DRAINAGE STUDY

for the

Canyon Vista Subdivision
APN 010-19-407 and 408
Carson City, Nevada

Prepared For:

Divinni LLC.

1320 Hwy 395 N.
Gardnerville, NV 89410

Prepared By:

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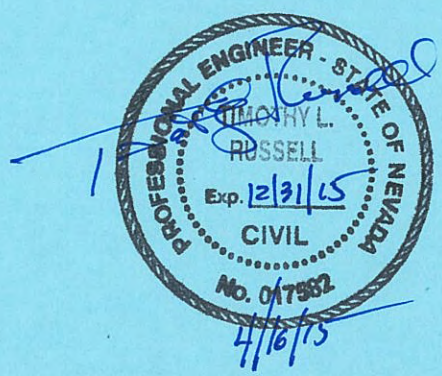
April, 2015
Job No. 8747.000



I. Introduction

A. Description of Project

This conceptual drainage report presents the finding of the preliminary drainage study for the Tentative Parcel Map Application for APN 010-19-408 and 409 located in Section 33, Township 15N, Range 20E of the Mount Diablo Meridian. It identifies the existing and proposed site conditions, and the potential drainage improvements. This study has been conducted in accordance to the Carson City Municipal Code and Carson City Development Standards.

B. Existing Site Conditions

The project site of Canyon Vista Subdivision is 19.54 acres and is bounded by East Clearview Drive, Hillview Drive, and East Appion Way (see Appendix A). To the East of the development the subdivision is bound by 6 single family parcels (APN 010-19-406 through 410), that are currently being developed. The site is currently covered in sagebrush and short grass. The site generally slopes from the East to West with a slight shift to the North. The average slope across the project is 2% to 3%.

This conceptual drainage report is in accompany to the Tentative Map application for submittal of Canyon Vista Subdivision. The proposed Canyon Vista Subdivision consists of 18 - 1 acres sites to be served by two cul-de-sacs connecting to Hillview Drive.

C. Other Previous Studies

The project site of Canyon Vista Subdivision is located within the Edmonds-West Drainage Basin and has been addressed in the various studies in this area, namely the "Southwest Carson City Flood Study" prepared by Kimley-Horn and Associates, February 2014, and the Hydraulic Design Report Carson City Freeway Phases 2A and 2B, prepared by Louis Berger Group, April 2008

D. General Location Map

See Section V: Exhibits, Figure 1

II. Existing and Proposed Hydrology

A. Drainage Basin

The existing offsite drainage basin is roughly 191.85 acres pre-Carson City Freeway. Once the construction of Phase 2A and 2B of the freeway completed (anticipated 2016/2017), the off-site drainage basin is reduced to approximately 45.5 acres.

Off-site flow consists of sheet flow from Prison Hill, across S. Edmonds Drive, into the Saliman Tributary Canal (See Appendix C). Prison Hill is to the east of the project site, while the Saliman Tributary Canal is west of the project site. The run-off from the offsite was estimated using the Rational Method.

Table 1 – Existing Off-Site Flow

	Duration	Existing Conditions	Post Carson Freeway Conditions
5-Year	24-hour	3.68 cfs	1.31 cfs
100-Year	24-hour	6.56 cfs	2.34 cfs

B. Design and 100-Year Storm Calculations

The rainfall data was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Retrieved from the Hydrometeorlogical Design Studies Center – Precipitation Frequency Data Server. The Design Storm events considered were 5 and 100-year storm events (see Appendix B).

C. Existing Drainage Problems

There are no known existing drainage problems

D. On-site and Downstream Drainage

Currently, rainfall on the project site, sheet and shallow flows northwest off the site to Hillview Drive and Clearview Drive and ultimately into the Saliman Tributary Canal at the southwest corner of Hillview and Clearview Drive. The canal connects to a 36-inch pipe which crosses below the southwest corner of the intersection of Hillview Drive and East Clearview Drive and carries storm water north. During large flood events, any run-off in the Saliman Tributary Canal that does not pass through the culvert, continues north.

Canyon Vista Subdivision on-site peak runoff figures for the 5-year and 100-year storm events are shown in Table 2. The rational method was used to determine runoff. The post-development runoff coefficient is a weighted average of impervious areas (paved areas and buildings) and landscaped areas. Detailed calculations are in the attachments.

Table 2 – On-Site Flow

	Duration	Existing Conditions	Proposed Conditions
5-Year	24-hour	0.61 cfs	0.72 cfs
100-Year	24-hour	1.09 cfs	1.28 cfs

Table 3 – Total Flows Entering the Saliman Tributary Canal from offsite subbasin and proposed onsite (Post Carson Freeway Construction)

	Duration	Onsite and Offsite Total Flow	Reduction in Flow
5-Year	24-hour	1.33 cfs	-2.35 cfs
100-Year	24-hour	2.27 cfs	-4.29 cfs

On-site detention is not proposed for this property. As the net increase due to this project is an increase of 0.11 cfs, which is negligible for the 5-year storm event. Additionally the construction of the Carson City Freeway will significantly reduce the runoff that will more than compensate for any minor increase in the design storm runoff.

E. Floodplain

The project site is in FEMA Zone X, determined to be outside 500-year floodplain determined to be outside the 1% and 0.2% annual chance floodplains.

See Section V: Exhibits, Figure 3

F. Existing Irrigation

There is no existing irrigation on the project site.

G. Tributary Exhibit

See Section V: Exhibits, Figure 3

III. Proposed Drainage Facilities (on-site and off-site)

A. Routing of flow in and/or around site, downstream, and location of drainage facilities

On-Site Flow

Beginning at the building pads, which are the high points on the sites, the water flows out towards the two proposed cul-de-sacs then westerly to Hillview Drive. The storm water will flow north, along the west side of the site, contained within the roadside ditches to a 15" cross culvert, located approximated 180' south of Clearview Drive, and outletting to the existing drainage conveyance (Saliman Tributary Canal) at the southwest corner of the intersection of Hillview Drive and Clearview Drive. The individual lots will be graded with a series of earthen ditches, along property

lines, to convey the flow towards the proposed cul-de-sacs. Storm drain cross culverts (sized per Carson City Standards) will convey the flow under the two cul-de-sacs.

Off-Site Flow

Off-site flow is believed to come from the east and southeast from two sources. The first is via a roadside ditch along Clearview Drive, and the second is via sheet flow from bordering properties originating from the Prison Hill area. We are proposing not to disturb the flow along Clearview Drive, by keeping roadside ditches along the north side of the site. We are proposing to route the sheet flow, first to the west along Appion Way via a proposed roadside ditch, then north via proposed road ditches and approach cross culverts along Hillview Drive at the west side of the site. The sheet flow will be routed north along Hillview Drive to a cross culvert approximately 180' south of the intersection of Hillview Drive and Clearview Drive, which will outlet into the roadside ditch and into the Saliman Tributary Canal. This will improve the existing condition by reducing the sheet flow across Hillview Drive and concentrate it into the Saliman Tributary Canal sooner.

