



***HORSESHOE DRAW FLOOD CONTROL, RESTORATION
AND EROSION MITIGATION STUDY AND DESIGN PROJECT***

**VOLUME 2
EXISTING CONDITIONS HYDRAULIC REPORT
COCHISE COUNTY, ARIZONA**

Prepared for:

**Hereford Natural Resource
Conservation District**
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October, 2015
HilgartWilson Project No. 1472



VOLUME 2
HYDRAULIC DESIGN REPORT

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1. INTRODUCTION

1.1. PURPOSE

The purpose of this study is to provide hydraulic analysis of the existing conditions for Horseshoe Draw (the Project), which is a tributary to the San Pedro River. This study analyzes the floodplain inundation limits of the 2, 10, 25, 50, and 100-year storm events. The design flow rates utilized within this study were obtained from the Horseshoe Draw Flood Control, Restoration and Mitigation Study and Design Project Volume 1 – Existing Conditions Hydrologic Study Report.

The hydraulic analysis for the Project has been prepared using HEC-RAS version 4.1. The methodology and design parameters used within the model are detailed below.

1.2. PROJECT LOCATION AND DESCRIPTION

The hydraulic study area lies just north of the United States and Mexico border roughly 7 miles west of Naco, Arizona/Sonora within Township 24 South, Range 22 East of the Gila and Salt River Base and Meridian in Cochise County, Arizona. The Project's location is highlighted in the Vicinity Map, Figure 1, Appendix A.

This study has been prepared for the Hereford Natural Resource Conservation District (NRCD), who has identified the need for a project which will significantly reduce flooding, erosion and soil loss, as well as road and property damage in and adjacent to Horseshoe Draw. The Project also aims to improve groundwater recharge by slowing the rate of discharge to downstream waters. In order to complete such a project, the Hereford NRCD was awarded a grant from the Arizona Department of Water Resources (ADWR) through the Arizona Water Protection Fund Program. In turn, HILGARTWILSON has been contracted under the Water Protection Fund grant for professional engineering services.

This study and corresponding report make up Volume 2 in a series of reports that will be prepared under the awarded grant. This study provides existing conditions hydraulic analyses which will be used as a baseline comparison for the future hydraulic analysis that will be prepared for the proposed water impoundment structure. The proposed impoundment structure will reduce head cutting within Horseshoe Draw and sedimentation transportation to the San Pedro River. It will also attenuate flows within the Draw which has the added benefit of improving groundwater recharge by slowing the rate of discharge to downstream waters.

1.3. FLOOD HAZARD IDENTIFICATION

As shown in Figure 2 of Appendix A, there is a Zone A floodplain associated with Horseshoe Draw, shown on FEMA Flood Insurance Rate Map 04003C2780F, dated August 28, 2008. Flood Zone A is defined as:

“Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.”

Ultimately, with the construction of the impoundment structure, the 100-year Zone A floodplain associated with Horseshoe Draw will be revised. This study however, will be used only as a basis to compare 100-year floodplain inundation limits determined with the updated hydrologic study and topography with the FEMA floodplain.

2. HYDROLOGIC STUDY OVERVIEW

Horseshoe Draw conveys runoff from roughly 17 square miles of undeveloped rangeland to the San Pedro River. The watershed of the Project originates in the Sierra San Jose mountains in Mexico and extends to the confluence of Horseshoe Draw and the San Pedro River, located just south of Highway 92.

HEC-HMS was used for the hydrologic analysis of the Project which was detailed within Volume 1 of this report series. Due to the size of the watershed, both, the 100-year, 6-hour and 100-year, 24-hour storm events were modeled to compare the calculated flow rates. Based on the hydrologic modeling results, the flows determined during the 100-year, 6-hour storm exceed those determined using the 100-year, 24-hour storm; therefore, the flowrates from the 100-year, 6-hour model have been utilized in this hydraulic study. Subsequently, the 2-year, 10-year, 25-year, and 50-year flow rates with the 6-hour storm duration were determined using the same methodology outlined in the Volume 1 Report.

