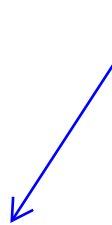


Revise title to  
Final Drainage Report for Cherry  
Creek Crossing Filing No. 1 Lot 111.



**Amended Final Drainage Plan,  
Cherry Creek Crossing Filing No. 1  
El Paso County, Colorado**

Prepared for:  
Colorado Highway 382 Limited Partnership  
6070 North Camino Almonte  
Tucson, Arizona 85718

Prepared by:

**Kiowa**  
Engineering Corporation

1604 South 21st Street  
Colorado Springs, Colorado 80904  
(719) 630-7342

Kiowa Project No. 14028  
July 26, 2017

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## Appendix A – Hydraulic Calculations

**Engineer's Statement:**

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21<sup>st</sup> Street, Colorado Springs, Colorado 80904

\_\_\_\_\_  
Richard N. Wray  
Registered Engineer #19310  
For and on Behalf of Kiowa Engineering Corporation

\_\_\_\_\_  
Date

**Developer's Statement:**

I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

BY: \_\_\_\_\_

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed

ADDRESS: Colorado Highway 382 Limited Partnership  
6070 North Camino Almonte  
Tucson, Arizona 85718

**El Paso County:**

Filed in accordance with the requirements of the Drainage Criteria Manual Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code, as amended.

\_\_\_\_\_  
Jennifer Irvine, P.E.  
County Engineer/ECM Administrator

\_\_\_\_\_  
Date

The floodplain and no-build easement is not identified as County maintenance. Plat note 12 states sole responsibility for maintenance of easements is vested with the individual property owners. The extent of permanent easement (Reception No 206076662) to the County only extends 95 feet from Hodgen Road, not the entire length of the natural swale crossing Lot 111.

## **I. General Location and Description of Project**

Cherry Creek Crossing Filing No. 1 is a platted subdivision in northern El Paso County that consists of 53 single family lots ranging in size from 2.5 to 5 acres, and one 8-acre commercial lot. The commercial lot, Lot 111, is located at the northwest corner of State Highway 83 and Hodgen Road. The owner of Lot 111 is proposing to carry out overlot grading in anticipation of a commercial use being established on the lot. The location of Lot 111 is shown on Figure 1.

The final drainage report for Filing No. 1 was approved by the County in 1998. Since that time the single-family lots have all been developed while Lot 111 has remains undeveloped. The public roadways that serve the subdivision have all been built and are currently maintained by the County. An overlot grading and erosion control plan has been prepared to show the extent of grading that is proposed for Lot 111. In addition to the overlot grading operations, an, an existing 48-inch reinforced concrete pipe presently maintained by the County that conveys runoff from offsite watersheds into Lot 111 is proposed for extension approximately 200 feet to the north. The proposed extension to this culvert is shown on Figure 2. When Filing 1 was platted, a drainage, floodplain and no-build easement was provided to the County for maintenance of the culvert and natural swale the crosses Lot 111 from south to north. This easement is shown on Figure 2.

Prior to the final development of Lot 111 a site plan will have to be provided to the County for review and approval per the requirements of the approved development plan for Cherry Creek Crossing. A specific use has not been identified for Lot 111. It is anticipated that onsite drainage facilities as well as water quality storage will be installed at that time. There are no stormwater detention or water quality facilities proposed for construction as part of the overlot grading.