B. Mitigation Measures

Best Management Practices techniques should be implemented to manage the quantity and improve the quality of stormwater runoff, minimize local erosion and potential discharges to adjacent properties.

C. Floodplain Modifications

There are no floodplain modification required for this project

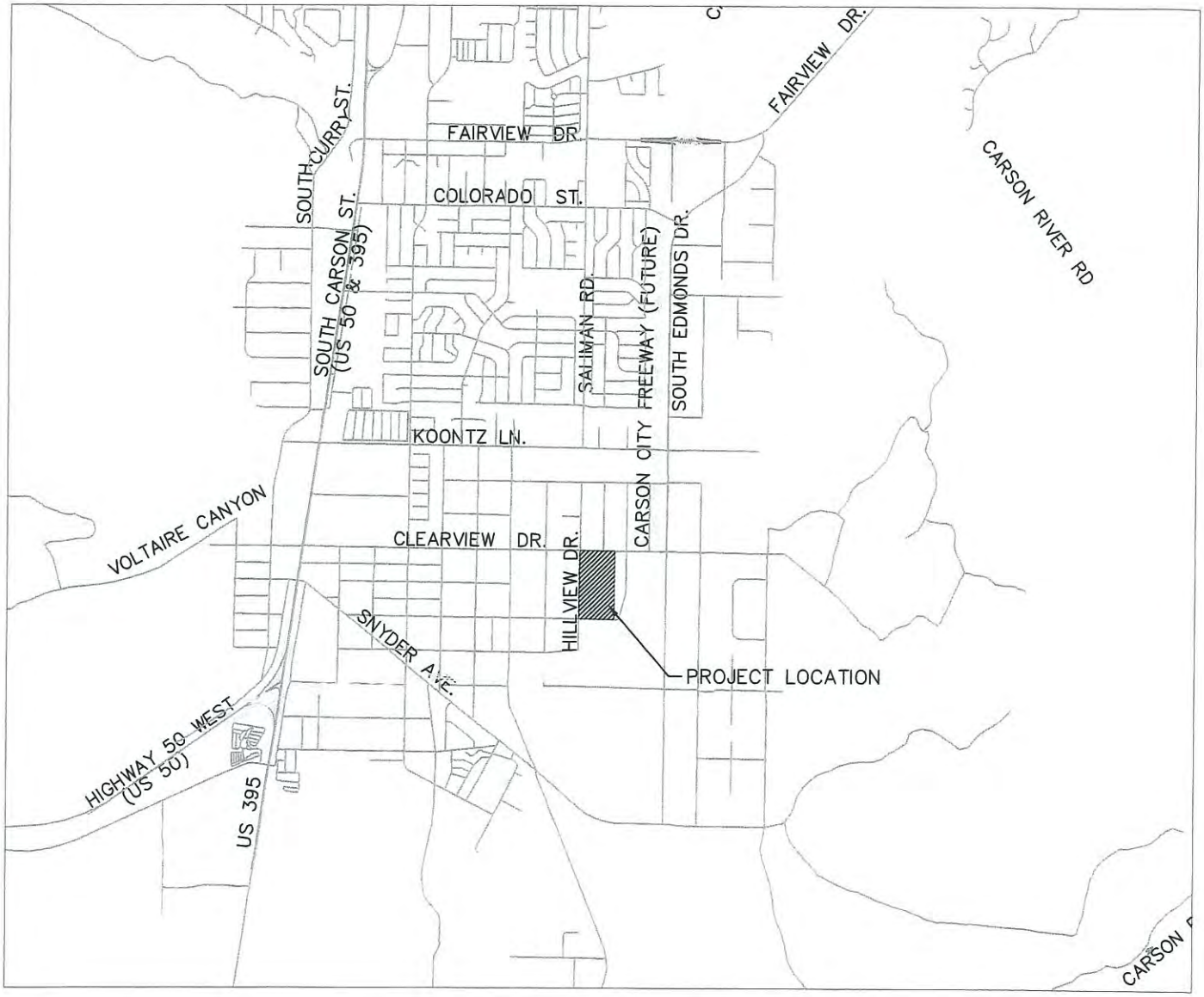
D. See Section V: Exhibits, Figure 4 Drainage Basins

IV. Conclusions

The Canyon Vista Subdivision will be designed in accordance with Carson City Municipal Code and Carson City Development Standards. The project will not have a detrimental effect on surrounding properties. On-site detention is not proposed for this property, as the net increase due to this project is an increase of 0.11 cfs, which is negligible for the 5-year storm event. Additionally the construction of the Carson City Freeway will significantly reduce the runoff that will more than compensate for any minor increase in the design storm runoff.

Section V: Exhibits

Figure 1: GENERAL LOCATION MAP
Figure 2: DRAINAGE PLAN
Figure 3: FEMA FLOODPLAIN MAP
Figure 4: DRAINAGE BASINS



