



Technical Memorandum

Petun Creek Floodplain Analysis

Date: December 4, 2019 **Project No.:** 300050300.0000

Project Name: 645 Sixth Street

Client Name: Silver Oak Developers Inc.

Submitted To: Peter Alm, P.Eng. (Nottawasaga Valley Conservation Authority)

Submitted By: Adam Crookes, P.Eng.

Reviewed By: Jody Smith, P. Eng.

R.J. Burnside & Associates Limited (Burnside) has been retained by Silver Oak Developers Inc. to prepare a floodplain analysis in support of the development of a 40-unit freehold condominium. The 1.02 ha site is located on the North side of Sixth Street between Alyssa Drive and Stewart Road, in the Town of Collingwood. Petun Creek (a tributary of Black Ash Creek) and the associated floodplain is located immediately north of the proposed development. Refer to Figure 1 for the site location and the location of Petun Creek.

This memo describes the floodplain analysis and discusses the implication of the results on the grading design of the proposed development. The objectives of the analysis include:

- Determine existing Regional flood line location and elevation.
- Determine proposed Regional flood line location and elevation.
- Verify the proposed development does not have any impact on upstream or downstream flood elevations.
- Verify that the proposed development is not located within the floodplain.

1.0 Background

Black Ash Creek has been the subject of extensive study since the 1970's, notably the Black Ash Creek Subwatershed Plan (NVCA, 2000), and flood control improvement works including channelization of the main branch of Black Ash Creek to contain the regulatory flood flow. More locally, Petun Creek was analyzed from Sixth Street to the main channel of Black Ash Creek in support of the Georgian Meadows Subdivision design completed by Burnside in 2009. The

proposed development was included within the limits of the approved Georgian Meadows Subdivision, but it was not developed at that time. The analysis included a one-dimensional floodplain model developed in HEC-RAS to establish floodplain extents and development setbacks. The results of this analysis are shown on the enclosed Figure 2, and the analysis ultimately led to the establishment of a 60 m wide engineered corridor along Petun Creek, between the Georgian Meadows Subdivision and the proposed development. The corridor was to be constructed by berming both sides of Petun Creek, as shown in Figure 2. The existing and proposed floodplain model files prepared for the Georgian Meadows Subdivision Design have been included digitally for reference.

Since 2009, the Georgian Meadows subdivision has been constructed, which included berming along the north boundary of the 60 m wide corridor, containing potential shallow flooding which previously occurred to the north during the Regional Event. The berming on the south side (right bank) of the creek shown in Figure 2 was not constructed. In addition, the formerly single culvert conveying flow in Petun Creek across Sixth street has been upgraded, and now consists of twin 1900 x 1200 mm CSP culverts.

2.0 Floodplain Analysis Methodology

The floodplain analysis carried out in support of the proposed development builds on the work previously completed for the Georgian Meadows Subdivision. Following consultation with NVCA, the previously approved HEC-RAS models for Georgian Meadows have been modified as follows:

1. The culverts beneath Sixth Street have been modified in the proposed and existing models to reflect the twinning which occurred after the 2009 model was completed.
2. The HEC-RAS cross sections have been revised in the proposed conditions model to reflect the proposed grading for the portion of the proposed development which fronts onto the 60 m wide Petun Creek corridor. In addition, the cross-sections have been revised in the existing conditions model to reflect 2019 conditions.
3. The potential spill at Sixth Street due to insufficient capacity in the twinned culverts has been modeled.

Revisions 1 and 2 above required only minor modifications be made to the HEC-RAS model as follows:

- Revising the culverts between Cross Sections 4602 and 4582.
- Revising the left bank of the existing model cross-sections to reflect the construction of the Georgian Meadows Subdivision.
- Minor revisions to the cross section geometry of the right bank for Cross Sections 4582 to 4340 to reflect the proposed development grading and to reflect minor works completed on the right bank during construction of the Georgian Meadows subdivision (flattening of soil mounds previously placed in the floodplain).

Revision 3 entailed introducing a second river reach into the models, as shown on Figure 1 (entitled SPILL in the models). The SPILL Reach represents the south ditch along Sixth Street and the floodplain which extends into the field south of Sixth Street (Cross Sections 3000 to 2837). The flow in this reach travels east, parallel to Sixth Street, and would ultimately discharge to the main channel of Black Ash Creek before continuing north to Georgian Bay.

