

**FINAL DRAINAGE REPORT  
FOR  
SADDLEHORN RANCH – FILING 2**

**Prepared For:  
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**November 18, 2022  
Project No. 25142.04**

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**El Paso County PCD File No.:  
SF-21-033**

Statement added.

Add a statement that these areas will be analyzed in detail with the Filing 3 FDR and CDs

Final Drainage Report  
Filing 2 - Saddlehorn Ranch

existing conditions only one channel criteria is violated in isolated 150' sections of the 5,300' reach that violate the max Froude number criteria of 0.90 per El Paso County. The maximum Froude number in these short distance areas is calculated at 1.02. These seven sections have small flow depths ranging from 6" to 23", therefore the actual risk presented by critical-supercritical flow in these areas is minor. Critical behavior with Fr near 1.0 for these abbreviated segments is not sustained in long enough stretches to achieve supercritical behavior with the accompanying lower velocities. Shear velocities present in the channel are approximately 0.75 lbs/sf on average, below the MHFCD Maximum Shear Stress of 1.2 lbs/sf per Table 8-3. Isolated sections of the channel reach a maximum shear stress of 3.95 lbs/sf, however these sections are isolated and are not sustained for long stretches of the reach.

Text revised to read that the majority of the channel is stable.

most of?

Table 4: Channel Design Parameters

Design Parameter	Erosive Soils or Poor Vegetation	Erosion Resistant Soils and Vegetation
Max Low-flow Velocity (ft/sec)	3.5 ft/sec	5.0 ft/sec
Max 100-year Velocity (ft/sec)	5.0 ft/sec	7.0 ft/sec
Froude No. Low-flow	0.5	0.7
Froude No. 100-year	0.6	0.9

As compared to the prior HEC RAS model of MS-06 completed with the Haegler Ranch DBPS, this model differs with higher velocities and flow depths and a smaller top width of channel, see table 5 for a comparison on values between the models. These differences are most likely due to updated survey data for the topography of the channel that was used for the model completed with this report, showing a deeper channel than what was used in the Haegler Ranch DBPS. The analysis of the existing conditions of Drainageway MS-06 shows that the channel is stable and will require no improvements at the time of Filing 2 development.

Table 5: Haegler Ranch Model Comparison

HEC RAS Model Comparison for MS-06 @ Judge Orr Road		
Values for 100yr Storm	Haegler Ranch DBPS	JR GeoHEC RAS Model
Channel Velocity (ft/s)	3.48	6.50
Water Surface Depth in Channel (ft)	1.35	2.06
Top Width (ft)	539.34	329.3

Describe what the lateral structure, as shown on the HEC-RAS exhibit, will be (dirt berm, wall, etc). Also indicate that it will be designed with Filing 3 channel improvements

## DRAINAGE DESIGN CRITERIA

### Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the "City of Colorado Spring/El Paso County Drainage Criteria Manual" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "Urban Storm Drainage Criteria Manual" Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "Urban Storm Drainage Criteria Manual" dated May 2014, as adopted by El Paso County.

### Hydrologic Criteria

All hydrologic data was obtained from the "Urban Storm Drainage and Flood

This lateral structure is not a proposed improvement. The lateral structure is only a function of the CivilGeo HECRAS model that models how the EXISTING berms on site are being overtopped by one river reach and transferring flows to an adjacent river reach. This is not a proposed improvement and is only modeling existing berms within the flood plain.

Volumes 1 and 2, and the Volumes 1, 2, and

concurrently with this drainage report that details the required maintenance activities and intervals to ensure proper function of all stormwater infrastructure in the future.

***Drainage and Bridge Fees***

Drainage and Bridge Fees are due at time of final platting. An estimate of basin fees for the proposed development within Haegler Ranch drainage basin is provided below. Fee reduction for low density lots are applied to the overall basin fees in the next section. Additionally, reimbursable expenses are detailed below.

Total Filing 2 Platted Acres: 176.85 ac  
Total Filing 2 Impervious Acres = 17.7 ac (176.85 ac x 10%)

Open space tracts  
can be subtracted  
from calculation

Fee area revised to  
exclude open space  
tracts.

**Filing 2 Fee Totals (Prior to Reductions):**

**Bridge Fees**

\$ 1,640/ac x 17.7 ac = \$29,028

**Drainage Fees**

\$11,113/ac x 17.7 ac = \$196,700

**Filing 2 Drainage Fee Reduction:** 25% Reduction for Low Density Lots: \$196,700 x 25% = \$49,175

**Filing 2 Fee Totals (After Reductions):**

**Bridge Fees**

\$ 1,640/ac x 17.7 ac = \$29,028

**Drainage Fees**

\$196,700 - \$49,175 = \$145,858

***Construction Cost Opinion***

Cost opinion has been presented in Appendix A.

