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CAMELBACK ROAD CHANNEL

Litchfield Road to Agua Fria River

CONCEPT DESIGN REPORT

(100-Year, 24-Hour and 5-Year, 24-Hour Interim)

Prepared for:

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

October 21, 1993

Prepared by:

THE WLB GROUP, INC.

333 East Osborn, Suite 380

Phoenix, Arizona 85012

(602) 279-1016

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REGISTERED PROFESSIONAL ENGINEER (CIVIL)
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MARK T.
GAVAN
Date signed 11-5-93
ARIZONA, U.S.A.

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Date Signed 1-5-93
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I. EXECUTIVE SUMMARY

The purpose of this study is twofold. The first objective was to compare the cost of building a 100-year channel along Camelback Road from Litchfield Road to the Agua Fria River versus the Colter Channel alignment (¼ mile north of Camelback Road) that was previously designed for the Maricopa County Department of Transportation (MCDOT) and the Flood Control District of Maricopa County (FCDMC). The second objective was to analyze a 5-year interim channel design that will provide a 100-year level of protection in the future condition when the Colter channel is in place and the entire watershed for the 1/4 mile between Colter Channel and Camelback Road is fully developed. This channel is referred to as the 5-year interim channel because it will provide a 5-year level of protection in the interim time after the Colter Channel is constructed and before the watershed is developed. The level of protection is assumed to increase in the future because of the County requirement that any new development will provide stormwater retention for the 100-year runoff.

The following is a summary of the cost estimates. The estimate for the 100-year Camelback Channel does not include any costs associated with the undesirable safety, aesthetic and maintenance issues related to locating a major drainage channel along a high volume road of regional significance, such as, Camelback Road. These issues are difficult to place a value on; especially public safety. With this in mind, it is clear that a thorough evaluation of the alternatives requires consideration of a number of issues beyond just costs.

Channel Alternative	Cost Estimate
100-YEAR CAMELBACK CHANNEL (Without Colter Channel)	$4,060,000
100-YEAR COLTER CHANNEL (Developed Previously for MCDOT and FCDMC)	$3,113,900
5-YEAR INTERIM CAMELBACK CHANNEL (With Colter Channel in Place)	$ 739,800

It should be noted that these costs are not directly comparable because the two 100-year channel designs were based on somewhat different design criteria. The following paragraphs describe the differences in the design assumptions:

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1. Freeboard requirements differ for each alternative. The Colter Channel was designed with a minimum freeboard of 1 foot and also with extra capacity (in addition to the one foot of freeboard) to convey the increased runoff that will result from future development in the contributing drainage area. This extra capacity is being provided so that the property owners will not have to provide stormwater retention when they develop their property. In return, the property owners are donating right of way for the construction of the Colter Channel. The 100-year Camelback Channel has no freeboard. The channel is only required to keep one travel lane dry on the north side of the future Camelback Road during the 100-year storm event. There is no allowance for increased flows from future development. Freeboard for the 5-year interim design is a minimum of 0.5 feet within the channel. The freeboard requirements for the two Camelback Channel alternatives were given by MCDOT.

2. The cost estimate for the 100-year Colter Channel includes bridges at Dysart Road and at El Mirage Road, as requested by MCDOT. The 100-year Camelback Channel design incorporates box culverts at these roadway crossings (MCDOT requested the use of culverts because of the close proximity to the major intersections on Camelback Road). The bridge costs are higher than the culvert costs.

3. Fence costs are included for the Colter Channel design as required by FCDMC. Fence costs are also included in the 100-year Camelback Channel design on the north side of the channel and guardrail is included along the south side (adjacent to Camelback Road) in certain areas as needed to meet clear zone requirements.

4. Channel geometry and associated excavation costs are also different for each alternative. The Colter Channel has 6:1 side slopes on both sides and a larger bottom width to provide a greater conveyance capacity that allows future development to occur without providing stormwater retention (see item 1). The Camelback Channel has a 4:1 side slope on the north side and a 6:1 side slope on the south side adjacent to Camelback Road. The Camelback Channel was designed with a minimum channel bottom that does not provide any extra capacity for future development. In addition, the Colter Channel alignment is longer than the Camelback Channel alignment.

5. Driveway crossings are a significant cost factor. In the case of Colter Channel there are no existing driveways for which culverts are required. The Camelback Channel, on the other hand, requires numerous culverts to provide access for existing driveways.

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6. Both the 100-year Colter Channel and 100-year Camelback Channel designs incorporate a concrete valley gutter from El Mirage Road to the outfall in the Agua Fria River. However, due to the location of the outfall, the Camelback Channel has a considerably shorter length of valley gutter.

7. Right of way costs for each channel location are significantly different because of the higher cost associated with obtaining right of way along Camelback Road versus the Colter alignment and, as described above, much of the right of way for the Colter Channel will be donated. The Camelback Channel alignment requires the acquisition of the existing Tierra Buena subdivision lots and residences north of Camelback Road.

The following tables provide an item by item comparison of the cost for each channel design. Severance damages are included in the right of way costs for the 100-year Camelback Channel, 100-year Colter Channel, and the 5-year interim Camelback Channel designs to provide driveway crossings for future access.

COST COMPARISONS OF
100-YEAR CAMELBACK CHANNEL (WITHOUT COLTER CHANNEL)
VS.
100-YEAR COLTER CHANNEL

COST COMPARISONS		
Description	Camelback Channel (100-Year Without Colter Channel)	Colter Channel 100-Year [1]
Channel Excavation	262,680 C.Y. $394,000	284,310 C.Y. $426,500
Grouted Riprap	2,540 C.Y. $127,000	370 C.Y. $18,500
Drop Structures	9 Total $150,100	5 Total $192,800
Guardrail & Fence (Camelback) Wire Fence (Colter)	$125,200	$165,000
Access/Maintenance Roads/ Bridge Approaches	$60,300	$364,000
Valley Gutter	$101,500	$170,000
Side Weir Inflow Spillways	Assume Same as Colter $83,000	$83,900
El Mirage Road & Dysart Road Crossings Camelback - Box Culverts Colter - Bridges	$247,500	$770,000
Driveway Crossings & Airline Canal	$563,100	(Airline Canal Only) $44,000
Embankment Spillways	20 Each $30,000	8 Each $12,000
20% Contingencies - (Camelback) Miscellaneous[2] - (Colter)	$389,300	$302,200
Mobilization & Permits	$65,000	$65,000
Right of Way (Including Severance Damages)	$1,724,000	$500,000[3]
TOTAL COST	$4,060,000[4]	$3,113,900[4]

1 Colter Channel Cost Estimates and Design Plans were compiled by CRSS, Inc. for FCDMC.

2 Cost Estimates for Colter Channel are final bid estimates with no cost for contingencies.

3 Some of the right of way for Colter Channel will be donated and in return the County will upsize the capacity of the channel to allow the doner's to develop without providing stormwater retention.

4 Does not include landscaping costs.

Note: Cost for Colter Channel plus 5-year interim Camelback Channel is $3,853,200.

COST COMPARISONS OF
100-YEAR CAMELBACK CHANNEL (WITHOUT COLTER CHANNEL)
VS.
5-YEAR INTERIM CAMELBACK CHANNEL (WITH COLTER CHANNEL IN PLACE)

COST COMPARISONS		
Description	100-Year Camelback Channel Design (Without Colter Channel)	5-Year Interim Camelback Channel Design (With Colter Channel)
Channel Excavation	262,680 C.Y. $394,000	46,050 C.Y. $74,000
Drop Structures	9 Total $150,100	8 Total $30,650
Grouted Riprap	2,540 C.Y. $127,000	875 C.Y. $43,800
Wire Fence & Guardrail	$125,200	Not Required
Culvert Crossings	$810,600	$141,550
Maintenance Road	$60,300	Not Required
Valley Gutter	$101,500	Not Required
Side Wier Inflow Spillways	$83,000	Not Required
Embankment Spillways	20 Each $30,000	40 Each $60,000
20% Contingencies	$389,300	$70,000
Right of Way (Including Severance Damages)	$1,724,000	$274,800 (Without Subdivision Lots)
Mobilization & Permits	$65,000	$45,000
TOTAL COST	$4,060,000	$739,800

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II. INTRODUCTION

The WLB Group, Inc. was directed by the Flood Control District of Maricopa County (FCDMC), as requested by the Maricopa County Department of Transportation (MCDOT), to prepare conceptual plans and cost estimates for a drainage channel along the north side of Camelback Road from Litchfield Road to the Agua Fria River. The WLB Group had previously prepared concept plans and a report for a 10-year, 24-hour channel design assuming that the Colter Channel is in place 1/4 mile north of Camelback Road. That report is entitled "Preliminary Channel Design Report for Camelback Road Channel", dated April 13, 1993.

This study is an extension of that previous report and its purpose is to evaluate two additional alternatives for the Camelback Channel. The two additional alternatives include a channel design for the 100-year, 24-hour design storm assuming that Colter Channel would not be built; and a design for the future 10-year, 24-hour storm which assumes that Colter Channel is constructed and the area between Colter Channel and Camelback Road is in a fully developed future condition. This scenario assumes that runoff will be retained on future development for the 100-year, 2-hour storm (2.64 inches) per Maricopa County requirements.

In addition, two other interim design storms (the 2-year, 24-hour and 5-year, 24-hour events) were computed to compare the level of protection that the future 10-year, 24-hour channel design storm would provide under current conditions. Subsequently, after review by the Maricopa County Department of Transportation, the 5-year, 24-hour interim design storm was selected for the preparation of preliminary design plans and cost estimates. This storm was selected because it provided a greater amount of protection compared to the future 10-year design storm. These design storms will be discussed in greater detail later in this report.

III. EXISTING AND PROPOSED CONDITIONS

The existing drainage area consists predominantly of desert vegetation with a few pockets of agricultural and residential land.

Rainfall runoff flows from north to south where it is intercepted along Camelback Road. Presently a small channel conveys these flows along the north side of Camelback Road from Litchfield Road to Dysart Road, then in a median channel from Dysart Road to the Airline Canal, then along the north side of

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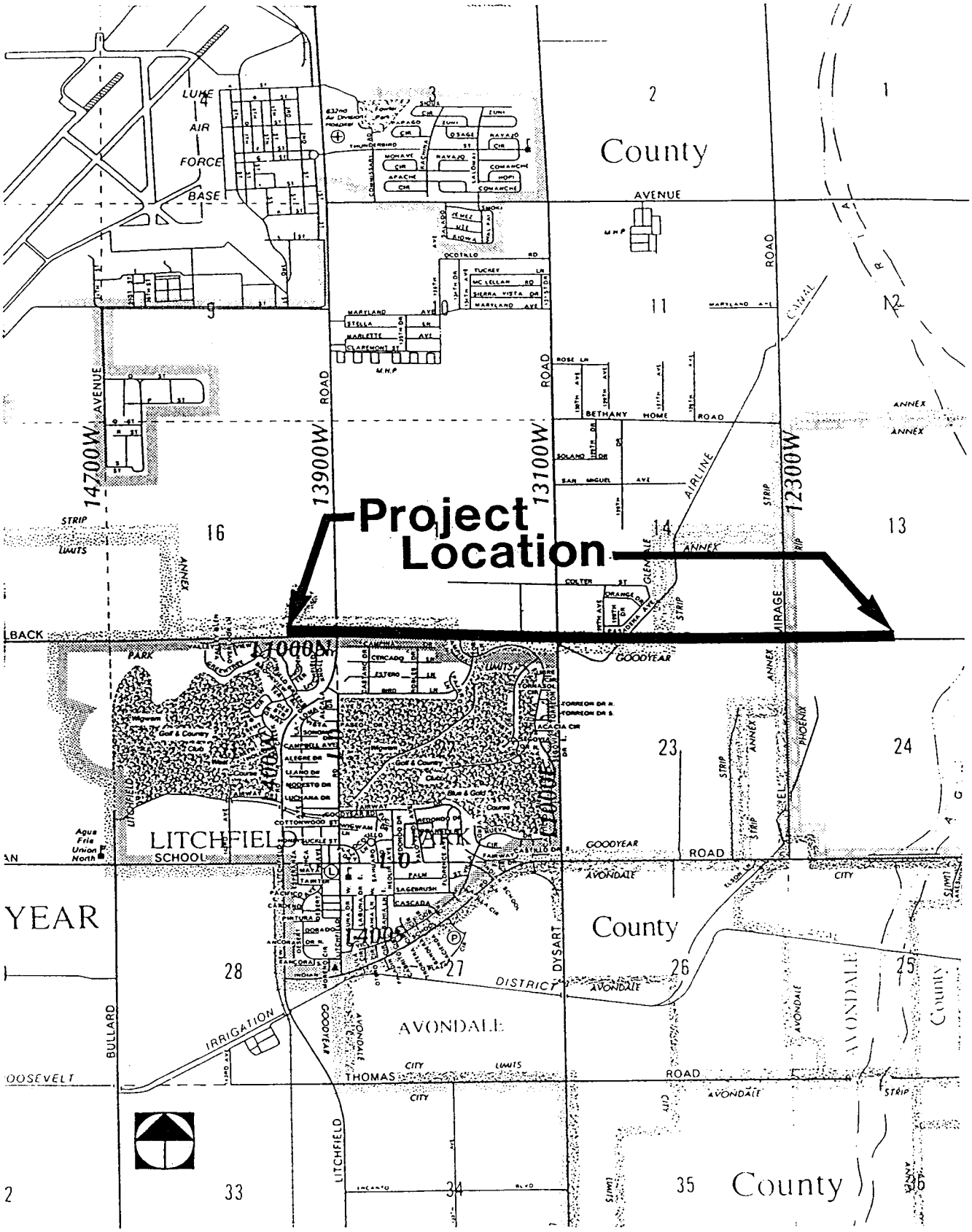
Camelback Road to an existing 8′ x 8′ box culvert outlet 1/2 mile east of El Mirage Road. The capacity of this channel is minimal, and once it is exceeded, runoff will cross over Camelback Road and flow to the south. This causes flooding within the City of Litchfield Park and along Dysart Road south of Camelback Road.

Recently, design work on a 100-year channel was completed for FCDMC and MCDOT along an alignment of approximately Colter Road. Colter Channel, as it has been named, is located approximately 1/4 mile north of Camelback Road and will convey 100-year storm water flows from Litchfield Road east to the Agua Fria River. This channel will intercept a major portion of the flows that would otherwise reach Camelback Road, including outlet flows from the recently constructed Litchfield Park Detention Facility. This channel will significantly reduce the drainage area that contributes runoff to Camelback Road.



LOCATION MAP

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IV. DESIGN ASSUMPTIONS

The following design assumptions were made with respect to the Camelback Road Channel.

100-YEAR, 24-HOUR DESIGN - NO COLTER CHANNEL

A. The channel and associated drainage structures are sized to convey the runoff from the 100-year storm as directed by the Maricopa County Department of Transportation.

B. The channel location will accommodate the ultimate build out of Camelback Road. The future build out requires three full lanes with curb and sidewalk on the north side (see the following typical cross section).

C. Guardrail is included in the cost estimate for the 100-year channel design. The guardrail should not be required in the ultimate roadway configuration which includes curb and gutter. However, in the interim, before the ultimate roadway section is constructed, guardrail may be necessary to protect motorist from colliding with the culvert headwalls. The interim roadway section, which will be constructed at the same time as the channel, will include the median but only 39 feet of pavement and no curb and gutter.

D. Assume that the roadway centerline for the future buildout condition is 4 feet north of the monument line. This is the proposed roadway location from Litchfield Road to Dysart Road. The existing roadway east of El Mirage Road will stay essentially the same with no median. The above assumption will require that seven Tierra Buena subdivision lots east of 129th Avenue will have to be taken for right of way purposes. Four of these lots have houses located on them. An offset roadway alignment at this location (which is possible and could significantly reduce right of way costs) should be analyzed with the roadway design.

E. The Airline Canal siphon will need to be rebuilt and lowered based on the projected channel profile.

F. Stormwater flows will be directed south, across Camelback Road, at the location of the existing 8′ x 8′ box culvert; 2500′ east of El Mirage Road. Three additional 8′ x 8′ box culverts will be required at this location.

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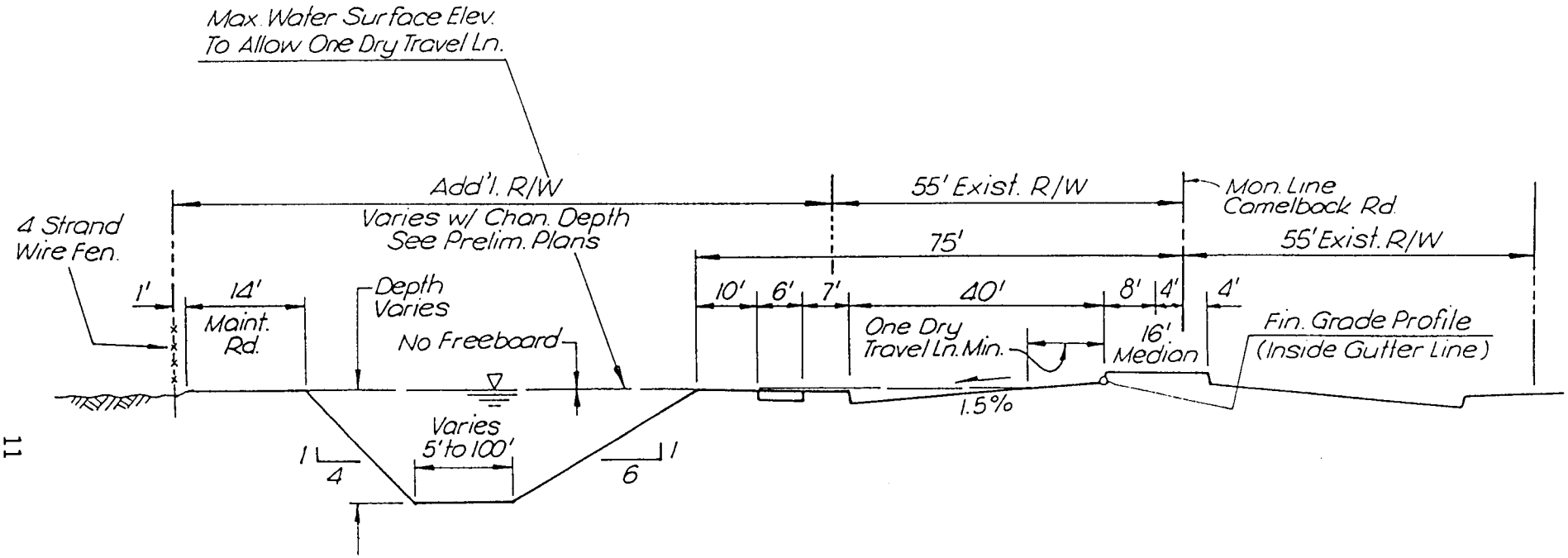
G. Stormwater flows for the 100-year event will be allowed to exceed the channel capacity and inundate the two north lanes of the ultimate Camelback Roadway section; leaving one dry travel lane as directed by Maricopa County Department of Transportation.

H. The required channel capacity is based on the assumption that the Colter Channel will not be built.

I. Culverts will be provided at existing driveway entrances and at major mile crossings.

J. The proposed centerline profile of Camelback Road was taken from the preliminary plans for Camelback Road by Cella Barr Associates, dated June 19, 1985.



100-YEAR, 24-HOUR DESIGN

TYPICAL CROSS SECTION

(Looking East)

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5-YEAR, 24-HOUR INTERIM DESIGN WITH COLTER CHANNEL IN PLACE

A. The channel and associated drainage structures are sized to convey the runoff from the 5-year interim storm as directed by the Maricopa County Department of Transportation.

B. The channel location will accommodate the ultimate build out of Camelback Road. The future build out requires three full lanes with curb and sidewalk on the north side (see the following typical cross section).

C. Assume that the roadway centerline for the future buildout condition is 4 feet north of the monument line. This is the proposed roadway location from Litchfield Road to Dysart Road. The existing roadway east of El Mirage Road will stay essentially the same with no median. The above assumption will require that the three Tierra Buena subdivision lots east of 129th Avenue will have to be taken for right of way purposes unless the roadway alignment can be shifted south to miss these lots. Roadway geometrics and design speed criteria will determine if this is feasible. Cost estimates for the 5-year interim design assume the roadway can be shifted south so the channel will not disturb this subdivision.

D. The Airline Canal siphon will need to be rebuilt and lowered, based on the projected channel profile.

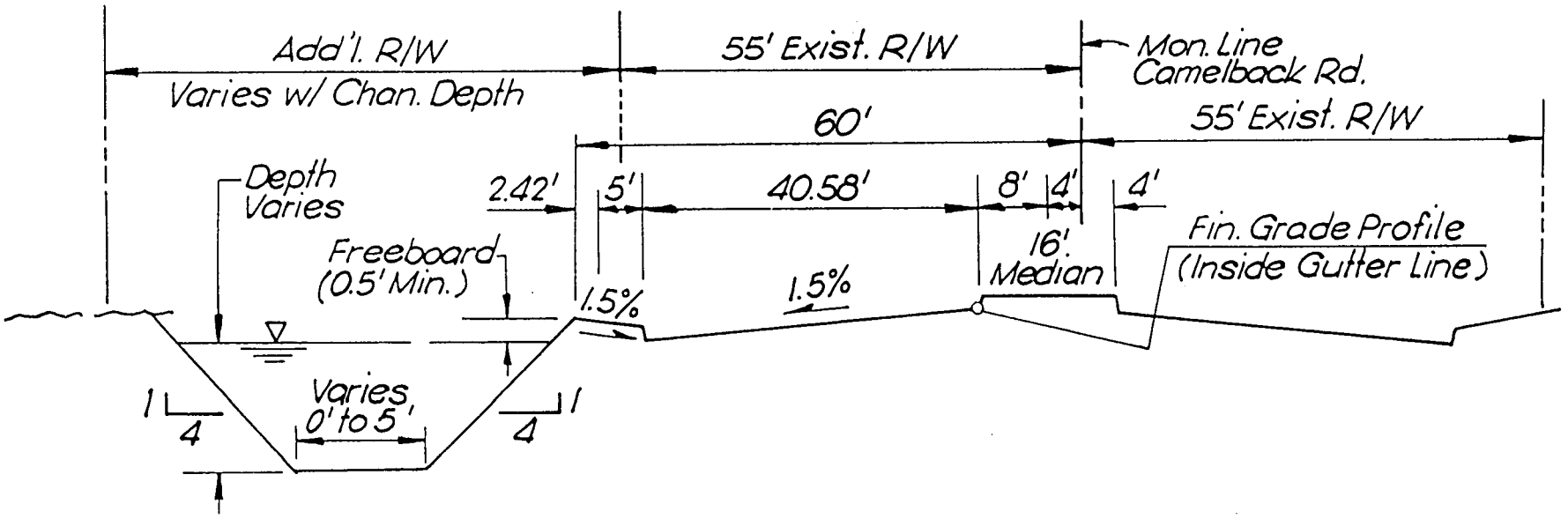
E. The existing 8′ x 8′ box culvert under Camelback Road, 2500′ east of El Mirage Road, will serve as the channel outlet.

F. The channel design for the 5-year event will incorporate a minimum of 0.5′ of freeboard within the channel as directed by the Maricopa County Department of Transportation.

G. The 5-Year channel design is based on the assumption that the Colter Channel will be built 1/4 mile north of Camelback Road and will collect flows from the 100-year storm event.

H. Culverts will be provided at existing driveway entrances and at major mile crossings.

I. The proposed centerline profile of Camelback Road was taken from the preliminary plans for Camelback Road by Cella Barr Associates, dated June 19, 1985.



5-YEAR, 24-HOUR INTERIM DESIGN

TYPICAL CROSS SECTION

(Looking East)

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V. HYDROLOGIC MODELING

The HEC-1 rainfall runoff model was utilized to compute peak discharges at various points of concentration along Camelback Road. Hydrologic base data for this model was created utilizing portions of the HEC-1 model created for the White Tanks/Agua Fria Area Drainage Master Study along with criteria set forth in the Hydrologic Design Manual for Maricopa County.

Subbasin runoff was computed using Green-Ampt soil loss rate parameters. The Phoenix Valley S-Graph was incorporated to calculate unit hydrographs for the 100-year, 2-year interim, and 5-year interim design storms. The Clark unit hydrograph was used to calculate peak discharges for the 10-year future developed condition model. The rainfall distribution pattern is the SCS Type II which is based on a 24-hour storm event. Rainfall data was computed using the Maricopa County Hydrology Manual. The following table shows the precipitation values in inches computed for storms of various duration and frequency.

Point Values
Return Period

FREQUENCY

DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	
5-Min	.33	.42	.49	.58	.65	.72	.89	5-Min
10-Min	.49	.64	.74	.88	.99	1.11	1.36	10-Min
15-Min	.59	.80	.93	1.12	1.27	1.42	1.76	15-Min
30-Min	.79	1.06	1.25	1.52	1.72	1.92	2.39	30-Min
1-Hr	.96	1.31	1.56	1.89	2.15	2.40	3.00	1-Hr
2-Hr	1.04	1.44	1.70	2.07	2.36	2.64	3.30	2-Hr
3-Hr	1.10	1.52	1.80	2.19	2.50	2.80	3.50	3-Hr
6-Hr	1.20	1.67	1.99	2.43	2.76	3.10	3.88	6-Hr
12-Hr	1.30	1.84	2.20	2.69	3.07	3.45	4.33	12-Hr
24-Hr	1.40	2.00	2.40	2.95	3.38	3.80	4.78	24-Hr

Point rainfall was reduced for each storm event utilizing data from the NOAA Atlas II. Normally the rainfall reduction is based on drainage area size. However, because the shape of the watershed is long and narrow, the reduction was based on a circular storm pattern with its diameter equal to the length of the watershed in the 2-year interim, 5-year interim, and 10-year future storm events. A circular pattern of areal reduction was also utilized for the 100-year storm event even though the contributing area is not as linear as the other scenarios.

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The HEC-1 models developed for this study utilize the JD card option in order to calculate the peak discharge at each point of concentration along the channel alignment. The rainfall depth recorded on the JD cards corresponds to a circular storm pattern and not the drainage area size. For example, the 5-year interim, 24-hour HEC-1 model has a JD card with a rainfall depth of 1.979 inches and a total contributing watershed of 0.85 square miles. The 1.979 inches corresponds to an area of 6.18 square miles which is an equivalent circular storm area.

The following table presents the rainfall reductions used in the HEC-1 models.

24-HOUR POINT RAINFALL REDUCTION BASED ON DEPTH-AREA CURVES FROM NOAA

ATLAS II, PRECIPITATION-FREQUENCY ATLAS OF THE WESTERN UNITED STATES, VOLUME III - ARIZONA

Area (Sq. Mile)	Percent of Point Precipitation
0.01	100%
1.0	100%
5.0	99.1%
10.0	98.5%

24-Hour Point-Rainfall Reduction Based on Circular Storm Patterns

Concen-tration Point	Circular Footprint Area (Sq. Mi.)	Watershed Area (Sq. Mi.)	Percent of Point Precip. (%)	RAINFALL (INCHES)			
				2-Year	5-Year	10-Year	100-Year
242A	0.11	0.11	100%	1.40	2.00	2.40	3.80
500	0.27	0.27	100%	1.40	2.00	2.40	3.80
503	1.29	0.45	99.93%	1.399	1.998	2.398	3.797
506	2.50	0.59	99.66%	1.395	1.993	2.392	3.787
508	4.10	0.72	99.30%	1.390	1.986	2.383	3.773
510	6.18	0.85	98.96%	1.385	1.979	2.375	3.760

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As mentioned previously in the introduction, this study concentrates on channel designs for the 100-year, 24-hour storm event without Colter Channel and the 10-year, 24-hour future conditions scenario with Colter Channel. In addition, a 2-year, 24-hour and 5-year, 24-hour existing conditions model was run to ascertain the level of service provided by the future 10-year scenario. To this end, the 10-year future hydrologic model was set up assuming future developed conditions in the watershed area between the proposed Colter Channel and Camelback Road. The Drainage Area Map for the 10-year future HEC-1 model at the back of this report shows the contributing drainage areas numbered 1 - 23. The assumption was made that the 100-year, 2-hour rainfall event (2.64 inches) would be retained on the developed areas, except for any existing developments, as per current Maricopa County retention requirements. The 10-year, 24-hour storm is 2.40 inches and, therefore, the only contributions in the watershed would be from existing and proposed mile, 1/2 mile, and 1/4 mile streets running north-south; from Camelback Road itself; and also from the existing Tierra Buena subdivision located east of 129th Avenue and north of Camelback Road.

Peak discharges for each of these models are presented on the following page and based upon review by the Maricopa County Department of Transportation, the 100-year, 24-hour event (without Colter Channel) and the 5-year, 24-hour existing conditions model (with Colter Channel) were selected for preparation of preliminary plans and cost estimates.

The 5-year, 24-hour interim model was chosen because it results in slightly higher flows than the 10-year future conditions model and MCDOT chose to provide a minimum of a 5-year level of protection.

The following summary of discharges table shows peak discharges for each storm event at pertinent points of concentration along Camelback Road. Drainage Area Maps are located at the back of this report and a floppy disk containing HEC-1 runs for each scenario are located in a plastic sleeve affixed to the back cover of this report.

CAMELBACK ROAD CHANNEL DISCHARGES (CFS)

POINTS OF CONCENTRATION		LOCATION	WITH COLTER CHANNEL IN PLACE				WITHOUT COLTER CHANNEL
Existing Condition	10-Year Future		2-YEAR INTERIM* (Existing Conditions)	5-YEAR INTERIM* (Existing Conditions)	10-YEAR FUTURE** (Future Conditions)	10-YEAR INTERIM* PREVIOUS STUDY (Existing Conditions)	100-YEAR (Existing Conditions)
CP242 A	(CP1)	Litchfield Road	5	36	4	59	137
CP500	(CP6)	1/2 Mile East of Litchfield Road	5	71	16	127	350
CP501	(CP7)	Driveway Entrance 1800' West of Dysart Road	5	86	18	157	745
CP502	(CP10)	Driveway Entrance 600' West of Dysart Road	5	99	22	184	829
CP503	(CP12)	Dysart Road	6	102	25	192	1067
CP504	(CP13)	129th Avenue	6	105	27	207	1102
CP505	(CP14)	Airline Canal	7	111	37	223	1303
CP506	(CP15)	2580' West of El Mirage Road	8	110	39	222	1296
CP507	(CP17)	1700' West of El Mirage Road	23	136	41	255	1349
CP508	(CP20)	El Mirage Road	35	161	45	294	1469
CP509	(CP22)	1350' East of El Mirage Road	33	157	47	287	1439
CP510	(CP23)	Driveway Entrance 1/2 Mile East of El Mirage Road	31	152	48	284	1726

Note:
* Existing conditions models with proposed Colter Channel in place.
** Future conditions model with proposed Colter Channel in place (100-Year, 2-Hour retention is assumed on future developed areas).

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VI. HYDRAULIC MODELING

Camelback Road Channel was modeled by utilizing the computer routine Standard Step Water Surface Profiles for Trapezoidal Channels by Dodson and Associates. Drainage culverts were modeled with the HY-8 Culvert Analysis computer program provided by the Federal Highway Administration. Peak discharges based on the 100-year, 24-hour storm without Colter Channel and the 5-year interim design storm with Colter Channel were used to design the Camelback Channel for each alternative.

Water surface elevations were computed by running the backwater analysis between drainage structures. The culvert analysis program was utilized to calculate the headwater on the upstream side of the culvert using the known tailwater elevation provided by the backwater analysis. This headwater elevation was then input as the starting water surface elevation for the backwater analysis which was then run to the next upstream drainage structure.

Many iterations were performed to determine the optimum channel slopes and drainage structure sizes. Also, the intent was to keep velocities around 5 ft/sec. or less and within a subcritical flow regime. This is one purpose for the drop structures at various locations. The second purpose of these drop structures is to minimize the channel depth thus reducing right of way requirements.

Freeboard requirements for the 5-year interim channel are a minimum of 0.5 feet and the 100-year design channel has a requirement of one dry travel lane for the future roadway configuration. These freeboard requirements were defined by the Maricopa County Department of Transportation.

Locations of the drainage structures, drop structures, and channel sizes are shown on the preliminary plan and profile sheets for each case (Appendix B). The culvert analyses and backwater analyses are located in Appendix A.

It should be pointed out that hydraulic analysis for the 100-year channel design is based on a channel cross section with 4:1 side slopes on both sides. However, the final proposed cross section has a 4:1 side slope on the north side and a 6:1 side slope on the south side. Therefore the channel, as shown in the preliminary plan, will have a little more freeboard than what is presented in the channel design summary sheet on page 30.

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VII. CHANNEL DESIGN RECOMMENDATIONS

The following recommendations are suggested for each channel design along Camelback Road. Reach by reach descriptions are given starting at the existing 8′ x 8′ box culvert under Camelback Road. This structure will serve as the outfall for the channel. The descriptions continue upstream to the channel termination at the high point west of Litchfield Road.

Right of way requirements throughout this project are based on the future build out of Camelback Road which includes a 16′ median, 3 traffic lanes each way with curb and gutter (the travel lanes each way have a 40′ width), a 6 foot sidewalk, and 17′ of landscaped area between the curb and the top of channel. These dimensions, along with the channel width requirements, will determine the future right of way widths for this project (see previous typical section). For ease of determining right of way for this project, it is assumed that the construction centerline is offset 4 feet to the north of the monument line from Litchfield Road to El Mirage Road, thus making the future roadway requirement approximately 75 total feet north of the monument line. No roadway changes are foreseen west of Litchfield Road which basically follows the existing preliminary roadway plans. The existing roadway configuration will also stay the same east of El Mirage Road. This particular alignment assumes that the seven Tierra Buena subdivision lots east of 129th Avenue will have to be acquired for the 100-year channel design and the cost estimates take this into account. However, it may be possible to shift the alignment south to miss four of the subdivision lots. In the case of the 5-year interim channel cost estimate, it was assumed that the alignment could be shifted to entirely miss the subdivision.

It is foreseen that many elements of these preliminary designs may change once the final roadway alignment location has been established. However, basic channel configurations and structural drainage elements should remain relatively unchanged for each alternative.

A table of right of way requirements for each project is shown at the end of this section. Stations, based on the preliminary roadway plans by Cella Barr Associates, have been extended east of El Mirage Road to pick up the remainder of the channel that reaches to the existing 8′ x 8′ box culvert outlet under Camelback Road.

Proposed Structures Tables and Channel Design Tables are also included at the end of this section for each scenario. These tables give pertinent design information in a tabular form for ease of review.

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100-YEAR CHANNEL DESIGN

A. **STA 130+16 TO STA 137+06**
FROM 4 - 8′ X 8′ BOX CULVERT OUTLET UNDER CAMELBACK ROAD TO 8 - 8′ X 4′ BOX CULVERTS 210 FEET UPSTREAM (2275′ EAST OF EL MIRAGE ROAD).

The existing 3′ drop inlet structure will need to be removed which will lower the proposed channel bottom to the invert of the box culvert at elevation 1013.96. The three additional box culverts will be built west and adjacent to the existing 8′ x 8′ box culvert.

