SCHOTT'S LAKE RV AND GUEST RANCH

STORMWATER MANAGEMENT PLAN

SCHOTT'S LAKE RV AND GUEST RANCH INC.

TYPE OF DOCUMENT (REVISION 3)

PROJECT NO.: 211-04399-00
CLIENT REF:
DATE: OCTOBER 25, 2021

WSP

WSP.COM

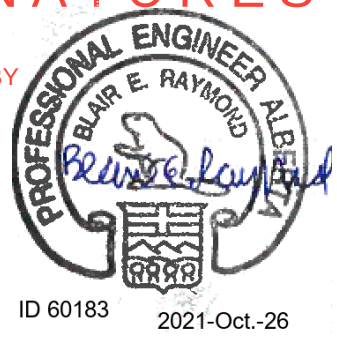
REVISION HISTORY

FIRST ISSUE

July 27, 2021	Draft for Review			
Prepared by	Reviewed by	Approved By		
Blair Raymond	Craig Suchy	Craig Suchy		
REVISION 1				
August 12, 2021	Draft for Review			
Prepared by	Reviewed by	Approved By		
Blair Raymond	Craig Suchy	Craig Suchy		
REVISION 2				
August 18, 2021	Final for Submission			
Prepared by	Reviewed by	Approved By		
Blair Raymond	Craig Suchy	Craig Suchy		
REVISION 3				
October 25, 2021	Final for Submission			
Prepared by	Reviewed by	Approved By		
Blair Raymond	Craig Suchy	Craig Suchy		

SIGNATURES

PREPARED BY



Blair Raymond, M.Sc., P.Eng.
Water Resources Engineer

Date

APPROVED[1] BY *(must be reviewed for technical accuracy prior to approval)*

Craig Suchy, P.Eng.
Senior Project Engineer

Date

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

TABLE OF CONTENTS

1 GENERAL 1

1.1 Introduction 1

1.2 Site Description 1

1.3 Topography 1

1.4 Project description 2

2 DESIGN OBJECTIVES 5

2.1 General 5

3 METHODOLGY 6

3.1 Data Collection and Review 6

3.2 Runoff Analysis 6

3.3 Rainfall 6

3.4 Model Parameters 6

3.5 Model Setup 7

3.6 Assumptions 7

4 MODELING RESULTS 8

4.1 Existing Development model 8

4.2 Post Development model 8

5 SUMMARY AND CONCLUSIONS 11

BIBLIOGRAPHY 12

TABLES

TABLE 3.1 MODELING PARAMETERS 7
TABLE 4.1 STORAGE REQUIREMENTS..... 8

FIGURES

FIGURE 1: LOCATION PLAN..... 1
FIGURE 2: EXISTING TOPOGRAPHY..... 3
FIGURE 3: PROPOSED DEVELOPMENT..... 4
FIGURE 4: EXISTING STORMWATER SYSTEM 9
FIGURE 5: PROPOSED STORMWATER SYSTEM 10

APPENDICES

A RAINFALL HYETOGRAPH

A-1 IDF Curve

A-2 Rainfall Hyetograph

B SUBCATCHMENT DATA

C PCSWMM STORAGE PLOTS

1 GENERAL

1.1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Schott's Lake RV and Guest Ranch Inc. to prepare a stormwater management report for the for the proposed expansion of the Schott's Lake RV and Guest Ranch. The purpose of this report is to demonstrate how the runoff from the proposed development will be managed. This report provides the basis for the detailed design of the proposed stormwater management that will serve the development.

1.2 SITE DESCRIPTION

Schott's Lake RV and Guest Ranch is located in Mountain View County approximately 13.7 km west of Sundre, Alberta and 800m north of Highway 584 on Range Road 71 as shown in **Figure 1**. The property is bounded by Range Road 71 to the west and the quarter section lines to the south, east and north. Schott's Lake lies in the northeast corner of the property.

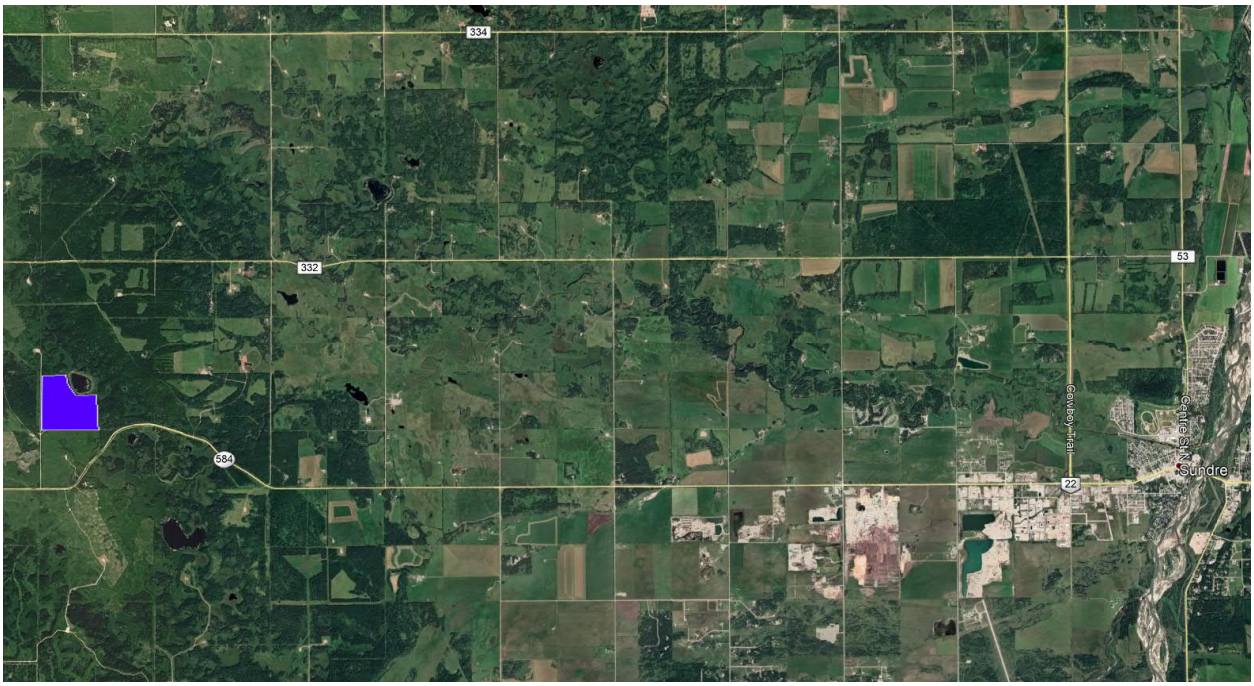


Figure 1: Location Plan

Image Source: Google Earth, earth.google.com/web

1.3 TOPOGRAPHY

The topography within the property ranges from a high elevation of approximately 1215 m in the southwest corner to a low of 1194 m on the north boundary or the property. Elevations bordering Schott's Lake in the northeast corner of the property are approximately 1196 m. There are four (4) drainage basins within the property as follows:

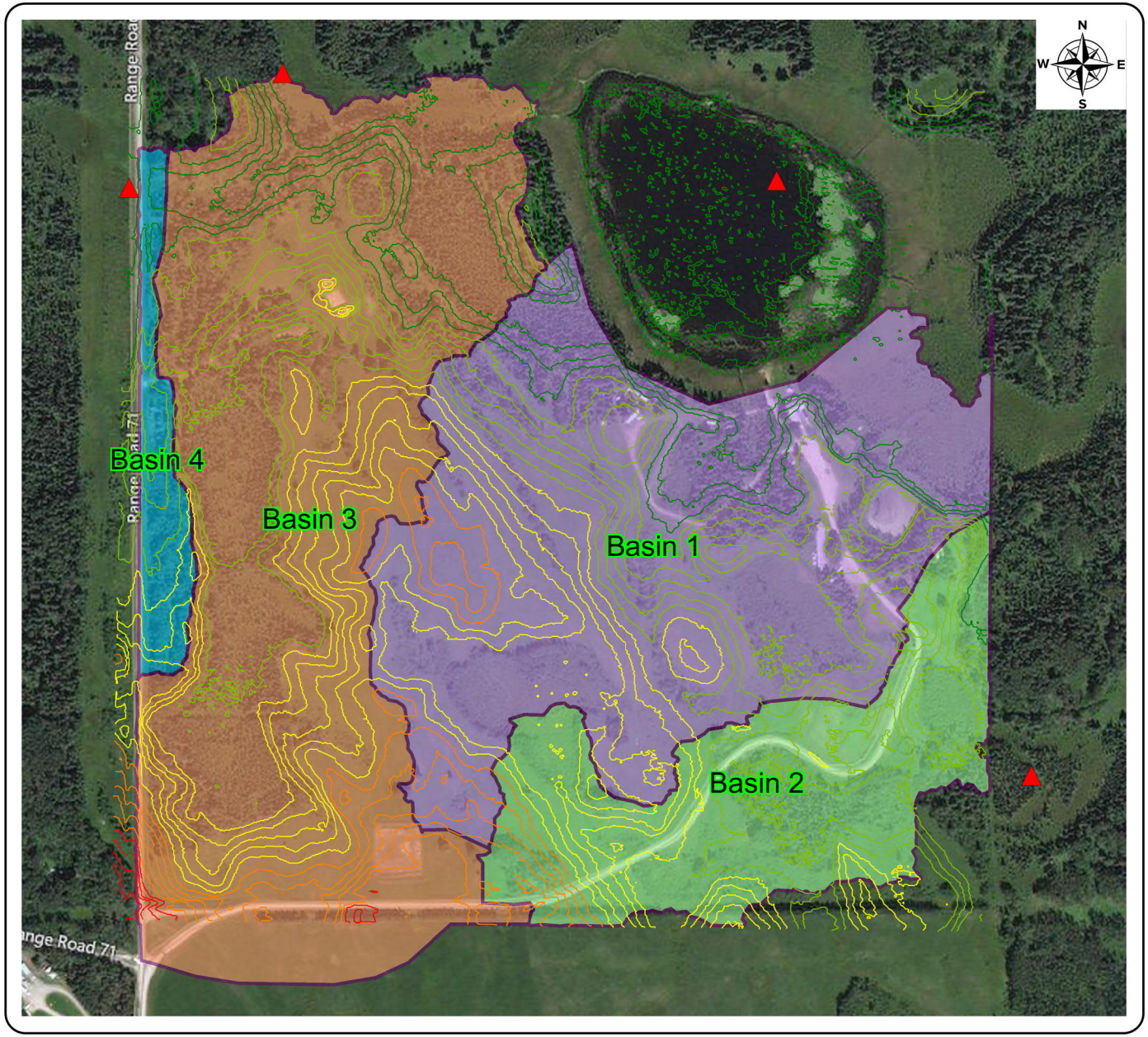
- Basin 1 consists of the central portion of the property and drains to Schott's Lake.

- Basin 2 consists of the southeastern portion of the property and drains to the southeast.
- Basin 3 consists of the western portion of the property and drains to the north.
- Basin 4 consists of a narrow portion of the property alongside Range Road 71 and also drains to the north.

The four drainage basins along with the existing topography can be seen in **Figure 2**.

1.4 PROJECT DESCRIPTION

The proposed expansion consists of additional recreational vehicle (RV) stalls, hotel, event centre, group campsites and cabins to the west of the existing development. The proposed development plan is shown in **Figure 3**. The proposed development consists of 7 cabins along the shore of Schott's Lake in Basin 1 with the remainder of the development occurring in Basin 3.



SCHOTT'S LAKE RV AND GUEST RANCH

PROJECT NO. : 211-04399-00

SCHOTT'S LAKE RV AND GUEST RANCH INC.

Legend

- Outfalls

Contours (m)

