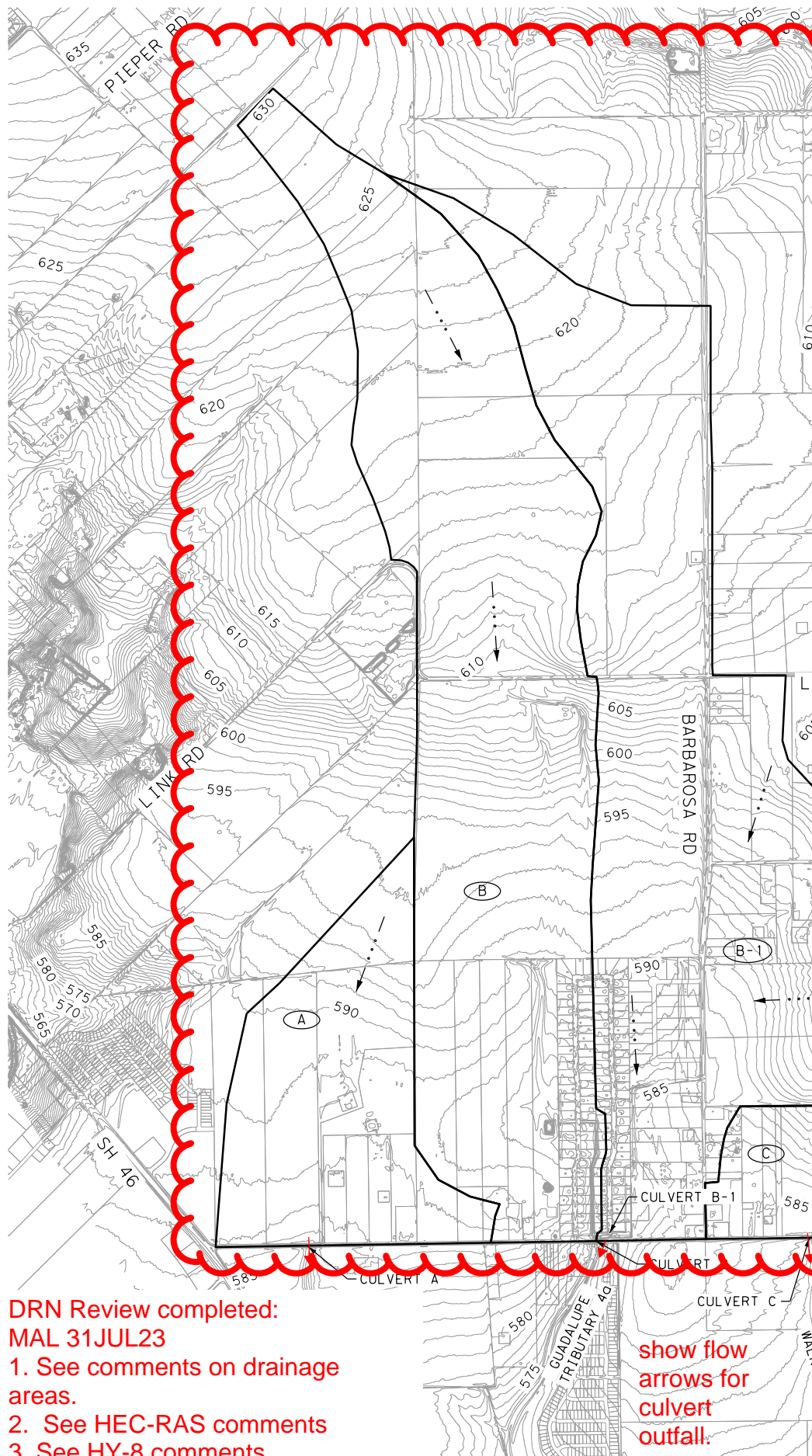


Plotted on: 6/30/2023

Design File name: P:\1275\00\Design\Civil\Drainage\1277500\_da01.dgn



COMPUTATION POINT	CONTRIBUTING DRAINAGE AREAS	DRAINAGE AREA (ACRES)	CONTRIBUTING METHOD	5-YEAR DISCHARGE (CFS)	10-YEAR DISCHARGE (CFS)	25-YEAR DISCHARGE (CFS)	50-YEAR DISCHARGE (CFS)	100-YEAR DISCHARGE (CFS)
CULVERT A	A	258.87	SCS	201.00	286.90	416.00	519.00	636.60
CULVERT B	B	1599.91	SCS	728.50	1060.80	1569.40	1996.70	2501.90
CULVERT B-1	B-1	813.16	SCS	346.10	506.70	754.20	963.00	1211.10
CULVERT C	C	115.38	SCS	162.90	222.30	326.10	400.60	481.50
CULVERT D	D	47.99	RATIONAL	63.55	76.51	94.46	108.63	123.95
CULVERT E	E	39.10	RATIONAL	51.40	74.70	94.26	108.63	123.95
CULVERT F	F + F-1	865.56	SCS	378.50	540.80	786.10	996.70	1251.90
CULVERT F-1	F-1	97.35	RATIONAL	126.55	151.51	188.26	219.60	249.25

A new version has been released. Updated to match NOAA Atlas 14, Vol. 11, Ver. 2.

CONTRIBUTING DRAINAGE AREA	LAG TIME (MIN)	CN
A	78.65	73
B	152.73	74
B-1	177.66	73
C	29.78	72
D	*	*
E	*	*
F	111.55	74
F-1	*	*

\* N/A. RATIONAL METHOD USED.

RAINFALL DEPTH (NOAA ATLAS 14, VOL. 11) PROFILE	24 HR EVENT DEPTH (IN)
5 YR	5.15
10 YR	6.55
25 YR	8.64
50 YR	10.40
100 YR	12.60

Verify depths. Website shows higher values.

- R.O.W.
- DRAINAGE AREA BOUNDARY
- 850- EXISTING CONTOUR
- Include FPA notification note **Agreed**

CONTRIBUTING DRAINAGE AREA	C	Tc (MIN)	5YR INTENSITY (IN/HR)	10YR INTENSITY (IN/HR)	25YR INTENSITY (IN/HR)	50YR INTENSITY (IN/HR)	100YR INTENSITY (IN/HR)
D	0.50	51.22	2.65	3.19	3.94	4.53	5.17
E	0.50	67.70	2.20	2.66	3.30	3.80	4.35
F-1	0.50	64.11	2.28	2.76	3.41	3.94	4.50

- NOTES:
- DRAINAGE AREAS OFF ROW DELINEATED USING EXISTING 1-FT CONTOURS FROM 2017 GIS DATA AND FIELD VERIFIED SITE IMPROVEMENTS.
  - HEC-HMS VERSION 4.10 AND FREQUENCY STORM HYDROGRAPH METHOD USED TO CALCULATE FLOWS.
  - A CLIMATIC ADJUSTMENT OF -15 APPLIED TO CN.

Using the PDS method has not been our practice in the past. We will study this for future submittals.

Use EBDLKUP-2019, Guadalupe County, Zone 1, PDS Method

DESIGN INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JACOB J. POWELL  
P.E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JOHN A. TYLER  
P.E. SERIAL NO: 105193  
DATE: 6/30/2023

SCALE: 1" = 2000'

REV. NO.	DATE	DESCRIPTION	BY



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EXISTING DRAINAGE AREA MAP

DRN Review completed: MAL 31JUL23  
1. See comments on drainage areas.  
2. See HEC-RAS comments  
3. See HY-8 comments

show flow arrows for culvert outfall.

Agreed. Added.

Adjusted Huber Rd label for greater clarity.

Label side streets

Existing conditions considers present-day conditions, while proposed takes into account the additional impervious cover created by the proposed roadway. Ultimate conditions considers the expected ultimate development of the watershed into single-family residential in addition to the additional roadway pavement.

Agreed. Added existing and proposed structure sizes to DAMs.

Not sure how this outfalls? Please add existing and proposed size to label below Culvert Name. May be extended or to remain. Nice to have an overall knowledge at DAM

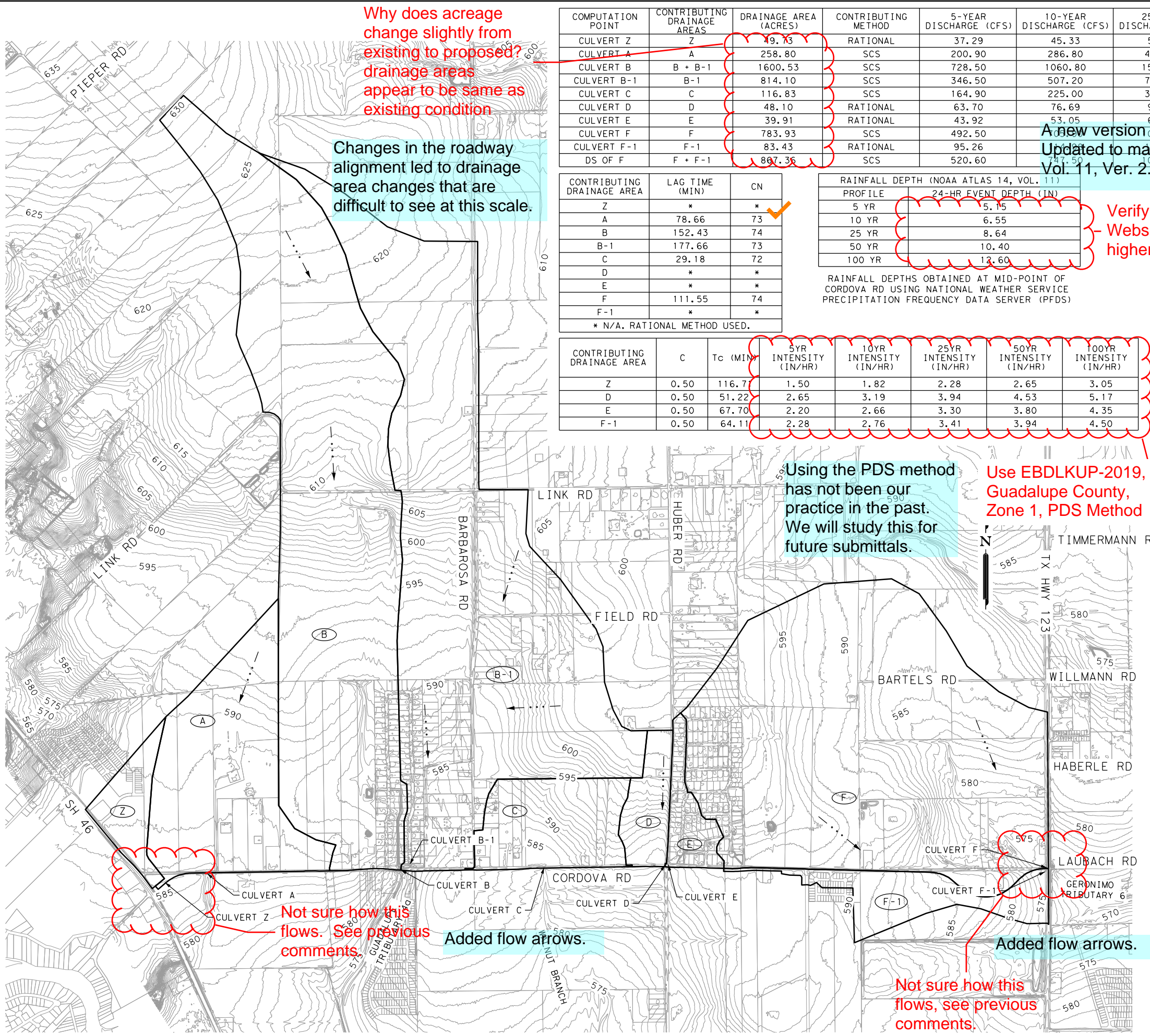
What is the difference between existing, proposed and ultimate. What are you using to design the structures?

SHEET 1 OF 3

DGN#	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN#	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG#	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG#	SAT	GUADALUPE	0915	45	052	

Plotted on: 6/30/2023

Design File name: P:\1275\00\Design\Civil\Drainage\127500\_da02.dgn



Why does acreage change slightly from existing to proposed? drainage areas appear to be same as existing condition

Changes in the roadway alignment led to drainage area changes that are difficult to see at this scale.

COMPUTATION POINT	CONTRIBUTING DRAINAGE AREAS	DRAINAGE AREA (ACRES)	CONTRIBUTING METHOD	5-YEAR DISCHARGE (CFS)	10-YEAR DISCHARGE (CFS)	25-YEAR DISCHARGE (CFS)	50-YEAR DISCHARGE (CFS)	100-YEAR DISCHARGE (CFS)
CULVERT Z	Z	49.73	RATIONAL	37.29	45.33	56.67	65.77	75.83
CULVERT A	A	258.80	SCS	200.90	286.80	415.90	518.80	636.50
CULVERT B	B + B-1	1600.53	SCS	728.50	1060.80	1569.40	1996.70	2502.00
CULVERT B-1	B-1	814.10	SCS	346.50	507.20	755.00	964.00	1212.40
CULVERT C	C	116.83	SCS	164.90	225.00	330.10	405.50	487.30
CULVERT D	D	48.10	RATIONAL	63.70	76.69	94.68	108.87	124.23
CULVERT E	E	39.91	RATIONAL	43.92	53.05	65.77	75.86	86.87
CULVERT F	F	783.93	SCS	492.50	707.60	1021.20	1271.20	1593.90
CULVERT F-1	F-1	83.43	RATIONAL	95.26	114.50	141.20	164.20	187.90
DS OF F	F + F-1	867.36	SCS	520.60	747.50	1090.60	1372.30	1699.50

A new version has been released. Updated to match NOAA Atlas 14, Vol. 11, Ver. 2.

CONTRIBUTING DRAINAGE AREA	LAG TIME (MIN)	CN
Z	*	*
A	78.66	73
B	152.43	74
B-1	177.66	73
C	29.18	72
D	*	*
E	*	*
F	111.55	74
F-1	*	*

\* N/A. RATIONAL METHOD USED.

PROFILE	24-HR EVENT DEPTH (IN)
5 YR	5.15
10 YR	6.55
25 YR	8.64
50 YR	10.40
100 YR	12.60

RAINFALL DEPTHS OBTAINED AT MID-POINT OF CORDOVA RD USING NATIONAL WEATHER SERVICE PRECIPITATION FREQUENCY DATA SERVER (PFDS)

Verify depths. Website shows higher values.

CONTRIBUTING DRAINAGE AREA	C	Tc (MIN)	5YR INTENSITY (IN/HR)	10YR INTENSITY (IN/HR)	25YR INTENSITY (IN/HR)	50YR INTENSITY (IN/HR)	100YR INTENSITY (IN/HR)
Z	0.50	116.77	1.50	1.82	2.28	2.65	3.05
D	0.50	51.22	2.65	3.19	3.94	4.53	5.17
E	0.50	67.70	2.20	2.66	3.30	3.80	4.35
F-1	0.50	64.11	2.28	2.76	3.41	3.94	4.50

- NOTES:
1. DRAINAGE AREAS OFF ROW DELINEATED USING EXISTING 1-FT CONTOURS FROM 2017 GIS DATA AND FIELD VERIFIED SITE IMPROVEMENTS.
  2. HEC-HMS VERSION 4.10 AND FREQUENCY STORM HYDROGRAPH METHOD USED TO CALCULATE FLOWS.
  3. A CLIMATIC ADJUSTMENT OF -15 APPLIED TO CN.

Include FPA notification note Agreed

Using the PDS method has not been our practice in the past. We will study this for future submittals.

Use EBDLUP-2019, Guadalupe County, Zone 1, PDS Method

Not sure how this flows. See previous comments.

Added flow arrows.

Not sure how this flows, see previous comments.

Added flow arrows.

DESIGN INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JACOB J. POWELL  
P.E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JOHN A. TYLER  
P.E. SERIAL NO: 105193  
DATE: 6/30/2023

SCALE: 1" = 2000'

REV. NO.	DATE	DESCRIPTION	BY
 SAN ANTONIO   AUSTIN   HOUSTON   FORT WORTH   DALLAS 2000 NW LOOP 410   SAN ANTONIO, TX 78213   210.375.9000 TEXAS ENGINEERING FIRM #470   TEXAS SURVEYING FIRM #10028800			



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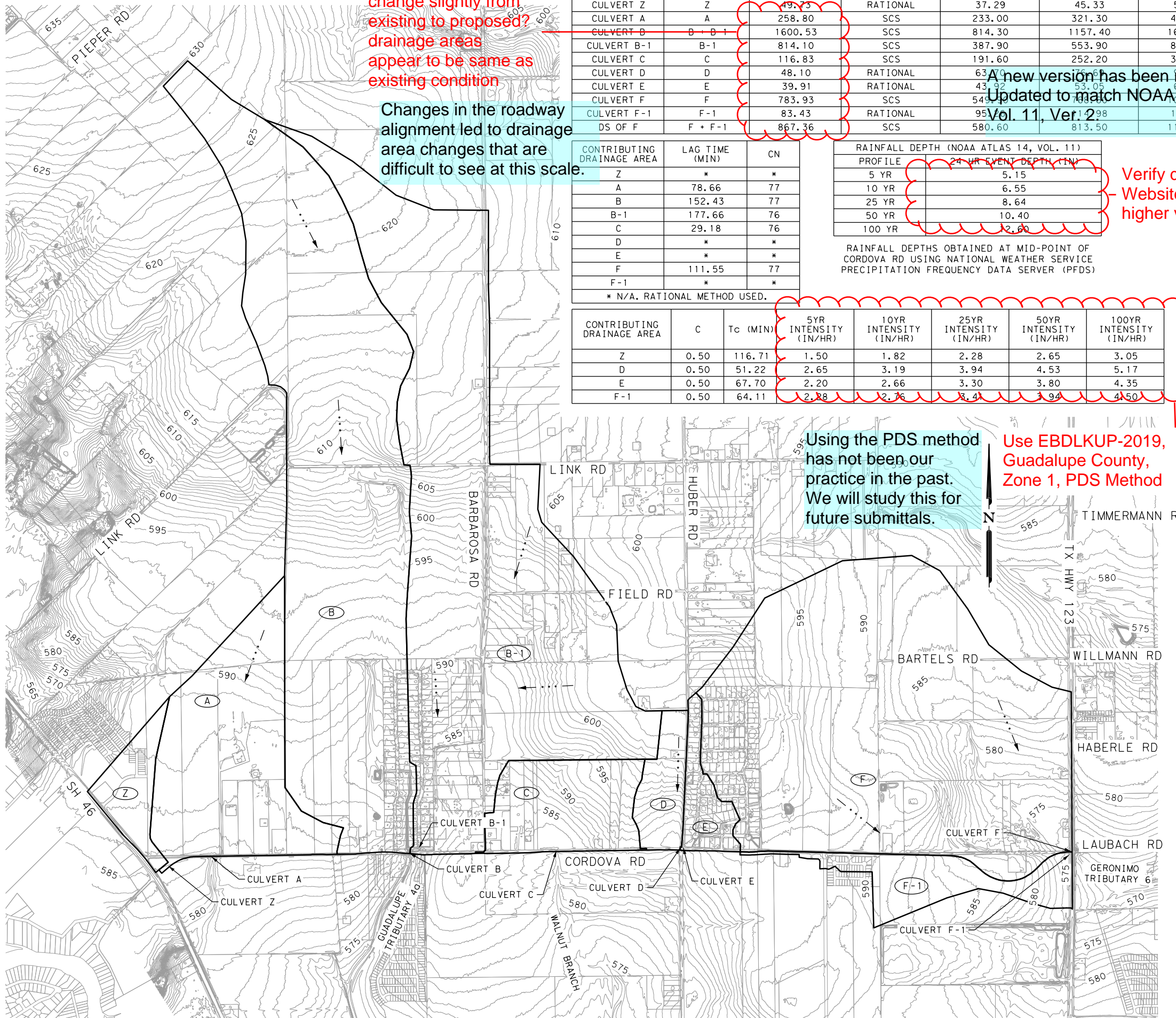
## PROPOSED DRAINAGE AREA MAP

SHEET 2 OF 3

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.
CHK DWG:	SAT	GUADALUPE	0915	45

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_da03.dgn



Why does acreage change slightly from existing to proposed? drainage areas appear to be same as existing condition

Changes in the roadway alignment led to drainage area changes that are difficult to see at this scale.

Using the PDS method has not been our practice in the past. We will study this for future submittals.

Use EBDLKUP-2019, Guadalupe County, Zone 1, PDS Method

COMPUTATION POINT	CONTRIBUTING DRAINAGE AREAS	DRAINAGE AREA (ACRES)	CONTRIBUTING METHOD	5-YEAR DISCHARGE (CFS)	10-YEAR DISCHARGE (CFS)	25-YEAR DISCHARGE (CFS)	50-YEAR DISCHARGE (CFS)	100-YEAR DISCHARGE (CFS)
CULVERT Z	Z	49.73	RATIONAL	37.29	45.33	56.67	65.77	75.83
CULVERT A	A	258.80	SCS	233.00	321.30	452.20	555.50	672.00
CULVERT B	B + B-1	1600.53	SCS	814.30	1157.40	1675.10	2105.50	2610.40
CULVERT B-1	B-1	814.10	SCS	387.90	553.90	806.60	1017.60	1266.10
CULVERT C	C	116.83	SCS	191.60	252.20	358.70	433.40	514.50
CULVERT D	D	48.10	RATIONAL	63.92	78.05	108.87	124.23	142.23
CULVERT E	E	39.91	RATIONAL	43.92	53.05	75.86	86.87	100.00
CULVERT F	F	783.93	SCS	543.00	763.00	1063.00	1356.90	1659.10
CULVERT F-1	F-1	83.43	RATIONAL	95.19	119.98	164.24	184.20	217.90
DS OF F	F + F-1	867.36	SCS	580.60	813.50	1160.70	1443.10	1768.50

A new version has been released. Updated to match NOAA Atlas 14, Vol. 11, Ver. 2.

CONTRIBUTING DRAINAGE AREA	LAG TIME (MIN)	CN
Z	*	*
A	78.66	77
B	152.43	77
B-1	177.66	76
C	29.18	76
D	*	*
E	*	*
F	111.55	77
F-1	*	*

\* N/A. RATIONAL METHOD USED.

