

2 COMBINED AT	DP10	1.38	1	FLOW TIME	328. 3.92	313. 4.00	306. 4.00	273. 4.00	948. 3.92	917. 3.92	902. 3.92	841. 3.92
ROUTED TO	RDP10	1.38	1	FLOW TIME	327. 4.00	313. 4.00	306. 4.00	272. 4.00	947. 3.92	916. 3.92	901. 3.92	840. 3.92
HYDROGRAPH AT	VG06D	.10	1	FLOW TIME	17. 3.92	16. 3.92	15. 3.92	13. 3.92	58. 3.92	56. 3.92	55. 3.92	51. 3.92
HYDROGRAPH AT	VG22D	.01	1	FLOW TIME	6. 3.58	5. 3.58	5. 3.58	5. 3.58	15. 3.58	14. 3.58	14. 3.58	13. 3.58
HYDROGRAPH AT	VG22E	.03	1	FLOW TIME	13. 3.67	12. 3.67	12. 3.67	11. 3.67	32. 3.58	31. 3.58	31. 3.58	29. 3.67
4 COMBINED AT	DP11	1.52	1	FLOW TIME	351. 3.92	335. 4.00	328. 4.00	292. 4.00	1028. 3.92	994. 3.92	978. 3.92	911. 3.92
ROUTED TO	RDP11	1.52	1	FLOW TIME	351. 4.00	335. 4.00	327. 4.00	291. 4.00	1027. 3.92	993. 3.92	977. 3.92	910. 3.92
HYDROGRAPH AT	VG22F	.01	1	FLOW TIME	6. 3.58	6. 3.58	6. 3.58	5. 3.58	12. 3.58	12. 3.58	12. 3.58	11. 3.58
2 COMBINED AT	DP12	1.53	1	FLOW TIME	352. 4.00	337. 4.00	329. 4.00	292. 4.00	1030. 3.92	996. 3.92	980. 3.92	913. 3.92
ROUTED TO	RDP12	1.53	1	FLOW TIME	352. 4.00	336. 4.00	328. 4.00	292. 4.00	1029. 3.92	995. 3.92	979. 3.92	912. 3.92
HYDROGRAPH AT	VG22G	.01	1	FLOW TIME	7. 3.58	7. 3.58	7. 3.58	6. 3.58	16. 3.58	16. 3.58	15. 3.58	15. 3.58
HYDROGRAPH AT	VG22H	.02	1	FLOW TIME	12. 3.58	12. 3.58	12. 3.58	11. 3.58	29. 3.58	29. 3.58	28. 3.58	27. 3.58
HYDROGRAPH AT	VG22I	.00	1	FLOW TIME	3. 3.58	3. 3.58	3. 3.58	3. 3.58	8. 3.58	7. 3.58	7. 3.58	7. 3.58
4 COMBINED AT	DP13	1.56	1	FLOW TIME	359. 4.00	343. 4.00	335. 4.00	299. 4.00	1050. 3.92	1016. 3.92	999. 3.92	931. 3.92
ROUTED TO	RDP13	1.56	1	FLOW TIME	359. 4.00	343. 4.00	335. 4.00	298. 4.00	1049. 3.92	1015. 3.92	998. 3.92	930. 3.92
HYDROGRAPH AT	LM09-C	.22	1	FLOW TIME	109. 3.75	106. 3.75	104. 3.75	95. 3.75	247. 3.75	240. 3.75	237. 3.75	224. 3.75
ROUTED TO	RCIM09-C	.22	1	FLOW TIME	107. 3.75	104. 3.75	101. 3.83	93. 3.75	243. 3.75	237. 3.75	233. 3.75	221. 3.75
HYDROGRAPH AT	LM08	.06	1	FLOW TIME	40. 3.58	39. 3.58	38. 3.58	35. 3.58	87. 3.58	85. 3.58	84. 3.58	79. 3.58
ROUTED TO	RIM08	.06	1	FLOW TIME	41. 3.83	40. 3.83	39. 3.83	36. 3.83	82. 3.83	83. 3.83	82. 3.83	78. 3.83
HYDROGRAPH AT	VG20A	.06	1	FLOW TIME	42. 3.67	41. 3.67	40. 3.67	37. 3.67	87. 3.67	85. 3.67	84. 3.67	80. 3.67
ROUTED TO	RVG20A	.06	1	FLOW TIME	42. 3.92	41. 3.92	40. 3.92	37. 3.92	89. 3.83	87. 3.83	86. 3.83	81. 3.83
HYDROGRAPH AT	VG20B	.13	1	FLOW TIME	66. 3.75	64. 3.75	63. 3.75	58. 3.75	147. 3.75	143. 3.75	141. 3.75	134. 3.75
4 COMBINED AT	CM2	.47	1	FLOW TIME	251. 3.83	243. 3.83	239. 3.83	220. 3.83	552. 3.75	541. 3.75	533. 3.75	504. 3.75
DIVERSION TO	DHOLLY	.47	1	FLOW TIME	51. 3.83	43. 3.83	39. 3.83	20. 3.83	326. 3.75	321. 3.75	317. 3.75	302. 3.75
HYDROGRAPH AT	DVG21	.47	1	FLOW TIME	200. 3.75	200. 3.75	200. 3.75	200. 3.75	226. 3.75	221. 3.75	217. 3.75	202. 3.75

D-5.3

HEC-1 Model

VD3U.dat

SDN3

(Ultimate Condition)

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
* RUN DATE 19MAY08 TIME 15:48:29
*****

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*****
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*****

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X X XXXXXXX XXXX X
X X X X X XX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM

*** FREE ***

```

1 ID *****
2 ID *
3 ID * VEGAS DRIVE - SHADOW MOUNTAIN PL TO RANCHO DR *
4 ID *
5 ID *****
6 ID
7 ID
8 ID PREPARED FOR: CITY OF LAS VEGAS
9 ID PREPARED BY: Poggemeyer Design Group
10 ID DATE: 05/06/2008
11 ID FILE: VD3U.dat
12 ID
13 ID ULTIMATE DEVELOPMENT WITH ULTIMATE DRAINAGE FACILITIES
14 ID DESIGN STORM = 10-YEAR 6-HR STORM, & 100-YEAR 6-HR STORM
15 ID STORM DISTRIBUTION: SDN3
16 ID
17 ID SUBBASINS DELINEATIONS ARE BASED ON THE FOLLOWING REFERENCED HYDROLOGY STUDI
18 ID VEGAS DRIVE / OWENS AVENUE IMPROVEMENTS (KIMELY HORN 2001)
19 ID CCRFCD 2002 MASTER PLAN UPDATE (PBS&J 2002)
20 ID
21 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
22 ID
23 ID CONCENTRATION AREA 100-YR 10-YR
24 ID POINT SQ. MI. DARF DARF
25 ID 0-0.5 1.000 0.570
26 ID 0.5-1 0.980 0.559
27 ID 1-2 0.970 0.553
28 ID 2-3 0.930 0.530
29 ID 3-4 0.920 0.525
30 ID 4-5 0.910 0.519
31 ID 5-6 0.905 0.516
32 ID 6-7 0.900 0.513
33 ID 7-8 0.890 0.508
34 ID
35 ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
36 ID
37 ID 6-HOUR STORM, SDN3
38 ID
39 ID 5 0 0 500
40 ID 5 0 0
41 ID 5 0 0
42 ID *
43 ID 10-YR 100-YR
44 ID PREC 0.570 0.559 0.553 0.525 1.000 0.980 0.970 0.930
45 ID
46 ID
47 ID KKO011A-C
48 ID BA 0.441
49 ID PB 2.77
50 ID PC 0.000 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.13
51 ID PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.18
52 ID PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.24
53 ID PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.40
54 ID PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.85

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1 HEC-1 INPUT PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

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50 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.97
51 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.99
52 PC 0.997 0.999 1.000

```

238 KK RDP9
239 RD 690 0.016 0.013 0 CIRC 5
*

240 KK VG22C
241 BA 0.0066
242 LS 0 91.0
243 UD 0.140
*

244 KK DP10
245 KM COMBINE DP9 AND VG22C
246 HC 2
*

247 KK RDP10
248 RD 1360 0.016 0.013 0 CIRC 5
*

249 KK VG06D
250 BA 0.0971
251 LS 0 80.0
252 UD 0.413
*

HEC-1 INPUT

PAGE 8

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

253 KK VG22D
254 BA 0.0116
255 LS 0 87.0
256 UD 0.169
*

257 KK VG22E
258 BA 0.0279
259 LS 0 87.0
260 UD 0.204
*

261 KK DP11
262 KM COMBINE DP10, VG06D, VG22D, AND VG22E
263 HC 4
*

264 KK RDP11
265 RD 940 0.012 0.013 0 CIRC 5
*

266 KK VG22F
267 BA 0.0071
268 LS 0 93.8
269 UD 0.119
*

270 KK DP12
271 KM COMBINE DP11 AND VG22F
272 HC 2
*

273 KK RDP12
274 RD 610 0.012 0.013 0 CIRC 5
*

275 KK VG22G
276 BA 0.0109
277 LS 0 90.2
278 UD 0.157
*

279 KK VG22H
280 BA 0.0213
281 LS 0 89.4
282 UD 0.173
*

283 KK VG22I
284 BA 0.0050
285 LS 0 91.3
286 UD 0.166
*

HEC-1 INPUT

PAGE 9

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

287 KK DP13
288 KM EAST LN AND VEGAS
289 KM COMBINE DP12, VG22G, VG22H, AND VG22I
290 HC 4
*

291 KK RDP13
292 RD 420 0.010 0.013 0 CIRC 5
*

293 KK LM09-C
294 BA 0.2205

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
42	OG011A-C V	
55	ROG011A V	
59	VG02-C	
64	CVG02-C..... V	
68	RCVG02 V	
74	VG03-C	
79	CVG03-C..... V	
83	RCVG03 V	
89	VG04	
93	DP1.....	
97	VG05A	
101	VG05B	
105	DP2..... V	
108	RDP2 V	
113	VG05C	
117	DP3..... V	
121	RDP3 V	
126	VG05D	
130	VG05E	
134	DP4..... V	
137	RDP4 V	
142	VG05F	
146	VG05G V	
150	RVG05G V	
153	VG05H	
157	DP5S.....	
161	VG05I	
165	DP5..... V	
169	RDP5 V	
174	VG05J	
178	VG05K	

297	.	.	.	V	
	.	.	.	RCLM09-C	
301	.	.	.		
	.	.	.	LM08	
305	.	.	.	V	
	.	.	.	V	
	.	.	.	RLM08	
308	.	.	.		
	.	.	.	VG20A	
312	.	.	.	V	
	.	.	.	V	
	.	.	.	RVG20A	
315	.	.	.		
	.	.	.		VG20B
319	.	.	.		
	.	.	.	CM2.....	
328	.	.	.		
321	.	.	.	DVG21	-----> DHOLLY
	.	.	.	V	
331	.	.	.	V	
	.	.	.	RDVG21	
335	.	.	.		
	.	.	.	VG20C	
339	.	.	.		
	.	.	.	DP14N.....	
342	.	.	.		
	.	.	.	DP14.....	