3. HYDRAULIC ANALYSIS

3.1. METHOD DESCRIPTION

Hydraulic analysis for this study was performed utilizing HEC-RAS version 4.1.0. Cross sections within the model were exported from a digital terrain model (DTM) from AutoCAD Civil 3D. The DTM was built based on a topographic aerial survey performed by Kenny Aerial Mapping, Inc. in October, 2014. The aerial mapping contains detailed topography at 2-foot intervals using the North American Vertical Datum of 1988 (NAVD 88).

An existing conditions hydraulic exhibit has been included as Figure 3 of Appendix A. This exhibit displays existing FEMA Zone A floodplain as well as the updated 100-year floodplain based off of the more recent and detailed topographic survey and the updated hydrologic study. Further description of the design parameters and methodology used in the HEC-RAS model in order to delineate the 100-year inundation limits is included herein.

3.2. HEC-RAS PARAMETERS

Manning's roughness coefficients for Horseshoe Draw were estimated to be 0.030 and 0.035 for the channel and overbank areas respectively. The HEC-RAS expansion and contraction coefficients were assumed to be 0.1 and 0.3.

The most upstream and downstream cross sections were cut as closely as possible to the limits of the updated topography along horseshoe draw as to encompass the largest reach possible to be used in the future hydraulic design of the impoundment structure. There are various locations where berms were constructed across the wash in order to mitigate velocities within the channel, however, these berms have been washed out by major storms and have a limited effect on the hydraulic model.

3.3. MODELING CONSIDERATIONS

The average slope of Horseshoe Draw within the study reach is roughly 1.0%. With this slope many of the cross sections yielded Froude numbers greater than 1 in the HEC-RAS output, meaning portions of the channel are operating under a supercritical flow regime. As a result, the HEC-RAS model was run two times using different flow regimes. Results from the model while using the subcritical flow regime were used in delineating the 100-year floodplain in order to produce a conservative estimation of the 100-year water surface elevations and corresponding inundation limits. The mixed condition flow regime was used to observe the maximum velocities within the wash.

The hydraulic analysis focuses on the main wash of Horseshoe draw while taking into consideration the lateral inflows from the wash tributaries. The flow rates from these tributaries were also determined in the hydrologic study detailed in Volume 1. Flow changes have been added to cross sections directly downstream of these tributaries in order to reflect these conditions.

Many of the cross sections within the model span both the main channel of Horseshoe Draw as well as various tributaries. Consequently, these cross sections graphically display low points in the main wash as well as the tributaries. The levee option has been used within the model at these sections in order to continue directing flows in the main channel and not allowing flow to be shown in the tributaries. This has the effect of calculating the most conservative water surface elevations within the main channel while also keeping the delineated floodplain uniform rather than inaccurately displaying flow spits where these tributaries intersect the main wash.

Matching what was done in the existing floodplain study, the floodplain analysis performed in this study does not include a floodway encroachment analysis.

3.4. FINAL MODELING RESULTS

As shown in Figure 3 of Appendix A, the results of this study are comparable to those shown on the effective FEMA mapping. In most cases however, this updated study shows the floodplain to be narrower than the FEMA mapping. It is evident that this is due to the extensive incising happening within the wash due to the erosive nature of the major flows. These results further clarify that mitigation measures need to be taken so that the channel does not continue to scour. HEC-RAS model output has been included in Appendix B.

The results generated by the hydraulic model were reasonable and within expected parameters.

4. CONCLUSION

This study has been prepared in order to provide an existing conditions hydraulic analysis for Horseshoe Draw. It was completed using HEC-RAS and will be used as a basis for future hydraulic analyses and the design and implementation of the proposed impoundment structure.

An unsteady flow state HEC-RAS model will be prepared for the proposed impoundment structure showing how it will hydraulically perform in real time during the 100-year, 6-hour storm. A sediment transport analysis will also be performed in order to more thoroughly understand the issues causing the erosive conditions currently observed at the site and to provide insight into what effect the impoundment structure will have on these conditions.

