

SPERLICH

Consulting, Inc.

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

January 12, 2007

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

**Subj: Report of Hydrologic and Hydraulic Calculations
Lots 12 and 13 of Carlin Subdivision
Rapid City, South Dakota
Project #3102**

1.0 INTRODUCTION

This report summarizes our hydrologic and hydraulic calculations for proposed Lots 12 and 13 of Carlin Subdivision, located in the W1/2 of the NW1/4 of the SE1/4 of Section 11, T1N, R8E, 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 gravel access road within the limits of an existing access easement. The two existing un-platted balances will then be platted into Lots 12 and 13, respectively. 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 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.

PREPARED BY

DATE

Table 1
(Existing Conditions Model)

| Sub-Basin | 2-Year Event (cfs) | 10-Year Event (cfs) | 100-Year Event (cfs) |
|------------------|-------------------------------|--------------------------------|---------------------------------|
| 1 | 1.1 | 7.0 | 21.2 |

3.2 DEVELOPED CONDITIONS MODEL

Developed discharge was calculated for the site. The developed conditions model assumes single-family residential development, with ½-acre lots or larger. A runoff coefficient 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 | 6.8 | 14.0 | 31.8 |

Note that the developed model includes existing lots within the sub-basin boundary. Those lots as well as the proposed lots 12 and 13 were modeled as developed to predict a peak discharge at full build-out.

4.0 CULVERT FLOW HYDRAULICS

A single 18-inch CMP culvert is proposed at the intersection of Mary Place and Pat Place. The portion of Sub-basin #1 contributing storm water discharge to the culvert location is limited to 0.6-acres. Assuming a time of concentration of 5-minutes, and a single-family residential coefficient (1/2-acre lots or larger), peak storm water discharge during the major event is anticipated to be on the order of 3.5-cfs. The 18-inch CMP proposed has a full flow capacity of 7.2-cfs, and

Lots 12 & 13 of Carlin Subdivision
Rapid City, South Dakota
Project #3102
January 12, 2007

should therefore have adequate capacity to convey the peak anticipated 100-year storm water discharge. Supporting calculations are attached for reference.

5.0 OPEN CHANNEL FLOW

Ditch sections are proposed for each of the aforementioned street sections. The minimum longitudinal slope along Pat Place is anticipated to be on the order of 1.04-percent. The proposed ditch section has a 1-foot bottom and 3(h):1(v) side-slopes. The ditch section will have a total depth of 2-feet. The full flow capacity of the ditch section is calculated at 61-cfs, which is in excess of the peak anticipated storm water discharge from the entire basin.