The 8 - 8′ x 4′ box culverts have a length of 36 feet with an outlet invert elevation of 1014.48 and an inlet invert elevation of 1014.67. The culvert slope is 0.2470%

The channel elements in this reach are a 100 foot bottom width; 4:1 and 6:1 side slopes, and a channel slope of 0.2470%

The right of way required in this section, north of the monument line, is 280 feet. The existing right of way north of the monument line is 85 feet.

B. **STA 136+70 TO STA 127+74**
FROM 8 - 8′ X 8′ BOX CULVERTS (2275′ EAST OF EL MIRAGE ROAD) TO 8 - 8′ X 4′ BOX CULVERTS 1142′ UPSTREAM FROM THE OUTLET UNDER CAMELBACK ROAD (1340′ EAST OF EL MIRAGE ROAD).

The channel elements in this reach are a 100 foot bottom width; 4:1 and 6:1 side slopes, and a channel slope of 0.2470%

The outlet invert elevation of the upstream 8 - 8′ x 4′ box culverts is 1016.78 and the inlet invert elevation is 1016.87.

Right of way required in this reach is 280 feet and the existing right of way is 85′ north of the monument line.

C. **STA 127+38 TO STA 114+71**
FROM 8 - 8′ X 4′ BOX CULVERTS (1340′ EAST OF EL MIRAGE ROAD) TO THE OUTLET OF 5 - 8′ X 4′ BOX CULVERTS UNDER EL MIRAGE ROAD.

Channel dimensions are a 100 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.2470%

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The 5 - 8′ x 4′ box culverts are 110 feet long with an outlet elevation of 1020.00 and an inlet elevation of 1020.55. The box culvert slope is 0.4400%

Required right of way in this reach is 260 feet and the existing right of way is 85 feet in this area.

D. **STA 113+46 TO STA 107+00**
FROM 2 FOOT DROP INLET UPSTREAM OF 5 - 8′ X 4′ BOX CULVERTS UNDER EL MIRAGE ROAD TO 3 FOOT DROP STRUCTURE (716 FEET WEST OF EL MIRAGE ROAD).

Channel elements in this reach are a 100 foot bottom width; 4:1 and 6:1 side slopes; and a channel slope of 0.2570%. The elevation at the top of the 2 foot drop inlet is 1022.02 and the elevation at the bottom of the 3 foot drop structure is 1024.28.

Right of way required on the north side of Camelback in this reach is 260 feet. Existing right of way is 55 feet and increases to 65 feet from 260 feet west of El Mirage Road to El Mirage Road.

E. **STA 107+00 TO STA 101+00**
FROM 3 FOOT DROP STRUCTURE TO 2 FOOT DROP STRUCTURE 1316 FEET WEST OF EL MIRAGE ROAD.

Channel elements are a 100 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.2000%.

The bottom invert of the 2 foot drop structure is 1028.48 and the top of the structure has an invert elevation of 1030.48.

Right of way required in this reach, north of Camelback Road, is 260 feet. Existing right of way in this reach is 55 feet.

F. **STA 101+00 TO STA 88+44**
FROM 2 FOOT DROP STRUCTURE TO 5 - 8′ X 5′ BOX CULVERTS (2572′ WEST OF EL MIRAGE ROAD).

Channel elements are a 100 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.1450%.

The 5 - 8′ x 5′ box culverts are 40 feet long and have an outlet elevation of 1032.30 and an inlet elevation of 1032.36.

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Right of way required in this reach is 260 feet and the existing right of way is 55 feet.

G. **STA 88+04 TO STA 85+88**
FROM 5 - 8′ X 5′ BOX CULVERTS 2572 FEET WEST OF EL MIRAGE ROAD TO 5 - 8′ X 5′ BOX CULVERTS 2828 FEET WEST OF EL MIRAGE ROAD. (FIRST DRIVEWAY EAST OF AIRLINE CANAL.)

Channel elements are a 60 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.1450%.

The 5 - 8′ x 5′ box culverts at the upstream driveway are 40 feet long with an outlet elevation of 1032.67 and an inlet elevation of 1032.73. The culvert slopes are the same as the channel slope.

Right of way required in this reach, north of Camelback Road, tapers from 260 feet to 225 feet. Existing right of way is 55 feet.

H. **STA 85+48 TO STA 78+23**
FROM 5 - 8′ X 5′ BOX CULVERTS (2828 FEET WEST OF EL MIRAGE ROAD) TO 5 - 8′ X 5′ BOX CULVERTS OVER THE AIRLINE CANAL.

The channel elements in this reach are a 40 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.1450%.

The 5 - 8′ x 5′ box culverts at the Airline Canal are 60 feet long and will cross over the top of the siphon for the Airline Canal. It may be necessary to put in a new siphon as the elevation of the culverts and channel depth may be too close to the top of the existing siphon. The cost estimates include the cost to relocate the siphon. The outlet elevation of the culverts is 1033.77 and the inlet elevation is 1033.86. The culvert slope is 0.1450%, the same as the channel.

Right of way required in this reach is 225 feet. Existing right of way on the north side is 55 feet.

I. **STA 77+63 TO STA 73+64**
FROM 5 - 8′ X 5′ BOX CULVERTS OVER THE AIRLINE CANAL TO 5 - 8′ X 5′ BOX CULVERTS UNDER 129TH AVENUE.

The channel elements are a 40 foot bottom width; 4:1 and 6:1 side slopes; and a channel slope of 0.1450%

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The 5 - 8′ x 5′ box culverts under 129th Avenue are 60 feet long with an outlet elevation of 1034.44 and an inlet elevation of 1034.53.

Right of way requirements include the acquisition of seven Tierra Buena subdivision lots (approximately 235 feet). Existing right of way is 55 feet.

The Tierra Buena subdivision lots represent a major right of way acquisition for this project. There are seven lots affected (refer to the preliminary plan and profile for the location of the lots). The southern 3 lots (lots 35 - 37) are required in their entirety. Only one of the lots has a house on it. The other two are undeveloped. In the case of the northern 4 lots (lots 38 - 41), only the south 35 feet is required which does not affect the housing structures themselves but does take almost the entire backyard. For that reason, these 4 lots were treated as total takes for purposes of right of way cost estimates. Lots 38 - 40 have houses on them and lot 41 is undeveloped.

As part of the design effort for Camelback Road it may be possible to shift the alignment to the south 35 feet in order to avoid any right of way acquisition from lots 38 - 41. The result would be a considerable savings in right of way costs.

J. **STA 73+04 TO STA 62+82**
FROM 5 - 8′ X 5′ BOX CULVERTS AT 129TH AVENUE TO 5 - 8′ X 5′ BOX CULVERTS UNDER DYSART ROAD.

The channel elements in this reach are a 40 foot bottom width; a 4:1 and 6:1 side slopes; and the channel slope is 0.1450%.

The 5 - 8′ x 5′ box culverts under Dysart Road are 110 feet long and have an outlet elevation of 1036.01 and an inlet elevation of 1036.20.

Right of way required in this reach is 225 feet. Existing right of way is 55 feet.

K. **STA 61+73 TO STA 55+76**
FROM 5 - 8′ X 5′ BOX CULVERTS UNDER DYSART ROAD TO 4 - 8′ X 5′ BOX CULVERTS 652 FEET WEST OF DYSART ROAD.

The channel elements are a 40 foot bottom width; 4:1 and 6:1 side slopes; and a channel slope of 0.1725%.

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The 4 - 8′ X 5′ box culverts are 40 feet long and have an outlet elevation of 1037.24 and an inlet elevation of 1037.31 feet. The culvert slope is 0.1725%.

Required right of way in this reach is 210 feet. Existing right of way is 55 feet.

L. **STA 55+36 TO STA 44+39**
FROM 4 - 8′ X 5′ BOX CULVERTS 652 FEET WEST OF DYSART ROAD TO 4 - 8′ X 4′ BOX CULVERTS 1789 FEET WEST OF DYSART ROAD.

The same channel elements apply as in the previous reach.

The 4 - 8′ x 4′ box culverts located 1789 feet west of Dysart Road are 40 feet long. The outlet elevation is 1039.20 and the inlet elevation 1039.27. The culvert slope is 0.1725%.

Required right of way in this reach is 200 feet. The existing right of way is 55 feet.

M. **STA 44+07 TO STA 39+00**
FROM 4 - 8′ X 4′ BOX CULVERTS 1789 FEET WEST OF DYSART ROAD TO 2 FOOT DROP STRUCTURE 2328 FEET WEST OF DYSART ROAD.

The channel elements in this reach are a 20 foot bottom width; 4:1 and 6:1 side slopes; and a channel slope of 0.1725%.

The 2 foot drop structure has a downstream elevation of 1040.12 feet and an upstream elevation of 1042.12 feet.

Required right of way is 175 feet. Existing right of way is 55 feet.

N. **STA 39+00 TO STA 35+25**
FROM 2 FOOT DROP STRUCTURE 2328 FEET WEST OF DYSART ROAD TO 3 FOOT DROP STRUCTURE 2703 FEET WEST OF DYSART ROAD.

The channel elements in this reach are a 10 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.3000%

The 3 foot drop structure has a downstream elevation of 1043.24 and an upstream elevation of 1046.24. The upstream channel slope is 0.5870%.

Required right of way is 165 feet. Existing right of way is 55 feet.

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O. **STA 35+25 TO STA 32+72**
FROM 3 FOOT DROP STRUCTURE 2703 FEET WEST OF DYSART ROAD TO 6' X 4' BOX CULVERT 2956 FEET WEST OF DYSART ROAD.

The channel elements in this reach are a 10 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.5870%.

The 6' x 4' box culvert is 40 feet long. The downstream elevation is 1047.73 and the upstream elevation is 1047.96. The culvert slope is 0.5870%.

A 3 foot drop inlet will be located just upstream of the culverts. The downstream elevation is 1048.00 and the upstream elevation is 1051.00.

Required right of way is 165 feet. Existing right of way is 55 feet.

P. **STA 32+25 TO STA 15+00**
FROM 3 FOOT DROP INLET UPSTREAM OF 6' X 4' BOX CULVERT TO CHANNEL GRADE BREAK 500 FEET EAST OF LITCHFIELD ROAD.

The channel elements in this reach are a 5 foot bottom width; 4:1 and 6:1 side slopes; and the channel slope is 0.4400%.

Required right of way is 145 feet from STA 32+25 TO STA 25+00 and 130 feet from STA 25+00 TO STA 15+00. The existing right of way is 55 feet.

Q. **STA 15+00 TO STA 10+62**
FROM CHANNEL GRADE BREAK 500 FEET EAST OF LITCHFIELD ROAD TO 6' X 3' BOX CULVERT UNDER LITCHFIELD ROAD.

The channel elements in this reach are a 5 foot bottom width; 4:1 and 6:1 side slopes; and a channel slope of 0.2030%.

The 6' x 3' box culvert under Litchfield Road is 100 feet long and has a slope of 0.2030%. The outlet elevation is 1059.47 and the inlet elevation is 1059.68. A 2 foot drop inlet will be required upstream of the culvert.

Required right of way in this reach is 145 feet. Existing right of way is 55 feet north of the section line.

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R. **STA 10+00 E. = STA -0+00 W. TO STA -12+00**
FROM LITCHFIELD ROAD WEST TO NATURAL HIGH POINT 1200 FEET WEST OF LITCHFIELD ROAD.

It is envisioned that a triangular V-ditch will extend from the 2 foot drop inlet located upstream of the Litchfield Road culvert to the high point to the west. The depth will vary from 2.5 feet immediately upstream of the drop inlet to approximately 2.6 foot at the high point to the west. Two additional drop structures (2 foot at STA -2+00 and 3 foot at STA -4+00) will also be required.

Channel slopes are 0.6500% and 0.5000% (see plans) and 4:1 side slopes will be incorporated.

Required right of way tapers from 70 feet to 60 feet from STA -0+55 TO STA -6+00, and continues west at 60 feet before it returns to the existing 33 feet of right of way at STA -12+00.

It is assumed that the present roadway configuration will not change west of Litchfield Road.

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RIGHT OF WAY REQUIREMENT TABLE FOR 100-YEAR CAMELBACK ROAD CHANNEL DESIGN FROM WEST OF LITCHFIELD ROAD TO EAST OF EL MIRAGE ROAD.

- Right of way requirements are tabulated below based on stations presented on preliminary plans for Camelback Road by Cella Barr & Associates, June, 1985. Stations are extended east of El Mirage Road to include the channel to the location of the existing 8′ x 8′ box culvert outlet. The area east of El Mirage Road was not included on Cella Barr & Associates' preliminary plans.

- The right of way is based on future buildout (6 lanes with median) of Camelback Road with the construction centerline located 4 feet North of monument line between Litchfield Road and El Mirage Road. Roadway configurations west of Litchfield Road and east of El Mirage Road stay essentially the same. An additional 15′ of right of way is required for an access road on the north side of the channel from Litchfield Road to the Agua Fria River.

Station	New R/W	Old R/W
-12+00 to -6+00 (West of Litchfield Road)	60′	33′
-6+00 to -0+55	Tapers from 60′ to 70′	33′
0+00 West = 10+00 East (Litchfield Road)	---	---
10+60 to 15+00	145′	55′
15+00 to 25+00	130′	55′
25+00 to 32+25	145′	55′
32+25 to 39+00	165′	55′
39+00 to 43+90	175′	55′
43+90 to 55+20	200′	55′
55+20 to 61+73	210′	55′
62+28 (Dysart Road)	---	---

Station	New R/W	Old R/W
62+83 to 73+04	225′	55′
73+64 to 77+63	235′	55′
78+23 to 85+90	225′	55′
85+90 to 87+75	Tapers from 225′ to 260′	55′
87+75 to 113+61	260′	55′
114+16 (El Mirage Road)	---	---
114+51 to 127+56	260′	85′
127+56 to 139+80	280′	85′

Proposed Drainage Structures Table
100-Year Camelback Road Channel Design
Litchfield Road to Agua Fria River

LOCATION	STRUCTURE TYPE	INVERT ELEVATION		LENGTH (FT)	SLOPE (FT/FT)
		INLET	OUTLET		
STA -4+00	3' Drop Structure	1068.76	1065.76	N/A	N/A
STA -2+00	2' Drop Structure	1064.46	1062.46	N/A	N/A
STA -0+48 to STA -0+38	2' Drop Inlet	1061.70 1059.70	1059.68	10	0.00203
STA -0+38 to STA 10+62 (Litchfield Road)	6' x 3' BC	1059.68	1059.47	100	0.00203
STA 32+25 to STA 32+32	3' Drop Inlet	1051.00 1048.00	1047.96	7	0.00587
STA 32+32 to STA 32+72	6' x 4' BC	1047.96	1047.73	40	0.00587
STA 35+25	3' Drop Structure	1046.24	1043.24	N/A	N/A
STA 39+00	2' Drop Structure	1042.12	1040.12	N/A	N/A
STA 43+99 to STA 44+39	4 - 8'x4' BC's	1039.27	1039.20	40	0.001725
STA 55+36 to STA 55+76	4 - 8'x5' BC's	1037.31	1037.24	40	0.001725
STA 61+73 to STA 62+83 (Dysart Road)	5 - 8'x5' BC's	1036.20	1036.01	110	0.001725
STA 73+04 to STA 73+64 (129th Avenue)	5 - 8'x5' BC's	1034.53	1034.44	60	0.00145
STA 77+63 to STA 78+23 (Airline Canal)	5 - 8'x5' BC's	1033.86	1033.77	60	0.00145
STA 85+48 to STA 85+88	5 - 8'x5' BC's	1032.73	1032.67	40	0.00145
STA 88+04 to STA 88+44	5 - 8'x5' BC's	1032.36	1032.30	40	0.00145
STA 101+00	2' Drop Structure	1030.48	1028.48	N/A	N/A
STA 107+00	3' Drop Structure	1027.28	1024.28	N/A	N/A
STA 113+46 to STA 113+61	2' Drop Inlet	1022.62 1020.62	1020.55	15	0.0044
STA 113+61 to STA 114+71 (El Mirage Road)	5 - 8'x4' BC's	1020.55	1020.00	110	0.0044
STA 127+38 to STA 127+74	8 - 8'x4' BC's	1016.87	1016.78	36	0.00247
STA 136+70 to STA 137+06	8 - 8'x4' BC's	1014.57	1014.48	36	0.00247
STA 139+16 (End of Project)	4 - 8'x8' BC's	1013.96	1013.46	108	0.00463

100-YEAR CAMELBACK CHANNEL DESIGN (Without Colter Channel)

Location: 1200 Feet West of Litchfield Road to 2500 Feet East of El Mirage Road - Working Upstream From 4 - 8' x 8' Box Culverts East of El Mirage Road
Channel Type: Trapezoidal - Earthen
Side Slopes: 4:1
Storm Type: 100-Year, 24-Hour
Mannings N: .025

LOCATION		CHANNEL PROFILE AND CHANNEL DESIGN									
FROM	TO	INVERT ELEV.		TOP OF BANK ELEV.		WATER SURFACE ELEV.		LENGTH (FT.)	SLOPE (FT/FT)	BOTTOM WIDTH (FT.)	DISCHARGE (CFS)
		INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)				
STA 139+16 (4 - 8' x 8' BC's)	STA 137+06 (8 - 8' x 4' BC's)	1013.96	1014.48	1018 (N) 1027.1 (S)	1022 (N) 1027.1 (S)	1020.89	1020.90	210	0.00247	100	1726
STA 136+70 (8 - 8' x 4' BC's)	STA 127+74 (8 - 8'x 4' BC's)	1014.57	1016.78	1022 (N) 1027.1 (S)	1023 (N) 1027.4 (S)	1021.82	1021.92	896	0.00247	100	1726
STA 127+38 (8 - 8' x 4' BC's)	STA 114+71 (5 - 8' x 4' BC's - El Mirage Road)	1016.87	1020.00	1024 (N) 1027.4 (S)	1026 (N) 1027.5 (S)	1022.55	1023.04	1267	0.00247	100	1439
STA 113+46 (2' Drop Inlet - El Mirage Road)	STA 107+00 3' Drop Structure)	1022.62	1024.28	1028 (N) 1027.6 (S)	1031 (N) 1030.5 (S)	1026.46	1027.03	646	0.00257	100	1469
STA 107+00 (3' Drop Structure)	STA 101+00 (2' Drop Structure)	1027.28	1028.48	1031 (N) 1030.6 (S)	1034 (N) 1034.6 (S)	1029.12	1031.18	600	0.0020	100	1469
STA 101+00 (2' Drop Structure)	STA 88+44 (5 - 8' x 5' BC's)	1030.48	1032.30	1034 (N) 1034.6 (S)	1039 (N) 1038.6 (S)	1032.22	1035.13	1256	0.00145	100	1349
STA 88+04 (5 - 8' x 5' BC's)	STA 85+88 (5 - 8' x 5' BC's)	1032.36	1032.67	1039 (N) 1038.6 (S)	1040 (N) 1039.4 (S)	1037.46	1037.55	216	0.00145	60	1296
STA 85+48 (5 - 8' x 5' BC's)	STA 78+23 (5 - 8' x 5' BC's - Airline Canal)	1032.73	1033.77	1040 (N) 1039.4 (S)	1045 (N) 1041.7 (S)	1038.41	1038.86	725	0.00145	40	1296
STA 77+63 (5 - 8' x 5' BC's - Airline Canal)	STA 73+64 (5 - 8' x 5' BC's - 129th Ave.)	1033.86	1034.44	1045 (N) 1041.7 (S)	1047 (N) 1042.4 (S)	1039.64	1039.79	399	0.00145	40	1102

NOTES: 1. (S) Refers to south top of bank.
2. (N) Refers to north top of bank (from White Tanks/Agua Fria ADMS topographic mapping - 2' C.I.).

100-YEAR CAMELBACK CHANNEL DESIGN (Without Colter Channel)

Location: 1200 Feet West of Litchfield Road to 2500 Feet East of El Mirage Road - Working Upstream From 4 - 8' x 8' Box Culverts East of El Mirage Road
Channel Type: Trapezoidal - Earthen
Side Slopes: 4:1
Storm Type: 100-Year, 24-Hour
Mannings N: .025

LOCATION		CHANNEL PROFILE AND CHANNEL DESIGN									
FROM	TO	INVERT ELEV.		TOP OF BANK ELEV.		WATER SURFACE ELEV.		LENGTH (FT.)	SLOPE (FT/FT)	BOTTOM WIDTH (FT.)	DISCHARGE (CFS)
		INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)				
STA 73+04 (5 - 8' x 5' BC's - 129th Ave.)	STA 62+83 (5 - 8' x 5' BC's - Dysart Road)	1034.53	1036.01	1047 (N) 1042.4 (S)	1044 (N) 1043.6 (S)	1040.42	1040.87	1021	0.00145	40	1102
STA 61+73 (5 - 8' x 5' BC's - Dysart Rd.)	STA 55+76 (4 - 8' x 5' BC's)	1036.20	1037.24	1044 (N) 1044.0 (S)	1043 (N) 1043.3 (S)	1041.52	1041.76	597	0.001725	40	1067 829
STA 55+36 (4 - 8' x 5' BC's)	STA 44+39 (4 - 8' x 4' BC's)	1037.31	1039.20	1043 (N) 1043.3 (S)	1044 (N) 1044.1 (S)	1042.41	1043.00	1097	0.001725	40	829
STA 43+99 (4 - 8' x 4' BC's)	STA 39+00 (2' Drop Structure)	1039.27	1040.12	1044 (N) 1044.1 (S)	1046 (N) 1046.9 (S)	1043.75	1044.41	499	0.001725	20	745
STA 39+00 (2' Drop Structure)	STA 35+25 (3' Drop Structure)	1042.12	1043.22	1046 (N) 1046.9 (S)	1050 (N) 1050.0 (S)	1044.56	1046.32	375	0.0030	10	350
STA 35+25 (3' Drop Structure)	STA 32+72 (6' x 4' BC)	1046.24	1047.73	1050 (N) 1050.0 (S)	1055 (N) 1054.9 (S)	1047.71	1049.37	253	0.00587	10	137
STA 32+32 (6' x 4' BC)	STA 32+25 (3' Drop Inlet)	1047.97	1048.00	1055 (N) 1054.9 (S)	1055 (N) 1055.0 (S)	1051.92	1051.92	7	0.00587	5	137
STA 32+25 (3' Drop Inlet)	STA 15+00 (Channel Grade Break)	1051.0	1058.59	1055 (N) 1055.0 (S)	1061 (N) 1061.1 (S)	1052.83	1060.74	1725	0.0044	5	137

NOTES: 1. (S) Refers to south top of bank.
2. (N) Refers to north top of bank (from White Tanks/Agua Fria ADMS topographic mapping - 2' C.I.).

100-YEAR CAMELBACK CHANNEL DESIGN (Without Colter Channel)

Location: 1200 Feet West of Litchfield Road to 2500 Feet East of El Mirage Road - Working Upstream From 4 - 8' x 8' Box Culverts East of El Mirage Road
Channel Type: Trapezoidal - Earthen
Side Slopes: 4:1
Storm Type: 100-Year, 24-Hour
Mannings N: .025

LOCATION		CHANNEL PROFILE AND CHANNEL DESIGN									
FROM	TO	INVERT ELEV.		TOP OF BANK ELEV.		WATER SURFACE ELEV.		LENGTH (FT.)	SLOPE (FT/FT)	BOTTOM WIDTH (FT.)	DISCHARGE (CFS)
		INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)				
STA 15+00 (Channel Grade Break)	STA 10+62 (6' x 3' BC - Litchfield Rd.)	1058.59	1059.47	1061 (N) 1061.1 (S)	1065 (N) 1064.6 (S)	1060.74	1062.01	438	0.00203	5	137
STA -0+38 (6' x 3' BC - Litchfield Rd.)	STA -0+48 (2' Drop Inlet)	1059.68	1059.70	1066 (N) 1064.6 (S)	1066 (N) 1064.7 (S)	1063.92	1063.92	10	0.00203	5	137
STA -0+48 (2' Drop Inlet)	STA -2+00 (2' Drop Structure)	1061.70	1062.46	1066 (N) 1064.7 (S)	1067 (N) 1067.5 (S)	1063.92	1064.40	152	0.0050	V-Ditch	70
STA -2+00 (2' Drop Structure)	STA -4+00 (3' Drop Structure)	1064.46	1065.76	1067 (N) 1067.5 (S)	1072 (N) 1071.2 (S)	1065.85	1067.29	200	0.008975	V-Ditch	45
STA -4+00 (3' Drop Structure)	STA -12+00 (High Point)	1068.76	1075.94	1072 (N) 1071.2 (S)	1077 (N) 1077.6 (S)	1070.01	1076.96	800	0.008975	V-Ditch	20

NOTES: 1. (S) Refers to south top of bank.
2. (N) Refers to north top of bank (from White Tanks/Agua Fria ADMS topographic mapping - 2' C.I.).

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5-YEAR INTERIM DESIGN CHANNEL

A. **STA 139+16 TO STA 137+06**
FROM EXISTING 8' X 8' BOX CULVERT OUTLET UNDER CAMELBACK ROAD TO EXISTING 2 - 58" X 36" CMPA'S 210 FEET UPSTREAM (2290' EAST OF EL MIRAGE ROAD).

The existing channel elements in this reach are an earthen trapezoidal channel with a varying bottom width; a 4:1 side slope on the roadway side; varying side slopes on the north side of the channel; an existing 3 foot drop inlet into the 8' x 8' box culvert; and a channel slope that varies from 0.0700% upstream of the box culvert to 0.1300% downstream of the 2 - 58" x 36" CMPA's. Some clearing of vegetation and regrading may be required.

The existing right of way north of the monument line is 85 feet and no additional right of way take is foreseen. The roadway configuration stays the same as existing.

B. **STA 136+70 TO STA 127+74**
FROM EXISTING 2 - 58" X 36" CMPA'S (2290' EAST OF EL MIRAGE ROAD) TO EXISTING 2 - 58" X 36" CMPA'S 1130' UPSTREAM FROM EXISTING 8' X 8' BOX CULVERT (1358' EAST OF EL MIRAGE ROAD).

The channel elements in this reach are an existing earthen trapezoidal channel with an approximate 4 foot bottom width; 4:1 and 2:1 side slopes, south and north respectively; and a channel slope of approximately 0.1300%.

The outlet invert elevation of the upstream 2 - 58" x 36" CMPA's is 1018.28 and the inlet invert elevation is 1018.33. Some clearing of vegetation and regrading may be required.

The existing right of way is 85' north of the monument line and no additional right of way take is foreseen. The roadway configuration stays the same as existing.

C. **STA 127+38 TO STA 114+71**
FROM EXISTING 2 - 58" X 36" CMPA'S (1358' EAST OF EL MIRAGE ROAD) TO THE OUTLET OF 1 - 60" RCP UNDER EL MIRAGE ROAD.

Existing channel dimensions are an approximate 4 foot bottom width; 4:1 and 2:1 side slopes for the roadway side and opposite side respectively; and the channel slope is approximately 0.1300%.

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The proposed 60" RCP is 110 feet long with an outlet elevation of 1020.0 and an inlet elevation of 1020.33. A 3 foot drop inlet is located upstream of the 60" RCP and is 10 feet long with a top elevation of 1023.33 and a bottom elevation of 1020.33.

The existing right of way is 85 feet in this area and no additional right of way take is foreseen. The roadway configurations stay the same as existing.

D. **STA 113+51 TO STA 103+00**
FROM 3 FOOT DROP INLET UPSTREAM OF 60" RCP UNDER EL MIRAGE ROAD TO 2 FOOT DROP STRUCTURE (1116 FEET WEST OF EL MIRAGE ROAD).

Channel elements in this reach are a 5 foot bottom width; 4:1 side slopes; and a channel slope of 0.4460% The elevation at the bottom of the 2 foot drop structure is 1028.02.

Right of way required on the north side of Camelback in this reach is 105 feet. Existing right of way is 55 feet and increases to 65 feet from 260 feet west of El Mirage Road to El Mirage Road.

E. **STA 103+00 TO STA 88+44**
FROM 2' DROP STRUCTURE TO 1 - 8' X 3' BOX CULVERT (2572' WEST OF EL MIRAGE RD).

Channel elements are a 5 foot bottom width; 4:1 side slopes; and the channel slope is 0.3600% from STA 103+00 to STA 101+00 and 0.1500% from STA 101+00 to STA 88+44.

The 8' x 3' box culvert is 40 feet long with an outlet elevation of 1032.61 and an inlet elevation of 1032.73. The slope of the culvert is 0.3000%.

Right of way required in this reach tapers from 105 feet at STA 101+00 to 125 feet at STA 89+00. Existing right of way in this reach is 55 feet.

F. **STA 88+04 TO STA 85+88**
FROM 8' x 3' BOX CULVERT 2572 FEET WEST OF EL MIRAGE ROAD TO 8' X 3' BOX CULVERT 2828 FEET WEST OF EL MIRAGE ROAD. (FIRST DRIVEWAY EAST OF AIRLINE CANAL.)

Channel elements are a 5 foot bottom width; 4:1 side slopes; and the channel slope is 0.1500%.

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The 8′ x 3′ box culvert at the upstream driveway is 40 feet long with an outlet elevation of 1033.05 and an inlet elevation of 1033.11. The culvert slope is the same as the channel slope.

Right of way required in this reach, north of Camelback Road, is 125 feet from STA 89+00 TO STA 85+20. Existing right of way is 55 feet.

G. **STA 85+48 TO STA 78+23**
FROM 8′ X 3′ BOX CULVERT (2828 FEET WEST OF EL MIRAGE ROAD) TO 8′ X 3′ BOX CULVERT OVER THE AIRLINE CANAL.

The channel elements in this reach are a 5 foot bottom width; 4:1 side slope; and the channel slope is 0.1500%

The 8′ x 3′ box culvert at the Airline Canal is 60 feet long and will cross over the top of the siphon for the Airline Canal. It may be necessary to put in a new siphon as the elevation of the culverts and channel depth may be too close to the top of the existing siphon. The cost estimates include the cost to relocate the siphon. The outlet elevation of the culvert is 1034.20 and the inlet elevation is 1034.34. The culvert slope is 0.2300%.

Right of way required in this reach is 130 feet from STA 85+20 TO STA 78+23. Existing right of way on the north side is 55 feet.

H. **STA 77+63 TO STA 73+64**
FROM 8′ X 3′ BOX CULVERT OVER THE AIRLINE CANAL TO 8′ X 3′ BOX CULVERT UNDER 129TH AVENUE.

The channel elements are a 5 foot bottom width; 4:1 side slopes; and a channel slope of 0.1500%

The 8′ x 3′ box culvert under 129th Avenue is 60 feet long with an outlet elevation of 1034.94 and an inlet elevation of 1035.09. The culvert slope is 0.2500%.

Right of way requirements are 130 feet from STA 77+63 TO STA 73+64. Existing right of way is 55 feet.

The existing Tierra Buena subdivision between 129th Avenue and the Airline Canal is probably the critical link in regards to right of way acquisition for this project. There are three lots in this area located beyond the existing 55 foot roadway right of way. The two easterly lots are vacant at this time and it appears that their only access is from Camelback Road. The third lot, located just east of 129th Avenue, has a residence built on it and access is from 129th Avenue. Presently, there are no driveway entrances to the two vacant lots and culverted driveways would have to be built in the future if the open channel is built. Two options are available at this time. The first option is to realign Camelback Road 75 feet to the south, therefore, negating the aspect of condemning these lots. Right of way would have to be taken south of Camelback Road to satisfy channel and future roadway requirements. The roadway alignment would be routed to the south to miss the subdivision, then curve back to its existing alignment at Dysart Road and at El Mirage Road.

The second option is to take the three subdivision lots and keep the Camelback Road alignment on the section line. It appears that the total lots would have to be taken. This may not be a bad trade-off to keep the alignment straight and clean and would preclude having to provide the two eastern lots with direct access to Camelback Road. Cost estimates for the 5-year interim channel design assume that the roadway alignment can be shifted 75 feet to the south so as to miss the subdivision lots. Therefore, right of way acquisition is assumed to be taken along the south side of Camelback Road. A future alignment study would be required to see if the alignment shift is feasible.

I. **STA 73+04 TO STA 62+83**
FROM 8′ X 3′ BOX CULVERT AT 129TH AVENUE TO 8′ X 3′ BOX CULVERT UNDER DYSART ROAD.

The channel elements in this reach are a 5 foot bottom width; 4:1 side slopes; and the channel slope is 0.1500%.

The 8′ x 3′ box culvert under Dysart Road is 110 feet long and has an outlet elevation of 1036.62 and an inlet elevation of 1036.79. The culvert slope is the same as the channel slope.

Right of way required in this reach is 130 feet. Existing right of way is 55 feet.

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J. **STA 61+73 TO STA 55+75**
FROM 8' X 3' BOX CULVERT UNDER DYSART ROAD TO 8' X 3' BOX CULVERT 653 FEET WEST OF DYSART ROAD.

The channel elements are a 5 foot bottom width; 4:1 side slopes; and a channel slope of 0.1500%

The 8' x 3' box culvert is 40 feet long and has an outlet elevation of 1037.69 and an inlet elevation of 1037.75. The culvert slope is 0.1500%.

Required right of way in this reach tapers from 130 feet at STA 61+73 to 115 feet at STA 55+00. Existing right of way is 55 feet.

K. **STA 55+35 TO STA 44+39**
FROM 8' X 3' BOX CULVERT 653 FEET WEST OF DYSART ROAD TO 6' X 3' BOX CULVERT 1789 FEET WEST OF DYSART ROAD.

The same channel elements apply as in the previous reach.

The 6' x 3' box culvert is 40 feet long. The outlet elevation is 1039.39 and the inlet elevation 1039.45. The culvert slope is 0.1500%. A 1 foot drop inlet is located 10 feet upstream of the box culvert and has a top elevation of 1040.47 and a bottom elevation of 1039.47.

Required right of way in this reach is 115 feet from STA 55+00 TO STA 43+75. The existing right of way is 55 feet.

L. **STA 43+89 TO STA 35+35**
FROM 1 FOOT DROP INLET UPSTREAM OF 6' X 3' BOX CULVERT TO 1 FOOT DROP STRUCTURE 2693 FEET WEST OF DYSART ROAD.

The same channel elements apply as in the previous reach.

The 1 foot drop structure has a downstream elevation of 1046.40 feet and an upstream elevation of 1047.40 feet. The downstream channel slope is 0.6940% and the upstream channel slope is 0.7300%.

Required right of way is 105 feet from STA 43+75 TO STA 35+35. Existing right of way is 55 feet.

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M. **STA 35+25 TO STA 32+64**
FROM 1 FOOT DROP STRUCTURE 2693 FEET WEST OF DYSART ROAD TO 1 - 36" RCP 2964 FEET WEST OF DYSART ROAD.

The channel elements in this reach are a 5 foot bottom width; 4:1 side slopes; and the channel slope is 0.7300%

The 36" RCP is 40 feet long. The downstream elevation is 1049.43 and the upstream elevation is 1049.58. The culvert slope is 0.7300%.

A 3 foot drop inlet structure will be located 10 feet upstream of the culvert. The downstream elevation is 1049.65 and the upstream elevation is 1052.65.

Required right of way is 105 feet from STA 35+25 TO STA 32+64. Existing right of way is 55 feet.

