



MEMO

TO: Town of Collingwood – Development Review Staff
FROM: Ben Worth
SUBJECT: 40 Sandford Fleming Drive (Phase 2)
PRELIMINARY Stormwater Management Memo
DATE: July 26, 2019

INTRODUCTION

This memo is provided to document the stormwater management (SWM) strategy for proposed development works at the 40 Sandford Fleming Drive site, in the Town of Collingwood. It should be read in conjunction with the following WSP documentation related to previously approved works on the subject site:

- Site Feasibility and Stormwater Management Design Letter to Town (April 13, 2017)
- Response to Submission Comments Letter to Town (August 31, 2017)

The current (Phase 2) development proposals consist of a new building in the south-west corner of the site, extension of the existing asphalt parking area, and grading modifications to surrounding soft landscaping areas to permit development. Please refer to the Engineering Drawing set for illustration of proposed works; specifically, drawing 161-00941-04 for the proposed lot grading, and 161-00941-05 for the proposed drainage catchment areas.

EXISTING CONDITIONS

As per analysis completed in support of previous site applications, the Rational Method has been used to establish existing peak runoff rates. IDF coefficients per the Town of Collingwood Development Standards (July 2007) have been used (as summarized in the table below), and the existing conditions catchment area plan (as presented in previous applications) has been used to sub-divide the site for the purpose of SWM analysis. The Airport Method has been used to estimate time of concentration for each sub-catchment, and the applicable percentage increase has been applied to runoff coefficients for larger storm events.

Return Period:		2-year	5-year	10-year	25-year	50-year	100-year
IDF Coefficients:	a =	807.4	1,135.4	1,387.0	1,676.2	1,973.1	2,193.1
	b =	0.828	0.841	0.852	0.858	0.868	0.871
	c =	6.75	7.50	7.97	8.30	9.00	9.04
C Increase (per MOE):		0%	0%	0%	10%	20%	25%



Please refer to appended calculation sheets for full details of the existing conditions SWM analysis. A summary of peak flow rates to Sandford Fleming Drive is provided below.

Return Period:	2-year	5-year	10-year	25-year	50-year	100-year
Total Pre-Development Peak Flow to Sandford (l/sec):	31.3	41.1	47.7	64.5	81.1	93.7

PROPOSED CONDITIONS

Based on the proposed catchment area plan (drawing ref. 161-00941-05), the following area breakdown has been established for proposed conditions.

Catchment ID	Area Breakdown (m ²) (and Runoff Coefficients)							Total Area (m ²)	Net Runoff Coefficient, C
	Asphalt	Bldg.	Gravel	Soft (A)	Soft (B)	Soft (C)	Clear Stone		
	0.80	0.80	0.60	0.10	0.20	0.25	0.40		
P1	1050	433	-	173	-	-	-	1,656	0.73
P2	330	123	-	239	-	-	-	692	0.56
P3	-	308	-	-	-	-	446	754	0.56
P4	-	-	178	-	197	-	-	375	0.39
P5	-	-	-	-	241	-	-	241	0.20
P6	-	126	-	117	-	-	-	243	0.46
Totals	1,380	990	178	529	438	0	446	3,961	0.59

The proposed drainage system consists of the following key elements:

- **Catchment P1** (consisting primarily of impervious parking surfaces, and some existing/proposed building rooftops) will drain westwards to a proposed grass swale running northward along the west edge of the site. This swale will discharge into the existing Sandford Fleming Drive roadside ditch adjacent to the site access.
- **Catchment P2** (consisting primarily of impervious parking surfaces at the northern limits of the site) will drain northward directly into the existing Sandford Fleming Drive roadside ditch.
- **Catchment P3** (consisting of the eastern portion of the new building rooftop, and the expanded clear stone area) will discharge all runoff directly into the clear stone storage/infiltration area. Excess runoff during large storm events would drain eastward into catchment P5, however, as per calculations provided in the following section, it is demonstrated that the clear stone storage area has capacity to collect and retain all runoff during a 100-year storm event. Therefore, no excess flow is anticipated to enter catchment P5 and ultimately drain offsite.
- **Catchment P4** (consisting of a gravel laneway at the southern edge of the site, and a proposed grass drainage swale along the site limits) will discharge into the proposed swale, which drains eastward.
- **Catchment P5** (consists entirely soft landscaping along the eastern edge of the site) will discharge into the proposed grass drainage swale, which drains northward along the eastern edge of the site (including conveyance of flow from the upstream P4 catchment).

- **Catchment P6** (consisting of a portion of the existing building rooftop area, and soft landscaping areas) will discharge into the proposed grass drainage swale, which drains northward along the eastern edge of the site (including conveyance of flow from the upstream P4 and P5 catchments).

