

# **STORMWATER MANAGEMENT OUTLINE**

**Sage Creek Fire Station # 27  
Fire Paramedic Service  
Winnipeg, Manitoba**

Prepared by:  
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Project No. 2010-08

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City of Winnipeg  
Fire Paramedic Service  
2<sup>nd</sup> Floor, 185 King Street  
Winnipeg, Manitoba R3B 1J1

Attention: Mr. Reid Douglas  
Deputy Chief, Support Services

Dear Mr. Douglas,

**Re: Stormwater Management Outline  
Sage Creek Fire Station # 27**

**1.0 Introduction**

This Stormwater Management Report outlines the measures to be used to control quantity and quality of the stormwater run-off from the proposed new fire Station on Sage Creek Boulevard. The site is located on the north side of the road about 70 metres east of Lagimodiere Boulevard. This report is prepared on behalf of the Support Services Group to support the development application and to satisfy the drainage criteria of the City of Winnipeg.

**2.0 Criteria**

Any new development in Winnipeg must provide on-site retention to control and contain post development peak run-off flows for the minor storm event of 1:5 year and the major storm event of 1:25 year to pre-development flows for the 1:5 year storm.

The Best Management Plan Features for this site indicate that the total storage requirements for flood control, protection of stream morphology, water quality protection and base flow augmentation for impervious areas would require "basic" measures.

The "basic" protection level (60% long term removal of TSS) is considered for this site. The water quality storage volume required for this protection level considering 85% impervious level using a dry pond SWMP type would be 240 m<sup>3</sup>/ha.

### **3.0 Pre-Development Conditions**

The site is currently vacant. The topography has a slight grade (0.5 %) from northeast to southwest.

The property is bounded on the north, east, and west by vacant lands currently under an application for a retail commercial mall complex. Sage Creek Boulevard is on the south boundary.

The Municipality's site plan development policy is that all surface rainfall runoff be contained within the site. The total area considered for Stormwater Management is 0.50 hectares with 0% imperviousness.

The Rational Method is being used since the site area is less than 5 ha. The equivalent run-off coefficient for the entire site is considered to be,  $C = 0.20$ . The predevelopment conditions are presented on Drawing LG-1.

There are municipal sanitary, storm and water services on Sage Creek Boulevard.

Using the Drainage Criteria Manual from the City of Winnipeg, Table 2.5, 5 year return for 5 minutes duration and the Rational Method for calculating runoff values, the pre-development runoff flow,  $Q_{pre}$ , was calculated to be 39.85 litres per second. This value is shown in the print out calculations in Appendix A. This run-off flow would require a 75 mm diameter with a hydraulic head of 1.5 metres.

A geotechnical investigation was prepared by TBT Engineering Consulting Group in August 2010. The existing soils are considered to be mainly stiff clay to depths of 11 and 13 metres. This type of material does not allow for ground water infiltration and therefore was not considered for stormwater dispersal.

### **4.0 Post-Development Flows**

The post development conditions were based on information taken from the Site Plan provided by Murphy & Murphy Architects. The proposed development consists of new one storey fire and paramedic station building, asphalt parking area along the west side of the property. Development is planned to proceed in late 2010 through to completion in 2011.

For the developed site, the equivalent run-off coefficient is calculated to be  $C_{pre} = 0.54$ , and is presented in Appendix A.

## 5.0 Critical Storage Volume for Retention

Considering the post development conditions of 2, 5, and 25 year storm return event and outlet control to pre-development conditions for the 5 year storm event, the volume of excess rainfall to be stored on site is presented in the table below.

The stormwater management in the form of a retention basin has been considered in the southeast side of the site. See Drawing LG-3

Using the 75 mm diameter restrictor to control the impact on the Municipal sewer, we calculated the volumes restricted to the 39.92 L/sec. The calculations are included in Appendix B.

In summary, the required volumes are tabulated below.

Return Storm	Peak Flow Q, L/s	Storage Volume V, m <sup>3</sup>
2	80.90	12.66
5	106.27	24.79
25	147.94	48.71

## 6.0 Mitigating Measures

In accordance with Municipal standard to maintain runoff to pre-development conditions, this SWM report considers an allowable run-off of  $Q = 39.85$  L/s as outlined in Section 3.0. Therefore, there will be no negative impact on the municipal sewer.

