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Consulting, Inc.
821 Columbus St., Suite 1
Rapid City, SD 57701

January 11, 2007

City of Rapid City Growth Management
300 Sixth Street
Rapid City, South Dakota 57701-2724

Subj: **Report of Hydrologic and Hydraulic Calculations**
Lot 7 of Block 2 of Stoney Creek South Subdivision
Rapid City, South Dakota
Project #3066.03

1.0 INTRODUCTION

This report summarizes our hydrologic and hydraulic calculations for the proposed commercial development on Lot 7 of Block 2 of Stoney Creek South Subdivision, located in the NW1/4 of the SW1/4 of Section 22, T1N, R7E, B.H.M., Rapid City, Pennington County, South Dakota. Reference the construction plans accompanying this report for project location.

2.0 BACKGROUND INFORMATION

Current plans call for constructing a single commercial building on Lot 7. At full build-out, two commercial buildings are anticipated for the site. Storm water discharge will be routed to the north gutter-line, and collected in a single Type "E" Inlet. The collected storm water will then be discharged to the existing box culvert located along the west property line. Reference the site plan for detail.

3.0 PEAK STORM WATER DISCHARGE

3.1 EXISTING CONDITIONS MODEL

An existing conditions model was created to predict peak storm water discharge from the site. The sub-basin includes the entirety of Lot 7. The runoff coefficients were selected from Table 3-1 of the Rapid City Drainage Criteria Manual. Peak discharge data for the 2, 10, and 100-year events are summarized in **Table 1** on the following page. Supporting calculations are attached.

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Table 1
(Existing Conditions Model)

Sub-Basin	2-Year Event (cfs)	10-Year Event (cfs)	100-Year Event (cfs)
1	0.3	1.9	5.7

3.2 DEVELOPED CONDITIONS MODEL

Developed discharge was calculated for the site. The developed conditions model assumes full commercial build-out of Lot 7. A runoff coefficient for "commercial" was selected from Table 3-1 of the Rapid City Drainage Criteria Manual. Peak discharge data for the 2, 10, and 100-year events are summarized in **Table 2**. Supporting calculations are attached.

Table 2
(Developed Discharge)

Sub-Basin	2-Year Event (cfs)	10-Year Event (cfs)	100-Year Event (cfs)
1	6.5	10.0	15.1

4.0 INLET CAPTURE CALCULATIONS

A single type "E" inlet is proposed for construction, and lies in a sump condition along the northernmost curb line. The calculations suggest that a 10-foot "Type E" inlet placed in a sump and inundated to the top of curb is capable of 100-percent inlet capture efficiency during the major event. Supporting calculations are attached for reference.

5.0 PIPE FLOW HYDRAULIC CALCULATIONS

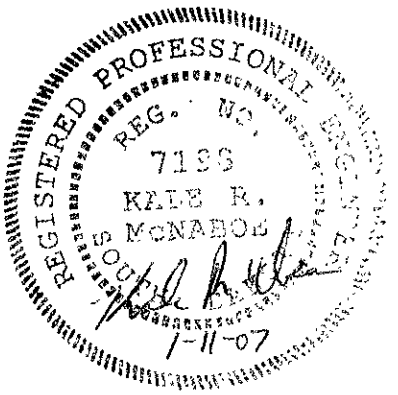
The project will include storm sewer expansion. Additional 12, 18 and 24-inch storm sewer is proposed. The existing storm sewer crossing on Bendt Drive consists of a single 18-inch RCP Barrel. The capacity of the culvert is estimated at 17-cfs. Inlet capture during the major event is estimated at 15-cfs. The combined pipe carrying capacity during the major event would then be on the order of 32-cfs. The attached calculations suggest that the proposed 24-inch RCP Barrel would have a capacity on the order of 37-cfs. The proposed storm sewer expansion should not negatively impact the existing storm sewer crossing on Bendt Drive. Supporting calculations are attached.

6.0 CLOSURE

If you have any questions or require additional information please do not hesitate to contact me at (605) 721-4040.

Sincerely;

Kale R. McNaboe, P.E.



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TIME OF CONCENTRATION CALCULATIONS
STONEY CREEK SOUTH SUBDIVISION
LOT 7 OF BLOCK 2

Note: Lot 7 of Block 2 of Stoney Creek South Subdivision is proposed for commercial development Under existing conditions, peak storm water discharge is routed to the northeast, towards an existing area inlet. In the developed conditions model, storm water will be captured in a Type "E" Inlet and routed to the aforementioned area inlet

Reach	Description	Properties		
A - B	Overland Flow	Slope (%) =	10 0	
		Length (ft) =	20	
		5-yr Coefficient (C5) =	0 05	Eq 2-4 (RCDCM)
		ti (min) =	4 11	
B - C	Channelized Flow	Slope (%) =	2 8	
	(short grass pasture or lawns)	Length (ft) =	355	
		Velocity (ft/s) =	1.3	fig 2-4 (RCDCM)
		tt (min) =	4 55	

TIME OF CONCENTRATION

Reach		Length	Velocity	ti (min)	tt (min)	tc (min)
A-B		20		4.11		4 11
B-C		355	1 3		4 55	4 55
	sum	375			tc (min) =	8 66

tc (min) = 8 7

FOR: City of Rapid City
616 6th Street
Rapid City, South Dakota 57701

BY: Sperlich Consulting, Inc.