- < 1200
- 1200 - 1205
- 1205 - 1210
- 1210 - 1215
- > 1215

Drainage Basins

- Basin 1
- Basin 2
- Basin 3
- Basin 4

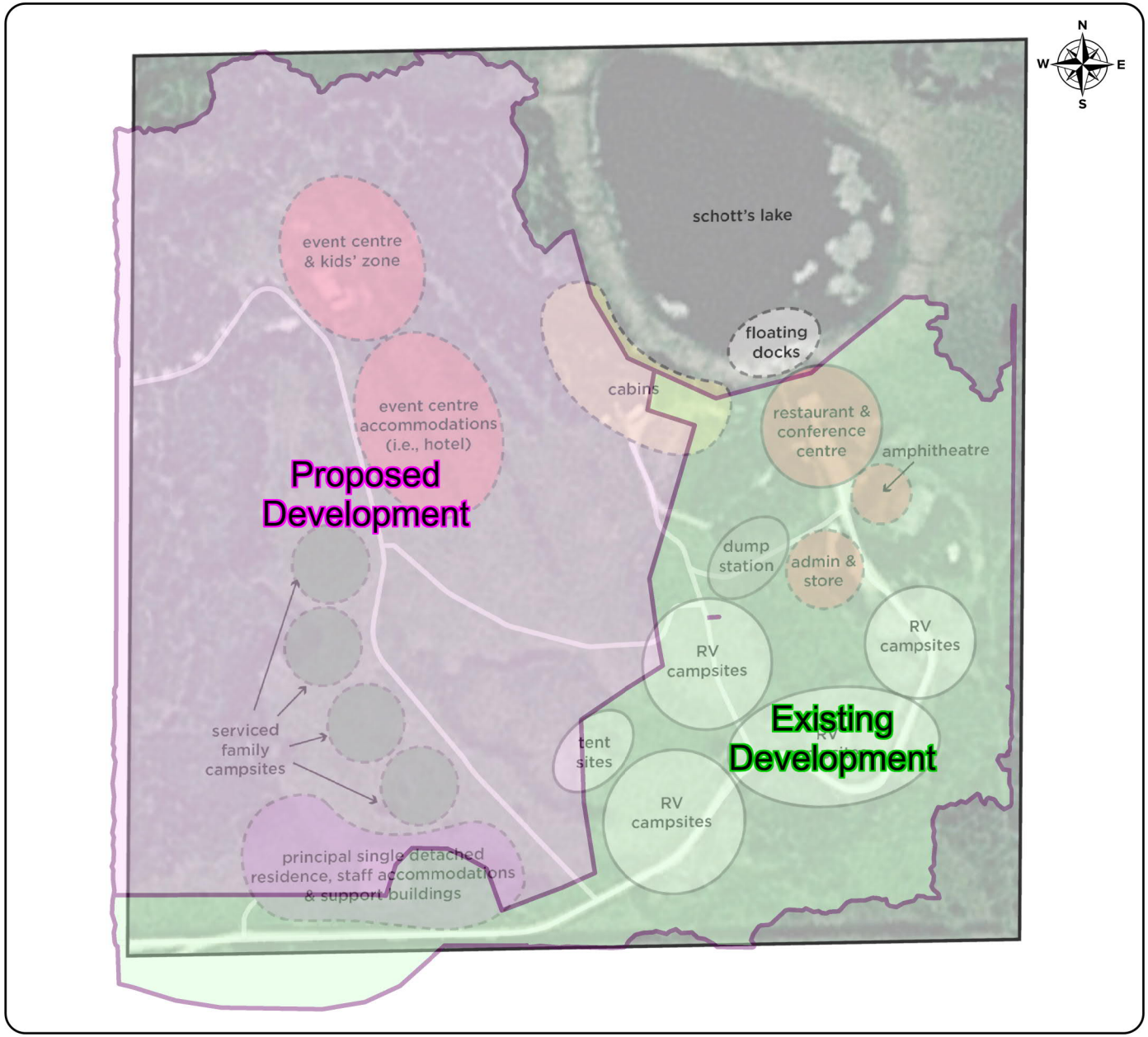
150 m

EXISTING TOPOGRAPHY

wsp

Suite 1200, 10909 Jasper Avenue
Edmonton, AB, Canada T5J 3L9
T +1 780 466-6555 | www.wsp.com

FIGURE 2



SCHOTT'S LAKE RV AND GUEST RANCH

PROJECT NO. : 211-04399-00

SCHOTT'S LAKE RV AND GUEST RANCH INC.

Legend

Development Areas

- Existing Development
- Proposed Development

150 m

PROPOSED DEVELOPMENT

Suite 1200, 10909 Jasper Avenue
Edmonton, AB, Canada T5J 3L9
T +1 780 466-6555 | www.wsp.com

FIGURE 3

2 DESIGN OBJECTIVES

2.1 GENERAL

The objective of the drainage design will be to limit flows from the expansion of the Schott's Lake RV and Guest Ranch to pre-development rates and to maintain existing drainage patterns.

It is expected that the existing drainage patterns and vegetation outside of the proposed development areas will be maintained in order to reduce the impact of construction activities.

3 METHODOLGY

3.1 DATA COLLECTION AND REVIEW

WSP gathered the available information for the site including:

- Topographic data and LiDAR
- Site survey data
- Proposed development plan

3.2 RUNOFF ANALYSIS

The PCSWMM software was selected for the single event runoff simulation analysis to estimate peak flow rates and storage volumes for the pre-development and post development conditions.

PCSWMM is an adaptation and enhancement of the widely used USEPA SWMM computer model. Four hydrologic/hydraulic processes are simulated by the model that includes precipitation event, rainfall losses, runoff transformations, and channel/reservoir routing. These represent the major processes occurring in the land surface portion of the hydrologic cycle. The precipitation inputs to the single event model are the design rainfall events with a specified distribution.

3.3 RAINFALL

Mountain View County follows the Red Deer County Design Guidelines which indicates that storm hyetographs (rainfall) are to be developed using the Chicago distribution.

Intensity-Duration-Frequency (IDF) data for the Environment Canada climate station at Rocky Mountain House, which was compiled from precipitation records spanning from 1964 to 2017 by Meteorological Service of Canada (MSC), was used in the generation of the design storms. MSC also has IDF curves for a station at Sundre, however it only has 10-12 years of record while the Rocky Mountain House station has 37-40 years of record depending on the duration of interest.

The Rocky Mountain House IDF Curve and the 1:100 year, 24 hour Chicago storm hyetograph are included in **Appendix A**.

3.4 MODEL PARAMETERS

Computation of runoff by PCSWMM is based on a number a physical parameters that include subcatchment area, length and width, slope, impervious ratio, Manning's n values for impervious and pervious surfaces, depression storage and infiltration. The parameters used in determining the stormwater management requirements are shown below in **Table 3.1.**

Table 3.1 Modeling Parameters

PARAMETER	VALUE
IMPERVIOUS AREA	
Vegetated	0%
Gravel Surfaces	70%
Buildings	100%
MANNING'S ROUGHNESS (n)	
Impervious Area	0.015
Pervious Area	0.25
HORTON INFILTRATION	
Maximum Infiltration Rate	75 mm/hr
Minimum Infiltration Rate	2.5 mm/hr
Decay Rate	5 /hr
DEPRESSION STORAGE	
Impervious Area	2 mm
Pervious Area	5 mm
IMPERVIOUSNESS	
Building	100%
Gravel	70%
Vegetated	0%

The subcatchment impervious ratio (percent) is used to represent the amount of development in the PCSWMM model, and for the subcatchments where the proposed expansion is located the values will differ from pre-development to post development. The subcatchment areas and impervious values used in the models are shown in **Appendix B**Error! Reference source not found..