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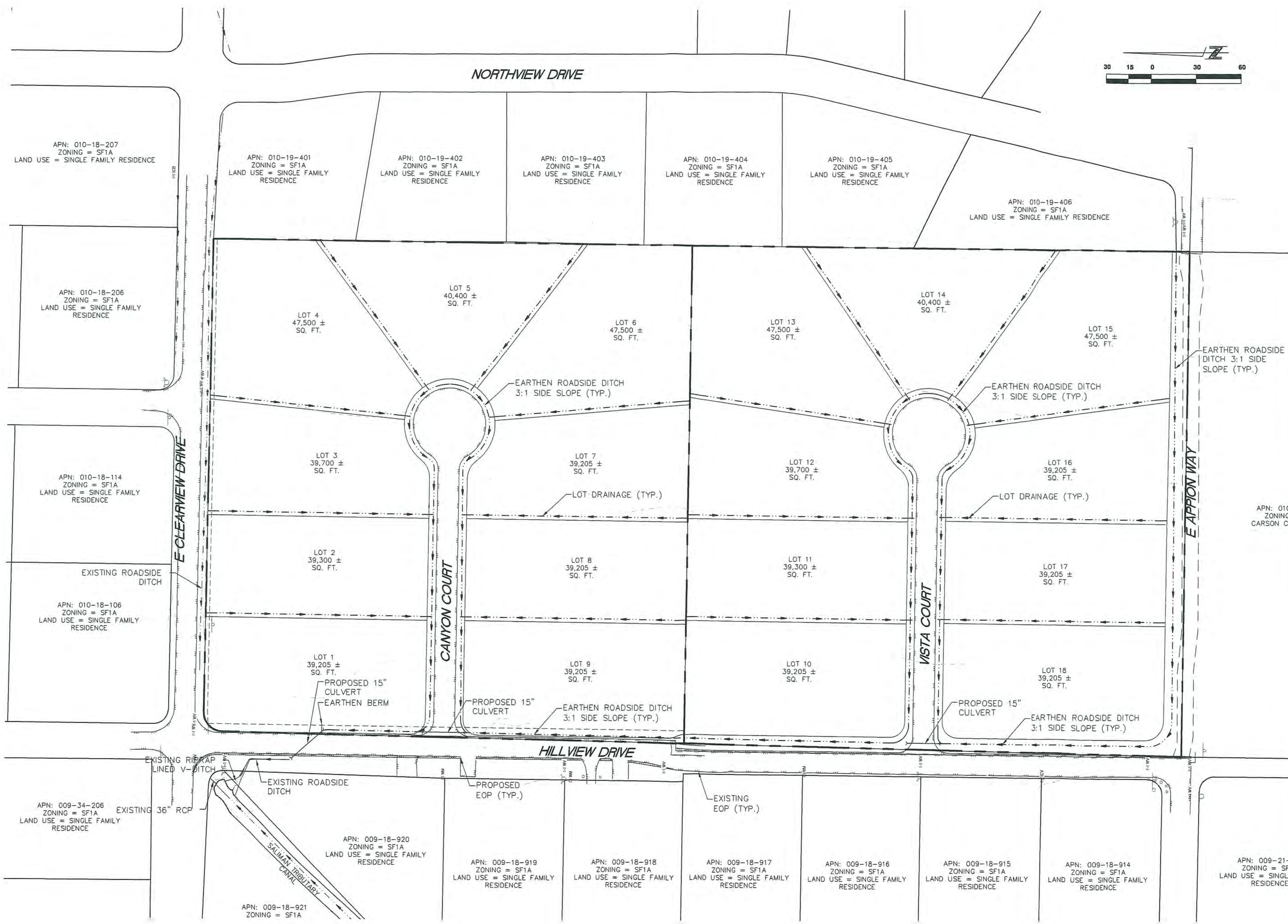
VICINITY MAP

CARSON NEVADA

Date:	APRIL, 2015
Scale:	N.T.S.
Job No:	8747.000
FIGURE	1



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CANYON VISTA SUBDIVISION
ONSITE CONCEPTUAL
DRAINAGE PLAN

CARSON CITY NEVADA

REV	DATE	DESCRIPTION	BY

FIG. 2

DATE: APRIL 2015
DRAWN BY: ASM
DESIGNED BY: ASM
CHECKED BY: TR
JOB NO.: 8747.000

ce is available in this community, contact your insurance
d Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 150 300 METERS

PANEL 0094E

FIRM
FLOOD INSURANCE RATE MAP

CARSON CITY, NEVADA
INDEPENDENT CITY

PANEL 94 OF 275
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CARSON CITY	320001	0094	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
3200010094E

MAP REVISED
JANUARY 16, 2009

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Date: APRIL, 2015
Scale: N.T.S.
Job No: 8747.000
FIGURE 3

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FEMA FLOODPLAIN MAP

CARSON CITY NEVADA

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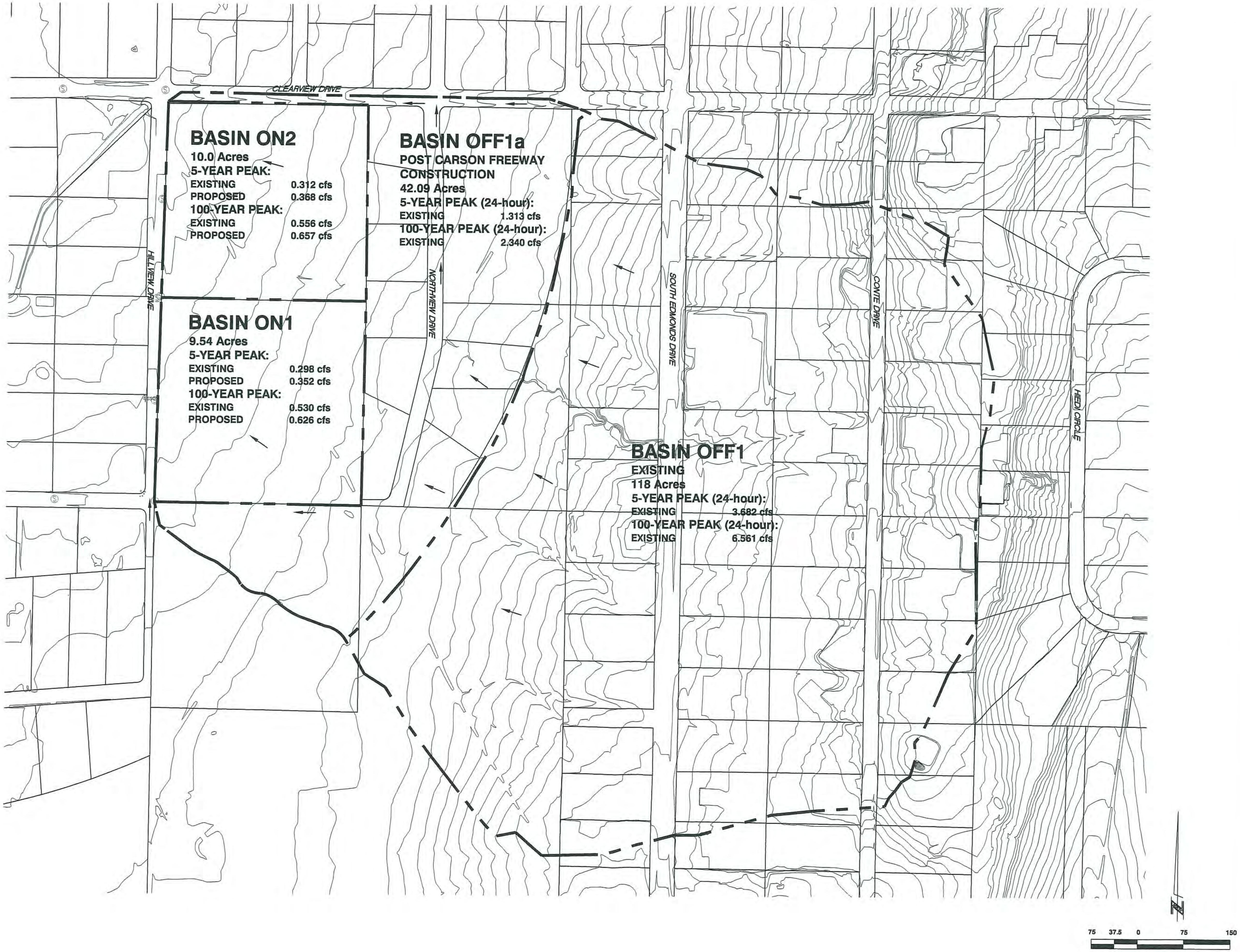
CARSON CITY, NEVADA 89706
PH. (775) 883-7077 FAX (775) 883-7114