N. **STA 32+14 TO STA 10+62**
FROM 3 FOOT DROP INLET UPSTREAM OF 36" RCP TO 36" RCP AT LITCHFIELD ROAD.

The channel elements in this reach are a 5 foot bottom width; 4:1 side slopes; and the channel slope is 0.7000% from STA 32+14 to STA 30+00, 0.2020% from STA 30+00 to STA 21+00, and 0.3700% from STA 21+00 to STA 10+62.

The 36" RCP under Litchfield Road is 100 feet long and has an outlet elevation of 1059.81 and an inlet elevation of 1060.18. The culvert slope is 0.3700%. A 2.5 foot drop inlet is located 10 feet upstream of the 36" RCP. The downstream elevation is 1060.22 and the upstream elevation is 1062.72.

Required right of way is 105 feet from STA 32+14 TO STA 31+00, 85 feet from STA 31+00 TO STA 21+00, and tapers from 85 feet at STA 21+00 to 105 feet at STA 11+00. The existing right of way is 55 feet.

O. **STA -0+48 TO STA -2+00**
FROM 2.5 FOOT DROP INLET UPSTREAM OF 36" RCP UNDER LITCHFIELD ROAD TO 1 FOOT DROP STRUCTURE.

The channel elements in this reach are an earthen V-ditch; 4:1 side slopes; and a channel slope of 0.7800%.

The downstream elevation of the 2.5 foot drop inlet is 1060.22 and the upstream elevation is 1062.72.

The downstream elevation of the 1 foot drop structure is 1063.90 and the upstream elevation is 1064.90.

Required right of way in this reach is 72 feet from STA -0+48 TO STA -2+00. Existing right of way is 33 feet north of the section line.

P. **STA -2+00 TO STA -4+00**
FROM 1 FOOT DROP STRUCTURE TO 3 FOOT DROP STRUCTURE WEST OF LITCHFIELD ROAD.

Channel elements in this reach are an earthen V-ditch; 4:1 side slopes; and a channel slope of 0.7500%. The downstream elevation of the 3 foot drop structure is 1066.40 and the upstream elevation is 1069.40.

Required right of way in this reach is 72 feet. Existing right of way is 33 feet north of the monument line.

Q. **STA -4+00 TO STA -12+00**
FROM 3 FOOT DROP STRUCTURE TO HIGH POINT 1200 FEET WEST OF LITCHFIELD ROAD.

The channel elements in this reach are an earthen V-ditch; 4:1 side slopes; and a channel slope of 0.8900%. The termination of the V-ditch channel at STA -12+00 has an invert elevation of 1075.96.

Required right of way in this reach tapers from 72 feet at STA -4+00 to 55 feet at STA -7+00 to 38 feet at STA -12+00. Existing right of way is 33 feet.

It is assumed that the proposed preliminary roadway configuration will not change west of Litchfield Road.

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RIGHT OF WAY REQUIREMENT TABLE FOR THE 5-YEAR INTERIM CAMELBACK ROAD CHANNEL FROM WEST OF LITCHFIELD ROAD TO EAST OF EL MIRAGE ROAD.

- Right of way requirements are tabulated below based on stations presented on preliminary plans for Camelback Road by Cella Barr & Associates, June, 1985. Stations are extended east of El Mirage Road to include the channel to the location of the existing 8′ x 8′ box culvert outlet. The area east of El Mirage Road was not included on Cella Barr & Associates' preliminary plans.

- The right of way is based on future buildout (6 lanes with median) of Camelback Road with the construction centerline located 4 feet North of monument line between Litchfield Road and El Mirage Road. The roadway configuration west of Litchfield Road and east of El Mirage Road would stay the same.

Station	New R/W	Old R/W
-12+00 to -7+00 (West of Litchfield Road)	Tapers from 38′ to 55′	33′
-7+00 to -4+00	Tapers from 55′ to 72′	33′
-4+00 to -0+55	72′	33′
0+00 West = 10+00 East (Litchfield Road)	---	---
10+60 to 11+00	105′	55′
11+00 to 21+00	Tapers from 105′ to 85′	55′
21+00 to 31+00	85′	55′
31+00 to 43+75	105′	55′
43+75 to 55+00	115′	55′
55+00 to 61+73	Tapers from 115′ to 130′	55′

Station	New R/W	Old R/W
62+28 (Dysart Road)	---	---
62+83 to 73+04	130′	55′
73+64 to 77+63	130′ or North Lot Line of Existing Tierra Buena Subdivision Lots (= 200′)	55′
78+23 to 85+20	130′	55′
85+20 to 89+00	125′	55′
89+00 to 101+00	Tapers from 125′ to 105′	55′
101+00 to 113+61	105′	55′ and 65′ to 263′ West of El Mirage Road
114+16 (El Mirage Road)	---	---
114+51 to 127+56	N/A	85′
127+56 to 136+88	N/A	85′
136+88 to 140+01 (End Project)	N/A	85′

Proposed Drainage Structures Table
5-Year Interim Camelback Road Channel Design
(Litchfield Road to Agua Fria River)

LOCATION	STRUCTURE TYPE	INVERT ELEVATION		LENGTH (FT)	SLOPE (FT/FT)
		INLET	OUTLET		
STA -4+00	3' Drop Structure	1069.40	1066.40	N/A	N/A
STA -2+00	1' Drop Structure	1064.90	1063.90	N/A	N/A
STA -0+48 to STA -0+38	2.5' Drop Inlet	1062.72 1060.22	1060.18	10	0.0037
STA -0+38 to STA 10+62 (Litchfield Road)	1 - 36" RCP	1060.18	1059.81	100	0.0037
STA 32+14 to STA 32+24	3' Drop Inlet	1052.65 1049.65	1049.58	10	0.0073
STA 32+24 to STA 32+64	1 - 36" RCP	1049.58	1049.43	40	0.0073
STA 35+35	1' Drop Structure	1047.40	1046.40	N/A	N/A
STA 43+89 to STA 43+99	1' Drop Inlet	1040.47 1039.47	1039.45	10	0.0015
STA 43+99 to STA 44+39	6' x 3' BC	1039.45	1039.39	40	0.0015
STA 55+35 to STA 55+75	8' x 3' BC	1037.75	1037.69	40	0.0015
STA 61+73 to STA 62+83 (Dysart Road)	8' x 3' BC	1036.79	1036.62	110	0.0015
STA 73+04 to STA 73+64 (129th Avenue)	8' x 3' BC	1035.09	1034.94	60	0.0025
STA 77+63 to STA 78+23 (Airline Canal)	8' x 3' BC	1034.34	1034.20	60	0.0023
STA 85+48 to STA 85+88	8' x 3' BC	1033.11	1033.05	40	0.0015
STA 88+04 to STA 88+44	8' x 3' BC	1032.73	1032.61	40	0.0030
STA 103+00	2' Drop Structure	1030.02	1028.02	N/A	N/A
STA 113+51 to STA 113+61	3' Drop Inlet	1023.33 1020.33	1020.33	10	0.0005
STA 113+61 to STA 114+71 (El Mirage Road)	1 - 60" RCP	1020.33	1020.00	110	0.0030
STA 127+38 to STA 127+74	Ex. 2 - 58" x 36" CMPA's	1018.33	1018.28	36	0.0013
STA 136+70 to STA 137+06	Ex. 2 - 58" x 36" CMPA's	1017.12	1017.07	36	0.0013
STA 139+06 to STA 139+16	Ex. 3' Drop Inlet	1016.96 1013.96	1013.96	10	0.0005
STA 139+16 (End of Project)	Existing 8'x8' BC 2500' E. of El Mirage Road	1013.96	1013.46	108	0.0046

5-YEAR INTERIM CAMELBACK CHANNEL DESIGN

Location: 1200 Feet West of Litchfield Road to 2500 Feet East of El Mirage Road - Working Upstream From Existing 8' x 8' Box Culvert East of El Mirage Road
Channel Type: Trapezoidal - Earthen
Side Slopes: 4:1
Storm Type: 5-Year, 24-Hour
Mannings N: .025

LOCATION		CHANNEL PROFILE AND CHANNEL DESIGN									
FROM	TO	INVERT ELEV.		TOP OF BANK ELEV.		WATER SURFACE ELEV.		LENGTH (FT.)	SLOPE (FT/FT)	BOTTOM WIDTH (FT.)	DISCHARGE (CFS)
		INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)				
STA 139+16 (Existing 8'x8' Box Culvert)	STA 137+06 (Ex. 2 - 58" x 36" CMPA's)	1016.96 (Top of 3' Drop Inlet)	1017.07	1020 (N) 1027.1 (S)	1022 (N) 1027.1 (S)	1018.68	1020.01	210	0.0013	Varies	160
STA 136+70 (Existing 2 - 58" x 36" CMPA's)	STA 127+74 (Ex. 2 - 58" x 36" CMPA's)	1017.12	1018.28	1022 (N) 1027.1 (S)	1023 (N) 1027.4 (S)	1021.89	1022.24	896	0.0013	4	160
STA 127+38 (Existing 2 - 58" x 36" CMPA's)	STA 114+71 (1 - 60" RCP - El Mirage Road)	1018.33	1020.33	1024 (N) 1027.4 (S)	1026 (N) 1027.5 (S)	1024.12	1024.36	1267	0.0013	4	160
STA 113+51 (3' Drop Inlet)	STA 103+00 (2' Drop Structure)	1023.33	1028.02	1028 (N) 1027.5 (S)	1032 (N) 1033.3 (S)	1025.30	1030.32	1051	0.00446	5	160
STA 103+00 (2' Drop Structure)	STA 101+00 (Channel Grade Break)	1030.02	1030.73	1032 (N) 1033.3 (S)	1034 (N) 1034.6 (S)	1031.99	1033.15	200	0.0036	5	160
STA 101+00 (Channel Grade Break)	STA 88+44 (8' x 3' BC)	1030.73	1032.61	1034 (N) 1034.6 (S)	1039 (N) 1038.6 (S)	1033.15	1035.34	1256	0.0015	5	136
STA 88+04 (8' x 3' BC)	STA 85+88 (8' x 3' BC)	1032.73	1033.05	1039 (N) 1038.6 (S)	1040 (N) 1039.4 (S)	1035.54	1035.73	216	0.0015	5	110
STA 85+48 (8' x 3' BC)	STA 78+23 (8' x 3' BC - Airline Canal)	1033.11	1034.20	1040 (N) 1039.4 (S)	1045 (N) 1041.7 (S)	1036.26	1036.82	725	0.0015	5	110
STA 77+63 (8' x 3' BC - Airline Canal)	STA 73+64 (8' x 3' BC - 129th Ave.)	1034.34	1034.94	1045 (N) 1041.7 (S)	1047 (N) 1042.4 (S)	1037.40	1037.66	399	0.0015	5	105

NOTES: 1. (S) Refers to south top of bank.
2. (N) Refers to north top of bank (from White Tanks/Agua Fria ADMS topographic mapping - 2' C.I.).

5-YEAR INTERIM CAMELBACK CHANNEL DESIGN

Location: 1200 Feet West of Litchfield Road to 2500 Feet East of El Mirage Road - Working Upstream From Existing 8' x 8' Box Culvert East of El Mirage Road
Channel Type: Trapezoidal - Earthen
Side Slopes: 4:1
Storm Type: 5-Year, 24-Hour
Mannings N: .025

LOCATION		CHANNEL PROFILE AND CHANNEL DESIGN									
FROM	TO	INVERT ELEV.		TOP OF BANK ELEV.		WATER SURFACE ELEV.		LENGTH (FT.)	SLOPE (FT/FT)	BOTTOM WIDTH (FT.)	DISCHARGE (CFS)
		INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)				
STA 73+04 (8' x 3' BC - 129th Ave.)	STA 62+83 (8' x 3' BC - Dysart Road)	1035.09	1036.62	1047 (N) 1042.4 (S)	1044 (N) 1043.6 (S)	1038.16	1039.11	1021	0.0015	5	105
STA 61+73 (8' x 3' BC - Dysart Rd.)	STA 55+75 (8' x 3' BC)	1036.79	1037.69	1044 (N) 1044.0 (S)	1043 (N) 1043.3 (S)	1039.72	1040.22	598	0.00138	5	102
STA 55+35 (8' x 3' BC)	STA 44+39 (6' x 3' BC)	1037.75	1039.39	1043 (N) 1043.3 (S)	1044 (N) 1044.1 (S)	1040.70	1041.80	1096	0.0015	5	99
STA 43+89 (1' Drop Inlet)	STA 35+35 (1' Drop Structure)	1040.47	1046.40	1044 (N) 1044.1 (S)	1050 (N) 1050.0 (S)	1042.52	1047.83	854	0.00694	5	71
STA 35+35 (1' Drop Structure)	STA 32+64 (1 - 36" RCP)	1047.40	1049.43	1050 (N) 1050.0 (S)	1055 (N) 1054.9 (S)	1048.78	1050.86	271	0.0073	5	36
STA 32+14 (3' Drop Inlet)	STA 21+00 (Grade Break)	1052.65	1055.97	1055 (N) 1054.9 (S)	1058 (N) 1058.4 (S)	1053.96	1057.86	1114	0.00202	V-Ditch	36

NOTES: 1. (S) Refers to south top of bank.
2. (N) Refers to north top of bank (from White Tanks/Agua Fria ADMS topographic mapping - 2' C.I.).

5-YEAR INTERIM CAMELBACK CHANNEL DESIGN

Location: 1200 Feet West of Litchfield Road to 2500 Feet East of El Mirage Road - Working Upstream From Existing 8' x 8' Box Culvert East of El Mirage Road
Channel Type: Trapezoidal - Earthen
Side Slopes: 4:1
Storm Type: 5-Year, 24-Hour
Mannings N: .025

LOCATION		CHANNEL PROFILE AND CHANNEL DESIGN									
FROM	TO	INVERT ELEV.		TOP OF BANK ELEV.		WATER SURFACE ELEV.		LENGTH (FT.)	SLOPE (FT/FT)	BOTTOM WIDTH (FT.)	DISCHARGE (CFS)
		INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)	INLET (FT.)	OUTLET (FT.)				
STA 21+00 (Channel Grade Break)	STA 10+62 (1 - 36" RCP - Litchfield Rd.)	1055.97	1059.81	1058 (N) 1058.4 (S)	1065 (N) 1064.6 (S)	1057.86	1061.50	1038	0.0037	V-Ditch	36
STA -0+38 (1 - 36" RCP - Litchfield Rd.)	STA -0+48 (2.5' Drop Inlet)	1060.18	1060.22	1066 (N) 1064.6 (S)	1066 (N) 1064.7 (S)	1063.37	1063.37	10	0.0037	5	36
STA -0+48 (2.5' Drop Inlet)	STA -2+00 (1' Drop Structure)	1062.72	1063.90	1066 (N) 1064.7 (S)	1067 (N) 1067.5 (S)	1063.98	1065.25	152	0.0078	V-Ditch	36
STA -2+00 (1' Drop Structure)	STA -4+00 (3' Drop Structure)	1064.90	1066.40	1067 (N) 1067.5 (S)	1072 (N) 1071.2 (S)	1065.96	1067.55	200	0.0075	V-Ditch	24
STA -4+00 (3' Drop Structure)	STA -12+00 (High Point)	1069.40	1075.96	1072 (N) 1071.2 (S)	1077 (N) 1077.6 (S)	1070.57	1077.02	800	0.0089	V-Ditch	16

NOTES: 1. (S) Refers to south top of bank.
2. (N) Refers to north top of bank (from White Tanks/Agua Fria ADMS topographic mapping - 2' C.I.).

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VIII. COST ESTIMATES

Cost estimates are limited to elements involved with the channel construction. This includes drainage structures, channel excavation, right of way acquisition, and various appurtenances and contingencies. No estimate was made for clearing and grubbing; asphalt removal and replacement; and existing structure removal. It was assumed that these costs would be included in the roadway costs.

Estimates for the structures are based on box culverts, concrete pipe, and headwalls. Other pipe materials may be substituted, where applicable, as long as the hydraulic properties of the channel design are not compromised.

Also, the right of way costs may be reduced by realigning Camelback Road to miss the Tierra Buena subdivision. This will have to be addressed during the final design of the roadway.

Estimates are grouped as follows:

- West of Litchfield Road
- Litchfield Road to Dysart Road
- Dysart Road to El Mirage Road
- El Mirage Road to the Existing 8′ x 8′ Box Culvert

These estimates are on the following pages. The total construction cost for drainage includes 20% for contingencies.

Severance damages for future driveway crossings at three locations are included in the right of way costs. This is consistent with the Colter Channel cost estimate.

Guardrail, wire fence, access road on north side, embankment spillways, and side weir inflow spillways are not shown on the 100-year preliminary plan, however, these associated costs are included in the 100-year Camelback Channel cost estimate and are shown on the typical sections.

Cost comparisons are included behind each cost estimate to compare the 100-year Colter Channel versus the 100-year Camelback Channel cost and to compare the 5-year interim Camelback Channel versus the 100-year Camelback Channel cost. It should be noted that the design assumptions for each channel alternative (Camelback vs. Colter) are somewhat different. It should also be noted that the estimate for the 100-year Camelback Channel does not include any costs associated with the undesirable safety, aesthetic and maintenance

The WLB Group Inc.

issues related to locating a major drainage channel along a high volume road of regional significance, such as, Camelback Road. These issues are difficult to place a value on; especially public safety. With this in mind, it is clear that a thorough evaluation of the alternatives requires consideration of a number of issues beyond just costs. The following paragraphs describe the differences in the design assumptions:

1. Freeboard requirements differ for each alternative. The Colter Channel was designed with a minimum freeboard of 1 foot and also with extra capacity (in addition to the one foot of freeboard) to convey the increased runoff that will result from future development in the contributing drainage area. This extra capacity is being provided so that the property owners will not have to provide stormwater retention when they develop their property. In return, the property owners are donating right of way for the construction of the Colter Channel. The 100-year Camelback Channel has no freeboard. The channel is only required to keep one travel lane dry on the north side of the future Camelback Road during the 100-year storm event. There is no allowance for increased flows from future development. Freeboard for the 5-year interim design is a minimum of 0.5 feet within the channel. The freeboard requirements for the two Camelback Channel alternatives were given by MCDOT.

2. The cost estimate for the 100-year Colter Channel includes bridges at Dysart Road and at El Mirage Road, as requested by MCDOT. The 100-year Camelback Channel design incorporates box culverts at these roadway crossings (MCDOT requested the use of culverts because of the close proximity to the major intersections on Camelback Road). The bridge costs are higher than the culvert costs.

3. Fence costs are included for the Colter Channel design as required by FCDMC. Fence costs are also included in the 100-year Camelback Channel design on the north side of the channel and guardrail is included along the south side (adjacent to Camelback Road) in certain areas as needed to meet clear zone requirements.

4. Channel geometry and associated excavation costs are also different for each alternative. The Colter Channel has 6:1 side slopes on both sides and a larger bottom width to provide a greater conveyance capacity that allows future development to occur without providing stormwater retention (see item 1). The Camelback Channel has a 4:1 side slope on

the north side and a 6:1 side slope on the south side adjacent to Camelback Road. The Camelback Channel was designed with a minimum channel bottom that does not provide any extra capacity for future development. In addition, the Colter Channel alignment is longer than the Camelback Channel alignment.

5. Driveway crossings are a significant cost factor. In the case of Colter Channel there are no existing driveways for which culverts are required. The Camelback Channel, on the other hand, requires numerous culverts to provide access for existing driveways.

6. Both the 100-year Colter Channel and 100-year Camelback Channel designs incorporate a concrete valley gutter from El Mirage Road to the outfall in the Agua Fria River. However, due to the location of the outfall, the Camelback Channel has a considerably shorter length of valley gutter.

7. Right of way costs for each channel location are significantly different because of the higher cost associated with obtaining right of way along Camelback Road versus the Colter alignment and, as described above, much of the right of way for the Colter Channel will be donated. The Camelback Channel alignment requires the acquisition of the existing Tierra Buena subdivision lots and residences north of Camelback Road.

CAMELBACK ROAD CHANNEL
100-YEAR DESIGN
(Without Colter Channel)

COST ESTIMATE West of Litchfield Road to Litchfield Road (Incuding Litchfield Road Drainage Structures)			
Description	Quantity	Unit Cost	Cost
Channel Excavation	2,731 C.Y.	$1.50/C.Y.	$4,100.00
3′ Drop Structure	1 Ea.	$5,000/Ea.	$5,000.00
2′ Drop Structure	1 Ea.	$4,500/Ea.	$4,500.00
2′ Drop Inlet	1 Ea.	$5,000/Ea.	$5,000.00
Grouted Riprap (1′ Thick)	125 C.Y.	$50.00/C.Y.	$6,300.00
1 - 6′ x 3′ B.C. w/Headwalls	100 L.F.	$200/L.F.	$20,000.00
Guardrail	500 L.F.	$10.00/L.F.	$5,000.00
Guardrail End Sections	2 Ea.	$800/Ea.	$1,600.00
		Subtotal	$51,500.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$10,300.00
		Total Construction Cost	$61,800.00
Right of Way	33,640 S.F.	$.40/S.F.	$13,500.00
		TOTAL COST THIS REACH	$75,300.00

CAMELBACK ROAD CHANNEL
100-YEAR DESIGN
(Without Colter Channel)

COST ESTIMATE Litchfield Road to Dysart Road (Incuding Dysart Road Drainage Structures)			
Description	Quantity	Unit Cost	Cost
Channel Excavation (Trapezoidal)	54,945 C.Y.	$1.50/C.Y.	$82,400.00
Grouted Riprap (1′ Thick)	945 C.Y.	$50.00/C.Y.	$47,200.00
3′ Drop Inlet	1 Ea.	$5,600/Ea.	$5,600.00
1 - 6′x4′ B.C. w/Headwalls	40 L.F.	$225/L.F.	$9,000.00
3′ Drop Structure	1 Ea.	$11,200/Ea.	$11,200.00
2′ Drop Structure	1 Ea.	$10,500/Ea.	$10,500.00
4 - 8′x4′ B.C. w/Headwalls	40 L.F.	$900/L.F.	$36,000.00
4 - 8′x5′ B.C. w/Headwalls	40 L.F.	$950/L.F.	$38,000.00
5 - 8′ x 5′ B.C. w/Headwalls (Dysart Road)	110 L.F.	$1,150/L.F.	$126,500.00
Guardrail	1,000 L.F.	$10.00/L.F.	$10,000.00
Guardrail End Sections	8 Ea.	$800/Ea.	$6,400.00
Access Rd. 14′Wide, 6"ABC	2,700 Ton	$9.00/Ton	$24,300.00
Wire Fence	5,110 L.F.	$5.00/L.F.	$25,600.00
Fence Gates	5 Ea.	$750/Ea.	$3,800.00
Embankment Spillways	8 Ea.	$1,500/Ea.	$12,000.00
		Subtotal	$448,500.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$89,700.00
		Total Construction Cost	$538,200.00
Right of Way	577,965 S.F.	$.40/S.F.	$231,200.00
Severance Damage (Cost of Culverts)	L.S.	$90,000	$90,000.00
		Total Right of Way	$321,200.00
		TOTAL COST THIS REACH	$859,400.00

CAMELBACK ROAD CHANNEL
100-YEAR DESIGN
(Without Colter Channel)

COST ESTIMATE
Dysart Road to El Mirage Road
(Incuding El Mirage Road Drainage Structures)

Description	Quantity	Unit Cost	Cost
Channel Excavation	122,833 C.Y.	$1.50/C.Y.	$184,200.00
5 - 8′ x 5′ B.C. w/Headwalls	60 L.F.	$1,150/L.F.	$69,000.00
5 - 8′ x 5′ B.C. w/Headwalls	60 L.F.	$1,150/L.F.	$69,000.00
Replace & Lower 36" Siphon for Airline Canal	150 L.F.	$70.00/L.F.	$10,500.00
5 - 8′ x 5′ B.C. w/Headwalls	40 L.F.	$1,150/L.F.	$46,000.00
5 - 8′ x 5′ B.C. w/Headwalls	40 L.F.	$1,150/L.F.	$46,000.00
2′ Drop Structure	1 Ea.	$45,500/Ea.	$45,500.00
3′ Drop Structure	1 Ea.	$51,625/Ea.	$51,600.00
2′ Drop Inlet (El Mirage Road)	1 Ea.	$11,200/Ea.	$11,200.00
Grouted Riprap (1′ Thick)	770 C.Y.	$50.00/C.Y.	$38,500.00
5 - 8′ x 4′ B.C. w/Headwalls (El Mirage Rd)	110 L.F.	$1,100/L.F.	$121,000.00
Guardrail	1,000 L.F.	$10.00/L.F.	$10,000.00
Guardrail End Sections	8 Ea.	$800/Ea.	$6,400.00
Access Road 14′ wide, 6" ABC	2,700 Ton	$9.00/Ton	$24,300.00
Wire Fence	5,080 L.F.	$5.00/L.F.	$25,400.00
Fence Gates	6 Ea.	$750/Ea.	$4,500.00
Embankment Spillways	8 Ea.	$1,500/Ea.	$12,000.00
		Subtotal	$775,100.00
20% Contingencies	(Removals, Pavement Replacement, Additional Spillways, Etc.)		$155,000.00
		Total Construction Cost	$930,100.00

(Continued)

COST ESTIMATE Dysart Road to El Mirage Road (Incuding El Mirage Road Drainage Structures)			
Description	Quantity	Unit Cost	Cost
Right of Way	868,778 S.F.	$.40/S.F.	$347,500.00
	3 Vacant Lots	$25,000/Ea.	$75,000.00
	4 Lots w/House	$150,000/Ea.	$600,000.00
Severance Damage (Cost of Culverts)	L.S.	$90,000	$90,000.00
		Total Right of Way	$1,112,500.00
		TOTAL COST THIS REACH	$2,042,600.00

CAMELBACK ROAD CHANNEL
100-YEAR DESIGN
(Without Colter Channel)

COST ESTIMATE
El Mirage Road to Existing 8′ x 8′ Box Culvert Outlet
(Incuding 3 Added Culverts at Outlet)

Description	Quantity	Unit Cost	Cost
Channel Excavation	82,171 C.Y.	$1.50/C.Y.	$123,300.00
8 - 8′x4′ B.C. w/Headwalls	36 L.F.	$1,700/L.F.	$61,200.00
8 - 8′x4′ B.C. w/Headwalls	36 L.F.	$1,700/L.F.	$61,200.00
Grouted Riprap	700 C.Y.	$50.00/C.Y.	$35,000.00
Additional 3 - 8′ x 8′ B.C. w/Headwalls	108 L.F.	$900/L.F.	$97,200.00
Concrete Valley Gutter	580 C.Y.	$175/C.Y.	$101,500.00
Guardrail	600 L.F.	$10.00/L.F.	$6,000.00
Guardrail End Sections	6 Ea.	$800/Ea.	$4,800.00
Access Road 14′ Wide, 6" ABC	1,300 Ton	$9.00/Ton	$11,700.00
Wire Fence	2,530 L.F.	$5.00/L.F.	$12,700.00
Fence Gates	4 Ea.	$750/Ea.	$3,000.00
Embankment Spillways	4 Ea.	$1,500/Ea.	$6,000.00
		Subtotal	$523,600.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$104,700.00
		Total Construction Cost	$628,300.00
Right of Way	467,055 S.F.	$.40/S.F.	$186,800.00
Severance Damage (Cost of Culverts)	L.S.	$90,000	$90,000.00
		Total Right of Way	$276,800.00
		TOTAL COST THIS REACH	$905,100.00

(Continued)

COST ESTIMATE El Mirage Road to Existing 8′ x 8′ Box Culvert Outlet (Incuding 3 Added Culverts at Outlet)			
Description	Quantity	Unit Cost	Cost
ADDITIONAL PROJECT COSTS			
Mobilization	L.S.	$50,000	$50,000.00
NPDES/SWPPP Permits	L.S.	$15,000	$15,000.00
Side Weir Inflow Spillways (Assumed Same as Colter Channel)	8 Ea.	$10,400/Ea.	$83,000.00
		Subtotal	$148,000.00
		+20% Contingencies	$29,600.00
		Total Additional Project Costs	$177,600.00

TOTAL PROJECT COST	
Total Project Construction Cost (Including Contingencies)	$2,336,000.00
Total Project Right of Way Cost (Including Severance Damages)	$1,724,000.00
TOTAL PROJECT COST	$4,060,000.00

COST COMPARISONS OF
100-YEAR CAMELBACK CHANNEL (WITHOUT COLTER CHANNEL)
VS.
100-YEAR COLTER CHANNEL

COST COMPARISONS		
Description	Camelback Channel (100-Year Without Colter Channel)	Colter Channel 100-Year [1]
Channel Excavation	262,680 C.Y. $394,000	284,310 C.Y. $426,500
Grouted Riprap	2,540 C.Y. $127,000	370 C.Y. $18,500
Drop Structures	9 Total $150,100	5 Total $192,800
Guardrail & Fence (Camelback) Wire Fence (Colter)	$125,200	$165,000
Access/Maintenance Roads/ Bridge Approaches	$60,300	$364,000
Valley Gutter	$101,500	$170,000
Side Weir Inflow Spillways	Assume Same as Colter $83,000	$83,900
El Mirage Road & Dysart Road Crossings Camelback - Box Culverts Colter - Bridges	$247,500	$770,000
Driveway Crossings & Airline Canal	$563,100	(Airline Canal Only) $44,000
Embankment Spillways	20 Each $30,000	8 Each $12,000
20% Contingencies - (Camelback) Miscellaneous[2] - (Colter)	$389,300	$302,200
Mobilization & Permits	$65,000	$65,000
Right of Way (Including Severance Damages)	$1,724,000	$500,000[3]
TOTAL COST	$4,060,000[4]	$3,113,900[4]

1 Colter Channel Cost Estimates and Design Plans were compiled by CRSS, Inc. for FCDMC.

2 Cost Estimates for Colter Channel are final bid estimates with no cost for contingencies.

3 Some of the right of way for Colter Channel will be donated and in return the County will upsize the capacity of the channel to allow the doner's to develop without providing stormwater retention.

4 Does not include landscaping costs.

Note: Cost for Colter Channel plus 5-year interim Camelback Channel is $3,853,200.

CAMELBACK ROAD CHANNEL
5-YEAR DESIGN (INTERIM DESIGN)
(With Colter Channel)

COST ESTIMATE West of Litchfield Road to Litchfield Road (Incuding Litchfield Road Drainage Structure)			
Description	Quantity	Unit Cost	Cost
Channel Excavation	1,219 C.Y.	$1.50/C.Y.	$1,800.00
3′ Drop Structure	1 Ea.	$4,500/Ea.	$4,500.00
1′ Drop Structure	1 Ea.	$3,250/Ea.	$3,250.00
2.5′ Drop Inlet	1 Ea.	$3,650/Ea.	$3,650.00
Grouted Riprap (1′ Thick)	85 C.Y.	$50.00/C.Y.	$4,300.00
1 - 36" RCP	100 L.F.	$70/L.F.	$7,000.00
Headwalls	2 Ea.	$1,500/Ea.	$3,000.00
		Subtotal	$27,500.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$5,500.00
		Total Construction Cost	$33,000.00
Right of Way	29,433 S.F.	$.40/S.F.	$11,800.00
		TOTAL COST THIS REACH	$44,800.00

CAMELBACK ROAD CHANNEL
5-YEAR DESIGN (INTERIM DESIGN)
(With Colter Channel)

COST ESTIMATE Litchfield Road to Dysart Road (Incuding Dysart Road Drainage Structure)			
Description	Quantity	Unit Cost	Cost
Channel Excavation	15,356 C.Y.	$1.50/C.Y.	$23,000.00
3′ Drop Inlet	1 Ea.	$4,050/Ea.	$4,050.00
1 - 36" RCP	40 L.F.	$70.00/Ea.	$2,800.00
Headwalls	2 Ea.	$1,500/Ea.	$3,000.00
1′ Drop Structure	1 Ea.	$3,550/Ea.	$3,550.00
1′ Drop Inlet	1 Ea.	$3,000/Ea.	$3,000.00
Grouted Riprap (1′ Thick)	370 C.Y.	$50.00/C.Y.	$18,500.00
1 - 6′ x 3′ B.C. w/Headwalls	40 L.F.	$200/L.F.	$8,000.00
1 - 8′ x 3′ B.C. w/Headwalls	40 L.F.	$250/L.F.	$10,000.00
1 - 8′ X 3′ B.C. w/Headwalls	100 L.F.	$250/L.F.	$27,500.00
Embankment Spillways	16 Ea.	$1,500/Ea.	$24,000.00
		Subtotal	$127,400.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$25,500.00
		Total Construction Cost	$152,900.00
Right of Way	237,855 S.F.	$.40/S.F.	$95,100.00
Severance Damage (Cost of Culverts)	L.S.	$20,000	$20,000.00
		Total Right of Way	$115,100.00
		TOTAL COST THIS REACH	$268,000.00

CAMELBACK ROAD CHANNEL
5-YEAR DESIGN (INTERIM DESIGN)
(With Colter Channel)

COST ESTIMATE
Dysart Road to El Mirage Road
(Incuding El Mirage Road Drainage Structure)

Description	Quantity	Unit Cost	Cost
Channel Excavation	29,474 C.Y.	$1.50/C.Y.	$44,200.00
1 - 8′ x 3′ B.C. w/Headwalls	60 L.F.	$250/L.F.	$15,000.00
1 - 8′ x 3′ B.C. w/Headwalls	60 L.F.	$250/L.F.	$15,000.00
Replace & Lower 36" Siphon for Airline Canal			
1 - 8′ x 3′ B.C. w/Headwalls	40 L.F.	$250/L.F.	$10,000.00
1 - 8′ x 3′ B.C. w/Headwalls	40 L.F.	$250/L.F.	$10,000.00
2′ Drop Structure	1 Ea.	$4,000/Ea.	$4,000.00
3′ Drop Inlet	1 Ea.	$4,650/Ea.	$4,650.00
1 - 8′ x 4′ B.C. w/Headwalls	110 L.F.	$275/L.F.	$30,250.00
Grouted Riprap	420 C.Y.	$50.00/C.Y.	$21,000.00
Embankment Spillways	16 Ea.	$1,500/Ea.	$24,000.00
		Subtotal	$178,100.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$35,600.00
		Total Construction Cost	$213,700.00
Right of Way	319,765 S.F.	$.40/S.F.	$127,900.00
Severance Damage (Culvert Costs)	L.S.	$20,000	$20,000.00
		Total Right of Way	$147,900.00
		TOTAL COST THIS REACH	$361,600.00

CAMELBACK ROAD CHANNEL
5-YEAR DESIGN (INTERIM DESIGN)
(With Colter Channel)

COST ESTIMATE El Mirage Road to Existing 8′ x 8′ Box Culvert Outlet Under Camelback Road			
Description	Quantity	Unit Cost	Cost
Regrade and Clear Existing Channel	Lump Sum	$5,000.00	$5,000.00
Embankment Spillways	8 Ea.	$1,500/Ea.	$12,000.00
		Subtotal	$17,000.00
		20% Contingencies (Removals, Pavement Replacement, Additional Spillways, Etc.)	$3,400.00
		Total Construction Cost	$20,400.00
ADDITIONAL PROJECT COSTS			
Mobilization	L.S.	$30,000	$30,000.00
NPDES/SWPPP Permits	L.S.	$15,000	$15,000.00
		Total Additional Project Costs	$45,000.00