3.5 MODEL SETUP

The PCSWMM model for Scott's Lake RV and Guest Ranch was developed from the LiDAR surface and site survey. Drainage routes were delineated based on the LiDAR surface which indicated there were four drainage basins within the study area draining to the north, Schott's Lake and the southeast.

Catchments were delineated based on the LiDAR surface and the identified drainage routes. Catchment parameters were assigned based on the existing development of the property.

3.6 ASSUMPTIONS

The following assumptions were made for this analysis:

1 Existing drainage patterns will be maintained and drainage basin boundaries will not be changed except as required to direct development to Basin 3.

4 MODELING RESULTS

4.1 EXISTING DEVELOPMENT MODEL

As previously discussed in **Section 1.3**, the existing drainage within the property results in four drainage basins, based on where the flow exits the property.

- Basin 1 draining to Schott's Lake consists of approximately 20 ha of land. Existing developed areas are scattered throughout this basin.
- Basin 2 draining towards the southeastern corner of property consists of approximately 8.8 ha of land. There is existing development in this basin along the main access road for the development.
- Basin 3 draining to the north consists of approximately 23.3 ha of land. There is some existing development at the south end of the drainage basin.
- Basin 4 also draining to the north alongside Range Road 71 consists of approximately 1.7 ha of land. There is no existing development of the property in this basin.

The existing drainage system is shown in **Figure 4**.

The peak flows for the existing development conditions are also shown on **Figure 4**, and listed below.

- Western portion of Basin 1 – 0.895 m^3/s
- Basin 3 – 1.396 m^3/s

4.2 POST DEVELOPMENT MODEL

The post development model was created by adjusting the subcatchment impervious percentage of the subcatchments that contain the proposed development and minor subcatchment boundary adjustments to direct runoff from the new development to Basin 3. The subcatchment area impervious values are included in **Appendix B**. The post development model is shown in **Figure 5**. This figure also shows the proposed storage location for management of the stormwater runoff.

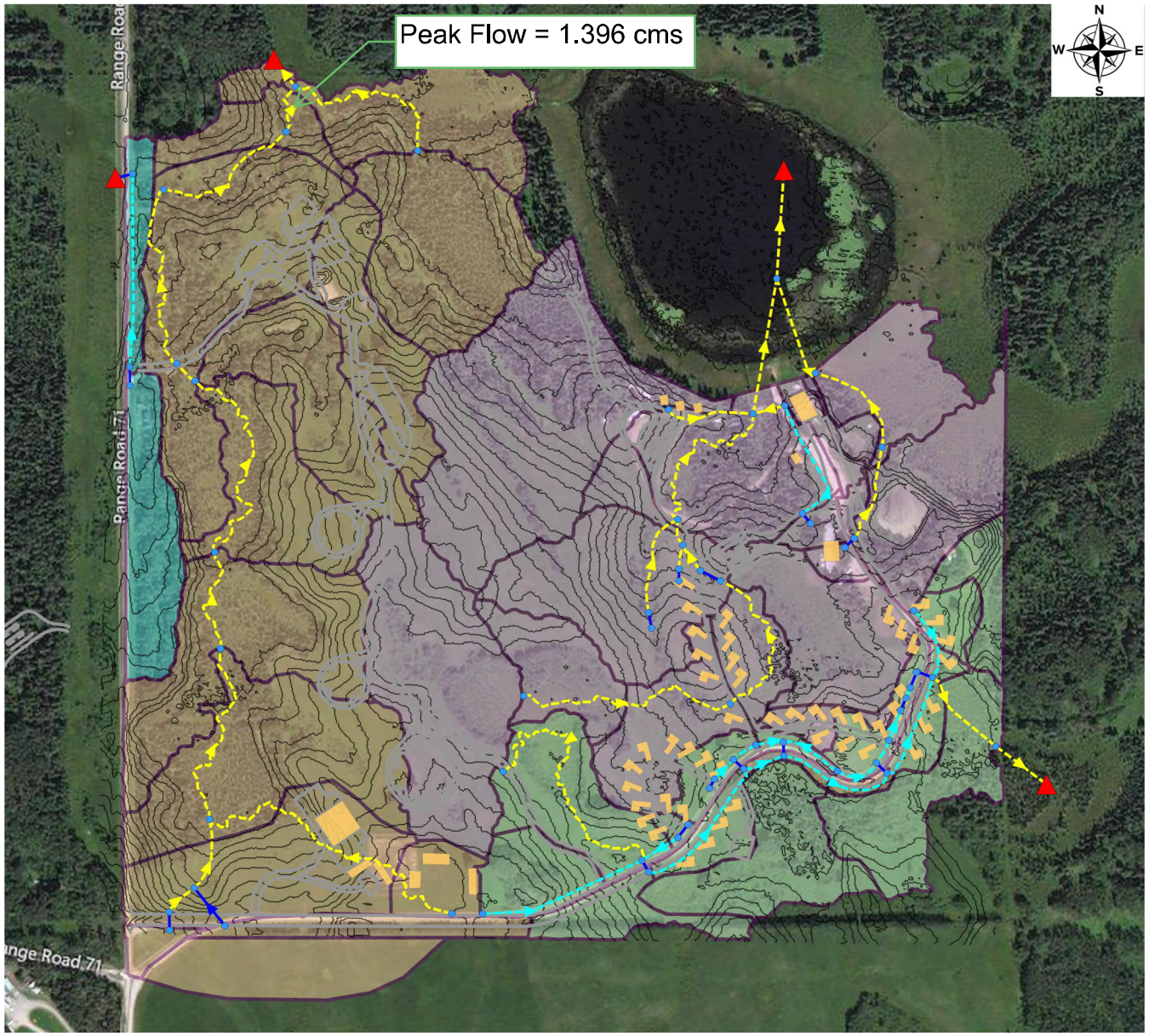
The post development model shows peak flows into SWMF-NORTH of 1.597 m^3/s versus the pre-development flow of 1.396 m^3/s.

The storage requirements for the stormwater management location was then determined utilizing the storage function within the PCSWMM software. The resulting storage requirements are shown below in **Table 4.1**. The plot of the storage output from PCSWMM is included in **Appendix C**.