**SUMMARY**

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The proposed development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements, including ditches, culverts and detention ponds. The proposed development will not adversely affect the offsite major drainageways or surrounding development. This report meets the latest El Paso County Drainage Criteria requirements for this site and is in accordance with the PDR/MDDP for Saddlehorn Ranch.

# Channel Report

Fr values added to these sheets.

## DP 9 Swale (100-Year)

Replace Fr values on these sheets

### Triangular

Side Slopes (z:1) = 4.00, 4.00  
 Total Depth (ft) = 3.00

Invert Elev (ft) = 10.00  
 Slope (%) = 1.30  
 N-Value = 0.030

### Calculations

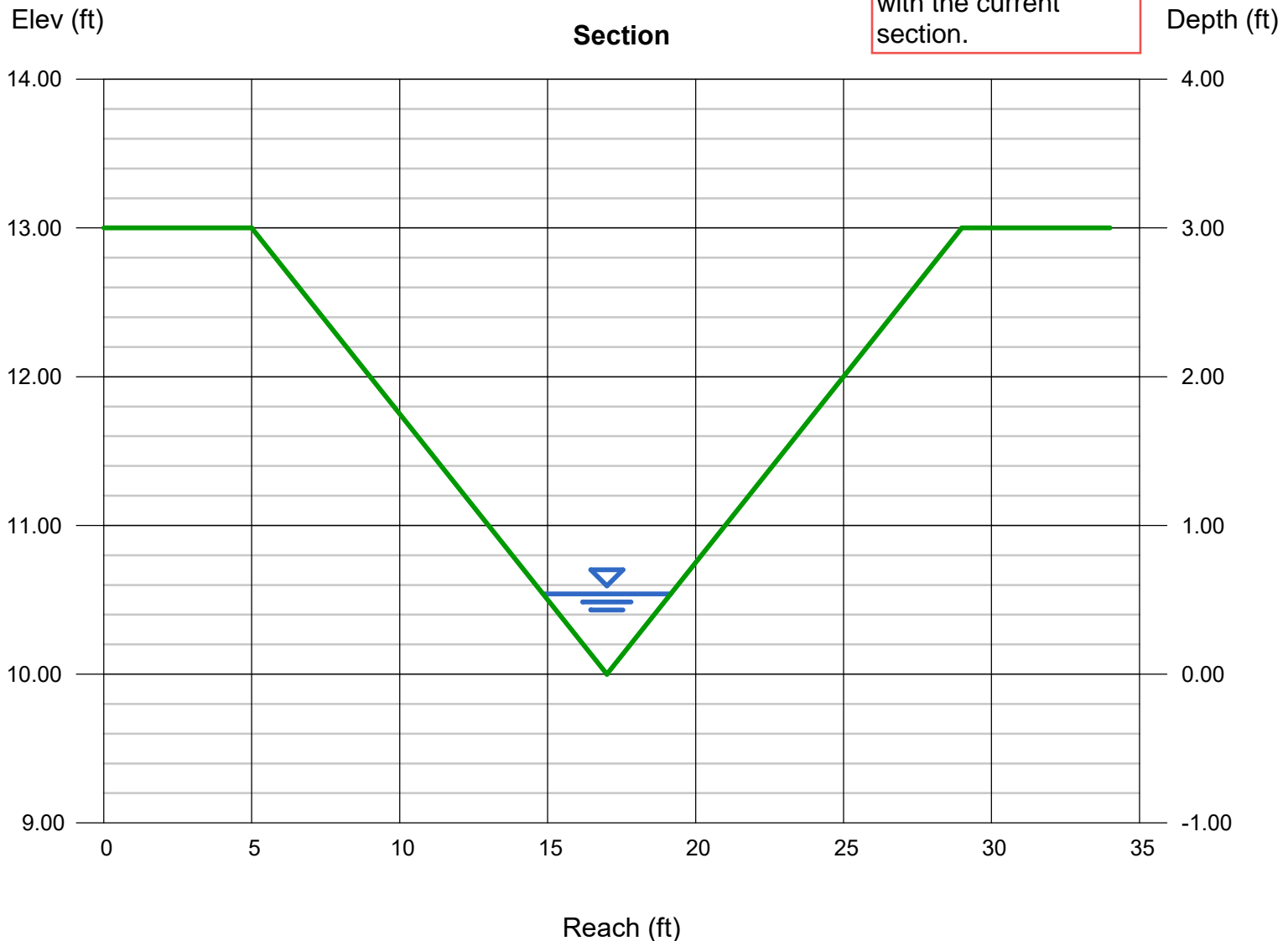
Compute by: Known Q  
 Known Q (cfs) = 2.60

### Highlighted

Depth (ft) = 0.54  
 Q (cfs) = 2.600  
 Area (sqft) = 1.17  
 Velocity (ft/s) = 2.23  
 Wetted Perim (ft) = 4.45  
 Crit Depth, Yc (ft) = 0.49  
 Top Width (ft) = 4.32  
 EGL (ft) = 0.62

Revise CDs and GEC plans for these changes

No changes were made from the GEC plans, this section was outdated and has been replaced with the current section.