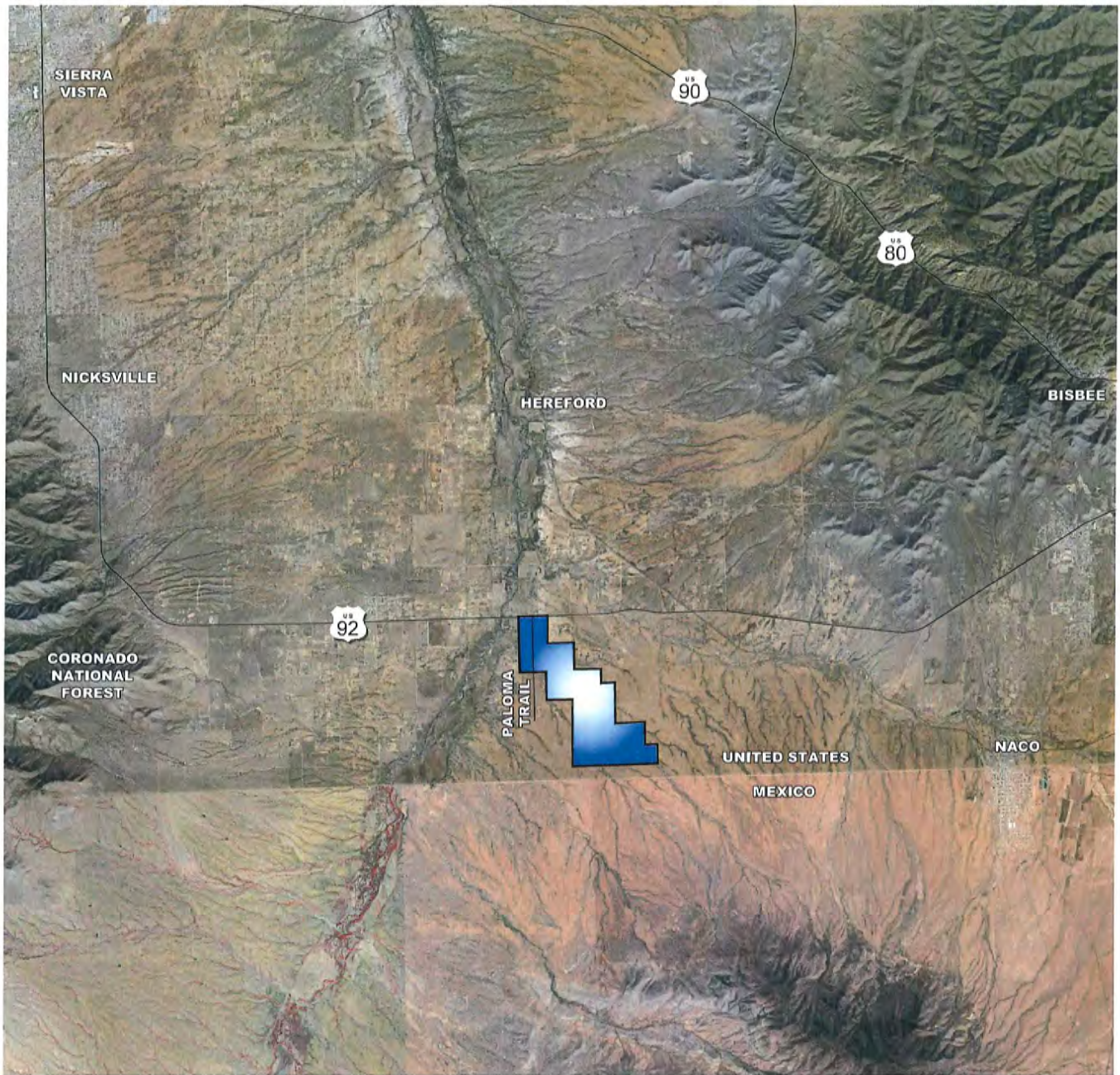
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APPENDIX A
FIGURES