RAINFALL DEPTH (NOAA ATLAS 14, VOL. 11)	
PROFILE	24 HR EVENT DEPTH (IN)
5 YR	5.15
10 YR	6.55
25 YR	8.64
50 YR	10.40
100 YR	12.60

RAINFALL DEPTHS OBTAINED AT MID-POINT OF CORDOVA RD USING NATIONAL WEATHER SERVICE PRECIPITATION FREQUENCY DATA SERVER (PFDS)

CONTRIBUTING DRAINAGE AREA	C	Tc (MIN)	5YR INTENSITY (IN/HR)	10YR INTENSITY (IN/HR)	25YR INTENSITY (IN/HR)	50YR INTENSITY (IN/HR)	100YR INTENSITY (IN/HR)
Z	0.50	116.71	1.50	1.82	2.28	2.65	3.05
D	0.50	51.22	2.65	3.19	3.94	4.53	5.17
E	0.50	67.70	2.20	2.66	3.30	3.80	4.35
F-1	0.50	64.11	2.28	2.76	3.41	3.94	4.50

Verify depths. Website shows higher values.

- R.O.W.
- DRAINAGE AREA BOUNDARY
- 850— EXISTING CONTOUR
- FLOW ARROW
- (X-X) DRAINAGE AREA

- NOTES:
1. DRAINAGE AREAS OFF ROW DELINEATED USING EXISTING 1-FT CONTOURS FROM 2017 GIS DATA AND FIELD VERIFIED SITE IMPROVEMENTS.
  2. HEC-HMS VERSION 4.10 AND FREQUENCY STORM HYDROGRAPH METHOD USED TO CALCULATE FLOWS.
  3. A CLIMATIC ADJUSTMENT OF .15 APPLIED TO CN.

Include FPA notification note **Agreed**

DESIGN  
 INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL  
 INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

SCALE: 1" = 2000'

REV. NO.	DATE	DESCRIPTION	BY
 SAN ANTONIO   AUSTIN   HOUSTON   FORT WORTH   DALLAS 2000 NW LOOP 410   SAN ANTONIO, TX 78213   210.375.9000 TEXAS ENGINEERING FIRM #470   TEXAS SURVEYING FIRM #10028800			

Texas Department of Transportation  
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## ULTIMATE DRAINAGE AREA MAP

SHEET 3 OF 3

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.
CHK DWG:	SAT	GUADALUPE	0915	45
				052

Plotted on: 6/30/2023

Design File Name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd...Z1.dgn

### Crossing Discharge Data

Discharge Selection Method: Recurrence

Rating Curve Plot for Crossing: Culvert\_Z\_Prop

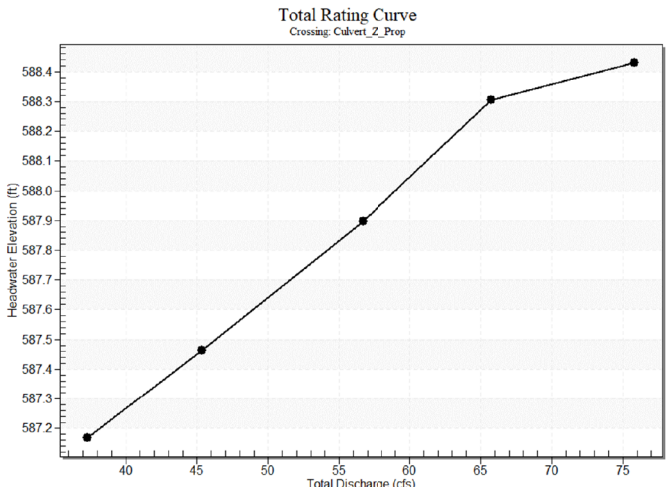


Table 1 - Summary of Culvert Flows at Crossing: Culvert\_Z\_Prop

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert_Z_Prop Discharge (cfs)	Roadway Discharge (cfs)	Iterations
587.17	5 year	37.29	37.29	0.00	1
587.46	10 year	45.33	45.33	0.00	1
587.90	25 year	56.67	56.67	0.00	1
588.30	50 year	65.77	63.10	2.60	15
588.43	100 year	75.83	64.93	10.85	7
588.20	Overtopping	61.50	61.50	0.00	Overtopping

### Culvert Data: Culvert\_Z\_Prop

Table 1 - Culvert Summary Table: Culvert\_Z\_Prop

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	37.29 cfs	37.29 cfs	587.17	2.24	2.478	2-M2c	1.49	1.46	1.46	0.44	5.25	0.86
10 year	45.33 cfs	45.33 cfs	587.46	2.60	2.774	7-M2c	1.70	1.62	1.62	0.47	5.74	0.88
25 year	56.67 cfs	56.67 cfs	587.90	3.21	3.193	7-M2c	2.07	1.81	1.81	0.50	7.42	0.89
50 year	65.77 cfs	63.10 cfs	588.30	3.61	3.466	7-M2c	2.50	1.91	1.91	0.53	7.83	0.87
100 year	75.83 cfs	64.93 cfs	588.43	3.74	3.555	7-M2c	2.50	1.94	1.94	0.55	7.94	0.89

### Culvert Barrel Data

Culvert Barrel Type Straight Culvert  
 Inlet Elevation (invert): 584.69 ft,  
 Outlet Elevation (invert): 584.08 ft  
 Culvert Length: 153.00 ft,  
 Culvert Slope: 0.0040

### Roadway Data for Crossing: Culvert\_Z\_Prop

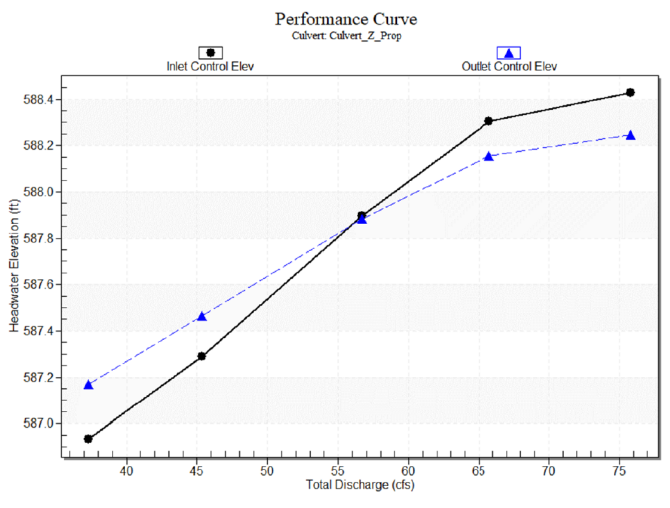
Roadway Profile Shape: Irregular Roadway Shape (coordinates)

### Irregular Roadway Cross-Section

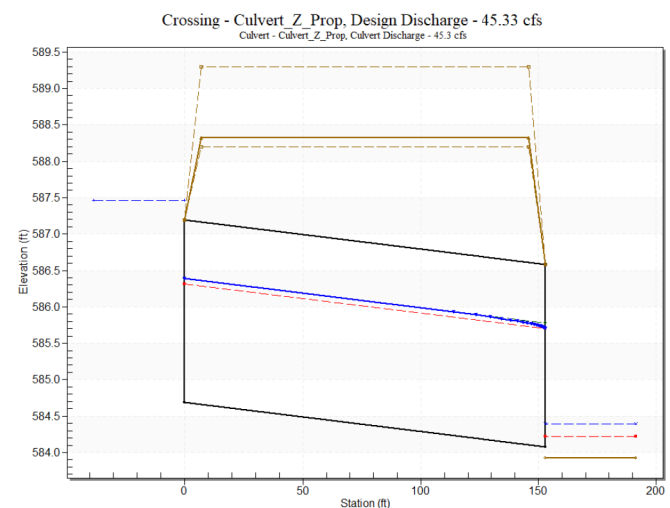
Coord No.	Station (ft)	Elevation (ft)
0	0.00	588.20
1	20.00	588.20
2	40.00	588.32
3	60.00	588.69
4	80.00	588.98
5	100.00	589.19
6	120.00	589.30

Roadway Surface: Paved  
 Roadway Top Width: 139.00 ft

### Culvert Performance Curve Plot: Culvert\_Z\_Prop



### Water Surface Profile Plot for Culvert: Culvert\_Z\_Prop



### Tailwater Data for Crossing: Culvert\_Z\_Prop

Table 2 - Downstream Channel Rating Curve (Crossing: Culvert\_Z\_Prop)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
37.29	584.36	0.44	0.86	0.08	0.41
45.33	584.39	0.47	0.88	0.09	0.40
56.67	584.42	0.50	0.89	0.09	0.39
65.77	584.45	0.53	0.87	0.10	0.39
75.83	584.47	0.55	0.89	0.10	0.38

### Tailwater Channel Data - Culvert\_Z\_Prop

Tailwater Channel Option: Irregular Channel  
 Channel Slope: Irregular Channel

What is channel slope?

### User Defined Channel Cross Section

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	584.51	0.0350
2	60.00	584.50	0.0350
3	120.00	584.44	0.0350
4	180.00	584.44	0.0350
5	240.00	584.39	0.0350
6	300.00	584.33	0.0350
7	360.00	584.34	0.0350
8	420.00	584.30	0.0350
9	480.00	584.28	0.0350
10	540.00	583.94	0.0320
11	555.00	583.92	0.0320
12	570.00	583.96	0.0300
13	585.00	584.08	0.0300
14	600.00	586.46	0.0160
15	615.00	587.94	0.0000

Note: Culvert Z is sized based on proposed conditions.

New Location

Channel is not big enough to convey flow

No defined channel exists along the eastern side of SH 46 at this new location. The irregular channel data was included in an attempt to capture the flat, open area on the downstream side of the proposed culvert.

### Site Data - Culvert\_Z\_Prop

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 584.69 ft  
 Outlet Station: 153.00 ft  
 Outlet Elevation: 584.08 ft  
 Number of Barrels: 2

Why are we proposing pipe other than concrete? Is City ok with this type of pipe?

### Culvert Data Summary - Culvert\_Z\_Prop

Barrel Shape: Circular  
 Barrel Diameter: 2.50 ft  
 Barrel Material: Smooth Polypropylene  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Mitered to Conform to Slope  
 Inlet Depression: None

Changed to concrete after further design development.

Once we see the culvert layout and where the elevation of edge of pavement vs the WS10. Need to check you have enough cover for plastic pipe.

DESIGN

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.

ENGINEER: JACOB J. POWELL

P. E. SERIAL NO: 108825

DATE: 6/30/2023

---

APPROVAL

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.

ENGINEER: JOHN A. TYLER

P. E. SERIAL NO: 105193

DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
 SAN ANTONIO   AUSTIN   HOUSTON   FORT WORTH   DALLAS 2000 NW LOOP 410   SAN ANTONIO, TX 78213   210.375.9000 TEXAS ENGINEERING FIRM #470   TEXAS SURVEYING FIRM #10028800			
© 2023			
HYDRAULIC DATA SHEET CULVERT Z			
DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$
DWG:	DIST.:	COUNTY:	CONT. NO. SECT. NO. JOB NO. SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915 45 052

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_A01.dgn

RS 2106  
RS 1974  
RS 1848  
RS 1751  
RS 1677  
RS 1652  
RS 1628  
RS 1619  
RS 1586



- NOTES:
1. HEC-RAS VERSION 6.3.1 USED FOR HYDRAULIC CALCULATIONS.
  2. 1-FT CONTOURS FROM 2017 STRATMAP CENTRAL TEXAS LIDAR DATASET.
  3. FOR CULVERTS CROSSING CORDOVA RD, 25YR AEP STORM USED FOR DESIGN, PER CITY OF SEGUIN CRITERIA.

RS 1519

Label streets

RS 1452

Added.

CULVERT LOCATION  
RS 1533  
CORDOVA RD

Note: Culvert A is sized based on ultimate conditions per City of Seguin. Proposed conditions were also compared to existing conditions to verify no adverse impact.

DESIGN

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.

ENGINEER: JACOB J. POWELL

P.E. SERIAL NO: 108825

DATE: 6/30/2023

585

RS 1265

APPROVAL

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.

ENGINEER: JOHN A. TYLER

P.E. SERIAL NO: 105193

DATE: 6/30/2023

Turn on roadway layer

Added.

RS 1136

RS 994

RS 852

Label streets and culverts

Downstream culvert is off the page.

680

RS 470

RS 263

RS 111

RS 1

Added.

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



# HYDRAULIC DATA SHEET CULVERT A

SHEET 1 OF 5

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:	JOB NO.:	SHEET NO.:
CHK DWG:	SAT	GUADALUPE	0915	45	052	



HEC-RAS OUTPUT

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_A02.dgn

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W. S. Elev (ft)	Crit W. S. (ft)	E. G. Elev (ft)	E. G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1136	5yr	PRE	201	580.05	581.42		581.48	0.002038	2.06	101.09	125.96	0.39
1136	5yr	POST_EX	201	580.05	581.42		581.48	0.002038	2.06	101.09	125.96	0.39
1136	5yr	POST_ULI	233	580.05	581.51		581.58	0.002013	2.14	113.13	133.52	0.39
1136	10yr	PRE	286.9	580.05	581.64		581.72	0.001965	2.3	130.93	144.03	0.39
1136	10yr	POST_EX	286.9	580.05	581.64		581.72	0.001965	2.3	130.94	144.03	0.39
1136	10yr	POST_ULI	321.3	580.05	581.71		581.8	0.001956	2.4	141.65	149.88	0.4
1136	25yr (Design)	PRE	416	580.05	581.89		582	0.001938	2.64	170.51	164.42	0.4
1136	25yr (Design)	POST_EX	416	580.05	581.89		582	0.001938	2.64	170.51	164.42	0.4
1136	25yr (Design)	POST_ULI	452.2	580.05	581.96		582.07	0.001939	2.72	181.23	171.49	0.41
1136	50yr	PRE	519	580.05	582.07		582.19	0.001938	2.86	200.44	180.2	0.41
1136	50yr	POST_EX	519	580.05	582.07		582.19	0.001938	2.86	200.44	180.2	0.41
1136	50yr	POST_ULI	555.5	580.05	582.12		582.25	0.001937	2.93	210.84	185.09	0.41
1136	100yr (Check)	PRE	636.6	580.05	582.24		582.38	0.001936	3.08	233.52	195.77	0.42
1136	100yr (Check)	POST_EX	636.6	580.05	582.24		582.38	0.001936	3.08	233.52	195.77	0.42
1136	100yr (Check)	POST_ULI	672	580.05	582.29		582.43	0.001935	3.14	243.33	200.59	0.42
994	5yr	PRE	201	579.39	581.13		581.2	0.001962	2.12	95.97	109.32	0.38
994	5yr	POST_EX	201	579.39	581.13		581.2	0.001962	2.12	95.97	109.32	0.38
994	5yr	POST_ULI	233	579.39	581.21		581.29	0.002073	2.26	104.99	115.36	0.4
994	10yr	PRE	286.9	579.39	581.33		581.42	0.002188	2.46	119.41	121.83	0.41
994	10yr	POST_EX	286.9	579.39	581.33		581.42	0.002187	2.46	119.42	121.83	0.41
994	10yr	POST_ULI	321.3	579.39	581.4		581.5	0.002231	2.59	127.88	127.22	0.42
994	25yr (Design)	PRE	416	579.39	581.57		581.69	0.002322	2.89	150.44	137.13	0.44
994	25yr (Design)	POST_EX	416	579.39	581.57		581.69	0.002322	2.89	150.44	137.13	0.44
994	25yr (Design)	POST_ULI	452.2	579.39	581.62		581.76	0.002369	3	158.41	141.77	0.45
994	50yr	PRE	519	579.39	581.72		581.87	0.002457	3.2	172.33	146.41	0.46
994	50yr	POST_EX	519	579.39	581.72		581.87	0.002457	3.2	172.33	146.41	0.46
994	50yr	POST_ULI	555.5	579.39	581.77		581.93	0.002508	3.3	179.63	150.94	0.47
994	100yr (Check)	PRE	636.6	579.39	581.87		582.06	0.002607	3.52	195.63	158.27	0.48
994	100yr (Check)	POST_EX	636.6	579.39	581.87		582.06	0.002607	3.52	195.63	158.27	0.48
994	100yr (Check)	POST_ULI	672	579.39	581.92		582.11	0.002648	3.61	202.44	162.13	0.49
852	5yr	PRE	201	579.18	580.82		580.88	0.002491	2	100.7	138.73	0.41
852	5yr	POST_EX	201	579.18	580.82		580.88	0.002491	2	100.7	138.73	0.41
852	5yr	POST_ULI	233	579.18	580.89		580.96	0.002469	2.09	111.25	141.64	0.42
852	10yr	PRE	286.9	579.18	581.01		581.09	0.00246	2.24	127.86	146.36	0.42
852	10yr	POST_EX	286.9	579.18	581.01		581.09	0.002457	2.24	127.9	146.38	0.42
852	10yr	POST_ULI	321.3	579.18	581.08		581.16	0.002475	2.33	137.67	149.27	0.43
852	25yr (Design)	PRE	416	579.18	581.24		581.34	0.002531	2.55	163.75	162.84	0.44
852	25yr (Design)	POST_EX	416	579.18	581.24		581.34	0.002531	2.55	163.75	162.84	0.44
852	25yr (Design)	POST_ULI	452.2	579.18	581.3		581.4	0.00253	2.62	172.92	164.94	0.44
852	50yr	PRE	519	579.18	581.39		581.51	0.00254	2.77	188.54	169.58	0.45
852	50yr	POST_EX	519	579.18	581.39		581.51	0.00254	2.77	188.54	169.58	0.45
852	50yr	POST_ULI	555.5	579.18	581.44		581.56	0.00255	2.85	196.53	172.47	0.46
852	100yr (Check)	PRE	636.6	579.18	581.54		581.68	0.002569	3.01	214.02	180.09	0.46
852	100yr (Check)	POST_EX	636.6	579.18	581.54		581.68	0.002569	3.01	214.02	180.09	0.46
852	100yr (Check)	POST_ULI	672	579.18	581.58		581.72	0.002584	3.08	221.31	181.75	0.47
680	5yr	PRE	201	579	580.4		580.46	0.002428	2.04	98.55	132.09	0.41
680	5yr	POST_EX	201	579	580.4		580.46	0.002428	2.04	98.55	132.09	0.41
680	5yr	POST_ULI	233	579	580.47		580.55	0.002444	2.14	109.21	141.4	0.42
680	10yr	PRE	286.9	579	580.59		580.67	0.00244	2.31	125.47	149.87	0.43
680	10yr	POST_EX	286.9	579	580.59		580.67	0.002439	2.31	125.48	149.88	0.43
680	10yr	POST_ULI	321.3	579	580.64		580.73	0.002487	2.43	134.26	154.05	0.43
680	25yr (Design)	PRE	416	579	580.79		580.9	0.002611	2.73	157.91	181.22	0.45
680	25yr (Design)	POST_EX	416	579	580.79		580.9	0.002611	2.73	157.91	181.22	0.45
680	25yr (Design)	POST_ULI	452.2	579	580.84		580.96	0.002619	2.82	167.95	192.82	0.46
680	50yr	PRE	519	579	580.92		581.06	0.002691	2.99	185.1	213.49	0.47
680	50yr	POST_EX	519	579	580.92		581.06	0.002691	2.99	185.1	213.49	0.47
680	50yr	POST_ULI	555.5	579	580.97		581.11	0.002719	3.08	194.43	223.22	0.48
680	100yr (Check)	PRE	636.6	579	581.06		581.22	0.002782	3.25	215.85	244.91	0.49
680	100yr (Check)	POST_EX	636.6	579	581.06		581.22	0.002782	3.25	215.85	244.91	0.49
680	100yr (Check)	POST_ULI	672	579	581.09		581.26	0.00281	3.33	225	253.46	0.49
470	5yr	PRE	201	578.6	579.94		579.99	0.002085	1.76	114.19	166.27	0.37
470	5yr	POST_EX	201	578.6	579.94		579.99	0.002085	1.76	114.19	166.27	0.37
470	5yr	POST_ULI	233	578.6	580.01		580.06	0.002141	1.84	126.82	176.68	0.38
470	10yr	PRE	286.9	578.6	580.12		580.18	0.00218	1.96	146.92	194.95	0.39
470	10yr	POST_EX	286.9	578.6	580.12		580.18	0.002216	1.97	146.13	194.6	0.39
470	10yr	POST_ULI	321.3	578.6	580.17		580.23	0.002228	2.06	156.81	205.26	0.4
470	25yr (Design)	PRE	416	578.6	580.31		580.39	0.002222	2.28	186.17	224.34	0.41
470	25yr (Design)	POST_EX	416	578.6	580.31		580.39	0.002222	2.28	186.17	224.34	0.41
470	25yr (Design)	POST_ULI	452.2	578.6	580.35		580.44	0.002239	2.36	196.47	228.28	0.41
470	50yr	PRE	519	578.6	580.43		580.53	0.002268	2.5	215.45	250	0.42
470	50yr	POST_EX	519	578.6	580.43		580.53	0.002268	2.5	215.45	250	0.42
470	50yr	POST_ULI	555.5	578.6	580.47		580.57	0.002283	2.57	226.07	264.89	0.43
470	100yr (Check)	PRE	636.6	578.6	580.56		580.67	0.00231	2.71	248.93	271.23	0.43
470	100yr (Check)	POST_EX	636.6	578.6	580.56		580.67	0.00231	2.71	248.93	271.23	0.43
470	100yr (Check)	POST_ULI	672	578.6	580.59		580.71	0.002323	2.77	258.41	281.38	0.44
263	5yr	PRE	201	578.21	579.51		579.55	0.002065	1.69	119.06	183.25	0.37
263	5yr	POST_EX	201	578.21	579.51		579.55	0.002065	1.69	119.06	183.25	0.37
263	5yr	POST_ULI	233	578.21	579.58		579.62	0.002117	1.77	131.82	198.07	0.38
263	10yr	PRE	286.9	578.21	579.66		579.72	0.002176	1.92	150.24	217.94	0.39
263	10yr	POST_EX	286.9	578.21	579.66		579.72	0.002178	1.92	150.2	217.93	0.39
263	10yr	POST_ULI	321.3	578.21	579.71		579.78	0.002205	2.02	161.09	223.45	0.4
263	25yr (Design)	PRE	416	578.21	579.84		579.91	0.002289	2.26	189.75	248.48	0.41
263	25yr (Design)	POST_EX	416	578.21	579.84		579.91	0.002289	2.26	189.75	248.48	0.41
263	25yr (Design)	POST_ULI	452.2	578.21	579.88		579.96	0.002319	2.34	200.26	254.6	0.42
263	50yr	PRE	519	578.21	579.95		580.04	0.002374	2.48	219.35	269.43	0.43
263	50yr	POST_EX	519	578.21	579.95		580.04	0.002374	2.48	219.35	269.43	0.43
263	50yr	POST_ULI	555.5	578.21	579.99		580.09	0.002401	2.56	229.62	279.65	0.43
263	100yr (Check)	PRE	636.6	578.21	580.07		580.18	0.002429	2.7	252.69	291.1	0.44
263	100yr (Check)	POST_EX	636.6	578.21	580.07		580.18	0.002429	2.7	252.69	291.1	0.44
263	100yr (Check)	POST_ULI	672	578.21	580.1		580.21	0.002451	2.76	262.01	298.61	0.45

