

2005P048
McMicken
Dam
Outlet
WASH



RANCHO CABRILLO

DRAINAGE REPORT FOR HAPPY VALLEY ROAD PHASE II

Prepared for:
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Phoenix, AZ 85012
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Revised: October 10, 2005
August 19, 2005
WLB Project No. 202017A001

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1.0 INTRODUCTION

Rancho Cabrillo is a planned residential community located in an unincorporated area of Maricopa County, Arizona within portions of Sections 3 and 10, Township 4 North, Range 1 West, Gila and Salt River Base and Meridian. It is bounded by Dysart Road to the east, Litchfield Road to the west, Jomax Road to the north and the McMicken Dam/Trilby Wash flowage easement to the south (see Figure 1, Vicinity Map). Happy Valley Road (Section Line Roadway) provides access to Rancho Cabrillo along a re-aligned right of way and traverses the south half of Sections 1 and 2, T 4N, R1W and connects with Vistancia Boulevard on the eastern end. Portion of Happy Valley Road Phase II will involve portion of the land owned by the Flood Control District of Maricopa County and referred to as the McMicken Dam / Trilby Wash Flowage Easement.

The purpose of this report is to present the roadway hydrologic and hydraulic designs for Happy Valley Road Phase II (HVR PII) (STA 50+44 to STA 106+00) and to be able to secure necessary clearances and permits for its construction. Happy Valley Road Phase I has already received approval from the FCDMC, MCEQ, and MCDOT. Construction of the water & sewer lines that emanate from Happy Valley Road Phase I and heading southward is already under construction. Phase II of Happy valley Road contains the remainder of the water and sewer lines that will serve Rancho Cabrillo. A separate report shall be produced to cover the hydrologic and hydraulic design for the arterial and collector streets for the Rancho Cabrillo development.

The drainage designs provided in this report are in accordance with the guidelines and criteria in the Drainage Design Manuals, Volume I – Hydrology, dated January 1995 and Volume II – Hydraulics dated January 1996 (Reference #3).

Limits of the mapped 100-year floodplain boundaries are from FEMA panel 04013C1155 H, dated September 30, 2005. Aside from the Zone A along 16-East Wash, most of HVR PII is within Zone X. Figure 2 shows the floodplain as depicted on the FIRM.

2.0 HYDROLOGY

The watershed area impacting HVR PII has been covered in studies by the Wittman ADMS that was completed in 1989 by The WLB Group and updated in December 2002 by The WLB Group through the Addendum to the Master Drainage Report for Rancho Cabrillo. This latter study was reviewed and accepted by the FCDMC and included detailed hydrologic data used in this report. The more recent Wittman Area Drainage Master Study Update (ADMSU) completed in October of 2004 by Entellus was also studied (Reference #9).

The drainage sub-basin upstream of HVR PII utilized for this study was called area C122E watershed in the HEC-1 models (wlbrcabx.out). See Figure 3. The 2004 update by Entellus utilized a sub-basin named PD700 for the watershed area between Beardsley Canal and the McMicken Dam Outlet Channel from 16-East Wash to Padelford Wash. See Figure 4. It was found that the 2004 update was not as detailed as the WLB study for the drainage watershed areas affecting HVR PII. Although the HEC-1 Models for the 2004 study gave existing and future conditions for the areas; there were no breakdown for the watershed affecting HVR PII as with the earlier studies.

Moreover, many of the smaller areas studied in the 2004 ADMSU resulted with a larger peak discharge for the existing conditions for a 100-year 6-hour event. This situation is apparently due to the factors chosen in the future conditions models. The WLB Group believes that the 100-year 24-hour event used on future conditions in the morphed HEC-1 models is a better model to represent the flows affecting HVR-P11 other than at 16-East Wash.

Based on the above, the areas and peak discharge for the flows presented in the earlier drainage report for the 100-year 24-hour peak discharges are valid and reasonable for the design of culverts crossing HVR P11. Figure 3 shows the HEC-1 areas used in the hydrologic modeling for the earlier studies.

The culverts at STA 60+00 has a Q_{100} discharge of 212 cfs and the culvert at STA 71+81 has a Q_{100} discharge of 28 cfs, which were both based on a spatial allocation from hydrologic watershed area C122E (WLB Combined model) flows. See Table 2 and Figure 5.

Estimated 100-year runoff to the culvert crossing 16-East Wash (STA 86+80) are based on flows from the Wittman Area Drainage Master Study Update of 2004 with the 100-year peak discharge of 3,676 cfs (Routing along wash RPD704 per HEC-1 model for 100-year 6-hour Future Conditions) that is added with the flow for the contributing area of 165.3 acre (Area C Q_{100} = 258 cfs) for a total of 3,954 cfs. These flows would give a maximum flow condition for the culvert crossing at 16-East Wash as depicted in Table 1 below. Figure 6 shows the 100-year floodplain and the transitions for the floodplain both upstream and downstream of the 16-East Wash crossing.

Table 1: Summary of 100-yr, 24-hour peak flows for 16-East Wash @ McMicken Dam Outlet Channel Confluence

Study: Date: Location	EXISTING CONDITIONS								FUTURE CONDITIONS			
	Original ADMS		Stantec		Entellus		WLB Combined / Morphed (wlbrcab.dat)		Entellus		WLB Combined / Morphed (wlbrcabx.dat)	
	(cfs)	(sm)	(cfs)	(sm)	(cfs)	(sm)	(cfs)	(sm)	(cfs)	(sm)	(cfs)	(sm)
McMicken Dam Outlet Channel & 16-East Wash Confluence	6,875	322.99	7,522	322.80	7,100	313.12	8,049	322.74	9,061	313.12	8,451	322.74
	(PT 15.20 hrs)		(PT 15.10 hrs)		(PT 15.50 hrs)		(PT 18.05 hrs)		(PT 15.17 hrs)		(PT 14.55 hrs)	

Note: cfs = cubic feet per second; sm = Square Miles; PT = Peak Time

Along HVR P11, drainage sub-areas A-1, A-2, A-3 & A-4 were delineated as shown on drainage map Figure 7. 100-year peak flows for the sub-areas were estimated using the Rational Method. Estimated peak discharges for 2-, 5-, 10-, 25-, 50- and 100-year storm

frequencies have been calculated for the offsite areas and are provided in Appendix A. Total drainage area within HVR PII right-of-way is 23.75 acres.

3.0 HYDRAULIC DESIGN

Design of HVR PII stormwater amenities, such as street capacities, curb openings and catch basins, are determined from the 10-year generated flows for drainage areas based on divisions at high points along its length and are included in Appendices C through E.

FlowMaster was used to design and check street capacity. For arterial streets, it is required to maintain one dry lane of 12' each direction for traffic during a 10-year storm event. Calculations for street capacity are included in Appendix C. Scupper or catch basin design calculations are given in Appendix D.

CulvertMaster was used to calculate cross culverts underneath HVR PII, while AutoCAD LDD HYDROLOGY module was used for the computation of the 8-barrel box culvert along Happy Valley Road at STA 86+80. The printouts are provided in Appendix E.

Detailed construction plans showing the alignment, elevations and floodplains are shown on sheets 1 to 7 for the Happy Valley Road Phase I improvements and on sheets 1 to 10 for the Happy Valley Phase II improvements. Only sheets 2 & 3 are included.

4.0 SCOUR CALCULATIONS AND OUTLET PROTECTION

Calculations for scour and outlet protection are from procedures outlined in Section 5 & 6 of the FCDMC Drainage Manual, Volume II. A factor of safety is inherent with the computations as "the equations are based on tests which were conducted to determine maximum scour for the given condition and therefore represent what might be termed worst case scour geometries".

The flow rates indicated in the previous section for the culvert crossing shall be used for scour and outlet analysis. Appendix F presents the calculations for the protection at the outlets for each culvert. Appendix G presents calculations for the lateral migration limits that were used to determine the easements for the outlets affecting the McMicken Dam Flowage Easement.

Figure 8 & 9, which are part of the improvements plans (Sheets 2 & 3), show the details for the culverts rip-rap apron & lining along HVR PII.

5.0 CONCLUSIONS

The hydrologic and hydraulic designs for HVR PII are included in the appendices of this report. All analyses and designs for proposed drainage infrastructures are in accordance with the FCDMC criteria.

Happy Valley Road is designed to adequately convey the 10-year peak flow with one dry lane open to traffic during the storm event. All catch basins and intakes properly convey flows to culverts and outlets.

Use of Rip-Rap for each crossing culvert outlet meets protection requirements for the flows downstream of Happy Valley Road Phase II.

6.0 REFERENCES

1. Master Drainage Report for Rancho Cabrillo, Stantec Consulting, Inc., revised September 18, 2001.
2. Addendum to the Master Drainage Report for Rancho Cabrillo, The WLB Group, Inc., December 2, 2002.
3. Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology and Volume II Hydraulics, Flood Control District of Maricopa County, January 1995.
4. Wittman Area Drainage Master Study, Part A – Hydrology & Hydraulics, The WLB Group, Inc., March 1989.
5. Hydrology Report for Padelford Wash Floodplain Delineation Study, A-N West Inc., April 2002.
6. Master Drainage Report for Rancho Cabrillo, Stantec Consulting, Inc., September 18, 2001.
7. Hydrology Report for Padelford Wash Floodplain Delineation Study, A-N West Inc., April 2002.
8. Hydraulic Design of Energy Dissipators for Culverts and Channels, U.S. Department of Transportation, Federal Highway Administration, HEC-14, September 1983.
9. Wittman Area Drainage Master Study. Technical Data Notebook – CD, Entellus, October 2004.

Table 1: Summary of 100-yr, 24-hour peak flows for 16-East Wash & McMiken Dam Outlet Channel

Study: Date: Location	EXISTING CONDITIONS						FUTURE CONDITIONS					
	Original ADMS 1989 (cfs) (sm)		Stantec 2004 (cfs) (sm)		Entellus 2004 (cfs) (sm)		WLB Combined / Morphed (wlbrcab.dat) 2004 (cfs) (sm)		Entellus 2004 (cfs) (sm)		WLB Combined / Morphed (wlbrcabx.dat) 2004 (cfs) (sm)	
Outlet Channel & 16-East Wash Confluence	6,875	322.99	7,522	322.80	7,100	313.12	8,049	322.74	9,061	313.12	8,451	322.74
	(PT 15.20 hrs)		(PT 15.10 hrs)		(PT 18.05 hrs)		(PT 18.05 hrs)		(PT 15.17 hrs)		(PT 14.55 hrs)	

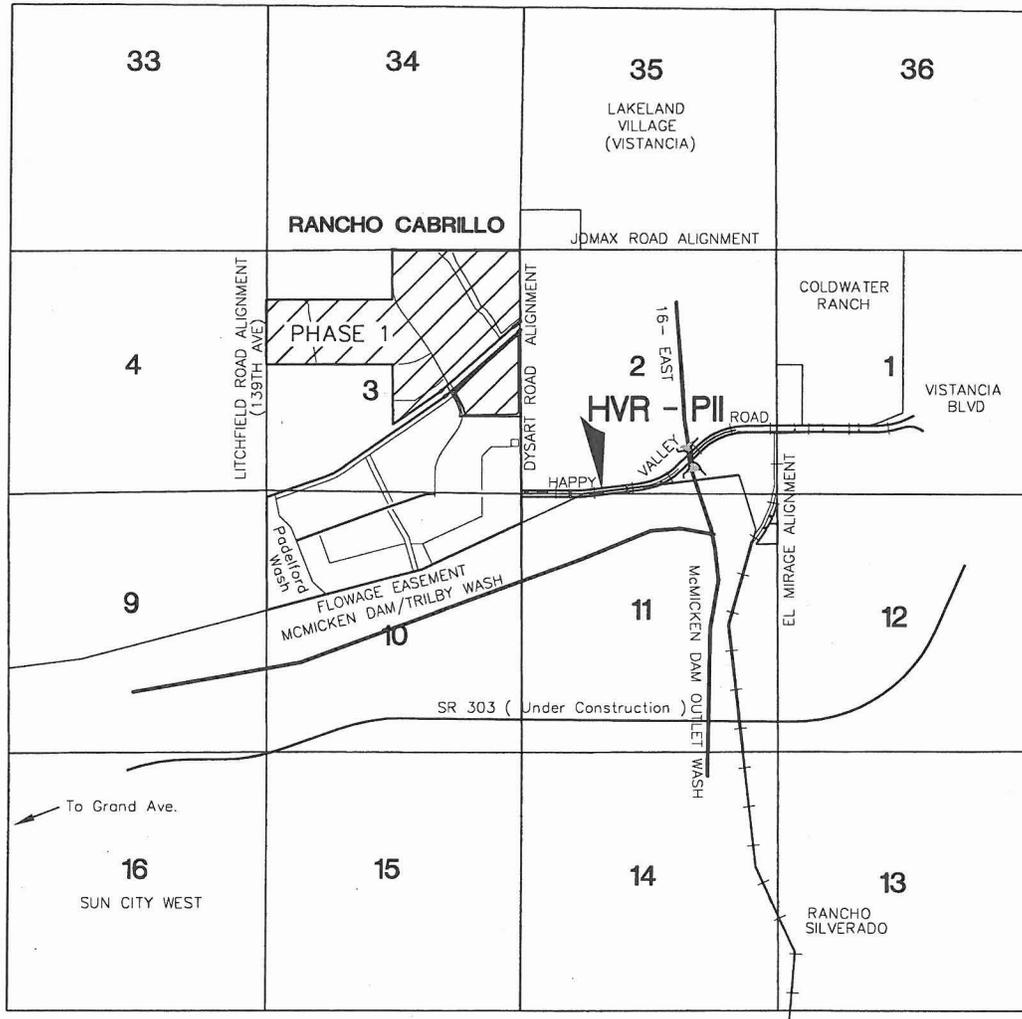
Note: cfs = cubic feet per second; sm = Square Miles; PT = Peak Time

TABLE 2: RANCHO CABRILLO - SUMMARY OF CROSS DRAINAGE CULVERTS FOR OFFSITE FLOWS

Culvert	Q100 (cfs)	Computation / Source	Size	Approx. Length (ft)	Bottom Slope (ft/ft)	Inlet Invert Elev. (ft)	Outlet Invert Elev. (ft)	Headwater Elev. (ft)	Headwater Depth (ft)	Tailwater Depth (ft)	Outlet Velo. (fps)
Happy Valley Rd @ Sta 86+80 & 16-East Wash	3954	Entellus + WLB Morphed - Area 122E	8 cell - 10'x8' Conc Box Culverts	255	0.0050	1311.00	1309.72	1319.40	8.40	5.80	10.3
Happy Valley Rd @ Sta 60+00	212	Spatial allocation - WLB Morphed	6 - 36.25" x 22.5" Arch Culverts	129	0.0050	1319.25	1318.60	1323.44	4.19	2.00	8.0
Happy Valley Rd @ Sta 71+81	28	Spatial Allocation - WLB Morphed	2 - 24" CMP Culvert	121	0.0050	1318.57	1317.96	1322.72	4.15	2.00	4.5

Note: Refer to Appendix C for detailed culvert design.

N:\202017\exhibit\HYDRO-DRNG\Vic Map 8X11 HVR PII.dwg, 10/10/2005 4:21:32 PM, dshtgeoka



VICINITY MAP

MARICOPA COUNTY, ARIZONA

HAPPY VALLEY ROAD - FIGURE 1

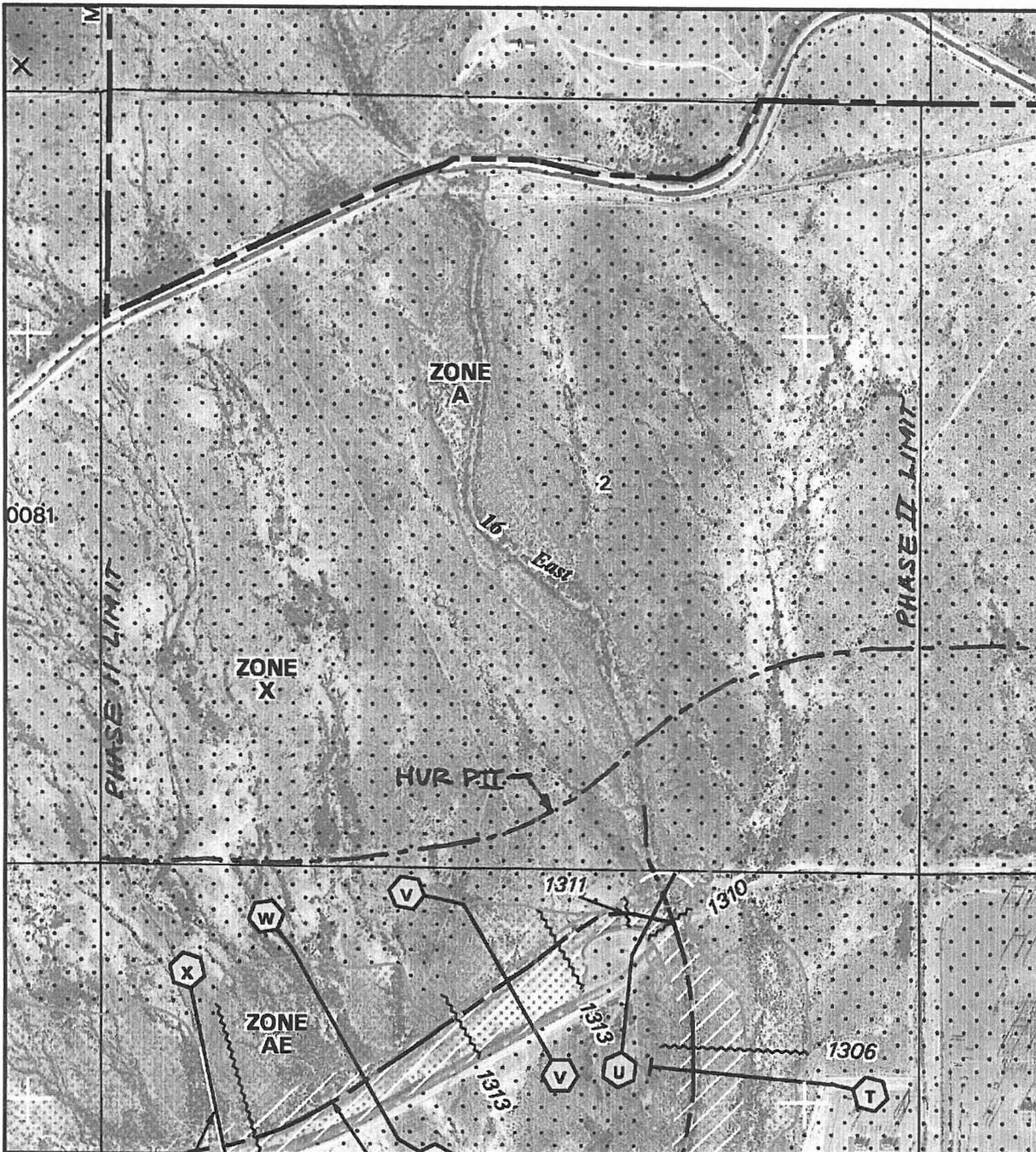


The
WLB
Group
INC

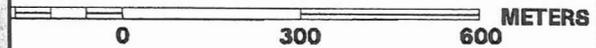
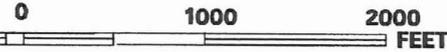
WLB

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Landscape Architecture • Urban Design
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333 East Osborn Road, Suite 380
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WLB No.