LEGEND

PROJECT LOCATION

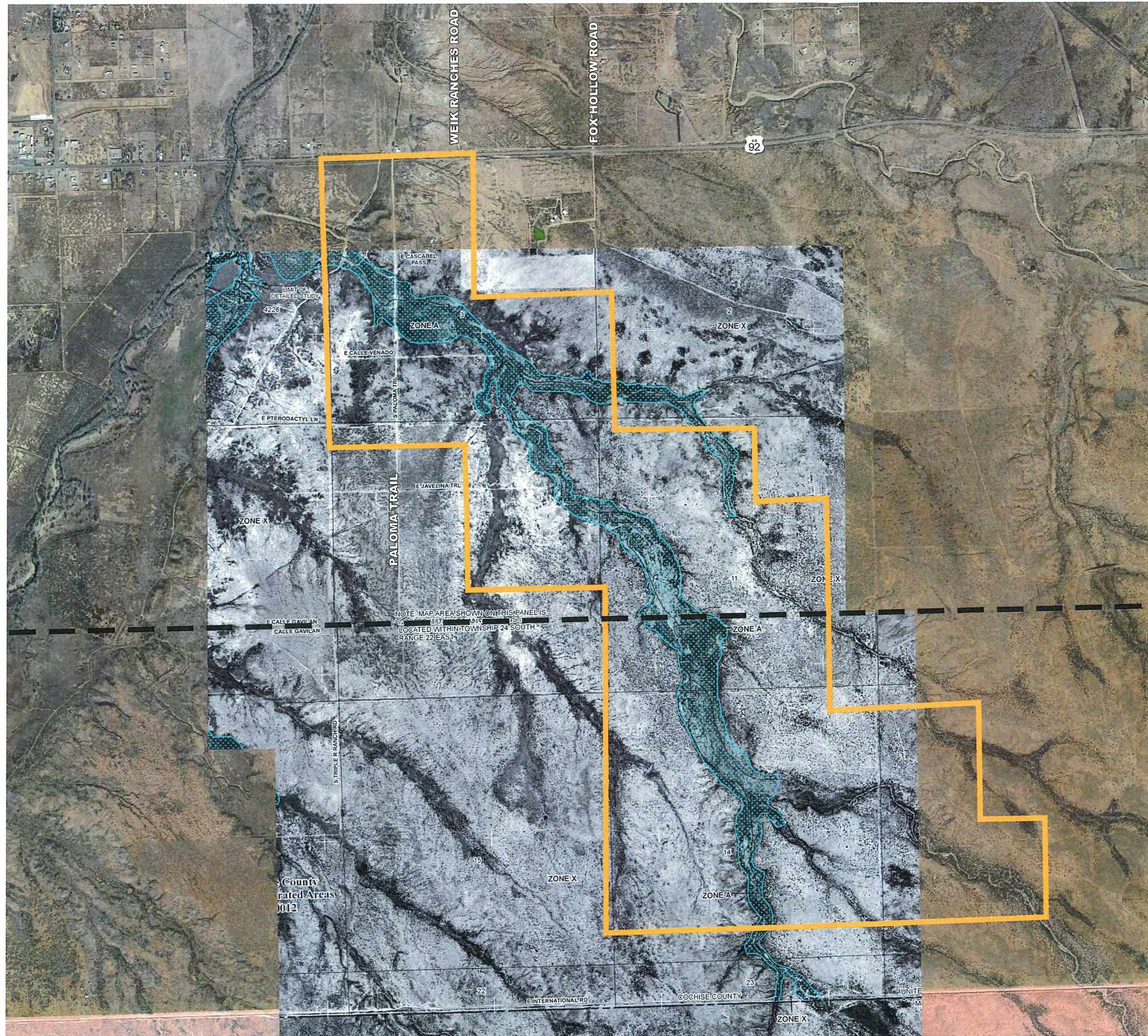


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CHECKED BY:	AT

HORSESHOE DRAW
COCHISE COUNTY, ARIZONA
FIG 1: VICINITY MAP



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LEGEND

PROJECT LOCATION

FEMA MAP LIMITS

PANEL 2780F

FIRM
FLOOD INSURANCE RATE MAP

COCHISE COUNTY,
ARIZONA
AND INCORPORATED AREAS

PANEL 2780 OF 3000
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY	NUMBER	PANEL	SUFFIX
COCHISE COUNTY	040012	2780	F