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W. S. Elev (ft)	Crit W. S. (ft)	E. G. Elev (ft)	E. G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	
111	5yr	PRE	201	577.96	579.18		578.79	579.22	0.002259	1.63	123.43	214.48	0.38
111	5yr	POST_EX	201	577.96	579.18		578.79	579.22	0.002259	1.63	123.43	214.48	0.38
111	5yr	POST_ULI	233	577.96	579.24		578.84	579.29	0.002341	1.71	136.33	226.46	0.39
111													

HEC-RAS CULVERT OUTPUT DATA - EXISTING

Plan: PRE	River 1	Reach 1	RS: 1533	Culv Group:	Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)				371.65		Culv Full Len (ft)
# Barrels				3		Culv Vel US (ft/s)
Q Barrel (cfs)				123.88		Culv Vel DS (ft/s)
E.G. US. (ft)				586.18		Culv Inv El Up (ft)
W.S. US. (ft)				586.14		Culv Inv El Dn (ft)
E.G. DS (ft)				583.89		Culv Frctn Ls (ft)
W.S. DS (ft)				583.02		Culv Exit Loss (ft)
Delta EG (ft)				2.29		Culv Entr Loss (ft)
Delta WS (ft)				3.12		Q Weir (cfs)
E.G. IC (ft)				586.18		Weir Sta Lft (ft)
E.G. OC (ft)				585.46		Weir Sta Rgt (ft)
Culvert Control				Inlet		Weir Submerg
Culv WS Inlet (ft)				584.4		Weir Max Depth (ft)
Culv WS Outlet (ft)				582.76		Weir Avg Depth (ft)
Culv Nml Depth (ft)				1.81		Weir Flow Area (sq ft)
Culv Crt Depth (ft)				2.67		Min El Weir Flow (ft)

Plan: PRE	River 1	Reach 1	RS: 1533	Culv Group:	Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)				503.6		Culv Full Len (ft)
# Barrels				3		Culv Vel US (ft/s)
Q Barrel (cfs)				167.87		Culv Vel DS (ft/s)
E.G. US. (ft)				586.42		Culv Inv El Up (ft)
W.S. US. (ft)				586.37		Culv Inv El Dn (ft)
E.G. DS (ft)				584.73		Culv Frctn Ls (ft)
W.S. DS (ft)				583.58		Culv Exit Loss (ft)
Delta EG (ft)				1.69		Culv Entr Loss (ft)
Delta WS (ft)				2.79		Q Weir (cfs)
E.G. IC (ft)				586.54		Weir Sta Lft (ft)
E.G. OC (ft)				586.42		Weir Sta Rgt (ft)
Culvert Control				Outlet		Weir Submerg
Culv WS Inlet (ft)				584.4		Weir Max Depth (ft)
Culv WS Outlet (ft)				583.96		Weir Avg Depth (ft)
Culv Nml Depth (ft)				2.27		Weir Flow Area (sq ft)
Culv Crt Depth (ft)				3		Min El Weir Flow (ft)

HEC-RAS CULVERT OUTPUT DATA - ULTIMATE PROPOSED

Plan: POST_ULT	River 1	Reach 1	RS: 1533	Culv Group:	Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)				452.2		Culv Full Len (ft)
# Barrels				6		Culv Vel US (ft/s)
Q Barrel (cfs)				75.37		Culv Vel DS (ft/s)
E.G. US. (ft)				583.55		Culv Inv El Up (ft)
W.S. US. (ft)				583.31		Culv Inv El Dn (ft)
E.G. DS (ft)				582.93		Culv Frctn Ls (ft)
W.S. DS (ft)				582.71		Culv Exit Loss (ft)
Delta EG (ft)				0.62		Culv Entr Loss (ft)
Delta WS (ft)				0.6		Q Weir (cfs)
E.G. IC (ft)				583.51		Weir Sta Lft (ft)
E.G. OC (ft)				583.55		Weir Sta Rgt (ft)
Culvert Control				Outlet		Weir Submerg
Culv WS Inlet (ft)				582.81		Weir Max Depth (ft)
Culv WS Outlet (ft)				582.71		Weir Avg Depth (ft)
Culv Nml Depth (ft)				1.62		Weir Flow Area (sq ft)
Culv Crt Depth (ft)				1.53		Min El Weir Flow (ft)

Plan: POST_ULT	River 1	Reach 1	RS: 1533	Culv Group:	Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)				672		Culv Full Len (ft)
# Barrels				6		Culv Vel US (ft/s)
Q Barrel (cfs)				112		Culv Vel DS (ft/s)
E.G. US. (ft)				584.28		Culv Inv El Up (ft)
W.S. US. (ft)				584		Culv Inv El Dn (ft)
E.G. DS (ft)				583.33		Culv Frctn Ls (ft)
W.S. DS (ft)				583		Culv Exit Loss (ft)
Delta EG (ft)				0.95		Culv Entr Loss (ft)
Delta WS (ft)				1		Q Weir (cfs)
E.G. IC (ft)				584.24		Weir Sta Lft (ft)
E.G. OC (ft)				584.28		Weir Sta Rgt (ft)
Culvert Control				Outlet		Weir Submerg
Culv WS Inlet (ft)				583.25		Weir Max Depth (ft)
Culv WS Outlet (ft)				583		Weir Avg Depth (ft)
Culv Nml Depth (ft)				2.14		Weir Flow Area (sq ft)
Culv Crt Depth (ft)				2		Min El Weir Flow (ft)

HEC-RAS CROSS SECTION OUTPUT



Need to go over model. This doesn't look right. What geometry is shown. You should show all the info in title block, geom, flow, date, plans. Clarify Post Ex. Notes have been added to clarify data presented.

DESIGN INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JACOB J. POWELL  
P.E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JOHN A. TYLER  
P.E. SERIAL NO: 105193  
DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
CULVERT A

SHEET 4 OF 5

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:	JOB NO.:	SHEET NO.:
CHK DWG:	SAT	GUADALUPE	0915	45	052	

Plotted on: 6/30/2023

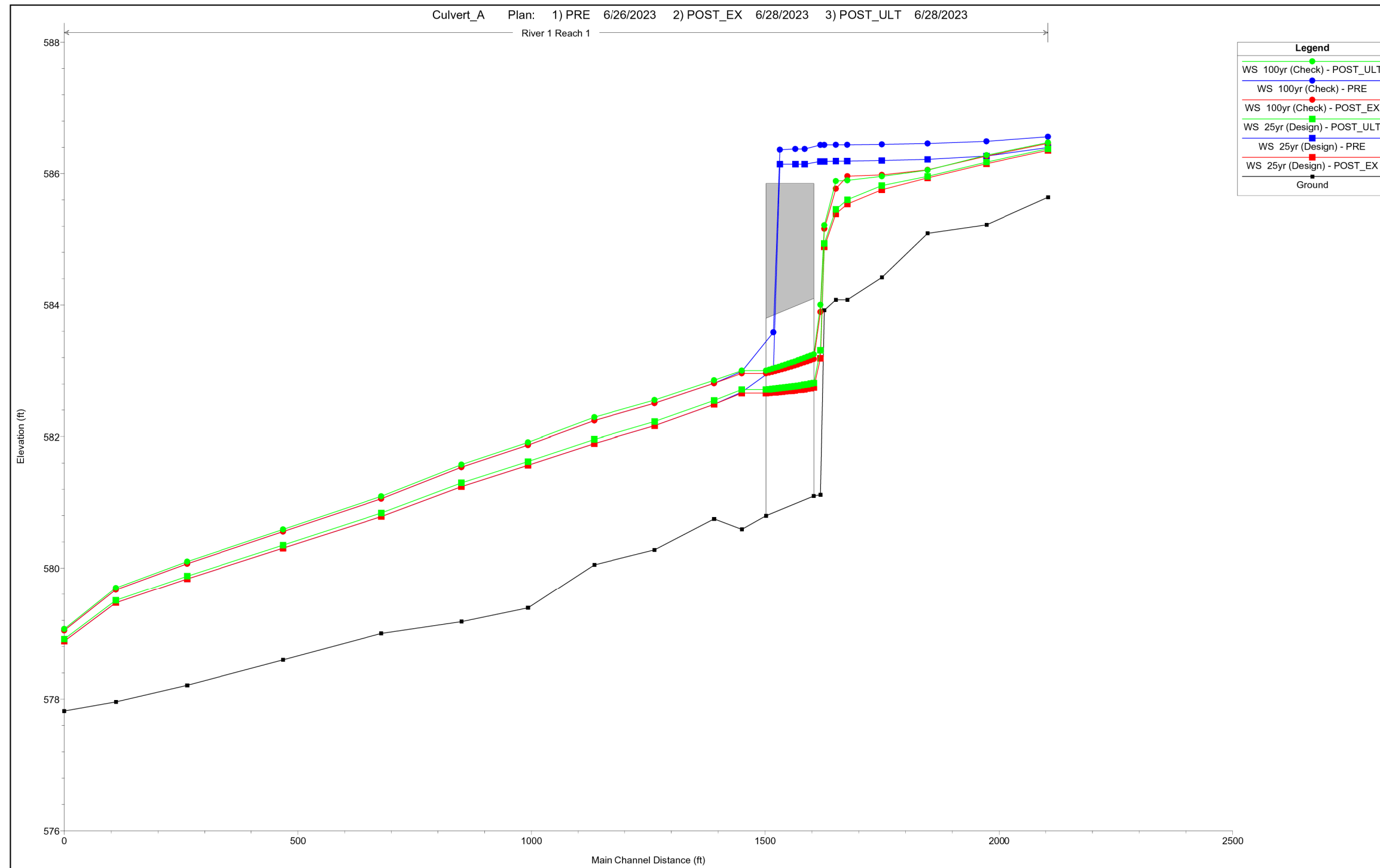
Design File name: P:\127\75\00\Design\Civi\Drainage\1277500\_hyd\_A03.dgn



Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_A04.dgn

HEC-RAS PROFILE PLOT OUTPUT



DESIGN

INTERIM REVIEW  
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 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
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SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
 CULVERT A

SHEET 5 OF 5

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_B01.dgn

Is there a FEMA model for this location (from FEMA BFE Viewer)?

Yes, our model is based on the effective FEMA floodplain model for this stream. The BLE model is not the effective FEMA model.

Show floodplain (FEMA Zone AE) Added.

Double-check Atlas 14 vs. FEMA LOMR

What are impacts to structures?

Model output shows no rise downstream. The pre-project and post-project WSEs converge upstream from structures.

What are impacts to downstream structures

Note: Culvert B is sized based on ultimate conditions per City of Seguin. Proposed conditions were also compared to existing conditions to verify no adverse impact.

NOTES:

1. HEC-RAS VERSION 6.3.1 USED FOR HYDRAULIC CALCULATIONS.
2. 1-FT CONTOURS FROM 2017 STRATMAP CENTRAL TEXAS LIDAR DATASET.
3. FOR CULVERTS CROSSING CORDOVA RD, 25YR AEP STORM USED FOR DESIGN, PER CITY OF SEGUIN CRITERIA.

DESIGN

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
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SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET CULVERT B

SHEET 1 OF 5

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	



Plotted on: 6/30/2023

Design File name: P:\127.75\00\Design\Civil\Drainage\1277500\_hyd\_B02.dgn

26701	5yr	CEM	730.9	573.88	576.39		576.48	0.001214	2.58	312.54	203.71	0.34
26701	5yr	POST_EX	730.9	573.88	576.39		576.48	0.001214	2.58	312.57	203.71	0.34
26701	5yr	POST_ULT	814.3	573.88	576.49		576.59	0.001251	2.69	332.86	205.9	0.34
26701	10yr	CEM	1064	573.88	576.76		576.88	0.001379	2.99	388.8	214.65	0.37
26701	10yr	POST_EX	1064	573.88	576.76		576.88	0.00138	2.99	388.79	214.64	0.37
26701	10yr	POST_ULT	1157.4	573.88	576.85		576.98	0.001444	3.07	409.21	220.7	0.37
26701	25yr (Design)	CEM	1574.2	573.88	577.21		577.38	0.001509	3.48	492.58	240.62	0.39
26701	25yr (Design)	POST_EX	1574.2	573.88	577.21		577.38	0.001508	3.48	492.6	240.62	0.39
26701	25yr (Design)	POST_ULT	1675.1	573.88	577.29		577.47	0.001522	3.57	511.62	245.92	0.4
26701	50yr	CEM	2002.6	573.88	577.53		577.73	0.001568	3.84	575.8	302.92	0.41
26701	50yr	POST_EX	2002.6	573.88	577.53		577.73	0.001567	3.84	575.84	302.95	0.41
26701	50yr	POST_ULT	2105.5	573.88	577.6		577.81	0.001575	3.92	597.2	305.45	0.41
26701	100yr (Check)	CEM	2508.9	573.88	577.85		578.09	0.001597	4.18	676.75	311.43	0.42
26701	100yr (Check)	POST_EX	2508.9	573.88	577.85		578.09	0.001597	4.18	676.73	311.43	0.42
26701	100yr (Check)	POST_ULT	2610.4	573.88	577.92		578.16	0.001597	4.24	696.62	312.18	0.42
26609	5yr	CEM	730.9	573.66	576.31		576.38	0.000949	2.19	350.98	223.44	0.29
26609	5yr	POST_EX	730.9	573.66	576.31		576.38	0.000949	2.19	351.01	223.45	0.29
26609	5yr	POST_ULT	814.3	573.66	576.41		576.48	0.000973	2.3	373.3	234.15	0.3
26609	10yr	CEM	1064	573.66	576.67		576.77	0.001033	2.59	435.4	243.39	0.32
26609	10yr	POST_EX	1064	573.66	576.67		576.76	0.001033	2.59	435.39	243.38	0.32
26609	10yr	POST_ULT	1157.4	573.66	576.76		576.86	0.001051	2.69	457.53	247.26	0.32
26609	25yr (Design)	CEM	1574.2	573.66	577.12		577.25	0.001126	3.08	548.45	261.98	0.34
26609	25yr (Design)	POST_EX	1574.2	573.66	577.12		577.25	0.001125	3.08	548.47	261.98	0.34
26609	25yr (Design)	POST_ULT	1675.1	573.66	577.19		577.34	0.001142	3.17	568.97	265.33	0.35
26609	50yr	CEM	2002.6	573.66	577.43		577.6	0.001194	3.43	631.97	273.87	0.36
26609	50yr	POST_EX	2002.6	573.66	577.43		577.6	0.001193	3.43	632.01	273.89	0.36
26609	50yr	POST_ULT	2105.5	573.66	577.5		577.67	0.001208	3.5	651.24	281.28	0.36
26609	100yr (Check)	CEM	2508.9	573.66	577.75		577.95	0.001264	3.79	726.8	321.38	0.38
26609	100yr (Check)	POST_EX	2508.9	573.66	577.75		577.95	0.001264	3.79	726.82	321.39	0.38
26609	100yr (Check)	POST_ULT	2610.4	573.66	577.81		578.02	0.001286	3.87	746.39	327.24	0.38
26412	5yr	CEM	730.9	572.44	576.05		576.15	0.001865	2.81	304.35	227.43	0.36
26412	5yr	POST_EX	730.9	572.44	576.05		576.15	0.001865	2.81	304.31	227.44	0.36
26412	5yr	POST_ULT	814.3	572.44	576.14		576.25	0.001896	2.92	325.47	235.12	0.36
26412	10yr	CEM	1064	572.44	576.39		576.52	0.001983	3.23	385.75	255.68	0.38
26412	10yr	POST_EX	1064	572.44	576.39		576.52	0.001984	3.23	385.68	255.67	0.38
26412	10yr	POST_ULT	1157.4	572.44	576.48		576.62	0.002	3.32	408.22	262.92	0.38
26412	25yr (Design)	CEM	1574.2	572.44	576.82		576.99	0.002078	3.71	503.38	291.55	0.4
26412	25yr (Design)	POST_EX	1574.2	572.44	576.82		576.99	0.002079	3.71	503.33	291.55	0.4
26412	25yr (Design)	POST_ULT	1675.1	572.44	576.89		577.07	0.002098	3.8	525.34	297.79	0.4
26412	50yr	CEM	2002.6	572.44	577.12		577.32	0.002158	4.06	594.31	316.56	0.41
26412	50yr	POST_EX	2002.6	572.44	577.12		577.32	0.002158	4.06	594.28	316.57	0.41
26412	50yr	POST_ULT	2105.5	572.44	577.19		577.4	0.002174	4.13	615.61	322.16	0.42
26412	100yr (Check)	CEM	2508.9	572.44	577.43		577.67	0.002228	4.4	697.41	342.73	0.43
26412	100yr (Check)	POST_EX	2508.9	572.44	577.43		577.67	0.002229	4.4	697.36	342.73	0.43
26412	100yr (Check)	POST_ULT	2610.4	572.44	577.49		577.73	0.002241	4.47	717.55	347.62	0.43
26118	5yr	CEM	730.9	573.82	575.38		575.49	0.003138	2.75	273.88	235.84	0.43
26118	5yr	POST_EX	730.9	573.82	575.38		575.49	0.003138	2.75	273.88	235.84	0.43
26118	5yr	POST_ULT	814.3	573.82	575.48		575.6	0.00305	2.83	296.41	239.52	0.43
26118	10yr	CEM	1064	573.82	575.73		575.87	0.002883	3.09	356.98	245.82	0.43
26118	10yr	POST_EX	1064	573.82	575.73		575.87	0.002883	3.09	356.98	245.82	0.43
26118	10yr	POST_ULT	1157.4	573.82	575.81		575.96	0.002849	3.18	377.88	247.94	0.43
26118	25yr (Design)	CEM	1574.2	573.82	576.12		576.31	0.002884	3.59	457.25	264.29	0.45
26118	25yr (Design)	POST_EX	1574.2	573.82	576.12		576.31	0.002884	3.59	457.25	264.29	0.45
26118	25yr (Design)	POST_ULT	1675.1	573.82	576.19		576.39	0.002897	3.68	475.35	270.76	0.45
26118	50yr	CEM	2002.6	573.82	576.4		576.63	0.002941	3.95	533.07	290.51	0.46
26118	50yr	POST_EX	2002.6	573.82	576.4		576.63	0.002941	3.95	533.07	290.51	0.46
26118	50yr	POST_ULT	2105.5	573.82	576.46		576.69	0.002954	4.03	550.94	296.37	0.47
26118	100yr (Check)	CEM	2508.9	573.82	576.68		576.95	0.002999	4.32	620.16	317.94	0.48
26118	100yr (Check)	POST_EX	2508.9	573.82	576.68		576.95	0.002999	4.32	620.16	317.94	0.48
26118	100yr (Check)	POST_ULT	2610.4	573.82	576.74		577.01	0.003009	4.39	637.35	323.09	0.48
25738	5yr	CEM	730.9	572	574.55	573.64	574.61	0.001438	1.95	377.2	293.85	0.3
25738	5yr	POST_EX	730.9	572	574.55	573.64	574.61	0.001438	1.95	377.2	293.85	0.3
25738	5yr	POST_ULT	814.3	572	574.64	573.71	574.71	0.001482	2.04	404.04	303.95	0.3
25738	10yr	CEM	1064	572	574.88	573.85	574.96	0.001596	2.25	479.78	331.06	0.32
25738	10yr	POST_EX	1064	572	574.88	573.85	574.96	0.001596	2.25	479.78	331.06	0.32
25738	10yr	POST_ULT	1157.4	572	574.96	573.9	575.04	0.001631	2.32	506.73	340.16	0.33
25738	25yr (Design)	CEM	1574.2	572	575.25	574.14	575.36	0.001737	2.64	608.34	356.14	0.34
25738	25yr (Design)	POST_EX	1574.2	572	575.25	574.14	575.36	0.001737	2.64	608.34	356.14	0.34
25738	25yr (Design)	POST_ULT	1675.1	572	575.31	574.19	575.43	0.001754	2.71	630.52	357.79	0.35
25738	50yr	CEM	2002.6	572	575.5	574.35	575.63	0.001808	2.93	698.67	362.84	0.36
25738	50yr	POST_EX	2002.6	572	575.5	574.35	575.63	0.001808	2.93	698.67	362.84	0.36
25738	50yr	POST_ULT	2105.5	572	575.56	574.4	575.7	0.001825	3	719.02	364.33	0.36
25738	100yr (Check)	CEM	2508.9	572	575.77	574.59	575.93	0.001872	3.24	796.65	369.97	0.37
25738	100yr (Check)	POST_EX	2508.9	572	575.77	574.59	575.93	0.001872	3.24	796.65	369.97	0.37
25738	100yr (Check)	POST_ULT	2610.4	572	575.82	574.63	575.99	0.001884	3.29	815.24	371.31	0.38
25369	5yr	CEM	730.9	571.95	572.93	572.93	573.24	0.021694	4.46	164	272.45	1.01
25369	5yr	POST_EX	730.9	571.95	572.93	572.93	573.24	0.021694	4.46	164	272.45	1.01
25369	5yr	POST_ULT	814.3	571.95	572.98	573.31	573.62	0.02124	4.59	177.22	276.81	1.01
25369	10yr	CEM	1064	571.95	573.11	573.11	573.49	0.020132	4.94	215.19	289.22	1.01
25369	10yr	POST_EX	1064	571.95	573.11	573.11	573.49	0.020132	4.94	215.19	289.22	1.01
25369	10yr	POST_ULT	1157.4	571.95	573.16	573.16	573.56	0.01983	5.06	228.69	293.44	1.01
25369	25yr (Design)	CEM	1574.2	571.95	573.35	573.35	573.82	0.018712	5.49	286.53	311.2	1.01
25369	25yr (Design)	POST_EX	1574.2	571.95	573.35	573.35	573.82	0.018712	5.49	286.53	311.2	1.01
25369	25yr (Design)	POST_ULT	1675.1	571.95	573.39	573.39	573.88	0.018533	5.59	299.7	314.91	1.01
25369	50yr	CEM	2002.6	571.95	573.52	573.52	574.06	0.017917	5.91	339.14	320.09	1.01
25369	50yr	POST_EX	2002.6	571.95	573.52	573.52	574.06	0.017917	5.91	339.14	320.09	1.01
25369	50yr	POST_ULT	2105.5	571.95	573.55	573.55	574.11	0.017712	5.99	351.23	321.41	1.01
25369	100yr (Check)	CEM	2508.9	571.95	573.7	573.7	574.32	0.01698	6.31	397.4	326.26	1.01
25369	100yr (Check)	POST_EX	2508.9	571.95	573.7	573.7	574.32	0.01698	6.31	397.4	326.26	1.01
25369	100yr (Check)	POST_ULT	2610.4	571.95	573.73	573.73	574.37	0.016913	6.4	407.97	327.35	1.01