Table 4.1 Storage Requirements

LOCATION	STORAGE REQUIREMENT (m^3)	MAXIMUM DISCHARGE (m^3/s)
SWMF-NORTH	785	1.396

For the additional cabins along Schott's Lake the rooftop runoff should be directed to local depressions to promote infiltration.



SCHOTT'S LAKE RV AND GUEST RANCH

PROJECT NO. : 211-04399-00

SCHOTT'S LAKE RV AND GUEST RANCH INC.

Legend

Subcatchments

- Basin 1
- Basin 2
- Basin 3
- Basin 4

- Junctions
- Outfalls

Conduits

- Flow Path
- Culvert
- Pipe
- Ditch

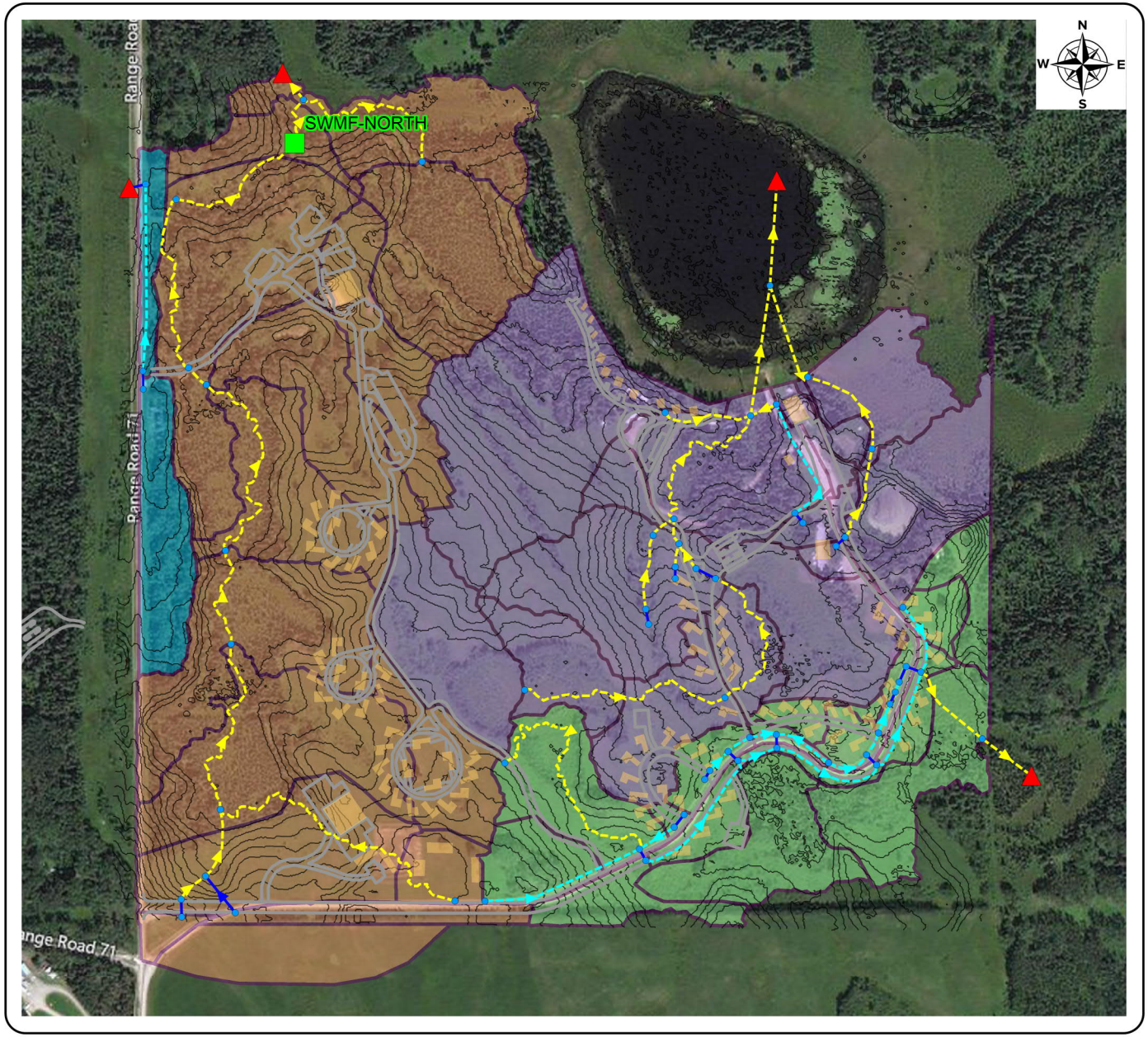
- Contours (m)
- Buildings
- Roads

150 m

EXISTING STORMWATER SYSTEM

Suite 1200, 10909 Jasper Avenue
Edmonton, AB, Canada T5J 3L9
T +1 780 466-6555 | www.wsp.com

FIGURE 4



SCHOTT'S LAKE RV AND GUEST RANCH

PROJECT NO. : 211-04399-00

SCHOTT'S LAKE RV AND GUEST RANCH INC.

Legend

Subcatchments

- Basin 1
- Basin 2
- Basin 3
- Basin 4

- Junctions
- Outfalls

Conduits

- Flow Path
- Culvert
- Ditch

- Storages
- Contours (m)
- Buildings
- Roads

150 m

PROPOSED STORMWATER SYSTEM

Suite 1200, 10909 Jasper Avenue
Edmonton, AB, Canada T5J 3L9
T +1 780 466-6555 | www.wsp.com

FIGURE 5

5 SUMMARY AND CONCLUSIONS

A hydrological assessment was completed using the PCSWMM modeling software for the Schott's Lake RV and Guest Ranch property. Precipitation data from the climate station at Rocky Mountain House was utilized to derive the 1:100 year, 24 hour Chicago storm used in the analysis.

The results of the analysis indicate a storage requirement for the new development of the property of 785 m3 for SWMF-NORTH located north of the proposed development.

Details of the finalized drainage system should be submitted to Alberta Environment and Parks for Water Act and/or EPEA approvals once the detailed design is near completion and no further amendments to the drainage system are anticipated.

BIBLIOGRAPHY

- Tagish Engineering. (1992, August). Red Deer County Design Guidelines.
- Environment and Climate Change Canada. (2019, February). Short Duration Rainfall Intensity-Duration-Frequency Data, Rocky Mountain House Composite.