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
04003C2780F

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

PANEL 2780F

FIRM
FLOOD INSURANCE RATE MAP

COCHISE COUNTY,
ARIZONA
AND INCORPORATED AREAS

PANEL 2780 OF 3000
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

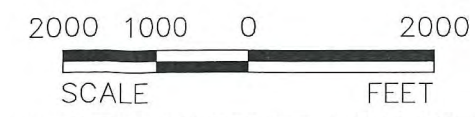
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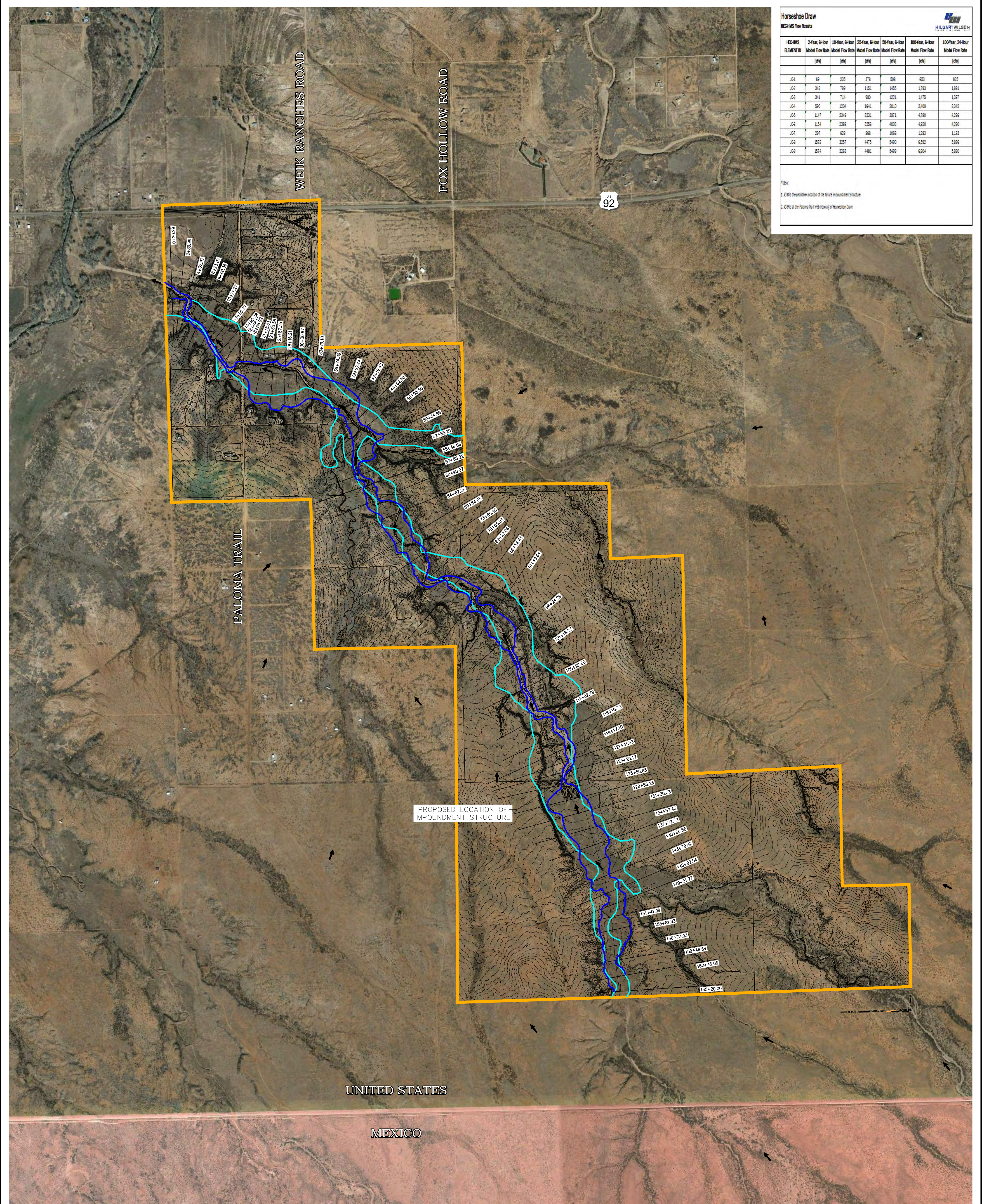
Federal Emergency Management Agency