DESIGN

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TY

HEC-RAS CULVERT OUTPUT DATA - EXISTING

Plan: CEM	Guadalupe River	Tributary 4a	RS: 26850	Culv Group: Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)		1310.42		Culv Full Len (ft)	
# Barrels		1		Culv Vel US (ft/s)	11.75
Q Barrel (cfs)		1310.42		Culv Vel DS (ft/s)	14.66
E.G. US. (ft)		581.21		Culv Inv El Up (ft)	573.95
W.S. US. (ft)		580.55		Culv Inv El Dn (ft)	573.5
E.G. DS (ft)		578.64		Culv Frctn Ls (ft)	0.11
W.S. DS (ft)		576.93		Culv Exit Loss (ft)	1.64
Delta EG (ft)		2.57		Culv Entr Loss (ft)	0.82
Delta WS (ft)		3.63		Q Weir (cfs)	263.78
E.G. IC (ft)		581.21		Weir Sta Lft (ft)	399.24
E.G. OC (ft)		580.81		Weir Sta Rgt (ft)	816.58
Culvert Control		Inlet		Weir Submerg	0
Culv WS Inlet (ft)		578.24		Weir Max Depth (ft)	0.89
Culv WS Outlet (ft)		576.94		Weir Avg Depth (ft)	0.53
Culv Nml Depth (ft)		2.3		Weir Flow Area (sq ft)	129.75
Culv Crt Depth (ft)		4.29		Min El Weir Flow (ft)	580.52

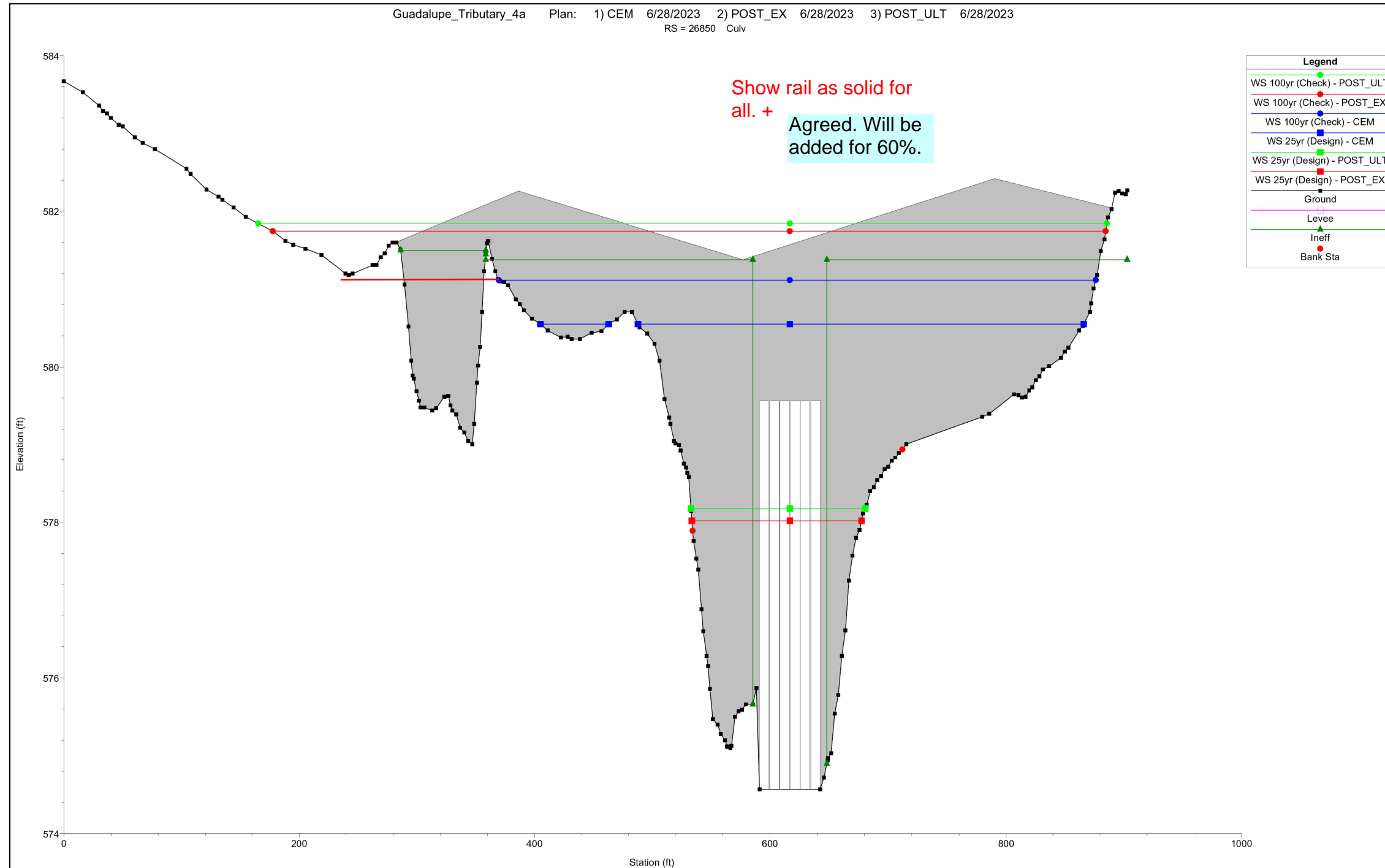
Plan: CEM	Guadalupe River	Tributary 4a	RS: 26850	Culv Group: Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)		1447.7		Culv Full Len (ft)	
# Barrels		1		Culv Vel US (ft/s)	12.15
Q Barrel (cfs)		1447.7		Culv Vel DS (ft/s)	15.06
E.G. US. (ft)		581.92		Culv Inv El Up (ft)	573.95
W.S. US. (ft)		581.12		Culv Inv El Dn (ft)	573.5
E.G. DS (ft)		580.52		Culv Frctn Ls (ft)	0.1
W.S. DS (ft)		578.18		Culv Exit Loss (ft)	0.21
Delta EG (ft)		1.4		Culv Entr Loss (ft)	1.09
Delta WS (ft)		2.94		Q Weir (cfs)	1079.84
E.G. IC (ft)		581.92		Weir Sta Lft (ft)	174.47
E.G. OC (ft)		581.29		Weir Sta Rgt (ft)	887.4
Culvert Control		Inlet		Weir Submerg	0
Culv WS Inlet (ft)		578.53		Weir Max Depth (ft)	1.6
Culv WS Outlet (ft)		577.2		Weir Avg Depth (ft)	0.78
Culv Nml Depth (ft)		2.45		Weir Flow Area (sq ft)	419.3
Culv Crt Depth (ft)		4.58		Min El Weir Flow (ft)	580.52

HEC-RAS CULVERT OUTPUT DATA - ULTIMATE PROPOSED

Plan: POST_ULT	Guadalupe River	Tributary 4a	RS: 26901	Culv Group: Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)		1675.1		Culv Full Len (ft)	
# Barrels		6		Culv Vel US (ft/s)	9.68
Q Barrel (cfs)		279.18		Culv Vel DS (ft/s)	10.39
E.G. US. (ft)		579.92		Culv Inv El Up (ft)	574.57
W.S. US. (ft)		578.88		Culv Inv El Dn (ft)	574.2
E.G. DS (ft)		578.72		Culv Frctn Ls (ft)	0.39
W.S. DS (ft)		577.39		Culv Exit Loss (ft)	0.51
Delta EG (ft)		1.2		Culv Entr Loss (ft)	0.29
Delta WS (ft)		1.49		Q Weir (cfs)	
E.G. IC (ft)		579.86		Weir Sta Lft (ft)	
E.G. OC (ft)		579.92		Weir Sta Rgt (ft)	
Culvert Control		Outlet		Weir Submerg	
Culv WS Inlet (ft)		578.17		Weir Max Depth (ft)	
Culv WS Outlet (ft)		577.56		Weir Avg Depth (ft)	
Culv Nml Depth (ft)		3.64		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)		3.36		Min El Weir Flow (ft)	581.39

Plan: POST_ULT	Guadalupe River	Tributary 4a	RS: 26901	Culv Group: Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)		2432.85		Culv Full Len (ft)	
# Barrels		6		Culv Vel US (ft/s)	10.78
Q Barrel (cfs)		405.48		Culv Vel DS (ft/s)	11.77
E.G. US. (ft)		581.9		Culv Inv El Up (ft)	574.57
W.S. US. (ft)		581.84		Culv Inv El Dn (ft)	574.2
E.G. DS (ft)		580.1		Culv Frctn Ls (ft)	0.42
W.S. DS (ft)		578.31		Culv Exit Loss (ft)	0.56
Delta EG (ft)		1.79		Culv Entr Loss (ft)	0.82
Delta WS (ft)		3.53		Q Weir (cfs)	177.55
E.G. IC (ft)		581.9		Weir Sta Lft (ft)	158.51
E.G. OC (ft)		581.67		Weir Sta Rgt (ft)	683.35
Culvert Control		Inlet		Weir Submerg	0
Culv WS Inlet (ft)		579.27		Weir Max Depth (ft)	0.72
Culv WS Outlet (ft)		578.51		Weir Avg Depth (ft)	0.29
Culv Nml Depth (ft)		4.82		Weir Flow Area (sq ft)	114.68
Culv Crt Depth (ft)		4.31		Min El Weir Flow (ft)	581.39

HEC-RAS CROSS SECTION OUTPUT



DESIGN

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JACOB J. POWELL  
P. E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JOHN A. TYLER  
P. E. SERIAL NO: 105193  
DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
CULVERT B

SHEET 4 OF 5

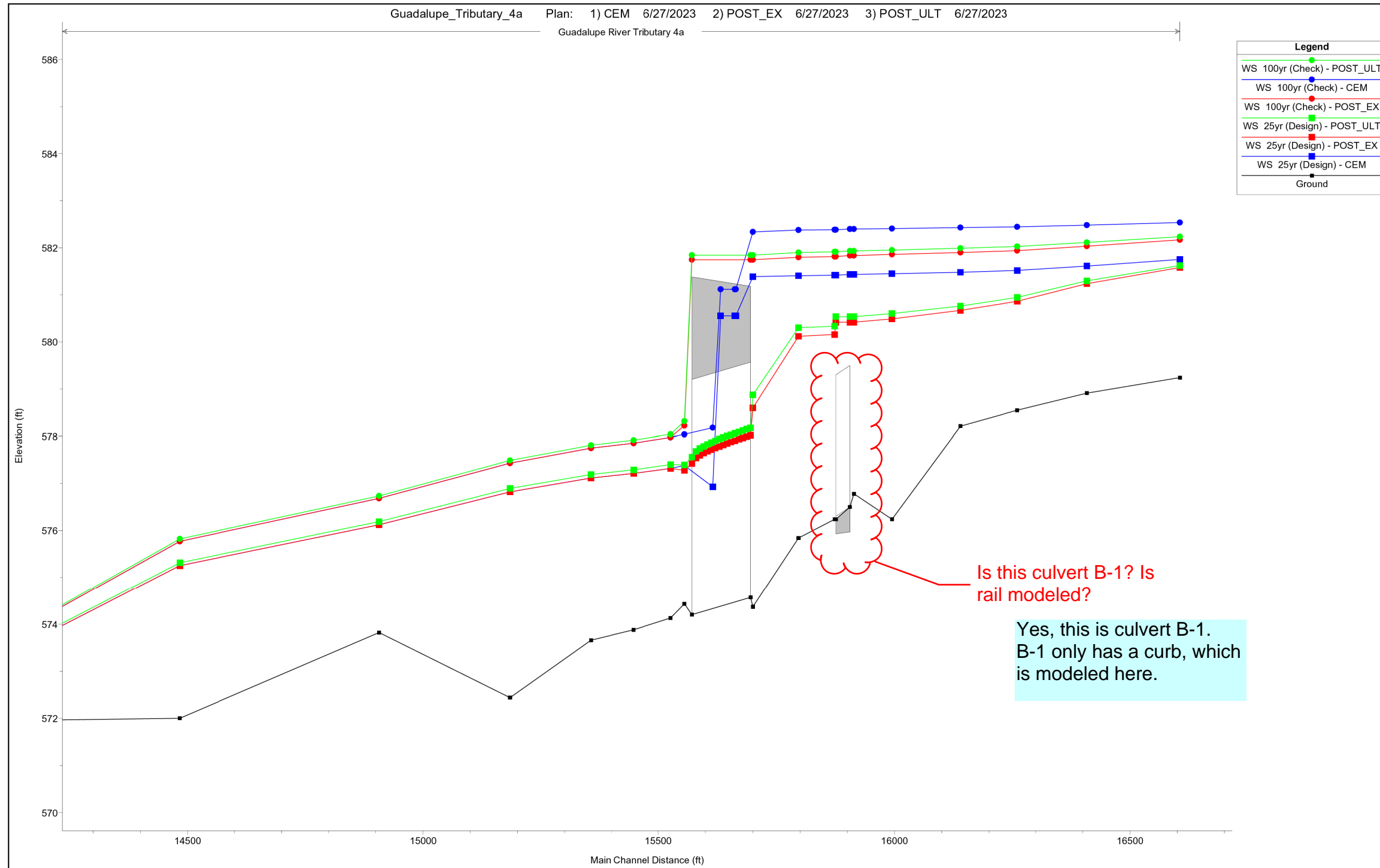
DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:	JOB NO.:	SHEET NO.:
CHK DWG:	SAT	GUADALUPE	0915	45	052	

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_B03.dgn

Plotted on: 6/30/2023

HEC-RAS PROFILE PLOT OUTPUT



Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_B04.dgn

DESIGN

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
 CULVERT B

SHEET 5 OF 5

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_B05.dgn

See comments from previous culvert



Note: Culvert B- West Drain is analyze based on ultimate conditions per City of Seguin. Proposed conditions were also compared to existing conditions to verify no adverse impact.

NOTES:

- 1. HEC-RAS VERSION 6.3.1 USED FOR HYDRAULIC CALCULATIONS.
- 2. 1-FT CONTOURS FROM 2017 STRATMAP CENTRAL TEXAS LIDAR DATASET.
- 3. FOR CULVERTS CROSSING CORDOVA RD, 25YR AEP STORM USED FOR DESIGN, PER CITY OF SEGUIN CRITERIA.

DESIGN

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

CULVERT LOCATION  
RS 26850  
CORDOVA RD

RS 494

RS 394

RS 279

RS 182

RS 111

REV. NO.	DATE	DESCRIPTION	BY
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SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
CULVERT B - WEST DRAIN

SHEET 1 OF 3

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

HEC-RAS OUTPUT

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_B06.dgn

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W. S. Elev (ft)	Crit W. S. (ft)	E. G. Elev (ft)	E. G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
494	5yr	PRE	391.5	577.33	580.64		580.9	0.003505	4.2	105.44	197.82	0.5
494	5yr	POST_EX	391.5	577.33	580.64		580.9	0.003511	4.2	105.35	197.55	0.5
494	5yr	POST_ULI	436.7	577.33	580.78	579.94	581.04	0.003334	4.27	122.33	241.6	0.49
494	10yr	PRE	566.3	577.33	581.17		581.33	0.002112	3.76	251.13	429.06	0.4
494	10yr	POST_EX	566.3	577.33	581.15		581.32	0.002251	3.86	241.36	415.2	0.41
494	10yr	POST_ULI	616.3	577.33	581.26		581.41	0.001953	3.7	290.76	466.53	0.39
494	25yr (Design)	PRE	832.9	577.33	581.73		581.8	0.000979	2.9	552.42	637.75	0.28
494	25yr (Design)	POST_EX	832.9	577.33	581.62		581.71	0.00134	3.32	480.87	600.27	0.33
494	25yr (Design)	POST_ULI	886.5	577.33	581.69		581.78	0.001249	3.25	524.7	620.69	0.32
494	50yr	PRE	1055	577.33	582.11		582.16	0.000672	2.59	849.04	922.28	0.24
494	50yr	POST_EX	1055	577.33	581.85		581.93	0.001215	3.31	630.58	743.54	0.32
494	50yr	POST_ULI	1109.5	577.33	581.89		581.98	0.001184	3.3	666.39	784.04	0.31
494	100yr (Check)	PRE	1316	577.33	582.49		582.52	0.000412	2.16	1217.19	1011.68	0.19
494	100yr (Check)	POST_EX	1316	577.33	582.12		582.19	0.001034	3.21	857.22	924.31	0.3
494	100yr (Check)	POST_ULI	1369.7	577.33	582.19		582.25	0.00093	3.08	920.4	935.47	0.28
394	5yr	PRE	391.5	577.08	580.15		580.48	0.004851	4.65	85.77	130.52	0.58
394	5yr	POST_EX	391.5	577.08	580.15		580.48	0.004878	4.66	85.57	129.3	0.58
394	5yr	POST_ULI	436.7	577.08	580.27		580.63	0.004878	4.85	94.82	153.48	0.59
394	10yr	PRE	566.3	577.08	580.71		581.04	0.003711	4.8	143.87	230.12	0.53
394	10yr	POST_EX	566.3	577.08	580.6	579.89	580.99	0.004563	5.16	128.35	210.4	0.58
394	10yr	POST_ULI	616.3	577.08	580.7	580.03	581.1	0.004477	5.26	142.46	228.96	0.58
394	25yr (Design)	PRE	832.9	577.08	581.53		581.67	0.001506	3.68	410.53	639.36	0.35
394	25yr (Design)	POST_EX	832.9	577.08	581.08	580.77	581.47	0.004046	5.48	212.32	340.27	0.56
394	25yr (Design)	POST_ULI	886.5	577.08	581.17	580.88	581.54	0.003884	5.48	234.98	374.75	0.56
394	50yr	PRE	1055	577.08	582.03		582.08	0.00071	2.77	784.06	836.34	0.25
394	50yr	POST_EX	1055	577.08	581.42	581.3	581.72	0.003163	5.22	344.19	534.12	0.51
394	50yr	POST_ULI	1109.5	577.08	581.58		581.8	0.002387	4.67	440.41	670.2	0.44
394	100yr (Check)	PRE	1316	577.08	582.44		582.48	0.000424	2.29	1166.89	964.45	0.19
394	100yr (Check)	POST_EX	1316	577.08	581.96		582.07	0.00132	3.73	727.29	818.55	0.34
394	100yr (Check)	POST_ULI	1369.7	577.08	582.05		582.14	0.001124	3.5	805.33	844.36	0.31
279	5yr	PRE	391.5	576.31	579.57		579.88	0.005501	4.5	90.23	129.62	0.6
279	5yr	POST_EX	391.5	576.31	579.56		579.87	0.005651	4.55	89.2	128.82	0.61
279	5yr	POST_ULI	436.7	576.31	579.68		580.01	0.005766	4.68	97.11	134.89	0.62
279	10yr	PRE	566.3	576.31	580.39		580.61	0.003227	3.93	161.93	202.81	0.48
279	10yr	POST_EX	566.3	576.31	580.01		580.38	0.006122	4.93	122.01	160.86	0.64
279	10yr	POST_ULI	616.3	576.31	580.12		580.49	0.006105	5.01	131.9	172.34	0.64
279	25yr (Design)	PRE	832.9	576.31	581.46		581.53	0.000817	2.6	547.14	631.32	0.26
279	25yr (Design)	POST_EX	832.9	576.31	580.57		580.95	0.005032	5.18	184.77	220.19	0.6
279	25yr (Design)	POST_ULI	886.5	576.31	580.68		581.05	0.004687	5.16	200.96	252.85	0.59
279	50yr	PRE	1055	576.31	581.98		582.01	0.000431	2.09	914.11	802.22	0.19
279	50yr	POST_EX	1055	576.31	581.16		581.37	0.002544	4.29	372.85	502.34	0.45
279	50yr	POST_ULI	1109.5	576.31	581.4		581.55	0.001662	3.67	513.84	620.53	0.37
279	100yr (Check)	PRE	1316	576.31	582.41		582.44	0.000285	1.83	1288.78	922.21	0.16
279	100yr (Check)	POST_EX	1316	576.31	581.87		581.94	0.00082	2.82	829.6	743.57	0.26
279	100yr (Check)	POST_ULI	1369.7	576.31	581.97		582.03	0.00072	2.7	907.71	774.48	0.25
182	5yr	PRE	391.5	576.18	579.2		579.43	0.003677	4	114.62	160.75	0.5
182	5yr	POST_EX	391.5	576.18	579.14		579.39	0.004156	4.19	108.29	154.99	0.53
182	5yr	POST_ULI	436.7	576.18	579.3		579.54	0.003828	4.16	124.63	170.75	0.52
182	10yr	PRE	566.3	576.18	580.31		580.39	0.001214	2.65	272.58	330.27	0.3
182	10yr	POST_EX	566.3	576.18	579.73		579.92	0.003091	3.86	176.74	203.73	0.47
182	10yr	POST_ULI	616.3	576.18	579.86		580.04	0.002921	3.82	194.33	211.85	0.46
182	25yr (Design)	PRE	832.9	576.18	581.45		581.47	0.000264	1.6	856.56	646.66	0.15
182	25yr (Design)	POST_EX	832.9	576.18	580.37		580.55	0.002574	3.92	290.28	377.84	0.44
182	25yr (Design)	POST_ULI	886.5	576.18	580.52		580.69	0.002276	3.83	338.03	415.88	0.42
182	50yr	PRE	1055	576.18	581.97		581.98	0.000176	1.43	1245.43	851.15	0.12
182	50yr	POST_EX	1055	576.18	581.13		581.2	0.000854	2.7	661.21	597.63	0.26
182	50yr	POST_ULI	1109.5	576.18	581.39		581.43	0.000528	2.23	818.96	634.1	0.21
182	100yr (Check)	PRE	1316	576.18	582.4		582.41	0.000142	1.37	1638.69	951.55	0.11
182	100yr (Check)	POST_EX	1316	576.18	581.85		581.88	0.000336	1.93	1146.84	800.35	0.17
182	100yr (Check)	POST_ULI	1369.7	576.18	581.95		581.98	0.000305	1.87	1231.47	841.3	0.16
111	5yr	PRE	391.5	575.78	578.82	578.11	579.15	0.003736	4.66	89.68	109.66	0.59
111	5yr	POST_EX	391.5	575.78	578.57	578.11	579.02	0.005606	5.42	74.34	67.36	0.71
111	5yr	POST_ULI	436.7	575.78	578.75	578.28	579.2	0.005201	5.42	85.04	95.12	0.69
111	10yr	PRE	566.3	575.78	580.21	578.71	580.31	0.000935	2.84	249.71	243.85	0.31
111	10yr	POST_EX	566.3	575.78	579.24	578.71	579.64	0.004183	5.25	123.74	157.91	0.63
111	10yr	POST_ULI	616.3	575.78	579.42	578.84	579.79	0.003855	5.08	142.55	172.08	0.61
111	25yr (Design)	PRE	832.9	575.78	581.41	579.42	581.45	0.00029	2.04	729.79	692.24	0.18
111	25yr (Design)	POST_EX	832.9	575.78	580.12	579.42	580.37	0.002344	4.39	234.88	235.12	0.49
111	25yr (Design)	POST_ULI	886.5	575.78	580.3	579.52	580.53	0.001985	4.23	265.19	254.36	0.45
111	50yr	PRE	1055	575.78	581.94	579.68	581.97	0.000205	1.87	1130.57	846.21	0.16
111	50yr	POST_EX	1055	575.78	580.98	579.68	581.12	0.001038	3.55	470.81	498.73	0.34
111	50yr	POST_ULI	1109.5	575.78	581.3	579.74	581.39	0.000637	2.96	654.98	660.47	0.27
111	100yr (Check)	PRE	1316	575.78	582.38	579.95	582.4	0.000155	1.73	1520.28	936.46	0.14
111	100yr (Check)	POST_EX	1316	575.78	581.8	579.95	581.85	0.000361	2.43	1014.64	801.63	0.21
111	100yr (Check)	POST_ULI	1369.7	575.78	581.9	580	581.95	0.000373	2.5	1096.92	839.16	0.21