TOTAL PROJECT COST	
TOTAL PROJECT CONSTRUCTION COST (Including Contingencies)	$465,000.00
TOTAL PROJECT RIGHT OF WAY COST (Including Severance Damages)	$274,800.00
TOTAL PROJECT COST	$739,800.00

COST COMPARISONS OF
100-YEAR CAMELBACK CHANNEL (WITHOUT COLTER CHANNEL)
VS.
5-YEAR INTERIM CAMELBACK CHANNEL (WITH COLTER CHANNEL IN PLACE)

COST COMPARISONS		
Description	100-Year Camelback Channel Design (Without Colter Channel)	5-Year Interim Camelback Channel Design (With Colter Channel)
Channel Excavation	262,680 C.Y. $394,000	46,050 C.Y. $74,000
Drop Structures	9 Total $150,100	8 Total $30,650
Grouted Riprap	2,540 C.Y. $127,000	875 C.Y. $43,800
Wire Fence & Guardrail	$125,200	Not Required
Culvert Crossings	$810,600	$141,550
Maintenance Road	$60,300	Not Required
Valley Gutter	$101,500	Not Required
Side Wier Inflow Spillways	$83,000	Not Required
Embankment Spillways	20 Each $30,000	40 Each $60,000
20% Contingencies	$389,300	$70,000
Right of Way (Including Severance Damages)	$1,724,000	$274,800 (Without Subdivision Lots)
Mobilization & Permits	$65,000	$45,000
TOTAL COST	$4,060,000	$739,800

APPENDIX A

STANDARD STEP BACKWATER ANALYSIS AND CULVERT ANALYSES

100-YEAR BACKWATER ANALYSES

STA 138+91
upst. face of Existing 8'x8' B.C
outlet under Camelback Road
Into Existing Sand & Gravel pi
(Add 3-8'x8' B.C)

100-Yr, Q = 1726 cfs

CURRENT DATE: 07-06-1993
CURRENT TIME: 10:25:55

FILE DATE: 06-24-1993
FILE NAME: CBOUT100

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1013.96	1013.46	100.00	4 RCB	8.00	8.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

FILE: CBOUT100 CULVERT HEADWATER ELEVATION (FT) DATE: 06-24-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1017.96	0.00	0.00	0.00	0.00	0.00	1023.60
173	1018.09	0.00	0.00	0.00	0.00	0.00	1024.07
345	1018.19	0.00	0.00	0.00	0.00	0.00	1024.33
518	1018.35	0.00	0.00	0.00	0.00	0.00	1024.55
690	1018.49	0.00	0.00	0.00	0.00	0.00	1024.74
863	1018.18	0.00	0.00	0.00	0.00	0.00	1024.90
1036	1018.76	0.00	0.00	0.00	0.00	0.00	1025.06
1208	1019.32	0.00	0.00	0.00	0.00	0.00	1025.21
1381	1019.85	0.00	0.00	0.00	0.00	0.00	1025.36
1553	1020.38	0.00	0.00	0.00	0.00	0.00	1025.50
1726	1020.89	0.00	0.00	0.00	0.00	0.00	1025.63
3452	1026.22	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

CURRENT DATE: 07-06-1993 FILE DATE: 06-24-1993
CURRENT TIME: 10:25:55 FILE NAME: CBOUT100

PERFORMANCE CURVE FOR CULVERT # 1 - 4 (8 BY 8) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1017.96	0.00	4.00	0-NF	0.00	0.00	0.00	0.00	0.00	4.50
173	1018.09	1.44	4.13	3-M1t	0.80	0.97	1.20	4.50	0.00	4.50
345	1018.19	2.28	4.23	3-M1t	1.23	1.54	2.40	4.50	0.00	4.50
518	1018.35	2.99	4.39	3-M1t	1.65	2.02	3.60	4.50	0.00	4.50
690	1018.49	3.62	4.53	3-M1t	2.01	2.44	4.79	4.50	0.00	4.50
863	1018.18	4.22	4.22	1-S2n	2.36	2.83	11.01	2.45	0.00	4.50
1036	1018.76	4.80	4.80	1-S2n	2.68	3.20	11.60	2.79	0.00	4.50
1208	1019.32	5.36	5.36	1-S2n	3.00	3.55	12.10	3.12	0.00	4.50
1381	1019.85	5.89	5.89	1-S2n	3.31	3.88	12.55	3.44	0.00	4.50
1553	1020.38	6.42	6.42	1-S2n	3.60	4.19	12.96	3.75	0.00	4.50
1726	1020.89	6.93	6.93	1-S2n	3.90	4.50	13.34	4.04	0.00	4.50

El. inlet face invert 1013.96 ft El. outlet invert 1013.46 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1013.96
OUTLET STATION (FT)	100.00
OUTLET ELEVATION (FT)	1013.46
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0050
CULVERT LENGTH ALONG SLOPE (FT)	100.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	8.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-06-1993
CURRENT TIME: 10:25:55

FILE DATE: 06-24-1993
FILE NAME: CBOUT100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1017.96

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH (FT)	50.00
CREST LENGTH (FT)	200.00
OVERTOPPING CREST ELEVATION (FT)	1023.60

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1726.0
Channel Bottom Slope (feet per foot).....	0.0025
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	100.0
Channel Flow-Line Elevation at Starting Station (feet)..	1013.96
Water Surface Elevation at Starting Station (feet).....	1020.89
Starting Channel Station (feet).....	0.00

S=.00247 1/1

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PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.82
Critical Depth (feet).....	2.04

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
139+16	0.0	1013.96	1020.89	6.93	885.10	1.95	0.059	0.000107
	50.0	1014.08	1020.89	6.81	866.43	1.99	0.062	0.000114
	100.0	1014.21	1020.90	6.69	847.91	2.04	0.064	0.000122
	150.0	1014.33	1020.90	6.57	829.55	2.08	0.067	0.000130
	200.0	1014.45	1020.90	6.45	811.33	2.13	0.070	0.000139
137+06	210.0	1014.48	1020.90	6.43	807.72	2.14	0.071	0.000141

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

STA 136+70 TO STA 137+06
Culvert under Driveway
2275' E. of El Mirage Rd.
100-Yr. Q = 1726 CFS

CURRENT DATE: 07-15-1993
CURRENT TIME: 12:04:58

FILE DATE: 06-24-1993
FILE NAME: CB1-100

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1014.57	1014.48	36.00	8 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB1-100 DATE: 06-24-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1020.90	0	0	0	0	0	0	0	0	1
1020.91	173	173	0	0	0	0	0	0	1
1020.94	345	345	0	0	0	0	0	0	1
1020.98	518	518	0	0	0	0	0	0	1
1021.05	690	690	0	0	0	0	0	0	1
1021.13	863	863	0	0	0	0	0	0	1
1021.23	1036	1036	0	0	0	0	0	0	1
1021.35	1208	1208	0	0	0	0	0	0	1
1021.49	1381	1381	0	0	0	0	0	0	1
1021.64	1553	1553	0	0	0	0	0	0	1
1021.82	1726	1726	0	0	0	0	0	0	1
1022.00	1880	1880	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB1-100 DATE: 06-24-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1020.90	0.00	0	0	0.00
1020.91	0.00	173	0	0.00
1020.94	0.00	345	0	0.00
1020.98	0.00	518	0	0.00
1021.05	0.00	690	0	0.00
1021.13	0.00	863	0	0.00
1021.23	0.00	1036	0	0.00
1021.35	0.00	1208	0	0.00
1021.49	0.00	1381	0	0.00
1021.64	0.00	1553	0	0.00
1021.82	0.00	1726	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-15-1993
CURRENT TIME: 12:04:58

FILE DATE: 06-24-1993
FILE NAME: CB1-100

PERFORMANCE CURVE FOR CULVERT # 1 - 8 (8 BY 4) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1020.90	0.00	6.33	0-NF	0.00	0.00	0.00	0.00	0.00	6.42
173	1020.91	0.91	6.34	4-FFt	0.63	0.61	0.67	4.00	0.00	6.42
345	1020.94	1.44	6.37	4-FFt	1.00	0.97	1.35	4.00	0.00	6.42
518	1020.98	1.89	6.41	4-FFt	1.31	1.27	2.02	4.00	0.00	6.42
690	1021.05	2.31	6.48	4-FFt	1.59	1.54	2.70	4.00	0.00	6.42
863	1021.13	2.70	6.56	4-FFt	1.85	1.78	3.37	4.00	0.00	6.42
1036	1021.23	3.08	6.66	4-FFt	2.10	2.02	4.05	4.00	0.00	6.42
1208	1021.35	3.44	6.78	4-FFt	2.34	2.23	4.72	4.00	0.00	6.42
1381	1021.49	3.80	6.92	4-FFt	2.57	2.44	5.39	4.00	0.00	6.42
1553	1021.64	4.15	7.07	4-FFt	2.80	2.64	6.07	4.00	0.00	6.42
1726	1021.82	4.51	7.25	4-FFt	3.02	2.83	6.74	4.00	0.00	6.42

El. inlet face invert 1014.57 ft El. outlet invert 1014.48 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1014.57
OUTLET STATION (FT)	36.00
OUTLET ELEVATION (FT)	1014.48
NUMBER OF BARRELS	8
SLOPE (V-FT/H-FT)	0.0025
CULVERT LENGTH ALONG SLOPE (FT)	36.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-15-1993
CURRENT TIME: 12:04:58

FILE DATE: 06-24-1993
FILE NAME: CB1-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1020.90

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE GRAVEL
EMBANKMENT TOP WIDTH (FT) 30.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1027.10
2	40.00	1026.50
3	48.00	1027.10
4	148.00	1022.00

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1726.0
Channel Bottom Slope (feet per foot).....	0.0025 S= .00247½
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	100.0
Channel Flow-Line Elevation at Starting Station (feet)..	1014.57
Water Surface Elevation at Starting Station (feet).....	1021.82
Starting Channel Station (feet).....	246.00

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PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.82
Critical Depth (feet).....	2.04

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
136+70	246.0	1014.57	1021.82	7.25	935.25	1.85	0.053	0.000091
	300.0	1014.70	1021.82	7.12	914.68	1.89	0.055	0.000098
	500.0	1015.20	1021.83	6.64	839.97	2.05	0.066	0.000125
	700.0	1015.69	1021.85	6.16	767.70	2.25	0.078	0.000163
	900.0	1016.19	1021.87	5.69	698.08	2.47	0.095	0.000217
	1100.0	1016.68	1021.90	5.22	631.41	2.73	0.116	0.000292
127+74	1142.0	1016.78	1021.91	5.13	617.81	2.79	0.121	0.000312

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

STA 127+38 TO STA 127+74

CULVERT UNDER DRIVEWAY ≅ 1300' E. OF EL MIRAGE ROAD.

100-YR Q = 1439 CFS

CURRENT DATE: 07-15-1993
CURRENT TIME: 12:18:06

FILE DATE: 06-24-1993
FILE NAME: CB2-100

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1016.87	1016.78	36.00	8 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB2-100 DATE: 06-24-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1021.91	0	0	0	0	0	0	0	0	1
1021.92	144	144	0	0	0	0	0	0	1
1021.94	288	288	0	0	0	0	0	0	1
1021.97	432	432	0	0	0	0	0	0	1
1022.01	576	576	0	0	0	0	0	0	1
1022.07	720	720	0	0	0	0	0	0	1
1022.14	863	863	0	0	0	0	0	0	1
1022.22	1007	1007	0	0	0	0	0	0	1
1022.32	1151	1151	0	0	0	0	0	0	1
1022.43	1295	1295	0	0	0	0	0	0	1
1022.55	1439	1439	0	0	0	0	0	0	1
1022.70	1592	1592	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB2-100 DATE: 06-24-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1021.91	0.00	0	0	0.00
1021.92	0.00	144	0	0.00
1021.94	0.00	288	0	0.00
1021.97	0.00	432	0	0.00
1022.01	0.00	576	0	0.00
1022.07	0.00	720	0	0.00
1022.14	0.00	863	0	0.00
1022.22	0.00	1007	0	0.00
1022.32	0.00	1151	0	0.00
1022.43	0.00	1295	0	0.00
1022.55	0.00	1439	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-15-1993 FILE DATE: 06-24-1993
CURRENT TIME: 12:18:06 FILE NAME: CB2-100

PERFORMANCE CURVE FOR CULVERT # 1 - 8 (8 BY 4) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1021.91	0.00	5.04	0-NF	0.00	0.00	0.00	0.00	0.00	5.13
144	1021.92	0.81	5.05	4-FFt	0.56	0.54	0.56	4.00	0.00	5.13
288	1021.94	1.28	5.07	4-FFt	0.89	0.86	1.12	4.00	0.00	5.13
432	1021.97	1.67	5.10	4-FFt	1.16	1.12	1.69	4.00	0.00	5.13
576	1022.01	2.03	5.14	4-FFt	1.40	1.36	2.25	4.00	0.00	5.13
720	1022.07	2.38	5.20	4-FFt	1.64	1.58	2.81	4.00	0.00	5.13
863	1022.14	2.70	5.27	4-FFt	1.85	1.79	3.37	4.00	0.00	5.13
1007	1022.22	3.02	5.35	4-FFt	2.06	1.98	3.93	4.00	0.00	5.13
1151	1022.32	3.32	5.45	4-FFt	2.26	2.16	4.50	4.00	0.00	5.13
1295	1022.43	3.62	5.56	4-FFt	2.46	2.34	5.06	4.00	0.00	5.13
1439	1022.55	3.92	5.68	4-FFt	2.65	2.51	5.62	4.00	0.00	5.13

El. inlet face invert 1016.87 ft El. outlet invert 1016.78 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1016.87
OUTLET STATION (FT)	36.00
OUTLET ELEVATION (FT)	1016.78
NUMBER OF BARRELS	8
SLOPE (V-FT/H-FT)	0.0025
CULVERT LENGTH ALONG SLOPE (FT)	36.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-15-1993
CURRENT TIME: 12:18:06

FILE DATE: 06-24-1993
FILE NAME: CB2-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1021.91

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE GRAVEL
EMBANKMENT TOP WIDTH (FT) 30.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1027.40
2	40.00	1026.80
3	48.00	1027.40
4	148.00	1022.70

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1439.0
Channel Bottom Slope (feet per foot).....	0.0025
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	100.0
Channel Flow-Line Elevation at Starting Station (feet)..	1016.87
Water Surface Elevation at Starting Station (feet).....	1022.55
Starting Channel Station (feet).....	1178.00

S= .00247 1/1

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PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.53
Critical Depth (feet).....	1.81

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
127+38	1178.0	1016.87	1022.55	5.68	697.05	2.06	0.066	0.000151
	1200.0	1016.92	1022.55	5.63	689.44	2.09	0.068	0.000156
	1400.0	1017.42	1022.57	5.16	621.80	2.31	0.083	0.000213
	1600.0	1017.91	1022.60	4.69	557.20	2.58	0.104	0.000296
	2000.0	1018.90	1022.72	3.82	440.52	3.27	0.166	0.000603
	2400.0	1019.89	1022.99	3.10	348.69	4.13	0.264	0.001235
114+71	2445.0	1020.00	1023.04	3.04	340.43	4.23	0.277	0.001330

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-16-1993
CURRENT TIME: 05:49:45

FILE DATE: 06-24-1993
FILE NAME: CBMIR100

STA 113+61 TO STA. 114+71

CULVERT UNDER EL MIRAGE ROAD

100-YR Q = 1469 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1020.55	1020.00	110.00	5 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CBMIR100 DATE: 06-24-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1023.04	0	0	0	0	0	0	0	0	1
1023.11	147	147	0	0	0	0	0	0	1
1023.21	294	294	0	0	0	0	0	0	1
1023.44	441	441	0	0	0	0	0	0	1
1023.42	588	588	0	0	0	0	0	0	1
1023.92	735	735	0	0	0	0	0	0	1
1024.40	881	881	0	0	0	0	0	0	1
1024.89	1028	1028	0	0	0	0	0	0	1
1025.39	1175	1175	0	0	0	0	0	0	1
1025.91	1322	1322	0	0	0	0	0	0	1
1026.46	1469	1469	0	0	0	0	0	0	1
1027.15	1640	1640	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CBMIR100 DATE: 06-24-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1023.04	0.00	0	0	0.00
1023.11	0.00	147	0	0.00
1023.21	0.00	294	0	0.00
1023.44	0.00	441	0	0.00
1023.42	0.00	588	0	0.00
1023.92	0.00	735	0	0.00
1024.40	0.00	881	0	0.00
1024.89	0.00	1028	0	0.00
1025.39	0.00	1175	0	0.00
1025.91	0.00	1322	0	0.00
1026.46	0.00	1469	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-16-1993 FILE DATE: 06-24-1993
CURRENT TIME: 05:49:45 FILE NAME: CBMIR100

PERFORMANCE CURVE FOR CULVERT # 1 - 5 (8 BY 4) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1023.04	0.00	2.49	0-NF	0.00	0.00	0.00	0.00	0.00	3.04
147	1023.11	1.11	2.56	3-M1t	0.61	0.75	1.21	3.04	0.00	3.04
294	1023.21	1.77	2.66	3-M1t	0.97	1.19	2.42	3.04	0.00	3.04
441	1023.44	2.34	2.89	3-M1t	1.28	1.56	3.62	3.04	0.00	3.04
588	1023.42	2.87	2.87	1-S2n	1.55	1.89	9.47	1.55	0.00	3.04
735	1023.92	3.37	3.37	1-S2n	1.80	2.19	9.89	1.86	0.00	3.04
881	1024.40	3.85	3.85	1-S2n	2.05	2.48	10.43	2.11	0.00	3.04
1028	1024.89	4.34	4.34	5-S2n	2.28	2.74	10.90	2.36	0.00	3.04
1175	1025.39	4.84	4.84	5-S2n	2.51	3.00	11.33	2.59	0.00	3.04
1322	1025.91	5.36	5.36	5-S2n	2.73	3.24	11.70	2.82	0.00	3.04
1469	1026.46	5.91	5.91	5-S2n	2.94	3.48	12.05	3.05	0.00	3.04

El. inlet face invert 1020.55 ft El. outlet invert 1020.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1020.55
OUTLET STATION (FT)	110.00
OUTLET ELEVATION (FT)	1020.00
NUMBER OF BARRELS	5
SLOPE (V-FT/H-FT)	0.0050
CULVERT LENGTH ALONG SLOPE (FT)	110.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-16-1993
CURRENT TIME: 05:49:45

FILE DATE: 06-24-1993
FILE NAME: CBMIR100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1023.04

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1027.80
2	100.00	1027.15
3	200.00	1027.25
4	250.00	1027.50
5	650.00	1027.90

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 16, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1469.0
Channel Bottom Slope (feet per foot).....	0.0027 S= 0.00268 1/1
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	100.0
Channel Flow-Line Elevation at Starting Station (feet)..	1022.55
Water Surface Elevation at Starting Station (feet).....	1026.46
Starting Channel Station (feet).....	0.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.50
Critical Depth (feet).....	1.84

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
113+46	0.0	1022.55	1026.46	3.91	452.15	3.25	0.164	0.000580
(2' Foot Drop Inlet)	100.0	1022.82	1026.50	3.68	422.55	3.48	0.188	0.000713
	200.0	1023.09	1026.55	3.47	394.81	3.72	0.215	0.000878
	300.0	1023.35	1026.62	3.27	369.32	3.98	0.246	0.001078
	400.0	1023.62	1026.71	3.08	346.53	4.24	0.279	0.001312
	500.0	1023.89	1026.82	2.93	326.90	4.49	0.314	0.001572
	600.0	1024.16	1026.95	2.80	310.84	4.73	0.347	0.001837
107+00 (3 FOOT DROP STRUCT.)	646.0	1024.28	1027.03	2.75	304.72	4.82	0.361	0.001954

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 16, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1469.0
Channel Bottom Slope (feet per foot).....	0.0020
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	100.0
Channel Flow-Line Elevation at Starting Station (feet)..	1027.28
Water Surface Elevation at Starting Station (feet).....	1029.12
Starting Channel Station (feet).....	646.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.73
Critical Depth (feet).....	1.84

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
107+00 (3' DROP STRUCT)	646.0	1027.28	1029.12	1.84	197.54	7.44	0.859	0.007623
	680.0	1027.35	1029.63	2.28	249.09	5.90	0.540	0.003669
	700.0	1027.39	1029.73	2.34	256.15	5.73	0.511	0.003361
	800.0	1027.59	1030.10	2.52	276.85	5.31	0.437	0.002636
	1000.0	1027.99	1030.63	2.65	292.67	5.02	0.391	0.002216
	1200.0	1028.39	1031.08	2.69	298.13	4.93	0.377	0.002092
101+00 (2' DROP STRUCT.)	1246.0	1028.48	1031.18	2.70	298.80	4.92	0.375	0.002078

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1349.0
Channel Bottom Slope (feet per foot).....	0.0014 S=.00145 1/1
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	100.0
Channel Flow-Line Elevation at Starting Station (feet)..	1030.48
Water Surface Elevation at Starting Station (feet).....	1032.22
Starting Channel Station (feet).....	1246.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.85
Critical Depth (feet).....	1.74

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
101+00 (2) DROP STRUCT	1246.0	1030.48	1032.22	1.74	186.11	7.25	0.816	0.007767
	1300.0	1030.56	1032.89	2.33	254.64	5.30	0.436	0.002888
	1400.0	1030.70	1033.21	2.51	275.62	4.89	0.372	0.002254
	1500.0	1030.85	1033.45	2.60	287.20	4.70	0.343	0.001982
	1600.0	1030.99	1033.66	2.66	294.81	4.58	0.325	0.001827
	1700.0	1031.14	1033.85	2.71	300.17	4.49	0.314	0.001727
	1800.0	1031.28	1034.02	2.74	304.11	4.44	0.306	0.001659
	2000.0	1031.57	1034.36	2.78	309.40	4.36	0.295	0.001572
	2200.0	1031.86	1034.67	2.81	312.51	4.32	0.289	0.001524
	2400.0	1032.15	1034.98	2.82	314.39	4.29	0.286	0.001496
	2500.0	1032.30	1035.13	2.83	315.03	4.28	0.285	0.001487
88+44	2502.0	1032.30	1035.13	2.83	315.03	4.28	0.285	0.001486

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:30:38

FILE DATE: 07-19-1993
FILE NAME: CB3-100

STA 88+04 TO STA 88+44
Driveway @ 2524' W. of El Mirage Road
(2nd Driveway E. of Airline Canal)
100-YR Q = 1296 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1032.36	1032.30	40.00	5 RCB	8.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB3-100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1035.13	0	0	0	0	0	0	0	0	1
1035.17	130	130	0	0	0	0	0	0	1
1035.24	259	259	0	0	0	0	0	0	1
1035.38	389	389	0	0	0	0	0	0	1
1035.56	518	518	0	0	0	0	0	0	1
1035.79	648	648	0	0	0	0	0	0	1
1036.07	778	778	0	0	0	0	0	0	1
1036.40	907	907	0	0	0	0	0	0	1
1036.75	1037	1037	0	0	0	0	0	0	1
1037.11	1166	1166	0	0	0	0	0	0	1
1037.46	1296	1296	0	0	0	0	0	0	1
1038.06	1525	1525	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB3-100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1035.13	0.00	0	0	0.00
1035.17	0.00	130	0	0.00
1035.24	0.00	259	0	0.00
1035.38	0.00	389	0	0.00
1035.56	0.00	518	0	0.00
1035.79	0.00	648	0	0.00
1036.07	0.00	778	0	0.00
1036.40	0.00	907	0	0.00
1036.75	0.00	1037	0	0.00
1037.11	0.00	1166	0	0.00
1037.46	0.00	1296	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993 FILE DATE: 07-19-1993
CURRENT TIME: 07:30:38 FILE NAME: CB3-100

PERFORMANCE CURVE FOR CULVERT # 1 - 5 (8 BY 5) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1035.13	0.00	2.77	0-NF	0.00	0.00	0.00	0.00	0.00	2.83
130	1035.17	1.03	2.81	3-M1t	0.84	0.69	1.14	2.83	0.00	2.83
259	1035.24	1.63	2.88	3-M1t	1.33	1.09	2.29	2.83	0.00	2.83
389	1035.38	2.14	3.02	3-M1t	1.76	1.43	3.43	2.83	0.00	2.83
518	1035.56	2.59	3.20	3-M1t	2.15	1.74	4.58	2.83	0.00	2.83
648	1035.79	3.04	3.43	3-M1t	2.52	2.02	5.72	2.83	0.00	2.83
778	1036.07	3.46	3.71	3-M2t	2.87	2.28	6.87	2.83	0.00	2.83
907	1036.40	3.86	4.04	3-M2t	3.21	2.52	8.01	2.83	0.00	2.83
1037	1036.75	4.25	4.39	3-M2t	3.54	2.76	9.16	2.83	0.00	2.83
1166	1037.11	4.63	4.75	2-M2c	3.87	2.98	9.77	2.98	0.00	2.83
1296	1037.46	5.02	5.10	2-M2c	4.18	3.20	10.12	3.20	0.00	2.83

El. inlet face invert 1032.36 ft El. outlet invert 1032.30 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1032.36
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1032.30
NUMBER OF BARRELS	5
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:30:38

FILE DATE: 07-19-1993
FILE NAME: CB3-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1035.13

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	25.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1038.66
2	40.00	1038.06
3	48.00	1038.66
4	148.00	1040.00

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1296.0
Channel Bottom Slope (feet per foot).....	0.0014 S= .00145 1/1
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	60.0
Channel Flow-Line Elevation at Starting Station (feet)..	1032.36
Water Surface Elevation at Starting Station (feet).....	1037.46
Starting Channel Station (feet).....	2542.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.66
Critical Depth (feet).....	2.31

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
88+04	2542.0	1032.36	1037.46	5.10	410.04	3.16	0.155	0.000443
	2600.0	1032.44	1037.48	5.04	403.74	3.21	0.160	0.000463
85+88	2758.0	1032.67	1037.55	4.87	387.29	3.35	0.174	0.000522

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:40:36

FILE DATE: 07-19-1993
FILE NAME: CB4-100

STA 85+48 TO STA 85+88
Driveway ≅ 2800' W. of El Mirage Road
(1st Driveway E. of Airline Canal)
100-YR Q = 1296 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1032.72	1032.66	40.00	5 RCB	8.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB4-100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1037.55	0	0	0	0	0	0	0	0	1
1037.57	130	130	0	0	0	0	0	0	1
1037.59	259	259	0	0	0	0	0	0	1
1037.64	389	389	0	0	0	0	0	0	1
1037.69	518	518	0	0	0	0	0	0	1
1037.77	648	648	0	0	0	0	0	0	1
1037.87	778	778	0	0	0	0	0	0	1
1037.97	907	907	0	0	0	0	0	0	1
1038.11	1037	1037	0	0	0	0	0	0	1
1038.25	1166	1166	0	0	0	0	0	0	1
1038.41	1296	1296	0	0	0	0	0	0	1
1038.86	1609	1609	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB4-100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1037.55	0.00	0	0	0.00
1037.57	0.00	130	0	0.00
1037.59	0.00	259	0	0.00
1037.64	0.00	389	0	0.00
1037.69	0.00	518	0	0.00
1037.77	0.00	648	0	0.00
1037.87	0.00	778	0	0.00
1037.97	0.00	907	0	0.00
1038.11	0.00	1037	0	0.00
1038.25	0.00	1166	0	0.00
1038.41	0.00	1296	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993 FILE DATE: 07-19-1993
CURRENT TIME: 07:40:36 FILE NAME: CB4-100

PERFORMANCE CURVE FOR CULVERT # 1 - 5 (8 BY 5) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1037.55	0.00	4.83	0-NF	0.00	0.00	0.00	0.00	0.00	4.89
130	1037.57	1.03	4.85	3-M1t	0.84	0.69	0.66	4.89	0.00	4.89
259	1037.59	1.63	4.87	3-M1t	1.33	1.09	1.33	4.89	0.00	4.89
389	1037.64	2.14	4.92	3-M1t	1.76	1.43	1.99	4.89	0.00	4.89
518	1037.69	2.59	4.97	3-M1t	2.15	1.74	2.65	4.89	0.00	4.89
648	1037.77	3.04	5.05	3-M1t	2.52	2.02	3.31	4.89	0.00	4.89
778	1037.87	3.46	5.15	3-M1t	2.87	2.28	3.98	4.89	0.00	4.89
907	1037.97	3.86	5.25	3-M1t	3.21	2.52	4.64	4.89	0.00	4.89
1037	1038.11	4.25	5.39	3-M1t	3.54	2.76	5.30	4.89	0.00	4.89
1166	1038.25	4.63	5.53	3-M1t	3.87	2.98	5.96	4.89	0.00	4.89
1296	1038.41	5.02	5.69	3-M1t	4.18	3.20	6.63	4.89	0.00	4.89

El. inlet face invert 1032.72 ft El. outlet invert 1032.66 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1032.72
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1032.66
NUMBER OF BARRELS	5
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:40:36

FILE DATE: 07-19-1993
FILE NAME: CB4-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1037.55

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE		PAVED
EMBANKMENT TOP WIDTH (FT)		25.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1039.46
2	40.00	1038.86
3	48.00	1039.46
4	148.00	1040.50

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1296.0
Channel Bottom Slope (feet per foot).....	0.0014
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	40.0
Channel Flow-Line Elevation at Starting Station (feet)..	1032.72
Water Surface Elevation at Starting Station (feet).....	1038.41
Starting Channel Station (feet).....	2798.00

S=.00145 ½

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	4.43
Critical Depth (feet).....	2.89

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
85+48	2798.0	1032.72	1038.41	5.69	357.10	3.63	0.205	0.000567
	2800.0	1032.72	1038.41	5.69	356.94	3.63	0.205	0.000567
	3000.0	1033.01	1038.51	5.50	340.98	3.80	0.224	0.000645
	3200.0	1033.30	1038.63	5.33	326.59	3.97	0.245	0.000728
	3400.0	1033.59	1038.76	5.17	313.80	4.13	0.265	0.000815
78+23	3523.0	1033.77	1038.86	5.08	306.75	4.22	0.277	0.000869

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:47:51

FILE DATE: 07-19-1993
FILE NAME: CBAIR100

STA 77+63 TO STA 78+23
AIRLINE CANAL
100-YR Q = 1296 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1033.86	1033.77	60.00	5 RCB	8.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CBAIR100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1038.86	0	0	0	0	0	0	0	0	1
1038.87	130	130	0	0	0	0	0	0	1
1038.89	259	259	0	0	0	0	0	0	1
1038.93	389	389	0	0	0	0	0	0	1
1038.99	518	518	0	0	0	0	0	0	1
1039.06	648	648	0	0	0	0	0	0	1
1039.14	778	778	0	0	0	0	0	0	1
1039.24	907	907	0	0	0	0	0	0	1
1039.36	1037	1037	0	0	0	0	0	0	1
1039.49	1166	1166	0	0	0	0	0	0	1
1039.64	1296	1296	0	0	0	0	0	0	1
1041.14	2018	2018	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CBAIR100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1038.86	0.00	0	0	0.00
1038.87	0.00	130	0	0.00
1038.89	0.00	259	0	0.00
1038.93	0.00	389	0	0.00
1038.99	0.00	518	0	0.00
1039.06	0.00	648	0	0.00
1039.14	0.00	778	0	0.00
1039.24	0.00	907	0	0.00
1039.36	0.00	1037	0	0.00
1039.49	0.00	1166	0	0.00
1039.64	0.00	1296	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993 FILE DATE: 07-19-1993
CURRENT TIME: 07:47:51 FILE NAME: CBAIR100

PERFORMANCE CURVE FOR CULVERT # 1 - 5 (8 BY 5) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1038.86	0.00	5.00	0-NF	0.00	0.00	0.00	0.00	0.00	5.09
130	1038.87	1.03	5.01	3-M1f	0.84	0.69	0.65	5.00	0.00	5.09
259	1038.89	1.63	5.03	3-M1f	1.33	1.09	1.30	5.00	0.00	5.09
389	1038.93	2.14	5.07	3-M1f	1.76	1.43	1.94	5.00	0.00	5.09
518	1038.99	2.59	5.13	3-M1f	2.15	1.74	2.59	5.00	0.00	5.09
648	1039.06	3.04	5.20	3-M1f	2.52	2.02	3.24	5.00	0.00	5.09
778	1039.14	3.46	5.28	3-M1f	2.87	2.28	3.89	5.00	0.00	5.09
907	1039.24	3.86	5.38	3-M1f	3.21	2.52	4.54	5.00	0.00	5.09
1037	1039.36	4.25	5.50	3-M1f	3.54	2.76	5.18	5.00	0.00	5.09
1166	1039.49	4.63	5.63	3-M1f	3.87	2.98	5.83	5.00	0.00	5.09
1296	1039.64	5.02	5.78	3-M1f	4.18	3.20	6.48	5.00	0.00	5.09

El. inlet face invert 1033.86 ft El. outlet invert 1033.77 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1033.86
OUTLET STATION (FT)	60.00
OUTLET ELEVATION (FT)	1033.77
NUMBER OF BARRELS	5
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	60.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:47:51

FILE DATE: 07-19-1993
FILE NAME: CBAIR100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1038.86

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	60.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1041.74
2	40.00	1041.14
3	48.00	1041.74
4	148.00	1044.30

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1102.0
Channel Bottom Slope (feet per foot).....	0.0014 S=.00145 1/1
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	40.0
Channel Flow-Line Elevation at Starting Station (feet)..	1033.86
Water Surface Elevation at Starting Station (feet).....	1039.64
Starting Channel Station (feet).....	3583.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	4.06
Critical Depth (feet).....	2.62

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
77+63	3583.0	1033.86	1039.64	5.78	364.83	3.02	0.142	0.000386
	3700.0	1034.03	1039.68	5.65	353.55	3.12	0.151	0.000421
	3800.0	1034.17	1039.71	5.54	344.28	3.20	0.159	0.000454
	3900.0	1034.32	1039.75	5.43	335.36	3.29	0.168	0.000489
73+64	3982.0	1034.44	1039.79	5.35	328.31	3.36	0.175	0.000519

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:54:07

FILE DATE: 07-19-1993
FILE NAME: CB129100

STA 73+04 TO STA 73+64
129TH AVENUE
100-YR Q= 1102 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1034.53	1034.44	60.00	5 RCB	8.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB129100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1039.79	0	0	0	0	0	0	0	0	1
1039.80	110	110	0	0	0	0	0	0	1
1039.82	220	220	0	0	0	0	0	0	1
1039.85	331	331	0	0	0	0	0	0	1
1039.89	441	441	0	0	0	0	0	0	1
1039.95	551	551	0	0	0	0	0	0	1
1040.02	661	661	0	0	0	0	0	0	1
1040.10	771	771	0	0	0	0	0	0	1
1040.19	882	882	0	0	0	0	0	0	1
1040.30	992	992	0	0	0	0	0	0	1
1040.42	1102	1102	0	0	0	0	0	0	1
1041.82	1970	1970	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB129100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1039.79	0.00	0	0	0.00
1039.80	0.00	110	0	0.00
1039.82	0.00	220	0	0.00
1039.85	0.00	331	0	0.00
1039.89	0.00	441	0	0.00
1039.95	0.00	551	0	0.00
1040.02	0.00	661	0	0.00
1040.10	0.00	771	0	0.00
1040.19	0.00	882	0	0.00
1040.30	0.00	992	0	0.00
1040.42	0.00	1102	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993 FILE DATE: 07-19-1993
CURRENT TIME: 07:54:07 FILE NAME: CB129100