APPENDIX

A RAINFALL HYETOGRAPH

APPENDIX

A-1 IDF CURVE

idf_v3-00_2019_02_27_301_AB_3015523_ROCKY_MTN_HOUSE_(AUT).txt
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Short Duration Rainfall Intensity-Duration-Frequency Data
Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2019/02/27

==========

ROCKY MTN HOUSE (AUT) AB 3015523
(composite)
Latitude: 52 25'N Longitude: 114 55'W Elevation/Altitude: 988 m

Years/Années : 1964 - 2017 # Years/Années : 37

==========

****

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

****

Year / Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
1964	3.3	6.6	8.1	11.7	13.7	14.2	14.5	23.4	35.6
1965	6.3	8.9	10.7	12.2	15.0	23.9	31.0	31.0	34.8
1966	5.8	8.6	9.1	9.4	11.9	20.6	33.5	56.9	78.2
1967	4.3	7.9	11.2	14.5	16.5	18.3	18.3	20.6	31.5
1968	3.8	7.1	8.9	11.2	11.4	16.0	35.3	59.7	82.3
1969	3.8	6.9	6.9	9.7	17.0	19.6	23.9	30.5	41.4
1970	9.1	15.5	20.1	29.7	36.3	36.3	36.3	42.9	57.7
1971	7.9	12.7	17.0	24.4	27.7	31.7	34.0	38.4	39.9
1974	16.5	21.8	24.9	27.2	29.5	29.7	34.5	64.5	64.5
1975	6.1	6.9	9.9	11.7	12.4	13.5	21.1	24.1	24.1
1976	8.4	9.9	10.4	17.3	21.8	32.0	45.0	51.6	54.9
1977	4.8	7.9	11.7	18.5	23.6	28.4	29.0	56.4	61.7
1978	17.3	21.8	30.4	33.5	35.2	35.5	36.5	38.8	43.5
1979	2.4	4.5	5.4	8.1	9.7	11.6	15.0	15.8	17.9
1980	3.6	7.1	9.7	13.9	15.4	16.0	25.7	36.6	41.1
1981	8.6	10.2	11.7	13.2	14.5	15.0	26.0	32.5	51.2
1982	4.4	5.5	6.9	12.0	12.7	12.8	23.0	26.2	44.5
1983	-99.9	-99.9	-99.9	-99.9	17.9	22.2	22.7	26.5	34.7
1984	3.9	5.4	7.1	7.3	8.7	16.8	41.7	56.2	67.9

1985	4.3	7.3	7.9	8.3	13.4	19.2	23.5	23.8	27.8
1986	4.8	5.8	6.2	7.3	8.1	15.2	39.0	64.4	97.0
1987	4.9	6.9	9.4	13.7	18.2	19.7	27.9	27.9	30.4
1988	8.6	17.2	20.4	20.7	21.7	21.7	21.9	23.6	37.2
1989	3.8	5.7	8.6	13.8	14.3	14.6	32.3	38.9	47.7
1990	3.8	5.4	7.8	9.0	12.4	15.0	27.3	47.4	69.2
1991	5.2	7.9	8.3	9.1	11.8	14.5	28.2	31.5	42.7
1992	3.6	4.6	5.3	8.9	10.1	12.4	20.6	26.3	38.0
1993	4.9	8.8	10.8	12.1	13.0	16.0	24.2	32.4	47.7
2006	4.8	7.2	8.6	8.8	11.2	13.4	24.2	34.6	48.6
2007	5.6	9.6	11.8	14.4	17.8	18.6	23.0	26.6	34.6
2008	4.2	6.4	7.2	9.0	10.8	12.2	20.2	26.0	42.6
2009	6.0	7.6	10.2	14.4	18.4	21.0	23.6	34.2	37.8
2010	11.2	19.4	23.4	24.2	26.2	27.2	29.4	36.0	47.4
2011	10.2	13.6	14.2	16.6	18.4	18.6	20.2	30.4	34.2
2012	2.8	4.0	5.4	7.6	10.4	17.2	30.2	36.0	40.6
2013	7.0	11.4	15.6	27.0	29.0	30.6	33.8	33.8	57.0
2015	2.2	3.8	5.4	8.4	10.2	10.6	16.6	23.4	30.6
2017	5.4	7.0	8.2	10.8	12.2	17.6	28.4	41.4	41.4
# Yrs. Années	37	37	37	37	38	38	38	38	38
Mean Moyenne	6.0	9.0	11.2	14.3	16.8	19.7	27.4	36.1	46.3
Std. Dev. Écart-type	3.4	4.7	5.9	6.9	7.2	7.0	7.3	12.7	16.6
Skew. Dissymétrie	1.93	1.56	1.70	1.31	1.24	0.98	0.38	0.86	1.13
Kurtosis	7.19	4.95	5.75	4.07	4.04	3.16	2.91	3.07	4.58

*-99.9 Indicates Missing Data/Données manquantes

Warning: annual maximum amount greater than 100-yr return period amount
Avertissement : la quantité maximale annuelle excède la quantité pour une période de retour de 100 ans

Year/Année	Duration/Durée	Data/Données	100-yr/ans
1978	5 min	17.3	16.7
1978	15 min	30.4	29.7

****

Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années

5 min	5.5	8.5	10.5	13.0	14.9	16.7	37
10 min	8.3	12.4	15.2	18.6	21.2	23.7	37
15 min	10.2	15.4	18.9	23.2	26.5	29.7	37
30 min	13.2	19.3	23.3	28.4	32.1	35.9	37
1 h	15.6	22.0	26.2	31.6	35.6	39.5	38
2 h	18.6	24.7	28.8	34.0	37.8	41.6	38
6 h	26.2	32.7	36.9	42.3	46.3	50.3	38
12 h	34.0	45.2	52.7	62.1	69.1	76.0	38
24 h	43.6	58.3	68.0	80.3	89.4	98.5	38