DESIGN

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

**INTERIM REVIEW**

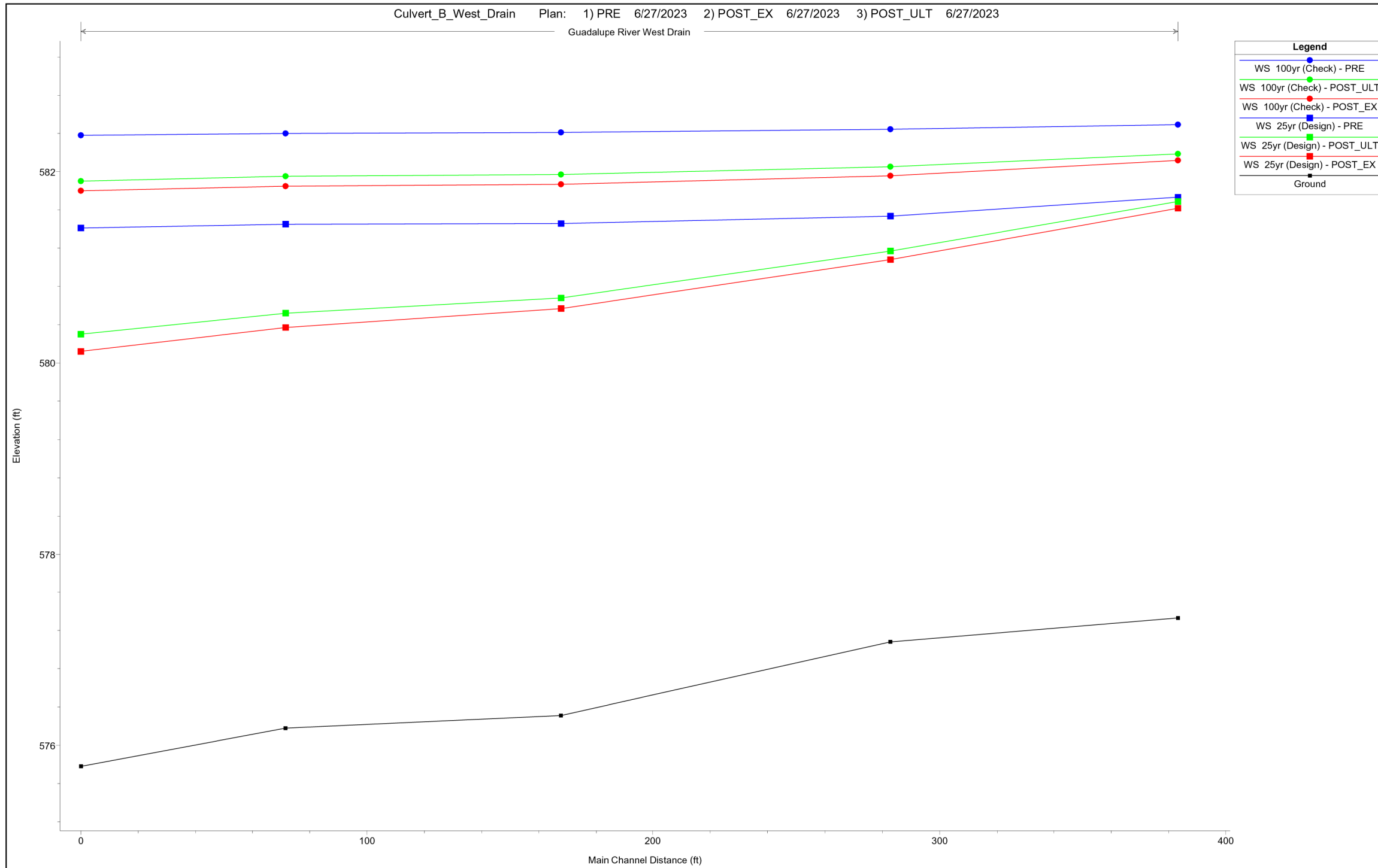
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
 SAN ANTONIO   AUSTIN   HOUSTON   FORT WORTH   DALLAS 2000 NW LOOP 410   SAN ANTONIO, TX 78213   210.375.9000 <small>TEXAS ENGINEERING FIRM #470   TEXAS SURVEYING FIRM #10028800</small>			
 © 2023			
HYDRAULIC DATA SHEET CULVERT B - WEST DRAIN			
SHEET 2 OF 3			
DON:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.
CHK DGN:	6	TEXAS	\$PROJNUM\$
DGN:	DIST.	COUNTY	CONT. NO. SECT. NO. JOB NO.
CHK DWG:	SAT	GUADALUPE	0915 45 052



Plotted on: 6/30/2023

HEC-RAS PROFILE PLOT OUTPUT



Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_B07.dgn

DESIGN

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



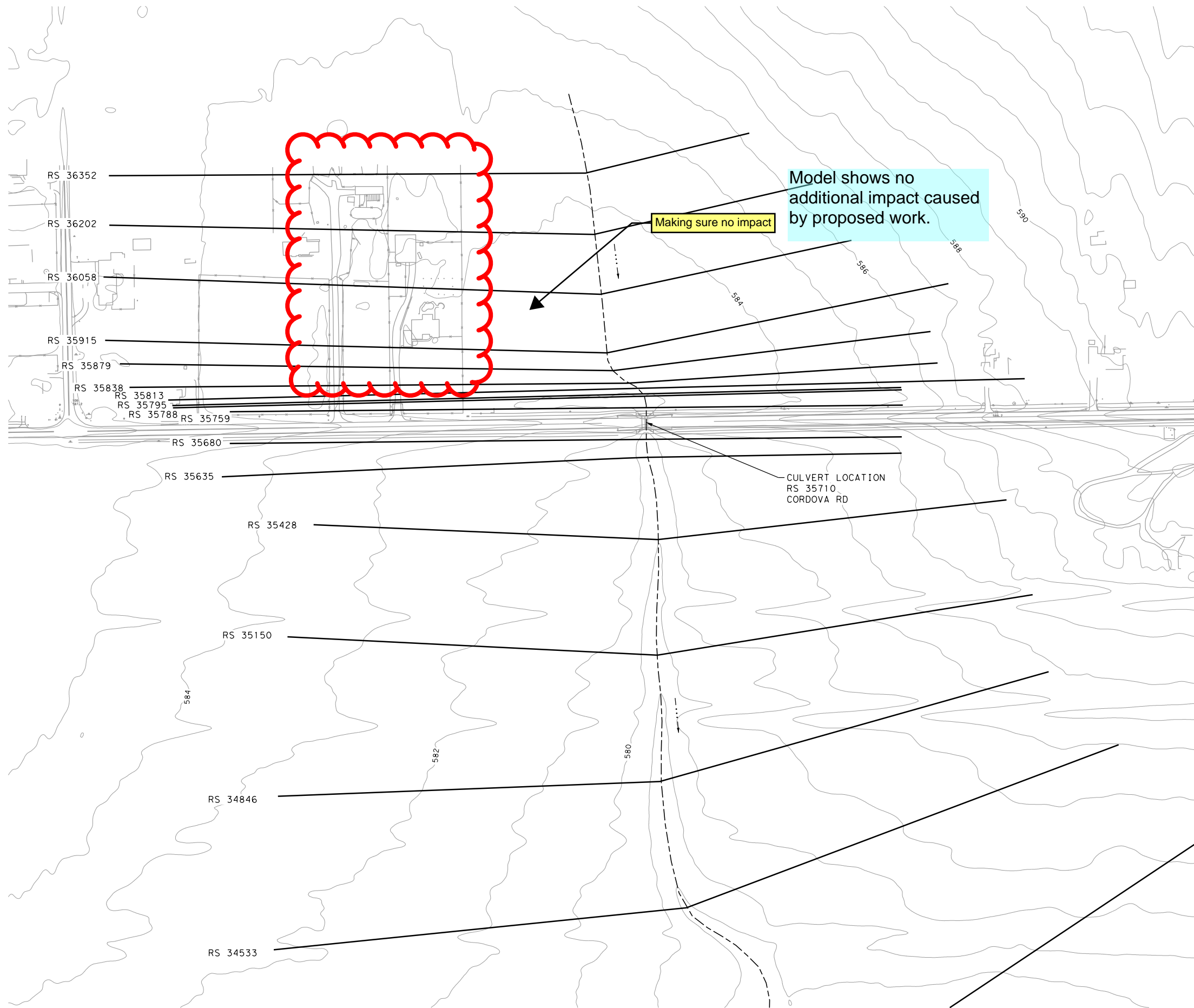
**HYDRAULIC DATA SHEET  
 CULVERT B - WEST DRAIN**

SHEET 3 OF 3

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_C01.dgn



Note: Culvert C is sized based on ultimate conditions per City of Seguin. Proposed conditions were also compared to existing conditions to verify no adverse impact.

NOTES:

1. HEC-RAS VERSION 6.3.1 USED FOR HYDRAULIC CALCULATIONS.
2. 1-FT CONTOURS FROM 2017 STRATMAP CENTRAL TEXAS LIDAR DATASET.
3. FOR CULVERTS CROSSING CORDOVA RD, 25YR AEP STORM USED FOR DESIGN, PER CITY OF SEGUIN CRITERIA.

DESIGN

INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JACOB J. POWELL  
P.E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JOHN A. TYLER  
P.E. SERIAL NO: 105193  
DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
CULVERT C

SHEET 1 OF 5

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	

HEC-RAS OUTPUT

Plotted on: 6/30/2023

Design File name: P:\127.75\00\Design\Civil\Drainage\1277500\_hyd\_C02.dgn

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W. S. Elev (ft)	Crit W. S. (ft)	E. G. Elev (ft)	E. G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
36352	5yr	CEM	162.9	584.14	584.46	584.32	584.48	0.002925	0.75	186.18	782.25	0.31
36352	5yr	POST_EX	162.9	584.14	584.54	584.32	584.55	0.002174	0.75	179.45	923.85	0.27
36352	5yr	POST_U LT	191.6	584.14	584.57	584.34	584.59	0.002275	0.84	199.77	945.2	0.29
36352	10yr	CEM	222.3	584.14	584.54	584.34	584.55	0.002797	0.85	252.05	922.31	0.31
36352	10yr	POST_EX	222.3	584.14	584.35	584.35	584.48	0.027246	1.83	84.81	588.68	0.88
36352	10yr	POST_U LT	252.2	584.14	584.6	584.4	584.62	0.01831	0.81	313.51	964	0.26
36352	25yr (Design)	CEM	326.1	584.14	584.6	584.44	584.61	0.003321	1.07	305.42	958.09	0.35
36352	25yr (Design)	POST_EX	326.1	584.14	584.67	584.44	584.68	0.001758	0.9	375.56	1001.52	0.26
36352	25yr (Design)	POST_U LT	358.7	584.14	584.69	584.46	584.71	0.001727	0.94	401.71	1015.26	0.27
36352	50yr	CEM	400.6	584.14	584.65	584.46	584.67	0.003172	1.16	354.51	990.47	0.35
36352	50yr	POST_EX	400.6	584.14	584.73	584.49	584.74	0.001688	0.98	434.99	1034.74	0.27
36352	50yr	POST_U LT	433.4	584.14	584.75	584.5	584.76	0.0017	1.02	459.12	1059.8	0.27
36352	100yr (Check)	CEM	481.5	584.14	584.71	584.5	584.73	0.002725	1.21	419.64	1026.56	0.34
36352	100yr (Check)	POST_EX	481.5	584.14	584.79	584.53	584.8	0.001626	1.05	498.98	1081.07	0.27
36352	100yr (Check)	POST_U LT	514.5	584.14	584.81	584.55	584.83	0.001576	1.07	529.87	1112.19	0.27

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W. S. Elev (ft)	Crit W. S. (ft)	E. G. Elev (ft)	E. G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
35813	5yr	CEM	162.9	582.84	583.58	583.24	583.62	0.002464	1.6	101.51	915.59	0.35
35813	5yr	POST_EX	162.9	582.14	582.76	582.76	583.05	0.021341	4.33	37.6	64.32	1
35813	5yr	POST_U LT	191.6	582.14	582.92	582.92	583.15	0.022253	3.84	49.85	246.74	0.98
35813	10yr	CEM	222.3	582.84	583.82	583.32	583.86	0.001666	1.62	137.59	1035.32	0.3
35813	10yr	POST_EX	222.3	582.14	582.97	582.97	583.22	0.023042	4.02	55.29	321.99	1.01
35813	10yr	POST_U LT	252.2	582.14	583.05	583.05	583.28	0.022697	3.9	64.72	386.17	1
35813	25yr (Design)	CEM	326.1	582.84	584.21	583.44	584.21	0.000075	0.44	893.22	1335.71	0.07
35813	25yr (Design)	POST_EX	326.1	582.14	583.13	583.13	583.41	0.021493	4.25	76.76	487.66	1
35813	25yr (Design)	POST_U LT	358.7	582.14	583.17	583.17	583.47	0.018814	4.24	84.59	572.27	0.95
35813	50yr	CEM	400.6	582.84	584.31	583.51	584.32	0.000082	0.48	996.81	1382.02	0.07
35813	50yr	POST_EX	400.6	582.14	583.28	583.28	583.55	0.015014	4.14	96.71	628.5	0.87
35813	50yr	POST_U LT	433.4	582.14	583.36	583.25	583.61	0.012289	4.03	107.67	658.99	0.8
35813	100yr (Check)	CEM	481.5	582.84	584.42	583.59	584.42	0.000062	0.43	1380.39	1426.91	0.06
35813	100yr (Check)	POST_EX	481.5	582.14	583.5	583.3	583.72	0.009009	3.83	125.88	841.54	0.7
35813	100yr (Check)	POST_U LT	514.5	582.14	583.59	583.34	583.81	0.007374	3.7	139.1	923.01	0.64

DESIGN

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



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Texas Department of Transportation  
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HYDRAULIC DATA SHEET  
CULVERT C

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_CO2.dgn

River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W. S. Elev (ft)	Crit W. S. (ft)	E. G. Elev (ft)	E. G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
35150	5yr	CEM	162.9	579.27	580.48		580.52	0.002325	1.63	99.79	176.54	0.38
35150	5yr	POST_EX	162.9	579.27	580.48		580.52	0.002325	1.63	99.78	176.52	0.38
35150	5yr	POST_ULT	191.6	579.27	580.57		580.61	0.002198	1.63	117.88	201.27	0.37
35150	10yr	CEM	222.3	579.27	580.65		580.69	0.002156	1.65	134.78	221.9	0.37
35150	10yr	POST_EX	222.3	579.27	580.65		580.69	0.00216	1.65	134.68	221.77	0.37
35150	10yr	POST_ULT	252.2	579.27	580.71		580.75	0.002134	1.71	147.39	244.91	0.38
35150	25yr (Design)	CEM	326.1	579.27	580.83		580.88	0.001958	1.85	182.33	320.12	0.37
35150	25yr (Design)	POST_EX	326.1	579.27	580.83		580.88	0.001957	1.85	182.37	320.2	0.37
35150	25yr (Design)	POST_ULT	358.7	579.27	580.88		580.93	0.001939	1.91	197.4	348.04	0.37
35150	50yr	CEM	400.6	579.27	580.93		580.99	0.001909	1.98	217.56	384.33	0.37
35150	50yr	POST_EX	400.6	579.27	580.93		580.99	0.001909	1.98	217.58	384.37	0.37
35150	50yr	POST_ULT	433.4	579.27	580.97		581.04	0.001866	2.02	234.95	416.39	0.37
35150	100yr (Check)	CEM	481.5	579.27	581.03		581.09	0.001859	2.09	258.85	474.86	0.37
35150	100yr (Check)	POST_EX	481.5	579.27	581.03		581.09	0.001859	2.09	258.88	474.94	0.37
35150	100yr (Check)	POST_ULT	514.5	579.27	581.07		581.13	0.001836	2.13	276.73	503.75	0.37
34846	5yr	CEM	162.9	578.42	579.81		579.86	0.002057	1.71	95.46	144.14	0.37
34846	5yr	POST_EX	162.9	578.42	579.81		579.86	0.002058	1.71	95.43	144.09	0.37
34846	5yr	POST_ULT	191.6	578.42	579.9		579.95	0.002178	1.75	109.6	166.61	0.38
34846	10yr	CEM	222.3	578.42	579.97		580.02	0.002249	1.82	121.88	178.07	0.39
34846	10yr	POST_EX	222.3	578.42	579.97		580.02	0.002247	1.82	121.91	178.09	0.39
34846	10yr	POST_ULT	252.2	578.42	580.03		580.09	0.002292	1.9	132.46	184.08	0.4
34846	25yr (Design)	CEM	326.1	578.42	580.17		580.24	0.002343	2.03	160.54	221.3	0.41
34846	25yr (Design)	POST_EX	326.1	578.42	580.17		580.24	0.002343	2.03	160.54	221.3	0.41
34846	25yr (Design)	POST_ULT	358.7	578.42	580.22		580.29	0.00235	2.11	170.87	238.9	0.41
34846	50yr	CEM	400.6	578.42	580.27		580.34	0.002388	2.22	183.6	254.34	0.42
34846	50yr	POST_EX	400.6	578.42	580.27		580.34	0.002391	2.22	183.52	254.3	0.42
34846	50yr	POST_ULT	433.4	578.42	580.31		580.39	0.00236	2.28	194.92	261.16	0.42
34846	100yr (Check)	CEM	481.5	578.42	580.37		580.45	0.002392	2.38	209.66	288.93	0.43
34846	100yr (Check)	POST_EX	481.5	578.42	580.37		580.45	0.002391	2.38	209.71	289.02	0.43
34846	100yr (Check)	POST_ULT	514.5	578.42	580.4		580.49	0.002396	2.44	220.93	315.27	0.43
34533	5yr	CEM	162.9	577.7	578.92		578.98	0.004006	1.95	83.43	169.68	0.49
34533	5yr	POST_EX	162.9	577.7	578.92		578.98	0.004001	1.95	83.46	169.7	0.49
34533	5yr	POST_ULT	191.6	577.7	578.98	578.68	579.04	0.003984	2.05	93.29	177.37	0.5
34533	10yr	CEM	222.3	577.7	579.03	578.73	579.1	0.004049	2.18	102.33	191.79	0.51
34533	10yr	POST_EX	222.3	577.7	579.03	578.73	579.1	0.004054	2.18	102.29	191.73	0.51
34533	10yr	POST_ULT	252.2	577.7	579.08	578.8	579.16	0.003937	2.27	112.26	206.32	0.51
34533	25yr (Design)	CEM	326.1	577.7	579.17	578.91	579.27	0.004183	2.56	130.98	220.85	0.53
34533	25yr (Design)	POST_EX	326.1	577.7	579.17	578.91	579.27	0.004171	2.56	131.11	221.08	0.53
34533	25yr (Design)	POST_ULT	358.7	577.7	579.2	578.94	579.31	0.004266	2.67	139.15	229.7	0.54
34533	50yr	CEM	400.6	577.7	579.25	578.98	579.37	0.004295	2.79	150.18	241.57	0.55
34533	50yr	POST_EX	400.6	577.7	579.25	578.98	579.37	0.00429	2.79	150.24	241.64	0.55
34533	50yr	POST_ULT	433.4	577.7	579.28	579.02	579.41	0.004322	2.88	158.8	254.04	0.56
34533	100yr (Check)	CEM	481.5	577.7	579.34	579.07	579.48	0.004179	2.97	174.28	275.31	0.55
34533	100yr (Check)	POST_EX	481.5	577.7	579.34	579.07	579.48	0.004182	2.97	174.23	275.27	0.55
34533	100yr (Check)	POST_ULT	514.5	577.7	579.37	579.1	579.51	0.004215	3.05	182.71	282.41	0.56

DESIGN

**INTERIM REVIEW**

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P. E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

**INTERIM REVIEW**

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 ENGINEER: JOHN A. TYLER  
 P. E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



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**HYDRAULIC DATA SHEET  
CULVERT C**

SHEET 3 OF 5

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.			HIGHWAY NO.
CHK DGN:	6	TEXAS	\$PROJNUM\$			CORDOVA RD
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	