Please refer to the appended calculations for full detail of proposed conditions analysis. The same methodology used to support previous applications has been followed, and is consistent with existing conditions analysis—i.e. IDF coefficients per Town standards, use of the Airport Method to estimate time of concentration for each sub-catchment, and applying the relevant percentage increase to runoff coefficients for larger storm events. Allowances have been made in the analysis for routing of runoff in proposed conditions; catchment P4 discharges into P5, which subsequently discharges into P6, before leaving site. This is represented in the cumulative ‘2.78AR’ values in the calculations.

As noted above sub-catchment P3 includes a large clear stone area for storage, retention, and infiltration of stormwater runoff. The depth of the clear stone layer will be 0.30 m, and it will cover an area of 446 m². Based on a void ratio of 30% (deemed suitable for 20 mm clear stone material), this indicates a total storage volume of 40.1 m³ will be available. Rational method runoff volume calculations have been completed for this catchment to determine what proportion of runoff will be retained within the clear stone.

- 100-year return period / duration 10 minutes, results in rainfall intensity of 168 mm/hour and a peak flow rate of 28.2 l/sec. Applying this runoff rate over the 10-minute duration results in a total runoff volume of 16.9 m³.
- 100-year return period / duration 60 minutes: rainfall intensity 54.8 mm/hour and peak flow rate 9.2 l/sec. Applying this runoff rate over the 60-minute duration results in a total runoff volume of 33.1 m³.

It can therefore be seen that the volume of storage available in the clear stone area exceeds anticipated 100-year runoff volumes. On this basis, the calculations undertaken to determine peak runoff rates leaving site exclude any contributions from sub-catchment P3.

A summary of post-development peak flows to Sandford Fleming Drive are presented below.

Return Period:	2-year	5-year	10-year	25-year	50-year	100-year
Total Post-Development Peak Flow to Sandford (l/sec):	28.9	37.9	43.7	61.5	74.7	85.6
Equivalent Pre-Development Rates (l/sec):	31.3	41.1	47.7	64.5	81.1	93.7
Difference (l/sec):	(2.4)	(3.2)	(4.0)	(3.0)	(6.4)	(8.1)



CONCLUSIONS

Stormwater management calculations have been completed to determine the impact of the proposed Phase 2 works at 40 Sanford Fleming Drive on peak runoff rates to the City's municipal drainage system. The results demonstrate that post-development peak runoff rates to Sanford Fleming Drive are controlled to below equivalent pre-development rates for all events, up to and including the 100-year return period. The proposals are therefore considered to satisfy Town requirements.

Respectfully submitted,

Ben Worth, P.Eng.
Manager, Water Resources

Applevale Properties Ltd. - 40 Sandford Fleming Drive (Phase 2)
Pre-Development Site Drainage Calculations

Return Period:	2-year	5-year	10-year	25-year	50-year	100-year	
IDF Coefficients:	a =	807.4	1,135.4	1,387.0	1,676.2	1,973.1	2,193.1
	b =	0.828	0.841	0.852	0.858	0.868	0.871
	c =	6.75	7.50	7.97	8.30	9.00	9.04
C Increase (per MOE):	0%	0%	0%	10%	20%	25%	

2-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
A1	0.25	65	1.2	0.40	0.278	0.278	17	57.97	16.1
A2	0.13	52	0.9	0.60	0.217	0.217	12	70.06	15.2
A3	0.03	8	1.3	0.40	0.033	0.033	10	78.28	2.6
Total Post-Development Peak Flow to Sandford:									31.3

5-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
A1	0.25	65	1.2	0.40	0.278	0.278	17	76.22	21.2
A2	0.13	52	0.9	0.60	0.217	0.217	12	91.79	19.9
A3	0.03	8	1.3	0.40	0.033	0.033	10	102.27	3.4
Total Post-Development Peak Flow to Sandford:									41.1

10-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
A1	0.25	65	1.2	0.40	0.278	0.278	17	88.45	24.6
A2	0.13	52	0.9	0.60	0.217	0.217	12	106.36	23.1
A3	0.03	8	1.3	0.40	0.033	0.033	10	118.36	3.9
Total Post-Development Peak Flow to Sandford:									47.7

25-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
A1	0.25	65	1.2	0.44	0.306	0.306	16	107.25	32.8
A2	0.13	52	0.9	0.66	0.239	0.239	11	132.74	31.7
A3	0.03	8	1.3	0.44	0.037	0.037	10	138.40	5.1
Total Post-Development Peak Flow to Sandford:									64.5

50-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
A1	0.25	65	1.2	0.48	0.334	0.334	15	123.53	41.2
A2	0.13	52	0.9	0.72	0.260	0.260	10	153.18	39.9
A3	0.03	8	1.3	0.48	0.040	0.040	10	153.18	6.1
Total Post-Development Peak Flow to Sandford:									81.1