****

Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	65.8	101.9	125.7	155.9	178.3	200.5	37
	+/- 12.1	+/- 20.3	+/- 27.4	+/- 37.0	+/- 44.3	+/- 51.6	37
10 min	49.7	74.5	90.9	111.7	127.1	142.4	37
	+/- 8.3	+/- 14.0	+/- 18.9	+/- 25.5	+/- 30.5	+/- 35.5	37
15 min	41.0	61.8	75.5	92.9	105.8	118.6	37
	+/- 7.0	+/- 11.7	+/- 15.8	+/- 21.3	+/- 25.5	+/- 29.7	37
30 min	26.4	38.5	46.5	56.7	64.2	71.7	37
	+/- 4.1	+/- 6.8	+/- 9.2	+/- 12.5	+/- 14.9	+/- 17.4	37
1 h	15.6	22.0	26.2	31.6	35.6	39.5	38
	+/- 2.1	+/- 3.6	+/- 4.8	+/- 6.5	+/- 7.7	+/- 9.0	38
2 h	9.3	12.4	14.4	17.0	18.9	20.8	38
	+/- 1.0	+/- 1.7	+/- 2.3	+/- 3.1	+/- 3.7	+/- 4.3	38
6 h	4.4	5.4	6.2	7.1	7.7	8.4	38
	+/- 0.4	+/- 0.6	+/- 0.8	+/- 1.1	+/- 1.3	+/- 1.5	38
12 h	2.8	3.8	4.4	5.2	5.8	6.3	38
	+/- 0.3	+/- 0.5	+/- 0.7	+/- 0.9	+/- 1.1	+/- 1.3	38
24 h	1.8	2.4	2.8	3.3	3.7	4.1	38
	+/- 0.2	+/- 0.3	+/- 0.5	+/- 0.6	+/- 0.7	+/- 0.9	38

****

Table 3 : Interpolation Equation / Équation d'interpolation: R = A*T^B

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)
RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)
T = Rainfall duration (h) / Durée de la pluie (h)

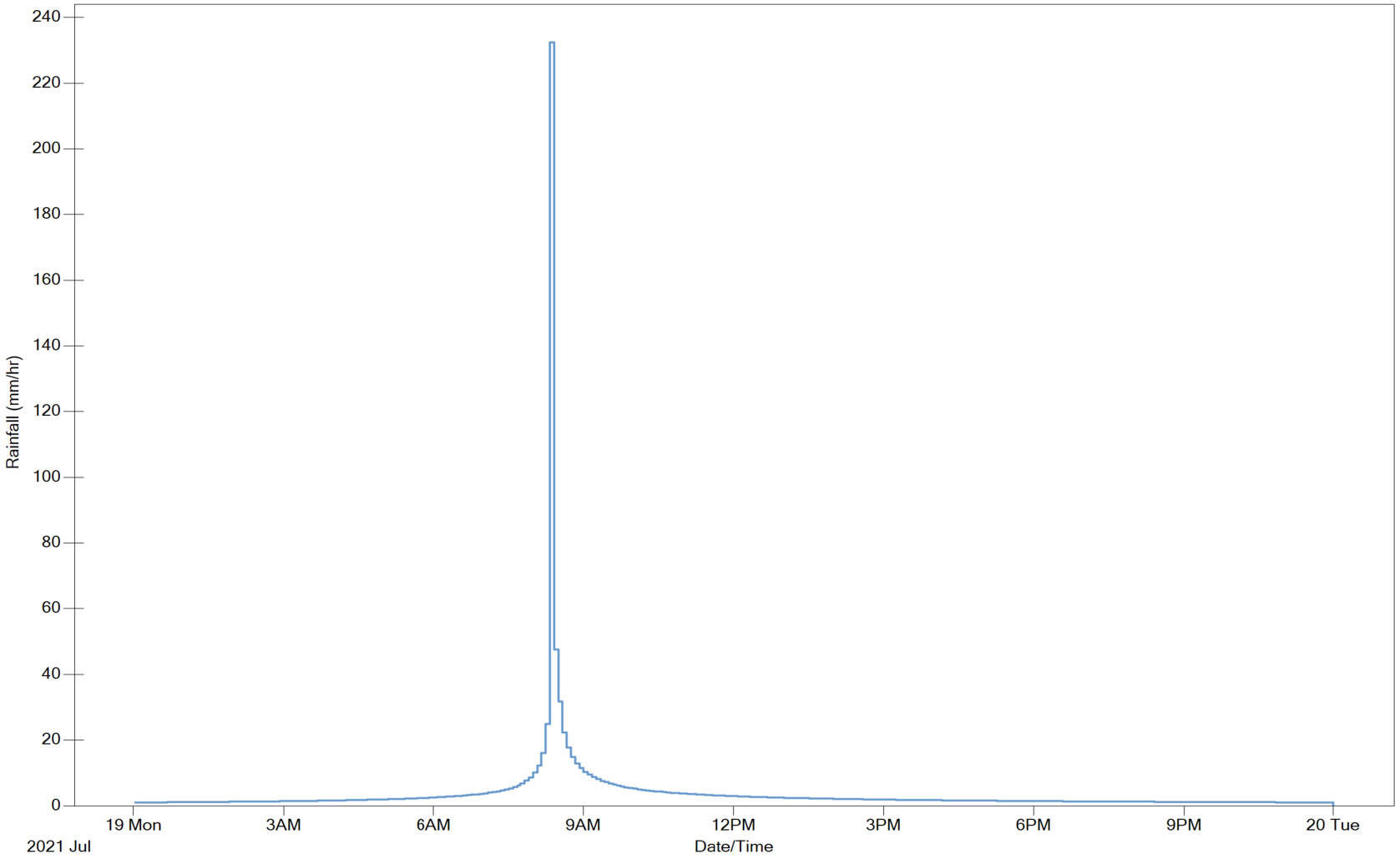
****

Statistics/Statistiques	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans
Mean of RR/Moyenne de RR	24.1	35.8	43.6	53.5	60.8	68.0
Std. Dev. /Écart-type (RR)	23.2	36.0	44.4	55.1	63.0	70.8
Std. Error/Erreur-type	4.7	7.0	8.6	10.6	12.1	13.7
Coefficient (A)	15.0	21.2	25.2	30.3	34.1	37.9
Exponent/Exposant (B)	-0.661	-0.694	-0.707	-0.718	-0.724	-0.729
Mean % Error/% erreur moyenne	5.8	7.3	8.2	9.1	9.6	10.0