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

ROUTED TO													
+	RDP9	.10	1	FLOW TIME	192.	191.	190.	185.	245.	243.	242.	237.	
					3.67	3.67	3.67	3.75	3.58	3.58	3.58	3.58	
HYDROGRAPH AT													
+	VG22C	.01	1	FLOW TIME	5.	5.	4.	4.	10.	10.	10.	9.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
2 COMBINED AT													
+	DP10	.10	1	FLOW TIME	196.	195.	194.	187.	256.	253.	252.	246.	
					3.67	3.67	3.67	3.75	3.58	3.58	3.58	3.58	
ROUTED TO													
+	RDP10	.10	1	FLOW TIME	194.	193.	192.	187.	253.	250.	249.	244.	
					3.67	3.67	3.67	3.75	3.58	3.58	3.58	3.58	
HYDROGRAPH AT													
+	VG06D	.10	1	FLOW TIME	17.	16.	15.	13.	58.	56.	55.	51.	
					3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	
HYDROGRAPH AT													
+	VG22D	.01	1	FLOW TIME	6.	5.	5.	5.	15.	14.	14.	13.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
HYDROGRAPH AT													
+	VG22E	.03	1	FLOW TIME	13.	12.	12.	11.	32.	31.	31.	29.	
					3.67	3.67	3.67	3.67	3.58	3.58	3.58	3.67	
4 COMBINED AT													
+	DP11	.24	1	FLOW TIME	223.	220.	219.	211.	341.	335.	332.	321.	
					3.67	3.75	3.75	3.75	3.67	3.67	3.67	3.67	
ROUTED TO													
+	RDP11	.24	1	FLOW TIME	223.	220.	218.	210.	340.	334.	331.	320.	
					3.75	3.75	3.75	3.75	3.67	3.67	3.67	3.67	
HYDROGRAPH AT													
+	VG22F	.01	1	FLOW TIME	6.	6.	6.	5.	12.	12.	12.	11.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
2 COMBINED AT													
+	DP12	.25	1	FLOW TIME	226.	223.	222.	213.	348.	343.	340.	328.	
					3.75	3.75	3.75	3.75	3.67	3.67	3.67	3.67	
ROUTED TO													
+	RDP12	.25	1	FLOW TIME	226.	223.	221.	212.	348.	342.	339.	327.	
					3.75	3.75	3.75	3.75	3.67	3.67	3.67	3.67	
HYDROGRAPH AT													
+	VG22G	.01	1	FLOW TIME	7.	7.	7.	6.	16.	16.	15.	15.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
HYDROGRAPH AT													
+	VG22H	.02	1	FLOW TIME	12.	12.	12.	11.	29.	29.	28.	27.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
HYDROGRAPH AT													
+	VG22I	.00	1	FLOW TIME	3.	3.	3.	3.	8.	7.	7.	7.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
4 COMBINED AT													
+	DP13	.28	1	FLOW TIME	243.	239.	237.	227.	395.	388.	384.	370.	
					3.75	3.75	3.75	3.75	3.67	3.67	3.67	3.67	
ROUTED TO													
+	RDP13	.28	1	FLOW TIME	243.	239.	237.	226.	394.	387.	383.	369.	
					3.75	3.75	3.75	3.75	3.67	3.67	3.67	3.67	
HYDROGRAPH AT													
+	LM09-C	.22	1	FLOW TIME	109.	106.	104.	95.	247.	240.	237.	224.	
					3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	
ROUTED TO													
+	RCLM09-C	.22	1	FLOW TIME	107.	104.	101.	93.	243.	237.	233.	221.	
					3.75	3.75	3.83	3.75	3.75	3.75	3.75	3.75	
HYDROGRAPH AT													
+	LM08	.06	1	FLOW TIME	40.	39.	38.	35.	87.	85.	84.	79.	
					3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	
ROUTED TO													
+	RLM08	.06	1	FLOW TIME	41.	40.	39.	36.	82.	83.	82.	78.	
					3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	
HYDROGRAPH AT													
+	VG20A	.06	1	FLOW TIME	42.	41.	40.	37.	87.	85.	84.	80.	
					3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	
ROUTED TO													
+	RVG20A	.06	1	FLOW TIME	42.	41.	40.	37.	89.	87.	86.	81.	
					3.92	3.92	3.92	3.92	3.83	3.83	3.83	3.83	
HYDROGRAPH AT													
+	VG20B	.13	1	FLOW TIME	66.	64.	63.	58.	147.	143.	141.	134.	
					3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	
4 COMBINED AT													
+	CH2	.47	1	FLOW TIME	251.	243.	239.	220.	552.	541.	533.	504.	
					3.83	3.83	3.83	3.83	3.75	3.75	3.75	3.75	

APPENDIX E

Hydraulics

E-1.1

Street Capacity Summary (10-Year Event)

For supporting calculations, see the *Drainage Study Update to the Preliminary Design Report, Vegas Drive –Shadow Mountain to Rancho Drive*, dated December 2007.

VEGAS DRIVE - SHADOW MOUNTAIN PLACE TO RANCHO DRIVE 10-Yr Event Street Capacity Analysis Summary