6.0 CLOSURE

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

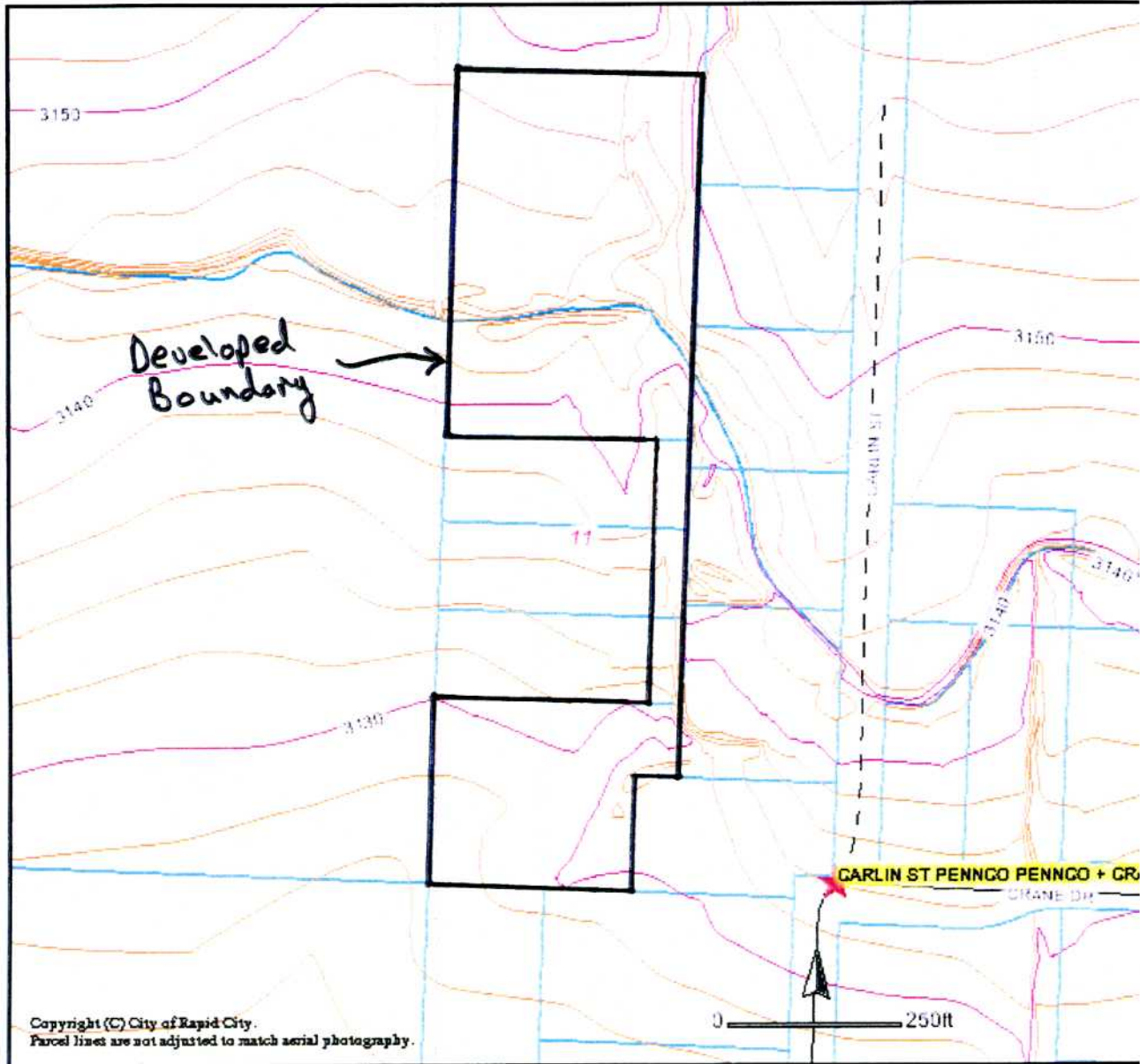
Sincerely;



Kale R. McNaboe, P.E.

