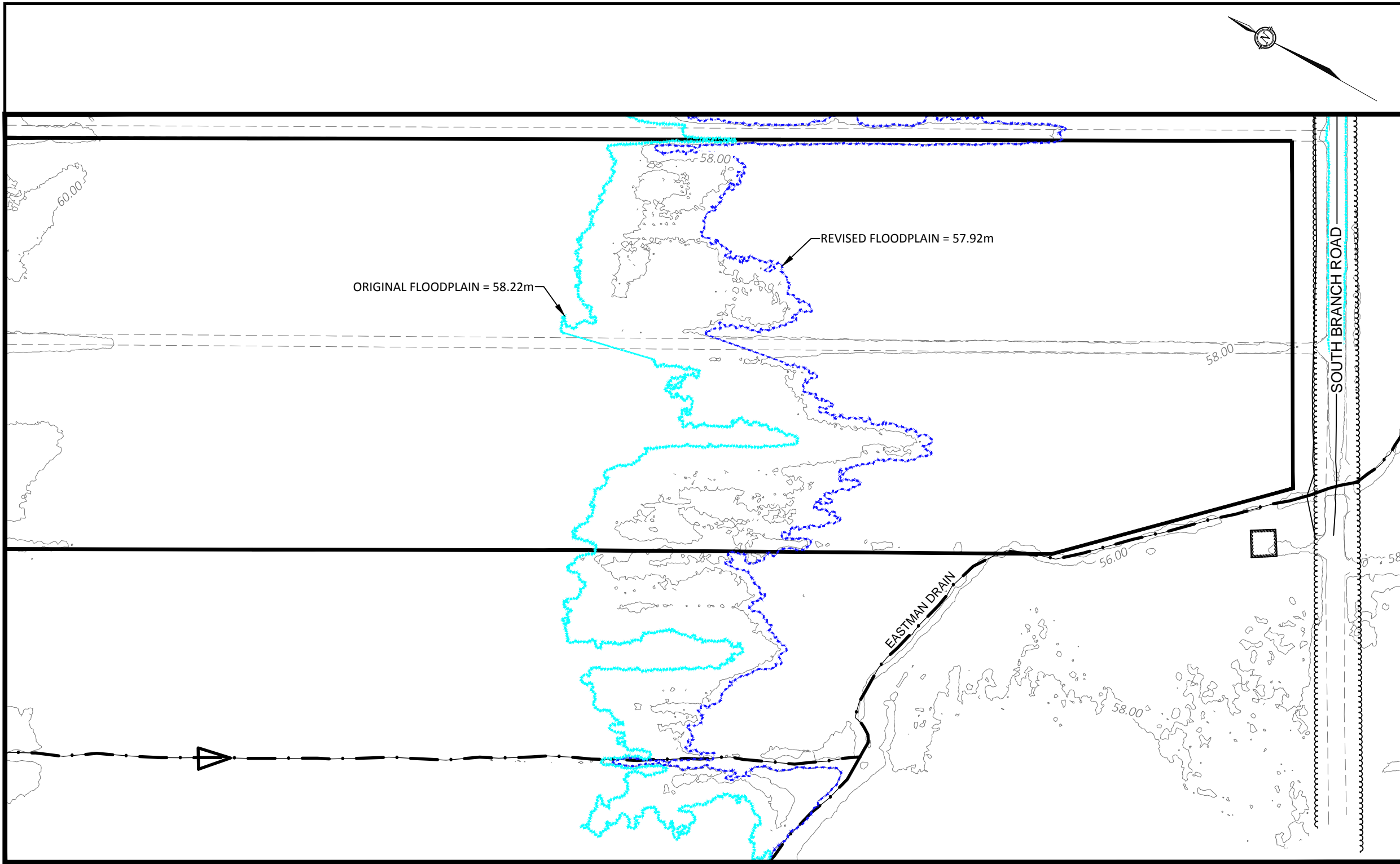
I trust that the preceding information is acceptable for your present purposes. If you have questions about anything contained herein please feel free to contact the undersigned.

Regards,




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Enclosed:
Revised Floodplain Sketch



LOCATION PLAN



0	ISSUED FOR REVIEW	FEB/21/2017
No.	Revision/Issue	Date
 1-1329 Gardiners Road, Kingston, ON K7P 0L8 Tel: 613-542-3788 Fax: 613-542-7583		
Stamp:	Stamp:	
Client: CORNWALL GRAVEL COMPANY LIMITED P.O. BOX 67 - 390 ELEVENTH STREET WEST CORNWALL, ONTARIO K6H 5R9		
Project: EASTMAN MUNICIPAL DRAIN FLOODPLAIN CORNWALL, ONTARIO		
Drawing Title: FLOODPLAIN SKETCH		
Scale:	1:2000	Project Number:
Drawn by:	D. LONGMUIR	CP-16-0280
Checked By:	J. SHARP	
Designed By:	J. SHARP	Drawing Number:
Date:	FEB/21/2017	FP

FILENAME: M:\02-Drawings\2016\CP-16-0280 Cornwall Gravel_APA Application_Cornwall\CP-16-0280 - MacLeod 3 - Floodplain Feb 10.dwg
 LAST MODIFIED: 2017-02-21 10:17:12 AM
 USER: J. SHARP