This reach is necessary to model because the 30.0 m³/s Regional Flow (identified in the Black Ash Creek Subwatershed Plan) at the culvert crossing cannot be conveyed through the culverts alone, causing the water level at Cross Sections 4671 and 4602 to be higher than the right bank of the channel, which indicates that a spill to the east would occur before Sixth Street is overtopped. The SPILL Reach was added to model this, which ultimately has the effect of decreasing the modeled flow in Petun Creek downstream of Sixth Street.

To determine the discharge rate of the spill between Cross Sections 4671 and 4602, the 30.0 m³/s Regional flow was split between the two reaches. An iterative process was used, varying the flow in each reach (while still totaling 30.0 m³/s) until the water levels at Cross Section 4602 and 3000 matched. This resulted in a water level of 193.13 m, a flow in the main channel of Petun Creek (Reach-1 in the HEC-RAS model) of 11.3 m³/s, and a flow in the SPILL Reach of 18.7 m³/s.

3.0 Floodplain Analysis Results

The HEC-RAS modeling results for both existing and proposed conditions are presented in Table 3.1 and on the enclosed Figure 1. These results were used to delineate the existing and proposed Regional floodlines, which are also shown on Figure 1 and have been used to set the development limits and rear lot grades for the proposed development. A minimum freeboard of 0.3 m has been provided along the rear lot grades for the proposed development. The existing and proposed models prepared for the proposed development have been included digitally for reference.

The results shown in Table 3.1 indicate that the proposed development does not have any effect on Regional flood elevations. Minor differences between the existing and proposed results (within 1 or 2 cm) are negligible.

Table 3.1 - HEC-RAS Model Results: Regional Flood Elevations

Reach	Cross Section ID	Existing Regional Flood Elevation (m)	Proposed Regional Flood Elevation (m)
Reach-1 (Main Channel of Petun Creek)	4671	193.24	193.24
	4602	193.13	193.13
	4582	191.80	191.80
	4562	191.66	191.65
	4521	191.48	191.48
	4480	191.26	191.26
	4422	191.16	191.17
	4400	191.01	191.00
	4380	190.98	190.98
	4360	190.90	190.92
	4340	190.80	190.79
	4320	190.80	190.80
	4300	190.74	190.73
	4280	190.62	190.62
4260	190.57	190.57	
SPILL (East spill, parallel to Sixth Street)	3000	193.13	193.13
	2977	192.94	192.94
	2957	192.69	192.69
	2937	192.50	192.50
	2917	192.24	192.24
	2897	192.05	192.05
	2877	191.91	191.91
	2857	191.78	191.78
	2837	191.63	191.63

It should be noted that the Regional flow is not contained downstream of HEC-RAS Section 4340 under existing conditions. Downstream of this point, a spill would occur to the east, and Petun Creek would essentially converge with the main channel of Black Ash Creek, forming one continuous floodplain. The existing HEC-RAS model does not account for this, so the modeled flood elevations under existing conditions between Sixth Street and the confluence with Black Ash Creek are artificially high, which is consistent with the previously approved model.

It should also be noted that the proposed conditions model assumes that the right bank of the 60 m wide corridor will be bermed downstream of the proposed development to the confluence of Petun and Black Ash Creek, with a minimum freeboard of 0.3 m above the proposed flood elevation. This has not been completed to date, and until it occurs the area immediately east of the proposed development will still be subject to Regional flooding, as occurs under existing conditions.

4.0 Conclusions

The floodplain analysis discussed in the technical memo builds on the work previously completed for the Georgian Meadows subdivision. It demonstrates that Petun Creek can be contained within a 60 m wide corridor with no changes to flood elevations upstream of

Sixth Street, and no changes to flood elevations downstream of the confluence of Petun Creek and Black Ash Creek.

Please contact the undersigned should you have any questions.

R.J. Burnside & Associates Limited

A handwritten signature in black ink, appearing to read "Adam Crookes". The signature is fluid and cursive, with the first name "Adam" written in a larger, more prominent script than the last name "Crookes".

Adam Crookes, P.Eng.
Project Engineer
AC:cv

Enclosure(s) Figure 1 – HEC-RAS CROSS SECTIONS (Proposed Development, 2019)
 Figure 2 – HEC-RAS CROSS SECTIONS (Georgian Meadows, 2009)
 2009 Model (Digitally)
 2019 Model (Digitally)

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