Section	Station to Station	Min. Longitudinal Street Slope (%)	Depth (ft)	Velocity (fps)	V X D	Interim Condition Actual Flow Rates		Ultimate Condition Actual Flow Rates	
						North Side Q ₁₀ (cfs)	South Side Q ₁₀ (cfs)	North Side Q ₁₀ (cfs)	South Side Q ₁₀ (cfs)
1	6+00 to 9+00	1.55	0.48	3.58	1.71	42.6	42.0	0.1	0.2
2	9+00 to 11+00	0.76	0.48	2.51	1.20	18.3	17.9	0.0	0.0
3	11+00 to 18+50	1.28	0.48	3.26	1.55	24.3	20.9	6.0	3.0
4	18+50 to 22+50	1.38	0.48	3.38	1.61	24.3	15.4	6.0	1.3
5	22+50 to 28+50	1.12	0.48	3.05	1.45	21.4	19.4	6.4	5.3
6	28+50 to 35+50	1.61	0.48	3.65	1.74	19.9	6.8	7.6	6.8
7	35+50 to 40+50	0.73	0.48	2.46	1.17	7.0	1.2	7.0	1.2
8	40+50 to 44+50	0.81	0.48	2.59	1.24	4.1	2.0	4.1	2.0
9	44+50 to 47+00	0.60	0.48	2.23	1.06	2.1	0.4	2.1	0.4
10	47+00 to 52+00	1.54	0.48	3.57	1.70	8.1	8.4	8.1	8.4
11	52+00 to 54+00	1.74	0.48	3.80	1.81	3.5	3.7	3.5	3.7
12	54+00 to 56+50	1.27	0.48	3.24	1.55	3.5	8.4	3.5	8.4
13	56+50 to 60+50	0.80	0.48	2.57	1.23	3.5	4.1	3.5	4.1
14	60+50 to 66+00	1.35	0.48	3.34	1.59	6.6	9.8	6.6	9.8
15	66+00 to 70+00	0.60	0.48	2.23	1.06	3.8	4.5	3.8	4.5
16	70+00 to 72+50	1.83	0.48	3.89	1.86	9.8	10.2	9.8	10.2
17	72+50 to 78+00	1.71	0.48	3.76	1.79	4.7	10.5	4.7	10.5
18	78+00 to 81+50	0.89	0.48	2.72	1.29	6.0	2.7	6.0	2.7
19	81+50 to 84+50	2.34	0.48	4.40	2.10	13.0	8.7	13.0	8.7
20	84+50 to 89+50	2.73	0.48	4.76	2.27	5.1	4.1	5.1	4.1
21	89+50 to 94+00	1.03	0.48	2.92	1.39	5.5	4.1	5.5	4.1

*Depth is the maximum depth determined that allows a minimum 12 ft dry travel lane in each direction.

Additional street flow analyses are provided and summarized below for locations where the 12 ft dry travel lane is not met.

Section	Station to Station	Section or Vegas Drive	Depth (ft)	Velocity (fps)	V X D	Actual Street Q ₁₀ (cfs)	Time Period	Actual Lane Width (ft)
1	6+00 to 9+00	North & South Side	0.69	4.75	3.30	42.60	Interim Condition	1.12
2	9+00 to 11+00	North & South Side	0.61	2.88	1.76	18.30	Interim Condition	5.33
3	11+00 to 18+50	North Side	0.61	3.77	2.31	24.30	Interim Condition	5.15
3	11+00 to 18+50	South Side	0.59	3.60	2.13	20.90	Interim Condition	6.28
4	18+50 to 22+50	North Side	0.61	3.87	2.35	24.30	Interim Condition	5.44
4	18+50 to 22+50	South Side	0.55	3.37	1.84	15.40	Interim Condition	8.56
5	22+50 to 28+50	North Side	0.60	3.46	2.09	21.40	Interim Condition	5.62
5	22+50 to 28+50	South Side	0.59	3.36	1.98	19.40	Interim Condition	6.34
6	28+50 to 35+50	North Side	0.57	3.85	2.19	19.90	Interim Condition	7.42

E-1.2

Street Capacity Summary (100-Year Event)

For supporting calculations, see the *Drainage Study Update to the Preliminary Design Report, Vegas Drive – Shadow Mountain to Rancho Drive*, dated December 2007.

VEGAS DRIVE - SHADOW MOUNTAIN PLACE TO RANCHO DRIVE
100-Yr Event Street Capacity Analysis Summary (INTERIM CONDITION)

Section	Station To Station	Longitudinal Street Slope (%)	Depth (ft)	Velocity (fps)	V X D	Allowable 1/2 Street Q ₁₀₀ (cfs)	Design Point	Total Q ₁₀₀ Flow Rate	Storm Drain Facility Flow	Flow Rates		Actual 1/2 Street Q ₁₀₀ (cfs)	Actual V X D	Check 100-yr Street Capacity
										North Side Q ₁₀₀ (cfs)	South Side Q ₁₀₀ (cfs)			
1	6+00 to 9+00	1.55	1.04	7.70	8.00	171.9	DP2	731	306	211.8	211.8	212.5	11.6	Street Capacity Exceeded
2	9+00 to 11+00	0.76	1.23	6.52	8.00	194.5	DP3	744	444	149.4	149.4	150.0	8.7	OK
3	11+00 to 18+50	1.28	1.09	7.37	8.00	178.2	DP3	744	444	163.4	156.4	150.0	9.2	OK
4	18+50 to 22+50	1.28	1.09	7.37	8.00	178.2	DP4	749	456	163.4	142.9	146.5	8.8	OK
5	22+50 to 28+50	1.12	1.12	7.15	8.00	182.5	DP4	749	468	156.7	150.9	140.5	8.4	OK
6	28+50 to 35+50	1.61	1.03	7.77	8.00	170.6	DP5	837	491	150.1	126.6	173.0	8.4	Street Capacity Exceeded
7	35+50 to 40+50	0.56	1.32	6.05	8.00	203.6	DP6	850	491	109.3	48.0	179.5	7.5	OK
8	40+50 to 44+50	0.81	1.21	6.62	8.00	192.6	DP7	861	503	97.9	36.3	179.0	7.8	OK
9	44+50 to 47+00	0.60	1.30	6.16	8.00	201.6	DP7	861	503	87.1	23.7	179.0	7.5	OK
10	47+00 to 52+00	1.54	1.04	7.69	8.00	172.1	DP7	861	503	99.1	40.7	179.0	8.5	Street Capacity Exceeded
11	52+00 to 54+00	1.55	1.04	7.70	8.00	171.9	DP8	867	507	79.7	28.0	180.0	8.5	Street Capacity Exceeded
12	54+00 to 56+50	1.27	1.09	7.36	8.00	178.5	DP8	867	507	79.7	40.7	180.0	8.3	Street Capacity Exceeded
13	56+50 to 60+50	0.80	1.21	6.60	8.00	193.0	DP9	899	509	79.7	38.8	195.0	8.3	Street Capacity Exceeded
14	60+50 to 66+00	1.16	1.11	7.21	8.00	181.4	DP9	899	509	79.6	58.1	195.0	8.7	Street Capacity Exceeded
15	66+00 to 70+00	0.60	1.30	6.16	8.00	201.6	DP10	902	515	69.5	42.8	193.5	8.0	OK
16	70+00 to 72+50	1.27	1.09	7.36	8.00	178.5	DP10	902	515	79.5	62.1	193.5	8.7	Street Capacity Exceeded
17	72+50 to 78+00	1.71	1.02	7.87	8.00	168.6	DP11	978	525	62.5	66.4	226.5	10.0	Street Capacity Exceeded
18	78+00 to 81+50	0.89	1.18	6.77	8.00	189.7	DP11	978	550	66.7	40.2	214.0	8.9	Street Capacity Exceeded
19	81+50 to 84+50	2.34	0.95	8.43	8.00	157.9	DP11	978	550	74.7	52.2	214.0	10.1	Street Capacity Exceeded
20	84+50 to 89+50	1.27	1.09	7.36	8.00	178.5	DP12	980	580	51.0	38.6	200.0	8.9	Street Capacity Exceeded
21	89+50 to 94+00	0.89	1.18	6.77	8.00	189.7	DP13	999	617	17.7	38.6	191.0	8.2	Street Capacity Exceeded