MAP SCALE 1" = 1000'



NFP

PANEL 1155H

**FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY,
ARIZONA
AND INCORPORATED AREAS**

PANEL 1155 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1155	H
FEDRIA, CITY OF	040050	1155	H

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



**MAP NUMBER
04013C1155H**

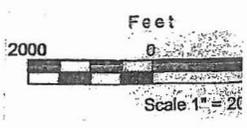
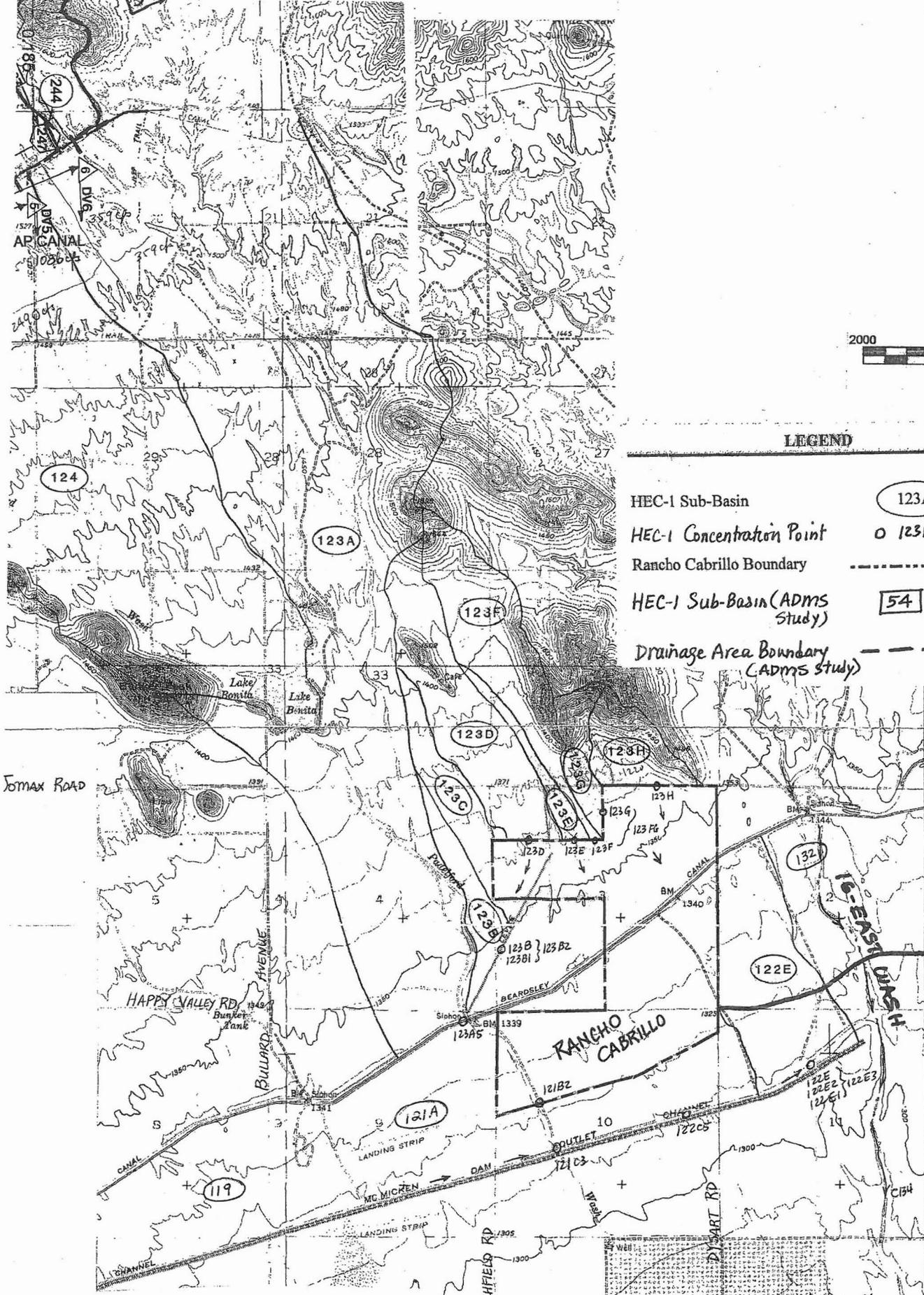
MAP REVISED

SEPTEMBER 30, 2005

Federal Emergency Management Agency

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

FIGURE 2



LEGEND

- HEC-1 Sub-Basin (123A)
- HEC-1 Concentration Point ○ 123B
- Rancho Cabrillo Boundary - - - - -
- HEC-1 Sub-Basin (ADMS Study) [54]
- Drainage Area Boundary (ADMS study) - - - - -

**OFFSITE WATERSHED
SUB-BASIN BOUNDARIES**

Master Drainage Report for Rancho Cabrillo, Stantec Consulting, September 18, 2001 and Preliminary Padelford Wash Flood Plain Delineation Study, A-N West, Inc., February 15, 2000.



FIGURE 3

Note: Re
dr
ex

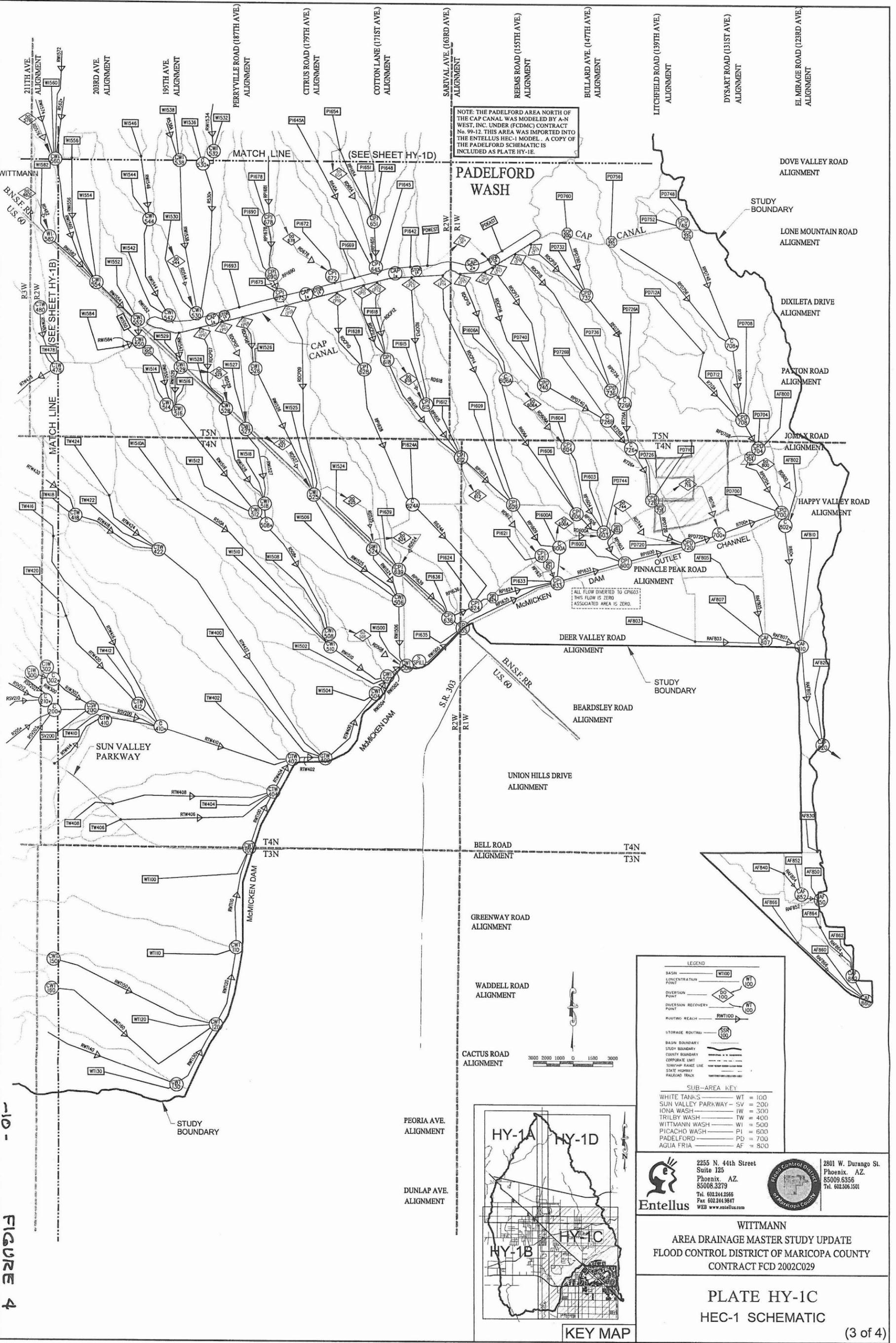


FIGURE 4

NOTE: THE PADELDFORD AREA NORTH OF THE CAP CANAL WAS MODELED BY A-N WEST, INC. UNDER FCDMC CONTRACT No. 99-12. THIS AREA WAS IMPORTED INTO THE ENTELLUS HEC-1 MODEL. A COPY OF THE PADELDFORD SCHEMATIC IS INCLUDED AS PLATE HY-1E.

ALL FLOW DIVERTED TO CP1603. THIS FLOW IS ZERO. ASSOCIATED AREA IS ZERO.

LEGEND

- BASIN: WT100
- CONCENTRATION POINT: WT100
- DIVERSION POINT: WT100
- DIVERSION RECOVERY POINT: WT100
- ROUTING REACH: RW100
- STORAGE ROUTE: SSR100
- BASIN BOUNDARY: [Symbol]
- COUNTY BOUNDARY: [Symbol]
- CORPORATE LIMIT: [Symbol]
- TOWNSHIP RANGE LINE: [Symbol]
- STATE HIGHWAY: [Symbol]
- RAILROAD TRACK: [Symbol]

SUB-AREA KEY

- WHITE TANKS - WT = 100
- SUN VALLEY PARKWAY - SV = 200
- IONA WASH - IW = 300
- TRILBY WASH - TW = 400
- WITTMANN WASH - WI = 500
- PICACHO - PI = 600
- PADELDFORD - PD = 700
- AGUA FRIA - AF = 800

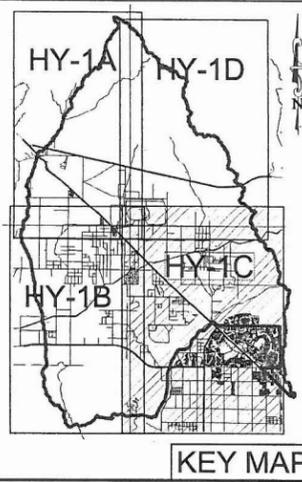
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Phoenix, AZ
85009.6356
Tel. 602.506.1501

WITTMANN
AREA DRAINAGE MASTER STUDY UPDATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONTRACT FCD 2002C029

PLATE HY-1C
HEC-1 SCHEMATIC
(3 of 4)



APPENDIX A

HYDROLOGIC DATA SHEETS

**Rational Method – Area A-1, A-2, A-3,
& A-4**

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: WLB GROUP

Date: 1-29-04

LOCATION DATA

Location: HAPPY VALLEY RD @ STA 60+00

Project Name: RANCHO CABRILLO Subarea id: A1

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area 2.97 acres
Watercourse Length 500.0 feet
Top Elevation 100.0 feet
Bottom Elevation 97.5 feet
Slope .00500 feet/feet
Roughness Coefficient (Kb) .03705
10-Year, 6-Hour Rainfall 2.07 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	7	10	12	17	21	24
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	9.0	7.9	7.4	6.8	6.5	6.1
i (in/hr)	3.1	4.3	5.1	6.3	7.3	8.4

For checking dry lane width during 10-yr storm event,

Use $Q_{10} = \frac{12}{2} = 6$ cfs (approx. 50% of 12 cfs) ^{of runoff} comes from east and west to CPCI

Note: No dry lane checking is needed because of no curb & gutter.

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: WLB GROUP

Date: 1-29-04

LOCATION DATA

Location: HAPPY VALLEY RD @ STA 79+00

Project Name: RANCHO CABRILLO Subarea id: A3

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area 4.51 acres
Watercourse Length 1020.0 feet
Top Elevation 100.0 feet
Bottom Elevation 94.8 feet
Slope .00510 feet/feet
Roughness Coefficient (Kb) .03591
10-Year, 6-Hour Rainfall 2.07 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	9	13	15	22	27	31
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	13.4	11.8	11.0	10.0	9.5	9.0
i (in/hr)	2.6	3.6	4.3	5.5	6.3	7.3

For dry lane calculations, approx. $\frac{1020}{1020 + 492} \times 100\% = 67\%$ ^{of runoff} from the east to CP C3
 $\therefore Q_{10} = 0.67 \times 15 = 10.0$ cfs.
 Q_{10} for east board = 5 cfs. (ck dry lane width)

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: WLB GROUP

Date: 1-29-04

LOCATION DATA

Location: HAPPY VALLEY RD @ STA 97+87

Project Name: RANCHO CABRILLO Subarea id: A4

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area 5.58 acres
 Watercourse Length 992.0 feet
 Top Elevation 100.0 feet
 Bottom Elevation 95.1 feet
 Slope .00497 feet/feet
 Roughness Coefficient (Kb) .03534
 10-Year, 6-Hour Rainfall 2.07 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	12	16	19	27	34	39
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	13.1	11.6	10.9	9.9	9.4	8.9
i (in/hr)	2.6	3.6	4.3	5.5	6.3	7.3

For dry lane calculations, approx. 53% of runoff comes from east to CP C4

$$Q_{10} = 0.53 \times 19 = 10.1 \text{ cfs}$$

$$Q_{10} \text{ for west bound} = \frac{1}{2}(10.1) = 5.1 \text{ cfs (check dry lane width)}$$

APPENDIX B

Hydrology for Flow in Culverts

Excerpt – wlbrcabx.out

Entellus - Appendix D.6

**Excerpt – Entellus 100-yr 6-hr Future
Conditions**

wlb reabx. out

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1*****
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*
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
U.S. ARMY CORPS OF ENGINEERS *
* JUN 1998 *
HYDROLOGIC ENGINEERING CENTER *
* VERSION 4.1 *
609 SECOND STREET *
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DAVIS, CALIFORNIA 95616 *
* RUN DATE 01OCT02 TIME 16:56:44 *
(916) 756-1104 *
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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 -AMSKK- 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

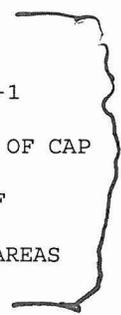
1 HEC-1 INPUT
PAGE 1

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

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1 ID RANCHO CABRILLO HYDROLOGIC STUDY FOR OFFSITE FLOWS
2 ID - POST-DEVELOPMENT CONDITIONS
3 ID THIS IS A MODEL PREPARED BY WLB GROUP TO COMBINE THE HEC-1
FILES:
4 ID PADEL24D.DAT PREPARED BY A-N WEST FOR AREAS UPSTREAM OF CAP
&
5 ID WLBR CAB.DAT PREPARED BY WLB GROUP (A REVISED MODEL OF
RNCHCAB.24I
6 ID PREPARED BY STANTEC BASED ON WITTMANN ADMS 1989 FOR AREAS
DOWN-
7 ID STREAM OF CAP ONLY)
8 ID NOTE: ADMS AND A-N WEST MODELS USED DIFFERENT
METHODOLOGIES/PARAMETERS:
9 ID *DIFFERENT RAINFALL DEPTHS
10 ID *UK VS UI FOR SUBBASINS
11 ID *RM VS RS/RC CHANNEL ROUTING
12 ID *LS VS LG FOR RATE LOSSES

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	.	V	
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	.	V	
	.	V	
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4910	.	C127.....	
	.	V	
	.	V	
4913	.	C125	

4780 KK 122B SUB
 4781 KM RUNOFF FROM SUB 122B
 4782 BA .2159
 4783 LS 77 51
 4784 UK 200 .011 .11 100
 4785 RK 2950 .0071 .05 TRAP 40 10

*

4786 KK 122BR DIV
 4787 KM DIVERT 100YR,2HR RET VOLUME REQ FROM THIS SUBBASIN
 4788 DT 122BD 17.08
 4789 DI 0 10000
 4790 DQ 0 10000

*

4791 KK 122C4 CP
 4792 KM ROUTE SUB 122B TO CP 122C4
 4793 RM 1.7 .083 .2

*

4794 KK 122C5 CP
 4795 KM COMBINE CP 122C3 & 122C4
 4796 HC 2

*

4797 KK 122E1 CP
 4798 KM ROUTE CP 122C5 TO CP 122E1
 4799 RM 3.8 .189 .2

*

4800 KK 122D SUB
 4801 KM RUNOFF FROM SUB 122D
 4802 BA .0775
 4803 LS 77 51
 4804 UK 200 .011 .11 100
 4805 RK 1400 .0071 .05 TRAP 30 10

*

4806 KK 122DR DIV
 4807 KM DIVERT 100YR 2HR RET VOLUME REQ FROM THIS SUBBASIN, INCL. PARCEL F
 4808 DT 122DD 6.13
 4809 DI 0 10000
 4810 DQ 0 10000

*

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

4811 KK 122E2 CP
 4812 KM ROUTE SUB 122D TO CP 122E2
 4813 RM 4.2 .211 .2

*



4814 KK 122E SUB
 4815 KM RUNOFF FROM SUB 122E
 4816 BA .3888
 4817 LS 77
 4818 UK 200 .011 .11 100
 4819 RK 5200 .0063 .05 TRAP 40 10

*

4820 KK 122E3 CP

4821 KM COMBINE SUB 122E, CP 122E1 & 122E2
4822 HC 3

*
* *****
* END OF SPETEMBER 2002 RANCHO CABRILLO REVISIONS
* THE LAST PORTION IS FROM THE WITTMANN ADMS STUDY
* *****

4823 KK C132
4824 KM ROUTE FLOW AT CP 122E3 TO C132 (USE ORIGINAL WLB ROUTING DATA)
4825 RM 1 .44 .2

4826 KK 55
4827 KM RUNOFF FROM SUBWATERSHED 55.
4828 BA 3.27
4829 LS 84
4830 UI 0 80 162 246 391 565 779 979 1228 1344
4831 UI 1308 1468 1468 1468 1403 1097 1026 964 825 744
4832 UI 706 723 510 487 467 447 340 336 324 313
4833 UI 302 292 305 195 189 184 179 174 114 93
4834 UI 90 88 86 84 75 50 49 48 47 46
4835 UI 45 44 43 42 50 23 22 22 21 21
4836 UI 21 20 20 20 19 4 0 0 0 0

4837 KK C55
4838 KM STORAGE ROUTE THROUGH C55. 4-84" CONCRETE OVERCHUTES ON CAP.
4839 RS 1 STOR 0 0
4840 SV 0 3.03 5.45 19.99 64.79
4841 SQ 0 2260 2740 3160 3600
4842 SE 1510.5 1524 1528 1532 1536

4843 KK C127A
4844 KM ROUTE FLOW FROM C55 TO C127A.
4845 RM 1 .43 .2

1 HEC-1 INPUT PAGE116

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

4846 KK 127A
4847 KM RUNOFF FROM SUBWATERSHED 127A.
4848 BA .61
4849 LS 82
4850 UK 200 .015 .10 100
4851 RK 4100 .0097 .07 .15 10
4852 RK 8800 .0097 .05 .61 50 5