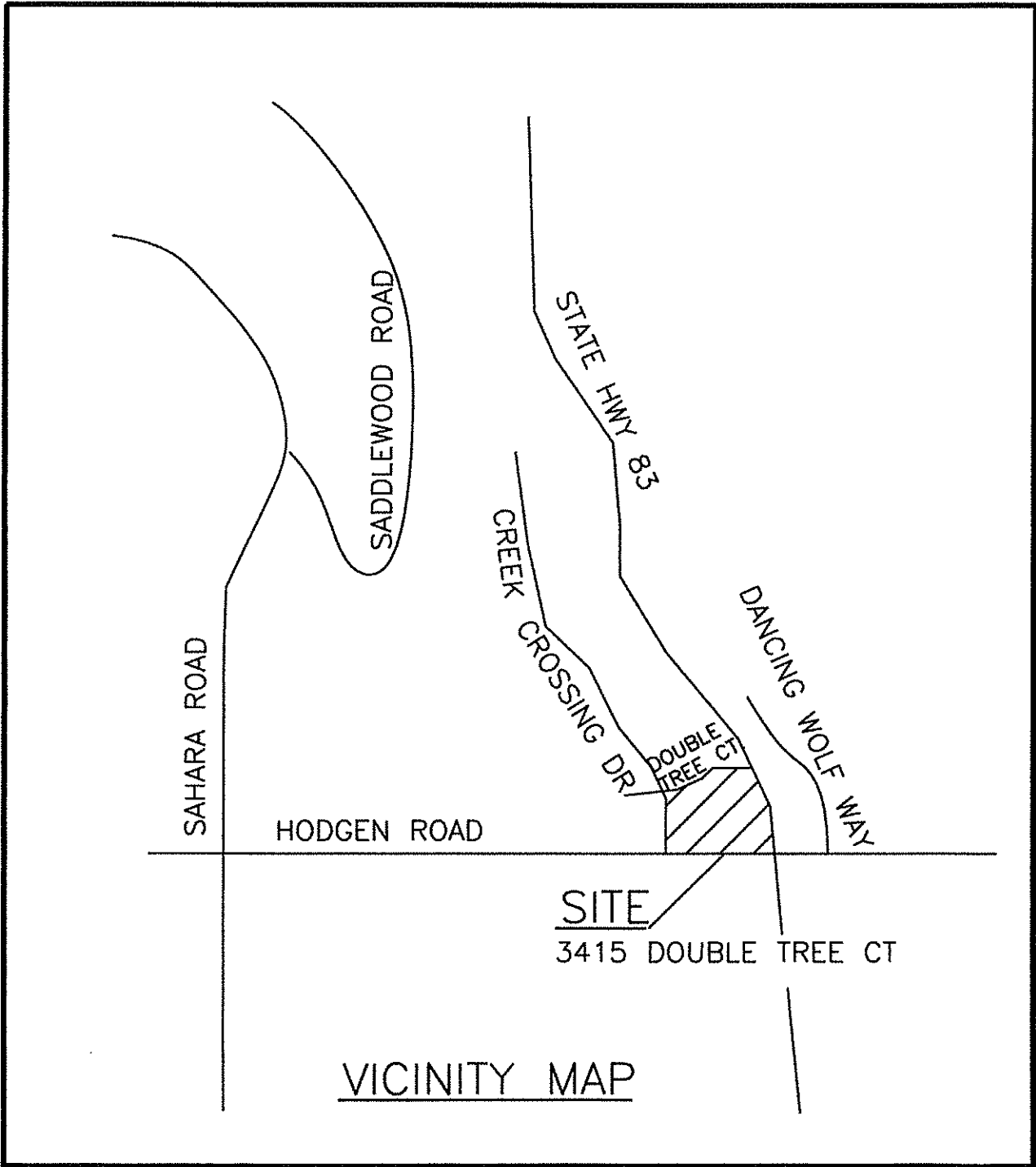
← **Temporary Sedimentation Pond  
is required.**

## **II. Hydrology**

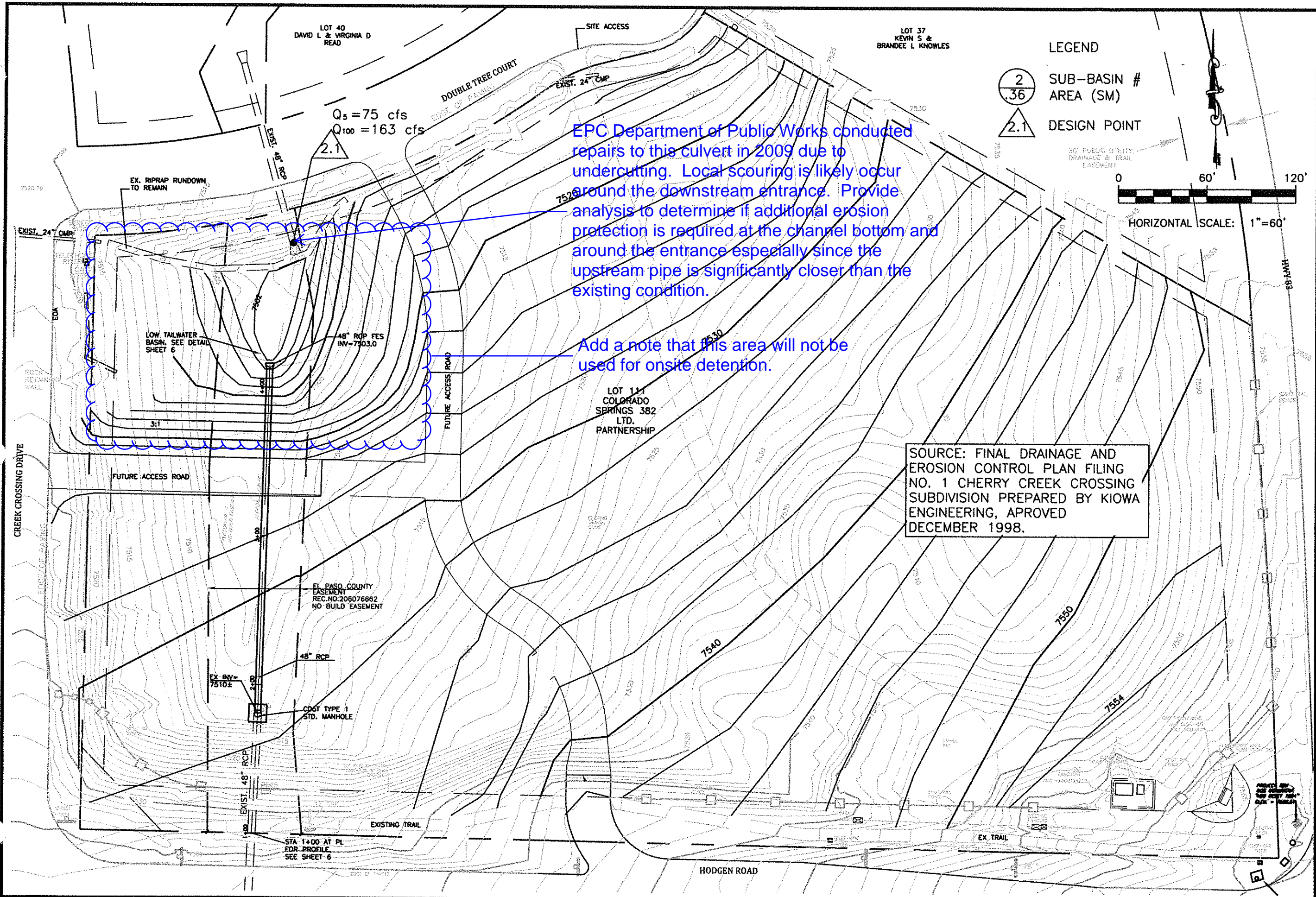
Onsite and offsite hydrology for Cherry Creek Crossing Filing 1 used to size the drainage facilities within the subdivision is summarized in the Filing 1 final drainage report. The hydrology work map from the Filing 1 final drainage plan showing the location of Lot 111 has been included within Appendix A. The overlot grading and eventual revegetation efforts will cause no change in the existing condition rates of runoff for Lot 111. The peak flow rates that are carried into the site by the existing 48-inch RCP under Hodgen Road are shown on Figure 2.