¹Flow Rates assume the mainline storm drain facility has the capacity to convey the total runoff flow intercepted by the drop inlets.
During the Interim Condition the maximum Storm Drain Facility Flow = 455cfs = Storm Drain Facility Design Flow Rate.

²Storm Drain Facility Flow = Lesser of Total Flow Intercepted by Upstream Drop Inlets OR Estimated surcharged capacity of Storm Drain determined by 100-yr Interim WSPG Model

³Actual 1/2 Street Q₁₀₀ = (Total Q₁₀₀ Flow Rate - Storm Drain Facility Flow)/2

⁴Check 100-yr Street Capacity, if Actual 1/2 Street Q₁₀₀ > Allowable 1/2 Street Q₁₀₀, then "Street Capacity Exceeded", else "OK".

VEGAS DRIVE - SHADOW MOUNTAIN PLACE TO RANCHO DRIVE
100-Yr Event Street Capacity Analysis Summary (ULTIMATE CONDITION)

Section	Station To Station	Min Longitudinal Street Slope (%)	Depth (ft)	Velocity (fps)	V X D Q ₁₀₀ (cfs)	Allowable 1/2 Street Q ₁₀₀ (cfs)	Design Point	Total Q ₁₀₀ Flow Rate	Storm Drain Facility Flow	Flow Rates North Side Q ₁₀₀ (cfs) South Side Q ₁₀₀ (cfs)	Actual 1/2 Street Q ₁₀₀ (cfs)	Actual V X D	Check 100-yr Street Capacity
1	6+00 to 9+00	1.55	1.04	7.70	8.00	171.90	DP2	731	731	0.6	1.4	< 8.0	OK
2	9+00 to 11+00	0.76	1.23	6.52	8.00	194.55	DP3	744	744	0.0	0.1	< 8.0	OK
3	11+00 to 18+50	1.28	1.09	7.37	8.00	178.20	DP3	744	744	14.0	14.0	< 8.0	OK
4	18+50 to 22+50	1.28	1.09	7.37	8.00	178.20	DP4	749	749	14.0	14.0	< 8.0	OK
5	22+50 to 28+50	1.12	1.12	7.15	8.00	182.51	DP4	749	749	16.6	16.6	< 8.0	OK
6	28+50 to 35+50	1.61	1.03	7.77	8.00	170.63	DP5	837	837	18.8	27.5	< 8.0	OK
7	35+50 to 44+50	0.56	1.32	6.05	8.00	203.56	DP6	850	850	14.0	14.0	< 8.0	OK
8	44+50 to 47+00	0.81	1.21	6.62	8.00	192.63	DP7	196	183	9.6	9.7	< 8.0	OK
9	47+00 to 52+00	0.60	1.30	6.16	8.00	201.57	DP7	196	192	6.1	4.2	< 8.0	OK
10	52+00 to 54+00	1.54	1.04	7.69	8.00	172.12	DP7	196	192	18.1	21.2	< 8.0	OK
11	54+00 to 56+50	1.55	1.04	7.70	8.00	171.90	DP8	225	209	10.1	12.3	< 8.0	OK
12	56+50 to 60+50	1.27	1.09	7.36	8.00	178.46	DP8	225	209	10.1	21.2	< 8.0	OK
13	60+50 to 66+00	0.80	1.21	6.60	8.00	193.00	DP9	247	230	10.1	26.7	< 8.0	OK
14	66+00 to 70+00	1.16	1.11	7.21	8.00	181.38	DP9	247	234	16.5	46.0	< 8.0	OK
15	70+00 to 72+50	0.60	1.30	6.16	8.00	201.57	DP10	256	253	11.7	32.4	< 8.0	OK
16	72+50 to 78+00	1.27	1.09	7.36	8.00	178.46	DP10	256	253	21.7	51.7	< 8.0	OK
17	78+00 to 81+50	1.71	1.02	7.87	8.00	168.61	DP11	341	322	12.9	57.2	< 8.0	OK
18	81+50 to 84+50	0.89	1.18	6.77	8.00	189.73	DP11	341	322	27.7	33.1	< 8.0	OK
19	84+50 to 89+50	2.34	0.95	8.43	8.00	157.88	DP11	341	322	35.7	45.1	< 8.0	OK
20	89+50 to 94+00	1.27	1.09	7.36	8.00	178.46	DP12	348	348	19.7	32.5	< 8.0	OK
21		0.89	1.18	6.77	8.00	189.73	DP13	395	395	17.7	32.5	< 8.0	OK

¹Flow Rates assume the mainline storm drain facility has the capacity to convey the total runoff flow intercepted by the drop inlets.