Reach	River Sta	Profile	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	Shear Chan (lb/sq ft)	Hydr Depth (ft)
Main Channel-0	1014	100 yr	505.00	6721.50	6723.80		6724.00	0.002891	3.61	139.94	116.54	0.58	0.22	1.20
Main Channel-0	1013	100 yr	505.00	6721.00	6722.98	6722.31	6723.07	0.007902	2.32	217.55	200.88	0.39	0.53	1.08
Main Channel-0	1012	100 yr	505.00	6720.30	6721.52	6721.18	6721.61	0.011583	2.34	221.16	303.86	0.45	0.59	0.73
Main Channel-0	1011	100 yr	505.00	6719.00	6720.18	6719.78	6720.23	0.007171	1.86	280.35	393.62	0.36	0.37	0.71
Main Channel-0	1010	100 yr	505.00	6718.00	6718.96		6719.02	0.008246	2.00	256.25	332.21	0.39	0.43	0.77
Main Channel-0	1009.5			Lat Struct										
Main Channel-0	1009	100 yr	505.00	6716.50	6717.80	6717.34	6717.86	0.007267	1.92	266.02	329.30	0.36	0.39	0.81
Main Channel-0	1008	100 yr	505.00	6714.70	6715.24	6715.22	6715.45	0.054239	3.64	139.41	304.56	0.91	1.69	0.46
Main Channel-0	1007	100 yr	505.00	6712.50	6713.54		6713.58	0.005047	1.68	306.71	366.97	0.31	0.29	0.84
Main Channel-0	1006	100 yr	505.00	6710.60	6711.39	6711.39	6711.67	0.063578	4.24	119.11	214.06	1.00	2.22	0.56
Main Channel-0	1005	100 yr	505.00	6708.40	6710.42		6710.45	0.002217	1.32	382.27	353.43	0.21	0.17	1.08
Main Channel-0	1004	100 yr	505.00	6706.70	6709.72		6709.81	0.009820	2.41	209.21	214.32	0.43	0.60	0.98
Main Channel-0	1003	100 yr	505.00	6704.90	6708.41		6708.53	0.007229	2.78	181.66	119.49	0.40	0.68	1.52
Main Channel-0	1002	100 yr	505.00	6704.10	6707.56		6707.66	0.004579	2.47	204.77	114.46	0.33	0.51	1.79
Main Channel-0	1001	100 yr	505.00	6704.10	6706.82		6706.89	0.005420	2.05	246.08	205.82	0.33	0.40	1.20
Main Channel-0	1000	100 yr	505.00	6702.50	6704.41	6704.41	6704.88	0.056085	5.49	92.02	101.57	1.02	3.17	0.91
Overflow 3	1007	100 yr	0.01	6717.70	6717.73	6717.73	6717.73	0.000010	0.01	1.62	70.54	0.01	0.00	0.02
Overflow 3	1006	100 yr	0.01	6716.00	6716.02	6716.02	6716.02	0.000282	0.03	0.32	15.35	0.04	0.00	0.02
Overflow 3	1005	100 yr	0.01	6714.70	6714.73	6714.73	6714.73	0.000072	0.02	0.67	35.03	0.02	0.00	0.02
Overflow 3	1004	100 yr	0.01	6712.70	6712.72	6712.72	6712.72	0.000015	0.01	1.44	74.63	0.01	0.00	0.02
Overflow 3	1003	100 yr	0.01	6709.00	6709.02	6709.02	6709.02	0.000026	0.01	1.07	53.13	0.01	0.00	0.02
Overflow 3	1001	100 yr	0.01	6705.00	6705.03	6705.03	6705.03	0.000103	0.02	0.47	19.16	0.02	0.00	0.02
Overflow 3	1000	100 yr	0.01	6702.90	6703.06		6703.06	0.000002	0.01	1.35	14.20	0.00	0.00	0.10
Main Channel-0-1	1019	100 yr	505.00	6700.60	6702.94		6703.05	0.007686	2.71	186.12	133.11	0.40	0.67	1.40
Main Channel-0-1	1018	100 yr	505.00	6699.00	6701.61		6701.75	0.009469	3.00	168.56	121.49	0.45	0.82	1.39
Main Channel-0-1	1017	100 yr	505.00	6697.80	6700.67	6699.70	6700.74	0.004788	2.09	241.29	178.67	0.32	0.40	1.35
Main Channel-0-1	1016	100 yr	505.00	6696.40	6699.67	6698.65	6699.80	0.008234	2.89	174.95	119.90	0.42	0.75	1.46