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CANYON VISTA SUBDIVISION
DRAINGAE REPORT
DRAINAGE BASINS

CARSON CITY NEVADA

REV	DATE	DESCRIPTION	BY

FIG. 4

DATE:	APRIL 2015
DRAWN BY:	ASM
DESIGNED BY:	ASM
CHECKED BY:	TR
JOB NO.:	8747.000

SECTION VI: Calculations Appendix

-NOAA – ATLAS 14
-RUNOFF CALCULATIONS
-STREET AND DRAINAGE FACILITY CAPACITY CALCULATIONS

NOAA Atlas 14, Volume 1, Version 5
Location name: Carson City, Nevada, US*
Latitude: 39.1265°, Longitude: -119.7511°
Elevation: 4717 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF tabular | PF graphical | Maps & aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.094 (0.081-0.111)	0.118 (0.102-0.139)	0.157 (0.135-0.186)	0.195 (0.167-0.231)	0.258 (0.212-0.305)	0.314 (0.252-0.375)	0.382 (0.295-0.460)	0.463 (0.344-0.567)	0.591 (0.414-0.740)	0.707 (0.471-0.900)
10-min	0.144 (0.124-0.169)	0.179 (0.155-0.212)	0.240 (0.206-0.284)	0.298 (0.254-0.352)	0.392 (0.323-0.464)	0.478 (0.383-0.570)	0.581 (0.450-0.700)	0.705 (0.523-0.863)	0.900 (0.630-1.13)	1.08 (0.717-1.37)
15-min	0.178 (0.154-0.210)	0.222 (0.193-0.263)	0.297 (0.255-0.352)	0.369 (0.315-0.436)	0.486 (0.401-0.575)	0.593 (0.475-0.707)	0.721 (0.557-0.868)	0.874 (0.648-1.07)	1.12 (0.781-1.40)	1.33 (0.889-1.70)
30-min	0.240 (0.207-0.283)	0.300 (0.260-0.355)	0.400 (0.344-0.474)	0.497 (0.424-0.587)	0.655 (0.540-0.775)	0.798 (0.639-0.952)	0.971 (0.751-1.17)	1.18 (0.873-1.44)	1.50 (1.05-1.88)	1.80 (1.20-2.29)
60-min	0.297 (0.257-0.350)	0.371 (0.322-0.439)	0.495 (0.425-0.587)	0.615 (0.524-0.727)	0.810 (0.668-0.959)	0.988 (0.791-1.18)	1.20 (0.929-1.45)	1.46 (1.08-1.78)	1.86 (1.30-2.33)	2.22 (1.48-2.83)
2-hr	0.406 (0.363-0.465)	0.504 (0.448-0.576)	0.642 (0.568-0.734)	0.765 (0.671-0.874)	0.951 (0.811-1.09)	1.12 (0.931-1.29)	1.30 (1.06-1.53)	1.53 (1.20-1.81)	1.91 (1.43-2.35)	2.27 (1.64-2.86)
3-hr	0.488 (0.437-0.549)	0.607 (0.547-0.686)	0.764 (0.682-0.859)	0.890 (0.788-0.999)	1.07 (0.932-1.21)	1.23 (1.05-1.39)	1.40 (1.17-1.61)	1.61 (1.32-1.89)	1.97 (1.56-2.37)	2.31 (1.78-2.89)
6-hr	0.678 (0.609-0.757)	0.846 (0.761-0.949)	1.05 (0.941-1.17)	1.21 (1.08-1.36)	1.43 (1.26-1.61)	1.61 (1.39-1.82)	1.78 (1.52-2.04)	1.98 (1.66-2.30)	2.28 (1.85-2.68)	2.53 (2.01-3.03)
12-hr	0.902 (0.804-1.01)	1.13 (1.01-1.28)	1.43 (1.27-1.61)	1.66 (1.46-1.86)	1.97 (1.72-2.23)	2.21 (1.90-2.51)	2.45 (2.08-2.82)	2.70 (2.25-3.15)	3.04 (2.46-3.61)	3.30 (2.62-3.98)
24-hr	1.19 (1.08-1.31)	1.49 (1.35-1.65)	1.88 (1.71-2.07)	2.19 (1.99-2.42)	2.63 (2.37-2.90)	2.98 (2.66-3.28)	3.34 (2.96-3.69)	3.71 (3.26-4.12)	4.22 (3.66-4.72)	4.62 (3.96-5.22)
2-day	1.42 (1.28-1.60)	1.79 (1.60-2.00)	2.27 (2.04-2.55)	2.67 (2.39-2.99)	3.22 (2.86-3.62)	3.66 (3.23-4.13)	4.12 (3.61-4.67)	4.61 (3.99-5.26)	5.28 (4.50-6.08)	5.82 (4.89-6.76)
3-day	1.56 (1.40-1.76)	1.97 (1.76-2.22)	2.52 (2.25-2.84)	2.97 (2.64-3.35)	3.60 (3.18-4.07)	4.10 (3.59-4.65)	4.63 (4.02-5.27)	5.20 (4.47-5.94)	5.98 (5.05-6.89)	6.61 (5.51-7.69)
4-day	1.70 (1.52-1.92)	2.15 (1.91-2.43)	2.77 (2.45-3.13)	3.27 (2.89-3.70)	3.97 (3.49-4.51)	4.54 (3.96-5.17)	5.15 (4.44-5.87)	5.78 (4.94-6.62)	6.68 (5.61-7.71)	7.40 (6.12-8.62)
7-day	1.97 (1.76-2.22)	2.49 (2.22-2.81)	3.21 (2.86-3.63)	3.79 (3.37-4.28)	4.60 (4.06-5.21)	5.24 (4.59-5.95)	5.91 (5.13-6.73)	6.61 (5.70-7.55)	7.59 (6.44-8.75)	8.36 (7.00-9.72)
10-day	2.17 (1.94-2.45)	2.76 (2.46-3.11)	3.57 (3.17-4.02)	4.20 (3.72-4.73)	5.07 (4.46-5.71)	5.74 (5.02-6.48)	6.44 (5.59-7.28)	7.15 (6.15-8.11)	8.12 (6.91-9.31)	8.88 (7.46-10.3)
20-day	2.67 (2.39-2.98)	3.38 (3.03-3.79)	4.36 (3.90-4.86)	5.09 (4.54-5.68)	6.08 (5.39-6.77)	6.81 (6.00-7.61)	7.57 (6.62-8.48)	8.31 (7.23-9.34)	9.29 (8.00-10.5)	10.0 (8.55-11.5)
30-day	3.02 (2.71-3.36)	3.84 (3.44-4.26)	4.92 (4.42-5.47)	5.74 (5.14-6.37)	6.83 (6.09-7.58)	7.65 (6.77-8.50)	8.47 (7.46-9.46)	9.29 (8.11-10.4)	10.4 (8.96-11.7)	11.2 (9.58-12.7)
45-day	3.55 (3.21-3.94)	4.52 (4.07-5.00)	5.79 (5.22-6.41)	6.73 (6.05-7.44)	7.94 (7.11-8.79)	8.82 (7.87-9.79)	9.68 (8.60-10.8)	10.5 (9.30-11.7)	11.5 (10.1-13.0)	12.3 (10.7-13.9)
60-day	4.07 (3.66-4.52)	5.19 (4.66-5.76)	6.64 (5.97-7.36)	7.68 (6.90-8.50)	8.97 (8.04-9.93)	9.89 (8.84-11.0)	10.8 (9.59-12.0)	11.6 (10.3-12.9)	12.5 (11.1-14.0)	13.2 (11.6-14.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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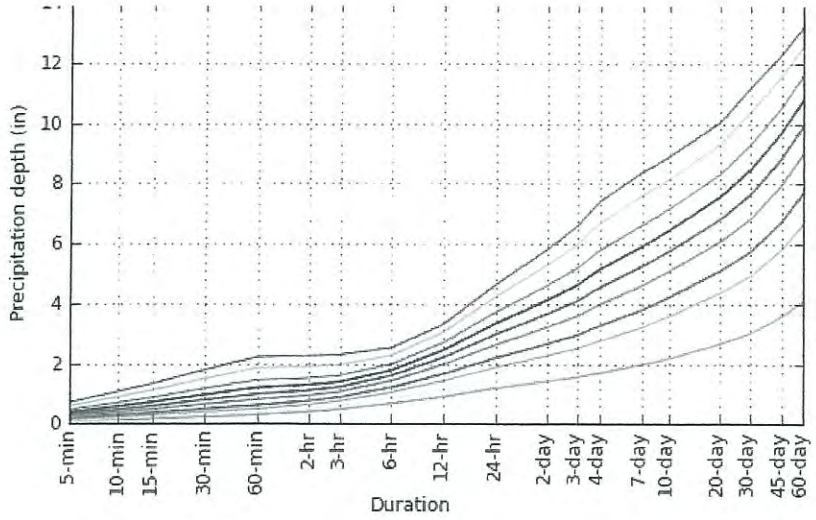
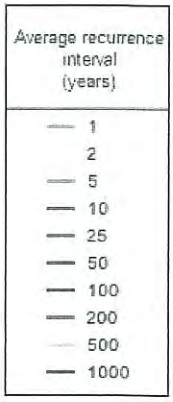
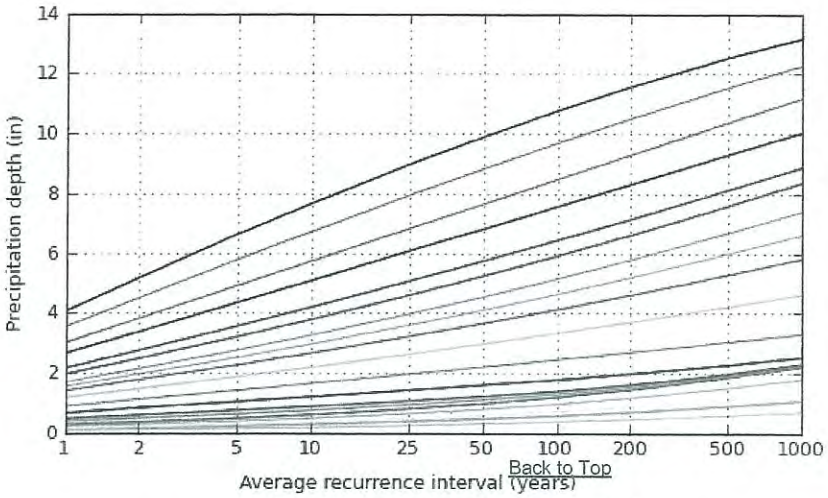
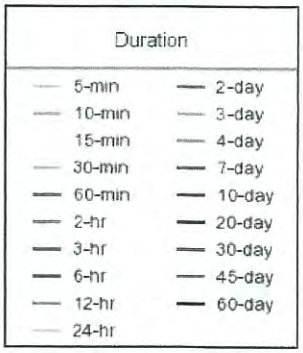
PF graphical