4853 KK C127A
4854 KM ADD HYDROGRAPHS AT C127A.
4855 HC 2

4856 KK 56
4857 KM RUNOFF FROM SUBWATERSHED 56.
4858 BA .48
4859 LS 86
4860 UI 0 101 346 725 935 991 709 542 428 316
4861 UI 230 208 173 124 90 60 54 33 31 29
4862 UI 24 15 14 13 3 0 0 0 0 0

4863 KK C56
4864 KM STORAGE ROUTE THROUGH C56. 72" CONCRETE OVERCHUTE ON CAP.
4865 RS 1 STOR 0 0
4866 SV 0 5.66 22.86 44.38 93.0 175.78
4867 SQ 0 260 460 550 620 700

+ 3211.	304.19	122E1	7232.	18.05	6797.	4271.
	HYDROGRAPH AT					
+ 5.	.08	122D	164.	12.05	19.	6.
	DIVERSION TO					
+ 2.	.08	122DD	164.	12.05	11.	3.
	HYDROGRAPH AT					
+ 3.	.08	122DR	87.	12.20	11.	3.
	ROUTED TO					
+ 3.	.08	122E2	59.	12.45	10.	3.
	HYDROGRAPH AT					
+ 15.	.39 (Area)	122E	390.	12.20	66.	20.
	3 COMBINED AT					
+ 3226.	304.66	122E3	7249.	18.05	6814.	4291.
	ROUTED TO					
+ 3174.	304.66	C132	7226.	18.50	6800.	4222.
	HYDROGRAPH AT					
+ 100.	3.27	55	1653.	12.50	428.	133.
	ROUTED TO					
+ 100.	3.27	C55	1651.	12.50	428.	133.
	ROUTED TO					
+ 100.	3.27	C127A	1310.	12.85	428.	133.
	HYDROGRAPH AT					
+ 29.	.61	127A	617.	12.45	124.	39.
	2 COMBINED AT					
+ 129.	3.88	C127A	1671.	12.75	550.	172.
	HYDROGRAPH AT					
+ 26.	.48	56	802.	12.15	113.	35.
	ROUTED TO					

Q100

122E



Table D.6: Summary of Peak Discharges

Model ID	100-yr 24-hr Storm			100-yr 6-hr Storm			Controlling Storm			
	Drainage Area	Exst. Cond.	Fut. Cond.	Drainage Area	Exst. Cond.	Fut. Cond.	Exst. Cond.		Fut. Cond.	
	[mi ²]	Q [cfs]	Q [cfs]	[mi ²]	Q [cfs]	Q [cfs]	Storm	Q [cfs]	Storm	Q [cfs]
IW392	1.11	1,713	1,572	1.11	1,985	1,811	6-hour	1,985	6-hour	1,811
IW394	4.17	2,569	2,624	4.17	2,700	2,805	6-hour	2,700	6-hour	2,805
IW395	7.86	6,223	6,506	7.86	5,796	6,231	24-hour	6,223	24-hour	6,506
IW396	0.59	260	256	0.59	390	389	6-hour	390	6-hour	389
IW397	4.81	3,716	3,909	4.81	3,845	4,160	6-hour	3,845	6-hour	4,160
PD700	1.40	1,491	1,451	1.40	1,703	1,683	6-hour	1,703	6-hour	1,683
PD704	0.36	337	342	0.36	480	491	6-hour	480	6-hour	491
PD708	2.40	1,690	1,596	2.40	1,840	1,829	6-hour	1,840	6-hour	1,829
PD712	0.89	755	742	0.89	1,003	987	6-hour	1,003	6-hour	987
PD712A	0.77	407	382	0.77	570	546	6-hour	570	6-hour	546
PD716	1.75	2,751	2,662	1.75	2,644	2,642	24-hour	2,751	24-hour	2,662
PD720	0.59	668	664	0.59	942	944	6-hour	942	6-hour	944
PD726	1.35	843	797	1.35	1,071	1,051	6-hour	1,071	6-hour	1,051
PD726A	1.10	457	431	1.10	605	579	6-hour	605	6-hour	579
PD726B	0.93	642	654	0.93	832	849	6-hour	832	6-hour	849
PD732	0.48	461	462	0.48	681	687	6-hour	681	6-hour	687
PD736	0.78	269	256	0.78	373	358	6-hour	373	6-hour	358
PD740	1.28	798	809	1.28	991	1,005	6-hour	991	6-hour	1,005
PD744	0.80	531	508	0.80	732	709	6-hour	732	6-hour	709
PD748	0.28	374	381	0.28	557	559	6-hour	557	6-hour	559
PD752	0.19	236	239	0.19	354	356	6-hour	354	6-hour	356
PD756	3.23	1,528	1,554	3.23	1,655	1,791	6-hour	1,655	6-hour	1,791
PD760	0.87	1,161	1,168	0.87	1,444	1,464	6-hour	1,444	6-hour	1,464
PDEAST	16.44	8,461	10,018	16.44	6,672	8,797	24-hour	8,461	24-hour	10,018
PDWEST	7.08	4,394	5,033	7.08	3,720	4,407	24-hour	4,394	24-hour	5,033
PI600	0.61	731	718	0.61	1,023	1,007	6-hour	1,023	6-hour	1,007
PI600A	0.52	822	817	0.52	1,191	1,179	6-hour	1,191	6-hour	1,179
PI603	0.52	418	423	0.52	623	633	6-hour	623	6-hour	633
PI604	0.36	312	329	0.36	469	494	6-hour	469	6-hour	494
PI606	1.08	708	790	1.08	921	1,033	6-hour	921	6-hour	1,033
PI606A	0.46	374	353	0.46	575	546	6-hour	575	6-hour	546
PI609	1.94	960	1,030	1.94	1,135	1,233	6-hour	1,135	6-hour	1,233
PI612	0.74	458	492	0.74	656	701	6-hour	656	6-hour	701
PI615	0.84	625	628	0.84	852	855	6-hour	852	6-hour	855
PI618	0.29	323	300	0.29	470	448	6-hour	470	6-hour	448
PI621	0.90	645	667	0.90	865	907	6-hour	865	6-hour	907
PI624	1.23	847	879	1.23	1,112	1,157	6-hour	1,112	6-hour	1,157

ADMSU - Entellus

* Drainage areas may differ between the 24-hour and 6-hour storms: the HEC-1 hard coding was performed separately for the 24-hour and 6-hour storms.

Wittmann ADMSU 100-year 6-hour Future Conditions

+		PD756	1791.	4.83	663.	174.	58.	3.23	
	ROUTED TO								
+		SCP210	1778.	4.92	663.	174.	58.	3.23	
	ROUTED TO								
+		RPD756	1746.	5.25	663.	174.	58.	3.23	
	2 COMBINED AT								
+		C708*	2010.	5.00	755.	198.	66.	3.70	
	ROUTED TO								
+		R708*	1956.	5.42	754.	198.	66.	3.70	
	HYDROGRAPH AT								
+		PD708	1829.	4.58	466.	118.	39.	2.40	
	HYDROGRAPH AT								
+		PD712A	546.	4.58	162.	41.	14.	.77	
	ROUTED TO								
+		R712A	535.	4.92	162.	41.	14.	.77	
	HYDROGRAPH AT								
+		PD712	987.	4.67	198.	50.	17.	.89	
	4 COMBINED AT								
+		CPD708	3529.	5.08	1401.	368.	123.	7.76	
	ROUTED TO								
+		RPD708	3489.	5.17	1400.	368.	123.	7.76	
	HYDROGRAPH AT								
+		PD704	491.	4.25	77.	19.	6.	.36	←
	HYDROGRAPH AT								
+		AF800	952.	4.25	168.	42.	14.	.72	
	3 COMBINED AT								
+		CPD704	3804.	5.08	1574.	414.	138.	8.84	
	ROUTED TO								
+		SPD704	3708.	5.25	1574.	414.	138.	8.84	
	DIVERSION TO								
+		DO800	0.	.00	0.	0.	0.	8.84	
	HYDROGRAPH AT								
+		D800	3708.	5.25	1574.	414.	138.	8.84	
	ROUTED TO								
+	16 EAST WASH	RPD704	3676.	5.50	1573.	414.	138.	8.84	←
	HYDROGRAPH AT								
+		PD700	1683.	4.33	274.	69.	23.	1.40	
	3 COMBINED AT								
+		CPD700	5673.	8.75	5104.	3313.	1845.	313.12	←
	HYDROGRAPH AT								
+		D800	0.	.00	0.	0.	0.	8.84	
	ROUTED TO								
+		RD800	0.	.00	0.	0.	0.	8.84	
	HYDROGRAPH AT								
+		AF802	671.	4.25	105.	26.	9.	.39	
	3 COMBINED AT								
+		C802*	5672.	8.75	5103.	3316.	1847.	313.51	
	ROUTED TO								
+		R810*	5655.	9.25	5098.	3313.	1845.	313.51	
	HYDROGRAPH AT								
+		AF803	2004.	4.67	547.	139.	46.	2.84	

APPENDIX C
STREET CAPACITY CALCULATIONS

Happy Valley Rd @ Sta 79+00
Worksheet for Irregular Channel

Project Description	
Project File	h:\al'spr~1\rancho~1\roads.fm2
Worksheet	Street Capacity for Happy Valley Rd
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.005100 ft/ft			
Elevation range: 99.39 ft to 100.04 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-14.00	100.00	-14.00	44.00	0.015
11.00	99.89			
11.50	99.89			
11.50	99.39			
44.00	100.04			
Discharge	5.00	ft ³ /s		

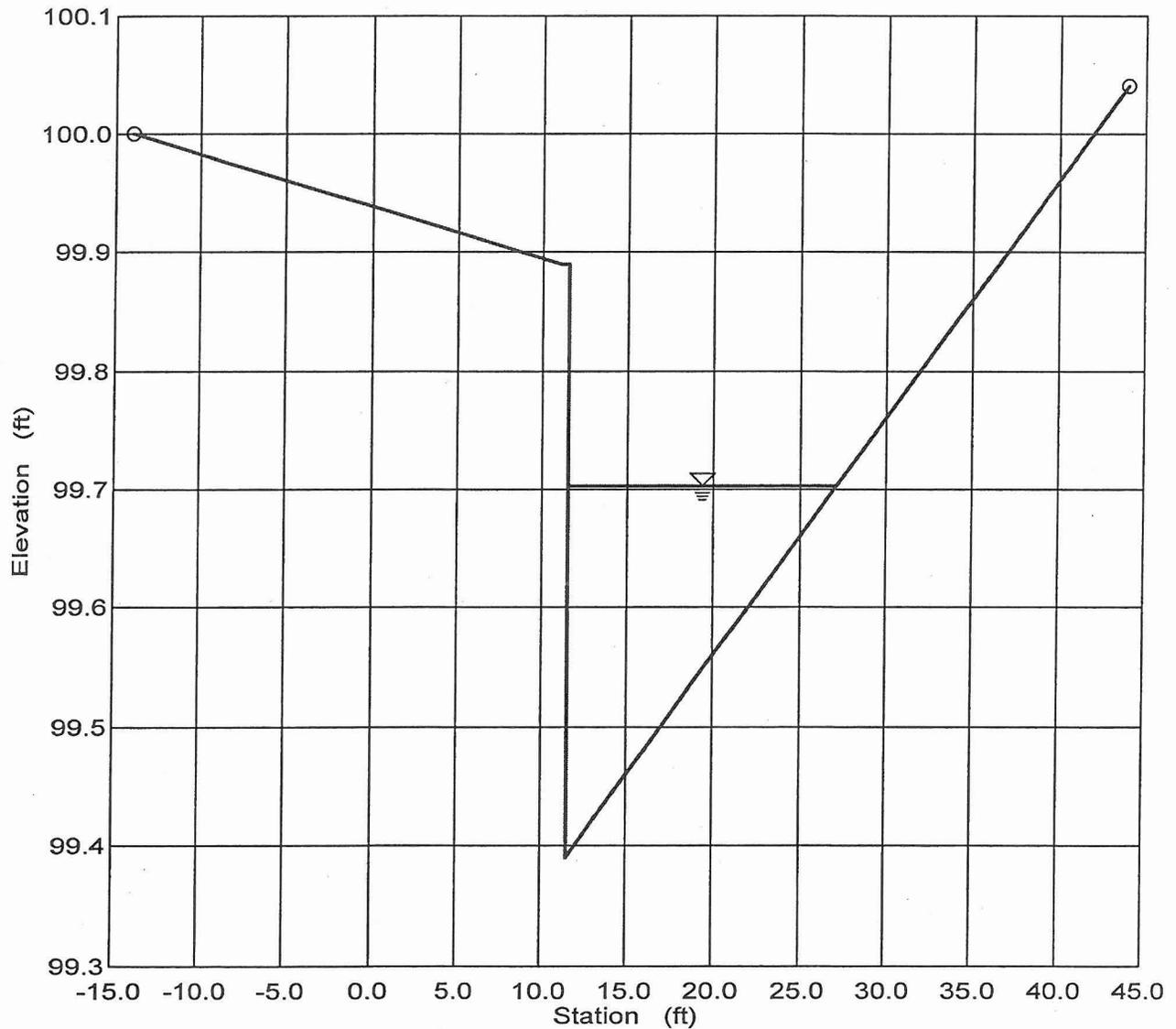
Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	99.70	ft
Flow Area	2.46	ft ²
Wetted Perimeter	16.01	ft
Top Width	15.69	ft
Depth	0.31	ft
Critical Water Elev.	99.69	ft
Critical Slope	0.006327	ft/ft
Velocity	2.03	ft/s
Velocity Head	0.06	ft
Specific Energy	99.77	ft
Froude Number	0.90	
Full Flow Capacity	33.78	ft ³ /s
Flow is subcritical.		

*Dry lane width = 32.5 - 15.69
= 16.8' > 12' (OK)*

Happy Valley Rd @ Sta 79+00 Cross Section for Irregular Channel

Project Description	
Project File	h:\al\spr~1\rancho~1\roads.fm2
Worksheet	Street Capacity for Happy Valley Rd
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.015
Channel Slope	0.005100 ft/ft
Water Surface Elevation	99.70 ft
Discharge	5.00 ft ³ /s



Happy Valley Rd @ Sta 97+87
Worksheet for Irregular Channel

Project Description	
Project File	h:\al'spr~1\rancho~1\roads.fm2
Worksheet	Street Capacity for Happy Valley Rd
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.007400 ft/ft			
Elevation range: 99.39 ft to 100.04 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-14.00	100.00	-14.00	44.00	0.015
11.00	99.89			
11.50	99.89			
11.50	99.39			
44.00	100.04			
Discharge	5.10	ft ³ /s		

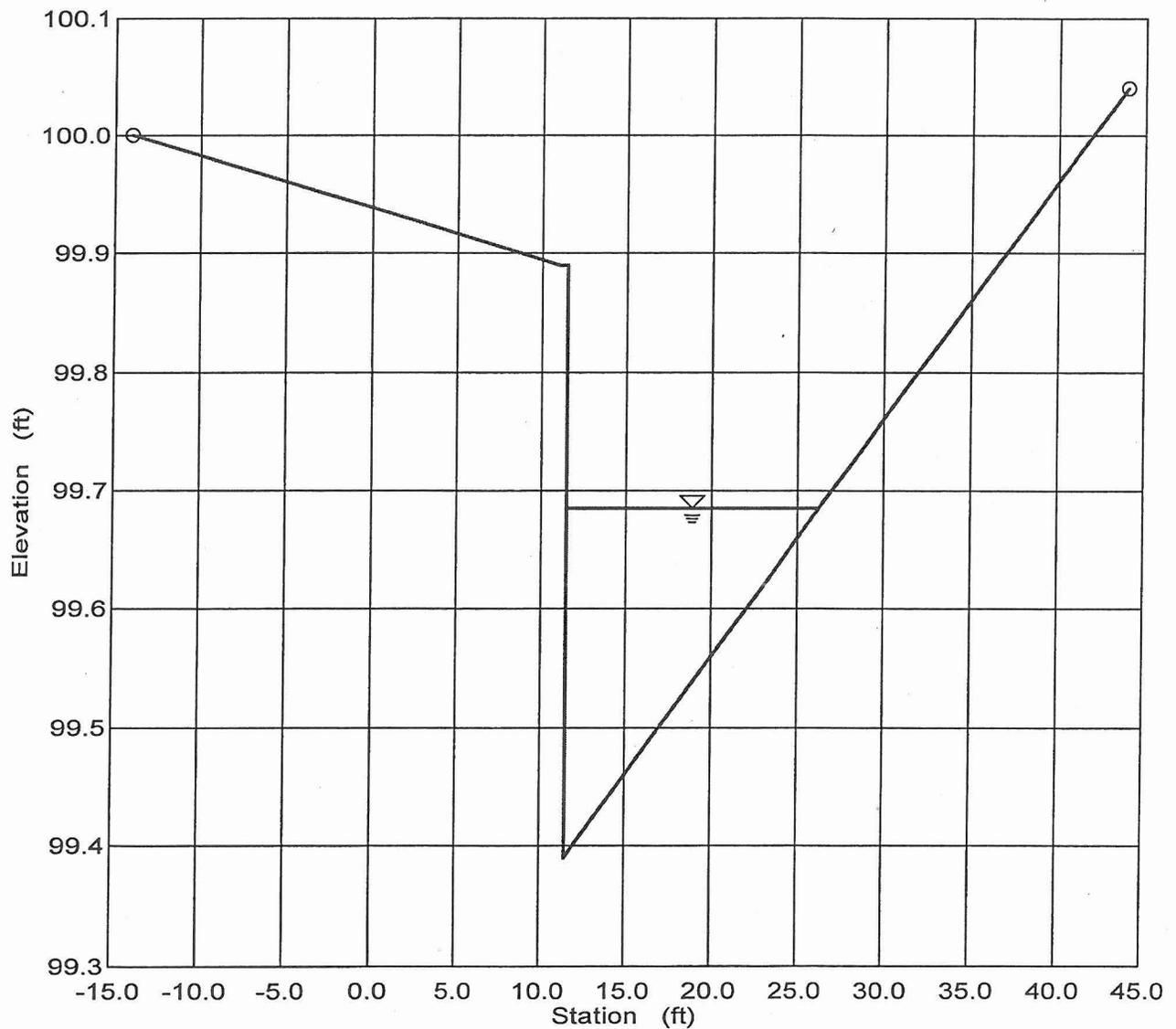
Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	99.68	ft
Flow Area	2.17	ft ²
Wetted Perimeter	15.04	ft
Top Width	14.74	ft
Depth	0.29	ft
Critical Water Elev.	99.69	ft
Critical Slope	0.006311	ft/ft
Velocity	2.35	ft/s
Velocity Head	0.09	ft
Specific Energy	99.77	ft
Froude Number	1.08	
Full Flow Capacity	40.69	ft ³ /s
Flow is supercritical.		