C:\WINDOWS\Word\letters\carlin.doc



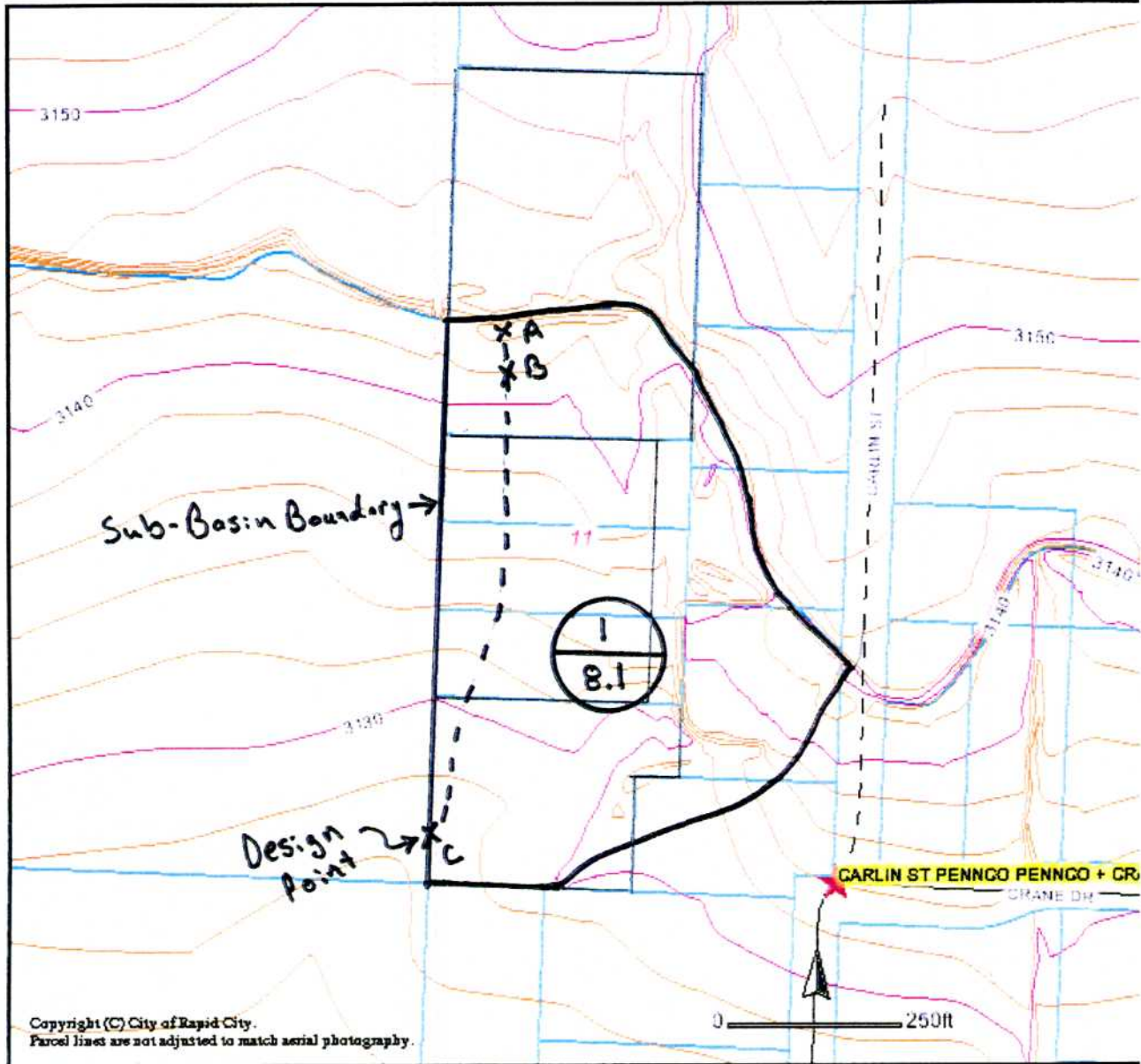


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Site Vicinity
Project # 3102
Date: 1-12-07