HEC-RAS CULVERT OUTPUT DATA - EXISTING

Plan: CEM	WALNUT BRANCH	Reach-1	RS: 35710	Culv Group: Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)		273.18		Culv Full Len (ft)	
# Barrels		3		Culv Vel US (ft/s)	8.37
Q Barrel (cfs)		91.06		Culv Vel DS (ft/s)	11.12
E.G. US. (ft)		584.2		Culv Inv El Up (ft)	580.5
W.S. US. (ft)		584.17		Culv Inv El Dn (ft)	579.95
E.G. DS (ft)		582.72		Culv Frctn Ls (ft)	0.26
W.S. DS (ft)		582.06		Culv Exit Loss (ft)	0.79
Delta EG (ft)		1.48		Culv Entr Loss (ft)	0.44
Delta WS (ft)		2.11		Q Weir (cfs)	52.92
E.G. IC (ft)		584.01		Weir Sta Lft (ft)	707.08
E.G. OC (ft)		584.2		Weir Sta Rgt (ft)	975.44
Culvert Control		Outlet		Weir Submerg	0
Culv WS Inlet (ft)		582.68		Weir Max Depth (ft)	0.3
Culv WS Outlet (ft)		581.59		Weir Avg Depth (ft)	0.17
Culv Nml Depth (ft)		1.35		Weir Flow Area (sq ft)	46.67
Culv Crt Depth (ft)		2.18		Min El Weir Flow (ft)	583.91

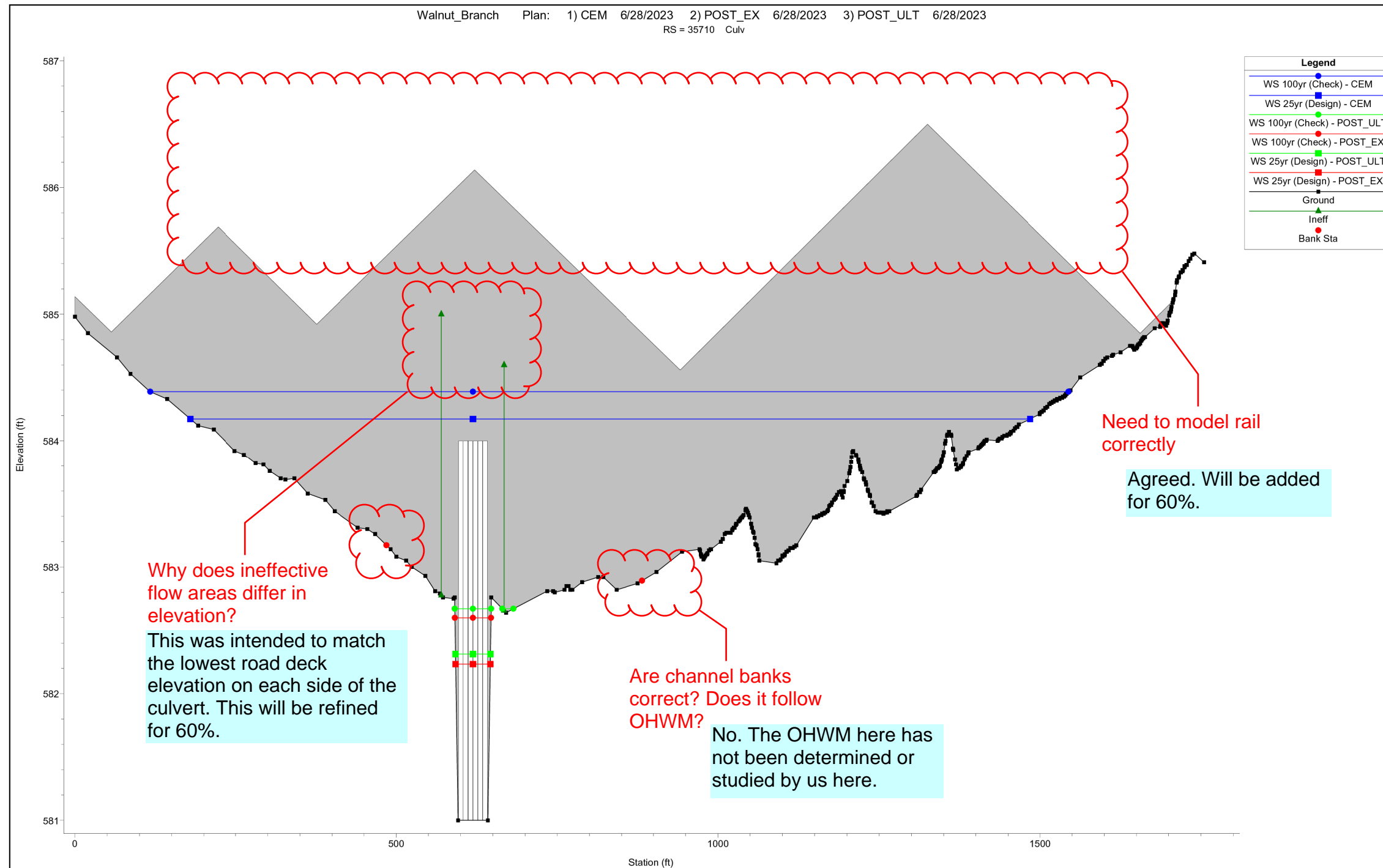
Plan: CEM	WALNUT BRANCH	Reach-1	RS: 35710	Culv Group: Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)		297.6		Culv Full Len (ft)	
# Barrels		3		Culv Vel US (ft/s)	8.61
Q Barrel (cfs)		99.2		Culv Vel DS (ft/s)	11.36
E.G. US. (ft)		584.42		Culv Inv El Up (ft)	580.5
W.S. US. (ft)		584.39		Culv Inv El Dn (ft)	579.95
E.G. DS (ft)		583.3		Culv Frctn Ls (ft)	0.25
W.S. DS (ft)		582.44		Culv Exit Loss (ft)	0.41
Delta EG (ft)		1.12		Culv Entr Loss (ft)	0.46
Delta WS (ft)		1.94		Q Weir (cfs)	183.9
E.G. IC (ft)		584.35		Weir Sta Lft (ft)	549.03
E.G. OC (ft)		584.42		Weir Sta Rgt (ft)	1056.23
Culvert Control		Outlet		Weir Submerg	0
Culv WS Inlet (ft)		582.8		Weir Max Depth (ft)	0.52
Culv WS Outlet (ft)		581.7		Weir Avg Depth (ft)	0.32
Culv Nml Depth (ft)		1.43		Weir Flow Area (sq ft)	120.76
Culv Crt Depth (ft)		2.3		Min El Weir Flow (ft)	583.91

HEC-RAS CULVERT OUTPUT DATA - ULTIMATE PROPOSED

Plan: POST_ULT	WALNUT BRANCH	Reach-1	RS: 35710	Culv Group: Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)		358.7		Culv Full Len (ft)	
# Barrels		6		Culv Vel US (ft/s)	6.5
Q Barrel (cfs)		59.78		Culv Vel DS (ft/s)	5.36
E.G. US. (ft)		583.07		Culv Inv El Up (ft)	581
W.S. US. (ft)		582.86		Culv Inv El Dn (ft)	580.6
E.G. DS (ft)		582.42		Culv Frctn Ls (ft)	0.33
W.S. DS (ft)		582.19		Culv Exit Loss (ft)	0.21
Delta EG (ft)		0.64		Culv Entr Loss (ft)	0.1
Delta WS (ft)		0.67		Q Weir (cfs)	
E.G. IC (ft)		583.07		Weir Sta Lft (ft)	
E.G. OC (ft)		583.1		Weir Sta Rgt (ft)	
Culvert Control		Inlet		Weir Submerg	
Culv WS Inlet (ft)		582.31		Weir Max Depth (ft)	
Culv WS Outlet (ft)		582.19		Weir Avg Depth (ft)	
Culv Nml Depth (ft)		1.26		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)		1.31		Min El Weir Flow (ft)	584.61

Plan: POST_ULT	WALNUT BRANCH	Reach-1	RS: 35710	Culv Group: Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)		514.5		Culv Full Len (ft)	
# Barrels		6		Culv Vel US (ft/s)	7.33
Q Barrel (cfs)		85.75		Culv Vel DS (ft/s)	6.85
E.G. US. (ft)		583.63		Culv Inv El Up (ft)	581
W.S. US. (ft)		583.46		Culv Inv El Dn (ft)	580.6
E.G. DS (ft)		582.76		Culv Frctn Ls (ft)	0.39
W.S. DS (ft)		582.39		Culv Exit Loss (ft)	0.36
Delta EG (ft)		0.88		Culv Entr Loss (ft)	0.13
Delta WS (ft)		1.08		Q Weir (cfs)	
E.G. IC (ft)		583.63		Weir Sta Lft (ft)	
E.G. OC (ft)		583.67		Weir Sta Rgt (ft)	
Culvert Control		Inlet		Weir Submerg	
Culv WS Inlet (ft)		582.67		Weir Max Depth (ft)	
Culv WS Outlet (ft)		582.39		Weir Avg Depth (ft)	
Culv Nml Depth (ft)		1.6		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)		1.67		Min El Weir Flow (ft)	584.61

HEC-RAS CROSS SECTION OUTPUT



DESIGN

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P. E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

INTERIM REVIEW

DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P. E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



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HYDRAULIC DATA SHEET  
 CULVERT C

SHEET 4 OF 5

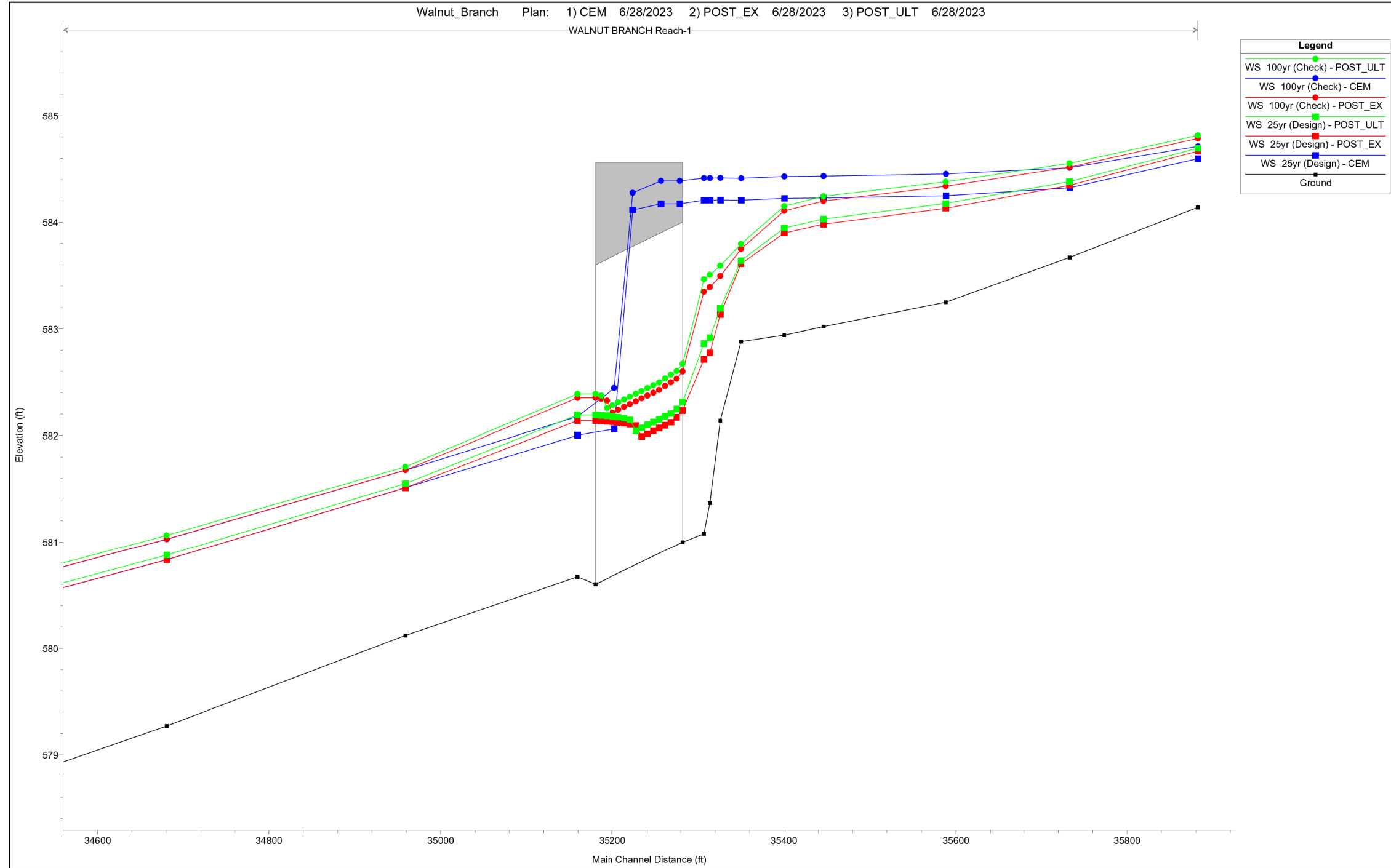
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CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:	JOB NO.:	SHEET NO.:
CHK DWG:	SAT	GUADALUPE	0915	45	052	

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_C03.dgn

Plotted on: 6/30/2023

HEC-RAS PROFILE PLOT OUTPUT



DESIGN

INTERIM REVIEW  
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ENGINEER: JACOB J. POWELL  
P. E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
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ENGINEER: JOHN A. TYLER  
P. E. SERIAL NO: 105193  
DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
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SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
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HYDRAULIC DATA SHEET  
CULVERT C

SHEET 5 OF 5

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_C04.dgn

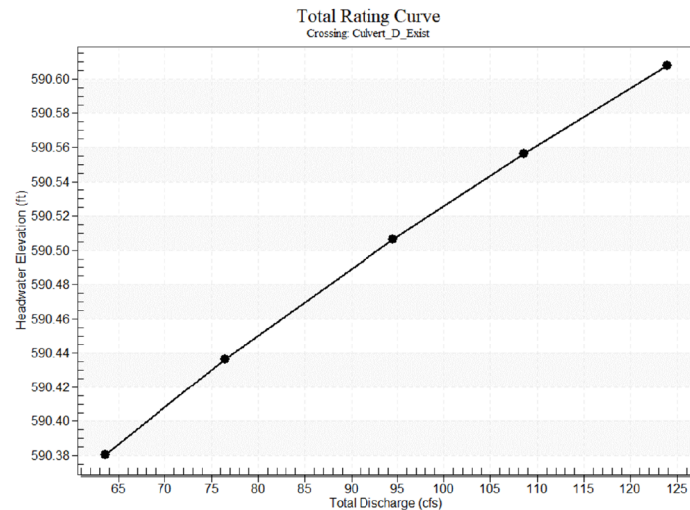
Plotted on: 6/30/2023

Design File name: P:\1275\00\Design\Civil\Drainage\1277500\_hyd\_D01.dgn

**Crossing Discharge Data**

Discharge Selection Method: Recurrence

**Rating Curve Plot for Crossing: Culvert\_D\_Exist**



**Table 1 - Summary of Culvert Flows at Crossing: Culvert\_D\_Exist**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert_D_Exist Discharge (cfs)	Roadway Discharge (cfs)	Iterations
590.38	5 year	63.60	26.12	37.45	8
590.44	10 year	76.50	25.60	50.89	5
590.51	25 year	94.50	24.94	69.53	4
590.56	50 year	108.60	24.47	84.12	4
590.61	100 year	123.90	24.01	99.89	4
590.13	Overtopping	32.58	32.58	0.00	Overtopping

**Culvert Data: Culvert\_D\_Exist**

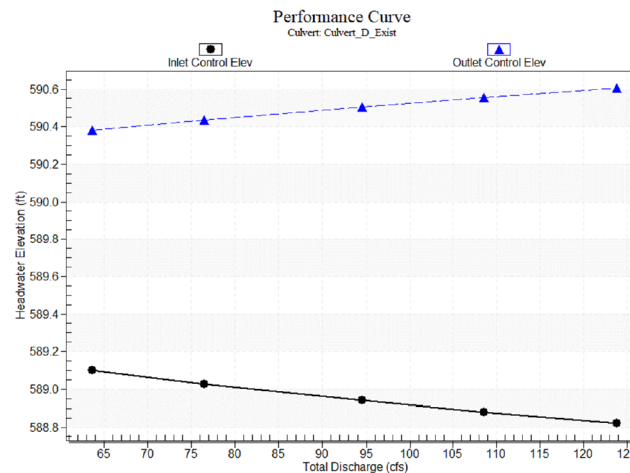
**Table 2 - Culvert Summary Table: Culvert\_D\_Exist**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	63.60 cfs	26.12 cfs	590.38	2.94	4.221	4-FFF	-1.00	1.36	1.85	2.01	5.95	2.31
10 year	76.50 cfs	25.60 cfs	590.44	2.87	4.277	4-FFF	-1.00	1.34	1.85	2.15	5.83	2.42
25 year	94.50 cfs	24.94 cfs	590.51	2.78	4.346	4-FFF	-1.00	1.32	1.85	2.33	5.68	2.55
50 year	108.60 cfs	24.47 cfs	590.56	2.72	4.396	4-FFF	-1.00	1.31	1.85	2.45	5.58	2.64
100 year	123.90 cfs	24.01 cfs	590.61	2.66	4.448	4-FFF	-1.00	1.29	1.85	2.58	5.47	2.73

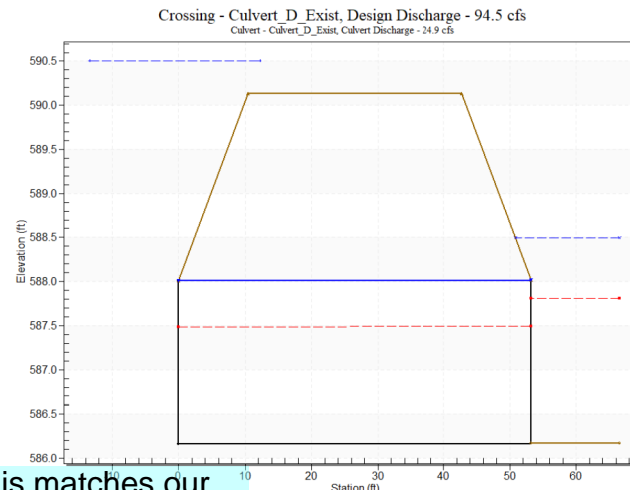
**Culvert Barrel Data**

Culvert Barrel Type: Straight Culvert  
 Inlet Elevation (invert): 586.16 ft,  
 Outlet Elevation (invert): 586.17 ft  
 Culvert Length: 53.20 ft,  
 Culvert Slope: -0.0002

**Culvert Performance Curve Plot: Culvert\_D\_Exist**



**Water Surface Profile Plot for Culvert: Culvert\_D\_Exist**



This matches our survey elevations.

Is this correct, negative slope

**Site Data - Culvert\_D\_Exist**

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 586.16 ft  
 Outlet Station: 53.20 ft  
 Outlet Elevation: 586.17 ft  
 Number of Barrels: 1

**Culvert Data Summary - Culvert\_D\_Exist**

Barrel Shape: Pipe Arch  
 Barrel Span: 36.10 in  
 Barrel Rise: 22.20 in  
 Barrel Material: Steel or Aluminum  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0250  
 Culvert Type: Straight  
 Inlet Configuration: Projecting (Ke=0.9)  
 Inlet Depression: None

Doesn't match existing drainage flows

Appears to have been rounded. Will make sure this matches the drainage area map.

**Tailwater Data for Crossing: Culvert\_D\_Exist**

**Table 3 - Downstream Channel Rating Curve (Crossing: Culvert\_D\_Exist)**

Flow (cfs)	Water Surface Elev. (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
63.60	588.18	2.01	2.31	0.38	0.41
76.50	588.32	2.15	2.42	0.40	0.41
94.50	588.50	2.33	2.55	0.44	0.42
108.60	588.62	2.45	2.64	0.46	0.42
123.90	588.75	2.58	2.73	0.48	0.42

**Tailwater Channel Data - Culvert\_D\_Exist**

Tailwater Channel Option: Triangular Channel  
 Side Slope (H:V): 6.83 (:1)  
 Channel Slope: 0.0030  
 Channel Manning's n: 0.0350  
 Channel Invert Elevation: 586.17 ft

**Roadway Data for Crossing: Culvert\_D\_Exist**

Roadway Profile Shape: Constant Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 590.13 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 32.30 ft

Agreed. Will add roadway elevations.

Needs to be irregular with coordinates. Constant Roadway is not allowed.