*dry lane width = 32.5 - 14.74
= 17.8' > 12' (OK)*

Happy Valley Rd @ Sta 97+87 Cross Section for Irregular Channel

Project Description	
Project File	h:\al\spr~1\rancho~1\roads.fm2
Worksheet	Street Capacity for Happy Valley Rd
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.015
Channel Slope	0.007400 ft/ft
Water Surface Elevation	99.68 ft
Discharge	5.10 ft ³ /s



APPENDIX D

SCUPPER/CATCH BASIN DESIGN

SCUPPER/CATCH BASIN DESIGN CALCULATIONS

Project Name: Rancho Cabrillo - Offsite Roadways
Name of Scupper or Curb Opening Catch Basin: **CB1 @ Happy Valley Road Sta. 79+00**
At Concentration Point No.: **C3**

10-year peak flow to scupper or catch basin = Q10 = 7.5 cfs

Formula used for Sump type of scupper or catch basin:

$$Q10 = Cw (L + 1.8 \times W) d^{1.5} \times \text{Reduction Factor}$$

where Cw =

2.3

L = length of opening UNKNOWN Feet

W = width of depression 1.5 Feet

d = flow depth 0.5 Feet

Reduction Factor 0.8

$$L = Q10 / (Cw \times \text{Reduction Factor} \times \text{Flow Depth}^{1.5}) - 1.8 \times W$$

= 8.8 FEET

Therefore, use the following curb opening catch basin:

INSTALL 1- CATCH BASIN ON NORTH EDGE PER CITY OF PHOENIX STANDARD DETAIL P-1569, TYPE "M"
SINGLE WING L = 6' (TOTAL OPENING INCLUDING MAINTENANCE BASIN = 9')
USE 24" DISCHARGE PIPE FROM BASIN @ 0.2% TO OUTLET

SCUPPER/CATCH BASIN DESIGN CALCULATIONS

Project Name: Rancho Cabrillo - Offsite Roadways
Name of Scupper or Curb Opening Catch Basin: **CB2 @ Happy Valley Road Sta. 97+87**
At Concentration Point No.: **C4**

10-year peak flow to scupper or catch basin = Q10 = 9.5 cfs

Formula used for Sump type of scupper or catch basin:

$$Q10 = Cw (L + 1.8 x W) d^{1.5} x \text{Reduction Factor}$$

where Cw = 2.3

L = length of opening UNKNOWN Feet

W = width of depression 1.5 Feet

d = flow depth 0.5 Feet

Reduction Factor 0.8

$$L = Q10 / (Cw x \text{Reduction Factor} x \text{Flow Depth}^{1.5}) - 1.8 x W$$
$$= \underline{11.9} \text{ FEET}$$

Therefore, use the following curb opening catch basin:

INSTALL 1- CATCH BASIN ON NORTH EDGE PER CITY OF PHOENIX STANDARD DETAIL P-1569, TYPE "M"

SINGLE WING L = 10' (TOTAL OPENING INCLUDING MAINTENANCE BASIN = 13').

USE 24" DISCHARGE PIPE FROM BASIN @ 0.2% TO OUTLET

APPENDIX E

CULVERT DESIGN

Culvert Designer/Analyzer Report
HV - Offsite Cross Culvert @ Sta 60+00

HW = 1323.44 - 1319.25
 = 4.19'

Component: Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,323.44 ft	Discharge	212.00 cfs
Inlet Control HW Elev	1,323.04 ft	Tailwater Elevation	1,320.60 ft
Outlet Control HW Elev	1,323.44 ft	Control Type	Outlet Control
Headwater Depth/ Height	2.24		

Grades			
Upstream Invert	1,319.25 ft	Downstream Invert	1,318.60 ft
Length	129.00 ft	Constructed Slope	0.005039 ft/ft

Hydraulic Profile			
Profile	Pressure	Depth, Downstream	2.00 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	1.60 ft
Velocity Downstream	7.99 ft/s	Critical Slope	0.009453 ft/ft

Section			
Section Shape	Arch	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.02 ft
Section Size	36.25 x 22.5 inch	Rise	1.88 ft
Number Sections	6		

Outlet Control Properties			
Outlet Control HW Elev	1,323.44 ft	Upstream Velocity Head	0.99 ft
Ke	0.50	Entrance Loss	0.50 ft

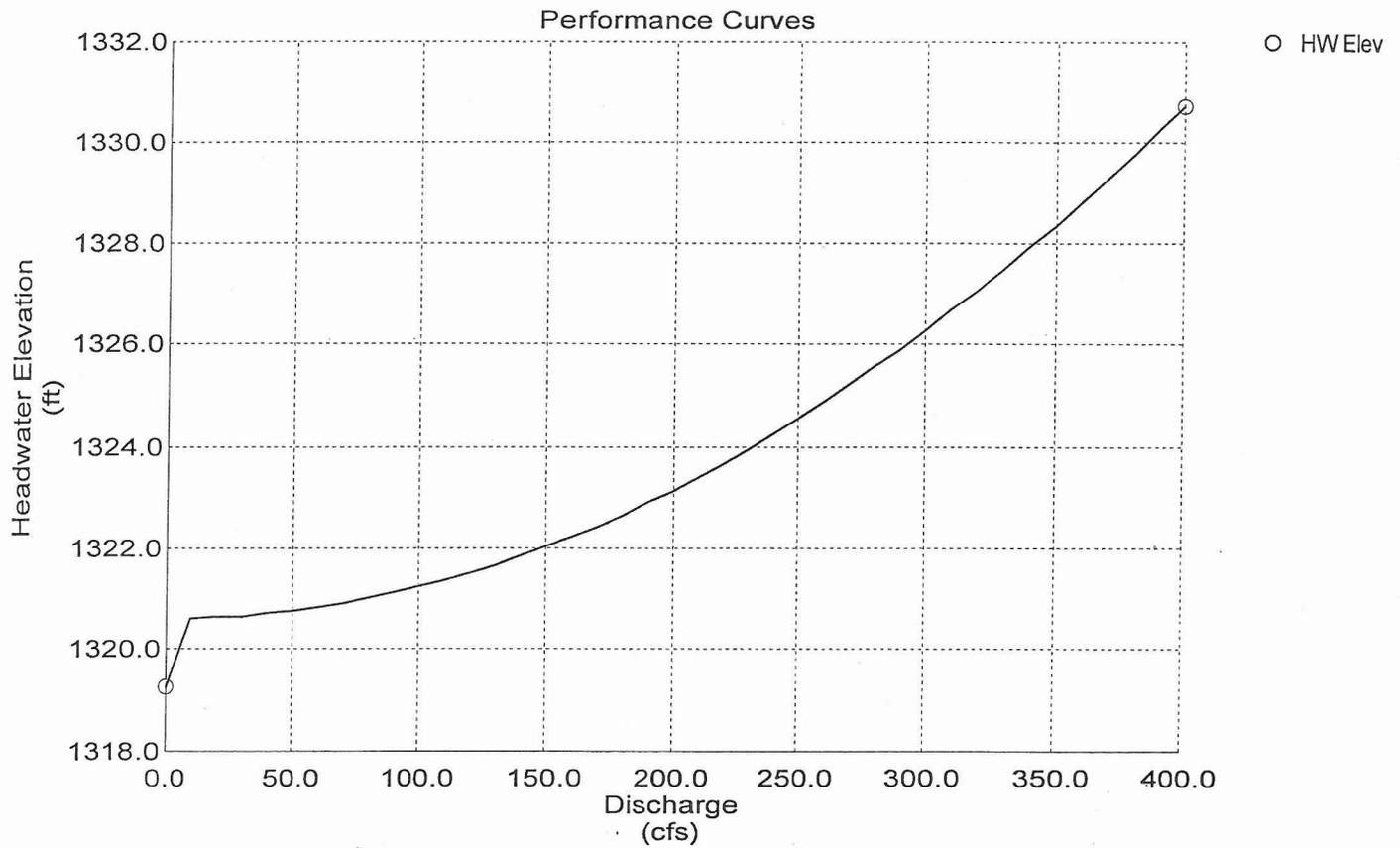
Inlet Control Properties			
Inlet Control HW Elev	1,323.04 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	26.5 ft ²
K	0.00980	HDS 5 Chart	0
M	2.00000	HDS 5 Scale	0
C	0.03980	Equation Form	1
Y	0.67000		

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Performance Curves Report

HV - Offsite Cross Culvert @ Sta 60+00

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	400.00	10.00 cfs



HAPPY VALLEY RD PII - NATURAL CHANNEL
Worksheet for Irregular Channel

Project Description	
Project File	h:\hhproj~1\rancho~1\rcscour.fm2
Worksheet	NATURAL CHANNEL D/S STA 60+00
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

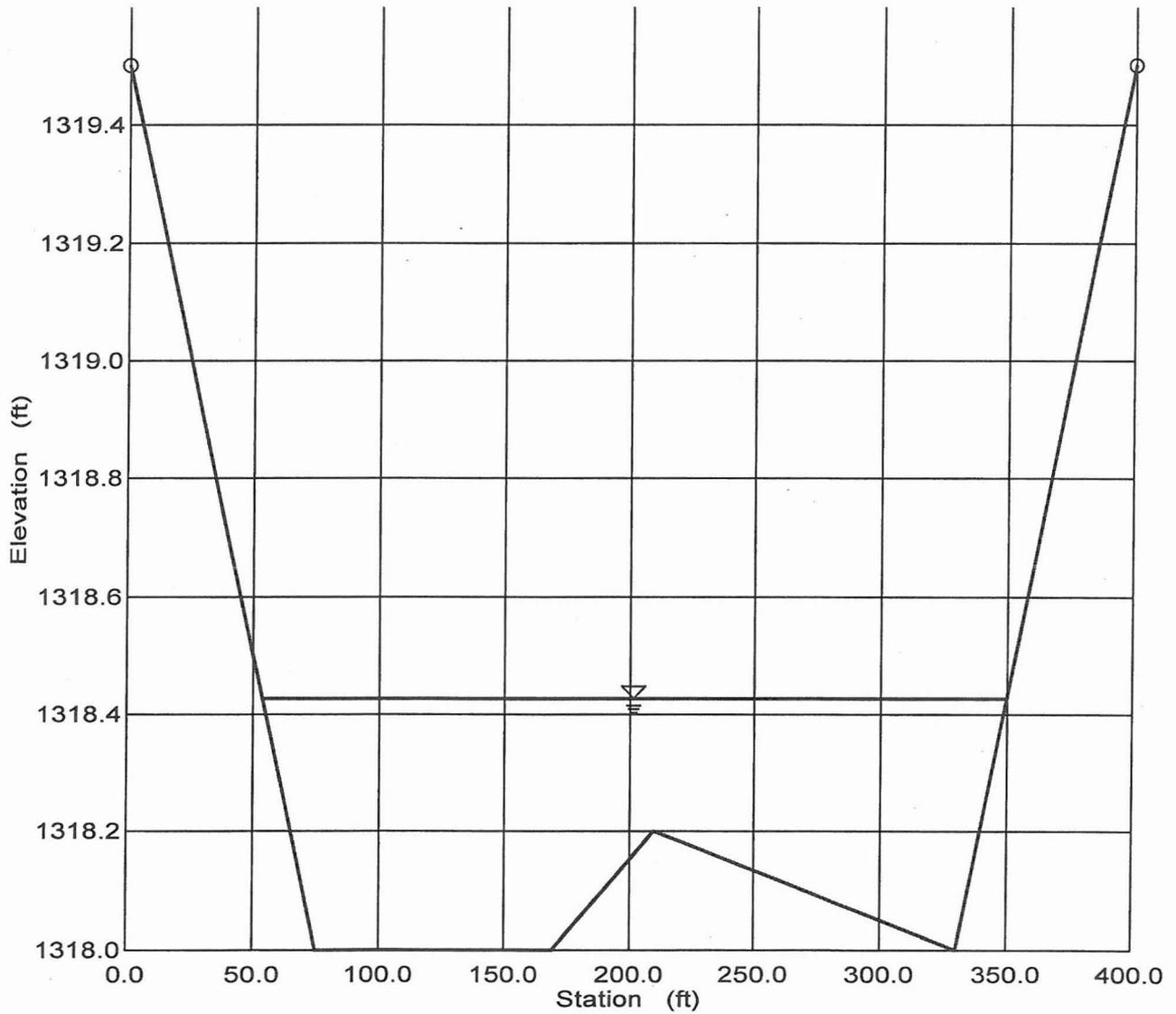
Input Data				
Channel Slope	0.010000 ft/ft			
Elevation range: 1318.00 ft to 1319.50 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1319.50	0.00	400.00	0.035
75.00	1318.00			
170.00	1318.00			
210.00	1318.20			
330.00	1318.00			
400.00	1319.50			
Discharge	212.00	ft ³ /s		

Results		
Wtd. Mannings Coefficient	0.035	
Water Surface Elevation	1318.43	ft
Flow Area	101.80	ft ²
Wetted Perimeter	296.32	ft
Top Width	296.31	ft
Depth	0.43	ft
Critical Water Elev.	1318.33	ft
Critical Slope	0.028080 ft/ft	
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	1318.49	ft
Froude Number	0.63	
Full Flow Capacity	2263.26	ft ³ /s
Flow is subcritical.		

Cross Section - STA 60+00 D/S OF CULVERT
Cross Section for Irregular Channel

Project Description	
Project File	h:\hhproj~1\rancho~1\rcscour.fm2
Worksheet	NATURAL CHANNEL D/S STA 60+00
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.035
Channel Slope	0.010000 ft/ft
Water Surface Elevation	1318.43 ft
Discharge	212.00 ft ³ /s



Culvert Calculator Report

HV - Offsite Cross Culvert @ Sta 71+81

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	1,322.75 ft	Headwater Depth/ Height	1.15
Computed Headwater Elevation	1,320.87 ft	Discharge	28.00 cfs
Inlet Control HW Elev	1,320.71 ft	Tailwater Elevation	1,319.96 ft
Outlet Control HW Elev	1,320.87 ft	Control Type	Outlet Control

Grades			
Upstream Invert	1,318.57 ft	Downstream Invert	1,317.96 ft
Length	121.00 ft	Constructed Slope	0.005041 ft/ft

Hydraulic Profile			
Profile	M1	Depth, Downstream	2.00 ft
Slope Type	Mild	Normal Depth	1.44 ft
Flow Regime	Subcritical	Critical Depth	1.35 ft
Velocity Downstream	4.46 ft/s	Critical Slope	0.006053 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	1,320.87 ft	Upstream Velocity Head	0.35 ft
Ke	0.50	Entrance Loss	0.18 ft

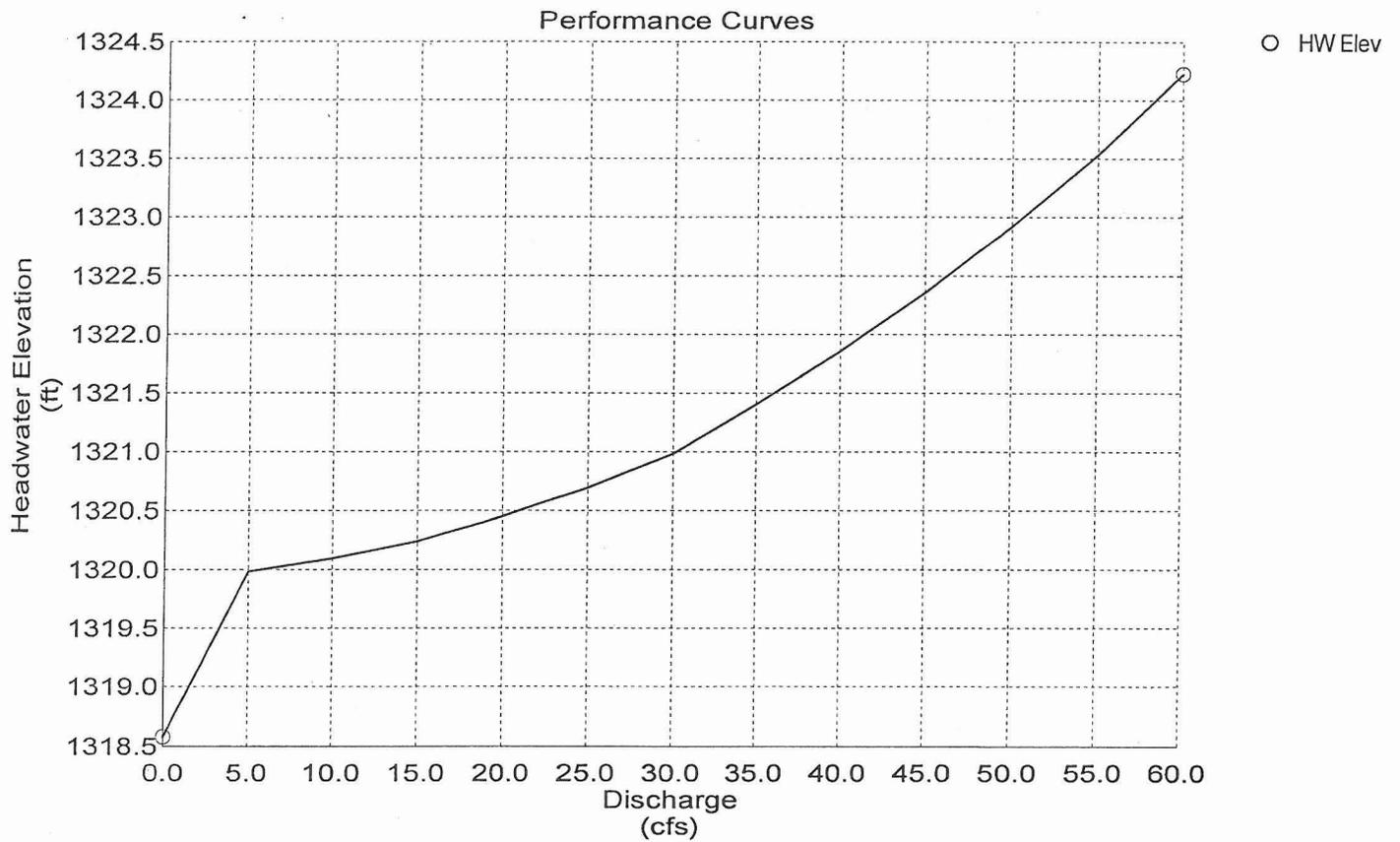
Inlet Control Properties			
Inlet Control HW Elev	1,320.71 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	6.3 ft ²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

102

Performance Curves Report

HV - Offsite Cross Culvert @ Sta 71+81

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	60.00	5.00 cfs



NATURAL CHANNEL D/S STA 71+80
Worksheet for Irregular Channel

Project Description	
Project File	h:\hhproj~1\rancho~1\rcscour.fm2
Worksheet	NATURAL CHANNEL D/S STA 71+80
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