## **III. Hydraulic Calculations**

The hydraulic capacity of the existing 48-inch CMP under Hodgen Road has been verified in its as-built condition. A field survey was conducted in 2014 whereby the as-built invert of the 48-inch RCP under Hodgen Road as well as for the 48-inch culvert under Double Tree Court were confirmed. The overlot grading as proposed would not affect the culvert under Double Tree Court. The hydraulic capacity of the 48-inch RCP under Hodgen Road extended



VICINITY MAP



EPC Department of Public Works conducted repairs to this culvert in 2009 due to undercutting. Local scouring is likely occur around the downstream entrance. Provide analysis to determine if additional erosion protection is required at the channel bottom and around the entrance especially since the upstream pipe is significantly closer than the existing condition.

Add a note that this area will not be used for onsite detention.

SOURCE: FINAL DRAINAGE AND EROSION CONTROL PLAN FILING NO. 1 CHERRY CREEK CROSSING SUBDIVISION PREPARED BY KIOWA ENGINEERING, APPROVED DECEMBER 1998.

**Kiowa**  
Engineering Corporation  
1804 South 21st Street  
Colorado Springs, Colorado 80904  
(719) 690-7342

CHERRY CREEK CROSSING, FILING NO. 1 LOT 111  
AMENDED FINAL DRAINAGE PLAN

EL PASO COUNTY, COLORADO

Project No.:	14028
Date:	JULY 25, 2017
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	

FIG.2

as shown on Figure 2 was reverified. Based upon the hydraulic calculations, extending the 48-inch into the site will not affect the capacity of the culvert. While there would be an increase in the 100-year water surface at the inlet side of the existing 48-inch RCP in the extended condition, the headwater to depth ratio will only be increased to 4.0 from 3.5. The culvert calculations have been included in Appendix A.

#### **IV. Floodplain Statement**

The Floodplain Insurance Rate Map (FIRM) for El Paso County Flood Insurance Study (FIS) panel 285 was reviewed to determine any potential regulatory floodplains within Lot 111. There is no land within the Filing 1 subdivision that is located within a 100-year floodplain as delineated in the FIS. A copy of the relevant portion of FIRM panel 285F is shown on Figure 3.

#### **V. Drainage and Bridge Fees**

Drainage and bridge fees for Filing No.1 were determined in the Filing No. 1 final drainage report. The drainage and bridge fees were paid with the development of Filing 1. Therefore, there are no fees due for Lot 111.

#### **VI. Economic Analysis**

Summarized on Table 1 is the cost estimate for the extension of the 48-inch culvert through Lot 111.

Per the County Engineer, EPC Department of public works conducted a drainage study for Hodgen Road. Review and ensure compatibility with the study. Contact Alissa Werre at 520-6873.