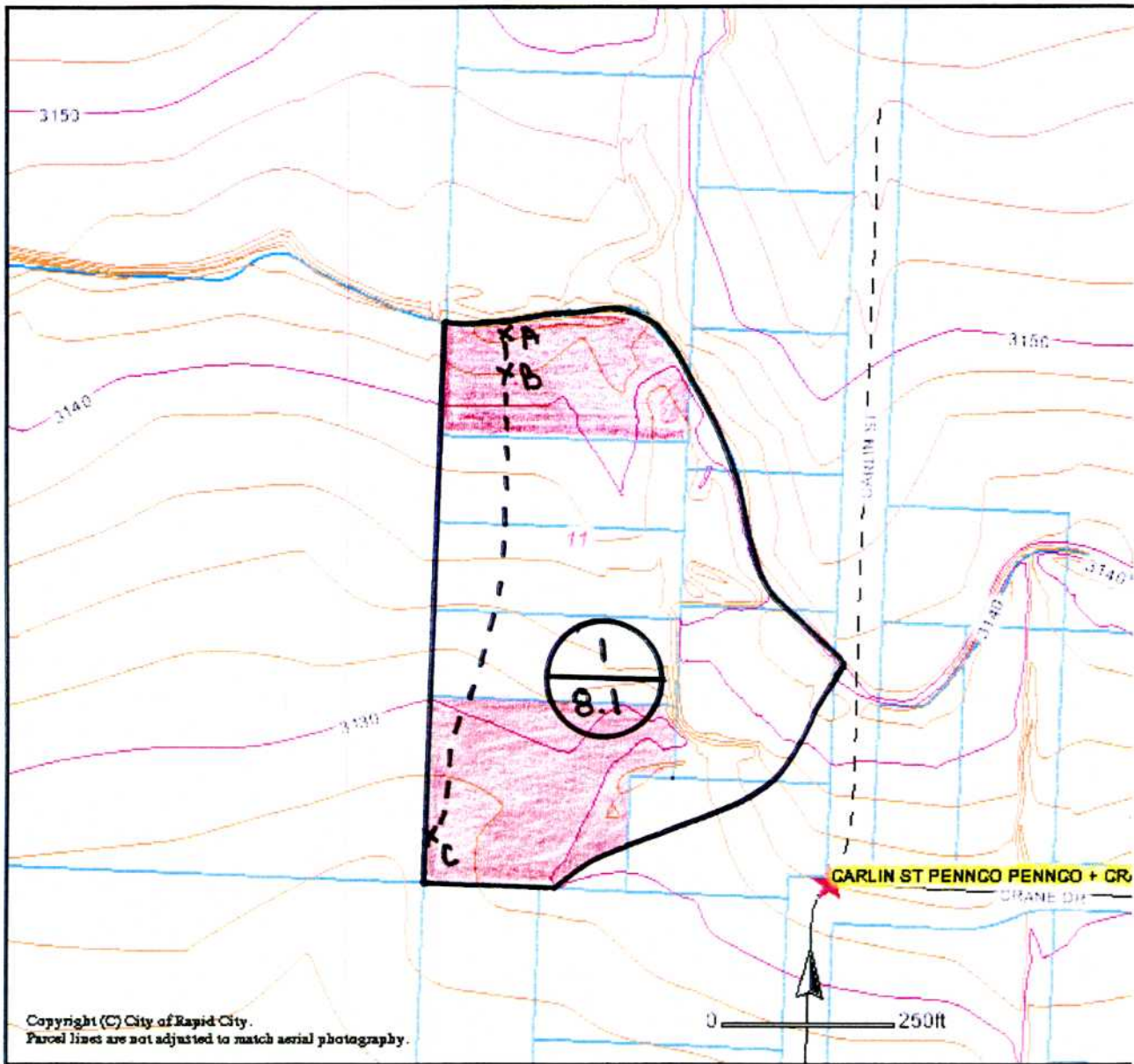
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Existing Conditions Model

Project #3102

Date: 1-17-07



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Proposed Conditions
Project # 3102
Date: 1-12-07

TIME OF CONCENTRATION CALCULATIONS
CARLIN SUBDIVISION
LOTS 12 & 13

Note: Sub-basin #1 consists of 8.1 acres of property. Peak storm water discharge is routed to the southwest, onto proposed Lot 13. Reference the attached sub-basin delineation map.

| Reach | Description | Properties | | |
|-------|--|-------------------------|-------|-----------------|
| A - B | Overland Flow | Slope (%) = | 4.0 | Eq 2-4 (RCDCM) |
| | | Length (ft) = | 60 | |
| | | 5-yr Coefficient (C5) = | 0.05 | |
| | | tt (min) = | 9.63 | |
| B - C | Channelized Flow (short grass pasture or lawns) | Slope (%) = | 2.0 | fig 2-4 (RCDCM) |
| | | Length (ft) = | 700 | |
| | | Velocity (ft/s) = | 1.0 | |
| | | tt (min) = | 11.67 | |