During the Ultimate Condition it is assumed that the Storm Drain Facility Flow capacity will be increased with a future storm drain facility west of Decatur Blvd so that the Total Q₁₀₀ Flow Rate can be conveyed in the future storm drain facility. The 690cfs of the Total Q₁₀₀ Flow Rate at Decatur Blvd (850cfs - DP6) is assumed to be diverted in a future facility north along Decatur Blvd and into the Lake Mead Detention Basin. The remaining 160cfs is assumed to continue East along Vegas Drive.

² (For Sections 1 - 7) Storm Drain Facility Flow = Total Q₁₀₀ Flow Rate

² (For Sections 8-21) Storm Drain Facility Flow = Lesser of Total Flow Intercepted by Upstream Drop Inlets plus 160cfs OR Total Q₁₀₀ Flow Rate

³ Actual 1/2 Street Q₁₀₀ = Maximum of North Side Q₁₀₀ or South Side Q₁₀₀

⁴Check 100-yr Street Capacity, if Actual 1/2 Street Q₁₀₀ > Allowable 1/2 Street Q₁₀₀, then "Street Capacity Exceeded", else "OK".

E-1.3

Existing Condition Street Capacity Summary (10-Year Event)

For supporting calculations, see the *Drainage Study Update to the Preliminary Design Report, Vegas Drive – Shadow Mountain to Rancho Drive*, dated December 2007.

VEGAS DRIVE - SHADOW MOUNTAIN PLACE TO RANCHO DRIVE
10-Yr Event Street Capacity Analysis Summary (EXISTING CONDITION)

Section	Station To Station	Min Structural Street Slope (%)	Depth (ft)	Velocity (fps)	V _{XB}	Allowable 1/2 Street Q ₁₀ (gals)	Design Point	Total Q ₁₀ Flow Rate	Actual Street Q ₁₀ (gals)	Actual Lane Width (ft)	Check 10-yr Street Capacity
1	6+00 to 9+00	1.55	0.48	3.58	1.71	10.8	DP2	241	120.5	0.0	Street Capacity Exceeded
2	9+00 to 11+00	0.76	0.48	2.51	1.20	7.6	DP3	246	123.0	0.0	Street Capacity Exceeded
3	11+00 to 18+50	1.28	0.48	3.26	1.55	9.9	DP3	246	123.0	0.0	Street Capacity Exceeded
4	18+50 to 22+50	1.38	0.48	3.38	1.61	10.2	DP4	248	124.0	0.0	Street Capacity Exceeded
5	22+50 to 28+50	1.12	0.48	3.05	1.45	9.2	DP4	248	124.0	0.0	Street Capacity Exceeded
6	28+50 to 35+50	1.61	0.48	3.65	1.74	11.1	DP5	285	142.5	0.0	Street Capacity Exceeded
7	35+50 to 40+50	0.73	0.48	2.46	1.17	7.4	DP6	290	145.0	0.0	Street Capacity Exceeded
8	40+50 to 44+50	0.81	0.48	2.59	1.24	7.8	DP7	294	147.0	0.0	Street Capacity Exceeded
9	44+50 to 47+00	0.60	0.48	2.23	1.06	6.7	DP7	294	147.0	0.0	Street Capacity Exceeded
10	47+00 to 52+00	1.54	0.48	3.57	1.70	10.8	DP7	294	147.0	0.0	Street Capacity Exceeded
11	52+00 to 54+00	1.74	0.48	3.80	1.81	11.5	DP8	296	148.0	0.0	Street Capacity Exceeded
12	54+00 to 56+50	1.27	0.48	3.24	1.55	9.8	DP8	296	148.0	0.0	Street Capacity Exceeded
13	56+50 to 60+50	0.80	0.48	2.57	1.23	7.8	DP9	305	152.5	0.0	Street Capacity Exceeded
14	60+50 to 66+00	1.35	0.48	3.34	1.59	10.1	DP9	305	152.5	0.0	Street Capacity Exceeded
15	66+00 to 70+00	0.60	0.48	2.23	1.06	6.7	DP10	306	153.0	0.0	Street Capacity Exceeded
16	70+00 to 72+50	1.83	0.48	3.89	1.86	11.8	DP10	306	153.0	0.0	Street Capacity Exceeded
17	72+50 to 78+00	1.71	0.48	3.76	1.79	11.4	DP11	328	164.0	0.0	Street Capacity Exceeded
18	78+00 to 81+50	0.89	0.48	2.72	1.29	8.2	DP11	328	164.0	0.0	Street Capacity Exceeded
19	81+50 to 84+50	2.34	0.48	4.40	2.10	13.3	DP11	328	164.0	0.0	Street Capacity Exceeded
20	84+50 to 89+50	2.73	0.48	4.76	2.27	14.4	DP12	329	164.5	0.0	Street Capacity Exceeded
21	89+50 to 94+00	1.03	0.48	2.92	1.39	8.8	DP13	335	167.5	0.0	Street Capacity Exceeded

*Depth is the maximum depth determined that allows a minimum 12 ft dry travel lane in each direction.