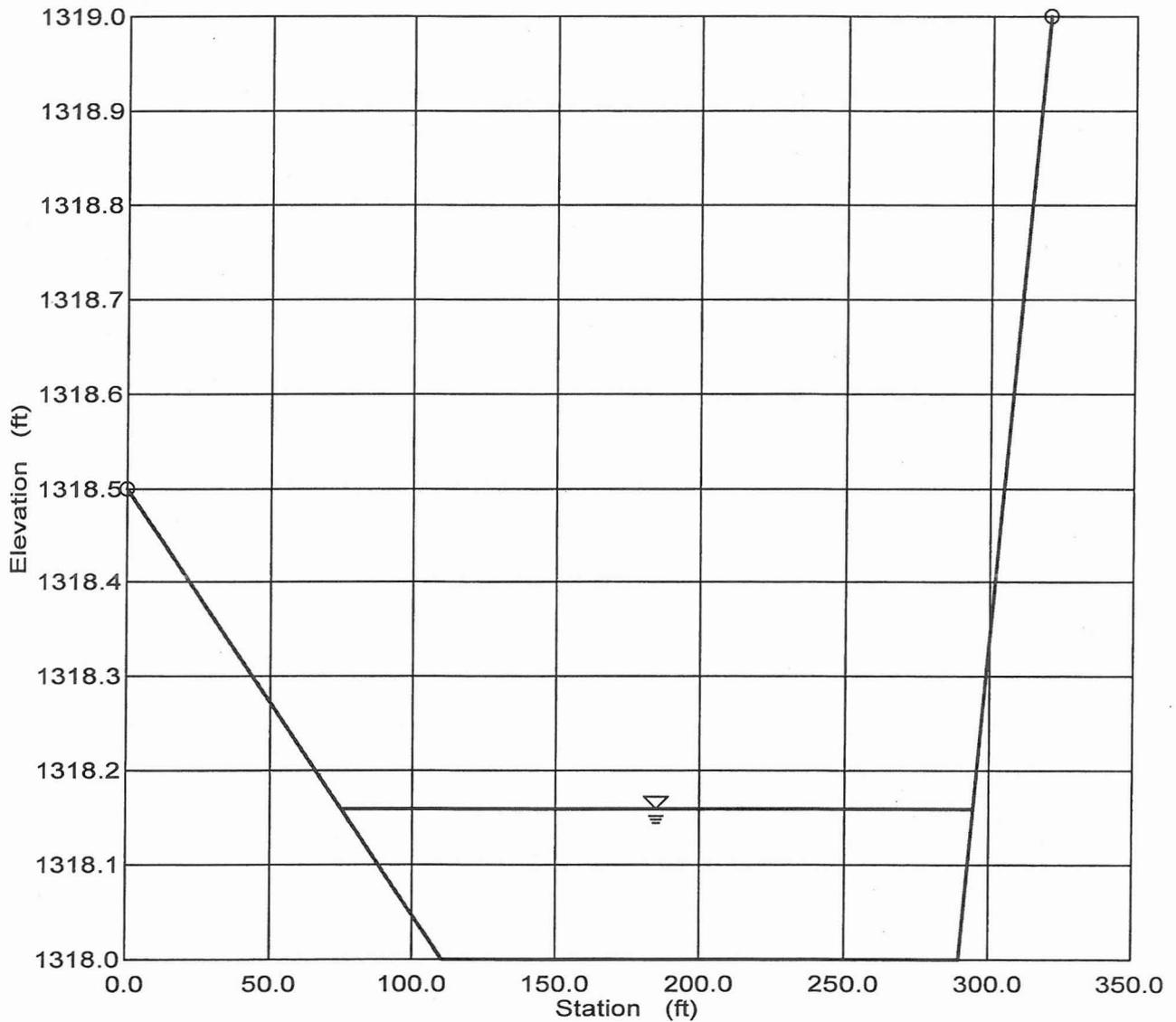
Input Data					
Channel Slope	0.005550 ft/ft				
Elevation range: 1318.00 ft to 1319.00 ft.					
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness	
0.00	1318.50	0.00	320.00	0.035	
110.00	1318.00				
290.00	1318.00				
320.00	1319.00				
Discharge	28.00	ft ³ /s			

Results		
Wtd. Mannings Coefficient	0.035	
Water Surface Elevation	1318.16	ft
Flow Area	32.01	ft ²
Wetted Perimeter	220.01	ft
Top Width	220.01	ft
Depth	0.16	ft
Critical Water Elev.	1318.09	ft
Critical Slope	0.040739 ft/ft	
Velocity	0.87	ft/s
Velocity Head	0.01	ft
Specific Energy	1318.17	ft
Froude Number	0.40	
Full Flow Capacity	797.28	ft ³ /s
Flow is subcritical.		

NATURAL CHANNEL D/S STA 71+80 Cross Section for Irregular Channel

Project Description	
Project File	h:\hhproj~1\rancho~1\rcscour.fm2
Worksheet	NATURAL CHANNEL D/S STA 71+80
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.035
Channel Slope	0.005550 ft/ft
Water Surface Elevation	1318.16 ft
Discharge	28.00 ft ³ /s



Culvert Calculator – CULVERT AT STA 86+79.71 HAPPY VALLEY RD – PH II

Entered Data:

Shape Rectangular
 Number of Barrels 8
 Solving for Headwater
 Chart Number 11
 Scale Number 4
 Chart DescriptionBOX CULVERT; SKEWED HEADWALL; CHAMFERED OR BEVELED INLET EDGES
 Scale DescriptionHEADWALL SKEWED 10 TO 45 DEGREES; INLET EDGES BEVELED
 Overtopping Off
 Flowrate 3954.0000 cfs
 Manning's n 0.0150
 Roadway Elevation1326.5500 ft
 Inlet Elevation 1311.0000 ft
 Outlet Elevation 1309.7200 ft
 Height 96.0000 in
 Width 120.0000 in
 Length 255.0000 ft
 Entrance Loss 0.2000
 Tailwater 5.8000 ft

Computed Results:

Headwater 1316.5945 ft Inlet Control
 Slope 0.0050 ft/ft
 Velocity 12.0485 fps

Messages:

Inlet head > Outlet head.
 Computing Inlet Control headwater.

DIS-CHARGE	HEAD- ELEV.	INLET DEPTH	INLET CONTROL DEPTH	OUTLET CONTROL TYPE	CONTROL FLOW DEPTH	NORMAL FLOW DEPTH	CRITICAL FLOW VEL.	OUTLET DEPTH	OUTLET VEL.	TAILWATER DEPTH
Flow cfs	ft	ft	ft	in	in	ft	fps	ft	fps	ft
37.50	1313.87	0.00	2.87	NA	8.70	50.81	0.50	0.73	0.00	7.52
137.50	1314.46	0.00	3.46	NA	20.19	50.81	1.83	1.68	0.00	7.52
237.50	1315.02	0.00	4.02	NA	29.25	50.81	3.16	2.44	0.00	7.52
337.50	1315.62	0.00	4.62	NA	37.40	50.81	4.49	3.12	0.00	7.52
437.50	1316.27	0.00	5.27	NA	45.04	50.81	5.82	3.75	0.00	7.52
500.00	1316.70	0.00	5.70	NA	49.64	50.81	6.65	4.14	0.00	7.52



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**Natural Channel at HV Rd. PII Crossing
Worksheet for Irregular Channel**

Project Description	
Project File	h:\hhproj~1\rancho~1\rcscour.fm2
Worksheet	Channel at Box Culvert and Happy Valley
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
-------------------	--

Channel Slope	0.007692 ft/ft
---------------	----------------

Elevation range: 1308.30 ft to 1319.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1316.00	0.00	375.00	0.035
21.00	1315.00			
36.00	1314.00			
78.00	1313.00			
81.00	1312.00			
85.00	1311.00			
90.00	1312.00			
94.00	1313.00			
102.00	1313.00			
106.00	1312.00			
110.00	1312.00			
113.00	1313.00			
144.00	1314.00			
152.00	1314.00			
162.00	1309.00			
176.00	1308.30			
190.00	1309.00			
200.00	1313.00			
207.00	1313.00			
214.00	1313.00			
240.00	1314.00			
275.00	1315.00			
375.00	1319.00			
Discharge	3954.00			ft³/s

Results	
----------------	--

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	1315.21 ft
Flow Area	610.84 ft ²
Wetted Perimeter	266.49 ft
Top Width	263.60 ft
Depth	6.91 ft
Critical Water Elev.	1314.72 ft
Critical Slope	0.014312 ft/ft
Velocity	6.47 ft/s
Velocity Head	0.65 ft

**Natural Channel at HV Rd. PII Crossing
Worksheet for Irregular Channel**

Specific Energy	1315.86	ft
Froude Number	0.75	
Full Flow Capacity	19687.23	ft ³ /s

Flow is subcritical.

Notes:

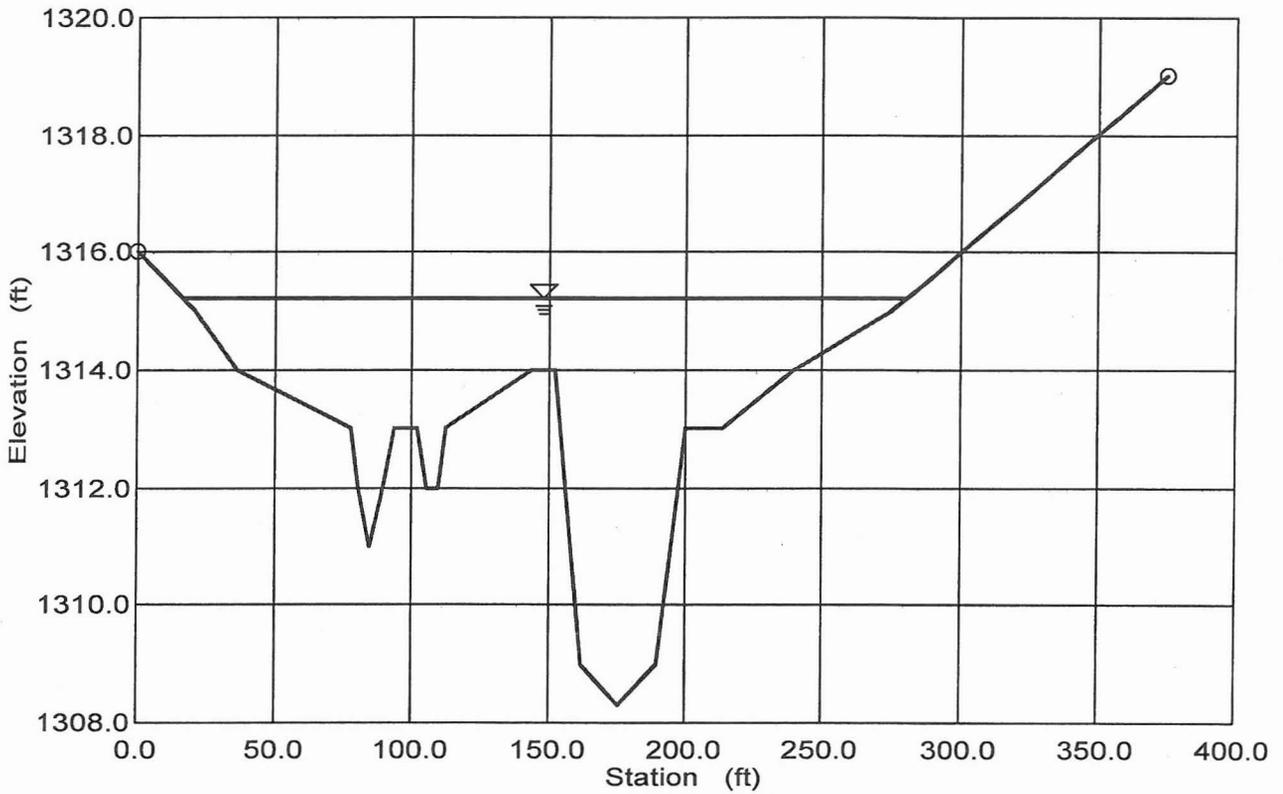
Rancho Cabrillo - Happy Valley Road @ 16-East Wash Crossing

Natural conditions Downstream of Culvert Outlet.

Cross Section of 16-East Wash (Irregular Channel)
Cross Section for Irregular Channel

Project Description	
Project File	h:\hhproj~1\rancho~1\rcscour.fm2
Worksheet	Channel at Box Culvert and Happy Valley
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.035
Channel Slope	0.007692 ft/ft
Water Surface Elevation	1315.21 ft
Discharge	3954.00 ft ³ /s



Notes:

Rancho Cabrillo - Happy Valley Road Phase II

OUTPUT FOR 16-EAST WASH NATURAL CONDITIONS DOWNSTREAM END OF PROPOSED 8 BARREL BOX CULVERT

APPENDIX F

**SCOUR AND OUTLET PROTECTION
CALCULATIONS**

APPENDIX G

**LATERAL MIGRATION
CALCULATIONS**

COMPUTE LATERAL MIGRATION FOR MINOR WATERCOURSES
 PER ARIZONA STATE STANDARD 5-96 (SSA 5-96) DATED SEPT 1996- LEVEL I

$LM = 1.0 * (Q_D)^{0.5}$ Straight channel w/ minor curvature

$LM = 2.5 * (Q_D)^{0.5}$ Obvious curvature or Channel Bend

Where: LM = The minimum "safe" setback distance necessary to preclude impacts from lateral migration of the channel along a curved reach, in feet

Q_D = Design Flow = 100yr, cfs

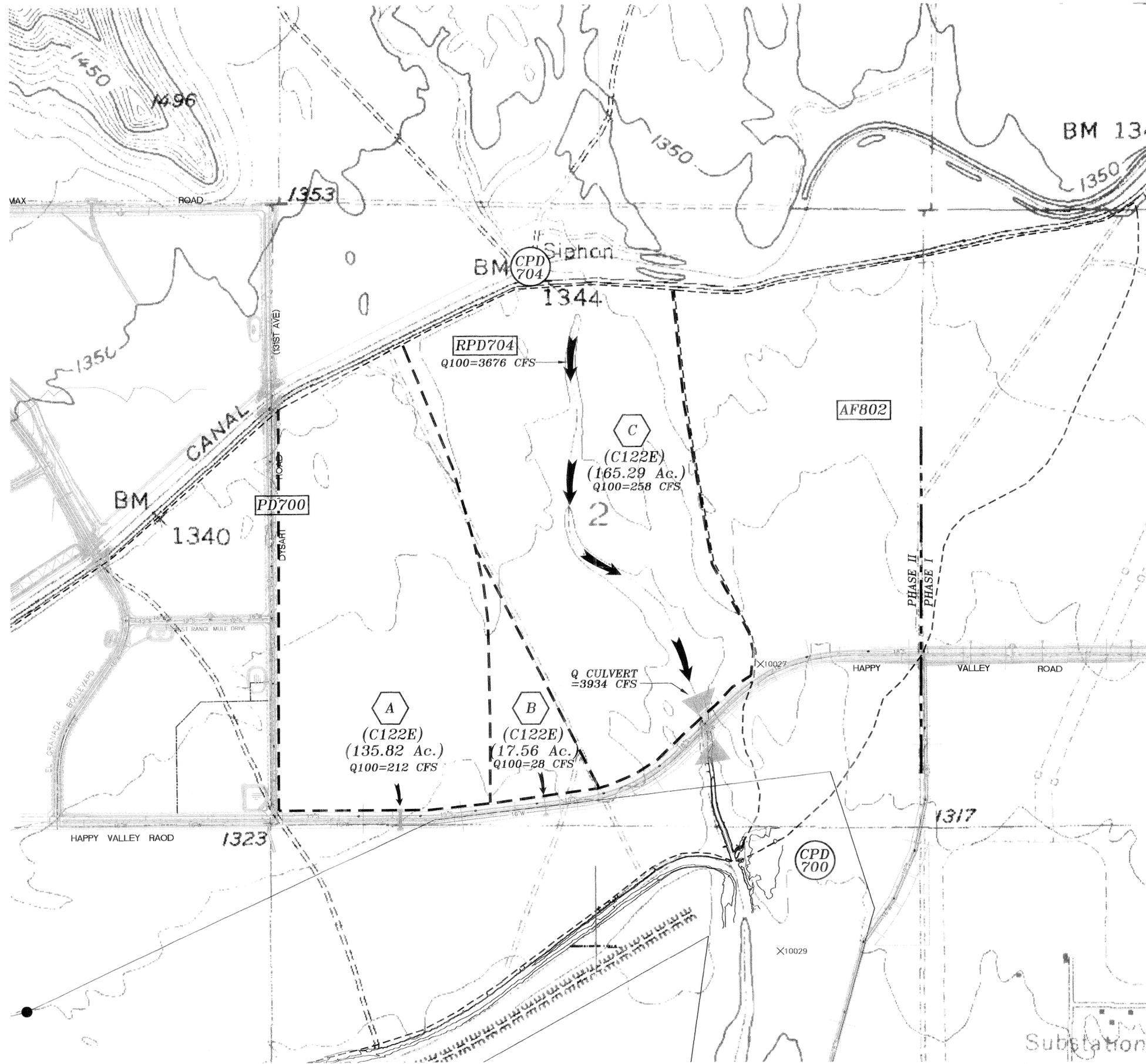
Use minimum 2' freeboard for channel to top bank.

Easement is from top of banks to outer limits of lateral setback

If lateral setback is less than 20' use 20' min.

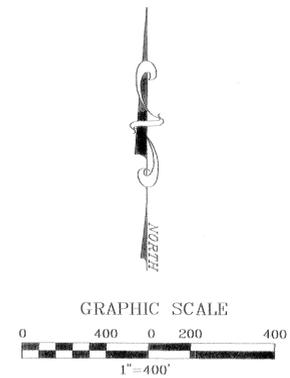
Minimum easement length is equal to width

HAPPY VALLEY PHASE II STATION	MULT. FACTOR (unitless)	Q_D [cfs]	MINIMUM LATERAL SETBACK (ft)	COMPUTED LATERAL MIGRATION - LM (ft)	CHANNEL SIDE SLOPES	CHANNEL MINIMUM DEPTH	CHANNEL BOTTOM (ft)	MINIMUM EASEMENT WIDTH (ft)
60+00	1.0	212	20	15	3:1	2.00	25.5	89.5
71+80	1.0	28	20	5	3:1	2.00	5	69
79+00	1.0	31	20	6	3:1	2.00	2	66
86+80	1.0	3954	20	63	3:1	5.80	30	116.8



LEGEND:

- PD700 2004 WATERSHED LABEL
- CPD 704 POINT OF CONCENTRATION LABEL (2004 STUDY)
- C WLB WATERSHED LABEL
- FLOW ARROW
- 2004 WATERSHED BOUNDARY
- WLB WATERSHED BOUNDARY



TWO WORKING DAYS BEFORE YOU DO
 CALL FOR THE BLUE STAKES
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 BLUE STAKE CENTER

NO.	DATE	REVISIONS

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RANCHO CABRILLO
 OFFSITE ROADWAYS
FIGURE 5
 HAPPY VALLEY ROAD PHASE II - DRAINAGE MAP