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HORSESHOE DRAW
COCHISE COUNTY ARIZONA
FIG 2 FEMA MAP

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DRAWN BY:	JM
CHECKED BY:	AT



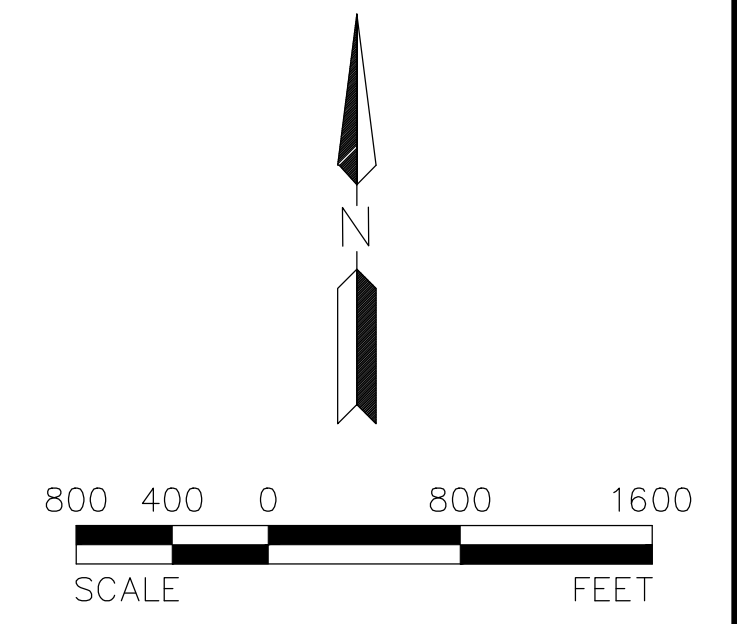
Horseshoe Draw
HEC-HMS Flow Results

HEC-HMS ELEMENT ID	2-Year, 6-Hour Model Flow Rate [cfs]	10-Year, 6-Hour Model Flow Rate [cfs]	25-Year, 6-Hour Model Flow Rate [cfs]	50-Year, 6-Hour Model Flow Rate [cfs]	100-Year, 6-Hour Model Flow Rate [cfs]	100-Year, 24-Hour Model Flow Rate [cfs]
JC1	69	235	379	506	693	825
JC2	342	799	1151	1455	1769	1891
JC3	341	714	990	1221	1475	1587
JC4	990	1204	1641	2010	2409	2542
JC5	1247	2349	3231	3971	4780	4998
JC6	1154	2386	3236	4003	4820	4990
JC7	297	628	896	1096	1283	1383
JC8	3572	3237	4473	5490	6392	6996
JC9	3574	3233	4481	5489	6304	6990

Notes:
1. JC8 is the possible location of the future impoundment structure.
2. JC9 is at the Paloma Trail wet crossing of Horseshoe Draw.

LEGEND

PROJECT BOUNDARY	
EXISTING FEMA FLOODPLAIN	
PROPOSED 100-YEAR FLOODPLAIN	
FLOW ARROW	



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PROJ NO.: 1472
DATE: OCT. 2015
SCALE: 1" = 800'
DRAWN: JM
DESIGNED: HW
APPROVED: AT