PROJECT: Stoney Creek South Subdivision
Lot 7 of Block 2
Project #3066.03

DATE: January 11, 2007

EXISTING CONDITIONS MODEL

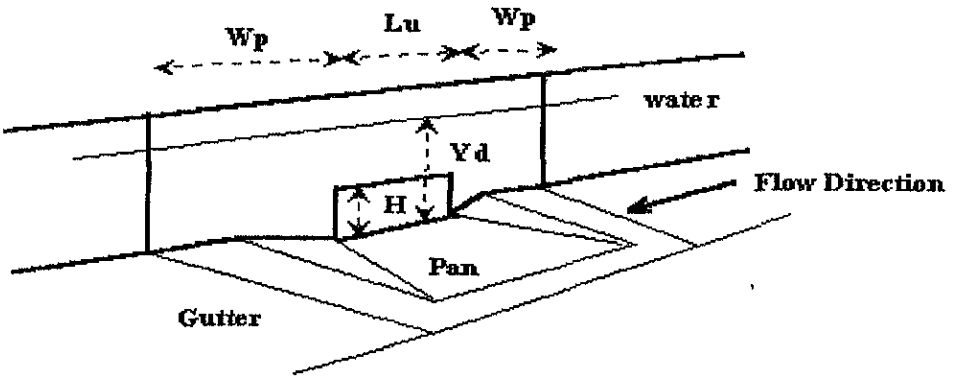
SUB-BASIN	AREA (ac.)	DISCHARGE COEFFICIENT	TIME OF CONCENTRATION (Minutes)	INTENSITY (in/hr)	PEAK DISCHARGE (cfs)
2-YEAR	1.786	0.05	8.7	3.51	0.3
10-YEAR	1.786	0.2	8.7	5.36	1.9
100-YEAR	1.786	0.4	8.7	8.01	5.7

DEVELOPED CONDITIONS MODEL

SUB-BASIN	AREA (ac.)	DISCHARGE COEFFICIENT	TIME OF CONCENTRATION (Minutes)	INTENSITY (in/hr)	PEAK DISCHARGE (cfs)
2-YEAR	1.786	0.87	5.0	4.20	6.5
10-YEAR	1.786	0.88	5.0	6.37	10.0
100-YEAR	1.786	0.89	5.0	9.48	15.1

CURB OPENING INLET IN A SUMP

Project = Type "E" Inlet Innundated to Top of Curb
Inlet ID = 10-Foot Long Inlet



Design Information (Input)		
Length of a Unit Inlet	L_u =	10.00 ft
Local Depression, if any (not part of upstream Composite Gutter)	a_{local} =	2.00 inches
Height of Curb Opening in Inches	H =	5.75 inches
Side Width for Depression Pan	W_p =	3.00 ft
Clogging Factor for a Single Unit (typical value = 0.1)	C_o =	0.00
Angle of Throat (see USDCM Figure ST-5)	Theta =	71.6 degrees
Orifice Coefficient (see USDCM Table ST-7)	C_d =	0.67
Weir Coefficient (see USDCM Table ST-7)	C_w =	2.30
Total Number of Units in the Curb Opening Inlet	No =	1

Curb Opening Inlet Capacity in a Sump		
As a Weir		
Design Discharge on the Street (from *Street Hy*)	Q_o =	**1.4 cfs**
Water Depth for the Design Condition	Y_d =	8.01 inches
Total Length of Curb Opening Inlet	L =	10.00 ft
Capacity as a Weir without Clogging	Q_{wi} =	19.3 cfs
Clogging Coefficient for Multiple Units	Coef =	1.00
Clogging Factor for Multiple Units	Clog =	0.00
Capacity as a Weir with Clogging	Q_{wa} =	19.3 cfs
As an Orifice		
Capacity as an Orifice without Clogging	Q_{oi} =	17.1 cfs
Capacity as an Orifice with Clogging	Q_{oa} =	17.1 cfs
Capacity for Design with Clogging	Q_a =	**17.1 cfs**
Capture Percentage for this Inlet = Q_a / Q_o =	C% =	**100.00 %**

Note: Unless additional ponding depth or spilling over the curb is acceptable, a capture percentage of less than 100% in a sump may indicate the need for additional inlet units.

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Circular X-Section
Date: 01/11/2007

Project No. :3066.03
Project Name.:Stone Creek South
Computed by :McNaboe

Project Description
Stoney Creek South Subdivision

INPUT PARAMETERS

1.	Pipe Slope (ft/ft)	0.0233
2.	Pipe Diameter (in)	18.0
3.	Manning's Coefficient	0.012
4.	Discharge (cfs)	17.370

OUTPUT RESULTS

Full Flow Conditions

Depth of Flow (ft)	1.50
Velocity (ft/sec)	9.83

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Circular X-Section
Date: 01/11/2007

Project No. :3066.03
Project Name.:Stone Creek South
Computed by :McNaboe

Project Description
Stoney Creek South Subdivision

INPUT PARAMETERS

1.	Pipe Slope (ft/ft)	0.0233
2.	Pipe Diameter (in)	24.0
3.	Manning's Coefficient	0.012
4.	Discharge (cfs)	37.409

OUTPUT RESULTS

Full Flow Conditions

Depth of Flow (ft)	2.00
Velocity (ft/sec)	11.91