PERFORMANCE CURVE FOR CULVERT # 1 - 5 (8 BY 5) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1039.79	0.00	5.26	0-NF	0.00	0.00	0.00	0.00	0.00	5.35
110	1039.80	0.92	5.27	4-FFt	0.75	0.62	0.55	5.00	0.00	5.35
220	1039.82	1.46	5.29	4-FFt	1.20	0.98	1.10	5.00	0.00	5.35
331	1039.85	1.92	5.32	4-FFt	1.58	1.29	1.65	5.00	0.00	5.35
441	1039.89	2.32	5.36	4-FFt	1.92	1.56	2.20	5.00	0.00	5.35
551	1039.95	2.71	5.42	4-FFt	2.24	1.81	2.75	5.00	0.00	5.35
661	1040.02	3.08	5.49	4-FFt	2.56	2.04	3.31	5.00	0.00	5.35
771	1040.10	3.44	5.57	4-FFt	2.85	2.27	3.86	5.00	0.00	5.35
882	1040.19	3.78	5.66	4-FFt	3.14	2.48	4.41	5.00	0.00	5.35
992	1040.30	4.12	5.77	4-FFt	3.43	2.68	4.96	5.00	0.00	5.35
1102	1040.42	4.44	5.89	4-FFt	3.70	2.87	5.51	5.00	0.00	5.35

El. inlet face invert 1034.53 ft El. outlet invert 1034.44 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1034.53
OUTLET STATION (FT)	60.00
OUTLET ELEVATION (FT)	1034.44
NUMBER OF BARRELS	5
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	60.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 07:54:07

FILE DATE: 07-19-1993
FILE NAME: CB129100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1039.79

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	50.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1042.42
2	40.00	1041.82
3	48.00	1042.42
4	148.00	1043.00

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1102.0
Channel Bottom Slope (feet per foot).....	0.0014
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	40.0
Channel Flow-Line Elevation at Starting Station (feet)..	1034.53
Water Surface Elevation at Starting Station (feet).....	1040.42
Starting Channel Station (feet).....	4042.00

S = .00145 1/1

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	4.06
Critical Depth (feet).....	2.62

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
73+04	4042.0	1034.53	1040.42	5.89	374.37	2.94	0.135	0.000359
	4100.0	1034.61	1040.44	5.82	368.54	2.99	0.139	0.000375
	4200.0	1034.76	1040.47	5.71	358.76	3.07	0.147	0.000404
	4400.0	1035.05	1040.54	5.49	340.19	3.24	0.163	0.000469
	4600.0	1035.34	1040.62	5.28	323.03	3.41	0.181	0.000543
	4793.0	1035.62	1040.72	5.10	307.90	3.58	0.199	0.000622
	4900.0	1035.77	1040.78	5.00	300.15	3.67	0.209	0.000668
	5000.0	1035.92	1040.84	4.92	293.32	3.76	0.219	0.000713
62+83	5063.0	1036.01	1040.87	4.86	289.23	3.81	0.225	0.000742

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:00:14

FILE DATE: 07-19-1993
FILE NAME: CBDYS100

STA 61+73 TO STA 62+83
DYSART ROAD
100-YR Q = 1067CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1036.20	1036.01	110.00	5 RCB	8.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CBDYS100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1040.87	0	0	0	0	0	0	0	0	1
1040.89	107	107	0	0	0	0	0	0	1
1040.91	213	213	0	0	0	0	0	0	1
1040.94	320	320	0	0	0	0	0	0	1
1040.99	427	427	0	0	0	0	0	0	1
1041.04	534	534	0	0	0	0	0	0	1
1041.12	640	640	0	0	0	0	0	0	1
1041.20	747	747	0	0	0	0	0	0	1
1041.29	854	854	0	0	0	0	0	0	1
1041.40	960	960	0	0	0	0	0	0	1
1041.52	1067	1067	0	0	0	0	0	0	1
1043.18	1931	1931	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CBDYS100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1040.87	0.00	0	0	0.00
1040.89	0.00	107	0	0.00
1040.91	0.00	213	0	0.00
1040.94	0.00	320	0	0.00
1040.99	0.00	427	0	0.00
1041.04	0.00	534	0	0.00
1041.12	0.00	640	0	0.00
1041.20	0.00	747	0	0.00
1041.29	0.00	854	0	0.00
1041.40	0.00	960	0	0.00
1041.52	0.00	1067	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:00:14

FILE DATE: 07-19-1993
FILE NAME: CBDYS100

PERFORMANCE CURVE FOR CULVERT # 1 - 5 (8 BY 5) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1040.87	0.00	4.67	0-NF	0.00	0.00	0.00	0.00	0.00	4.86
107	1040.89	0.90	4.69	3-M1t	0.70	0.61	0.55	4.86	0.00	4.86
213	1040.91	1.43	4.71	3-M1t	1.12	0.96	1.10	4.86	0.00	4.86
320	1040.94	1.88	4.74	3-M1t	1.47	1.26	1.65	4.86	0.00	4.86
427	1040.99	2.27	4.79	3-M1t	1.79	1.53	2.20	4.86	0.00	4.86
534	1041.04	2.65	4.84	3-M1t	2.09	1.77	2.74	4.86	0.00	4.86
640	1041.12	3.01	4.92	3-M1t	2.37	2.00	3.29	4.86	0.00	4.86
747	1041.20	3.36	5.00	3-M1t	2.65	2.22	3.84	4.86	0.00	4.86
854	1041.29	3.69	5.09	3-M1t	2.92	2.42	4.39	4.86	0.00	4.86
960	1041.40	4.02	5.20	3-M1t	3.18	2.62	4.94	4.86	0.00	4.86
1067	1041.52	4.34	5.32	3-M1t	3.43	2.81	5.49	4.86	0.00	4.86

El. inlet face invert 1036.20 ft El. outlet invert 1036.01 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1036.20
OUTLET STATION (FT)	110.00
OUTLET ELEVATION (FT)	1036.01
NUMBER OF BARRELS	5
SLOPE (V-FT/H-FT)	0.0017
CULVERT LENGTH ALONG SLOPE (FT)	110.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:00:14

FILE DATE: 07-19-1993
FILE NAME: CBDYS100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1040.87

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 80.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1044.00
2	728.00	1043.18
3	1600.00	1044.00

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 19, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	1067.0
Channel Bottom Slope (feet per foot).....	0.0017
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	40.0
Channel Flow-Line Elevation at Starting Station (feet)..	1036.20
Water Surface Elevation at Starting Station (feet).....	1041.52
Starting Channel Station (feet).....	0.00

.001725 1/1

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.81
Critical Depth (feet).....	2.56

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
61+73	0.0	1036.20	1041.52	5.32	326.01	3.27	0.166	0.000496
	50.0	1036.29	1041.54	5.25	320.53	3.33	0.172	0.000520
	100.0	1036.37	1041.56	5.19	315.18	3.39	0.178	0.000546
	200.0	1036.54	1041.61	5.06	304.86	3.50	0.190	0.000599
58+78	295.0	1036.71	1041.65	4.94	295.55	3.61	0.202	0.000654

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	829.0
Channel Bottom Slope (feet per foot).....	0.0017 S=.001725 ½
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	40.0
Channel Flow-Line Elevation at Starting Station (feet)..	1036.71
Water Surface Elevation at Starting Station (feet).....	1041.65
Starting Channel Station (feet).....	295.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.32
Critical Depth (feet).....	2.20

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
5B+78	295.0	1036.71	1041.65	4.94	295.21	2.81	0.122	0.000396
	400.0	1036.89	1041.68	4.79	283.59	2.92	0.133	0.000444
	500.0	1037.06	1041.72	4.66	273.01	3.04	0.143	0.000494
55+76	597.0	1037.23	1041.76	4.53	263.23	3.15	0.154	0.000548

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:06:21

FILE DATE: 07-19-1993
FILE NAME: CB5-100

STA 55+36 TO STA 55+76

DRIVEWAY ≅ 600' W. OF DYSART ROAD

100-YR Q = 829 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1037.31	1037.23	40.00	4 RCB	8.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB5-100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1041.76	0	0	0	0	0	0	0	0	1
1041.78	83	83	0	0	0	0	0	0	1
1041.80	166	166	0	0	0	0	0	0	1
1041.83	249	249	0	0	0	0	0	0	1
1041.87	332	332	0	0	0	0	0	0	1
1041.93	415	415	0	0	0	0	0	0	1
1042.00	497	497	0	0	0	0	0	0	1
1042.09	580	580	0	0	0	0	0	0	1
1042.18	663	663	0	0	0	0	0	0	1
1042.28	746	746	0	0	0	0	0	0	1
1042.41	829	829	0	0	0	0	0	0	1
1042.63	958	958	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB5-100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1041.76	0.00	0	0	0.00
1041.78	0.00	83	0	0.00
1041.80	0.00	166	0	0.00
1041.83	0.00	249	0	0.00
1041.87	0.00	332	0	0.00
1041.93	0.00	415	0	0.00
1042.00	0.00	497	0	0.00
1042.09	0.00	580	0	0.00
1042.18	0.00	663	0	0.00
1042.28	0.00	746	0	0.00
1042.41	0.00	829	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:06:21

FILE DATE: 07-19-1993
FILE NAME: CB5-100

PERFORMANCE CURVE FOR CULVERT # 1 - 4 (8 BY 5) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1041.76	0.00	4.45	0-NF	0.00	0.00	0.00	0.00	0.00	4.53
83	1041.78	0.88	4.47	3-M1t	0.65	0.59	0.57	4.53	0.00	4.53
166	1041.80	1.40	4.49	3-M1t	1.05	0.94	1.14	4.53	0.00	4.53
249	1041.83	1.84	4.52	3-M1t	1.37	1.24	1.72	4.53	0.00	4.53
332	1041.87	2.23	4.56	3-M1t	1.67	1.50	2.29	4.53	0.00	4.53
415	1041.93	2.59	4.62	3-M1t	1.95	1.74	2.86	4.53	0.00	4.53
497	1042.00	2.95	4.69	3-M1t	2.21	1.96	3.43	4.53	0.00	4.53
580	1042.09	3.29	4.78	3-M1t	2.46	2.17	4.00	4.53	0.00	4.53
663	1042.18	3.62	4.87	3-M1t	2.71	2.38	4.58	4.53	0.00	4.53
746	1042.28	3.94	4.97	3-M1t	2.95	2.57	5.15	4.53	0.00	4.53
829	1042.41	4.25	5.10	3-M1t	3.18	2.76	5.72	4.53	0.00	4.53

El. inlet face invert 1037.31 ft El. outlet invert 1037.23 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1037.31
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1037.23
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0020
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:06:21

FILE DATE: 07-19-1993
FILE NAME: CB5-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1041.76

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	40.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1043.23
2	40.00	1042.63
3	48.00	1043.23
4	148.00	1043.23

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	829.0
Channel Bottom Slope (feet per foot).....	0.0017
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	40.0
Channel Flow-Line Elevation at Starting Station (feet)..	1037.31
Water Surface Elevation at Starting Station (feet).....	1042.41
Starting Channel Station (feet).....	637.00

S=.001725 ½

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.32
Critical Depth (feet).....	2.20

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
55+36	637.0	1037.31	1042.41	5.10	308.04	2.69	0.112	0.000351
	673.0	1037.37	1042.42	5.05	303.83	2.73	0.116	0.000365
	700.0	1037.42	1042.43	5.01	300.70	2.76	0.118	0.000376
	800.0	1037.59	1042.46	4.87	289.41	2.86	0.127	0.000419
	1000.0	1037.94	1042.53	4.59	268.24	3.09	0.148	0.000520
	1200.0	1038.28	1042.62	4.34	249.12	3.33	0.172	0.000642
	1400.0	1038.63	1042.74	4.11	232.26	3.57	0.198	0.000784
	1600.0	1038.97	1042.89	3.91	217.88	3.80	0.225	0.000941
44+39	1734.0	1039.20	1043.00	3.80	209.69	3.95	0.243	0.001050

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:15:58

FILE DATE: 07-19-1993
FILE NAME: CB6-100

STA 43+99 TO STA 44+39
DRIVEWAY @ 1748' W. OF DYSART ROAD
100-YR Q = 745 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1039.27	1039.20	40.00	4 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB6-100 DATE: 07-19-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1043.00	0	0	0	0	0	0	0	0	1
1043.02	75	75	0	0	0	0	0	0	1
1043.04	149	149	0	0	0	0	0	0	1
1043.08	224	224	0	0	0	0	0	0	1
1043.13	298	298	0	0	0	0	0	0	1
1043.19	373	373	0	0	0	0	0	0	1
1043.28	447	447	0	0	0	0	0	0	1
1043.37	522	522	0	0	0	0	0	0	1
1043.48	596	596	0	0	0	0	0	0	1
1043.61	671	671	0	0	0	0	0	0	3
1043.75	745	748	0	0	0	0	0	1	3
1043.59	660	660	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB6-100 DATE: 07-19-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1043.00	0.00	0	0	0.00
1043.02	0.00	75	0	0.00
1043.04	0.00	149	0	0.00
1043.08	0.00	224	0	0.00
1043.13	0.00	298	0	0.00
1043.19	0.00	373	0	0.00
1043.28	0.00	447	0	0.00
1043.37	0.00	522	0	0.00
1043.48	0.00	596	0	0.00
1043.61	0.00	671	-0	-0.05
1043.75	0.01	745	-4	-0.48

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993 FILE DATE: 07-19-1993
CURRENT TIME: 08:15:58 FILE NAME: CB6-100

PERFORMANCE CURVE FOR CULVERT # 1 - 4 (8 BY 4) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1043.00	0.00	3.73	0-NF	0.00	0.00	0.00	0.00	0.00	3.80
75	1043.02	0.82	3.75	3-M1t	0.64	0.55	0.61	3.80	0.00	3.80
149	1043.04	1.31	3.77	3-M1t	1.02	0.88	1.23	3.80	0.00	3.80
224	1043.08	1.71	3.81	3-M1t	1.34	1.15	1.84	3.80	0.00	3.80
298	1043.13	2.08	3.86	3-M1t	1.63	1.39	2.45	3.80	0.00	3.80
373	1043.19	2.44	3.92	3-M1t	1.89	1.62	3.06	3.80	0.00	3.80
447	1043.28	2.77	4.01	3-M1t	2.15	1.83	3.68	3.80	0.00	3.80
522	1043.37	3.10	4.10	3-M1t	2.40	2.02	4.29	3.80	0.00	3.80
596	1043.48	3.41	4.21	3-M1t	2.63	2.21	4.90	3.80	0.00	3.80
671	1043.61	3.72	4.34	3-M1t	2.87	2.39	5.52	3.80	0.00	3.80
748	1043.75	4.04	4.48	3-M1t	3.10	2.57	6.15	3.80	0.00	3.80

El. inlet face invert 1039.27 ft El. outlet invert 1039.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1039.27
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1039.20
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0018
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:15:58

FILE DATE: 07-19-1993
FILE NAME: CB6-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1043.00

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	40.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1044.19
2	40.00	1043.59
3	48.00	1044.59
4	148.00	1045.00

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	745.0
Channel Bottom Slope (feet per foot).....	0.0017 S= .001725 1/1
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	20.0
Channel Flow-Line Elevation at Starting Station (feet)..	1039.27
Water Surface Elevation at Starting Station (feet).....	1043.75
Starting Channel Station (feet).....	1774.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	4.15
Critical Depth (feet).....	2.87

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
43+99	1774.0	1039.27	1043.75	4.48	169.88	4.39	0.299	0.001267
	1800.0	1039.31	1043.78	4.47	169.07	4.41	0.301	0.001284
	1900.0	1039.49	1043.90	4.41	166.22	4.48	0.312	0.001346
	2000.0	1039.66	1044.03	4.37	163.77	4.55	0.321	0.001402
	2200.0	1040.00	1044.30	4.30	159.90	4.66	0.337	0.001497
39+00	2273.0	1040.13	1044.41	4.28	158.80	4.69	0.342	0.001526

(2' DROP STRUCT.)

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 6, 1993

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	350.0
Channel Bottom Slope (feet per foot).....	0.0030
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	10.0
Channel Flow-Line Elevation at Starting Station (feet)..	1042.12
Water Surface Elevation at Starting Station (feet).....	1044.04
Starting Channel Station (feet).....	2273.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.09
Critical Depth (feet).....	2.44

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
39+00	2273.0	1042.12	1044.56	2.44	48.25	7.25	0.817	0.007948
2' Drop struc.	2300.0	1042.20	1045.01	2.81	59.72	5.86	0.533	0.004440
	2400.0	1042.50	1045.50	3.00	65.95	5.31	0.437	0.003390
	2500.0	1042.80	1045.85	3.05	67.63	5.18	0.416	0.003166
	2600.0	1043.10	1046.17	3.07	68.34	5.12	0.407	0.003077
35+25	2648.0	1043.24	1046.32	3.07	68.52	5.11	0.405	0.003055

3' Drop struc.

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	137.0
Channel Bottom Slope (feet per foot).....	0.0059 S=.00587 1/1
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	10.0
Channel Flow-Line Elevation at Starting Station (feet)..	1046.24
Water Surface Elevation at Starting Station (feet).....	1047.71
Starting Channel Station (feet).....	2648.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.65
Critical Depth (feet).....	1.47

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
35+25 (5' DROP STRUCT.)	2648.0	1046.24	1047.71	1.47	23.34	5.87	0.535	0.009074
	2670.0	1046.37	1048.02	1.65	27.43	4.99	0.387	0.005784
	2700.0	1046.55	1048.19	1.65	27.32	5.01	0.390	0.005847
	2800.0	1047.13	1048.78	1.64	27.27	5.02	0.392	0.005877
32+72	2901.0	1047.73	1049.37	1.65	27.29	5.02	0.391	0.005869

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TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:25:00

FILE DATE: 07-06-1993
FILE NAME: CB7-100

STA 32+32 TO STA 32+72

Driveway ≅ 2220' E. of LITCHFIELD ROAD

100-YR Q = 137 CFS

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1047.96	1047.73	40.00	1 RCB	6.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB7-100 DATE: 07-06-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1049.37	0	0	0	0	0	0	0	0	1
1049.43	14	14	0	0	0	0	0	0	1
1049.56	27	27	0	0	0	0	0	0	1
1049.65	41	41	0	0	0	0	0	0	1
1050.00	55	55	0	0	0	0	0	0	1
1050.36	69	69	0	0	0	0	0	0	1
1050.69	82	82	0	0	0	0	0	0	1
1051.01	96	96	0	0	0	0	0	0	1
1051.31	110	110	0	0	0	0	0	0	1
1051.62	123	123	0	0	0	0	0	0	1
1051.92	137	137	0	0	0	0	0	0	1
1053.96	224	224	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB7-100 DATE: 07-06-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1049.37	0.00	0	0	0.00
1049.43	0.00	14	0	0.00
1049.56	0.00	27	0	0.00
1049.65	0.00	41	0	0.00
1050.00	0.00	55	0	0.00
1050.36	0.00	69	0	0.00
1050.69	0.00	82	0	0.00
1051.01	0.00	96	0	0.00
1051.31	0.00	110	0	0.00
1051.62	0.00	123	0	0.00
1051.92	0.00	137	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-22-1993 FILE DATE: 07-06-1993
CURRENT TIME: 08:25:00 FILE NAME: CB7-100

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (6 BY 4) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1049.37	0.00	1.41	0-NF	0.00	0.00	0.00	0.00	0.00	1.64
14	1049.43	0.81	1.47	3-M1t	0.44	0.55	1.39	1.64	0.00	1.64
27	1049.56	1.29	1.60	3-M1t	0.69	0.87	2.78	1.64	0.00	1.64
41	1049.65	1.69	1.69	1-S2n	0.91	1.14	7.14	0.96	0.00	1.64
55	1050.00	2.04	2.04	1-S2n	1.11	1.38	7.82	1.17	0.00	1.64
69	1050.36	2.40	2.40	1-S2n	1.29	1.60	8.33	1.37	0.00	1.64
82	1050.69	2.73	2.73	1-S2n	1.47	1.80	8.78	1.56	0.00	1.64
96	1051.01	3.05	3.05	1-S2n	1.63	2.00	9.17	1.74	0.00	1.64
110	1051.31	3.35	3.35	1-S2n	1.79	2.18	9.53	1.92	0.00	1.64
123	1051.62	3.66	3.66	1-S2n	1.95	2.36	9.85	2.09	0.00	1.64
137	1051.92	3.96	3.96	1-S2n	2.10	2.54	10.15	2.25	0.00	1.64

El. inlet face invert 1047.96 ft El. outlet invert 1047.73 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1047.96
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1047.73
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0057
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	6.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993
CURRENT TIME: 08:25:00

FILE DATE: 07-06-1993
FILE NAME: CB7-100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1049.37

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE GRAVEL
EMBANKMENT TOP WIDTH (FT) 20.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1054.56
2	40.00	1053.96
3	48.00	1054.56
4	148.00	1054.70

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 9, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	137.0
Channel Bottom Slope (feet per foot).....	0.0059
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1047.96
Water Surface Elevation at Starting Station (feet).....	1051.92
Starting Channel Station (feet).....	2941.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.02
Critical Depth (feet).....	1.83

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
32+32	2941.0	1047.96	1051.92	3.96	82.53	1.66	0.043	0.000274
32+25	2948.0	1048.00	1051.92	3.92	81.04	1.69	0.044	0.000288

3' DROP INLET.

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 9, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	137.0
Channel Bottom Slope (feet per foot).....	0.0044
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1051.00
Water Surface Elevation at Starting Station (feet).....	1051.92
Starting Channel Station (feet).....	2948.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.15
Critical Depth (feet).....	1.83

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
32+25 (3' DROP INLET)	2948.0	1051.00	1052.83	1.83	22.54	6.08	0.574	0.008972
	3000.0	1051.23	1053.42	2.19	30.24	4.53	0.319	0.004058
	3100.0	1051.67	1053.83	2.16	29.41	4.66	0.337	0.004370
	3200.0	1052.11	1054.26	2.15	29.34	4.67	0.338	0.004398
	3300.0	1052.55	1054.70	2.15	29.34	4.67	0.339	0.004399
	3800.0	1054.75	1056.90	2.15	29.34	4.67	0.339	0.004400
21+00 —	4073.0	1055.95	1058.10	2.15	29.34	4.67	0.339	0.004400
	4400.0	1057.39	1059.54	2.15	29.34	4.67	0.339	0.004400
15+00 —	4673.0	1058.59	1060.74	2.15	29.34	4.67	0.339	0.004400

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 9, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	137.0
Channel Bottom Slope (feet per foot).....	0.0020
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1058.59
Water Surface Elevation at Starting Station (feet).....	1060.74
Starting Channel Station (feet).....	4673.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.57
Critical Depth (feet).....	1.83

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
15+00	4673.0	1058.59	1060.74	2.15	29.24	4.69	0.341	0.004441
	4700.0	1058.64	1060.90	2.25	31.57	4.34	0.292	0.003611
	4800.0	1058.84	1061.27	2.43	35.70	3.84	0.229	0.002595
	4900.0	1059.04	1061.54	2.49	37.28	3.67	0.210	0.002309
	5000.0	1059.24	1061.77	2.52	38.11	3.59	0.201	0.002176
10+62	5111.0	1059.47	1062.01	2.54	38.63	3.55	0.195	0.002098

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

STA -0+38 TO 1062
At Litchfield Rd.
(0+00 W. = 10+00 E)
100-Yr, Q = 137 cfs

CURRENT DATE: 07-09-1993
CURRENT TIME: 07:32:38

FILE DATE: 06-24-1993
FILE NAME: CBLIT100

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1059.67	1059.47	100.00	1 RCB	6.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

FILE: CBLIT100 CULVERT HEADWATER ELEVATION (FT) DATE: 06-24-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1062.01	0.00	0.00	0.00	0.00	0.00	1064.10
14	1062.13	0.00	0.00	0.00	0.00	0.00	1064.58
27	1062.18	0.00	0.00	0.00	0.00	0.00	1064.73
41	1062.20	0.00	0.00	0.00	0.00	0.00	1064.82
55	1062.32	0.00	0.00	0.00	0.00	0.00	1064.89
69	1062.50	0.00	0.00	0.00	0.00	0.00	1064.94
82	1062.70	0.00	0.00	0.00	0.00	0.00	1064.99
96	1062.93	0.00	0.00	0.00	0.00	0.00	1065.03
110	1063.18	0.00	0.00	0.00	0.00	0.00	1065.07
123	1063.54	0.00	0.00	0.00	0.00	0.00	1065.10
137	1063.92	0.00	0.00	0.00	0.00	0.00	1065.13
178	1065.24	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

CURRENT DATE: 07-09-1993 FILE DATE: 06-24-1993
CURRENT TIME: 07:32:38 FILE NAME: CBLIT100

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (6 BY 3) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1062.01	0.00	2.34	0-NF	0.00	0.00	0.00	0.00	0.00	2.54
14	1062.13	0.81	2.46	3-M1t	0.63	0.55	0.90	2.54	0.00	2.54
27	1062.18	1.29	2.51	3-M1t	0.99	0.87	1.80	2.54	0.00	2.54
41	1062.20	1.70	2.53	3-M1t	1.31	1.14	2.70	2.54	0.00	2.54
55	1062.32	2.09	2.65	3-M1t	1.60	1.38	3.60	2.54	0.00	2.54
69	1062.50	2.45	2.83	3-M1t	1.87	1.60	4.49	2.54	0.00	2.54
82	1062.70	2.80	3.03	3-M1t	2.13	1.80	5.39	2.54	0.00	2.54
96	1062.93	3.15	3.26	3-M1t	2.38	2.00	6.29	2.54	0.00	2.54
110	1063.18	3.50	3.51	3-M2t	2.63	2.18	7.19	2.54	0.00	2.54
123	1063.54	3.87	3.66	6-FFn	3.00	2.36	6.85	3.00	0.00	2.54
137	1063.92	4.25	4.02	6-FFn	3.00	2.54	7.61	3.00	0.00	2.54

El. inlet face invert 1059.67 ft El. outlet invert 1059.47 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1059.67
OUTLET STATION (FT)	100.00
OUTLET ELEVATION (FT)	1059.47
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0020
CULVERT LENGTH ALONG SLOPE (FT)	100.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	6.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-09-1993
CURRENT TIME: 07:32:38

FILE DATE: 06-24-1993
FILE NAME: CBLIT100

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1062.01

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	68.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1064.70
2	40.00	1064.10
3	48.00	1064.70
4	148.00	1065.00

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 9, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	137.0
Channel Bottom Slope (feet per foot).....	0.0020
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1059.67
Water Surface Elevation at Starting Station (feet).....	1063.92
Starting Channel Station (feet).....	38.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.57
Critical Depth (feet).....	1.83

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
— 38.0	1059.67	1063.92	4.25	93.50	1.47	0.033	0.000196
— 48.0	1059.69	1063.92	4.23	92.78	1.48	0.034	0.000200

2' Drop Inlet

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 19, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	70.0
Channel Bottom Slope (feet per foot).....	0.0050
Manning°s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	1.0
Channel Flow-Line Elevation at Starting Station (feet)..	1061.70
Water Surface Elevation at Starting Station (feet).....	1063.92
Starting Channel Station (feet).....	48.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.93
Critical Depth (feet).....	1.68

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
2' Drop Inlet	-48.0	1061.70	1063.92	2.22	21.93	3.19	0.158	0.002432
	70.0	1061.81	1063.96	2.15	20.59	3.40	0.180	0.002879
	100.0	1061.96	1064.02	2.06	19.11	3.66	0.208	0.003513
	150.0	1062.21	1064.18	1.97	17.56	3.99	0.247	0.004403
2' Drop Struct.	200.0	1062.46	1064.40	1.94	16.94	4.13	0.265	0.004844

==========

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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 19, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	45.0
Channel Bottom Slope (feet per foot).....	0.0065
Manning°s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	1.0
Channel Flow-Line Elevation at Starting Station (feet)..	1064.46
Water Surface Elevation at Starting Station (feet).....	1065.85
Starting Channel Station (feet).....	200.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.53
Critical Depth (feet).....	1.39

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
2' Drop-Struct	200.0	1064.46	1065.85	1.39	9.14	4.92	0.377	0.010396
	220.0	1064.59	1066.14	1.55	11.17	4.03	0.252	0.006079
	250.0	1064.78	1066.32	1.53	10.93	4.12	0.263	0.006450
	300.0	1065.11	1066.64	1.53	10.89	4.13	0.265	0.006508
3' DROP STRUCT.	400.0	1065.76	1067.29	1.53	10.90	4.13	0.265	0.006497

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
August 3, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	35.0
Channel Bottom Slope (feet per foot).....	0.0090
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	1.0
Channel Flow-Line Elevation at Starting Station (feet)..	1068.76
Water Surface Elevation at Starting Station (feet).....	1070.01
Starting Channel Station (feet).....	400.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.29
Critical Depth (feet).....	1.25

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
3' DROP STRUCT. -400.0	1068.76	1070.01	1.25	7.50	4.67	0.338	0.010656
-420.0	1068.94	1070.26	1.32	8.29	4.22	0.277	0.008163
-450.0	1069.21	1070.49	1.28	7.87	4.45	0.307	0.009357
-500.0	1069.66	1070.96	1.30	8.09	4.33	0.291	0.008710
-600.0	1070.55	1071.84	1.29	7.93	4.42	0.303	0.009195
-700.0	1071.45	1072.75	1.30	8.06	4.34	0.293	0.008792
-800.0	1072.35	1073.64	1.29	7.95	4.40	0.301	0.009126

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
August 3, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	20.0
Channel Bottom Slope (feet per foot).....	0.0090
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	1.0
Channel Flow-Line Elevation at Starting Station (feet)..	1072.35
Water Surface Elevation at Starting Station (feet).....	1073.64
Starting Channel Station (feet).....	800.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.03
Critical Depth (feet).....	0.98

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
800.0	1072.35	1073.64	1.29	7.95	2.52	0.098	0.002982
850.0	1072.80	1073.82	1.02	5.16	3.88	0.234	0.009466
900.0	1073.25	1074.28	1.04	5.33	3.75	0.218	0.008646
1000.0	1074.14	1075.17	1.02	5.20	3.84	0.229	0.009242
1100.0	1075.04	1076.08	1.03	5.31	3.77	0.220	0.008755
1200.0	1075.94	1076.96	1.02	5.22	3.83	0.228	0.009154

END CHANNEL

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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(713) 895-8322. A manual with equations & flow chart is available.

5-YEAR INTERIM BACKWATER ANALYSES

Sta. 139+16

Existing 8'x8' B.C Outlet under Camelback Rd.
Into Existing Sand & Gravel pit.