*Check 10-yr Street Capacity, if Actual 1/2 Street Q₁₀ > Allowable 1/2 Street Q₁₀, then "Street Capacity Exceeded", else "OK".

E-1.4

Existing Condition Street Capacity Summary (100-Year Event)

For supporting calculations, see the *Drainage Study Update to the Preliminary Design Report, Vegas Drive – Shadow Mountain to Rancho Drive*, dated December 2007.

VEGAS DRIVE - SHADOW MOUNTAIN PLACE TO RANCHO DRIVE
100-Yr Event Street Capacity Analysis Summary (EXISTING CONDITION)

Station	Station to Station	Longitudinal Street Slope (%)	Depth (ft)	Velocity (ft/s)	VAD	Allowable 1/2 Street Capacity (G/S)	Design Point	Total Q ₁₀₀ Flow Rate	Actual 1/2 Street Q ₁₀₀ (G/S)	Actual VAD	Street Capacity
1	6+00 to 9+00	1.55	1.04	7.70	8.00	171.9	DP2	731	365.5	14.1	Street Capacity Exceeded
2	9+00 to 11+00	0.76	1.23	6.52	8.00	194.5	DP3	744	372.0	13.3	Street Capacity Exceeded
3	11+00 to 18+50	1.28	1.09	7.37	8.00	178.2	DP3	744	372.0	14.0	Street Capacity Exceeded
4	18+50 to 22+50	1.28	1.09	7.37	8.00	178.2	DP4	749	374.5	14.1	Street Capacity Exceeded
5	22+50 to 28+50	1.12	1.12	7.15	8.00	182.5	DP4	749	374.5	13.9	Street Capacity Exceeded
6	28+50 to 35+50	1.61	1.03	7.77	8.00	170.6	DP5	837	418.5	15.8	Street Capacity Exceeded
7	35+50 to 40+50	0.56	1.32	6.05	8.00	203.6	DP6	850	425.0	14.5	Street Capacity Exceeded
8	40+50 to 44+50	0.81	1.21	6.62	8.00	192.6	DP7	861	430.5	15.1	Street Capacity Exceeded
9	44+50 to 47+00	0.60	1.30	6.16	8.00	201.6	DP7	861	430.5	14.8	Street Capacity Exceeded
10	47+00 to 52+00	1.54	1.04	7.69	8.00	172.1	DP7	861	430.5	16.1	Street Capacity Exceeded
11	52+00 to 54+00	1.55	1.04	7.70	8.00	171.9	DP8	867	433.5	16.2	Street Capacity Exceeded
12	54+00 to 56+50	1.27	1.09	7.36	8.00	178.5	DP8	867	433.5	15.9	Street Capacity Exceeded
13	56+50 to 60+50	0.80	1.21	6.60	8.00	193.0	DP9	899	449.5	15.7	Street Capacity Exceeded
14	60+50 to 66+00	1.16	1.11	7.21	8.00	181.4	DP9	899	449.5	16.2	Street Capacity Exceeded
15	66+00 to 70+00	0.60	1.30	6.16	8.00	201.6	DP10	902	451.0	15.3	Street Capacity Exceeded
16	70+00 to 72+50	1.27	1.09	7.36	8.00	178.5	DP10	902	451.0	16.4	Street Capacity Exceeded
17	72+50 to 78+00	1.71	1.02	7.87	8.00	168.6	DP11	978	489.0	18.0	Street Capacity Exceeded
18	78+00 to 81+50	0.89	1.18	6.77	8.00	189.7	DP11	978	489.0	17.0	Street Capacity Exceeded
19	81+50 to 84+50	2.34	0.95	8.43	8.00	157.9	DP11	978	489.0	18.6	Street Capacity Exceeded
20	84+50 to 89+50	1.27	1.09	7.36	8.00	178.5	DP12	980	490.0	17.5	Street Capacity Exceeded
21	89+50 to 94+00	0.89	1.18	6.77	8.00	189.7	DP13	999	499.5	17.3	Street Capacity Exceeded

*Check 100-yr Street Capacity, if Actual 1/2 Street Q₁₀₀ > Allowable 1/2 Street Q₁₀₀, then "Street Capacity Exceeded", else "OK".



Department of Public Works

500 S Grand Central Pky • Box 554000 • Las Vegas NV 89155-4000
(702) 455-6000 • Fax (702) 455-6040

Denis Cederburg, P.E., Director • E-Mail: dlc@co.clark.nv.us

Drainage Study Approval Letter

Date: December 28, 2010
Firm: Warling Engineering
Engineer: Mark L. Warling, P.E.
Address: 9101 W. Sahara Avenue, #105-L8, Las Vegas, NV 89117
Phone: (702) 927-5464
Fax: (702) 269-6275
E-mail:

Subject: Technical Drainage Study for Vegas Drive Church of Christ
Location: North of Vegas Drive east of Mountain Trail
APN: 139-19-812-052; -053
Sec, Township, Range: S19, T20S, R61E
Flood Zone & Panel: Zone X, 2155E, Revised September 27, 2002
Application Tracking #: 10-26822



H T E 1 0 - 2 6 8 2 2

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	09/30/2010	10/22/2010	WG	
Addendum #1	12/16/2010	12/28/2010	WG	

Concurrence Required: (Must be obtained prior to permit issuance)		Reason Concurrence is required
	City of Henderson	Adjacent to or Impacts Henderson
X	City of Las Vegas	Adjacent to or Impacts Las Vegas
	City of North Las Vegas	Adjacent to or Impacts North Las Vegas
	Nevada Department of Transportation	Impacts NDOT Facility
	Union Pacific Rail Road	Adjacent to or Impacts a UPRR Facility
	US Army Corp of Engineers	Impacts a USACE Facility
X	Clark County Regional Flood Control District	Adjacent to or Impacts CCRFCD MPU Facility or in a SFHA

BOARD OF COUNTY COMMISSIONERS

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VIRGINIA VALENTINE, P.E., County Manager

The referenced **Technical Drainage Study** has been reviewed and is accepted as complying with minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards.