100-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
A1	0.25	65	1.2	0.50	0.348	0.348	15	138.24	48.0
A2	0.13	52	0.9	0.75	0.271	0.271	10	168.45	45.7
A3	0.03	8	1.3	0.50	0.042	0.042	10	168.45	7.0
Total Post-Development Peak Flow to Sandford:									93.7

Notes:

C values factored from MOE guidelines (10% for 25-year, 20% for 50-year, 25% for 100-year)

Tc calculated using Airport Formula, minimum 10 minutes

IDF parameters as per Town of Collingwood (and Owen Sound) values

Applevale Properties Ltd. - 40 Sandford Fleming Drive (Phase 2)
Post-Development Site Drainage Calculations

Return Period:	2-year	5-year	10-year	25-year	50-year	100-year	
IDF Coefficients:	a =	807.4	1,135.4	1,387.0	1,676.2	1,973.1	2,193.1
	b =	0.828	0.841	0.852	0.858	0.868	0.871
	c =	6.75	7.50	7.97	8.30	9.00	9.04
C Increase (per MOE):	0%	0%	0%	10%	20%	25%	

2-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
P1	0.17	66	0.5	0.73	0.335	0.335	12	69.99	23.4
P2	0.07	20	3.9	0.23	0.044	0.044	10	78.28	3.5
P3	0.08	40	2.0	0.64	0.134	0.134	10	78.28	10.5
P4	0.04	60	2.0	0.20	0.021	0.021	18		
P5	0.02	38	2.0	0.20	0.013	0.034	32		
P6	0.02	25	3.5	0.39	0.026	0.061	40	33.39	2.0
Total Post-Development Peak Flow to Sandford:									28.9

5-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
P1	0.17	66	0.5	0.73	0.335	0.335	12	91.71	30.7
P2	0.07	20	3.9	0.23	0.044	0.044	10	102.27	4.5
P3	0.08	40	2.0	0.64	0.134	0.134	10	102.27	13.7
P4	0.04	60	2.0	0.20	0.021	0.021	18		
P5	0.02	38	2.0	0.20	0.013	0.034	32		
P6	0.02	25	3.5	0.39	0.026	0.061	40	44.07	2.7
Total Post-Development Peak Flow to Sandford:									37.9

10-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
P1	0.17	67	0.5	0.73	0.335	0.335	13	105.86	35.4
P2	0.07	20	4.3	0.23	0.044	0.044	10	118.36	5.2
P3	0.08	40	2.3	0.64	0.134	0.134	10	118.36	15.9
P4	0.04	62	2.0	0.20	0.021	0.021	18		
P5	0.02	38	2.0	0.20	0.013	0.034	33		
P6	0.02	27	3.5	0.39	0.026	0.061	41	50.62	3.1
Total Post-Development Peak Flow to Sandford:									43.7

25-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
P1	0.17	67	0.5	0.80	0.368	0.368	10	137.90	50.8
P2	0.07	20	4.3	0.25	0.049	0.049	10	138.40	6.7
P3	0.08	40	2.3	0.70	0.148	0.148	10	138.40	20.4
P4	0.04	62	2.0	0.22	0.023	0.023	18		
P5	0.02	38	2.0	0.22	0.015	0.038	32		
P6	0.02	27	3.5	0.43	0.029	0.067	40	60.66	4.0
Total Post-Development Peak Flow to Sandford:									61.5

50-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
P1	0.17	67	0.5	0.87	0.402	0.402	10	153.18	61.5
P2	0.07	20	4.3	0.28	0.053	0.053	10	153.18	8.1
P3	0.08	40	2.3	0.77	0.161	0.161	10	153.18	24.7
P4	0.04	62	2.0	0.24	0.025	0.025	18		
P5	0.02	38	2.0	0.24	0.016	0.041	31		
P6	0.02	27	3.5	0.47	0.032	0.073	38	69.29	5.0
Total Post-Development Peak Flow to Sandford:									74.7

100-year									
Catchment ID	Area (ha)	Catchment Length (m)	Catchment Slope (%)	Runoff Coefficient, C	Indiv. 2.78 AR	Accum. 2.78 AR	Time of Conc. (mins)	Intensity (mm/hour)	Peak Flow, Q (L/sec)
P1	0.17	67	0.5	0.91	0.418	0.418	10	168.45	70.5
P2	0.07	20	4.3	0.29	0.055	0.055	10	168.45	9.3
P3	0.08	40	2.3	0.80	0.168	0.168	10	168.45	28.2
P4	0.04	62	2.0	0.25	0.026	0.026	17		
P5	0.02	38	2.0	0.25	0.017	0.043	31		
P6	0.02	27	3.5	0.49	0.033	0.076	38	76.89	5.8
Total Post-Development Peak Flow to Sandford:									85.6

Notes:
C values factored from MOE guidelines (10% for 25-year, 20% for 50-year, 25% for 100-year)
Tc calculated using Airport Formula, minimum 10 minutes
IDF parameters as per Town of Collingwood (and Owen Sound) values