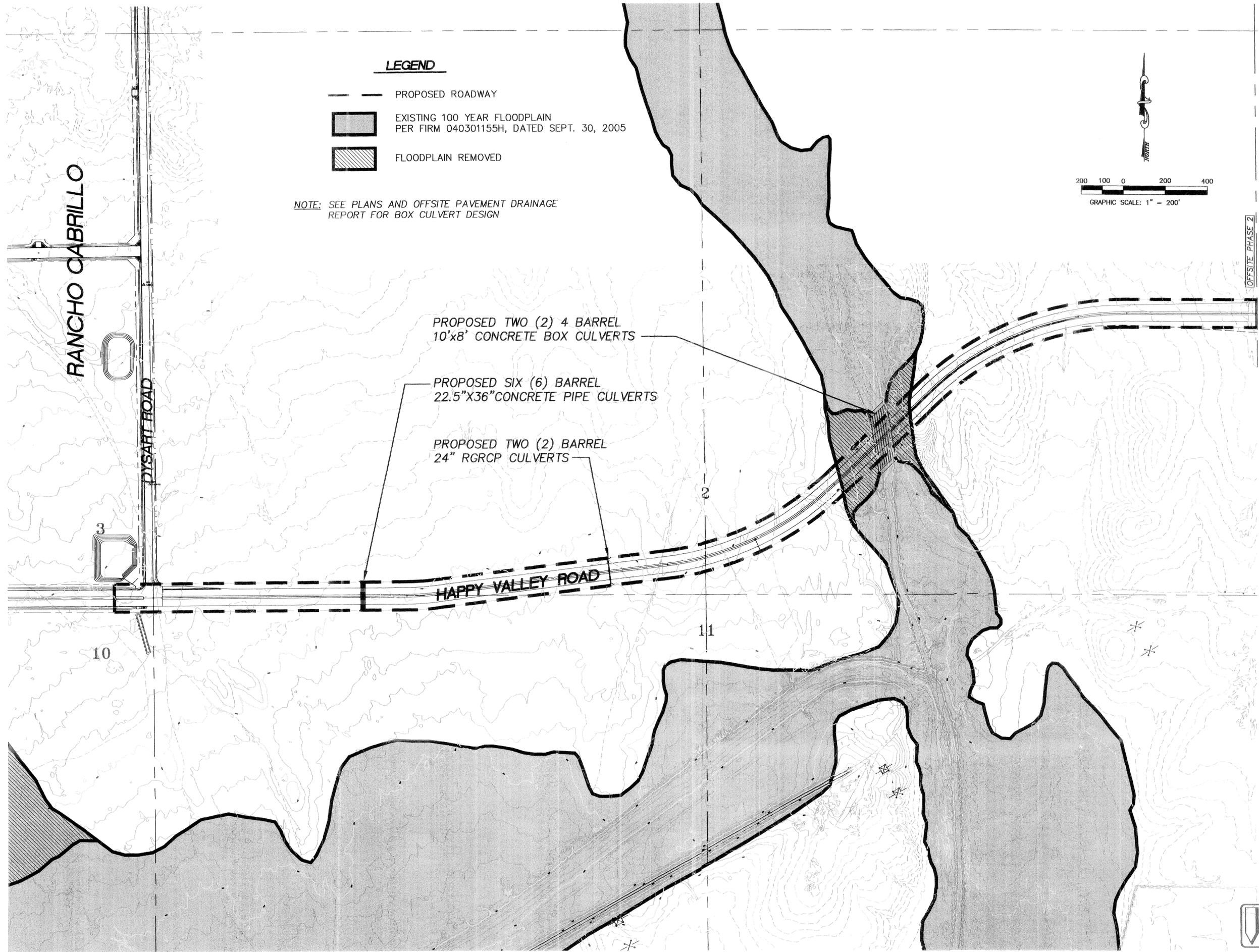


DRAWN BY:	K.B.
CHECK BY:	J.W.
APPR. BY:	D.K.S.
DATE:	SEPT. 2005
BY:	G.A. REVIEW
DATE:	

PROJECT NO. 202017-A-001	
SHEET	OF
1	3

N:\2020\Hydro\FIGURE 5.dwg, 10/12/2005 12:22:47 PM, deligecia

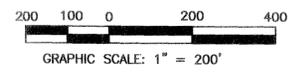
N:\202017\Hydro\Offsite Drainage Fig. 2.dwg, 10/12/2005 11:59:38 AM, abrown



LEGEND

-  PROPOSED ROADWAY
-  EXISTING 100 YEAR FLOODPLAIN
PER FIRM 040301155H, DATED SEPT. 30, 2005
-  FLOODPLAIN REMOVED

NOTE: SEE PLANS AND OFFSITE PAVEMENT DRAINAGE REPORT FOR BOX CULVERT DESIGN



PROPOSED TWO (2) 4 BARREL
10'x8' CONCRETE BOX CULVERTS

PROPOSED SIX (6) BARREL
22.5"X36" CONCRETE PIPE CULVERTS

PROPOSED TWO (2) BARREL
24" RGRCP CULVERTS

HAPPY VALLEY ROAD

OFFSITE PHASE 2

NO.	DATE	ITEM

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RANCHO CABRILLO
 OFFSITE ROADWAYS
 FIGURE 6
 PHASE II 100-YEAR FLOODPLAIN MAP

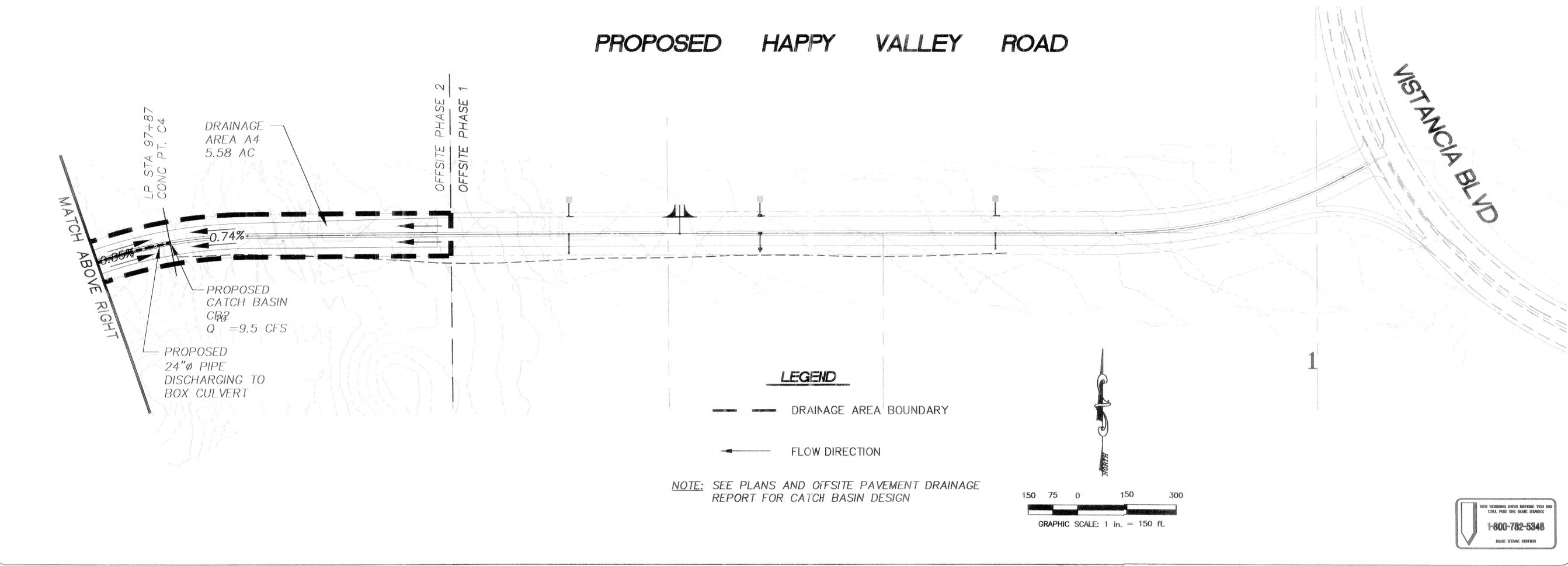
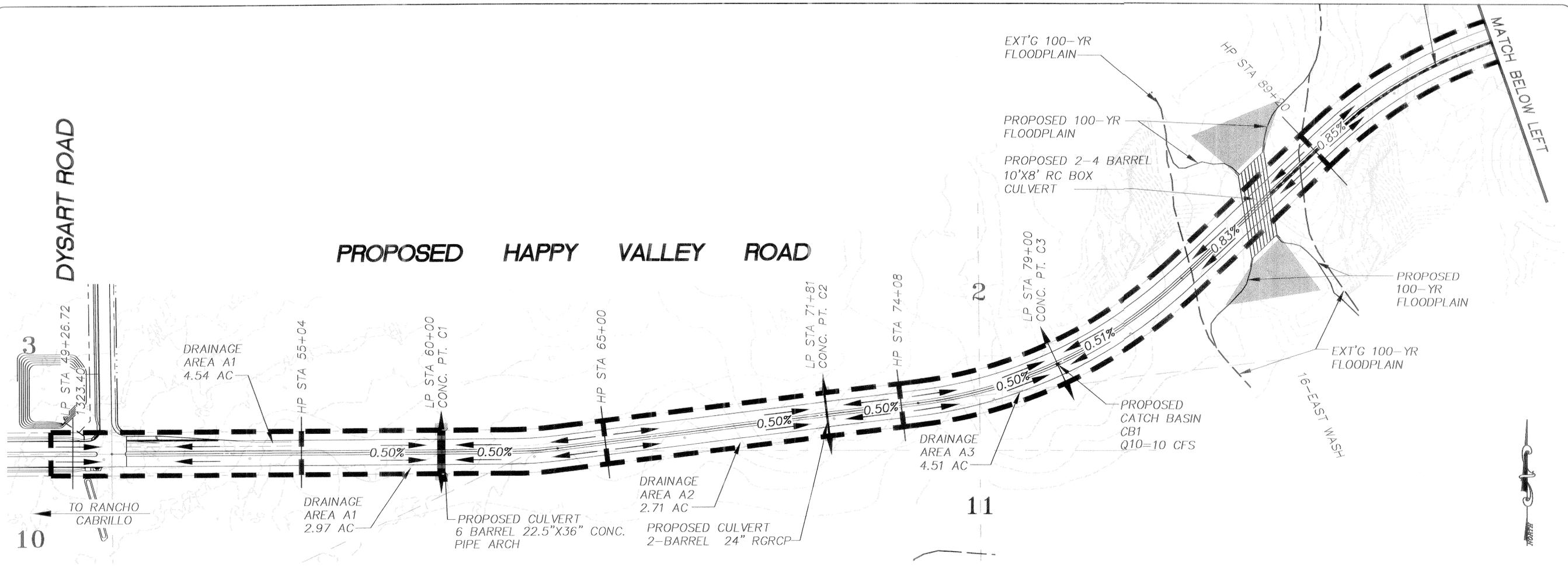


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CHECK BY:	JW
APPR. BY:	KAM
DATE:	AUG. 2005
BY:	G.A. REVIEW
DATE:	

PROJECT NO.
202017-A-001

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2	3

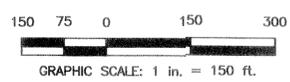
THIS DRAWING DATE BEFORE YOU GO
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LEGEND

- DRAINAGE AREA BOUNDARY
- FLOW DIRECTION

NOTE: SEE PLANS AND OFFSITE PAVEMENT DRAINAGE REPORT FOR CATCH BASIN DESIGN



SEE WEBSITE FOR MORE INFORMATION
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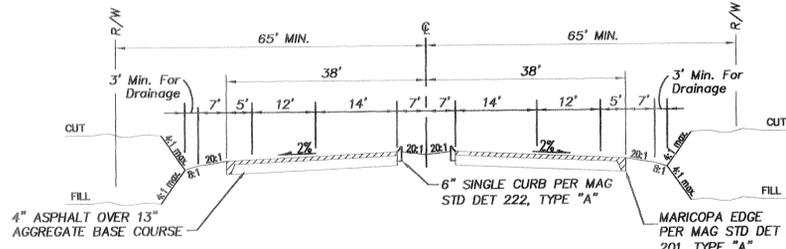


RANCHO CABRILLO
 OFFSITE ROADWAYS
 FIGURE 7
 HAPPY VALLEY ROAD PHASE II DRAINAGE MAP

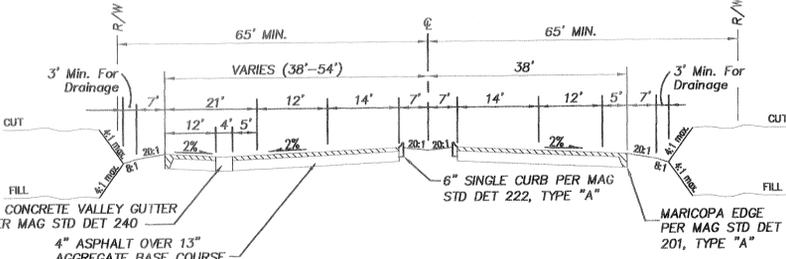


TEAM:	
DRAWN BY:	JW
CHECK BY:	DKS
APPR. BY:	
DATE:	AUGUST, 2005
BY:	C.A. REVIEW
DATE:	

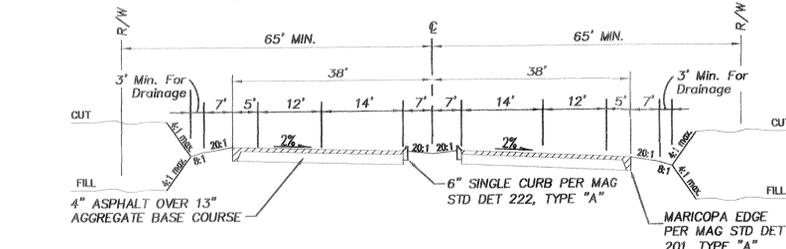
PROJECT NO.	202017-A-001
SHEET	OF
3	3



MINOR ARTERIAL ROAD
HAPPY VALLEY ROAD
TYPICAL SECTION
 N.T.S.

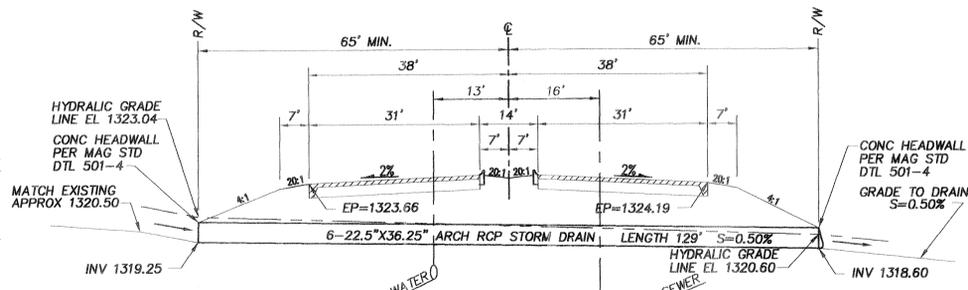


MINOR ARTERIAL ROAD
HAPPY VALLEY ROAD
DECELERATION SECTION
 N.T.S.

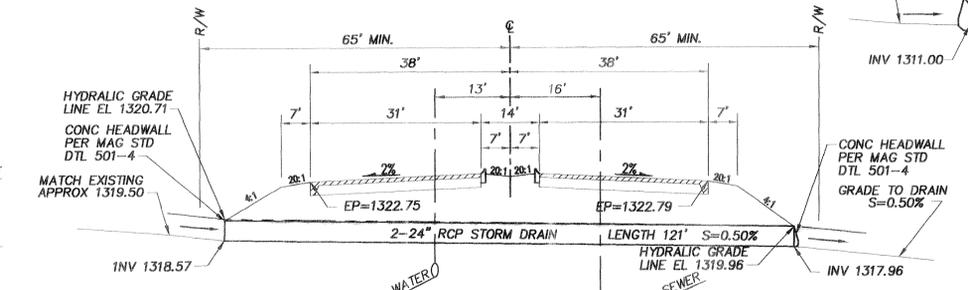


MINOR ARTERIAL ROAD
HAPPY VALLEY ROAD
TYPICAL SUPERELEVATED SECTION
 N.T.S.

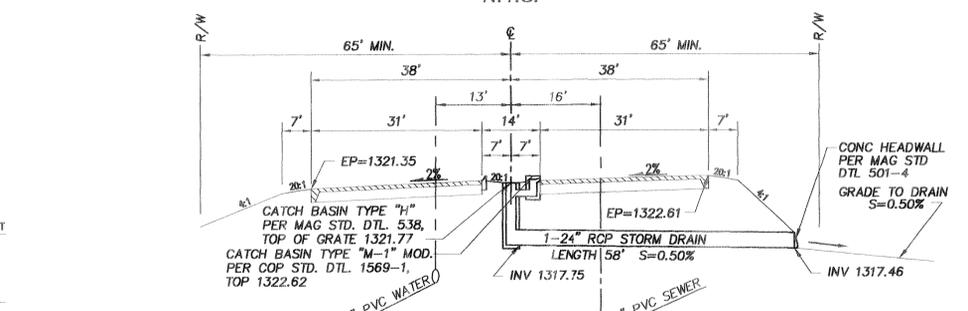
TYPICAL SECTIONS - HAPPY VALLEY ROAD
 N.T.S.



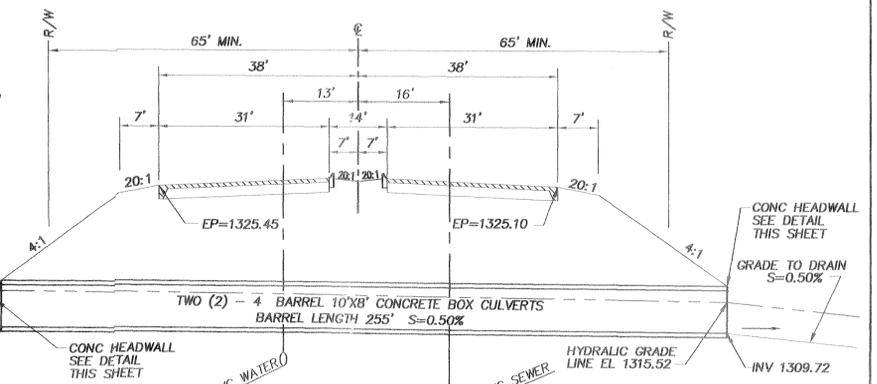
SECTION A-A
HAPPY VALLEY ROAD STA 60+00.00
 N.T.S.



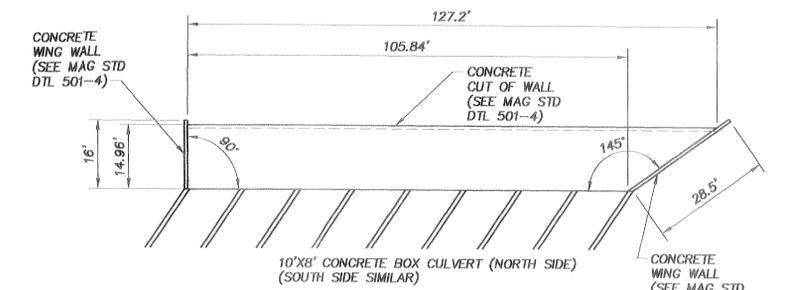
SECTION B-B
HAPPY VALLEY ROAD STA 71+80.86
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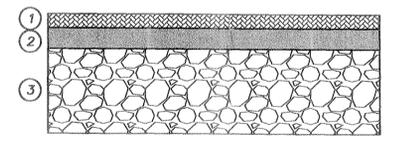
SECTION C-C
HAPPY VALLEY ROAD STA 78+98.97
 N.T.S.



SECTION D-D
HAPPY VALLEY ROAD STA 86+79.71
 N.T.S.