### 6.1 Stormwater Reservoir

It is proposed to control the excess run-off in arecessed yard depression, a dry type detention pond, in the southeast corner of the property. See Drawing LG-1, Appendix C.

The storm drainage run off is directed overland by proper grading and roof water drains into the proposed catchbasins and drainage piping. The storm sewer system is connected to a 300 diameter sewer connected to the existing 1350 diameter Municipal sewer on the boulevard.

Our calculations indicate that the 25 year storm volume will be discharged in approximately 1 hour.

### 6.2 Outlet Control

In order to control the excess volume, a restricting circular orifice, 75 mm diameter will be installed in the outlet pipe of the proposed storm manhole CBMH 1. See a detail section on Drawing SS-1.

### 6.3 Stormwater Quality Measures

In order to further contain the amount of sediments and various pollutants within the site, we recommend that deep sumps and goss traps be provided in the out letting pipe of each catchbasin. These goss traps and parking lot ponding will provide a 60% long term removal of total suspended solids i.e. basic level of protection.

The storm volume for the impervious level is  $48.71/0.2384 = 204$  m<sup>3</sup>/ha which is close to the recommended value of 240 m<sup>3</sup>/ha for 85% impervious level.

### 6.4 Maintenance Measures

We recommend, as a minimum, annual clean out of the catchbasins and CBMH 1. It may be possible to reduce the frequency of the times of cleaning once the amount of sediment becomes known.

## 7.0 Summary

The stormwater run-off from this site will be controlled in the following manner:

- 7.1 The retention facility consists of yard storage reservoir i.e. a dry pond. The maximum volume of water retained is 57.8 cm. The required amount for the 1:25 year storm event amounts to 48.71 cm.
- 7.2 The storm drainage outlet will be controlled by a circular orifice 75 mm diameter located in the storm manhole CBMH 1. The discharge rate at 1.5 meter head is 39.85 L/sec.

- 7.3 The stormwater quality control will be enhanced by providing sumps and goss traps in the storm sewer system.

These facilities will provide a basic level of protection for Total Suspended Solids

- 7.4 Annual cleaning catchbasins and the catchbasin manhole will insure the efficiency of the quality control measures on the property.

Should you have any questions concerning our report, please call us.

Sincerely,  
STEVENSON ENGINEERING LIMITED

Robert C. Stevenson

Cc: Murphy and Murphy Architects Inc.



Mr. David Murphy, Architect

Appendix A

Consider predevelopment rainfall run-off

Area = 0.50 hectares

Run-off Coefficient.  $C = 0.20$

Intensity,  $I$

Where  $I = (25.4) 47.2 / (td + 8)^{0.828}$  and where  $td = 5$  minutes

$$I = (25.4)(47.2) / 8.3627$$

$$= 143.33 \text{ mm/hr}$$

Using the Rational Method,  $Q_{pre} = 2.78 C I A$

$$= 2.78 \times 0.20 \times 143.33 \times 0.50$$

$$= 39.85 \text{ L/sec}$$



Appendix B

DATE August 23, 2010

JOB NO.: 2010-08

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Storm Water Mangement For:  
Local Winnipeg Manitoba

Sage Creek Fire Station

CLIENT:

Murphy & Murphy Archifect Inc.

**POST-DEVELOPMENT**

Area	C	A*C
Lot area: 4976 sm		
Building Areas 690	0.9	621
Parking/Gravel 1694 sm	0.9	1524.6
Landscape 2585 sm	0.2	517
<b>Total</b> 4969		<b>2662.6</b>
New "C" 0.54		
Area "A" 0.50 Ha		
1.23 Acres		

**Q(allowed)= 39.85 l/s**  
**PRE-DEVELOPMENT FLOW**

**PRE-DEVELOPMENT**

Area	Unit	C	C*A
Lot area: 4967	sm		
Building Area	sm	0.9	0.00
Parking/Gravel	sm	0.9	0.00
Landscaping 4967	sm	0.2	993.40
<b>Total</b> 4967	sm		<b>993.40</b>

**PRE-DEVELOPMENT**

Time of concentration (t) 5 min  
Slope 0.5%  
c= 0.2  
i= 4.32 Intensity at 20 minutes