**NATIONAL FLOOD INSURANCE PROGRAM**


**FIRM**  
**FLOOD INSURANCE RATE MAP**  
EL PASO COUNTY,  
COLORADO AND  
INCORPORATED AREAS

PANEL 285 OF 1300  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

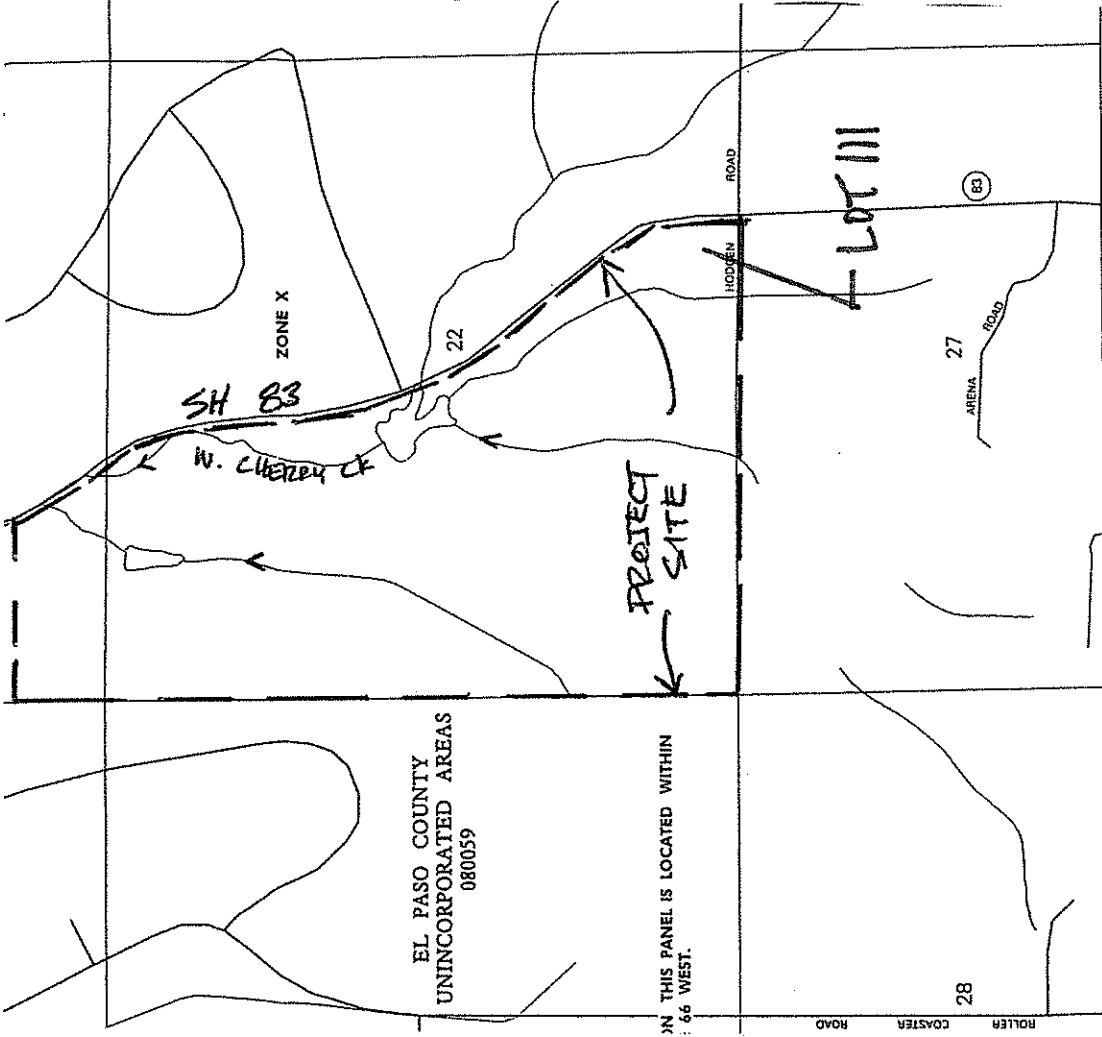
CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0285	F

MAP NUMBER  
08041C0285 F

EFFECTIVE DATE:  
MARCH 17, 1997



Federal Emergency Management Agency



**FIGURE 3**  
NO SCALE



**TABLE 1: HILLCREST ACRES SUBDIVISION PARTS DEPOT  
DRAINAGE IMPROVEMENT COST ESTIMATE  
KIOWA PROJECT NUMBER 16041**

ITEM	UNIT COST	UNIT	QUANTITY	TOTAL
<b>PUBLIC DRAINAGE FACILITIES</b>				
48-INCH RCP	\$150	LF	215	\$32,250
48-INCH RCP FES	\$500	EA	1	\$500
BOX BASE MANHOLE	\$10,000	EA	1	\$10,000
LOW TAILWATER OUTLET PROTECTION	\$5,000	EA	1	\$5,000
SUBTOTAL				\$47,750.00
CONTINGENCY (5 %)				\$2,387.50
ENGINEERING (10 %)				\$4,775.00
<b>TOTAL</b>				<b>\$54,912.50</b>