CURRENT DATE: 07-09-1993
CURRENT TIME: 11:04:25

5-Year Q = 152 cfs

FILE DATE: 07-09-1993
FILE NAME: CB8X8-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1013.96	1013.46	108.00	1	RCB	8.00	8.00	.012	CONVENTIONAL
2									
3									
4									
5									
6									

****

SUMMARY OF CULVERT FLOWS (CFS) FILE: CB8X8-5 DATE: 07-09-1993

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1015.80	0	0	0	0	0	0	0	0	1
1015.92	16	16	0	0	0	0	0	0	1
1015.98	32	32	0	0	0	0	0	0	1
1016.00	48	48	0	0	0	0	0	0	1
1015.83	64	64	0	0	0	0	0	0	1
1016.13	80	80	0	0	0	0	0	0	1
1016.41	96	96	0	0	0	0	0	0	1
1016.68	112	112	0	0	0	0	0	0	1
1016.93	128	128	0	0	0	0	0	0	1
1017.17	144	144	0	0	0	0	0	0	1
1017.41	160	160	0	0	0	0	0	0	1
1023.60	662	662	0	0	0	0	0	OVERTOPPING	

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CB8X8-5 DATE: 07-09-1993

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1015.80	0.00	0	0	0.00
1015.92	0.00	16	0	0.00
1015.98	0.00	32	0	0.00
1016.00	0.00	48	0	0.00
1015.83	0.00	64	0	0.00
1016.13	0.00	80	0	0.00
1016.41	0.00	96	0	0.00
1016.68	0.00	112	0	0.00
1016.93	0.00	128	0	0.00
1017.17	0.00	144	0	0.00
1017.41	0.00	160	0	0.00

****

(1) TOLERANCE (FT) = 0.010 (2) TOLERANCE (%) = 1.000

****

CURRENT DATE: 07-09-1993 FILE DATE: 07-09-1993
CURRENT TIME: 11:04:25 FILE NAME: CB8X8-5

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 8) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1015.80	0.00	1.84	0-NF	0.00	0.00	0.00	0.00	0.00	2.34
16	1015.92	0.78	1.96	3-M1t	0.31	0.50	0.85	2.34	0.00	2.34
32	1015.98	1.18	2.02	3-M1t	0.62	0.79	1.71	2.34	0.00	2.34
48	1016.00	1.55	2.04	3-M1t	0.87	1.04	2.56	2.34	0.00	2.34
64	1015.83	1.87	1.87	1-S2n	1.04	1.26	7.72	1.04	0.00	2.34
80	1016.13	2.17	2.17	1-S2n	1.20	1.46	8.31	1.20	0.00	2.34
96	1016.41	2.45	2.45	1-S2n	1.37	1.65	8.51	1.41	0.00	2.34
112	1016.68	2.72	2.72	1-S2n	1.54	1.83	8.92	1.57	0.00	2.34
128	1016.93	2.97	2.97	1-S2n	1.68	2.00	9.29	1.72	0.00	2.34
144	1017.17	3.21	3.21	1-S2n	1.82	2.16	9.68	1.86	0.00	2.34
160	1017.41	3.45	3.45	1-S2n	1.96	2.32	9.95	2.01	0.00	2.34

El. inlet face invert 1013.96 ft El. outlet invert 1013.46 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1013.96
OUTLET STATION (FT)	108.00
OUTLET ELEVATION (FT)	1013.46
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0046
CULVERT LENGTH ALONG SLOPE (FT)	108.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	8.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-09-1993
CURRENT TIME: 11:04:25

FILE DATE: 07-09-1993
FILE NAME: CB8X8-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1015.80

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH (FT)	50.00
CREST LENGTH (FT)	200.00
OVERTOPPING CREST ELEVATION (FT)	1023.60

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	160.0
Channel Bottom Slope (feet per foot).....	~~0.0001~~ .0070
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	10.0
Channel Flow-Line Elevation at Starting Station (feet)..	1017.00
Water Surface Elevation at Starting Station (feet).....	1017.41
Starting Channel Station (feet).....	0.00

100 0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	5.09
Critical Depth (feet).....	1.68

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
39+16 —	0.0	1017.00	1018.68	1.68	25.17	6.36	0.628	0.008788
	10.0	1017.00	1018.96	1.96	31.10	5.15	0.411	0.004855
	20.0	1017.00	1019.05	2.05	33.13	4.83	0.362	0.004067
	40.0	1017.00	1019.18	2.18	36.00	4.44	0.307	0.003229
	60.0	1017.01	1019.27	2.27	38.12	4.20	0.274	0.002755
	80.0	1017.01	1019.35	2.34	39.86	4.01	0.250	0.002433
38+16 —	100.0	~~1017.01~~ 1016.93	1019.41	2.40	41.37	3.87	0.232	0.002196

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986 Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092 (713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	160.0
Channel Bottom Slope (feet per foot).....	0.0013
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	4.0
Channel Flow-Line Elevation at Starting Station (feet)..	1016.93
Water Surface Elevation at Starting Station (feet).....	1019.41
Starting Channel Station (feet).....	100.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.42
Critical Depth (feet).....	2.24

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
138+16	100.0	1016.93	1019.41	2.48	28.37	5.64	0.494	0.005561
	120.0	1016.96	1019.60	2.65	31.61	5.06	0.398	0.004159
	140.0	1016.98	1019.72	2.74	33.53	4.77	0.354	0.003549
	160.0	1017.01	1019.82	2.81	34.97	4.58	0.325	0.003171
	180.0	1017.03	1019.90	2.87	36.13	4.43	0.304	0.002904
137+06	210.0	1017.07	1020.01	2.93	37.56	4.26	0.282	0.002619

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 136+70 TO 137+06
Existing 58"x36" cmpA
At Driveway 2275' E. of EL Mirage Rd

CURRENT DATE: 07-15-1993
CURRENT TIME: 14:33:20

FILE DATE: 07-13-1993
FILE NAME: CB1-5EX

5-Yr Q = 152 cfs

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1017.12	1017.07	36.00	2 CMPA	4.83	3.00	.028	CONVENTIONAL
2								
3								
4								
5								
6								

58"x36"

****

FILE: CB1-5EX CULVERT HEADWATER ELEVATION (FT) DATE: 07-13-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1020.01	0.00	0.00	0.00	0.00	0.00	1022.00
16	1020.03	0.00	0.00	0.00	0.00	0.00	1022.24
32	1020.09	0.00	0.00	0.00	0.00	0.00	1022.31
48	1020.18	0.00	0.00	0.00	0.00	0.00	1022.37
64	1020.31	0.00	0.00	0.00	0.00	0.00	1022.41
80	1020.48	0.00	0.00	0.00	0.00	0.00	1022.45
96	1020.69	0.00	0.00	0.00	0.00	0.00	1022.48
112	1020.93	0.00	0.00	0.00	0.00	0.00	1022.51
128	1021.21	0.00	0.00	0.00	0.00	0.00	1022.54
144	1021.53	0.00	0.00	0.00	0.00	0.00	1022.57
160	1021.89	0.00	0.00	0.00	0.00	0.00	1022.59
192	1022.71	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-15-1993 FILE DATE: 07-13-1993
CURRENT TIME: 14:33:20 FILE NAME: CB1-5EX

****

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (4.833333 BY 3) CMPA

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1020.01	0.00	2.89	0-NF	0.00	0.00	0.00	0.00	0.00	2.94
16	1020.03	0.88	2.91	3-M1t	1.16	0.60	0.71	2.94	0.00	2.94
32	1020.09	1.31	2.97	3-M1t	1.84	0.87	1.42	2.94	0.00	2.94
48	1020.18	1.67	3.06	6-FFn	3.00	1.09	2.11	3.00	0.00	2.94
64	1020.31	2.00	3.19	6-FFn	3.00	1.28	2.82	3.00	0.00	2.94
80	1020.48	2.30	3.36	6-FFn	3.00	1.45	3.52	3.00	0.00	2.94
96	1020.69	2.59	3.57	6-FFn	3.00	1.61	4.23	3.00	0.00	2.94
112	1020.93	2.89	3.81	6-FFn	3.00	1.76	4.93	3.00	0.00	2.94
128	1021.21	3.19	4.09	6-FFn	3.00	1.89	5.64	3.00	0.00	2.94
144	1021.53	3.53	4.41	6-FFn	3.00	2.02	6.34	3.00	0.00	2.94
160	1021.89	3.89	4.77	6-FFn	3.00	2.14	7.05	3.00	0.00	2.94

****

El. inlet face invert 1017.12 ft El. outlet invert 1017.07 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1017.12
OUTLET STATION (FT)	36.00
OUTLET ELEVATION (FT)	1017.07
NUMBER OF BARRELS	2
SLOPE (V-FT/H-FT)	0.0014
CULVERT LENGTH ALONG SLOPE (FT)	36.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	4.83 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.028
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-15-1993 FILE DATE: 07-13-1993
CURRENT TIME: 14:33:20 FILE NAME: CB1-5EX

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1020.01

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 30.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1027.00
2	75.00	1023.00
3	175.00	1022.00
4	1100.00	1024.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	160.0
Channel Bottom Slope (feet per foot).....	0.0013
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	4.0
Channel Flow-Line Elevation at Starting Station (feet)..	1017.12
Water Surface Elevation at Starting Station (feet).....	1021.89
Starting Channel Station (feet).....	246.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.42
Critical Depth (feet).....	2.24

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
136+70 —	246.0	1017.12	1021.89	4.77	87.34	1.83	0.052	0.000274
	270.0	1017.15	1021.90	4.74	86.51	1.85	0.053	0.000281
	300.0	1017.19	1021.90	4.71	85.48	1.87	0.054	0.000290
	350.0	1017.26	1021.92	4.66	83.81	1.91	0.057	0.000305
	400.0	1017.32	1021.93	4.61	82.17	1.95	0.059	0.000322
	500.0	1017.45	1021.96	4.51	79.01	2.03	0.064	0.000358
	600.0	1017.58	1021.99	4.41	76.01	2.10	0.069	0.000396
	700.0	1017.71	1022.03	4.32	73.19	2.19	0.074	0.000439
	800.0	1017.84	1022.07	4.23	70.54	2.27	0.080	0.000484
	900.0	1017.97	1022.11	4.14	68.06	2.35	0.086	0.000533
	1000.0	1018.10	1022.16	4.06	65.77	2.43	0.092	0.000584
	1100.0	1018.23	1022.22	3.99	63.65	2.51	0.098	0.000637
127+74 —	1142.0	1018.28	1022.24	3.96	62.82	2.55	0.101	0.000660

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 127+38 TO 127+74
Existing 2-58"x36" CMPA
At Driveway 1300' E. of El Mirage Rd.
5-Yr Q = 157 cfs

CURRENT DATE: 07-15-1993
CURRENT TIME: 14:50:00

FILE DATE: 07-13-1993
FILE NAME: CB2-5EX

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1018.33	1018.28	36.00	2 CMPA	4.83	3.00	.028	CONVENTIONAL
2					58"x36"			
3								
4								
5								
6								

****
FILE: CB2-5EX CULVERT HEADWATER ELEVATION (FT) DATE: 07-13-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1022.24	0.00	0.00	0.00	0.00	0.00	1023.50
16	1022.26	0.00	0.00	0.00	0.00	0.00	1023.69
32	1022.32	0.00	0.00	0.00	0.00	0.00	1023.75
48	1022.41	0.00	0.00	0.00	0.00	0.00	1023.80
64	1022.54	0.00	0.00	0.00	0.00	0.00	1023.83
80	1022.71	0.00	0.00	0.00	0.00	0.00	1023.86
96	1022.92	0.00	0.00	0.00	0.00	0.00	1023.89
112	1023.16	0.00	0.00	0.00	0.00	0.00	1023.92
128	1023.44	0.00	0.00	0.00	0.00	0.00	1023.94
144	1023.76	0.00	0.00	0.00	0.00	0.00	1023.96
160	1024.12	0.00	0.00	0.00	0.00	0.00	1023.98
160	1024.12	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.
****

CURRENT DATE: 07-15-1993 FILE DATE: 07-13-1993
CURRENT TIME: 14:50:00 FILE NAME: CB2-5EX

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (4.833333 BY 3) CMPA

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1022.24	0.00	3.91	0-NF	0.00	0.00	0.00	0.00	0.00	3.96
16	1022.26	0.88	3.93	4-FFt	1.16	0.60	0.70	3.00	0.00	3.96
32	1022.32	1.31	3.99	4-FFt	1.84	0.87	1.41	3.00	0.00	3.96
48	1022.41	1.67	4.08	4-FFt	3.00	1.09	2.11	3.00	0.00	3.96
64	1022.54	2.00	4.21	4-FFt	3.00	1.28	2.82	3.00	0.00	3.96
80	1022.71	2.30	4.38	4-FFt	3.00	1.45	3.52	3.00	0.00	3.96
96	1022.92	2.59	4.59	4-FFt	3.00	1.61	4.23	3.00	0.00	3.96
112	1023.16	2.89	4.83	4-FFt	3.00	1.76	4.93	3.00	0.00	3.96
128	1023.44	3.19	5.11	4-FFt	3.00	1.89	5.63	3.00	0.00	3.96
144	1023.76	3.53	5.43	4-FFt	3.00	2.02	6.34	3.00	0.00	3.96
160	1024.12	3.89	5.79	4-FFt	3.00	2.14	7.04	3.00	0.00	3.96

El. inlet face invert 1018.33 ft El. outlet invert 1018.28 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1018.33
OUTLET STATION (FT)	36.00
OUTLET ELEVATION (FT)	1018.28
NUMBER OF BARRELS	2
SLOPE (V-FT/H-FT)	0.0014
CULVERT LENGTH ALONG SLOPE (FT)	36.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	4.83 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.028
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 07-15-1993 FILE DATE: 07-13-1993
CURRENT TIME: 14:50:00 FILE NAME: CB2-5EX

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1022.24

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 30.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1027.40
2	75.00	1024.00
3	150.00	1023.50
4	550.00	1024.00
5	1300.00	1026.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	160.0
Channel Bottom Slope (feet per foot).....	0.0013
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	4.0
Channel Flow-Line Elevation at Starting Station (feet)..	1018.33
Water Surface Elevation at Starting Station (feet).....	1024.12
Starting Channel Station (feet).....	1178.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	3.42
Critical Depth (feet).....	2.24

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
127+38 –	1178.0	1018.33	1024.12	5.79	123.73	1.29	0.026	0.000108
	1200.0	1018.36	1024.12	5.76	122.70	1.30	0.026	0.000110
	1300.0	1018.49	1024.13	5.64	118.10	1.35	0.028	0.000122
	1400.0	1018.62	1024.14	5.52	113.63	1.41	0.031	0.000135
	1500.0	1018.75	1024.15	5.41	109.28	1.46	0.033	0.000150
	1600.0	1018.88	1024.17	5.29	105.07	1.52	0.036	0.000167
	1700.0	1019.01	1024.18	5.17	100.99	1.58	0.039	0.000186
	1800.0	1019.14	1024.20	5.06	97.05	1.65	0.042	0.000206
	1900.0	1019.27	1024.22	4.95	93.25	1.72	0.046	0.000230
	2000.0	1019.40	1024.24	4.84	89.60	1.79	0.050	0.000256
	2100.0	1019.53	1024.26	4.73	86.09	1.86	0.054	0.000284
	2200.0	1019.66	1024.29	4.63	82.75	1.93	0.058	0.000316
	2300.0	1019.79	1024.31	4.53	79.56	2.01	0.063	0.000351
	2400.0	1019.92	1024.35	4.43	76.53	2.09	0.068	0.000389
114+71 –	2445.0	1019.98	1024.36	4.39	75.23	2.13	0.070	0.000408

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 113+61 TO 114+71

At El Mirage Rd. 1-60" RCP

5 Yr Q = 161 cfs

CURRENT DATE: 07-23-1993 FILE DATE: 07-13-1993
CURRENT TIME: 10:19:05 FILE NAME: CBELMR-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1020.33	1020.00	110.00	1 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

****
FILE: CBELMR-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-13-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1024.36	0.00	0.00	0.00	0.00	0.00	1027.40
16	1024.37	0.00	0.00	0.00	0.00	0.00	1027.66
32	1024.38	0.00	0.00	0.00	0.00	0.00	1027.74
48	1024.41	0.00	0.00	0.00	0.00	0.00	1027.80
64	1024.45	0.00	0.00	0.00	0.00	0.00	1027.85
80	1024.51	0.00	0.00	0.00	0.00	0.00	1027.89
96	1024.57	0.00	0.00	0.00	0.00	0.00	1027.93
112	1024.65	0.00	0.00	0.00	0.00	0.00	1027.97
128	1024.74	0.00	0.00	0.00	0.00	0.00	1028.00
144	1024.84	0.00	0.00	0.00	0.00	0.00	1028.03
160	1024.95	0.00	0.00	0.00	0.00	0.00	1028.06
384	1028.18	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-23-1993 FILE DATE: 07-13-1993
CURRENT TIME: 10:19:05 FILE NAME: CBELMR-5

****

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 4) RCB

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1024.36	0.00	4.03	0-NF	0.00	0.00	0.00	0.00	0.00	4.36
16	1024.37	0.74	4.04	4-FFt	0.49	0.50	0.50	4.00	0.00	4.36
32	1024.38	1.18	4.05	4-FFt	0.78	0.79	1.00	4.00	0.00	4.36
48	1024.41	1.55	4.08	4-FFt	1.01	1.04	1.50	4.00	0.00	4.36
64	1024.45	1.87	4.12	4-FFt	1.23	1.26	2.00	4.00	0.00	4.36
80	1024.51	2.19	4.18	4-FFt	1.42	1.46	2.50	4.00	0.00	4.36
96	1024.57	2.49	4.24	4-FFt	1.61	1.65	3.00	4.00	0.00	4.36
112	1024.65	2.78	4.32	4-FFt	1.78	1.83	3.50	4.00	0.00	4.36
128	1024.74	3.05	4.41	4-FFt	1.96	2.00	4.00	4.00	0.00	4.36
144	1024.84	3.32	4.51	4-FFt	2.12	2.16	4.50	4.00	0.00	4.36
160	1024.95	3.59	4.62	4-FFt	2.29	2.32	5.00	4.00	0.00	4.36

****

El. inlet face invert 1020.33 ft El. outlet invert 1020.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1020.33
OUTLET STATION (FT)	110.00
OUTLET ELEVATION (FT)	1020.00
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0030
CULVERT LENGTH ALONG SLOPE (FT)	110.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-23-1993 FILE DATE: 07-13-1993
CURRENT TIME: 10:19:05 FILE NAME: CBELMR-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1024.36

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 60.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1030.00
2	330.00	1028.00
3	430.00	1027.40
4	510.00	1027.70
5	530.00	1028.00
6	680.00	1030.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 23, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	160.0
Channel Bottom Slope (feet per foot).....	0.0045 S=.00446 1/1
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1023.33
Water Surface Elevation at Starting Station (feet).....	1025.30
Starting Channel Station (feet).....	10.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.30
Critical Depth (feet).....	1.97

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
1/3+51	10.0	1023.33	1025.30	1.97	25.48	6.28	0.612	0.008784
	20.0	1023.37	1025.53	2.16	29.36	5.45	0.461	0.005995
	30.0	1023.42	1025.61	2.19	30.24	5.29	0.435	0.005532
	50.0	1023.51	1025.75	2.24	31.25	5.12	0.407	0.005066
	100.0	1023.73	1026.02	2.28	32.30	4.95	0.381	0.004634
	200.0	1024.18	1026.48	2.30	32.75	4.89	0.371	0.004465
	400.0	1025.07	1027.37	2.30	32.76	4.88	0.370	0.004459
	600.0	1025.96	1028.27	2.30	32.76	4.88	0.370	0.004460
	800.0	1026.85	1029.16	2.30	32.76	4.88	0.370	0.004460
	1000.0	1027.75	1030.05	2.30	32.76	4.88	0.370	0.004460
103+00	1061.0	1028.02	1030.32	2.30	32.76	4.88	0.370	0.004460

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 23, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	160.0
Channel Bottom Slope (feet per foot).....	0.0036
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1030.02
Water Surface Elevation at Starting Station (feet).....	1031.99
Starting Channel Station (feet).....	1061.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.42
Critical Depth (feet).....	1.97

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
103+00	1061.0	1030.02	1031.99	1.97	25.48	6.28	0.612	0.008784
	1080.0	1030.09	1032.34	2.25	31.45	5.09	0.402	0.004978
	1100.0	1030.16	1032.46	2.30	32.65	4.90	0.373	0.004501
	1200.0	1030.52	1032.92	2.40	35.03	4.57	0.324	0.003723
101+00	1261.0	1030.74	1033.15	2.41	35.27	4.54	0.320	0.003657

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1985
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	136.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1030.73
Water Surface Elevation at Starting Station (feet).....	1033.15
Starting Channel Station (feet).....	1261.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.73
Critical Depth (feet).....	1.82

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
101+00	1261.0	1030.73	1033.15	2.42	35.53	3.83	0.228	0.002590
	1300.0	1030.79	1033.26	2.47	36.85	3.69	0.212	0.002348
	1400.0	1030.94	1033.50	2.56	39.14	3.47	0.187	0.001996
	1500.0	1031.09	1033.71	2.62	40.51	3.36	0.175	0.001820
	1600.0	1031.24	1033.89	2.65	41.40	3.28	0.168	0.001716
	1800.0	1031.54	1034.23	2.69	42.46	3.20	0.159	0.001604
	2000.0	1031.84	1034.55	2.71	42.98	3.16	0.156	0.001553
	2200.0	1032.14	1034.86	2.72	43.24	3.15	0.154	0.001527
	2400.0	1032.44	1035.17	2.73	43.38	3.14	0.153	0.001515
88+44	2517.0	1032.61	1035.34	2.73	43.42	3.13	0.152	0.001510

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 88+04 TO 88+44

At Driveway 25.17' W. of EL Mirage Rd.

(2nd Driveway E. of Airline canal)

5-Yr Q = 110 cfs

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:16:33 FILE NAME: CB3-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1032.73	1032.61	40.00	1 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

FILE: CB3-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-22-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1035.34	0.00	0.00	0.00	0.00	0.00	1038.06
11	1035.36	0.00	0.00	0.00	0.00	0.00	1038.50
22	1035.37	0.00	0.00	0.00	0.00	0.00	1038.64
33	1035.40	0.00	0.00	0.00	0.00	0.00	1038.73
44	1035.43	0.00	0.00	0.00	0.00	0.00	1038.81
55	1035.48	0.00	0.00	0.00	0.00	0.00	1038.87
66	1035.53	0.00	0.00	0.00	0.00	0.00	1038.93
77	1035.60	0.00	0.00	0.00	0.00	0.00	1038.99
88	1035.68	0.00	0.00	0.00	0.00	0.00	1039.04
99	1035.77	0.00	0.00	0.00	0.00	0.00	1039.08
110	1035.54	0.00	0.00	0.00	0.00	0.00	1039.13
275	1039.36	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:16:33 FILE NAME: CB3-5

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 3) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1035.34	0.00	2.61	0-NF	0.00	0.00	0.00	0.00	0.00	2.73
11	1035.36	0.58	2.63	3-M1t	0.39	0.39	0.50	2.73	0.00	2.73
22	1035.37	0.92	2.64	3-M1t	0.61	0.62	1.01	2.73	0.00	2.73
33	1035.40	1.21	2.67	3-M1t	0.79	0.81	1.51	2.73	0.00	2.73
44	1035.43	1.46	2.70	3-M1t	0.96	0.98	2.01	2.73	0.00	2.73
55	1035.48	1.71	2.75	3-M1t	1.11	1.14	2.52	2.73	0.00	2.73
66	1035.53	1.94	2.80	3-M1t	1.25	1.29	3.02	2.73	0.00	2.73
77	1035.60	2.17	2.87	3-M1t	1.38	1.43	3.53	2.73	0.00	2.73
88	1035.68	2.39	2.95	3-M1t	1.52	1.56	4.03	2.73	0.00	2.73
99	1035.77	2.60	3.04	5-M1t	1.64	1.69	4.53	2.73	0.00	2.73
110	1035.54	2.81	2.81	1-S2n	1.77	1.81	7.79	1.77	0.00	2.73

El. inlet face invert 1032.73 ft El. outlet invert 1032.61 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1032.73
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1032.61
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0030
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:16:33 FILE NAME: CB3-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1035.34

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 25.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1038.66
2	40.00	1038.06
3	48.00	1038.66
4	148.00	1040.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	110.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1032.73
Water Surface Elevation at Starting Station (feet).....	1035.54
Starting Channel Station (feet).....	2557.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.49
Critical Depth (feet).....	1.64

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
88+04	2557.0	1032.73	1035.54	2.81	45.63	2.41	0.090	0.000864
	2600.0	1032.79	1035.57	2.78	44.82	2.45	0.094	0.000907
	2700.0	1032.94	1035.66	2.72	43.16	2.55	0.101	0.001004
85+88	2773.0	1033.05	1035.73	2.68	42.13	2.61	0.106	0.001071

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 85+48 To 85+88

At Driveway 2773' W. of El Mirage Rd.

(1st Driveway E. of Airline Canal)

5-Yr Q = 110 cfs

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:18:25 FILE NAME: CB4-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1033.11	1033.05	40.00	1 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

FILE: CB4-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-22-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1035.73	0.00	0.00	0.00	0.00	0.00	1038.86
11	1035.74	0.00	0.00	0.00	0.00	0.00	1039.30
22	1035.76	0.00	0.00	0.00	0.00	0.00	1039.44
33	1035.79	0.00	0.00	0.00	0.00	0.00	1039.53
44	1035.82	0.00	0.00	0.00	0.00	0.00	1039.60
55	1035.87	0.00	0.00	0.00	0.00	0.00	1039.67
66	1035.93	0.00	0.00	0.00	0.00	0.00	1039.73
77	1036.00	0.00	0.00	0.00	0.00	0.00	1039.78
88	1036.07	0.00	0.00	0.00	0.00	0.00	1039.83
99	1036.17	0.00	0.00	0.00	0.00	0.00	1039.87
110	1036.26	0.00	0.00	0.00	0.00	0.00	1039.91
286	1040.08	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:18:25 FILE NAME: CB4-5

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 3) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1035.73	0.00	2.62	0-NF	0.00	0.00	0.00	0.00	0.00	2.68
11	1035.74	0.58	2.64	3-M1t	0.48	0.39	0.51	2.68	0.00	2.68
22	1035.76	0.92	2.65	3-M1t	0.76	0.62	1.03	2.68	0.00	2.68
33	1035.79	1.21	2.68	3-M1t	0.99	0.81	1.54	2.68	0.00	2.68
44	1035.82	1.46	2.71	3-M1t	1.20	0.98	2.05	2.68	0.00	2.68
55	1035.87	1.71	2.76	3-M1t	1.39	1.14	2.57	2.68	0.00	2.68
66	1035.93	1.94	2.82	3-M1t	1.58	1.29	3.08	2.68	0.00	2.68
77	1036.00	2.17	2.89	3-M1t	1.75	1.43	3.59	2.68	0.00	2.68
88	1036.07	2.39	2.96	3-M1t	1.92	1.56	4.10	2.68	0.00	2.68
99	1036.17	2.60	3.06	3-M1t	2.09	1.69	4.62	2.68	0.00	2.68
110	1036.26	2.81	3.15	3-M1t	2.24	1.81	5.13	2.68	0.00	2.68

El. inlet face invert 1033.11 ft El. outlet invert 1033.05 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1033.11
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1033.05
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:18:25 FILE NAME: CB4-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1035.73

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 25.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1039.46
2	40.00	1038.86
3	48.00	1039.46
4	148.00	1040.50

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	110.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1033.11
Water Surface Elevation at Starting Station (feet).....	1036.26
Starting Channel Station (feet).....	2813.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.49
Critical Depth (feet).....	1.64

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
85+48 –	2813.0	1033.11	1036.26	3.15	55.44	1.98	0.061	0.000513
85+00 –	2861.0	1033.18	1036.28	3.10	53.94	2.04	0.065	0.000552
	2900.0	1033.24	1036.30	3.06	52.78	2.08	0.067	0.000585
	3000.0	1033.39	1036.36	2.97	50.03	2.20	0.075	0.000675
	3100.0	1033.54	1036.42	2.88	47.61	2.31	0.083	0.000772
	3200.0	1033.69	1036.50	2.81	45.51	2.42	0.091	0.000871
	3300.0	1033.84	1036.58	2.74	43.73	2.52	0.098	0.000969
	3400.0	1033.99	1036.68	2.68	42.25	2.60	0.105	0.001063
	3500.0	1034.14	1036.78	2.64	41.05	2.68	0.111	0.001148
78+23 –	3538.0	1034.20	1036.82	2.62	40.67	2.70	0.114	0.001178

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 77+63 To 78+23

At Airline Canal

5-Yr Q = 110 cfs

CURRENT DATE: 07-22-1993 FILE DATE: 07-18-1993
CURRENT TIME: 08:20:06 FILE NAME: CBAIR-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1034.34	1034.20	60.00	1 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

****

FILE: CBAIR-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-18-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1036.81	0.00	0.00	0.00	0.00	0.00	1041.14
11	1036.83	0.00	0.00	0.00	0.00	0.00	1041.58
22	1036.84	0.00	0.00	0.00	0.00	0.00	1041.72
33	1036.87	0.00	0.00	0.00	0.00	0.00	1041.81
44	1036.91	0.00	0.00	0.00	0.00	0.00	1041.89
55	1036.97	0.00	0.00	0.00	0.00	0.00	1041.96
66	1037.03	0.00	0.00	0.00	0.00	0.00	1042.02
77	1037.11	0.00	0.00	0.00	0.00	0.00	1042.08
88	1037.19	0.00	0.00	0.00	0.00	0.00	1042.13
99	1037.30	0.00	0.00	0.00	0.00	0.00	1042.18
110	1037.40	0.00	0.00	0.00	0.00	0.00	1042.23
319	1042.41	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-18-1993
CURRENT TIME: 08:20:06 FILE NAME: CBAIR-5

****

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 3) RCB

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1036.81	0.00	2.47	0-NF	0.00	0.00	0.00	0.00	0.00	2.61
11	1036.83	0.58	2.49	3-M1t	0.42	0.39	0.53	2.61	0.00	2.61
22	1036.84	0.92	2.50	3-M1t	0.66	0.62	1.05	2.61	0.00	2.61
33	1036.87	1.21	2.53	3-M1t	0.86	0.81	1.58	2.61	0.00	2.61
44	1036.91	1.46	2.57	3-M1t	1.04	0.98	2.11	2.61	0.00	2.61
55	1036.97	1.71	2.63	3-M1t	1.21	1.14	2.63	2.61	0.00	2.61
66	1037.03	1.94	2.69	3-M1t	1.36	1.29	3.16	2.61	0.00	2.61
77	1037.11	2.17	2.77	3-M1t	1.51	1.43	3.69	2.61	0.00	2.61
88	1037.19	2.39	2.85	3-M1t	1.65	1.56	4.21	2.61	0.00	2.61
99	1037.30	2.60	2.96	3-M1t	1.79	1.69	4.74	2.61	0.00	2.61
110	1037.40	2.81	3.06	3-M1t	1.92	1.81	5.27	2.61	0.00	2.61

****

El. inlet face invert 1034.34 ft El. outlet invert 1034.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1034.34
OUTLET STATION (FT)	60.00
OUTLET ELEVATION (FT)	1034.20
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0023
CULVERT LENGTH ALONG SLOPE (FT)	60.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-18-1993
CURRENT TIME: 08:20:06 FILE NAME: CBAIR-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1036.81

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 60.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1041.74
2	40.00	1041.14
3	48.00	1041.74
4	148.00	1044.30

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 17, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	105.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1034.34
Water Surface Elevation at Starting Station (feet).....	1037.40
Starting Channel Station (feet).....	3598.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.44
Critical Depth (feet).....	1.60

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
77+63 –	3598.0	1034.34	1037.40	3.06	52.75	1.99	0.062	0.000534
	3650.0	1034.42	1037.43	3.01	51.21	2.05	0.065	0.000578
	3700.0	1034.49	1037.45	2.96	49.80	2.11	0.069	0.000623
	3800.0	1034.64	1037.51	2.87	47.24	2.22	0.077	0.000718
	3900.0	1034.79	1037.58	2.79	45.00	2.33	0.085	0.000818
73+64 –	3997.0	1034.94	1037.66	2.72	43.14	2.43	0.092	0.000916

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 73+04 TO 73+64
At 129th Av.
5-Yr Q = 105 cfs

CURRENT DATE: 07-18-1993 FILE DATE: 07-18-1993
CURRENT TIME: 13:33:24 FILE NAME: CB129-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1035.09	1034.94	60.00	1 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

FILE: CB129-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-18-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1037.66	0.00	0.00	0.00	0.00	0.00	1041.82
11	1037.67	0.00	0.00	0.00	0.00	0.00	1042.25
21	1037.69	0.00	0.00	0.00	0.00	0.00	1042.39
32	1037.71	0.00	0.00	0.00	0.00	0.00	1042.48
42	1037.75	0.00	0.00	0.00	0.00	0.00	1042.55
53	1037.79	0.00	0.00	0.00	0.00	0.00	1042.61
63	1037.85	0.00	0.00	0.00	0.00	0.00	1042.66
74	1037.91	0.00	0.00	0.00	0.00	0.00	1042.71
84	1037.99	0.00	0.00	0.00	0.00	0.00	1042.75
95	1038.07	0.00	0.00	0.00	0.00	0.00	1042.79
105	1038.16	0.00	0.00	0.00	0.00	0.00	1042.82
315	1043.02	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-18-1993 FILE DATE: 07-18-1993
CURRENT TIME: 13:33:24 FILE NAME: CB129-5

****

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 3) RCB

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1037.66	0.00	2.57	0-NF	0.00	0.00	0.00	0.00	0.00	2.72
11	1037.67	0.56	2.58	3-M1t	0.40	0.38	0.48	2.72	0.00	2.72
21	1037.69	0.89	2.60	3-M1t	0.63	0.60	0.97	2.72	0.00	2.72
32	1037.71	1.17	2.62	3-M1t	0.81	0.79	1.45	2.72	0.00	2.72
42	1037.75	1.42	2.66	3-M1t	0.98	0.95	1.93	2.72	0.00	2.72
53	1037.79	1.65	2.70	3-M1t	1.14	1.10	2.41	2.72	0.00	2.72
63	1037.85	1.88	2.76	3-M1t	1.29	1.25	2.90	2.72	0.00	2.72
74	1037.91	2.10	2.82	3-M1t	1.43	1.38	3.38	2.72	0.00	2.72
84	1037.99	2.31	2.90	3-M1t	1.56	1.51	3.86	2.72	0.00	2.72
95	1038.07	2.51	2.98	3-M1t	1.69	1.63	4.34	2.72	0.00	2.72
105	1038.16	2.71	3.07	3-M1t	1.82	1.75	4.83	2.72	0.00	2.72

****

El. inlet face invert 1035.09 ft El. outlet invert 1034.94 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1035.09
OUTLET STATION (FT)	60.00
OUTLET ELEVATION (FT)	1034.94
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0025
CULVERT LENGTH ALONG SLOPE (FT)	60.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-18-1993 FILE DATE: 07-18-1993
CURRENT TIME: 13:33:24 FILE NAME: CB129-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1037.66

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 50.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1042.42
2	40.00	1041.82
3	48.00	1042.42
4	148.00	1043.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 17, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	105.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1035.09
Water Surface Elevation at Starting Station (feet).....	1038.16
Starting Channel Station (feet).....	4057.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.44
Critical Depth (feet).....	1.60

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
73+04 –	4057.0	1035.09	1038.16	3.07	53.05	1.98	0.061	0.000526
	4100.0	1035.15	1038.18	3.03	51.75	2.03	0.064	0.000562
	4200.0	1035.30	1038.23	2.93	48.96	2.14	0.071	0.000652
	4300.0	1035.45	1038.30	2.84	46.50	2.26	0.079	0.000749
	4400.0	1035.60	1038.37	2.76	44.37	2.37	0.087	0.000849
	4500.0	1035.75	1038.45	2.70	42.56	2.47	0.095	0.000950
	4600.0	1035.90	1038.54	2.64	41.05	2.56	0.102	0.001047
	4700.0	1036.05	1038.65	2.59	39.83	2.64	0.108	0.001135
64+83 –	4808.0	1036.22	1038.77	2.55	38.79	2.71	0.114	0.001219
	4900.0	1036.35	1038.88	2.52	38.10	2.76	0.118	0.001279
	5000.0	1036.50	1039.01	2.50	37.52	2.80	0.122	0.001333
62+83 –	5078.0	1036.62	1039.11	2.49	37.18	2.82	0.124	0.001366

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 61+73 To 62+83
At Dysart Rd.

5-Yr Q = 102 cfs

CURRENT DATE: 07-18-1993 FILE DATE: 07-18-1993
CURRENT TIME: 13:35:24 FILE NAME: CBDYS-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1036.79	1036.62	110.00	1 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

FILE: CBDYS-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-18-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1039.11	0.00	0.00	0.00	0.00	0.00	1043.40
10	1039.13	0.00	0.00	0.00	0.00	0.00	1043.83
20	1039.15	0.00	0.00	0.00	0.00	0.00	1043.96
31	1039.18	0.00	0.00	0.00	0.00	0.00	1044.04
41	1039.22	0.00	0.00	0.00	0.00	0.00	1044.08
51	1039.28	0.00	0.00	0.00	0.00	0.00	1044.12
61	1039.34	0.00	0.00	0.00	0.00	0.00	1044.15
71	1039.42	0.00	0.00	0.00	0.00	0.00	1044.18
82	1039.51	0.00	0.00	0.00	0.00	0.00	1044.21
92	1039.61	0.00	0.00	0.00	0.00	0.00	1044.24
102	1039.72	0.00	0.00	0.00	0.00	0.00	1044.26
306	1044.42	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-18-1993 FILE DATE: 07-18-1993
CURRENT TIME: 13:35:24 FILE NAME: CBDYS-5

****

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 3) RCB

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1039.11	0.00	2.32	0-NF	0.00	0.00	0.00	0.00	0.00	2.49
10	1039.13	0.55	2.34	3-M1t	0.45	0.37	0.51	2.49	0.00	2.49
20	1039.15	0.88	2.36	3-M1t	0.72	0.59	1.02	2.49	0.00	2.49
31	1039.18	1.15	2.39	3-M1t	0.94	0.77	1.54	2.49	0.00	2.49
41	1039.22	1.39	2.43	3-M1t	1.13	0.93	2.05	2.49	0.00	2.49
51	1039.28	1.62	2.49	3-M1t	1.31	1.08	2.56	2.49	0.00	2.49
61	1039.34	1.84	2.55	3-M1t	1.49	1.22	3.07	2.49	0.00	2.49
71	1039.42	2.06	2.63	3-M1t	1.65	1.36	3.58	2.49	0.00	2.49
82	1039.51	2.26	2.72	3-M1t	1.81	1.48	4.10	2.49	0.00	2.49
92	1039.61	2.46	2.82	3-M1t	1.96	1.60	4.61	2.49	0.00	2.49
102	1039.72	2.66	2.93	3-M1t	2.11	1.72	5.12	2.49	0.00	2.49

****

El. inlet face invert 1036.79 ft El. outlet invert 1036.62 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1036.79
OUTLET STATION (FT)	110.00
OUTLET ELEVATION (FT)	1036.62
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	110.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-18-1993 FILE DATE: 07-18-1993
CURRENT TIME: 13:35:24 FILE NAME: CBDYS-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1039.11

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 80.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1044.00
2	40.00	1043.40
3	48.00	1044.00
4	148.00	1044.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	102.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1036.79
Water Surface Elevation at Starting Station (feet).....	1039.72
Starting Channel Station (feet).....	0.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.40
Critical Depth (feet).....	1.58

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
61+73 —	0.0	1036.79	1039.72	2.93	48.99	2.08	0.067	0.000614
	50.0	1036.86	1039.75	2.88	47.67	2.14	0.071	0.000661
	100.0	1036.94	1039.78	2.84	46.42	2.20	0.075	0.000710
	200.0	1037.09	1039.85	2.76	44.19	2.31	0.083	0.000810
58+78 —	295.0	1037.23	1039.92	2.69	42.36	2.41	0.090	0.000908
	400.0	1037.39	1040.01	2.62	40.68	2.51	0.098	0.001012
	500.0	1037.54	1040.11	2.57	39.37	2.59	0.104	0.001105
55+75 —	598.0	1037.69	1040.22	2.53	38.35	2.66	0.110	0.001186

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 55+35 TO 55+75

At Driveway 600' W. of Dysart Rd.