**DESIGN**

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

**APPROVAL**

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



**HYDRAULIC DATA SHEET  
 CULVERT D EXIST**

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	

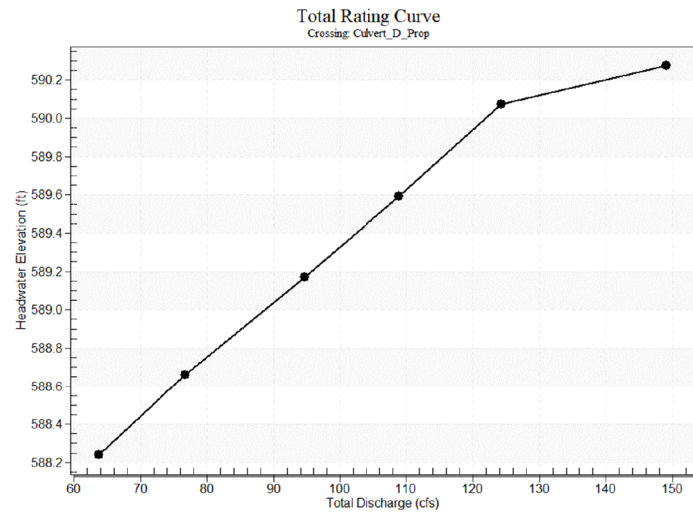
Plotted on: 6/30/2023

Design File Name: P:\1275\00\Design\Civil\Drainage\127500\_hyd\_D02.dgn

**Crossing Discharge Data**

Discharge Selection Method: Recurrence

**Rating Curve Plot for Crossing: Culvert\_D\_Prop**



**Table 1 - Summary of Culvert Flows at Crossing: Culvert\_D\_Prop**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert_D_Prop Discharge (cfs)	Roadway Discharge (cfs)	Iterations
588.24	5 year	63.70	63.70	0.00	1
588.66	10 year	76.69	76.69	0.00	1
589.17	25 year	94.68	94.68	0.00	1
589.59	50 year	108.87	108.87	0.00	1
590.07	100 year	124.23	124.00	0.07	21
590.07	Overtopping	123.92	123.92	0.00	Overtopping

**Culvert Data: Culvert\_D\_Prop**

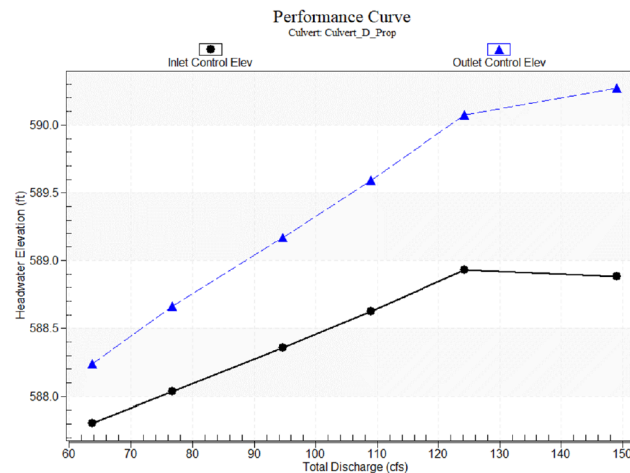
**Table 2 - Culvert Summary Table: Culvert\_D\_Prop**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	63.70 cfs	63.70 cfs	588.24	1.70	2.141	7-M11	1.74	1.08	1.99	1.99	3.21	1.89
10 year	76.69 cfs	76.69 cfs	588.66	1.94	2.560	4-FF1	2.00	1.22	2.00	2.18	3.83	1.99
25 year	94.68 cfs	94.68 cfs	589.17	2.26	3.069	4-FF1	2.00	1.41	2.00	2.41	4.73	2.10
50 year	108.87 cfs	108.87 cfs	589.59	2.52	3.494	4-FF1	2.00	1.54	2.00	2.58	5.44	2.18
100 year	124.23 cfs	124.00 cfs	590.07	2.83	3.974	4-FF1	2.00	1.68	2.00	2.75	6.20	2.26

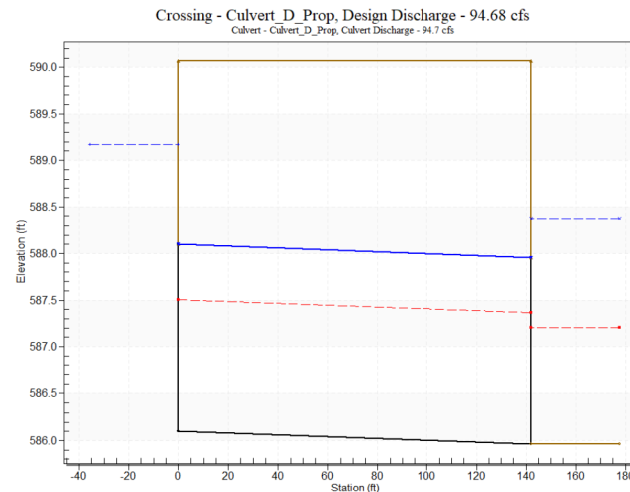
**Culvert Barrel Data**

Culvert Barrel Type Straight Culvert  
 Inlet Elevation (invert): 586.10 ft,  
 Outlet Elevation (invert): 585.96 ft  
 Culvert Length: 142.00 ft,  
 Culvert Slope: 0.0010

**Culvert Performance Curve Plot: Culvert\_D\_Prop**



**Water Surface Profile Plot for Culvert: Culvert\_D\_Prop**



**Site Data - Culvert\_D\_Prop**

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 586.10 ft  
 Outlet Station: 142.00 ft  
 Outlet Elevation: 585.96 ft  
 Number of Barrels: 2

**Culvert Data Summary - Culvert\_D\_Prop**

Barrel Shape: Concrete Box  
 Barrel Span: 5.00 ft  
 Barrel Rise: 2.00 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0130  
 Culvert Type: Straight  
 Inlet Configuration: 1:1 Bevel Headwall (Ke=0.2)  
 Inlet Depression: None

**Tailwater Data for Crossing: Culvert\_D\_Prop**

**Table 3 - Downstream Channel Rating Curve (Crossing: Culvert\_D\_Prop)**

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
63.70	587.95	1.99	1.89	0.12	0.29
76.69	588.14	2.18	1.99	0.14	0.29
94.68	588.37	2.41	2.10	0.15	0.29
108.87	588.54	2.58	2.18	0.16	0.30
124.23	588.71	2.75	2.26	0.17	0.30

**Tailwater Channel Data - Culvert\_D\_Prop**

Tailwater Channel Option: Trapezoidal Channel  
 Bottom Width: 9.00 ft  
 Side Slope (H:V): 4.00 (1:1)  
 Channel Slope: 0.0010  
 Channel Manning's n: 0.0300  
 Channel Invert Elevation: 585.96 ft

**Roadway Data for Crossing: Culvert\_D\_Prop**

Roadway Profile Shape: Constant Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 590.07 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 142.00 ft

Agreed. Will add roadway elevations.

Needs to be irregular with coordinates. Constant Roadway is not allowed.

**DESIGN**

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P. E. SERIAL NO: 108825  
 DATE: 6/30/2023

**APPROVAL**

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P. E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
 SAN ANTONIO   AUSTIN   HOUSTON   FORT WORTH   DALLAS 2000 NW LOOP 410   SAN ANTONIO, TX 78213   210.375.9000 TEXAS ENGINEERING FIRM #470   TEXAS SURVEYING FIRM #10028800			
©2023			
<b>HYDRAULIC DATA SHEET</b> <b>CULVERT D PROP</b>			
DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$
DWG:	DIST.:	COUNTY:	CONT. NO. SECT. NO. JOB NO.:
CHK DWG:	SAT	GUADALUPE	0915 45 052
			HIGHWAY NO.:
			CORDOVA RD
			SHEET NO.:

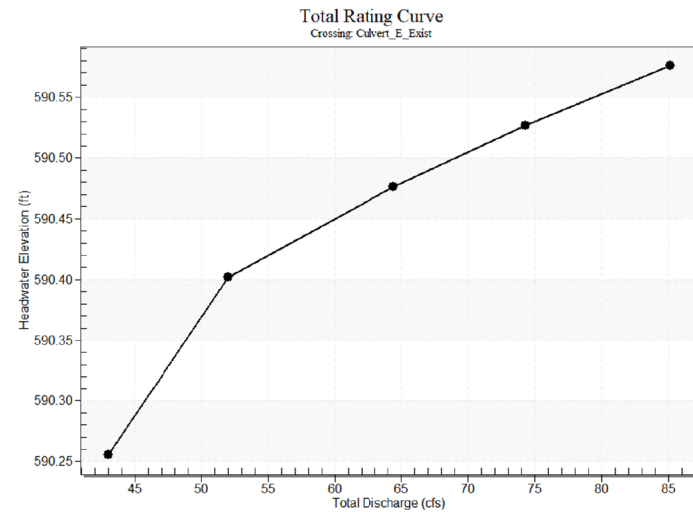


Plotted on: 6/30/2023

Design File Name: P:\1275\00\Design\Civil\Drainage\127500\_hyd\_E01.dgn

**Crossing Discharge Data**  
Discharge Selection Method: Recurrence

**Rating Curve Plot for Crossing: Culvert\_E\_Exist**



**Table 1 - Summary of Culvert Flows at Crossing: Culvert\_E\_Exist**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert_E_Exist Discharge (cfs)	Roadway Discharge (cfs)	Iterations
590.26	5 year	43.00	43.00	0.00	1
590.40	10 year	52.00	43.89	8.07	9
590.48	25 year	64.40	44.41	19.97	6
590.53	50 year	74.30	44.48	29.81	5
590.58	100 year	85.10	44.35	40.72	4
590.31	Overtopping	43.39	43.39	0.00	Overtopping

**Culvert Data: Culvert\_E\_Exist**

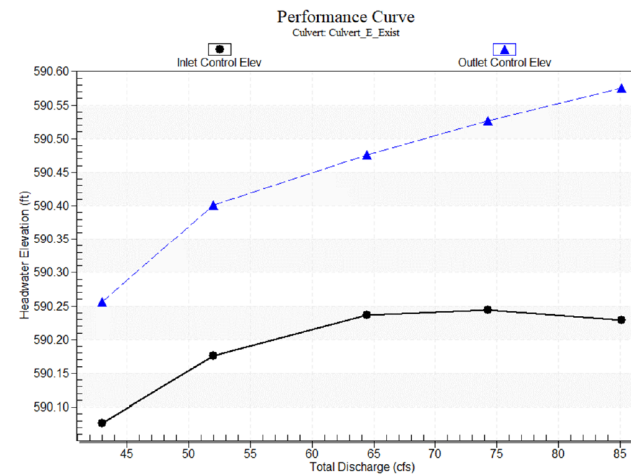
**Table 2 - Culvert Summary Table: Culvert\_E\_Exist**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	43.00 cfs	43.00 cfs	590.26	3.72	3.896	7-M2c	2.22	1.67	1.67	1.58	8.12	2.59
10 year	52.00 cfs	43.89 cfs	590.40	3.82	4.042	7-M2t	2.22	1.68	1.69	1.69	8.17	2.72
25 year	64.40 cfs	44.41 cfs	590.48	3.88	4.116	7-M2t	2.22	1.70	1.84	1.84	7.78	2.87
50 year	74.30 cfs	44.48 cfs	590.53	3.88	4.167	7-M2t	2.22	1.70	1.94	1.94	7.52	2.98
100 year	85.10 cfs	44.35 cfs	590.58	3.87	4.216	7-M2t	2.22	1.69	2.04	2.04	7.28	3.08

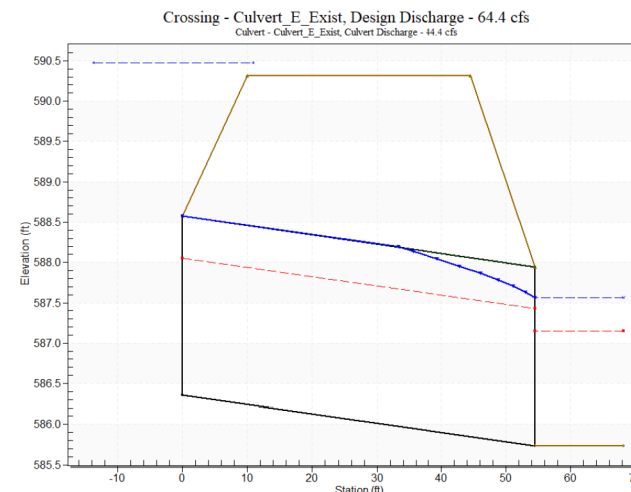
**Culvert Barrel Data**

Culvert Barrel Type: Straight Culvert  
 Inlet Elevation (invert): 586.36 ft,  
 Outlet Elevation (invert): 585.73 ft  
 Culvert Length: 54.51 ft,  
 Culvert Slope: 0.0116

**Culvert Performance Curve Plot: Culvert\_E\_Exist**



**Water Surface Profile Plot for Culvert: Culvert\_E\_Exist**



**Site Data - Culvert\_E\_Exist**

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 586.36 ft  
 Outlet Station: 54.51 ft  
 Outlet Elevation: 585.73 ft  
 Number of Barrels: 1

**Culvert Data Summary - Culvert\_E\_Exist**

Barrel Shape: Pipe Arch  
 Barrel Span: 43.30 in  
 Barrel Rise: 26.60 in  
 Barrel Material: Steel or Aluminum  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0250  
 Culvert Type: Straight  
 Inlet Configuration: Projecting (Ke=0.9)  
 Inlet Depression: None

Doesn't match existing drainage flows  
 Appears to have been rounded. Will make sure this matches the drainage area map.

**Tailwater Data for Crossing: Culvert\_E\_Exist**

**Table 3 - Downstream Channel Rating Curve (Crossing: Culvert\_E\_Exist)**

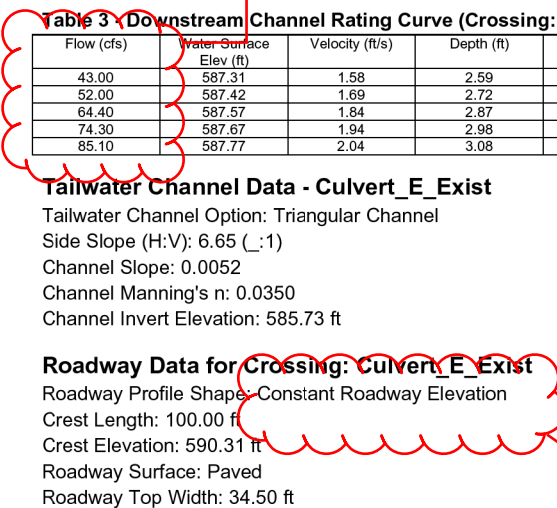
Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
43.00	587.31	1.58	2.59	0.51	0.51
52.00	587.42	1.69	2.72	0.55	0.52
64.40	587.57	1.84	2.87	0.60	0.53
74.30	587.67	1.94	2.98	0.63	0.53
85.10	587.77	2.04	3.08	0.66	0.54

**Tailwater Channel Data - Culvert\_E\_Exist**

Tailwater Channel Option: Triangular Channel  
 Side Slope (H:V): 6.65 (:1)  
 Channel Slope: 0.0052  
 Channel Manning's n: 0.0350  
 Channel Invert Elevation: 585.73 ft

**Roadway Data for Crossing: Culvert\_E\_Exist**

Roadway Profile Shape: Constant Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 590.31 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 34.50 ft



Agreed. Will add roadway elevations.

Needs to be irregular with coordinates. Constant Roadway is not allowed.

**DESIGN**

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

**APPROVAL**

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



**HYDRAULIC DATA SHEET  
 CULVERT E EXIST**

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	

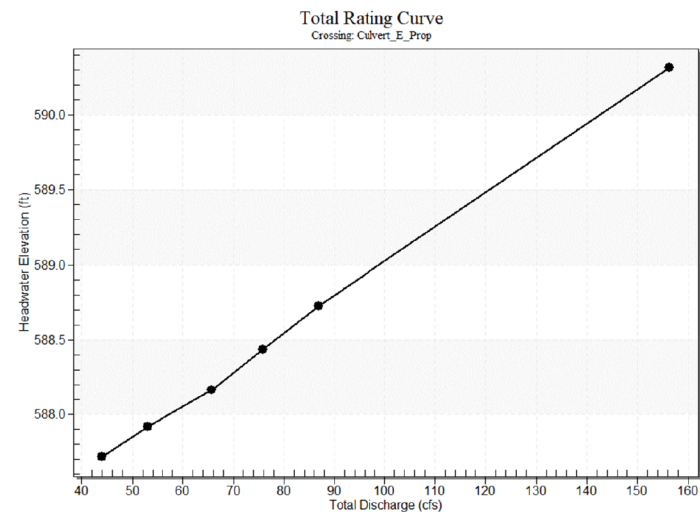
Note: Culvert E is sized based on proposed conditions per City of Seguin. Proposed conditions were assumed to be equal to ultimate conditions. Those results were compared to existing conditions to verify no adverse impact.

Plotted on: 6/30/2023

Design File name: P:\1275\00\Design\Civil\Drainage\1277500\_hyd\_E02.dgn

**Crossing Discharge Data**  
Discharge Selection Method: Recurrence

**Rating Curve Plot for Crossing: Culvert\_E\_Prop**



**Table 1 - Summary of Culvert Flows at Crossing: Culvert\_E\_Prop**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert_E_Prop Discharge (cfs)	Roadway Discharge (cfs)	Iterations
587.72	5 year	43.92	43.92	0.00	1
587.91	10 year	53.05	53.05	0.00	1
588.16	25 year	65.77	65.77	0.00	1
588.44	50 year	75.86	75.86	0.00	1
588.73	100 year	86.87	86.87	0.00	1
590.14	Overtopping	135.94	135.94	0.00	Overtopping

**Culvert Data: Culvert\_E\_Prop**

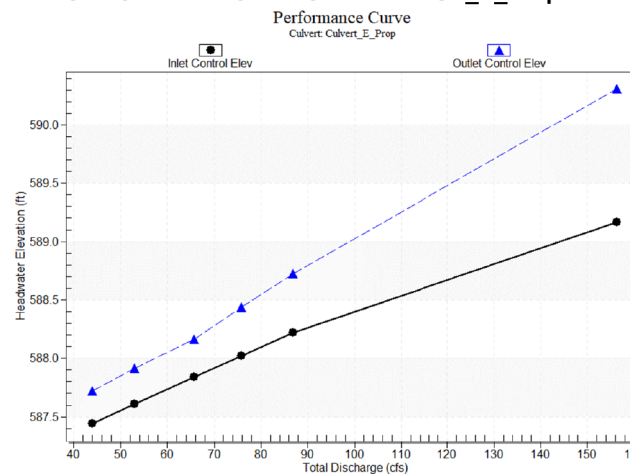
**Table 1 - Culvert Summary Table: Culvert\_E\_Prop**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	43.92 cfs	43.92 cfs	587.72	1.34	1.619	3-M1t	1.21	0.84	1.53	1.53	2.87	1.68
10 year	53.05 cfs	53.05 cfs	587.91	1.51	1.815	3-M1t	1.37	0.96	1.69	1.69	3.14	1.77
25 year	65.77 cfs	65.77 cfs	588.16	1.74	2.065	7-M1t	1.60	1.10	1.89	1.89	3.49	1.88
50 year	75.86 cfs	75.86 cfs	588.44	1.92	2.338	4-FFf	1.77	1.21	2.00	2.03	3.79	1.96
100 year	86.87 cfs	86.87 cfs	588.73	2.12	2.625	4-FFf	2.00	1.33	2.00	2.17	4.34	2.03

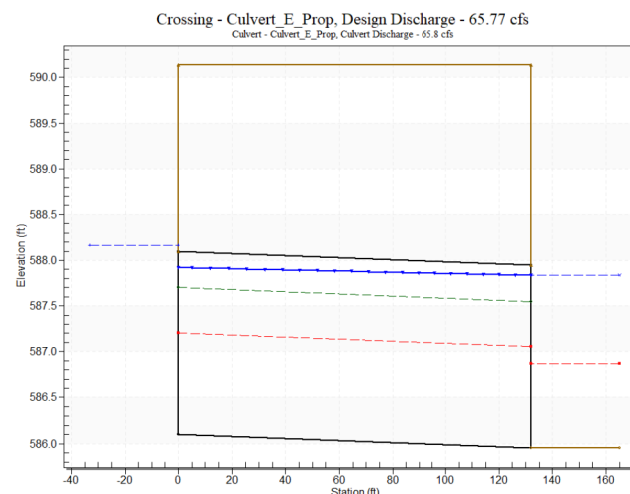
**Culvert Barrel Data**

Culvert Barrel Type Straight Culvert  
Inlet Elevation (invert): 586.10 ft,  
Outlet Elevation (invert): 585.95 ft  
Culvert Length: 132.00 ft,  
Culvert Slope: 0.0011

**Culvert Performance Curve Plot: Culvert\_E\_Prop**



**Water Surface Profile Plot for Culvert: Culvert\_E\_Prop**



**Site Data - Culvert\_E\_Prop**

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 586.10 ft  
Outlet Station: 132.00 ft  
Outlet Elevation: 585.95 ft  
Number of Barrels: 2

**Culvert Data Summary - Culvert\_E\_Prop**

Barrel Shape: Concrete Box  
Barrel Span: 5.00 ft  
Barrel Rise: 2.00 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0120  
Culvert Type: Straight  
Inlet Configuration: 1:1 Bevel Headwall (Ke=0.2)  
Inlet Depression: None

**Tailwater Channel Data for Crossing: Culvert\_E\_Prop**

**Table 3 - Downstream Channel Rating Curve (Crossing: Culvert\_E\_Prop)**

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
43.92	587.48	1.53	1.68	0.10	0.28
53.05	587.64	1.69	1.77	0.11	0.28
65.77	587.84	1.89	1.88	0.12	0.29
75.86	587.98	2.03	1.96	0.13	0.29
86.87	588.12	2.17	2.03	0.14	0.29

**Tailwater Channel Data - Culvert\_E\_Prop**

Tailwater Channel Option: Trapezoidal Channel  
Bottom Width: 11.00 ft  
Side Slope (H:V): 4.00 (1:1)  
Channel Slope: 0.0010  
Channel Manning's n: 0.0300  
Channel Invert Elevation: 585.95 ft

**Roadway Data for Crossing: Culvert\_E\_Prop**

Roadway Profile Shape: Constant Roadway Elevation  
Crest Length: 100.00 ft  
Crest Elevation: 590.14 ft  
Roadway Surface: Paved  
Roadway Top Width: 132.00 ft

Agreed. Will add roadway elevations.

Needs to be irregular with coordinates. Constant Roadway is not allowed.

DESIGN  
INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JACOB J. POWELL  
P.E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL  
INTERIM REVIEW  
DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
ENGINEER: JOHN A. TYLER  
P.E. SERIAL NO: 105193  
DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



**HYDRAULIC DATA SHEET  
CULVERT E PROP**

DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_F01.dgn

Note: Culvert F has been analyzed based on existing and proposed conditions. Proposed conditions include modifications to drainage area and adjustments to impervious cover based on this project.

Culvert improvement include lengthening the existing culverts.

Full realignment and reconstruction of the culverts at Crossing F will be done with the TxDOT Hwy 123 project.



NOTES:

1. HEC-RAS VERSION 6.3.1 USED FOR HYDRAULIC CALCULATIONS.
2. 1-FT CONTOURS FROM 2017 STRATMAP CENTRAL TEXAS LIDAR DATASET.
3. FOR CULVERTS CROSSING CORDOVA RD, 25YR AEP STORM USED FOR DESIGN, PER CITY OF SEGUIN CRITERIA.