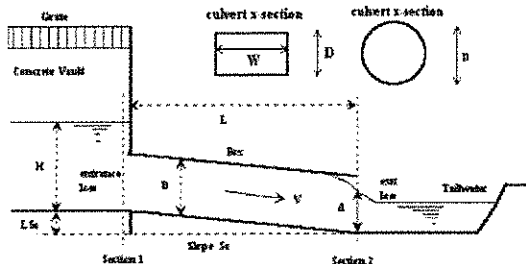
**Appendix A**  
**Hydraulic Calculations**

## CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: 14028 Cherry Creek Crossing Filing No. 1, Lot 111

Basin ID: Hodgen Road Culvert- Extended Condition

Status:



What is the velocity exiting the pipe?  
Is the outflow super critical?

Provide riprap calculations for the pipe flow.

### Design Information (input):

Circular Culvert: Barrel Diameter in Inches  
Inlet Edge Type (choose from pull-down list)

D = 48 inches  
Grooved End Projection

OR:

Box Culvert: Barrel Height (Rise) in Feet  
Barrel Width (Span) in Feet  
Inlet Edge Type (choose from pull-down list)

Height (Rise) = ft.  
Width (Span) = ft.  
Square Edge w/ 90-15 Deg. Headwall

Number of Barrels  
Inlet Elevation at Culvert Invert  
Outlet Elevation at Culvert Invert OR Slope of Culvert (ft v./ft h.)  
Culvert Length in Feet  
Manning's Roughness  
Bend Loss Coefficient  
Exit Loss Coefficient

No = 1  
Inlet Elev = 7316 ft. elev.  
Outlet Elev = 7303 ft. elev.  
L = 430 ft.  
n = 0.025  
 $K_b$  = 0  
 $K_x$  = 1

### Design Information (calculated):

Entrance Loss Coefficient  
Friction Loss Coefficient  
Sum of All Loss Coefficients  
Orifice Inlet Condition Coefficient  
Minimum Energy Condition Coefficient

$K_e$  = 0.20  
 $K_f$  = 7.79  
 $K_{\Sigma}$  = 8.99  
 $C_d$  = 0.95  
 $KE_{inv}$  = -0.0816