APPENDIX

A-2 RAINFALL HYETOGRAPH

1:100 Year 24 Hour Chicago Storm



APPENDIX

B SUBCATCHMENT DATA

APPENDIX

SUBCATCHMENT ID	PRE-DEVELOPMENT		POST DEVELOPMENT	
	AREA (ha)	IMPERVIOUSNESS (%)	AREA (ha)	IMPERVIOUSNESS (%)
S10	1.7831	0	1.7831	3.863
S11	1.7371	0	1.8947	5.939
S12	2.2663	0	2.2663	0
S13	2.9584	0	1.7619	0
S13_2			1.0876	5.319
S14_2	0.1566	12.516	0.1566	12.516
S14_3	1.629	5.672	1.629	5.672
S14_4	0.2665	18.229	0.2665	18.229
S15	2.6063	0	2.6063	2.124
S16_2	0.6134	10.282	0.6134	10.282
S16_3	0.9684	0	0.9684	0
S16_4	1.272	10.731	1.272	10.731
S17_1	2.3244	8.884	2.3244	8.884
S17_2	2.7242	0	2.7242	5.865
S18	0.0824	27.184	0.0824	27.184
S18_1	0.7098	0	0.7098	0
S18_2	0.4396	29.236	0.4396	29.236
S18_3	0.3832	21.51	0.3832	21.51
S18_5	1.4496	1.763	1.4647	1.763
S18_6	0.1154	75.217	0.1154	75.217
S18_7	0.5927	7.322	0.5927	7.322
S18_8	0.0958	32.15	0.0958	32.15
S18_9	1.3769	5.694	1.3769	5.694
S19_1	0.0961	21.852	0.0961	21.852
S19_2	0.3497	0	0.3497	0
S19_3	0.1931	6.434	0.1931	6.434
S19_5	0.2818	32.789	0.2818	32.789
S19_6	0.187	56.337	0.187	56.337
S19_7	1.4914	0	1.4914	0
S19_8	0.3821	20.885	0.3821	20.885
S19_9	1.9905	3.935	1.9905	3.935
S2	0.527	10.626	0.527	10.626

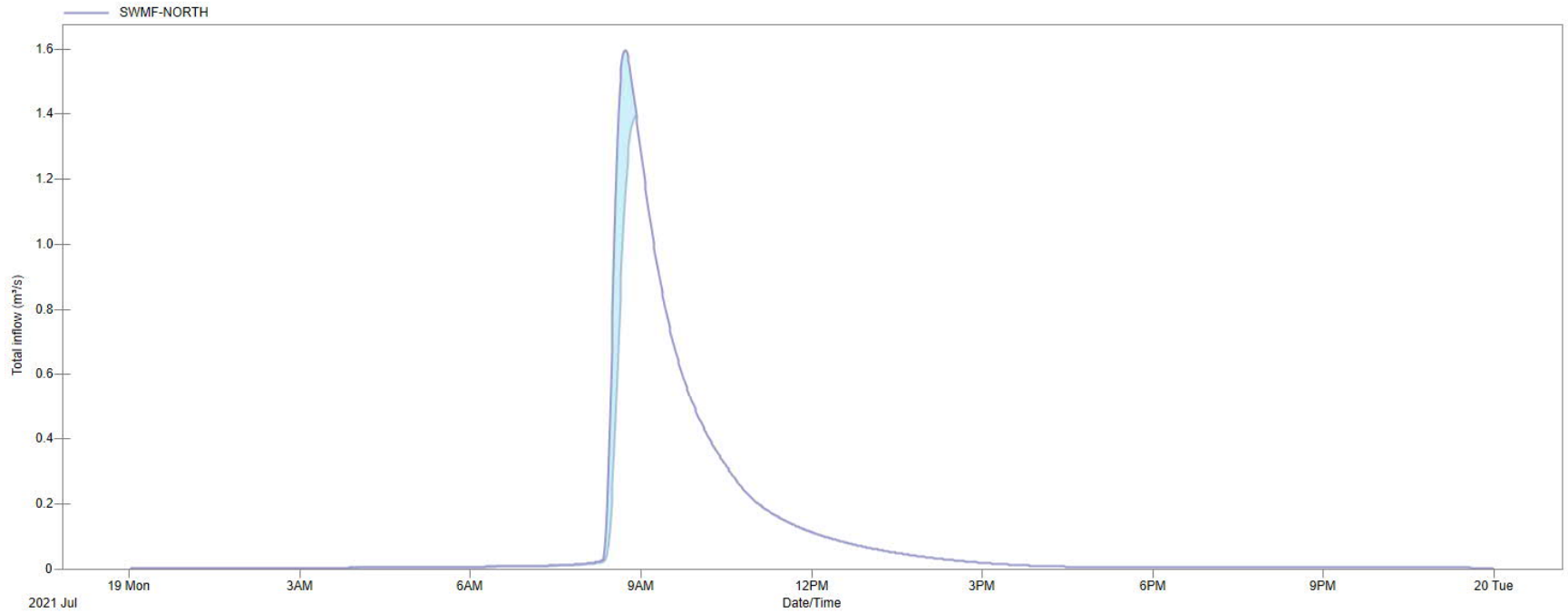
APPENDIX

SUBCATCHMENT ID	PRE-DEVELOPMENT		POST DEVELOPMENT	
	AREA (ha)	IMPERVIOUSNESS (%)	AREA (ha)	IMPERVIOUSNESS (%)
S20_1	0.13	64.615	0.13	64.615
S20_2	0.311	12.492	0.311	12.492
S20_3	1.7011	0.72	1.7011	0.72
S20_5	0.5355	0	0.5355	0
S23	0.5954	29.721	0.5954	29.721
S24	1.249	0	1.249	0
S3	1.5779	0	1.5779	0
S32	1.2834	0	1.2834	0
S4	0.1704	0	0.1704	0
S5	0.4607	0	0.4607	0
S5_1	0.6951	0	0.6951	0
S5_3	3.3743	0	3.3743	6.348
S7_1	1.4172	0	1.5315	15.502
S7_2	2.2979	0	2.2979	0
S8_2	4.2069	0	4.151	0.642
S9	0.1863	11.742	0.1863	11.742
S9_1	0.1794	0	0.1794	0
S9_2	1.1783	0	1.1783	0
S9_3	0.2383	38.687	0.2383	38.687

APPENDIX

C PCSWMM STORAGE PLOTS

APPENDIX



Data | Objectives | Error | Storage | Patterns | Edit | Derive | Audit | Events | Scatter | Duration | IDF

Storage required for SWMF-NORTH Total inflow (m³/s)

From Jul 18, 2021 10:49 PM to Jul 20, 2021 1:11 AM (26.38 hours)

Available storage before outflow: 0 m³

Maximum design outflow: 1.396 m³/s

Storage volume required to obtain a peak flow of 1.396 m³/s at location SWMF-NORTH is 785.1 m³.