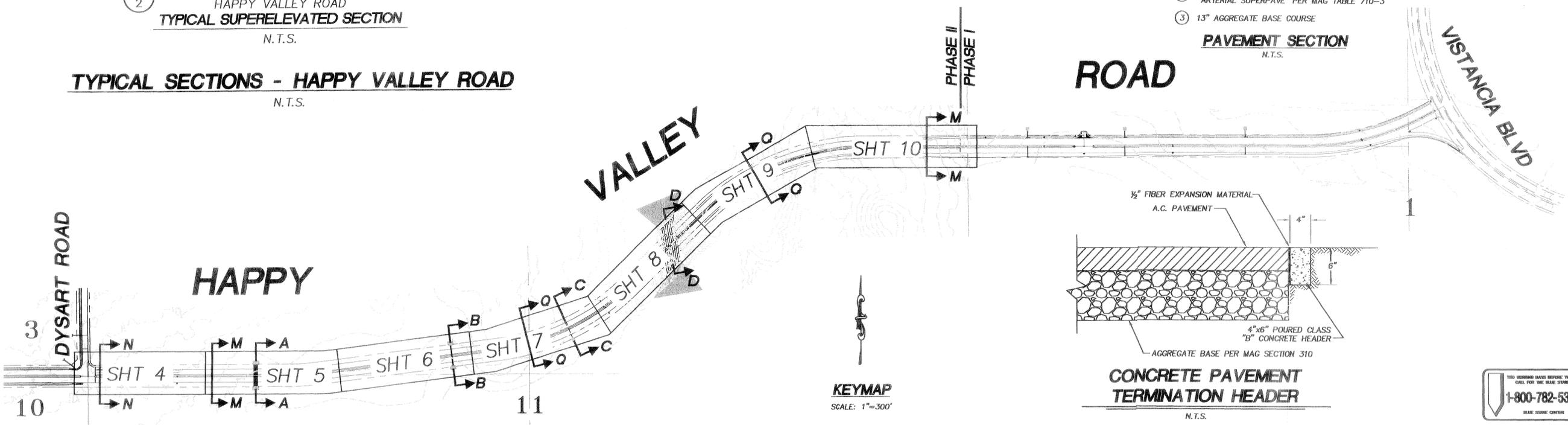
HEADWALL DETAIL
HAPPY VALLEY ROAD STA 86+79.71
 N.T.S.



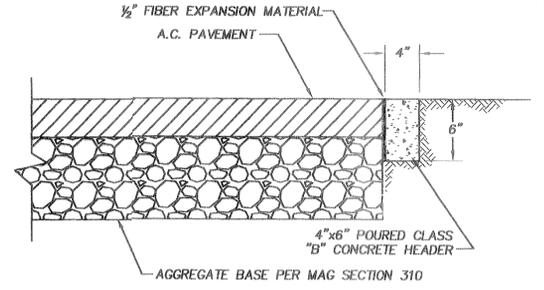
- ① 1.5" ASPHALTIC CONCRETE, MAG "FINE" (12.5 mm) MIX DESIGN "ARTERIAL SUPERPAVE" PER MAG TABLE 710-3
- ② 2.5" ASPHALTIC CONCRETE, MAG "COARSE" (19 mm) MIX DESIGN "ARTERIAL SUPERPAVE" PER MAG TABLE 710-3
- ③ 13" AGGREGATE BASE COURSE

PAVEMENT SECTION
 N.T.S.

ROAD



KEYMAP
 SCALE: 1"=300'



CONCRETE PAVEMENT TERMINATION HEADER
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RANCHO CABRILLO
PHASE II - HAPPY VALLEY ROAD
OFFSITE PAVING AND GRADING PLANS
 TYPICAL SECTIONS AND KEYMAP



DESIGNED BY: PAC
 DRAWN BY: RLP
 CHECK BY: RGB
 DATE: JANUARY, 2004
 BY: C.A. REVIEW
 DATE:

PROJECT NO.
 202017X-A-001
 SHEET 2 OF 10

N:\2020\TX\Cu-shis OFFSITE PAVING\PHASE II\2017X-A-001\PHASE II\2017X-A-001\PHASE II\2017X-A-001.dwg, 10/12/2006 12:07:48 PM, kbtwin

ENGINEER'S GENERAL NOTES:

- (Maricopa County Standards)
- MARICOPA ASSOCIATION OF GOVERNMENTS (MAG) UNIFORM STANDARD SPECIFICATIONS AND DETAILS FOR PUBLIC WORKS CONSTRUCTION (LATEST EDITION INCLUDING LATEST REVISIONS) ARE INCORPORATED INTO THESE PLANS AND THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.
 - ALL WORK REQUIRED TO COMPLETE THE CONSTRUCTION COVERED BY THESE PLANS SHALL BE IN ACCORDANCE WITH APPLICABLE MAG STANDARD SPECIFICATIONS AND DETAILS, UNLESS SPECIFIED OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS. BIDDING CONTRACTORS SHALL FAMILIARIZE THEMSELVES WITH ALL MAG STANDARD SPECIFICATIONS AND DETAILS THAT ARE REFERENCED IN THESE PLANS, OR ELSEWHERE IN THE CONTRACT DOCUMENTS, PRIOR TO BIDDING THE WORK THAT IS COVERED BY THESE PLANS. FOR THE CONVENIENCE OF THE CONTRACTOR, CERTAIN COMMONLY USED MAG STANDARD SPECIFICATIONS AND DETAILS MAY HAVE BEEN REPRODUCED IN THESE PLANS. THE CONTRACTOR SHALL NOT INTERPRET THAT A MAG STANDARD IS NOT APPLICABLE IF IT IS NOT INCLUDED IN THESE PLANS.
 - THE ENGINEER RESERVES THE RIGHT TO DETERMINE WHICH PORTIONS (IF ANY) OF THE MAG STANDARD SPECIFICATIONS AND DETAILS ARE APPLICATORY TO THE WORK COVERED BY THESE PLANS. SHOULD CONTRADICTION OR CONFLICT ARISE BETWEEN THESE PLANS AND THE MAG STANDARDS, THE CONTRACTOR IS ADVISED TO HAVE THE CONFLICT CLARIFIED PRIOR TO BIDDING THE WORK.
 - THE CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION METHODS, CONSTRUCTION SEQUENCING, AND SAFETY PROCEDURES USED DURING CONSTRUCTION, UNLESS SPECIFICALLY ADDRESSED OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - THE CONTRACTOR IS TO COMPLY WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS APPLICABLE TO THE WORK COVERED BY THESE PLANS, INCLUDING BUT NOT LIMITED TO THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS.
 - THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING (AT THE CONTRACTOR'S SOLE EXPENSE) AND COMPLYING WITH ALL PERMITS AND LICENSES REQUIRED TO COMPLETE ALL WORK COVERED BY THESE PLANS.
 - EACH BIDDING CONTRACTOR CERTIFIES, BY SUBMITTING A BID PROPOSAL FOR THE WORK COVERED BY THESE PLANS, THAT HE/SHE AND HIS/HER SUBCONTRACTORS HOLD A CURRENT AND APPROPRIATE LICENSE(S), ISSUED BY THE STATE OF ARIZONA'S REGISTRAR OF CONTRACTORS, FOR THE WORK TO BE PERFORMED.
 - THE QUANTITIES AND SITE CONDITIONS DEPICTED ON THESE PLANS ARE FOR INFORMATIONAL PURPOSES ONLY AND ARE SUBJECT TO ERROR AND OMISSION. BIDDING CONTRACTORS SHALL SATISFY THEMSELVES AS TO THE QUANTITIES AND SITE CONDITIONS TO BE BIDDING THE WORK COVERED BY THESE PLANS. EACH BIDDING CONTRACTOR CERTIFIES, BY SUBMITTING A BID PROPOSAL FOR THE WORK COVERED BY THESE PLANS, THAT HE/SHE HAS THOROUGHLY EXAMINED THESE PLANS AND THE LOCATION WHERE THE WORK IS TO BE PERFORMED, IS FAMILIAR WITH LOCAL CODES, AND HAS READ AND THOROUGHLY UNDERSTOOD THE CONTRACT DOCUMENTS AS THEY RELATE TO THE WORK INVOLVED, TO THE MEASUREMENT AND PAYMENT FOR ALL WORK, AND TO THE PHYSICAL CONDITIONS PREVALENT OR LIKELY TO BE ENCOUNTERED IN THE PERFORMANCE OF THE WORK AT SUCH LOCATION.
 - A REASONABLE EFFORT HAS BEEN MADE TO SHOW THE LOCATIONS OF EXISTING UNDERGROUND FACILITIES AND UTILITIES IN THE CONSTRUCTION AREA. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO UTILITIES AND/OR FACILITIES CAUSED BY THE CONTRACTOR'S, OR SUBCONTRACTOR'S, CONSTRUCTION OPERATIONS. THE CONTRACTOR SHALL REPAIR OR REPLACE ANY DAMAGED UTILITY AND/OR FACILITY (AT THE CONTRACTOR'S SOLE EXPENSE) TO THE SATISFACTION OF THE OWNER OF THE UTILITY AND/OR FACILITY. THE CONTRACTOR SHALL CALL FOR BLUE STAKE (1-800-782-5348) TWO WORKING DAYS PRIOR TO ANY EXCAVATION.
 - DURING THE DEVELOPMENT OF THESE PLANS, EXISTING FACILITIES SUCH AS a) BURIED FACILITIES, b) STRUCTURALLY UNSOUND FACILITIES, c) LOW HANGING OVERHEAD UTILITY LINES AND d) OTHER FACILITIES WHICH MIGHT NOT HAVE BEEN INVESTIGATED TO A DEGREE OF CERTAINTY THAT THESE PLANS REPRESENT THE TOTAL IMPACT OF THE PROPOSED WORK ON ALL EXISTING FACILITIES. THEREFORE, UNIDENTIFIED ADDITIONAL WORK AND/OR UTILITY RELOCATION MIGHT BE REQUIRED IN ORDER TO COMPLETE THE WORK COVERED BY THESE PLANS. THE CONTRACTOR SHALL NOTIFY THE CONTRACTING PARTY IMMEDIATELY UPON THE DISCOVERY OF ANY CONFLICT NOT IDENTIFIED IN THESE PLANS, AND THEN AVOID DISCOVERY FROM THE CONTRACTING PARTY PRIOR TO ANY RESOLUTION OF THE CONFLICT. THE CONTRACTOR IS RESPONSIBLE FOR ALL COORDINATION OF CONSTRUCTION AFFECTING UTILITIES AND THE COORDINATION OF ANY NECESSARY UTILITY RELOCATION WORK.
 - ALL GRADING, EXCAVATION, CUTS, FILL, TRENCHING, PIPE BEDDING AND BACKFILL SHALL COMPLY WITH THE RECOMMENDATIONS SET FORTH IN THE SOILS (GEOTECHNICAL) REPORT FOR THIS PROJECT, AND IN ADDITION, TO THE MAG STANDARD SPECIFICATIONS AND DETAILS, ANY GOVERNMENT AGENCY HAVING JURISDICTION, THESE PLANS AND ALL OTHER CONTRACT DOCUMENTS.
 - THE CONTRACTING PARTY, AND/OR THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING, FROM AFFECTED LAND OWNERS, ALL EASEMENTS, PERMITS, RIGHTS, PERMISSIONS AND LICENSES NECESSARY TO PERFORM THE WORK COVERED BY THESE PLANS.
 - DEVIATION FROM THESE PLANS WILL NOT BE ALLOWED WITHOUT AN APPROVED PLAN REVISION FROM THE CONTRACTING PARTY AND/OR THE GOVERNMENT AGENCY HAVING JURISDICTION. AN APPROVED SET OF PLANS SHALL BE MAINTAINED AT THE JOB SITE AT ALL TIMES WHEN WORK IS IN PROGRESS.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING AND SEEING THAT ALL WORK IS "AS-BUILT". THE CONTRACTING PARTY'S, OR THE CONTRACTOR'S, SURVEYOR AND/OR ENGINEER SHALL PREPARE, MAINTAIN AND CERTIFY RECORD "AS-BUILT" DOCUMENTS FOR THIS PROJECT, IN ORDER TO ACCURATELY REFLECT THE PROJECT'S CONSTRUCTION WORK "AS-BUILT". DURING CONSTRUCTION, THE SURVEYOR AND/OR ENGINEER SHALL LEGIBLY MARK AND MAINTAIN ALL PLAN CHANGES AND DEVIATIONS ON A SET OF BLUELINE DRAWINGS WITH RED PENCIL OR PEN. AFTER CONSTRUCTION IS COMPLETE, THE CONTRACTING PARTY, OR THE CONTRACTOR, IS TO HAVE THE "AS-BUILT" DATA TRANSFERRED TO REPRODUCIBLE MYLARS AND CERTIFIED BY THE SURVEYOR AND/OR ENGINEER, PRIOR TO FINAL ACCEPTANCE. THE CONTRACTING PARTY, OR THE CONTRACTOR, SHALL SUBMIT THE RECORD "AS-BUILT" DOCUMENTS TO THE GOVERNMENT AGENCY HAVING JURISDICTION FOR REVIEW AND APPROVAL. IMPROPER "AS-BUILT" RECORD KEEPING MAY BE REASON FOR THE CONTRACTING PARTY TO REQUIRE THE CONTRACTOR TO EXPOSE BURIED WORK FOR INSPECTION BY CONTRACTING PARTY OR THE GOVERNMENT AGENCY HAVING JURISDICTION, AT NO ADDITIONAL COST TO THE CONTRACTING PARTY.
 - THIS PROJECT MIGHT BE SUBJECT TO THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) REQUIREMENTS FOR CONSTRUCTION SITES UNDER THE ENVIRONMENTAL PROTECTION AGENCY (EPA) GENERAL PERMIT FOR ARIZONA. THE CONTRACTING PARTY, AND/OR CONTRACTOR, SHALL BE RESPONSIBLE FOR PREPARING AND SUBMITTING ALL DOCUMENTS REQUIRED BY THE NPDES REGULATION, INCLUDING BUT NOT LIMITED TO SWPPP/SWMP, NOW AND NOT, UNLESS PROVIDED FOR ELSEWHERE BY THE CONTRACTING PARTY.
 - THE CONTRACTOR SHALL PROVIDE FOR TRAFFIC CONTROL IN CONFORMANCE WITH MAG STANDARD SPECIFICATIONS SECTION 401, WITH THE FEDERAL HIGHWAY ADMINISTRATION "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS", WITH THE ARIZONA DEPARTMENT OF TRANSPORTATION "TRAFFIC CONTROL MANUAL FOR HIGHWAYS CONSTRUCTION AND MAINTENANCE", AND WITH ANY OTHER REQUIREMENTS OF THE GOVERNMENT AGENCY HAVING JURISDICTION, USING LATEST EDITIONS, REVISIONS AND POLICIES. THERE WILL BE NO SEPARATE MEASUREMENT NOR PAYMENT FOR TRAFFIC CONTROL. TRAFFIC CONTROL IS INCIDENTAL TO THE WORK COVERED BY THESE PLANS.
 - THE CONTRACTOR SHALL PERFORM SITE CLEANUP AND DISPOSAL IN A LEGAL MANNER ON A DAILY BASIS, OR AS DIRECTED BY THE CONTRACTING PARTY OR ANY GOVERNMENT AGENCY HAVING JURISDICTION. THERE WILL BE NO SEPARATE MEASUREMENT NOR PAYMENT FOR THIS WORK.
 - IF THE CONTRACTOR IS NOT PROVIDING HIS/HER OWN ENGINEER/SURVEYOR, THE CONTRACTOR SHALL GIVE SEVENTY-TWO (72) HOURS NOTICE TO THE CONTRACTING PARTY WHEN HE/SHE REQUIRES THE SERVICES OF THE ENGINEER/SURVEYOR OR ANY OTHER PARTY PROPERLY AUTHORIZED FOR THE PURPOSE OF LAYING OUT ANY PORTION OF THE WORK.

ENGINEER'S PAVING NOTES:

- (Maricopa County Standards)
- THE ARIZONA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AND STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION (LATEST EDITIONS AND REVISIONS) ARE INCORPORATED INTO THESE PLANS AND THE CONTRACT DOCUMENTS IN THEIR ENTIRETY.
 - THE ENGINEER RESERVES THE RIGHT TO DETERMINE WHICH PORTIONS (IF ANY) OF THE ADO STANDARD SPECIFICATIONS AND DRAWINGS ARE APPLICATORY TO THE STRUCTURAL EXCAVATION PLANS. SHOULD CONTRADICTION OR CONFLICT ARISE BETWEEN THESE PLANS, THE ADO STANDARDS, AND THE MAG STANDARDS, THE CONTRACTOR IS ADVISED TO HAVE THE CONFLICT CLARIFIED PRIOR TO BIDDING THE WORK.
 - PREPARATION OF PAVEMENT AND SIDEWALK SUBGRADE SHALL NOT BEGIN UNTIL ALL UNDERGROUND WORK (UTILITIES AND STORM DRAINS) HAS BEEN COMPLETED, WITHIN THE PAVEMENT AND SIDEWALK CORRIDORS, AND FOUND ACCEPTABLE BY THE CONSTRUCTION INSPECTOR.
 - ALL PEDESTRIAN PATHWAYS, SIDEWALKS AND RAMPS ARE TO MEET THE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (ADA). SHOULD THE WORK COVERED BY THESE PLANS NOT MEET ALL ADA REQUIREMENTS, THE CONTRACTOR IS TO CEASE WORK IN THE AREA OF CONCERN AND CONTACT THE CONSTRUCTION INSPECTOR FOR DIRECTION. SOME ADA REQUIREMENTS ARE:
 - MAXIMUM GROSS SLOPE IS 2%
 - MAXIMUM LONGITUDINAL SLOPE IS 5%
 - MAXIMUM RAMP SLOPE IS 5%
 - MAXIMUM FLARED RAMP SIDE SLOPE IS 5%
 - LEVEL LANDINGS ARE REQUIRED AT THE BOTTOM AND TOP OF RAMPS.
 - SAWCUTTING IS INCIDENTAL TO THE WORK BEING PERFORMED. THERE IS NO SEPARATE MEASUREMENT NOR PAYMENT FOR SAWCUTTING.
 - STRUCTURAL EXCAVATION IS INCIDENTAL TO THE EARTHWORK OR TO THE STRUCTURAL WORK BEING PERFORMED. THERE IS NO SEPARATE MEASUREMENT NOR PAYMENT FOR STRUCTURAL EXCAVATION.
 - ROADWAY EXCAVATION IS INCIDENTAL TO THE EARTHWORK OR TO THE ROADWAY WORK BEING PERFORMED. THERE IS NO SEPARATE MEASUREMENT NOR PAYMENT FOR ROADWAY EXCAVATION.
 - ALL PAVEMENT STRUCTURAL SECTIONS AND ALL EXCAVATION FOR ROADWAYS SHALL BE IN CONFORMANCE WITH THE GEOTECHNICAL REPORT'S RECOMMENDATIONS, THAT HAS BEEN DEVELOPED FOR THIS PROJECT, WITH THESE PLANS AND WITH THE MAG STANDARD SPECIFICATIONS.
 - NO CONCRETE NOR AGGREGATE BASE COURSE SHALL BE PLACED ON SUBGRADE UNTIL AFTER THE SUBGRADE COMPACTION REQUIREMENTS HAVE BEEN MET AND ACCEPTED BY THE CONSTRUCTION INSPECTOR. ASPHALT SHALL NOT BE PLACED ON THE AGGREGATE BASE COURSE UNTIL AFTER THE AGGREGATE BASE COURSE COMPACTION AND GRADE REQUIREMENTS HAVE BEEN MET AND ACCEPTED BY THE CONSTRUCTION INSPECTOR.
 - THE CONTRACTOR, AT NO ADDITIONAL COST TO THE CONTRACTING PARTY, MAY BE REQUIRED TO TEST ALL FINISHED GUTTERS, CONCRETE AND ASPHALT FOR POSITIVE DRAINAGE BY INUNDATING THE FINISHED IMPROVEMENTS WITH WATER. THIS TEST MAY BE REQUIRED BY THE CONSTRUCTION INSPECTOR, AND IF REQUIRED, SHALL BE PERFORMED IN THE PRESENCE OF THE CONSTRUCTION INSPECTOR. ANY WORK WHICH DOES NOT HAVE POSITIVE DRAINAGE SHALL BE REMOVED AND REPLACED TO THE DESIGN GRADES CALLED FOR IN THESE PLANS AT THE CONTRACTOR'S SOLE EXPENSE.
 - THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL NEW AND PREVIOUSLY EXISTING MONUMENTS, VALVES, MANHOLES, CLEANOUTS AND STORM GRATES IN ADVANCE OF PERFORMING PAVING WORK. THE CONTRACTOR SHALL ADJUST ALL FRAMES, COVERS AND GRATES TO FINISH GRADE PRIOR TO THE COMPLETION OF PAVING OPERATIONS. THE CONTRACTOR SHALL INSTALL CONCRETE COLLARS AROUND FRAMES WHERE CALLED FOR IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - GRINDING AND/OR EPOXY PATCHING SHALL NOT BE PERMITTED FOR CORRECTING CONCRETE/MASONRY DEFICIENCIES IN CURBS, GUTTERS, VALLEY GUTTERS, APRONS, SCUPPERS, CATCH BASINS, DRIVEWAYS, SIDEWALKS, FRAME COLLARS, WALLS OR ANY OTHER CONCRETE/MASONRY STRUCTURE THAT ARE A RESULT FROM IMPROPER GRADE SETTING, FROM CONSTRUCTION METHODS USED, OR FROM BREAKAGE DUE TO ANY CIRCUMSTANCE. DEFECTIVE CONCRETE AND/OR MASONRY WORK SHALL BE REMOVED AND REPLACED AT THE CONTRACTOR'S SOLE EXPENSE.
 - PAVING ASPHALT SHALL BE PG 70-10; THE ASPHALTIC MIX DESIGN SHALL MEET SUPERPAVE CRITERIA FOR HEAVY TRAFFIC PER MAG STANDARD SPECIFICATION 710; AND, THE ASPHALTIC CONCRETE AGGREGATE STRUCTURE FOR MIX DESIGN SHALL MEET THE REQUIREMENTS FOR 3/4 INCH (19mm) GRADATION PER MAG STANDARD SPECIFICATION 710, UNLESS CALLED FOR OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - USE OF "RECLAIMED ASPHALT" IS PROHIBITED, UNLESS CALLED FOR OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - THE PAVING WORK COVERED BY THESE PLANS WILL NOT BE CONSIDERED COMPLETE AND ACCEPTABLE UNTIL AFTER ALL CURBS, PAVEMENT AND SIDEWALKS HAVE BEEN SWEEP CLEAN OF ALL DIRT AND DEBRIS AND AFTER ALL SURVEY MONUMENTS, PAVEMENT STRIPING, AND STREET SIGNS HAVE BEEN INSTALLED IN ACCORDANCE WITH THESE PLANS.