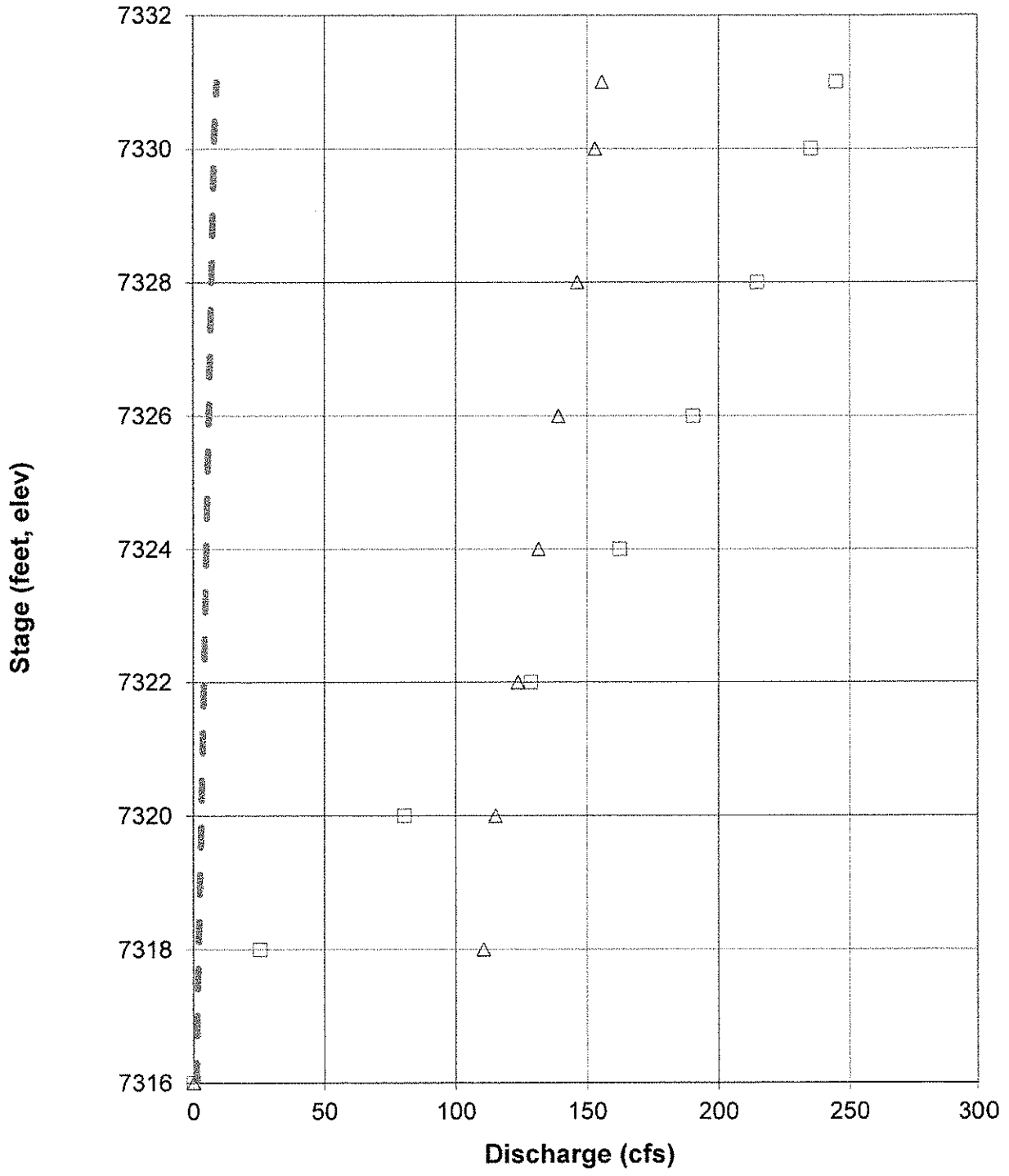
### Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation (ft)	Culvert Inlet-Control Flowrate (cfs)	Culvert Outlet-Control Flowrate (cfs)	Controlling Culvert Flowrate (cfs (output))	Inlet Equation Used:	Flow Control Used
7316.00	7303.00	0.00	0.00	0.00	No Flow (WS < inlet)	N/A
7318.00	7303.25	25.50	110.59	25.50	Min. Energy Eqn.	INLET
7320.00	7303.50	80.50	115.13	80.50	Regression Eqn.	INLET
7322.00	7304.00	128.60	123.64	123.64	Regression Eqn.	OUTLET
7324.00	7304.50	162.50	131.56	131.56	Regression Eqn.	OUTLET
7326.00	7305.00	190.30	139.10	139.10	Regression Eqn.	OUTLET
7328.00	7305.50	214.70	146.24	146.24	Regression Eqn.	OUTLET
7330.00	7306.00	235.20	153.06	153.06	Orifice Eqn.	OUTLET
7332.00	7306.50	254.10	159.55	159.55	Orifice Eqn.	OUTLET
					Invalid Entry	
					Invalid Entry	
					Invalid Entry	
					Invalid Entry	
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					Invalid Entry	
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$e Q = 160 cfs$   
 $k_w / D = \frac{16}{4} = 4.0$

