

**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**

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

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.

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                                    |

most of?

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

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### 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 "Colorado Springs Drainage Criteria Manual (CCSDCM), dated May 2014, as adopted by El Paso County.

### Hydrologic Criteria

All hydrologic data was obtained from the "El Paso Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and

Final Drainage Report  
Filing 2 - Saddlehorn Ranch


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



**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

## 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

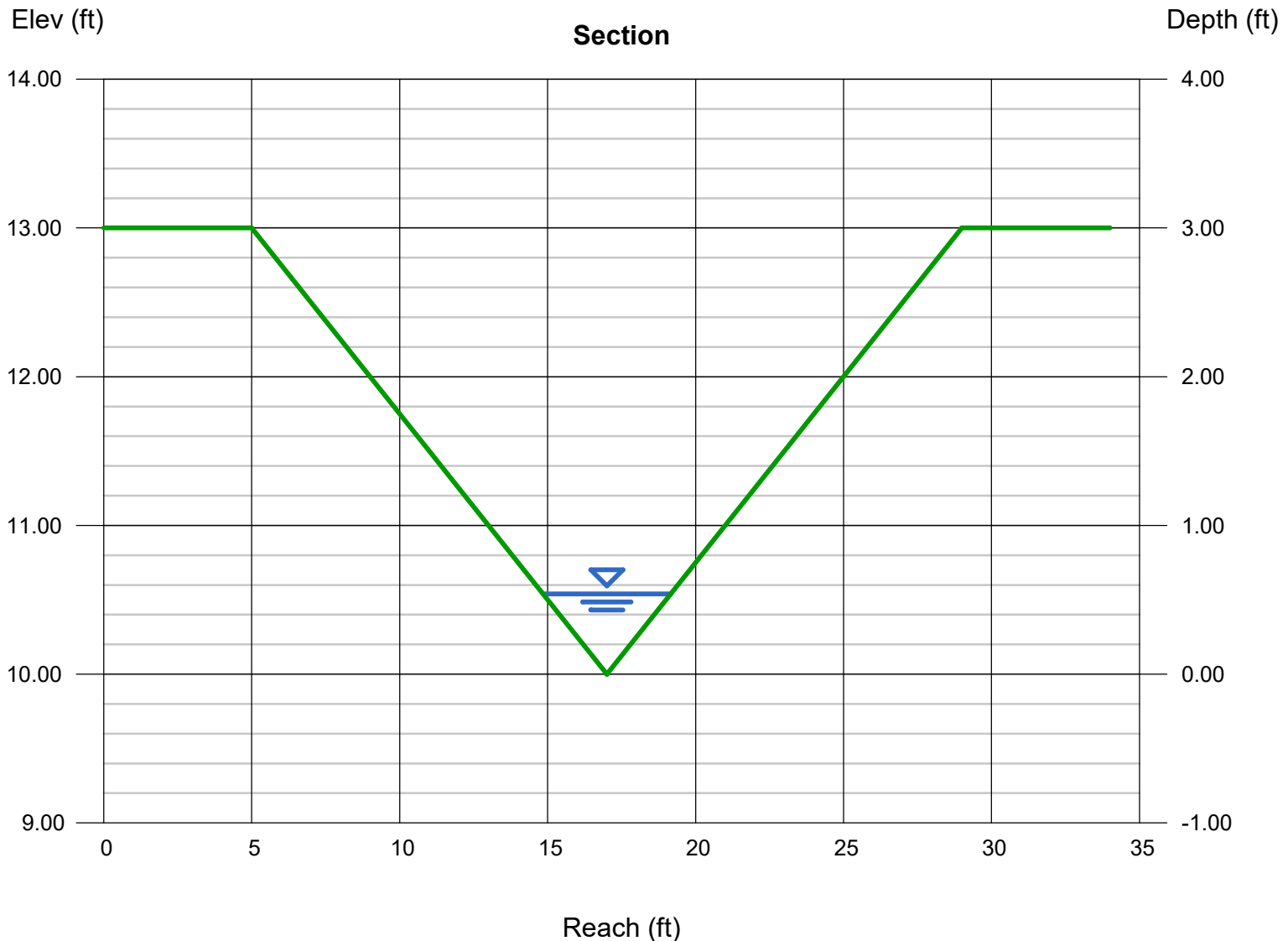
### Calculations

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



HEC-RAS Plan: Default Scenario Profile: 100 yr

| Reach            | River Sta | Profile | Q Total<br>(cfs) | Min Ch El<br>(ft) | W.S. Elev<br>(ft) | Crit W.S.<br>(ft) | E.G. Elev<br>(ft) | E.G. Slope<br>(ft/ft) | Vel Chnl<br>(ft/s) | Flow Area<br>(sq ft) | Top Width<br>(ft) | Froude # Chl | Shear Chan<br>(lb/sq ft) | Hydr Depth<br>(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