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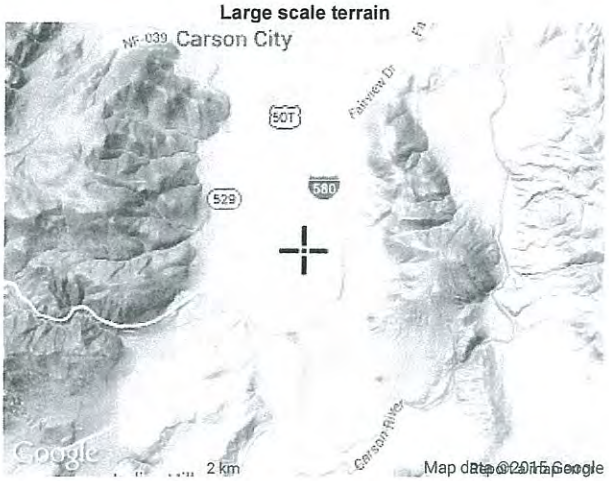
Maps & aerials

NOAA Atlas 14, Volume 1, Version 5

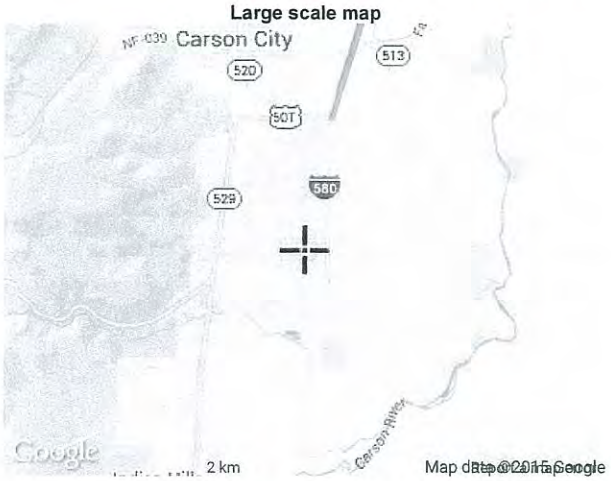
Created (GMT): Mon Apr 6 20:17:22 2015

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910

Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 1, Version 5
Location name: Carson City, Nevada, US*
Latitude: 39.1265°, Longitude: -119.7511°
Elevation: 4717 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.13 (0.972–1.33)	1.42 (1.22–1.67)	1.88 (1.62–2.23)	2.34 (2.00–2.77)	3.10 (2.54–3.66)	3.77 (3.02–4.50)	4.58 (3.54–5.52)	5.56 (4.13–6.80)	7.09 (4.97–8.88)	8.48 (5.65–10.8)
10-min	0.864 (0.744–1.01)	1.07 (0.930–1.27)	1.44 (1.24–1.70)	1.79 (1.52–2.11)	2.35 (1.94–2.78)	2.87 (2.30–3.42)	3.49 (2.70–4.20)	4.23 (3.14–5.18)	5.40 (3.78–6.76)	6.46 (4.30–8.23)
15-min	0.712 (0.616–0.840)	0.888 (0.772–1.05)	1.19 (1.02–1.41)	1.48 (1.26–1.74)	1.94 (1.60–2.30)	2.37 (1.90–2.83)	2.88 (2.23–3.47)	3.50 (2.59–4.28)	4.46 (3.12–5.58)	5.34 (3.56–6.80)
30-min	0.480 (0.414–0.566)	0.600 (0.520–0.710)	0.800 (0.688–0.948)	0.994 (0.848–1.17)	1.31 (1.08–1.55)	1.60 (1.28–1.90)	1.94 (1.50–2.34)	2.35 (1.75–2.88)	3.01 (2.10–3.76)	3.59 (2.39–4.58)
60-min	0.297 (0.257–0.350)	0.371 (0.322–0.439)	0.495 (0.425–0.587)	0.615 (0.524–0.727)	0.810 (0.668–0.959)	0.988 (0.791–1.18)	1.20 (0.929–1.45)	1.46 (1.08–1.78)	1.86 (1.30–2.33)	2.22 (1.48–2.83)
2-hr	0.203 (0.182–0.232)	0.252 (0.224–0.288)	0.321 (0.284–0.367)	0.382 (0.336–0.437)	0.476 (0.406–0.546)	0.558 (0.466–0.647)	0.651 (0.528–0.763)	0.763 (0.598–0.907)	0.954 (0.716–1.17)	1.13 (0.820–1.43)
3-hr	0.163 (0.146–0.183)	0.202 (0.182–0.228)	0.254 (0.227–0.286)	0.296 (0.262–0.333)	0.357 (0.310–0.403)	0.408 (0.349–0.464)	0.465 (0.389–0.535)	0.537 (0.440–0.628)	0.655 (0.519–0.790)	0.768 (0.593–0.962)
6-hr	0.113 (0.102–0.126)	0.141 (0.127–0.158)	0.176 (0.157–0.196)	0.203 (0.180–0.226)	0.239 (0.210–0.269)	0.268 (0.232–0.303)	0.297 (0.253–0.340)	0.331 (0.276–0.383)	0.380 (0.309–0.447)	0.423 (0.336–0.506)
12-hr	0.075 (0.067–0.084)	0.094 (0.084–0.106)	0.118 (0.105–0.133)	0.138 (0.121–0.155)	0.163 (0.143–0.185)	0.183 (0.158–0.209)	0.203 (0.173–0.234)	0.224 (0.187–0.261)	0.252 (0.205–0.300)	0.274 (0.218–0.331)