The site shall be graded with respect to drainage as shown on "Vegas Drive Church of Christ", grading plan sheets C4, C5, signed and sealed by Mark L. Warling, P.E., on December 16, 2010.

Check appropriate conditions

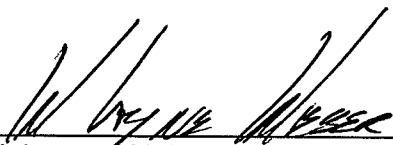
	Retaining/screen wall combination may be in excess of current Clark County Unified Development Code, Chapter 30.64.050.
	A FEMA Elevation Certificate, completed by a licensed surveyor, must be submitted to and approved by CCPW Development Review Plan Check prior to the issuance of Certificates of Occupancy for those structures.
X	Mylars of the grading plan must be submitted to the CCPW Development Review Plan Check for approval signatures prior to map recordation (residential) or permit issuance (commercial).
	An administrative variance to allow the finished floor elevation(s) to be set below the current Clark County criteria must be approved. The finished floor variance must be submitted to CCPW Development Review front counter after drainage study approval and prior to offsite final review.
X	The grading plan will be reviewed by the Building Office Operations Division to ensure compliance with the ADA access requirements. Revisions to the grading plan may be required if the site accessibility design does not comply with the requirements set forth in the Accessibility Chapter of the Clark County Building Code.
	The plans show work is proposed outside of the project boundary. Notarized written permission must be obtained prior to grading plan approval.
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
	Per <i>Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage</i> , the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal.
X	Plan revisions can be found on the red-lined plans and must be addressed.
	Prepare drainage easement documents as shown on the grading plans.

Additional Conditions:

1. Per County policy, please provide the **Stormwater Management Notes** on the grading plan set from Section 3.5.1 of *The Las Vegas Valley Construction Site BMP Guidance Manual*. A pdf of the document can be accessed at (<http://www.lvstormwater.com>). Please insert "Clark County" and reference "Title 24.40" where indicated.
2. It is noted that the 72-inch RCP within Vegas Drive is proposed by the CLV. However, to date this facility is not constructed. Note Certificates of Occupancy for the church will not be issued until the 72-inch RCP is constructed and functioning.

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record.

By


W. Layne Weber, P.E., CFM
Principal Engineer
Clark County Public Works
Development Review

cc: Vegas Drive Church of Christ
Andrew Trelease, RFCD

ADDENDUM NO. 1

TECHNICAL DRAINAGE STUDY

FOR

VEGAS DRIVE CHURCH OF CHRIST

**3816 & 3824 VEGAS DRIVE
LAS VEGAS, NV 89108**

DECEMBER 16, 2010

Prepared By:

Warling Engineering

**9101 W. Sahara Ave. #105-L8
Las Vegas, NV 89117
Tel: 702-WARLING (927-5464)
Fax: 702-269-6275**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Vegas Drive Church of Christ Date: December 16, 2010

Location of Development: a) Descriptive (Cross Streets) North/South Vegas Drive East/West Pyramid Avenue
 b) Sect. 19 Twn. 20 S. Rng. 61 E.

Name of Owner: Vegas Drive Church of Christ Assessors Parcel No: 139-19-812-052 & 139-19-812-053

Telephone No: 702-648-4827 Facsimile No: 702-360-4480

Address: 3816 Vegas Drive, Las Vegas, NV 89108

Contact Person-Name Tony Barajas Telephone No: 702-768-7180

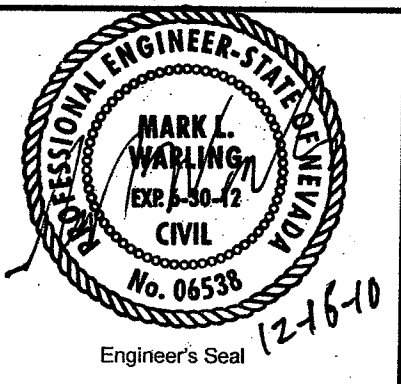
Firm: Barajas & Associates, Inc.

Address: 2965 West Lake Mead Blvd., North Las Vegas, NV 89032

Type of Land Development/Land Disturbance Process:

☐ Rezoning	☐ Subdivision Map	☐ Clearing and Grading Only
☐ Parcel Map	☐ Planned Unit Development	☐ Other (Please specify below)
☐ Large Parcel Map	☒ Building Permit	

- Total Owned Land Area: At Site: 0.87 Acres Being Developed/Disturbed: 0.87 Acres
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes* ☒ No
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes* ☒ No
- Proposed type of development (Residential, Commercial, Etc.)? Commercial
- Approximate upstream land area which drains to the subject site? 1.52 sq. mi.
- Has the site drainage been evaluated in the past ☒ Yes ☐ No If yes, please identify documentation:
Vegas Drive Improvements Shadow Mountain Place to Rancho Drive, by Poggemeyer Design Group, Inc. project no. 05333-C; for City of Las Vegas Dept. of Public Works
- If known, please briefly identify the proposed discharge point(s) of runoff from the site:
Proposed commercial driveway on Vegas Drive
- Briefly describe your proposed schedule for the subject project: commencing: 1st quarter, 2011 - estimated completion: 3rd quarter, 2011



Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

* Review and concurrence of the Clark County Regional Flood Control District is Required.

Local Entity File No.

Revision

Date

REFERENCE:

Standard Form 1