Main Channel-0-1	1015	100 yr	505.00	6694.20	6697.08		6697.56	0.032246	5.55	90.95	64.93	0.83	2.81	1.40
Main Channel-0-1	1014	100 yr	505.00	6692.20	6695.42	6694.26	6695.56	0.006596	3.09	163.60	85.75	0.39	0.78	1.91
Main Channel-0-1	1013	100 yr	505.00	6691.00	6692.71	6692.71	6693.37	0.048628	6.50	77.64	59.48	1.00	3.95	1.31
Main Channel-0-1	1012	100 yr	505.00	6687.30	6690.62		6690.70	0.003297	2.35	215.12	101.03	0.28	0.44	2.13
Main Channel-0-1	1011	100 yr	505.00	6685.40	6689.22		6689.66	0.019635	5.33	94.80	49.06	0.68	2.33	1.93
Main Channel-0-1	1010	100 yr	505.00	6683.40	6687.46		6687.68	0.008729	3.72	135.84	66.04	0.46	1.11	2.06
Main Channel-0-1	1009	100 yr	505.00	6683.00	6686.20		6686.29	0.009054	2.42	214.68	238.49	0.42	0.59	0.90
Main Channel-0-1	1008	100 yr	505.00	6683.00	6685.19		6685.25	0.005416	1.97	258.32	242.87	0.33	0.38	1.06
Main Channel-0-1	1007.5			Lat Struct										
Main Channel-0-1	1007	100 yr	495.52	6682.30	6683.83		6683.96	0.015299	2.90	170.62	184.08	0.50	0.88	0.93
Main Channel-0-1	1006	100 yr	437.50	6681.00	6682.15		6682.23	0.008346	2.23	196.24	199.56	0.40	0.51	0.98
Main Channel-0-1	1005	100 yr	364.06	6679.50	6680.71		6680.80	0.011063	2.41	151.00	168.54	0.45	0.62	0.90
Main Channel-0-1	1004	100 yr	307.49	6678.00	6679.33		6679.39	0.007656	2.04	151.03	164.90	0.38	0.44	0.92
Main Channel-0-1	1003	100 yr	282.02	6676.30	6677.25		6677.40	0.023386	3.04	92.71	152.48	0.69	1.11	0.61
Main Channel-0-1	1002	100 yr	253.89	6674.30	6675.34	6674.89	6675.39	0.006976	1.77	143.71	181.22	0.35	0.34	0.79
Main Channel-0-1	1001	100 yr	228.65	6672.30	6672.84	6672.84	6673.03	0.072944	3.42	66.87	182.58	1.00	1.66	0.37
Main Channel-0-1	1000	100 yr	212.32	6670.00	6670.46	6670.46	6670.46	0.000021	0.04	848.73	536.15	0.02	0.00	1.58
Downstream Ov	1009	100 yr	0.01	6682.70	6682.73	6682.73	6682.73	0.001427	0.06	0.16	9.47	0.08	0.00	0.02
Downstream Ov	1008	100 yr	0.01	6682.10	6682.60	6682.12	6682.60	0.000000	0.00	36.84	116.11	0.00	0.00	0.32
Downstream Ov	1007	100 yr	80.42	6680.20	6680.52	6680.52	6680.62	0.083611	2.47	32.52	160.20	0.97	1.06	0.20
Downstream Ov	1006	100 yr	196.17	6677.40	6678.05		6678.12	0.025914	2.07	94.87	253.99	0.60	0.60	0.37
Downstream Ov	1005	100 yr	224.28	6674.60	6675.42	6675.14	6675.48	0.013081	1.89	118.53	217.09	0.45	0.45	0.55
Downstream Ov	1004	100 yr	225.25	6672.20	6672.80	6672.65	6672.88	0.023526	2.26	100.02	224.82	0.59	0.68	0.44
Downstream Ov	1003	100 yr	236.39	6669.60	6670.57	6670.25	6670.62	0.010463	1.78	133.13	228.33	0.41	0.38	0.58
Downstream Ov	1002	100 yr	284.43	6667.30	6668.16	6667.98	6668.26	0.023487	2.51	113.35	210.84	0.60	0.79	0.54
Downstream Ov	1001	100 yr	292.70	6665.50	6666.30		6666.34	0.007891	1.58	187.58	345.81	0.36	0.30	0.54
Downstream Ov	1000	100 yr	292.70	6663.80	6664.73	6664.48	6664.79	0.013917	2.07	142.83	254.26	0.47	0.52	0.56



Add a note that these areas will be analyzed in detail with the Filing 3 FDR and CDs