24-hr	0.050 (0.045–0.055)	0.062 (0.056–0.069)	0.078 (0.071–0.086)	0.091 (0.083–0.101)	0.110 (0.099–0.121)	0.124 (0.111–0.137)	0.139 (0.123–0.154)	0.154 (0.136–0.172)	0.176 (0.152–0.197)	0.192 (0.165–0.217)
2-day	0.030 (0.027–0.033)	0.037 (0.033–0.042)	0.047 (0.043–0.053)	0.056 (0.050–0.062)	0.067 (0.060–0.075)	0.076 (0.067–0.086)	0.086 (0.075–0.097)	0.096 (0.083–0.110)	0.110 (0.094–0.127)	0.121 (0.102–0.141)
3-day	0.022 (0.019–0.024)	0.027 (0.024–0.031)	0.035 (0.031–0.039)	0.041 (0.037–0.046)	0.050 (0.044–0.056)	0.057 (0.050–0.065)	0.064 (0.056–0.073)	0.072 (0.062–0.083)	0.083 (0.070–0.096)	0.092 (0.076–0.107)
4-day	0.018 (0.016–0.020)	0.022 (0.020–0.025)	0.029 (0.026–0.033)	0.034 (0.030–0.039)	0.041 (0.036–0.047)	0.047 (0.041–0.054)	0.054 (0.046–0.061)	0.060 (0.051–0.069)	0.070 (0.058–0.080)	0.077 (0.064–0.090)
7-day	0.012 (0.010–0.013)	0.015 (0.013–0.017)	0.019 (0.017–0.022)	0.023 (0.020–0.025)	0.027 (0.024–0.031)	0.031 (0.027–0.035)	0.035 (0.031–0.040)	0.039 (0.034–0.045)	0.045 (0.038–0.052)	0.050 (0.042–0.058)
10-day	0.009 (0.008–0.010)	0.012 (0.010–0.013)	0.015 (0.013–0.017)	0.018 (0.016–0.020)	0.021 (0.019–0.024)	0.024 (0.021–0.027)	0.027 (0.023–0.030)	0.030 (0.026–0.034)	0.034 (0.029–0.039)	0.037 (0.031–0.043)
20-day	0.006 (0.005–0.006)	0.007 (0.006–0.008)	0.009 (0.008–0.010)	0.011 (0.009–0.012)	0.013 (0.011–0.014)	0.014 (0.013–0.016)	0.016 (0.014–0.018)	0.017 (0.015–0.019)	0.019 (0.017–0.022)	0.021 (0.018–0.024)
30-day	0.004 (0.004–0.005)	0.005 (0.005–0.006)	0.007 (0.006–0.008)	0.008 (0.007–0.009)	0.009 (0.008–0.011)	0.011 (0.009–0.012)	0.012 (0.010–0.013)	0.013 (0.011–0.014)	0.014 (0.012–0.016)	0.016 (0.013–0.018)
45-day	0.003 (0.003–0.004)	0.004 (0.004–0.005)	0.005 (0.005–0.006)	0.006 (0.006–0.007)	0.007 (0.007–0.008)	0.008 (0.007–0.009)	0.009 (0.008–0.010)	0.010 (0.009–0.011)	0.011 (0.009–0.012)	0.011 (0.010–0.013)
60-day	0.003 (0.003–0.003)	0.004 (0.003–0.004)	0.005 (0.004–0.005)	0.005 (0.005–0.006)	0.006 (0.006–0.007)	0.007 (0.006–0.008)	0.007 (0.007–0.008)	0.008 (0.007–0.009)	0.009 (0.008–0.010)	0.009 (0.008–0.010)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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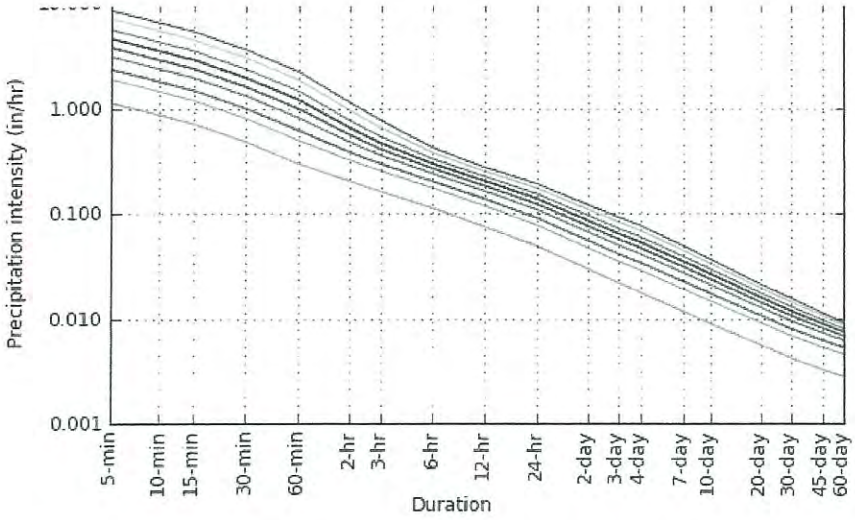
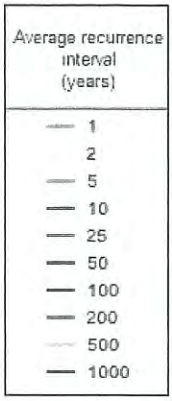
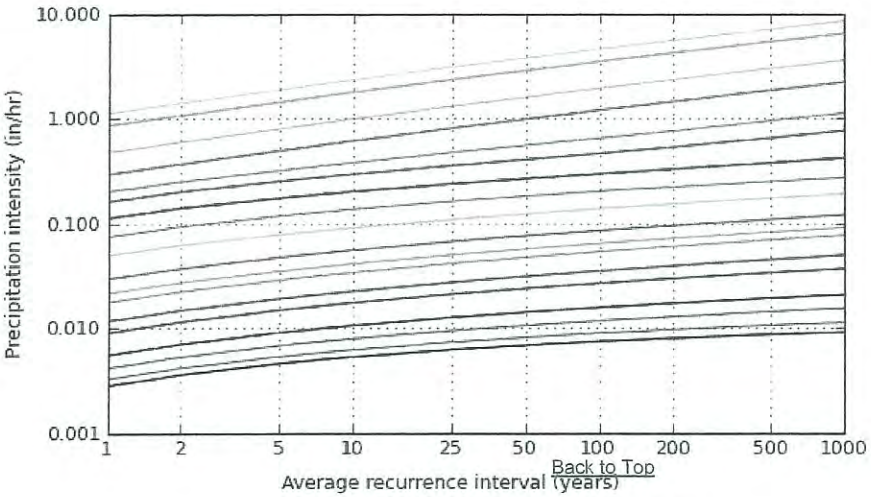
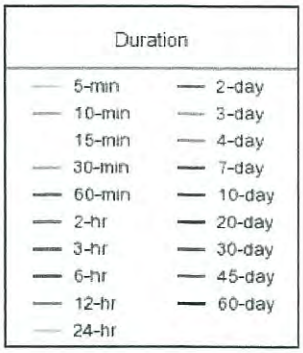
PF graphical