MCDOT GENERAL NOTES

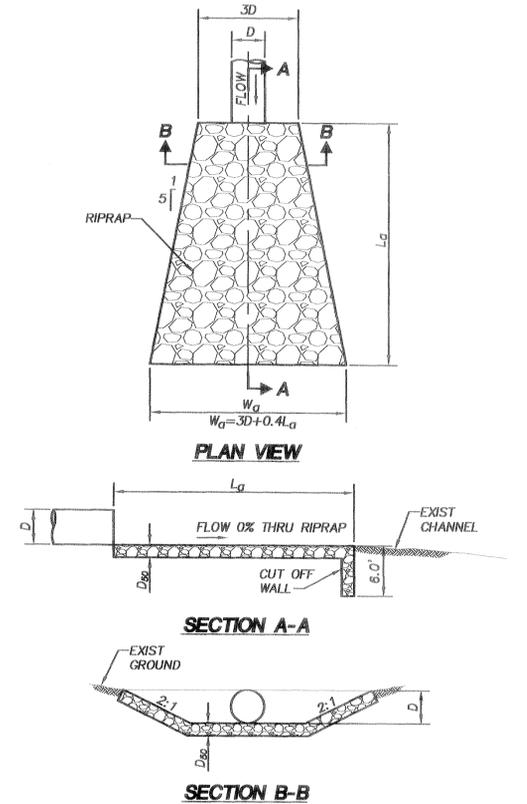
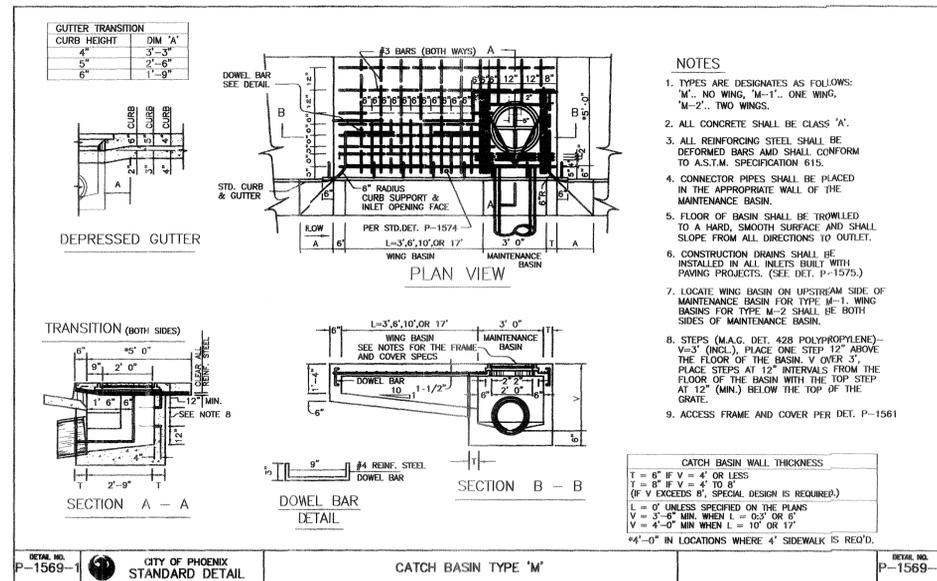
- ALL CONSTRUCTION SHALL CONFORM TO THE LATEST MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION (MCDOT) ROADWAY DESIGN MANUAL AND M.C. SPECIFICATIONS AND MARICOPA COUNTY SPECIAL PROVISIONS FOR CONSTRUCTION OF STREET IMPROVEMENTS.
- CONTRACTOR TO OBTAIN NECESSARY MCDOT PERMITS PRIOR TO CONSTRUCTION WITHIN COUNTY RIGHT-OF-WAY.
- THE ENGINEERING DESIGN ON THESE PLANS ARE ONLY APPROVED BY MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION IN SCOPE AND NOT IN DETAIL. CONSTRUCTION QUANTITIES ON THESE PLANS ARE NOT VERIFIED BY MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION. APPROVAL OF THESE ARE FOR PERMIT PURPOSES ONLY AND SHALL NOT PREVENT MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION FROM REQUIRING CORRECTION OF ERRORS IN THE PLANS WHERE SUCH ERRORS ARE SUBSEQUENTLY FOUND TO BE IN VIOLATION OF ANY LAW, ORDINANCE, HEALTH, SAFETY, OR OTHER DESIGN ISSUES.
- CONTRACTOR SHALL NOTIFY MCDOT INSPECTION DEPARTMENT AT LEAST 24 HOURS IN ADVANCE OF ANY CONSTRUCTION AT (602) 506-8606.
- AN APPROVED SET OF PLANS SHALL BE ON THE SITE DURING CONSTRUCTION AND INSPECTIONS.
- CONTRACTOR PERFORMING CONSTRUCTION OR EXCAVATING OPERATIONS IS RESPONSIBLE FOR LOCATING, RELOCATING, AND/OR PROTECTING ALL UTILITIES IN CONFLICT OR WITHIN THE CLEAR ZONE, AT NO EXPENSE TO MARICOPA COUNTY.
- ALL COMPACTION AND BACKFILL WITH COUNTY RIGHT-OF-WAY SHALL CONFORM TO THE SPECIAL PROVISIONS FOR CONSTRUCTION OF STREET IMPROVEMENTS AND INSTALLATION OF UNDERGROUND UTILITIES. BACKFILL UNDER ANY EXISTING OR PROPOSED PAVEMENT, CURB, GUTTER, OR WITHIN TWO (2') OR LESS FROM THE EDGE OF PAVEMENT SHALL CONSIST OF AGGREGATE BASE COURSE (ABC) MATERIAL.
- ALL STRUCTURES SUCH AS MANHOLES, VALVE BOX & COVERS, AND MONITORING WELLS MUST BE MARKED WITH AT LEAST TWO REFLECTIVE YELLOW FLEX POSTS WHEN STRUCTURES ARE LOCATED OUTSIDE THE TRAVELED WAY AND WITHIN THE RIGHT-OF-WAY. ("APPLIES ONLY WHEN THERE IS NO CURB")
- ALL EXISTING PAVEMENT MARKING, TRAFFIC SIGNS AND SIGNAL EQUIPMENT THAT NEEDS TO BE REMOVED, REPLACED, RELOCATED OR REPAIRED BECAUSE OF CONTRACTOR'S WORK WILL BE DONE BY THE CONTRACTOR AT HIS EXPENSE. ALL TRAFFIC SIGNS THAT ARE REMOVED SHALL BE STOCKPILED ON THE PROJECT SITE AND THE CONTRACTOR IS TO NOTIFY THE INSPECTOR WHEN ALL SIGNS HAVE BEEN REMOVED. ALL NEW STREET NAME SIGNS SHALL BE PROVIDED AND INSTALLED BY PERMITTEE AT NO EXPENSE TO MARICOPA COUNTY.
- PAVEMENT MARKING, SIGNING AND SIGNAL WORK WILL BE INSPECTED AND WILL HAVE TO MEET COUNTY STANDARDS BEFORE RELEASE OF BOND.
- ASPHALT MIX DESIGN SHALL BE SUBMITTED TO MCDOT A MINIMUM OF 48 HOURS PRIOR TO PLACING ANY ASPHALT COURSES. (TRENCH WORK INCLUDED.)
- PRIOR TO CONDUCTING EXCAVATION OPERATIONS, THE CONTRACTOR SHALL OBTAIN FROM THE ARIZONA STATE HISTORICAL PRESERVATION OFFICER (ASHP) (602) 542-4009, RECOMMENDATIONS REGARDING THE NEED FOR CULTURAL RESOURCES (ARCHAEOLOGICAL) CLEARANCE. ALL DISCOVERIES OF HUMAN REMAINS, CULTURAL ARTIFACTS, OR PALEONTOLOGICAL REMAINS SHALL BE REPORTED TO THE ARIZONA STATE MUSEUM AND MCDOT. UPON DISCOVERY, CONTRACTOR SHALL CEASE OPERATIONS IN THE VICINITY OF THE FIND AND PROTECT THE DISCOVERY AREA FROM FURTHER DISTURBANCE UNTIL THE FIND CAN BE PROFESSIONALLY INVESTIGATED BY THE ARIZONA STATE MUSEUM AND MCDOT.
- PRIOR TO MOVING OR DESTROYING PROTECTED PLANT SPECIES, THE CONTRACTOR SHALL FILE A FORMAL NOTICE OF INTENT WITH THE ARIZONA DEPARTMENT OF AGRICULTURE NATIVE PLANTS (602) 524-3292.
- EXCEPT UNDER EMERGENCY CONDITIONS, ROADS SHALL NOT BE CLOSED FOR CONSTRUCTION ACTIVITY UNLESS PRIOR APPROVAL IS OBTAINED FROM THE TRANSPORTATION DIRECTOR OR HIS REPRESENTATIVE.
- ALL BOX CULVERTS CONSTRUCTED IN THE PUBLIC RIGHT-OF-WAY SHALL COMPLY WITH ARIZONA DEPARTMENT OF TRANSPORTATION (ADOT) LATEST DESIGN SPECIFICATIONS AND STANDARDS. MINIMUM CLEAR HEIGHT OF BOX CULVERT SHALL BE 4 FEET.
- PRIOR TO INSTALLATION OF THE BASE COURSE AND WEARING SURFACE, SUBMIT SOIL TEST(S) OF SUB-GRADE AND REVISED PAVEMENT DESIGN/ CALCULATIONS TO THE MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION FOR REVIEW AND APPROVAL.

ENGINEER'S GRADING NOTES:

- (Maricopa County Standards)
- THE CONTRACTOR SHALL MARK AND PRESERVE ALL EXISTING PROPERTY CORNERS AND RIGHTS-OF-WAY MARKERS. ANY PROPERTY CORNER OR RIGHTS-OF-WAY MARKER DISTURBED OR REMOVED BY THE CONTRACTOR'S CLEARING AND/OR GRADING OPERATIONS SHALL BE RE-ESTABLISHED AT THE CONTRACTOR'S SOLE EXPENSE.
 - ALL EARTHWORK SHALL BE IN CONFORMANCE WITH THE GEOTECHNICAL REPORT'S RECOMMENDATIONS, THAT HAS BEEN DEVELOPED FOR THIS PROJECT, AND WITH THE MAG STANDARD SPECIFICATIONS, UNLESS NOTED OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - ALL BUILDING PADS SHALL EXTEND A MINIMUM OF FIVE FEET (5') BEYOND THE EXTERIOR FACE OF THE BUILDING, UNLESS NOTED OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - ALL FINISHED EARTHEN SLOPES SHALL BE AT A RATIO OF FOUR (4) HORIZONTAL TO ONE (1) VERTICAL, OR FLATTER, UNLESS NOTED OTHERWISE IN THESE PLANS OR ELSEWHERE IN THE CONTRACT DOCUMENTS.
 - ALL EARTHWORK WILL BE MEASURED AND PAID FOR BY THE CUBIC YARD IN ACCORDANCE WITH THE FOLLOWING CALCULATION: THE VOLUME OF EARTHWORK FOR MEASUREMENT AND PAYMENT WILL BE THE IN-PLACE VOLUME DIFFERENCE BETWEEN: 1) THE ENTIRE PROJECT'S APPROVED EARTHEN FINISHED GRADE SURFACE; AND 2) THE EXISTING GROUND'S SURFACE BEFORE CONSTRUCTION. BIDDING CONTRACTORS ARE ADVISED TO CONSIDER (PRIOR TO BIDDING THE EARTHWORK COVERED BY THESE PLANS) ALL NECESSARY CLEARING & GRUBBING, ALL NECESSARY GRADING, ALL NECESSARY EXCAVATION, ALL NECESSARY DEMOLITION, ANY NECESSARY BLASTING, ANY POTENTIAL SOIL SUBSIDENCE, ALL REQUIRED OVER-EXCAVATION & RE-COMPACTION, ALL REQUIRED COMPACTION DENSITIES, ANY BUILDING PAD REQUIREMENTS, ANY NEEDED BORROW/IMPORT, AND ANY POTENTIAL EXPORT. THERE WILL BE NO SEPARATE MEASUREMENT NOR PAYMENT FOR ANY OF THESE ITEMS. PRIOR TO EXECUTION OF THE CONTRACT, THE CONTRACTOR AND THE CONTRACTING PARTY ARE TO AGREE TO A RESPONSIBLE PARTY, WHOM IS TO DETERMINE THE CALCULATED VOLUME OF EARTHWORK, AND TO THE METHOD THAT IS TO BE USED BY THE RESPONSIBLE PARTY IN CALCULATING THE VOLUMETRIC DIFFERENCE BETWEEN THE AFOREMENTIONED SURFACES.
 - IF APPROVED BY THE CONSTRUCTION INSPECTOR, ANY EXCESS SOIL MAY BE SPOILED ON-SITE. IF APPROVED, THE CONSTRUCTION INSPECTOR IS TO IDENTIFY THE AREA(S) WHERE THE EXCESS SOIL MAY BE SPOILED. SPOILED EXCESS SOIL IS TO BE COMPACTED PER GEOTECHNICAL ENGINEER'S RECOMMENDATIONS. IN THE ABSENCE OF GEOTECHNICAL ENGINEER'S RECOMMENDATIONS, SPOILED EXCESS SOIL SHALL BE COMPACTED TO 95 PERCENT OF THE SOIL'S MAXIMUM DRY DENSITY, UNLESS APPROVED OTHERWISE BY THE CONSTRUCTION INSPECTOR.
 - STRUCTURAL EXCAVATION IS INCIDENTAL TO THE EARTHWORK OR TO THE STRUCTURAL WORK BEING PERFORMED. THERE IS NO SEPARATE MEASUREMENT NOR PAYMENT FOR STRUCTURAL EXCAVATION.
 - ROADWAY EXCAVATION IS INCIDENTAL TO THE EARTHWORK OR TO THE ROADWAY WORK BEING PERFORMED. THERE IS NO SEPARATE MEASUREMENT NOR PAYMENT FOR ROADWAY EXCAVATION.
 - DRAINAGE EXCAVATION IS INCIDENTAL TO THE EARTHWORK OR TO THE DRAINAGE WORK BEING PERFORMED. THERE IS NO SEPARATE MEASUREMENT NOR PAYMENT FOR DRAINAGE EXCAVATION.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY GENERAL NOTES:

- ALL CONSTRUCTION WITHIN DISTRICT RIGHT-OF-WAY AND/OR JURISDICTION SHALL CONFORM TO THE LATEST MAG SPECIFICATIONS.
- CONTRACTOR TO OBTAIN NECESSARY FLOOD CONTROL DISTRICT PERMIT PRIOR TO CONSTRUCTION WITHIN DISTRICT RIGHT-OF-WAY AND MAINTAIN A COPY OF THE PERMIT ON THE PROJECT SITE AT ALL TIMES.
- NOTIFY THE DISTRICT'S CONSTRUCTION & MAINTENANCE DIVISION AT 602-506-1501 AT LEAST 48 HOURS PRIOR TO ANY WORK TO BE PERFORMED IN THE DISTRICT'S RIGHTS-OF-WAY.
- CONTRACTOR PERFORMING EXCAVATION OPERATIONS IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES.
- ALL COMPACTION AND BACKFILL WITHIN DISTRICT RIGHT-OF-WAY SHALL CONFORM TO THE LATEST MAG SPECIFICATIONS UNLESS OTHERWISE IN THE DISTRICT'S PERMIT.
- ANY DAMAGE TO FCD STRUCTURES, EQUIPMENT, MATERIALS, VEGETATION, AND/OR PROPERTY SHALL BE REPLACED AND/OR REPAIRED IN-KIND TO THE SATISFACTION OF THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY.



STATION	Lg	Wg	D	D ₅₀
604+00	30.18'	66.07'	18.00'	6"
71+80	28.85'	23.54'	4.00'	6"
86+80	98.13'	279.25'	80.00'	14"

CONDUIT OUTLET PROTECTION DETAIL

N.T.S.



DATE:	REVISIONS:

Engineering - Planning - Surveying
 Professional - Urban Design
 Office Address: Tucson, Phoenix,
 and Las Vegas, NV
 333 E. Osborn, Suite 350, Phoenix, AZ
 PH: (602) 278-1016
 850 E.



RANCHO CABRILLO
 PHASE II - HAPPY VALLEY ROAD
 OFFSITE PAVING AND GRADING PLANS
 GENERAL NOTES AND DETAILS



DESIGNED BY: PAC
 DRAWN BY: RLD
 CHECK BY: RGS
 DATE: JANUARY, 2004
 BY: C.A. REVIEW
 DATE:

PROJECT NO.
 202017X-A-001

SHEET 3 OF 10