5-Yr Q = 99 cfs

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:22:06 FILE NAME: CB5-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1037.75	1037.69	40.00	1 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

FILE: CB5-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-22-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1040.22	0.00	0.00	0.00	0.00	0.00	1042.63
10	1040.23	0.00	0.00	0.00	0.00	0.00	1043.05
20	1040.25	0.00	0.00	0.00	0.00	0.00	1043.19
30	1040.27	0.00	0.00	0.00	0.00	0.00	1043.26
40	1040.30	0.00	0.00	0.00	0.00	0.00	1043.31
50	1040.34	0.00	0.00	0.00	0.00	0.00	1043.34
59	1040.40	0.00	0.00	0.00	0.00	0.00	1043.37
69	1040.47	0.00	0.00	0.00	0.00	0.00	1043.40
79	1040.53	0.00	0.00	0.00	0.00	0.00	1043.43
89	1040.62	0.00	0.00	0.00	0.00	0.00	1043.46
99	1040.70	0.00	0.00	0.00	0.00	0.00	1043.49
247	1043.59	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:22:06 FILE NAME: CB5-5

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (8 BY 3) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1040.22	0.00	2.47	0-NF	0.00	0.00	0.00	0.00	0.00	2.53
10	1040.23	0.54	2.48	3-M1t	0.45	0.36	0.49	2.53	0.00	2.53
20	1040.25	0.86	2.50	3-M1t	0.71	0.58	0.98	2.53	0.00	2.53
30	1040.27	1.13	2.52	3-M1t	0.93	0.76	1.47	2.53	0.00	2.53
40	1040.30	1.36	2.55	3-M1t	1.12	0.91	1.96	2.53	0.00	2.53
50	1040.34	1.59	2.59	3-M1t	1.30	1.06	2.45	2.53	0.00	2.53
59	1040.40	1.80	2.65	3-M1t	1.47	1.20	2.93	2.53	0.00	2.53
69	1040.47	2.01	2.72	3-M1t	1.63	1.33	3.42	2.53	0.00	2.53
79	1040.53	2.21	2.78	3-M1t	1.79	1.45	3.91	2.53	0.00	2.53
89	1040.62	2.41	2.87	3-M1t	1.94	1.57	4.40	2.53	0.00	2.53
99	1040.70	2.60	2.95	3-M1t	2.09	1.69	4.89	2.53	0.00	2.53

El. inlet face invert 1037.75 ft El. outlet invert 1037.69 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1037.75
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1037.69
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:22:06 FILE NAME: CB5-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1040.22

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 40.00

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1043.23
2	40.00	1042.63
3	48.00	1043.23
4	148.00	1043.23

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	99.0
Channel Bottom Slope (feet per foot).....	0.0015
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1037.75
Water Surface Elevation at Starting Station (feet).....	1040.70
Starting Channel Station (feet).....	638.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	2.37
Critical Depth (feet).....	1.55

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
55+35 —	638.0	1037.75	1040.70	2.95	49.56	2.00	0.062	0.000561
55+00 —	673.0	1037.80	1040.72	2.92	48.57	2.04	0.065	0.000592
	700.0	1037.84	1040.73	2.89	47.83	2.07	0.067	0.000617
	800.0	1037.99	1040.79	2.80	45.31	2.19	0.074	0.000714
	900.0	1038.14	1040.86	2.72	43.11	2.30	0.082	0.000816
	1000.0	1038.29	1040.94	2.65	41.24	2.40	0.089	0.000919
	1100.0	1038.44	1041.03	2.59	39.68	2.50	0.097	0.001020
	1200.0	1038.59	1041.13	2.54	38.41	2.58	0.103	0.001113
	1300.0	1038.74	1041.24	2.50	37.40	2.65	0.109	0.001195
	1400.0	1038.89	1041.36	2.46	36.61	2.70	0.114	0.001266
	1500.0	1039.04	1041.48	2.44	36.01	2.75	0.117	0.001323
	1600.0	1039.19	1041.61	2.42	35.57	2.78	0.120	0.001368
	1700.0	1039.34	1041.75	2.41	35.24	2.81	0.123	0.001403
44+39 —	1734.0	1039.39	1041.80	2.40	35.15	2.82	0.123	0.001413

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 43+99 To 44+39

At Driveway 1734' W. of Dysart Rd.

5-Yr Q = 86 cfs

1

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:24:51 FILE NAME: CB6-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1039.45	1039.39	40.00	1 RCB	6.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

****
FILE: CB6-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-22-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1041.80	0.00	0.00	0.00	0.00	0.00	1043.59
9	1041.82	0.00	0.00	0.00	0.00	0.00	1044.00
17	1041.84	0.00	0.00	0.00	0.00	0.00	1044.13
26	1041.87	0.00	0.00	0.00	0.00	0.00	1044.22
34	1041.92	0.00	0.00	0.00	0.00	0.00	1044.29
43	1041.99	0.00	0.00	0.00	0.00	0.00	1044.36
52	1042.06	0.00	0.00	0.00	0.00	0.00	1044.41
60	1042.16	0.00	0.00	0.00	0.00	0.00	1044.47
69	1042.27	0.00	0.00	0.00	0.00	0.00	1044.52
77	1042.39	0.00	0.00	0.00	0.00	0.00	1044.58
86	1042.52	0.00	0.00	0.00	0.00	0.00	1044.62
172	1044.81	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:24:51 FILE NAME: CB6-5

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (6 BY 3) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1041.80	0.00	2.35	0-NF	0.00	0.00	0.00	0.00	0.00	2.41
9	1041.82	0.60	2.37	3-M1t	0.51	0.40	0.59	2.41	0.00	2.41
17	1041.84	0.95	2.39	3-M1t	0.80	0.64	1.19	2.41	0.00	2.41
26	1041.87	1.24	2.42	3-M1t	1.05	0.83	1.78	2.41	0.00	2.41
34	1041.92	1.50	2.47	3-M1t	1.28	1.01	2.38	2.41	0.00	2.41
43	1041.99	1.76	2.54	3-M1t	1.49	1.17	2.97	2.41	0.00	2.41
52	1042.06	2.00	2.61	3-M1t	1.69	1.32	3.57	2.41	0.00	2.41
60	1042.16	2.24	2.71	3-M1t	1.89	1.47	4.16	2.41	0.00	2.41
69	1042.27	2.46	2.82	3-M1t	2.08	1.60	4.76	2.41	0.00	2.41
77	1042.39	2.68	2.94	3-M1t	2.26	1.73	5.35	2.41	0.00	2.41
86	1042.52	2.90	3.07	3-M2t	2.45	1.86	5.95	2.41	0.00	2.41

El. inlet face invert 1039.45 ft El. outlet invert 1039.39 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1039.45
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1039.39
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0015
CULVERT LENGTH ALONG SLOPE (FT)	40.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	6.00 FT
BARREL RISE	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:24:51 FILE NAME: CB6-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1041.80

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 40.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1044.19
2	40.00	1043.59
3	48.00	1044.59
4	148.00	1045.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	86.0
Channel Bottom Slope (feet per foot).....	0.0069 .00689
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1040.45
Water Surface Elevation at Starting Station (feet).....	1042.52
Starting Channel Station (feet).....	1774.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.56
Critical Depth (feet).....	1.45

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
43+99 —	1774.0	1040.45	1042.52	2.07	27.49	3.13	0.152	0.002067
	1800.0	1040.63	1042.54	1.91	24.17	3.56	0.197	0.002927
	1850.0	1040.97	1042.64	1.66	19.40	4.43	0.305	0.005308
	1900.0	1041.32	1042.88	1.56	17.50	4.91	0.375	0.007018
	1950.0	1041.66	1043.23	1.57	17.65	4.87	0.369	0.006855
	2000.0	1042.01	1043.57	1.56	17.61	4.88	0.370	0.006898
	2100.0	1042.70	1044.26	1.57	17.62	4.88	0.370	0.006887
39+00 —	2273.0	1043.89	1045.45	1.56	17.62	4.88	0.370	0.006892

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	71.0
Channel Bottom Slope (feet per foot).....	0.0069 .00689
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	5.0
Channel Flow-Line Elevation at Starting Station (feet)..	1043.89
Water Surface Elevation at Starting Station (feet).....	1045.45
Starting Channel Station (feet).....	2273.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.43
Critical Depth (feet).....	1.31

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
39+00 —	2273.0	1043.89	1045.45	1.56	17.53	4.05	0.255	0.004757
	2300.0	1044.08	1045.54	1.47	15.97	4.44	0.307	0.006128
	2350.0	1044.42	1045.84	1.42	15.18	4.68	0.340	0.007045
	2400.0	1044.77	1046.20	1.43	15.34	4.63	0.333	0.006847
	2500.0	1045.45	1046.88	1.43	15.28	4.65	0.335	0.006913
35+35	2638.0	1046.40	1047.83	1.43	15.31	4.64	0.334	0.006876

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	36.0
Channel Bottom Slope (feet per foot).....	0.0073
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	0.0
Channel Flow-Line Elevation at Starting Station (feet)..	1047.40
Water Surface Elevation at Starting Station (feet).....	1047.83
Starting Channel Station (feet).....	2638.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.48
Critical Depth (feet).....	1.38

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
3545	2638.0	1047.40	1048.78	1.38	7.63	4.72	0.345	0.010735
	2650.0	1047.49	1048.98	1.49	8.92	4.04	0.253	0.007097
	2700.0	1047.85	1049.33	1.48	8.79	4.10	0.260	0.007370
	2800.0	1048.58	1050.07	1.49	8.84	4.07	0.257	0.007257
3244	2909.0	1049.38	1050.86	1.48	8.81	4.09	0.259	0.007327

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

Sta. 32+24 TO 32+64

At Driveway 2162' E. of Litchfield Rd.

5-Yr Q = 36 cfs

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:27:21 FILE NAME: CB7-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1049.58	1049.38	40.00	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

FILE: CB7-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-22-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1050.86	0.00	0.00	0.00	0.00	0.00	1053.96
4	1050.99	0.00	0.00	0.00	0.00	0.00	1054.26
7	1051.08	0.00	0.00	0.00	0.00	0.00	1054.35
11	1051.00	0.00	0.00	0.00	0.00	0.00	1054.42
14	1051.29	0.00	0.00	0.00	0.00	0.00	1054.48
18	1051.54	0.00	0.00	0.00	0.00	0.00	1054.53
22	1051.78	0.00	0.00	0.00	0.00	0.00	1054.57
25	1051.99	0.00	0.00	0.00	0.00	0.00	1054.60
29	1052.20	0.00	0.00	0.00	0.00	0.00	1054.62
32	1052.41	0.00	0.00	0.00	0.00	0.00	1054.65
36	1052.63	0.00	0.00	0.00	0.00	0.00	1054.67
65	1054.90	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:27:21 FILE NAME: CB7-5

****

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3 BY 3) RCP

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1050.86	0.00	1.28	0-NF	0.00	0.00	0.00	0.00	0.00	1.48
4	1050.99	0.71	1.41	3-M1t	0.52	0.59	1.04	1.48	0.00	1.48
7	1051.08	1.09	1.50	3-M1t	0.75	0.84	2.07	1.48	0.00	1.48
11	1051.00	1.42	1.42	1-S2n	0.93	1.03	5.78	0.93	0.00	1.48
14	1051.29	1.71	1.71	1-S2n	1.08	1.21	6.25	1.08	0.00	1.48
18	1051.54	1.96	1.96	1-S2n	1.23	1.35	6.62	1.23	0.00	1.48
22	1051.78	2.20	2.20	1-S2n	1.36	1.49	6.95	1.36	0.00	1.48
25	1051.99	2.41	2.41	1-S2n	1.49	1.61	7.22	1.49	0.00	1.48
29	1052.20	2.62	2.62	1-S2n	1.61	1.73	7.46	1.61	0.00	1.48
32	1052.41	2.83	2.83	1-S2n	1.73	1.84	7.67	1.73	0.00	1.48
36	1052.63	3.05	3.05	5-S2n	1.86	1.94	7.84	1.86	0.00	1.48

****

El. inlet face invert 1049.58 ft El. outlet invert 1049.38 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

**** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1049.58
OUTLET STATION (FT)	40.00
OUTLET ELEVATION (FT)	1049.38
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0050
CULVERT LENGTH ALONG SLOPE (FT)	40.00

**** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-22-1993 FILE DATE: 07-22-1993
CURRENT TIME: 08:27:21 FILE NAME: CB7-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1050.86

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE GRAVEL
EMBANKMENT TOP WIDTH (FT) 20.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1054.56
2	40.00	1053.96
3	48.00	1054.56
4	148.00	1054.70

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 21, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	36.0
Channel Bottom Slope (feet per foot).....	0.0070
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	0.0
Channel Flow-Line Elevation at Starting Station (feet)..	1052.58
Water Surface Elevation at Starting Station (feet).....	1052.63
Starting Channel Station (feet).....	2949.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.50
Critical Depth (feet).....	1.38

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
3214 –	2949.0	1052.58	1053.96	1.38	7.63	4.72	0.345	0.010735
	2960.0	1052.66	1054.15	1.50	8.96	4.02	0.251	0.007006
	2980.0	1052.80	1054.29	1.50	8.96	4.02	0.251	0.007004
	3000.0	1052.94	1054.43	1.50	8.96	4.02	0.251	0.007003
3000 –	3173.0	1054.15	1055.64	1.50	8.96	4.02	0.251	0.006998

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 22, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	36.0
Channel Bottom Slope (feet per foot).....	0.0020 .00202
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	0.0
Channel Flow-Line Elevation at Starting Station (feet)..	1054.15
Water Surface Elevation at Starting Station (feet).....	1055.64
Starting Channel Station (feet).....	3173.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.89
Critical Depth (feet).....	1.38

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
30+00 —	3173.0	1054.15	1055.64	1.49	8.88	4.05	0.255	0.007171
	3200.0	1054.20	1055.89	1.68	11.30	3.19	0.158	0.003773
	3300.0	1054.41	1056.24	1.83	13.43	2.68	0.112	0.002380
	3400.0	1054.61	1056.47	1.87	13.92	2.59	0.104	0.002165
	3500.0	1054.81	1056.69	1.88	14.12	2.55	0.101	0.002084
	3600.0	1055.01	1056.90	1.88	14.20	2.53	0.100	0.002050
	3700.0	1055.21	1057.10	1.89	14.24	2.53	0.099	0.002034
	3800.0	1055.42	1057.30	1.89	14.26	2.52	0.099	0.002027
21+00 —	4073.0	1055.97	1057.86	1.89	14.28	2.52	0.099	0.002020

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	36.0
Channel Bottom Slope (feet per foot).....	0.0037
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	0.0
Channel Flow-Line Elevation at Starting Station (feet)..	1055.97
Water Surface Elevation at Starting Station (feet).....	1057.86
Starting Channel Station (feet).....	4073.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.69
Critical Depth (feet).....	1.38

	Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
2400 —	4073.0	1055.97	1057.86	1.89	14.29	2.52	0.099	0.002017
	4100.0	1056.07	1057.91	1.84	13.50	2.67	0.110	0.002346
	4200.0	1056.44	1058.16	1.72	11.81	3.05	0.144	0.003352
	4300.0	1056.81	1058.50	1.69	11.42	3.15	0.154	0.003670
	4400.0	1057.18	1058.87	1.69	11.38	3.16	0.155	0.003698
	4500.0	1057.55	1059.24	1.69	11.38	3.16	0.155	0.003699
	4800.0	1058.66	1060.35	1.69	11.38	3.16	0.155	0.003700
10462 —	5111.0	1059.81	1061.50	1.69	11.38	3.16	0.155	0.003700

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

sta. -0+38 TO 10+62
At Litchfield Rd.

CURRENT DATE: 07-15-1993 FILE DATE: 07-14-1993 5-Yr Q = 36 cfs
CURRENT TIME: 13:21:43 FILE NAME: CBLIT-5

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.0 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1060.18	1059.81	100.00	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

36"

****
FILE: CBLIT-5 CULVERT HEADWATER ELEVATION (FT) DATE: 07-14-1993

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1061.50	0.00	0.00	0.00	0.00	0.00	1064.10
4	1061.55	0.00	0.00	0.00	0.00	0.00	1064.38
7	1061.65	0.00	0.00	0.00	0.00	0.00	1064.47
11	1061.60	0.00	0.00	0.00	0.00	0.00	1064.54
14	1061.89	0.00	0.00	0.00	0.00	0.00	1064.59
18	1062.15	0.00	0.00	0.00	0.00	0.00	1064.64
22	1062.38	0.00	0.00	0.00	0.00	0.00	1064.68
25	1062.77	0.00	0.00	0.00	0.00	0.00	1064.71
29	1062.99	0.00	0.00	0.00	0.00	0.00	1064.74
32	1063.17	0.00	0.00	0.00	0.00	0.00	1064.77
36	1063.37	0.00	0.00	0.00	0.00	0.00	1064.79
58	1064.81	0.00	0.00	0.00	0.00	0.00	0.00

The above Q and HW are for a point above the roadway.

****

CURRENT DATE: 07-15-1993 FILE DATE: 07-14-1993
CURRENT TIME: 13:21:43 FILE NAME: CBLIT-5

****

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3 BY 3) RCP

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE (F4)	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1061.50	0.00	1.32	0-NF	0.00	0.00	0.00	0.00	0.00	1.69
4	1061.55	0.71	1.37	3-M1t	0.57	0.59	0.88	1.69	0.00	1.69
7	1061.65	1.09	1.47	3-M1t	0.81	0.84	1.76	1.69	0.00	1.69
11	1061.60	1.42	1.42	1-S2n	1.00	1.03	5.18	1.00	0.00	1.69
14	1061.89	1.71	1.71	1-S2n	1.18	1.21	5.58	1.18	0.00	1.69
18	1062.15	1.97	1.97	1-S2n	1.33	1.35	5.93	1.33	0.00	1.69
22	1062.38	2.20	2.20	1-S2n	1.48	1.49	6.20	1.48	0.00	1.69
25	1062.77	2.42	2.59	3-M1t	1.63	1.61	6.15	1.69	0.00	1.69
29	1062.99	2.63	2.81	2-M2c	1.77	1.73	6.81	1.73	0.00	1.69
32	1063.17	2.84	2.99	2-M2c	1.92	1.84	7.11	1.84	0.00	1.69
36	1063.37	3.05	3.19	2-M2c	2.06	1.94	7.44	1.94	0.00	1.69

****

El. inlet face invert 1060.18 ft El. outlet invert 1059.81 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1060.18
OUTLET STATION (FT)	100.00
OUTLET ELEVATION (FT)	1059.81
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0037
CULVERT LENGTH ALONG SLOPE (FT)	100.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 07-15-1993 FILE DATE: 07-14-1993
CURRENT TIME: 13:21:43 FILE NAME: CBLIT-5

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1061.50

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH (FT) 68.00
***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X (FT)	Y (FT)
1	0.00	1064.70
2	40.00	1064.10
3	48.00	1064.70
4	148.00	1065.00

****

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
August 3, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	36.0
Channel Bottom Slope (feet per foot).....	0.0037
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	0.00
Channel Side Slope - Right Side (horizontal/vertical)...	0.00
Channel Bottom Width (feet).....	6.0
Channel Flow-Line Elevation at Starting Station (feet)..	1060.18
Water Surface Elevation at Starting Station (feet).....	1063.37
Starting Channel Station (feet).....	38.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.61
Critical Depth (feet).....	1.04

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
-38.0	1060.18	1063.37	3.19	19.14	1.88	0.055	0.000560
-48.0	1060.22	1063.37	3.16	18.95	1.90	0.056	0.000575

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
August 3, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	36.0
Channel Bottom Slope (feet per foot).....	0.0078
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	1.0
Channel Flow-Line Elevation at Starting Station (feet)..	1062.72
Water Surface Elevation at Starting Station (feet).....	1063.98
Starting Channel Station (feet).....	48.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.35
Critical Depth (feet).....	1.26

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
48.0	1062.72	1063.98	1.26	7.65	4.71	0.344	0.010709
60.0	1062.81	1064.17	1.36	8.77	4.11	0.262	0.007430
80.0	1062.97	1064.32	1.35	8.61	4.18	0.271	0.007798
100.0	1063.13	1064.47	1.35	8.61	4.18	0.271	0.007799
200.0	1063.91	1065.25	1.35	8.61	4.18	0.272	0.007799

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
August 3, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	24.0
Channel Bottom Slope (feet per foot).....	0.0075
Manning`s Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	1.0
Channel Flow-Line Elevation at Starting Station (feet)..	1064.90
Water Surface Elevation at Starting Station (feet).....	1065.96
Starting Channel Station (feet).....	200.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.15
Critical Depth (feet).....	1.06

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
200.0	1064.90	1065.96	1.06	5.55	4.32	0.290	0.011176
210.0	1064.97	1066.13	1.16	6.50	3.69	0.212	0.007352
220.0	1065.05	1066.20	1.15	6.47	3.71	0.214	0.007441
300.0	1065.65	1066.80	1.15	6.44	3.73	0.216	0.007534
400.0	1066.40	1067.55	1.15	6.46	3.72	0.215	0.007477

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	24.0
Channel Bottom Slope (feet per foot).....	0.0075
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	0.0
Channel Flow-Line Elevation at Starting Station (feet)..	1069.40
Water Surface Elevation at Starting Station (feet).....	1070.00
Starting Channel Station (feet).....	400.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.27
Critical Depth (feet).....	1.17

Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
400.0	1069.40	1070.57	1.17	5.52	4.35	0.294	0.011332
410.0	1069.47	1070.75	1.27	6.50	3.69	0.212	0.007323
420.0	1069.55	1070.82	1.27	6.46	3.71	0.214	0.007430
500.0	1070.15	1071.42	1.27	6.43	3.73	0.216	0.007540
600.0	1070.90	1072.17	1.27	6.45	3.72	0.215	0.007474
700.0	1071.65	1072.92	1.27	6.44	3.73	0.216	0.007517
800.0	1072.40	1073.67	1.27	6.45	3.72	0.215	0.007490

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
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TRAPEZOIDAL CHANNEL ANALYSIS
STANDARD STEP WATER SURFACE PROFILE
July 15, 1993

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	16.0
Channel Bottom Slope (feet per foot).....	0.0089
Manning's Roughness Coefficient (n-value).....	0.0250
Channel Side Slope - Left Side (horizontal/vertical)....	4.00
Channel Side Slope - Right Side (horizontal/vertical)...	4.00
Channel Bottom Width (feet).....	0.0
Channel Flow-Line Elevation at Starting Station (feet)..	1072.40
Water Surface Elevation at Starting Station (feet).....	1073.67
Starting Channel Station (feet).....	800.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	1.06
Critical Depth (feet).....	1.00

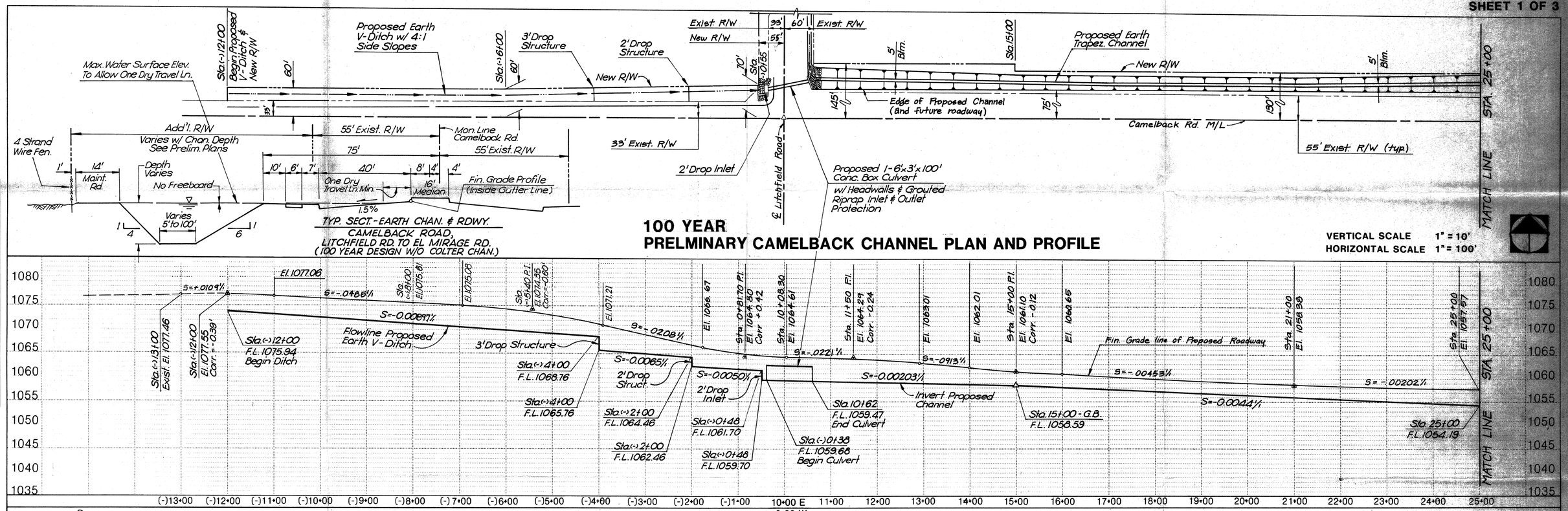
Station (ft)	Flowline (ft)	WS Elev. (ft)	Depth (ft)	Flow Area (sq ft)	Vel (fps)	Velocity Head(ft)	EGL Slope (ft/ft)
800.0	1072.40	1073.67	1.27	6.45	2.48	0.095	0.003321
820.0	1072.58	1073.71	1.13	5.11	3.13	0.152	0.006178
840.0	1072.76	1073.81	1.06	4.45	3.59	0.200	0.008917
900.0	1073.29	1074.35	1.06	4.46	3.59	0.200	0.008889
1000.0	1074.18	1075.24	1.06	4.46	3.59	0.200	0.008907
1100.0	1075.07	1076.13	1.06	4.46	3.59	0.200	0.008895
1200.0	1075.96	1077.02	1.06	4.46	3.59	0.200	0.008903

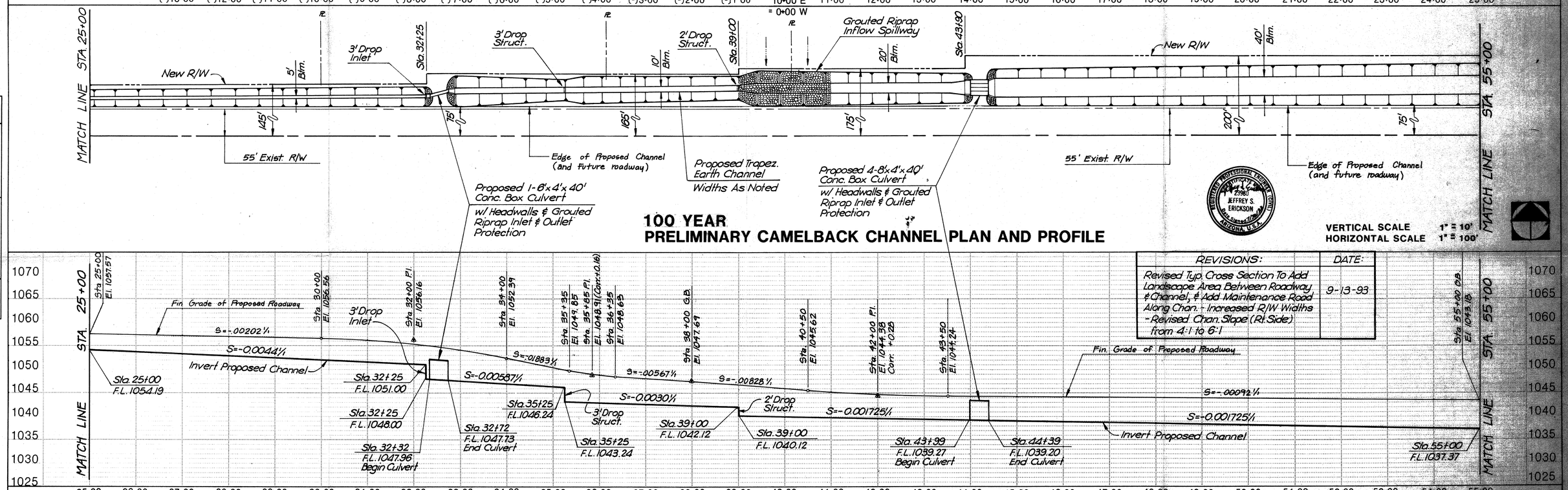
==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

APPENDIX B

PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE (100-YEAR AND 5-YEAR INTERIM)





REVISIONS:	DATE:
Revised Typ. Cross Section To Add Landscape Area Between Roadway & Channel, & Add Maintenance Road Along Chan. - Increased R/W Widths - Revised Chan. Slope (Rt. Side) from 4:1 to 6:1	9-13-93

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 23960 JEFFREY S. ERICKSON Expires 6/30/94 ARIZONA, U.S.A.

PLATE 2-DOUBLE PLAN AND PROFILE-FULL DOT

HIGHWAY FEDERAL AID SHEET

TELEDYNE

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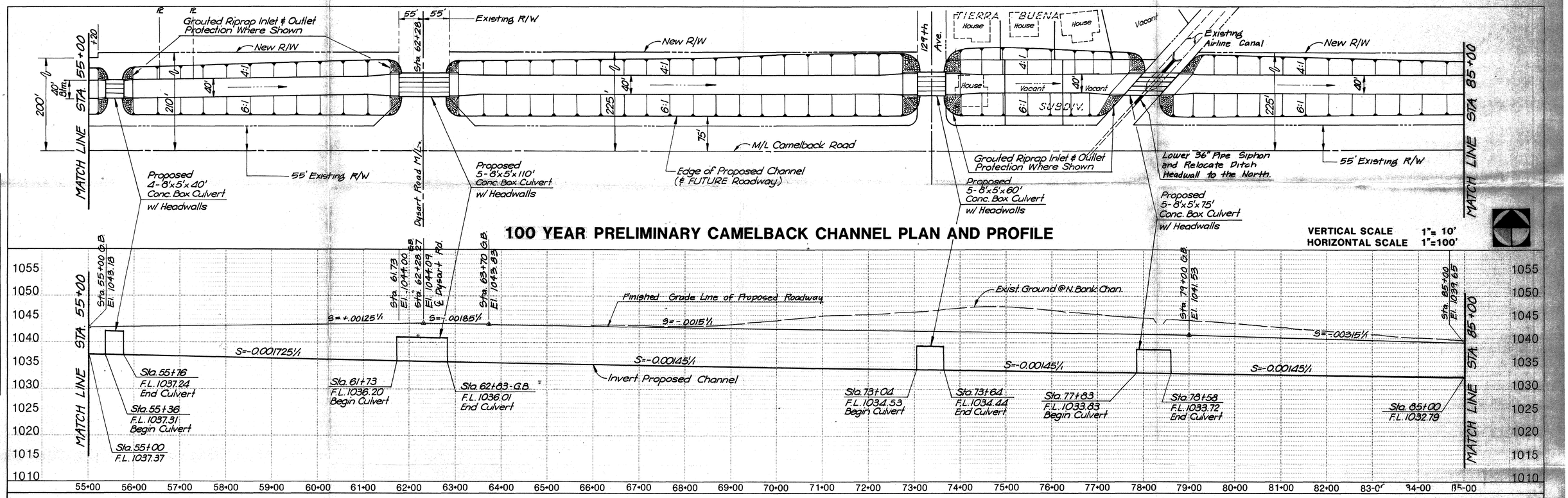
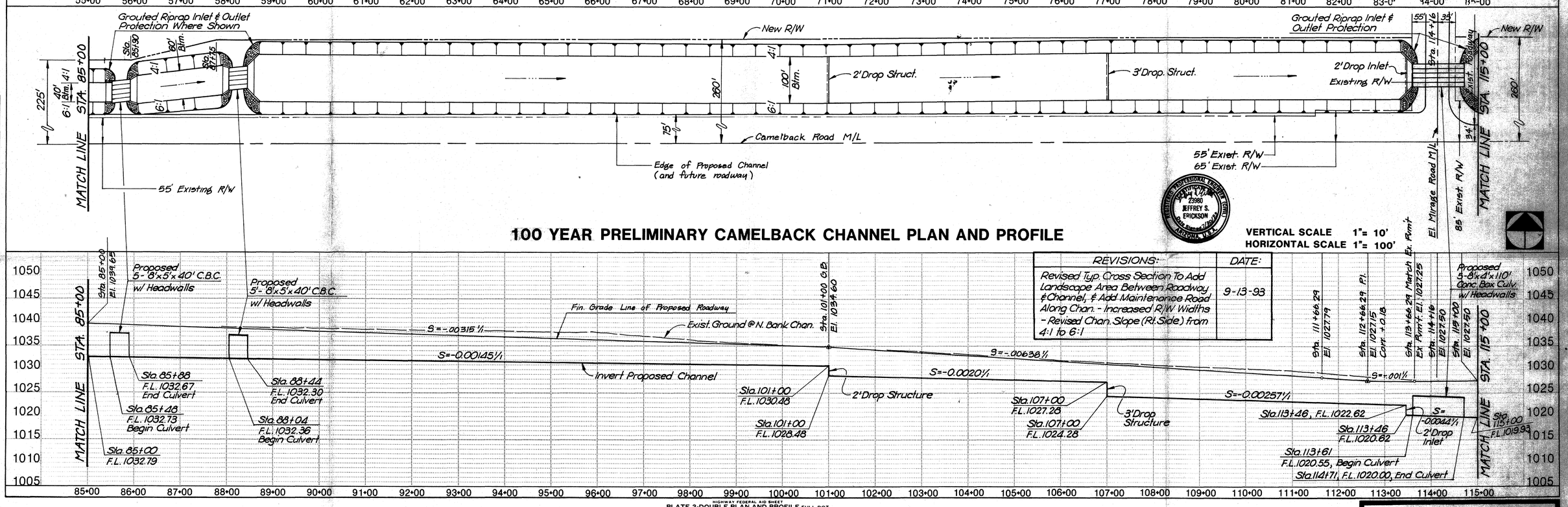


100 YEAR PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE

VERTICAL SCALE 1"= 10'
HORIZONTAL SCALE 1"=100'



100 YEAR PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE

VERTICAL SCALE 1"= 10'
HORIZONTAL SCALE 1"= 100'

REVISIONS:	DATE:
Revised Typ. Cross Section To Add Landscape Area Between Roadway & Channel, & Add Maintenance Road Along Chan. - Increased R/W Widths - Revised Chan. Slope (Rt. Side) from 4:1 to 6:1	9-13-93

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 23980 JEFFREY S. ERICKSON Date Signed 7/28/93 ARIZONA, U.S.A.