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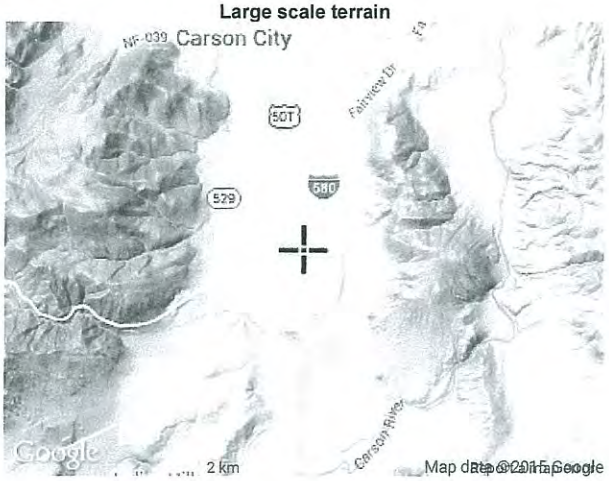
Maps & aerials

NOAA Atlas 14, Volume 1, Version 5

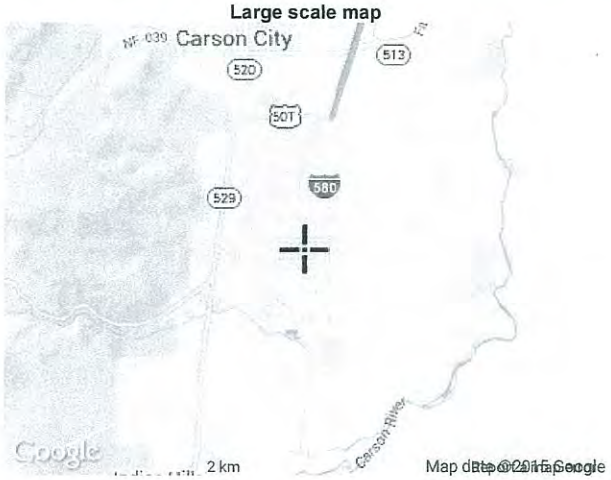
Created (GMT): Mon Apr 6 17:22:47 2015

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910

Hillview Subdivision
Existing Condition
April 2015

Use T_c = **24.0 hours**

Onsite

$Q_5 = Ci_5A$

where: C = 0.40 Undeveloped Area
i_5 = *0.078* From NOAA Atlas 14 (5-yr, 24-hr)
A = *19.54* Acres (Total Area)