TIME OF CONCENTRATION

| Reach | Length | Velocity | tt (min) | tt (min) | tc (min) |
|-------|--------|----------|----------|------------|----------|
| A-B | 60 | | 9.63 | | 9.63 |
| B-C | 700 | 1.0 | | 11.67 | 11.67 |
| | sum | 760 | | tc (min) = | 21.29 |

Regional Tc = 14.2

tc (min) = 21.3

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

BY: Sperlich Consulting, Inc.

PROJECT: Carlin Subdivision
Lots 12 and 13 of Carlin Subdivision
Project #3102

DATE: January 12, 2007

EXISTING CONDITIONS MODEL

| SUB-BASIN | AREA (ac.) | DISCHARGE COEFFICIENT | TIME OF CONCENTRATION (Minutes) | INTENSITY (in/hr) | PEAK DISCHARGE (cfs) |
|-----------|---------------|--------------------------|------------------------------------|----------------------|-------------------------|
| 2-YEAR | 8.1 | 0.05 | 14.0 | 2.81 | 1.1 |
| 10-YEAR | 8.1 | 0.2 | 14.0 | 4.32 | 7.0 |
| 100-YEAR | 8.1 | 0.4 | 14.0 | 6.54 | 21.2 |

DEVELOPED CONDITIONS MODEL

| SUB-BASIN | AREA (ac.) | DISCHARGE COEFFICIENT | TIME OF CONCENTRATION (Minutes) | INTENSITY (in/hr) | PEAK DISCHARGE (cfs) |
|-----------|---------------|--------------------------|------------------------------------|----------------------|-------------------------|
| 2-YEAR | 8.1 | 0.3 | 14.0 | 2.81 | 6.8 |
| 10-YEAR | 8.1 | 0.4 | 14.0 | 4.32 | 14.0 |
| 100-YEAR | 8.1 | 0.6 | 14.0 | 6.54 | 31.8 |

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

Circular X-Section
Date: 01/12/2007

Project No. :3102
Project Name.:Carlin Subdivision
Computed by :McNaboe

Project Description
Lots 12 & 13 of Carlin Subdivision
Project #3102

INPUT PARAMETERS

| | |
|--------------------------|--------|
| 1. Pipe Slope (ft/ft) | 0.0161 |
| 2. Pipe Diameter (in) | 18.0 |
| 3. Manning's Coefficient | 0.024 |
| 4. Discharge (cfs) | 7.220 |

OUTPUT RESULTS

| | |
|----------------------|------|
| Full Flow Conditions | |
| Depth of Flow (ft) | 1.50 |
| Velocity (ft/sec) | 4.09 |

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

Trapezoidal, Rectangular, or Triangular X-Section
Date: 01/12/2007

Project No. :3102
Project Name.:Carlin Subdivision
Computed by :McNaboe

Project Description
Lots 12 & 13 of Carlin Subdivision
Project #3102

INPUT PARAMETERS

| | |
|---------------------------------------|--------|
| 1. Channel Slope (ft/ft) | 0.0104 |
| 2. Channel Bottom Width (ft) | 1.00 |
| 3. Left Side Slope (Horizontal to 1) | 3.00 |
| 4. Right Side Slope (Horizontal to 1) | 3.00 |
| 5. Manning's Coefficient | 0.035 |
| 6. Discharge (cfs) | 61.65 |
| 7. Depth of Flow (ft) | 2.00 |

OUTPUT RESULTS

| | |
|---------------------------|-------|
| Cross Section Area (Sqft) | 14.00 |
| Average Velocity (ft/sec) | 4.40 |
| Top Width (ft) | 13.00 |
| Hydraulic Radius (ft) | 1.03 |
| Froude Number | 0.75 |