DESIGN

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JACOB J. POWELL  
 P.E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



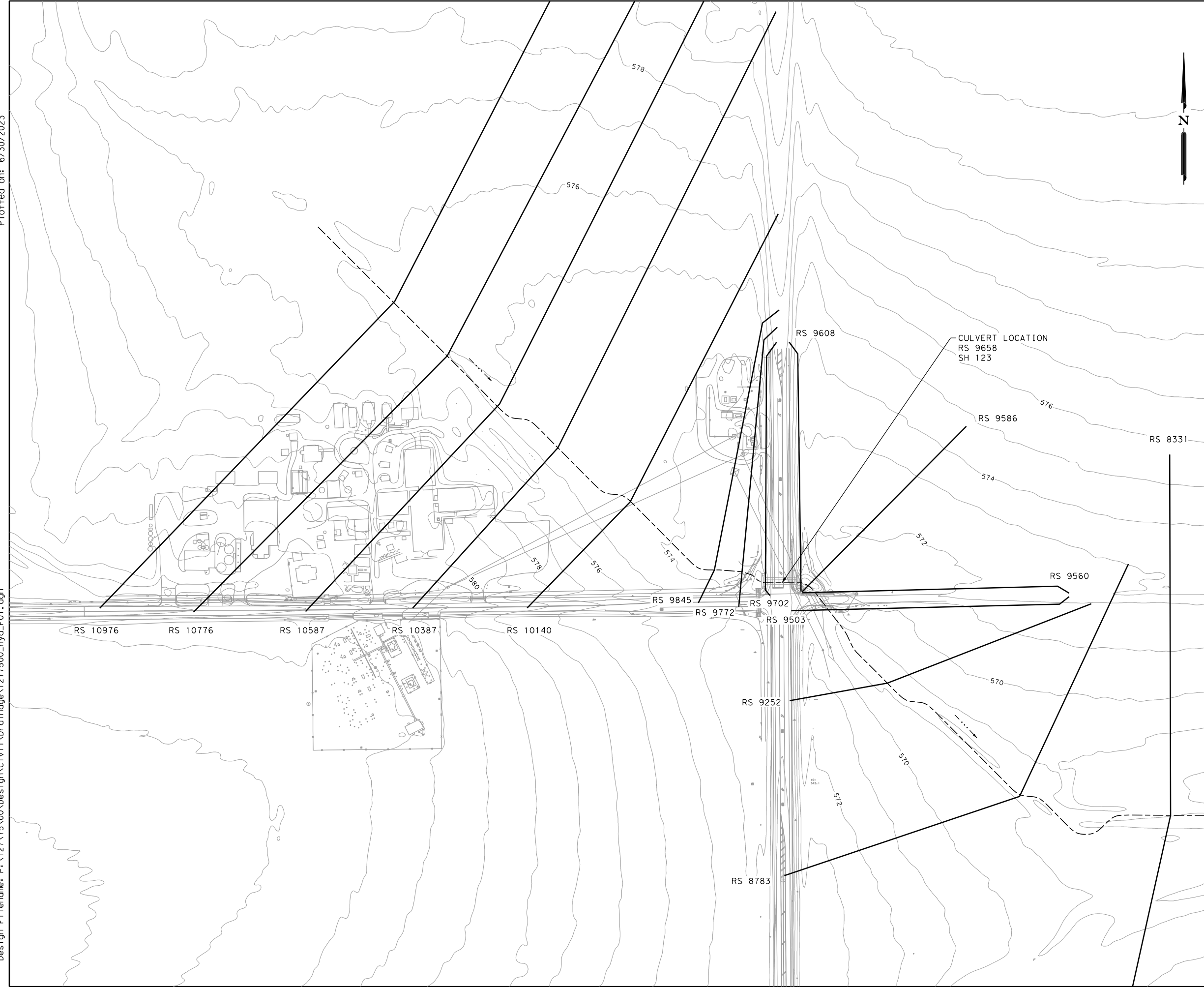
It's real.



HYDRAULIC DATA SHEET  
CULVERT F

SHEET 1 OF 4

CHK DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.
CHK DWG:	SAT	GUADALUPE	0915	45
			052	





HEC-RAS CULVERT OUTPUT DATA - EXISTING

Plan: PRE	GERONIMO TRIBUTA	Reach 1 RS: 9658	Culv Group: Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)		827.37	Culv Full Len (ft)	84
# Barrels		4	Culv Vel US (ft/s)	11.49
Q Barrel (cfs)		206.84	Culv Vel DS (ft/s)	11.49
E.G. US. (ft)		576.74	Culv Inv El Up (ft)	571.37
W.S. US. (ft)		575.48	Culv Inv El Dn (ft)	569.57
E.G. DS (ft)		575.04	Culv Frctn Ls (ft)	0.94
W.S. DS (ft)		573.43	Culv Exit Loss (ft)	0.44
Delta EG (ft)		1.7	Culv Entr Loss (ft)	0.41
Delta WS (ft)		2.05	Q Weir (cfs)	253.43
E.G. IC (ft)		579.47	Weir Sta Lft (ft)	24.47
E.G. OC (ft)		576.74	Weir Sta Rgt (ft)	683.4
Culvert Control		Outlet	Weir Submerg	0
Culv WS Inlet (ft)		574.37	Weir Max Depth (ft)	0.4
Culv WS Outlet (ft)		572.57	Weir Avg Depth (ft)	0.26
Culv Nml Depth (ft)		1.87	Weir Flow Area (sq ft)	173.17
Culv Crt Depth (ft)		3	Min El Weir Flow (ft)	576.38

Plan: PRE	GERONIMO TRIBUTA	Reach 1 RS: 9658	Culv Group: Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)		549.74	Culv Full Len (ft)	84
# Barrels		4	Culv Vel US (ft/s)	7.64
Q Barrel (cfs)		137.43	Culv Vel DS (ft/s)	7.64
E.G. US. (ft)		577.27	Culv Inv El Up (ft)	571.37
W.S. US. (ft)		576.13	Culv Inv El Dn (ft)	569.57
E.G. DS (ft)		576.72	Culv Frctn Ls (ft)	0.38
W.S. DS (ft)		574.54	Culv Exit Loss (ft)	0
Delta EG (ft)		0.56	Culv Entr Loss (ft)	0.18
Delta WS (ft)		1.59	Q Weir (cfs)	1135.46
E.G. IC (ft)		577.24	Weir Sta Lft (ft)	0
E.G. OC (ft)		577.27	Weir Sta Rgt (ft)	683.4
Culvert Control		Outlet	Weir Submerg	0
Culv WS Inlet (ft)		574.37	Weir Max Depth (ft)	0.89
Culv WS Outlet (ft)		572.57	Weir Avg Depth (ft)	0.73
Culv Nml Depth (ft)			Weir Flow Area (sq ft)	500.57
Culv Crt Depth (ft)		2.54	Min El Weir Flow (ft)	576.38

HEC-RAS CULVERT OUTPUT DATA - PROPOSED

Plan: POST	GERONIMO TRIBUTA	Reach 1 RS: 9658	Culv Group: Culvert #1	Profile: 25yr (Design)
Q Culv Group (cfs)		816.53	Culv Full Len (ft)	106.5
# Barrels		4	Culv Vel US (ft/s)	11.34
Q Barrel (cfs)		204.13	Culv Vel DS (ft/s)	11.34
E.G. US. (ft)		576.77	Culv Inv El Up (ft)	571.82
W.S. US. (ft)		576.76	Culv Inv El Dn (ft)	569.57
E.G. DS (ft)		574.88	Culv Frctn Ls (ft)	1.5
W.S. DS (ft)		573.32	Culv Exit Loss (ft)	0.43
Delta EG (ft)		1.88	Culv Entr Loss (ft)	0.4
Delta WS (ft)		3.44	Q Weir (cfs)	210.97
E.G. IC (ft)		579.61	Weir Sta Lft (ft)	29.8
E.G. OC (ft)		576.77	Weir Sta Rgt (ft)	759
Culvert Control		Outlet	Weir Submerg	0
Culv WS Inlet (ft)		574.82	Weir Max Depth (ft)	0.38
Culv WS Outlet (ft)		572.57	Weir Avg Depth (ft)	0.21
Culv Nml Depth (ft)		1.87	Weir Flow Area (sq ft)	153.42
Culv Crt Depth (ft)		3	Min El Weir Flow (ft)	576.45

Plan: POST	GERONIMO TRIBUTA	Reach 1 RS: 9658	Culv Group: Culvert #1	Profile: 100yr (Check)
Q Culv Group (cfs)		568.18	Culv Full Len (ft)	106.5
# Barrels		4	Culv Vel US (ft/s)	7.89
Q Barrel (cfs)		142.04	Culv Vel DS (ft/s)	7.89
E.G. US. (ft)		577.18	Culv Inv El Up (ft)	571.82
W.S. US. (ft)		577.17	Culv Inv El Dn (ft)	569.57
E.G. DS (ft)		576.48	Culv Frctn Ls (ft)	0.51
W.S. DS (ft)		574.38	Culv Exit Loss (ft)	0
Delta EG (ft)		0.7	Culv Entr Loss (ft)	0.19
Delta WS (ft)		2.79	Q Weir (cfs)	1025.72
E.G. IC (ft)		577.17	Weir Sta Lft (ft)	19.58
E.G. OC (ft)		577.18	Weir Sta Rgt (ft)	759
Culvert Control		Outlet	Weir Submerg	0
Culv WS Inlet (ft)		574.82	Weir Max Depth (ft)	0.82
Culv WS Outlet (ft)		572.57	Weir Avg Depth (ft)	0.65
Culv Nml Depth (ft)			Weir Flow Area (sq ft)	480.81
Culv Crt Depth (ft)		2.59	Min El Weir Flow (ft)	576.45

HEC-RAS CROSS SECTION OUTPUT



DESIGN  
**INTERIM REVIEW**  
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 ENGINEER: JACOB J. POWELL  
 P. E. SERIAL NO: 108825  
 DATE: 6/30/2023

APPROVAL  
**INTERIM REVIEW**  
 DOCUMENT INCOMPLETE. NOT INTENDED FOR PERMIT, BIDDING OR CONSTRUCTION.  
 ENGINEER: JOHN A. TYLER  
 P. E. SERIAL NO: 105193  
 DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY



SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
 2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
 TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
 CULVERT F

SHEET 3 OF 4

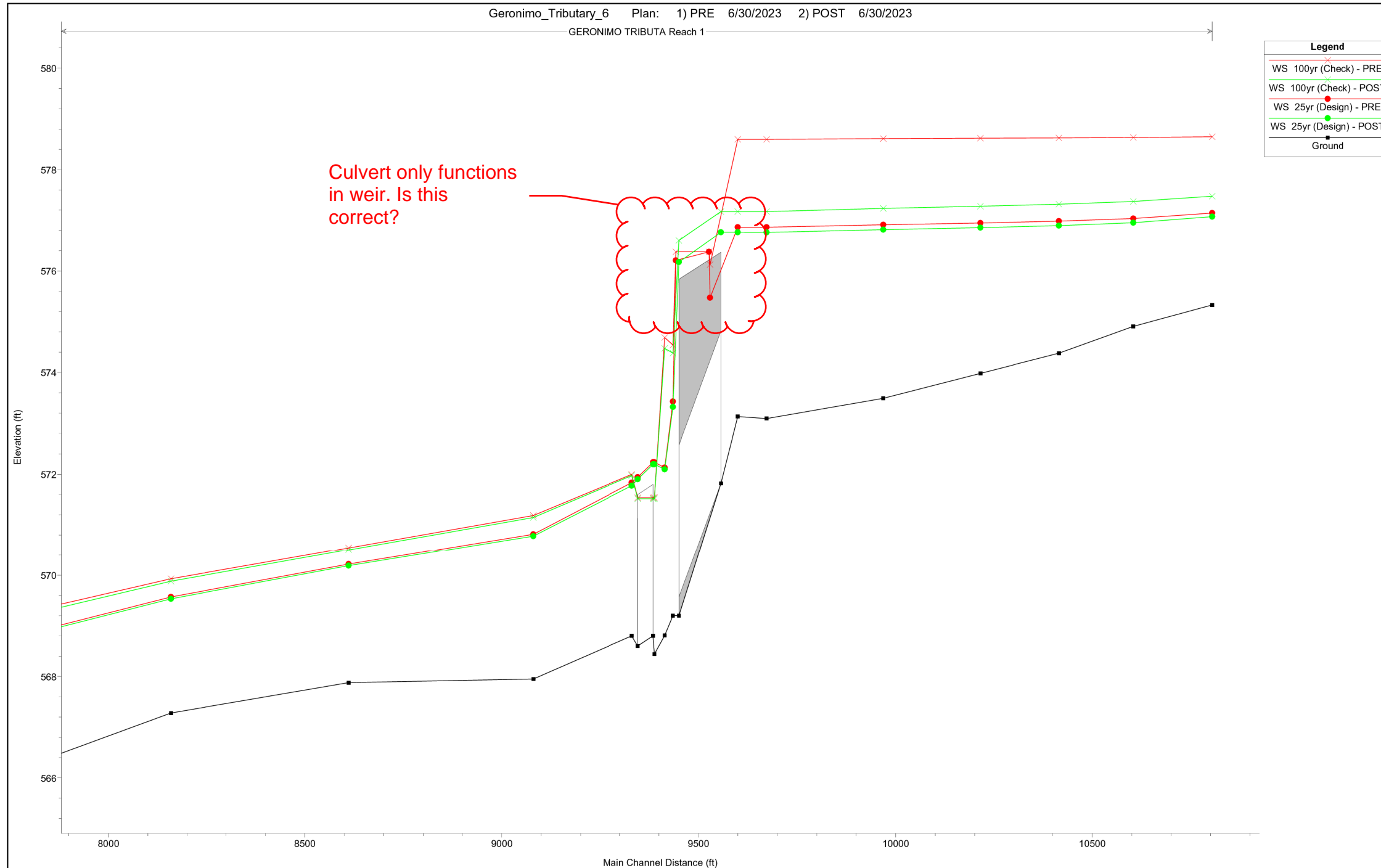
DGN:	FED. RD. DIV. NO.	STATE	FEDERAL AID PROJECT NO.	HIGHWAY NO.		
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD		
DWG:	DIST.	COUNTY	CONT. NO.	SECT. NO.	JOB NO.	SHEET NO.
CHK DWG:	SAT	GUADALUPE	0915	45	052	

Plotted on: 6/30/2023

Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_F03.dgn

Plotted on: 6/30/2023

HEC-RAS PROFILE PLOT OUTPUT



Design File name: P:\127\75\00\Design\Civil\Drainage\1277500\_hyd\_F04.dgn

DESIGN

INTERIM REVIEW  
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ENGINEER: JACOB J. POWELL  
P.E. SERIAL NO: 108825  
DATE: 6/30/2023

APPROVAL

INTERIM REVIEW  
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ENGINEER: JOHN A. TYLER  
P.E. SERIAL NO: 105193  
DATE: 6/30/2023

REV. NO.	DATE	DESCRIPTION	BY
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SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS  
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000  
TEXAS ENGINEERING FIRM #470 | TEXAS SURVEYING FIRM #10028800



It's real.



HYDRAULIC DATA SHEET  
CULVERT F

SHEET 4 OF 4

DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:
CHK DWG:	SAT	GUADALUPE	0915	45
				JOB NO.:
				052
				SHEET NO.:

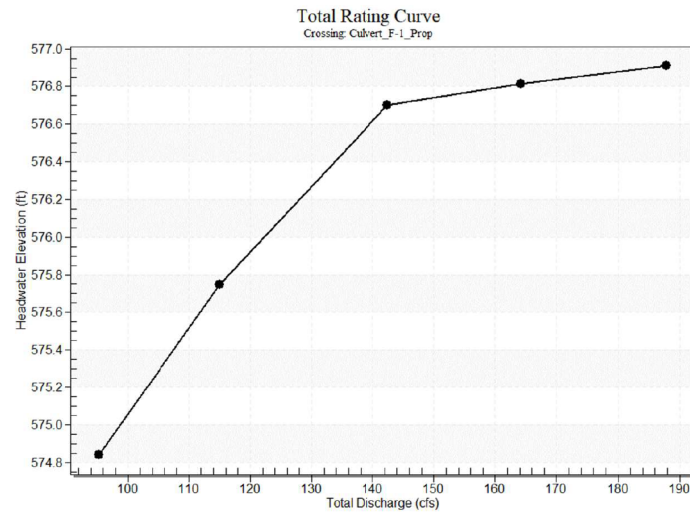
This was intended to model the lack of channel downstream.

Is this correct?

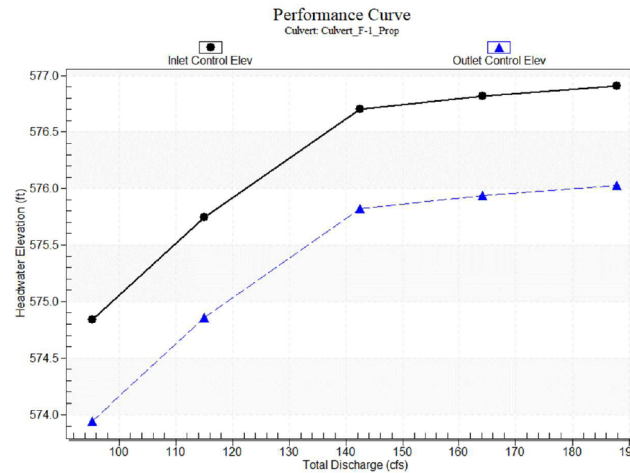
**Crossing Discharge Data**

Discharge Selection Method: Recurrence

**Rating Curve Plot for Crossing: Culvert\_F-1\_Prop**



**Culvert Performance Curve Plot: Culvert\_F-1\_Prop**



**Tailwater Data for Crossing: Culvert\_F-1\_Prop**

**Table 2 - Downstream Channel Rating Curve (Crossing: Culvert\_F-1\_Prop)**

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
95.26	570.47	0.51	2.56	0.64	0.85
114.98	570.52	0.56	2.68	0.69	0.86
142.44	570.57	0.61	2.83	0.76	0.88
164.20	570.60	0.64	2.93	0.80	0.88
187.90	570.64	0.68	3.03	0.84	0.89

**Tailwater Channel Data - Culvert\_F-1\_Prop**

Tailwater Channel Option: Trapezoidal Channel  
 Bottom Width: 10.56 ft  
 Side Slope (H:V): 120.00 (1:1)  
 Channel Slope: 0.0200  
 Channel Manning's n: 0.0350  
 Channel Invert Elevation: 569.96 ft

**Roadway Data for Crossing: Culvert\_F-1\_Prop**

Roadway Profile Shape: Constant Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 576.60 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 136.00 ft

Agreed. Will add roadway elevations.

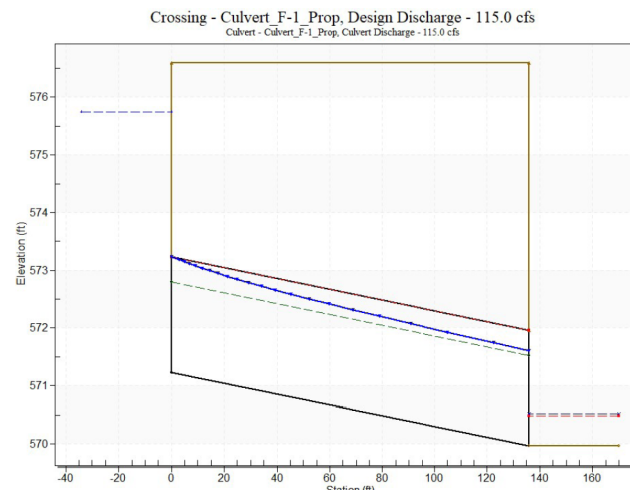
Needs to be irregular with coordinates. Constant Roadway is not allowed.

Design flow does not overtop roadway, which is the design standard. Since this is a cross culvert, it is acceptable that the system is under pressure. However, we are upsizing to reduce velocity.

Not allowed, put roadway profile at edge of pavement, this is under pressure, TxDOT does not design under pressure.

Understood. Changed to reflect elevation at SH 123 western edge of pavement.

**Water Surface Profile Plot for Culvert: Culvert\_F-1\_Prop**



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APPROVAL  
 INTERIM REVIEW  
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 ENGINEER: JOHN A. TYLER  
 P.E. SERIAL NO: 105193  
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REV. NO.	DATE	DESCRIPTION	BY
 SAN ANTONIO   AUSTIN   HOUSTON   FORT WORTH   DALLAS 2000 NW LOOP 410   SAN ANTONIO, TX 78213   210.375.9000 TEXAS ENGINEERING FIRM #470   TEXAS SURVEYING FIRM #10028800			
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HYDRAULIC DATA SHEET CULVERT F-1 PROP					
DGN:	FED. RD. DIV. NO.:	STATE:	FEDERAL AID PROJECT NO.:	HIGHWAY NO.:	
CHK DGN:	6	TEXAS	\$PROJNUM\$	CORDOVA RD	
DWG:	DIST.:	COUNTY:	CONT. NO.:	SECT. NO.:	JOB NO.:
CHK DWG:	SAT	GUADALUPE	0915	45	052

Agreed. Identified design and check storms in tables.

identify Design Q with a \*

**Table 1 - Summary of Culvert Flows at Crossing: Culvert\_F-1\_Prop**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert_F-1_Prop Discharge (cfs)	Roadway Discharge (cfs)	Iterations
574.84	5 year	95.26	95.26	0.00	1
575.75	10 year	114.98	114.98	0.00	1
576.70	25 year	142.44	132.72	9.72	6
576.81	50 year	164.20	134.63	29.49	6
576.91	100 year	187.90	136.24	51.60	5
576.60	Overtopping	130.91	130.91	0.00	Overtopping

Will add capacity.

Agreed. Capacity will be added to reduce velocities.

Does not pass Q25

High velocities. Any dissipation?

**Culvert Data: Culvert\_F-1\_Prop**

**Table 1 - Culvert Summary Table: Culvert\_F-1\_Prop**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5 year	95.26 cfs	95.26 cfs	574.84	3.61	2.713	S-S2n	1.38	1.99	1.44	0.51	11.02	2.55
10 year	114.98 cfs	114.98 cfs	575.75	4.52	3.629	S-S2n	1.57	2.00	1.65	0.56	11.64	2.63
25 year	142.44 cfs	132.72 cfs	576.70	5.47	4.592	S-S2n	1.73	2.00	1.81	0.61	12.21	2.83
50 year	164.20 cfs	134.63 cfs	576.81	5.58	4.704	S-S2n	1.75	2.00	1.83	0.64	12.23	2.93
100 year	187.90 cfs	136.24 cfs	576.91	5.68	4.800	S-S2n	1.77	2.00	1.77	0.68	12.86	3.03

**Culvert Barrel Data**

Culvert Barrel Type Straight Culvert  
 Inlet Elevation (invert): 571.23 ft,  
 Outlet Elevation (invert): 569.96 ft  
 Culvert Length: 136.01 ft,  
 Culvert Slope: 0.0093

**Site Data - Culvert\_F-1\_Prop**

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 571.23 ft  
 Outlet Station: 136.00 ft  
 Outlet Elevation: 569.96 ft  
 Number of Barrels: 1

**Culvert Data Summary - Culvert\_F-1\_Prop**

Barrel Shape: Concrete Box  
 Barrel Span: 6.00 ft  
 Barrel Rise: 2.00 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: 1:1 Bevel Headwall (Ke=0.2)  
 Inlet Depression: None

Note: Culvert F-1 has been designed based on proposed conditions. Proposed conditions include modifications to drainage area and adjustments to impervious cover based on this project.

Runoff currently crosses under Cordova Road at this point. The proposed configuration includes crossing Hwy 123, in accordance with the Hwy 123 Schematic. The F-1 culvert construction will be part of the Cordova Road project.

Plotted on: 6/30/2023

Design File Name: P:\1275\00\Design\Civil\Drainage\1277500\_hyd\_F101.dgn