Processing Time: 00.24 Seconds

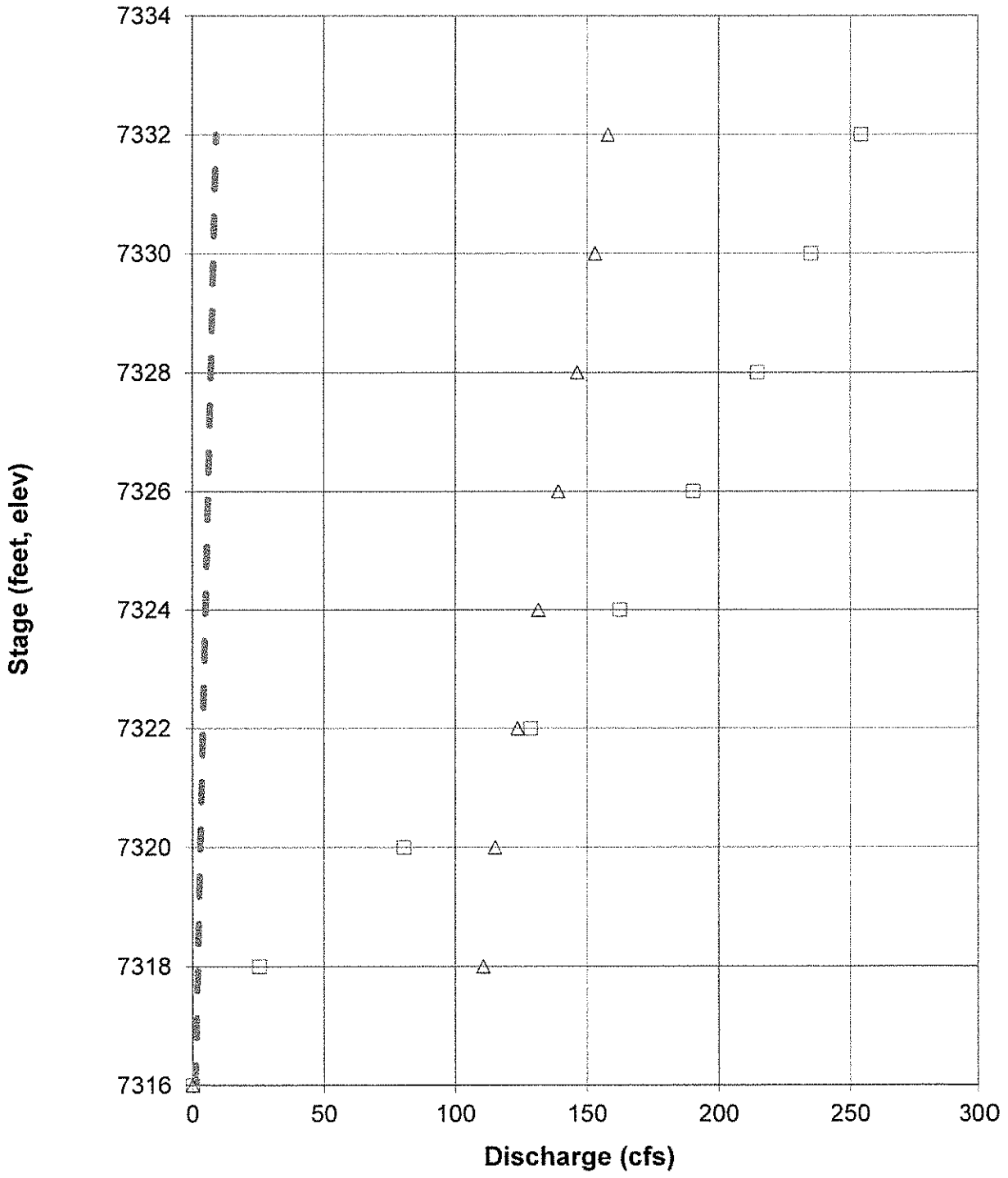
# STAGE-DISCHARGE CURVE FOR THE CULVERT



Stage-Discharge    □ Inlet Control    △ Outlet Control



# STAGE-DISCHARGE CURVE FOR THE CULVERT



Stage-Discharge    □ Inlet Control    △ Outlet Control

STA 32+75.24 RT  
BEGIN DRAINAGE RUNDOWN  
SECTION BB, SEE PG. 11  
END @ STA 34+75.85 RT

STA 33+41.03, END PAINTED  
MEDIAN, RAD. 6' LT (R=2)

STA 33+80.99  
CL-CL INTERSECTION  
CHERRY CROSSING DRIVE

STA 34+21.04, BEGIN PAINTED  
MEDIAN, 16' WIDE (0 RT)  
STA 22+41.92,

BEGIN STA 35+33.03,  
40.12' RT  
INSTALL 5'1" x 9'w x 1'1"  
RIP RAP PAD D50=6"  
ON 6" THICK TYPE II  
GRANULAR BEDDING  
STA 35+50.85 RT  
BEGIN DRAINAGE RUNDOWN  
SECTION BB, SEE PG. 11  
END @ STA 37+50.62 RT

*LLW = 16' +/-*

STA 36+26.81, BEGIN  
180 TAPER INTO LEFT  
AND RIGHT TURN LANES  
(8' LFT & RT)

CROSSHATCHING LINES  
YELLOW, 8" WIDE @  
45° TO PROJECTED CL  
& SPACED @ 10'

LANE LINE  
WHITE, 4" WIDE

CENTER LINES  
YELLOW, 4" WIDE (TYP.)

STA 38+06.81, END  
TAPER (4' LT)  
BEGIN LEFT TURN LANE  
(8' RT)

CHANNELIZING LINES  
WHITE, 8" WIDE

36"x36"  
RIGHT LANE MUST TURN  
RIGHT SIGN (R3-7)

EXIST. 48" CMP CULVERT  
BEGIN STA 35+33.03, 40.12'  
END STA 35+35.57, 50.92' L  
EXTEND CULVERT BY 180' NORTH  
OF HODGEN & 150' SOUTH OF  
HODGEN, FIELD VERIFY EXTENSIVE  
LENGTHS, USE CMP TO MATCH  
EXISTING CULVERT  
INSTALL 20' x 21'  
RIP RAP PAD D50=12"  
PAD IS 10' W @ SOUTH END  
INCREASING TO 20' W @ NORTH E  
ON 6" THICK TYPE II  
GRANULAR BEDDING

STA 35+50.85 RT  
BEGIN DRAINAGE RUNDOWN  
SECTION BB, SEE PG. 11  
END @ STA 37+50.62 RT

RIGHT LANE  
MUST  
TURN RIGHT

36"x36"  
RIGHT LANE MUST TURN  
RIGHT SIGN (R3-7)