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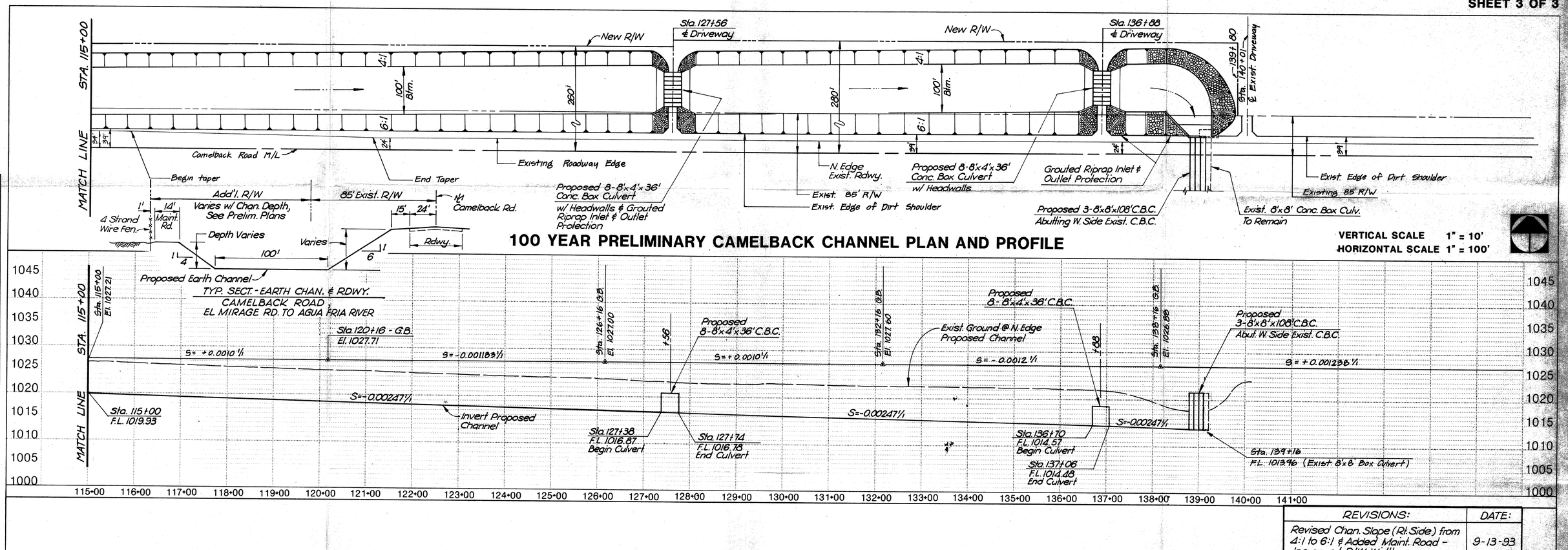

100 YEAR PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE

VERTICAL SCALE 1" = 10'
HORIZONTAL SCALE 1" = 100'

REVISIONS:	DATE:
Revised Chan. Slope (Rt. Side) from 4:1 to 6:1 & Added Maint. Road - Increased R/W Width	9-13-93

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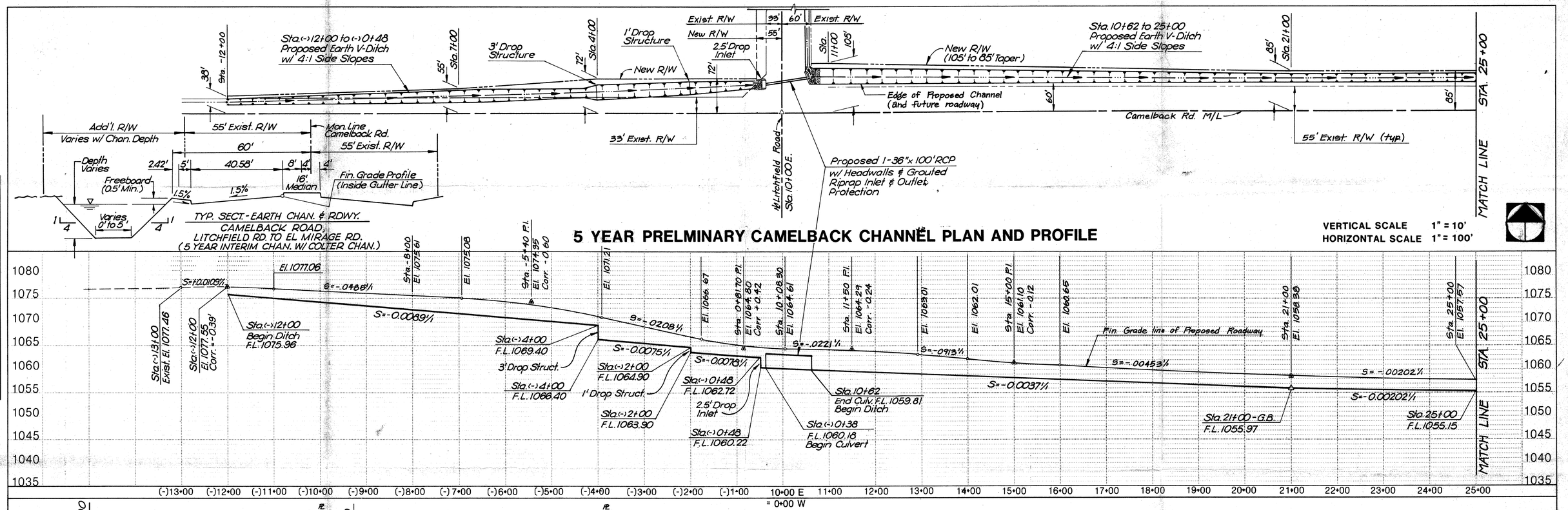
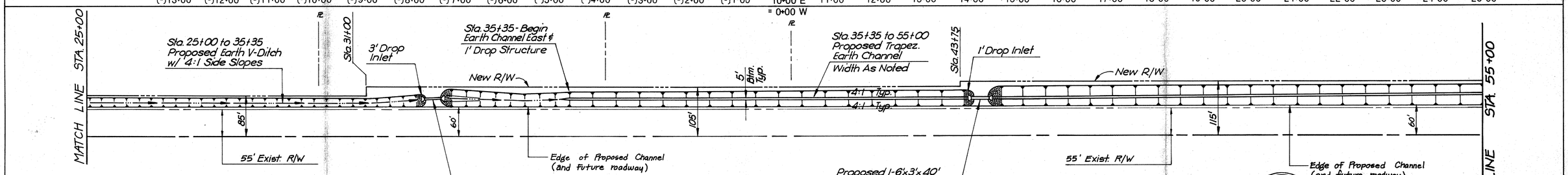
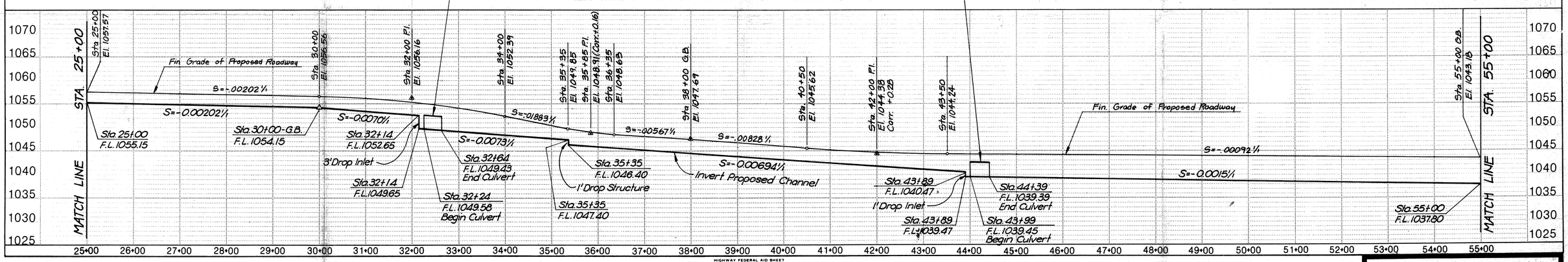


5 YEAR PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE



5 YEAR PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE



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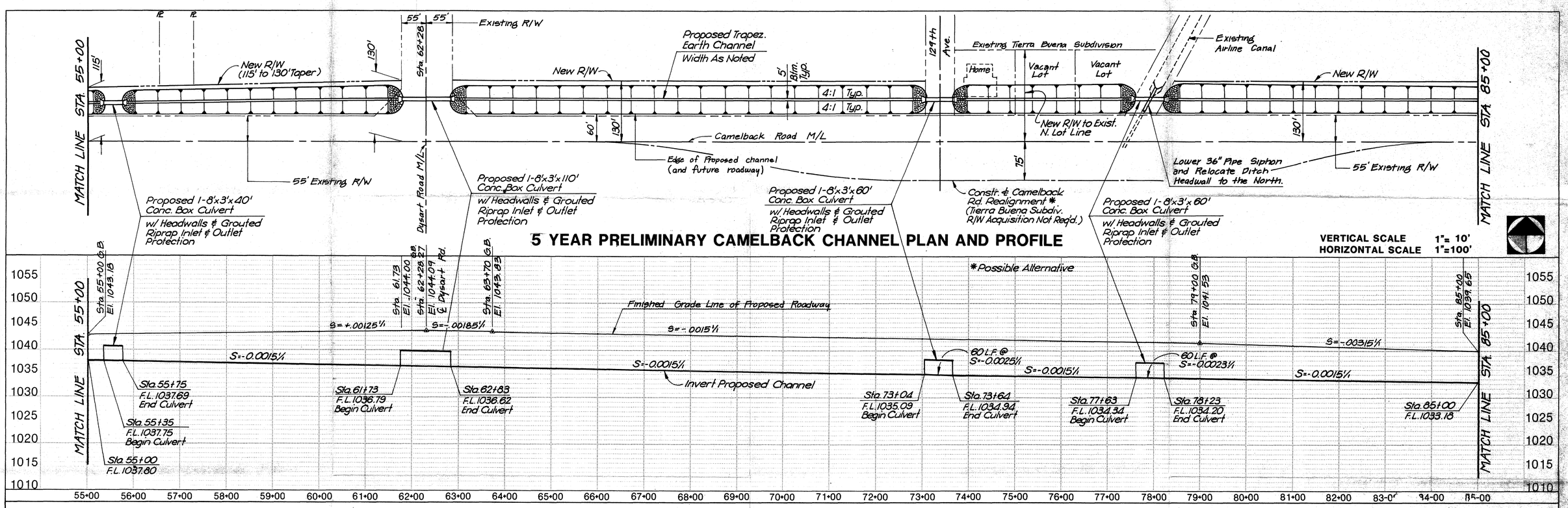
Phoenix, Arizona 85040 (602) 276-7251



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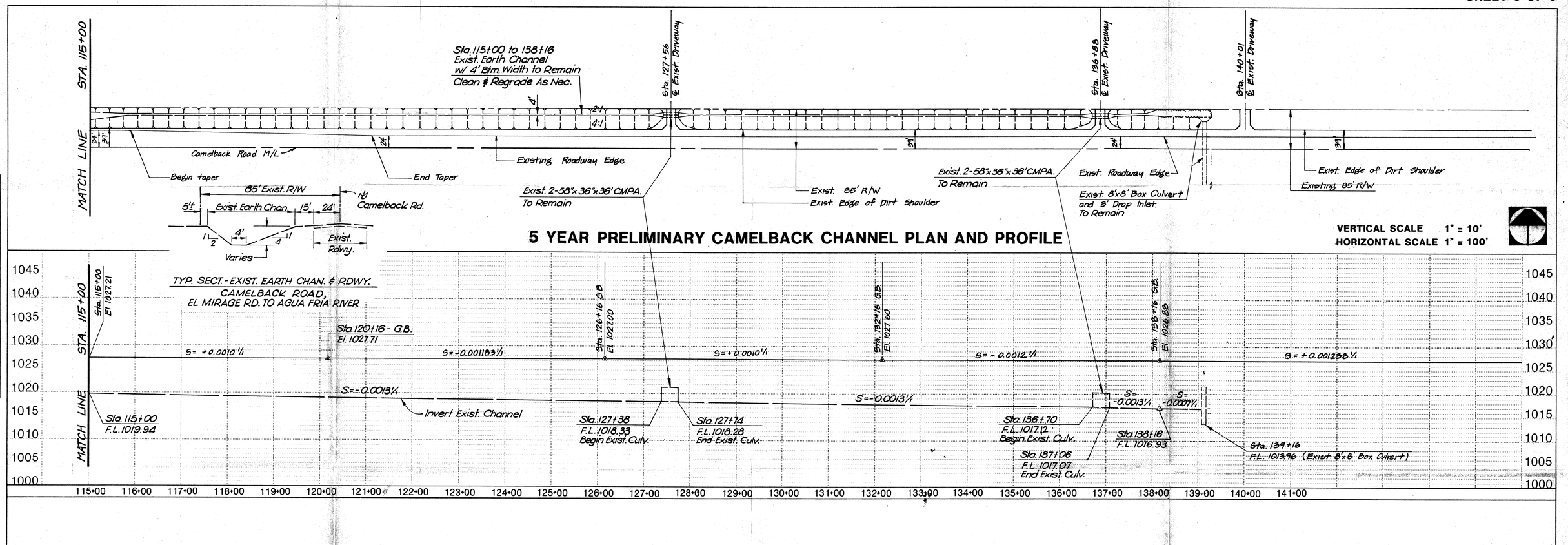

5 YEAR PRELIMINARY CAMELBACK CHANNEL PLAN AND PROFILE

VERTICAL SCALE 1" = 10'
HORIZONTAL SCALE 1" = 100'

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
23980
JEFFREY S. ERICKSON
DATE EXPIRES 12-31-2012
ARIZONA, U.S.A.

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ALIGNMENT CHECKED
RT OF WAY CHECKED
NOTE BOOK
NO.
BY
DATE

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SURVEYED
PLOTTED
GRADES CHECKED
B.M. NOTED
STRUCTURE NOTAT'NS CH'KD
NOTE BOOK
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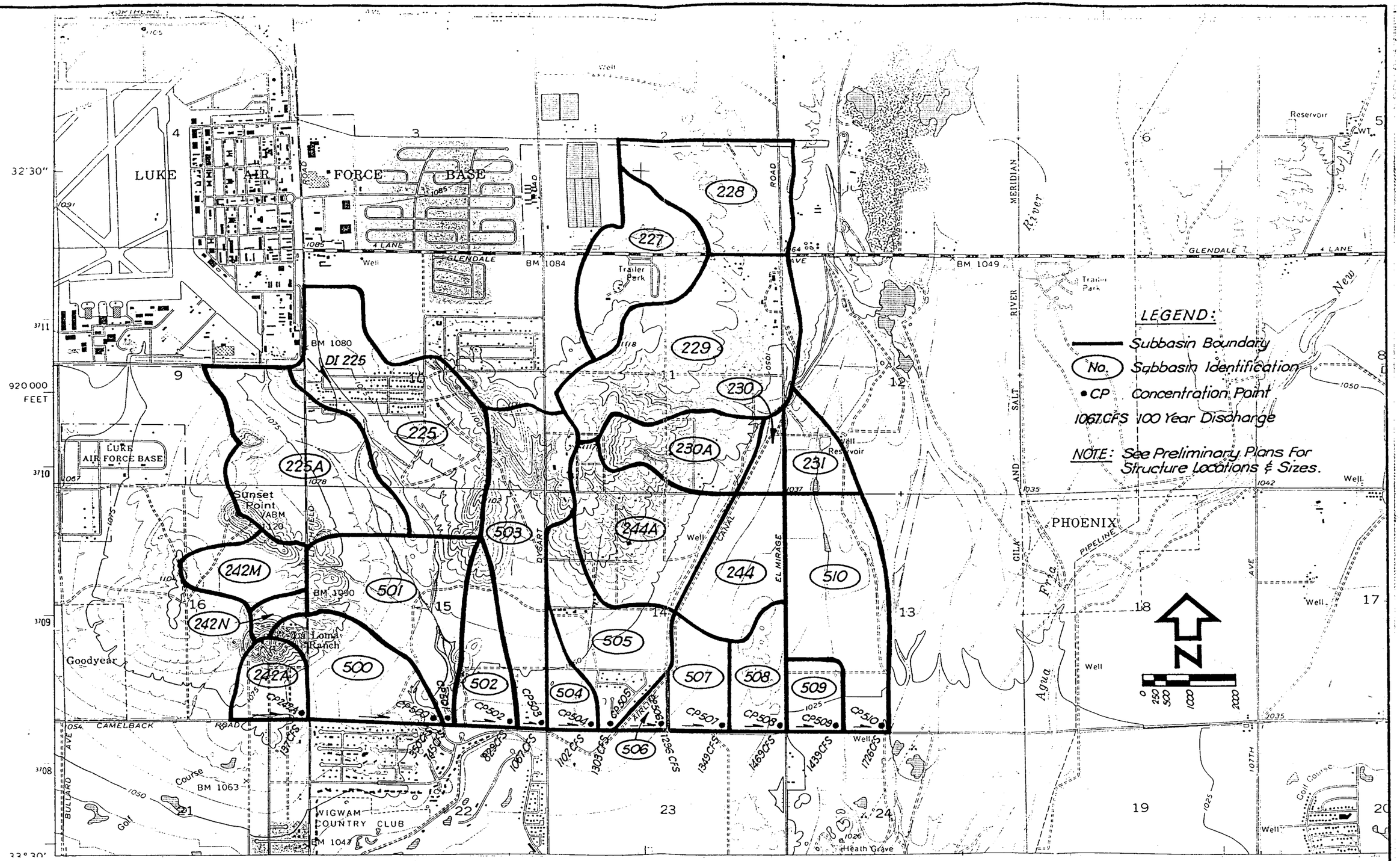
APPENDIX C

DRAINAGE MAPS



CAMELBACK ROAD CHANNEL DRAINAGE MAP

100 - YEAR DESIGN STORM WITH NO COLTER CHANNEL (Existing Conditions)

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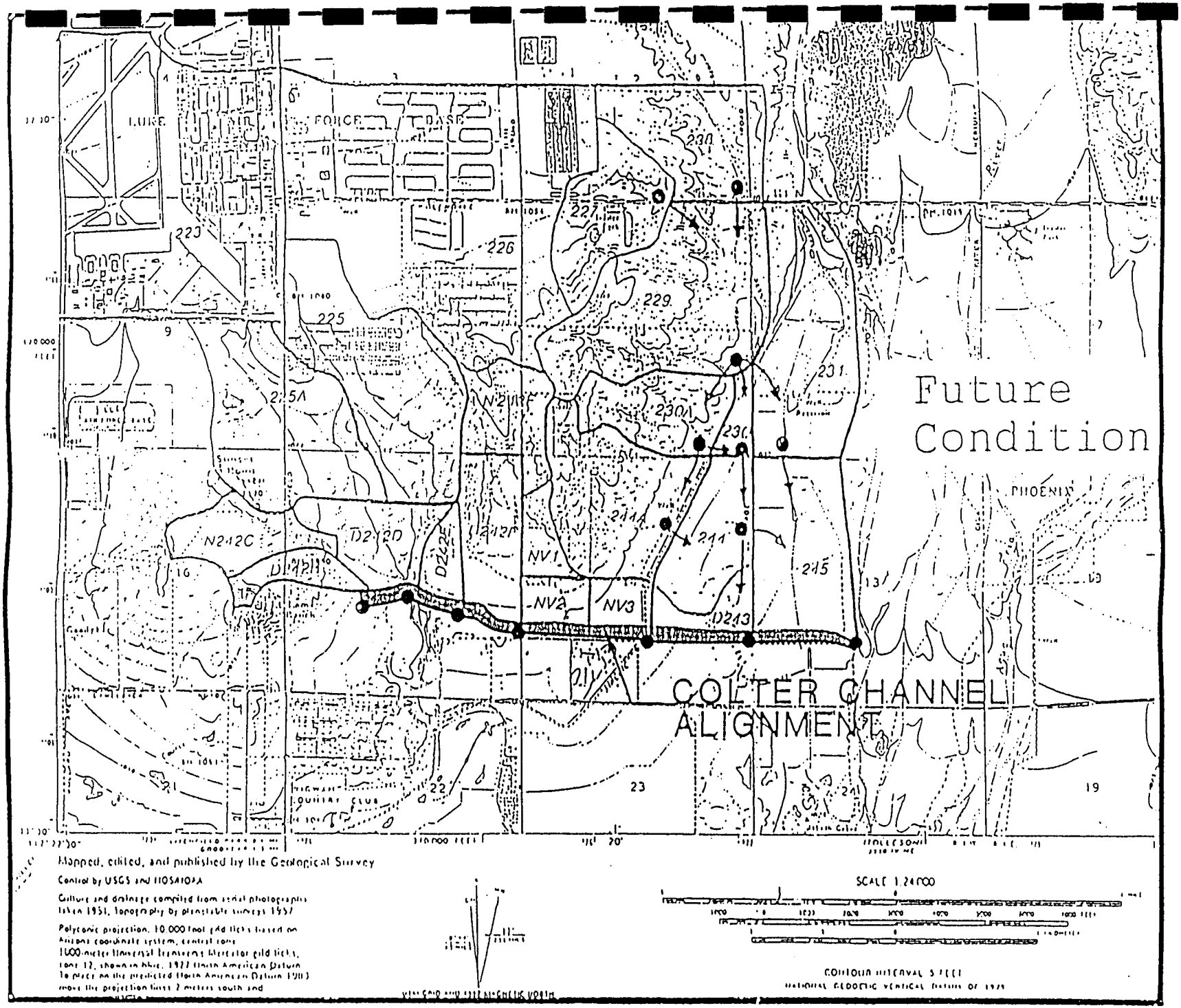
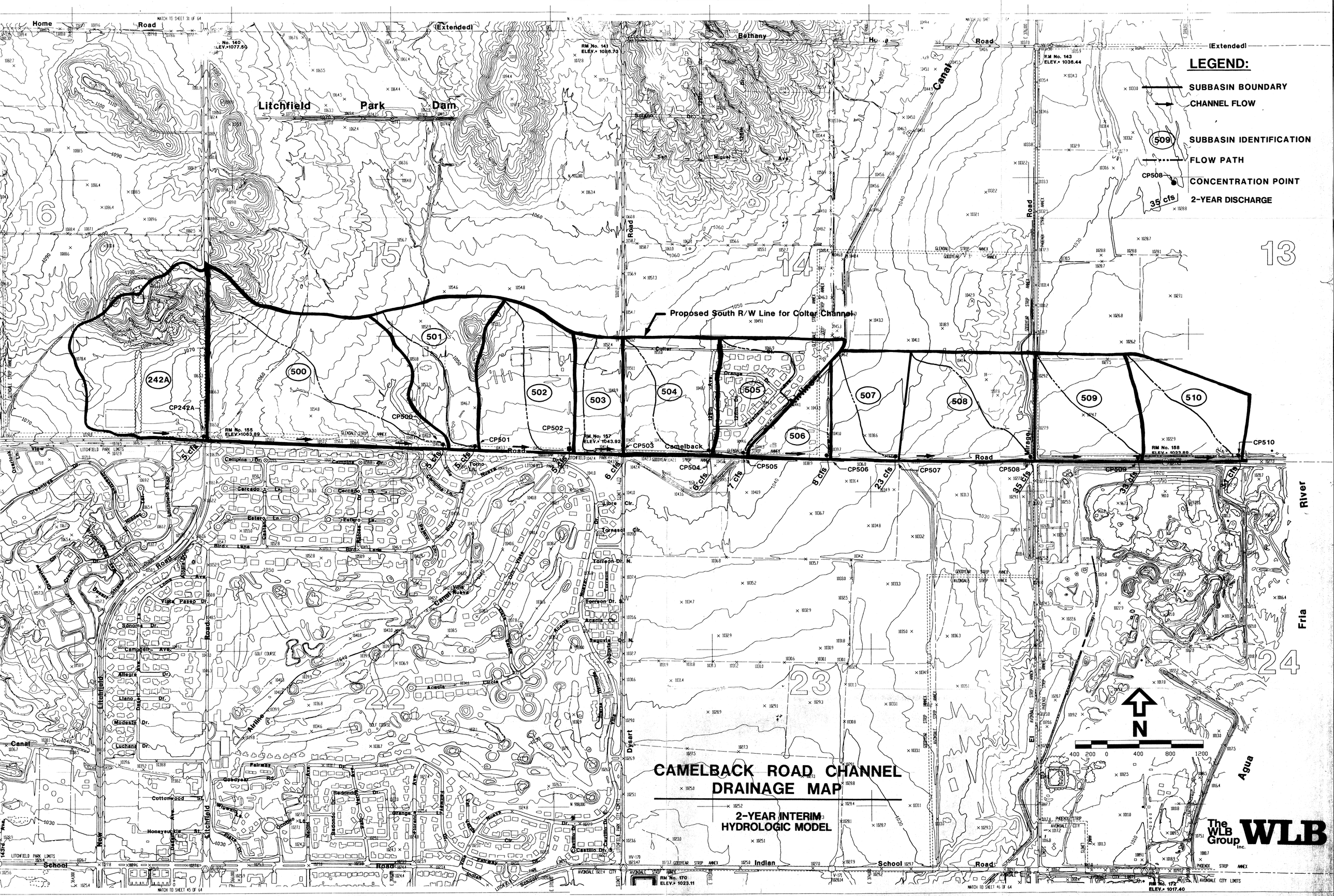


SOURCE: Recommendation Report
Colter Channel Project
Nov. 1992
CRSS Civil Engineers and Wood Patel & Assoc.

COLTER CHANNEL DRAINAGE MAP


LEGEND:
SUBBASIN BOUNDARY
CHANNEL FLOW
509
SUBBASIN IDENTIFICATION
FLOW PATH
CP508
CONCENTRATION POINT
35 cfs
2-YEAR DISCHARGE
Proposed South R/W Line for Colter Channel
242A
500
501
502
503
504
505
506
507
508
509
510
CP242A
CP500
CP501
CP502
CP503
CP504
CP505
CP506
CP507
CP508
CP509
CP510
5 cfs
5 cfs
5 cfs
6 cfs
8 cfs
7 cfs
8 cfs
23 cfs
35 cfs
35 cfs
35 cfs
RM No. 155
ELEV.=1063.89
RM No. 157
ELEV.= 1043.92
RM No. 158
ELEV.= 1023.89
RM No. 170
ELEV.= 1023.11
RM No. 172
ELEV.= 1017.40
RM No. 140
ELEV.=1077.50
RM No. 141
ELEV.= 1086.73
RM No. 143
ELEV.= 1038.44
Litchfield Park Dam
Home Road
Bethany Home Road
Canal
Litchfield Road
Dysart Road
Camelback Road
Indian School Road
Mirage Road
Fria River
Agua
N
400 200 0 400 800 1200
CAMELBACK ROAD CHANNEL
DRAINAGE MAP
2-YEAR INTERIM
HYDROLOGIC MODEL
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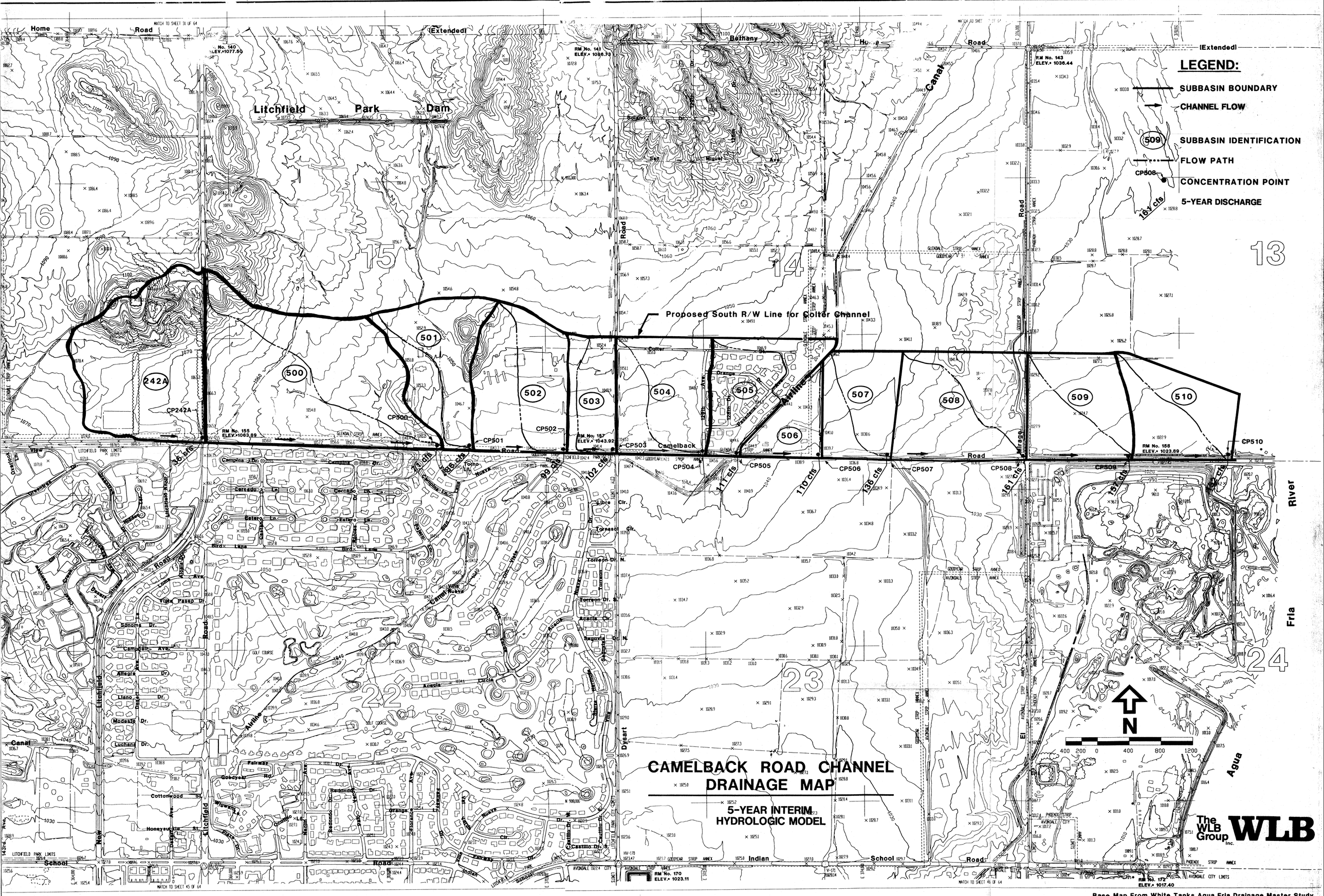
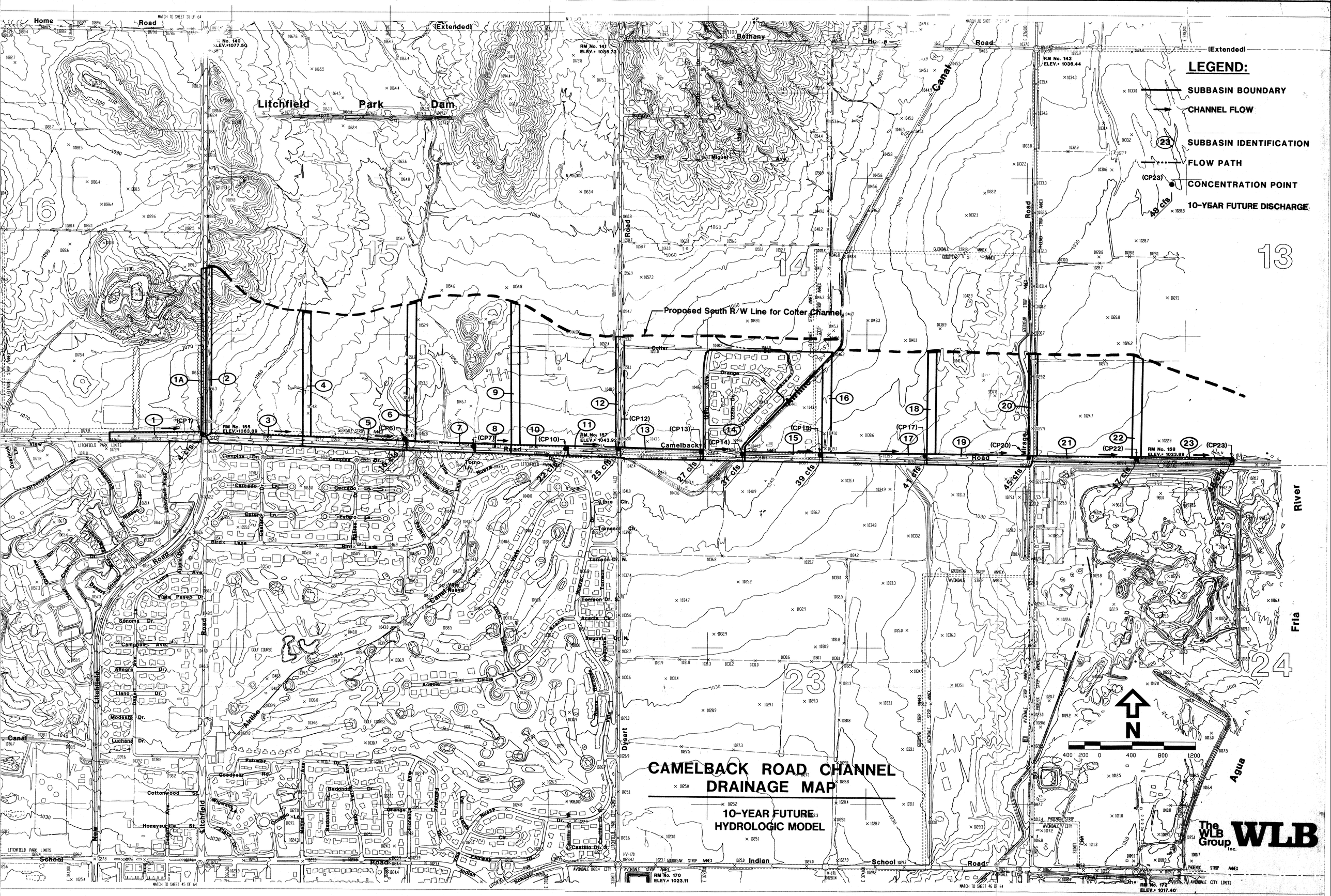
Base Map From White Tanks Agua Fria Drainage Master Study



Base Map From White Tanks Agua Fria Drainage Master Study


LEGEND:
SUBBASIN BOUNDARY
CHANNEL FLOW
SUBBASIN IDENTIFICATION
FLOW PATH
CONCENTRATION POINT
10-YEAR FUTURE DISCHARGE
Proposed South R/W Line for Cotter Channel
Litchfield Park Dam
Camelback Road
Indian School Road
Litchfield Road
Dysart Road
Cotton Lane
Bethany Home Road
Glendale Avenue
Thomas Road
Mirage Road
Canal
Agua Fria River
N
400 200 0 400 800 1200
CAMELBACK ROAD CHANNEL
DRAINAGE MAP
10-YEAR FUTURE
HYDROLOGIC MODEL
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Base Map From White Tanks Agua Fria Drainage Master Study