Q_5 = **0.610 cfs**

$Q_{100} = Ci_{100}A$

where: C = 0.40 Undeveloped Area
i_{100} = *0.14* From NOAA Atlas 14 (100-yr, 24-hr)
A = *19.54* Acres (Total Area)

Q_{100} = **1.086 cfs**

(1) $C = \dfrac{(.90 * \text{Developed}) + (.40 * \text{undeveloped})}{\text{Total Area}}$

Hillview Subdivision
Existing Condition
April 2015

Use T_c = **24.0 hours**

Offsite

$Q_5 = Ci_5A$

where: C = 0.40 Undeveloped Area
i_5 = *0.078* From NOAA Atlas 14 (5-yr, 24-hr)
A= 118 Acres (Total Area)

Q_5 = **3.682 cfs**

$Q_{100} = Ci_{100}A$

where: C = 0.40 Undeveloped Area
i_5 = *0.139* From NOAA Atlas 14 (100-yr, 24-hr)
A= 118 Acres (Total Area)

Q_5 = **6.561 cfs**

(1) $C = \frac{(.90 * \text{Developed}) + (.40 * \text{undeveloped})}{\text{Total Area}}$

Hillview Subdivision
Existing Condition
Post Carson City Freeway
April 2015

Use T_c = **24.0 hours**

Onsite

$Q_5 = Ci_5A$

where: C = 0.40 Undeveloped Area
i_5 = *0.078* From NOAA Atlas 14 (5-yr, 24-hr)
A = *42.09* Acres (Total Area)

Q_5 = **1.313 cfs**

$Q_{100} = Ci_{100}A$

where: C = 0.40 Undeveloped Area
i_{100} = *0.14* From NOAA Atlas 14 (100-yr, 24-hr)
A = *19.54* Acres (Total Area)

Q_{100} = **1.086 cfs**

(1) $C = \dfrac{(.90 * \text{Developed}) + (.40 * \text{undeveloped})}{\text{Total Area}}$

Hillview Subdivision
Existing Condition
Post Carson City Freeway
April 2015

Use T_c = **24.0 hours**

Offsite

$Q_5 = Ci_5A$

where: C = 0.40 Undeveloped Area
i_5 = *0.078* From NOAA Atlas 14 (5-yr, 24-hr)
A= 42.09 Acres (Total Area)

Q_5 = **1.313 cfs**

$Q_{100} = Ci_{100}A$

where: C = 0.40 Undeveloped Area
i_5 = *0.139* From NOAA Atlas 14 (100-yr, 24-hr)
A= 42.09 Acres (Total Area)

Q_5 = **2.340 cfs**

(1) $C = \frac{(.90 * \text{Developed}) + (.40 * \text{undeveloped})}{\text{Total Area}}$

Hillview Subdivision
Proposed Condition
April 2015

Use T_c = **24.0 hours**

Onsite

$Q_5 = Ci_5A$

where: C = *0.47* Weighted [1]
0.90 Developed Area
0.30 Landscaped Area
0.40 Undeveloped Area
i_5 = *0.078* From NOAA Atlas 14 (5-yr, 24-hr)
A = *19.54* Acres (Total Area)
3.22 Acres (Developed Area)
1.96 Acres (Landscaped Area)
14.36 Acres (Undeveloped Area)

Q_5 = **0.720 cfs**

$Q_{100} = Ci_{100}A$

where: C = *0.47* Weighted [1]
0.90 Developed Area
0.30 Landscaped Area
0.40 Undeveloped Area
i_{100} = *0.139* From NOAA Atlas 14 (100 yr, 24-hr)
A = *19.54* Acres (Total Area)
3.22 Acres (Developed Area)
1.96 Acres (Landscaped Area)
14.36 Acres (Undeveloped Area)

Q_{100} = **1.283 cfs**

[1] $C = \frac{(.90 * \text{Developed}) + (.40 * \text{undeveloped})}{\text{Total Area}}$

Hillview Subdivision
Proposed Condition
April 2015

Use T_c = **24.0 hours**

Offsite

$Q_5 = Ci_5A$

$Q_5 = Ci_5A$ L = 3802 feet
Tc = 24 hour

where: C = 0.40 Undeveloped Area
i_5 = *0.078* From NOAA Atlas 14 (5-yr, 24-hr)
A= 25.96 Acres (Total Area)

Q_5 = **0.810 cfs**

Onsite and Offsite Flow
Qtotal = 1.530

$Q_{100} = Ci_{100}A$

where: C = 0.40 Undeveloped Area
i_5 = *0.139* From NOAA Atlas 14 (100 yr, 24-hr)
A= 25.96 Acres (Total Area)

Total A = 45.50

Q_{100} = **1.443 cfs**

Onsite and Offsite Flow
Qtotal = 2.726

$$^{(1)}\ C = \frac{(.90 * \text{Developed}) + (.40 * \text{undeveloped})}{\text{Total Area}}$$

Worksheet for Cross culvert

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01500	ft/ft
Diameter	1.50	ft
Discharge	1.53	ft³/s

Results

Normal Depth	0.35	ft
Flow Area	0.31	ft²
Wetted Perimeter	1.51	ft
Hydraulic Radius	0.21	ft
Top Width	1.27	ft
Critical Depth	0.46	ft
Percent Full	23.3	%
Critical Slope	0.00490	ft/ft
Velocity	4.90	ft/s
Velocity Head	0.37	ft
Specific Energy	0.72	ft
Froude Number	1.74	
Maximum Discharge	13.84	ft³/s
Discharge Full	12.86	ft³/s
Slope Full	0.00021	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	23.27	%
Downstream Velocity	Infinity	ft/s

Worksheet for Cross culvert

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.35	ft
Critical Depth	0.46	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00490	ft/ft

Worksheet for Triangular Channel - 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00640	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	1.53	ft^3/s

Results

Normal Depth	0.41	ft
Flow Area	0.50	ft^2
Wetted Perimeter	2.58	ft
Hydraulic Radius	0.19	ft
Top Width	2.45	ft
Critical Depth	0.44	ft
Critical Slope	0.00438	ft/ft
Velocity	3.06	ft/s
Velocity Head	0.15	ft
Specific Energy	0.55	ft
Froude Number	1.19	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.41	ft
Critical Depth	0.44	ft
Channel Slope	0.00640	ft/ft
Critical Slope	0.00438	ft/ft

Cross Section for Triangular Channel - 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00640	ft/ft
Normal Depth	0.41	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	1.53	ft³/s

Cross Section Image