FOR TEMPORARY IMPROVEMENTS  
TO HODGEN ROAD, SEE SHEET  
6-1, STATION 33+00 TO 42+50

CHERRY CREEK CROSS

CHERRY CROSSING DRIVE

HODGEN ROAD

UNDEVELOPED ZONED RR

HODGEN ROAD

EXISTING 48" RCP

1"=50'

EDGE OF ASPHALT

530

7540

ONLY

ONLY

ONLY

20

20

40

38+00

37+00

38+00

39+00

40+00

33+96-86

34+00

35+00

33+00

402.00

1.96

00066

NORTH  
1" = 1000'

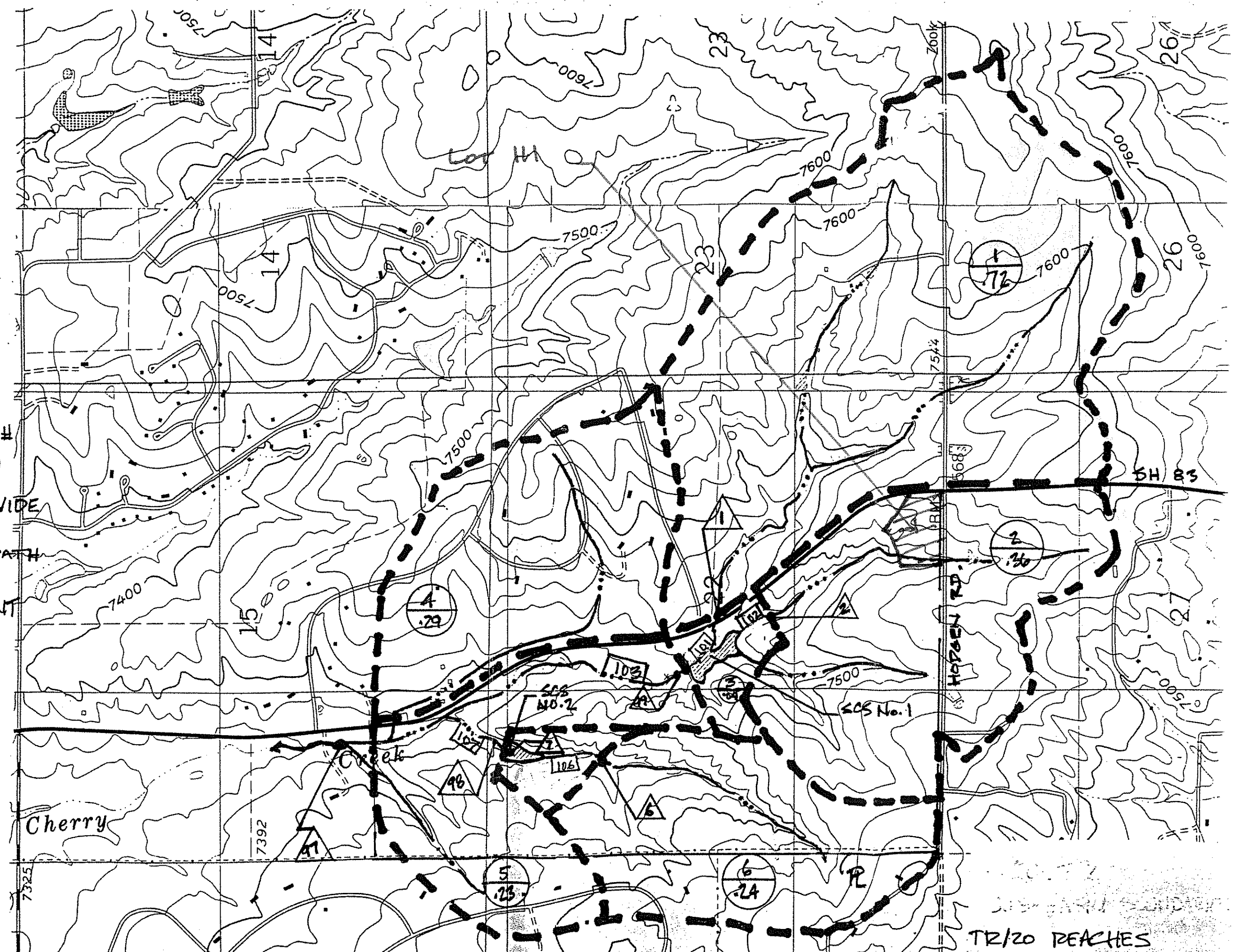
1  
--- GUB-BASIN #  
.72 --- AREA (SM)

--- BASIN DIVIDE

103  
--- Tc FLOWPATH

7  
--- DESIGN POINT

TR20 REACH  
ELEMENT



TR/20 REACHES