10PL014

FISK LAND SURVEYING & CONSULTING ENGINEERS, INC.
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March 12, 2010

Growth Management Department
City of Rapid City
300 Sixth Street
Rapid City, SD 57701

RE: Drainage Report
Lot 14 of Feay Reder Subdivision

This lot is on the upper fringes of the Spring Creek Drainage Basin. The discharge enters Spring Creek some 3 miles away via minor stream flow.

The northern half of the lot receives flow in a vee swale from a 4 acre mountain hillside that is Forest Service land.

Additional flow is directed to the south half from the west from a 12.5 acre mountain hillside. There is no defined channel for this flow and it appears to be spread over a 300' wide area.

Discharge from the north

A = 4 ac.

The upper 400' of this area is overland flow at:

s = 30/400 = .075 7.5%
Fig 2-4 v = .68 fps
t_1 = 400/.68 = 588 sec = 9.8'

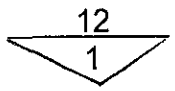
The lower 460' is more concentrated in a vee channel with:

s = 8.7%
velocities will increase to 1 fps
t_2 = 460 sec or 7.7 min

Tc = 9.8 + 7.7 = 17.5 min
i 100 = 6.9"/hr
c (forest – 100 year) = 0.37
Q = 0.37 x 6.9 x 4 = 10.2 cfs

Check flow at 1' deep vee channel – 12' wide.

Mean s = 22/190 = .1158 $s^{½}$ = 0.34



A = 6
P = 12.2
R = .49
$R^{2/3}$ = 0.62
Let n = 0.05

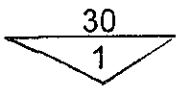
$$v = \frac{1.48 \times 0.62 \times 0.34}{.05} = 6.23 \qquad Q = 37 \text{ cfs} >> 10.2$$

Use 20' easement width, centered on mean alignment of channel to allow for variations.

Through the center portion of the site (before flow from the west is received) the channel widens and flattens.

Vee is 1' deep in 30' width.

s = 10/70 = .143 $s^{1/2}$ = 0.38



A = 15
P = 30.1
R = .50
$R^{2/3}$ = 0.63
n = 0.05

$$v = \frac{1.48 \times 0.63 \times 0.38}{0.05} = 7.08 \qquad Q = 106 >> 10.2$$

Try 20' wide 0.7' deep

A = 7
P = 20.1
R = 0.35
$R^{2/3}$ = 0.50

$$v = \frac{1.48 \times 0.50 \times .38}{.05} = 5.6 \text{ fps} \qquad Q = 39 >> 10.2$$

20' wide still ok for central

West Side Runoff Contribution

12.5 ac total channel length 1150'

Upper 500' s = 60/500 11.8%
v = 0.8 fps
t_1 = 10.4 M

Next 560' s = 70/560 12.5%
v = 1.2 fps
t_2 = 7.8
t_c = 18
i_{100} = 5.75 "/hr
c = 0.37
Q = .37 x 5.75 x 12.5 = 27.3 cfs

This flow appears to be uniformly spread across the lower 200 feet of the west side.

At the downstream end of the site, there is a combined discharge of 10.2 + 27.3 = 37.5 cfs. The channel at that point is very broad, being only 1' deep and 90' across.

The mean slope is 8/120 = 0.66% $s^{1/2}$ = 0.26

Capacity at 1' depth:

$A = \frac{30.1}{2} = 15$
P = 90
R = .167
$R^{2/3}$ = 0.30

$V = \frac{1.48 \times .30 \times .26}{.05} = 2.31$ fps

Q = 2.31 x 15 = 34.6 37.5, but close.

Use 100' wide easement @ south end of site.

Taper easement width to 20' in 220' length.

Sincerely,
FISK LAND SURVEYING & CONSULTING ENGINEERS, INC.

Warren L. Fisk, PE, LS
Senior Engineer

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