**SITE STORAGE AT POST-DEVELOPMENT FLOWS**

2 YEAR	12.66 cm
5 YEAR	24.79 cm
25 YEAR	48.71 cm
100 YEAR	0 cm

FILL IN BOXES

Duration: 2 Years

time	intensity	Q=2.78*C*I*A		Capacity	Difference	Storage
min.	"I"	l/s	0.74	l/s	"d"	d*I*0.06
					l/s	cm
5	109.15	80.90		39.85	41.05	12.32
10	82.23	60.95		39.85	21.10	12.66
15	66.68	49.43		39.85	9.58	8.62
30	43.69	32.39		39.85	-7.46	-13.43
60	26.96	19.99		39.85	-19.86	-71.51
120	16.03	11.88		39.85	-27.97	-201.36
360	6.77	5.01		39.85	-34.84	-752.44
720	3.88	2.88		39.85	-36.97	-1597.24
1440	2.22	1.64		39.85	-38.21	-3301.01

Storage:

12.66 cm

**PIPE RESTRICTOR**

(MUST DO CALCULATIONS MANUALLY)

Orifice Opening based on Bernoulli's equation:

Q= 39.85 l/s

H= 1.5 m

Q=Cd\*A\*(2gH) note:(I) is square root

Q= 39.85 l/s

Cd= 0.8 constant

A= area of opening in s.m.

g= 9.81 m/s

H= 1.5 m

A= (Q)/(0.6\*(2\*9.81\*H))^0.5

0.0044147 sm

Area=3.14159\*r^2

r=((A/3.14159))^0.5

Diameter= 0.075 m

75 mm

New "C" 0.54  
Area "A" 0.74 Ha

Duration: 5 Years

time	intensity	Q=2.78*C*I*A		Capacity	Difference	Storage
min.	"I"	l/s	0.74	l/s	"d"	d*I*0.06
					l/s	cm
5	143.36	106.27		39.85	66.42	19.92
10	109.50	81.17		39.85	41.32	24.79
15	89.39	66.26		39.85	26.41	23.77
30	58.98	43.72		39.85	3.87	6.97
45	44.78	33.19		39.85	-6.66	-17.98
60	36.43	27.00		39.85	-12.85	-46.25
90	26.92	19.95		39.85	-19.90	-107.45
120	21.58	15.99		39.85	-23.86	-171.76
150	18.13	13.44		39.85	-26.41	-237.73
180	15.70	11.63		39.85	-28.22	-304.73

Storage:

24.79 cm

Storm Water Mangement For: what  
 Location: where

New "C" 0.54  
 Area "A" 0.50 Ha

Duration: 25 Years

time	intensity "I"	Q=2.78"C*I"A 0.74		Capacity	Difference "d"	Storage d*t*0.06 cm
min.		I/s	I/s	I/s	I/s	
5	199.59	147.94	39.85	108.09	32.43	
10	154.33	114.40	39.85	74.55	44.73	
15	126.78	93.97	39.85	54.12	48.71	
30	84.24	62.44	39.85	22.59	40.66	
45	64.05	47.47	39.85	7.62	20.59	
60	52.10	38.62	39.85	-1.23	-4.42	
90	38.45	28.50	39.85	-11.35	-61.30	
120	30.76	22.80	39.85	-17.05	-122.73	
150	25.80	19.12	39.85	-20.73	-186.54	
180	22.30	16.53	39.85	-23.32	-251.82	
210	19.70	14.60	39.85	-25.25	-318.12	
Storage						48.71 cm

New "C" 0.54  
 Area "A" 0.50 Ha

Duration: 100 Years

time	intensity "I"	Q=2.78"C*I"A 0.74		Capacity	Difference "d"	Storage d*t*0.06 cm
min.		I/s	I/s	I/s	I/s	
5		0.00	39.85	-39.85	-11.96	
10		0.00	39.85	-39.85	-23.91	
15		0.00	39.85	-39.85	-35.87	
30		0.00	39.85	-39.85	-71.73	
60		0.00	39.85	-39.85	-143.46	
120		0.00	39.85	-39.85	-286.92	
360		0.00	39.85	-39.85	-860.76	
720		0.00	39.85	-39.85	-1721.52	
1440		0.00	39.85	-39.85	-3443.04	
Storage:						cm

Appendix C