EXISTING CONDITIONS HYDRAULIC EXHIBIT

COCHISE COUNTY, ARIZONA

FIG 3. HYDROLOGY EXHIBIT

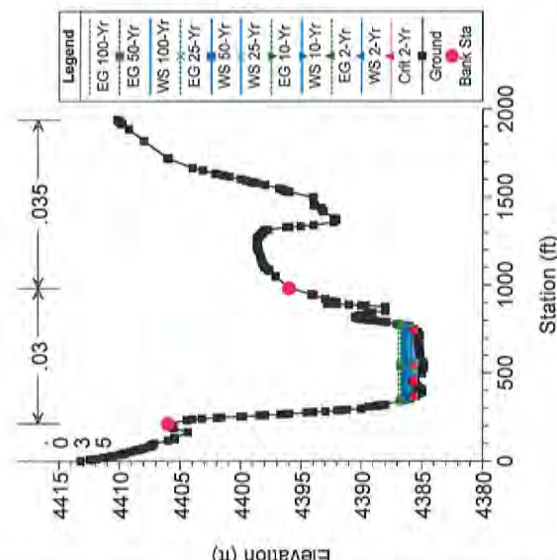
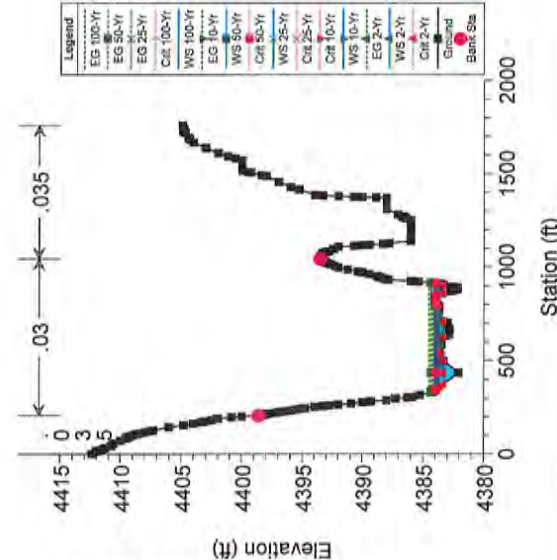
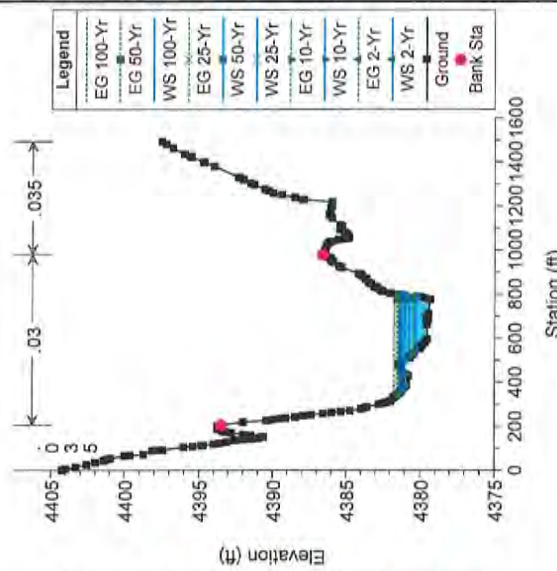
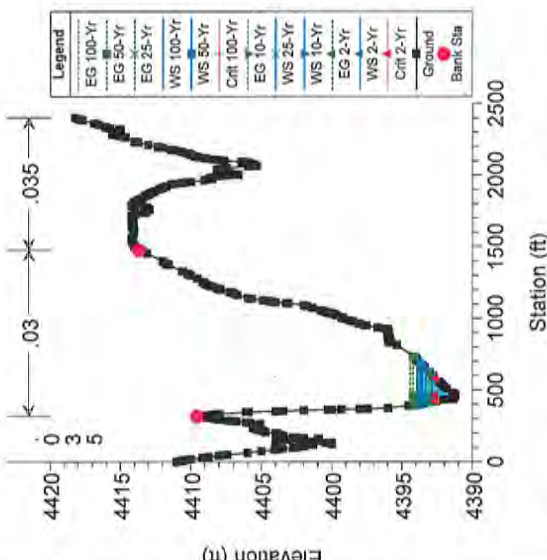
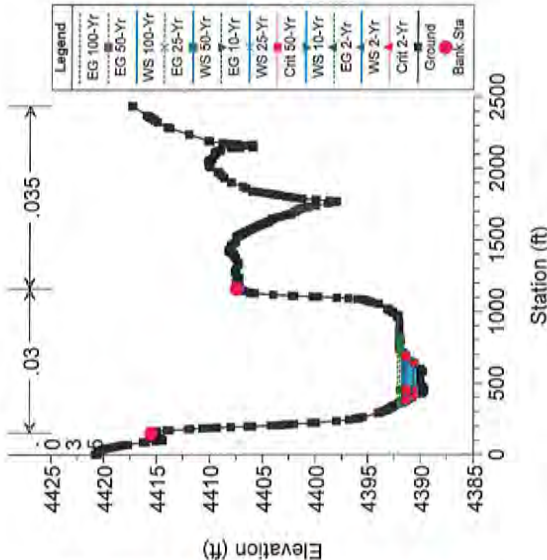
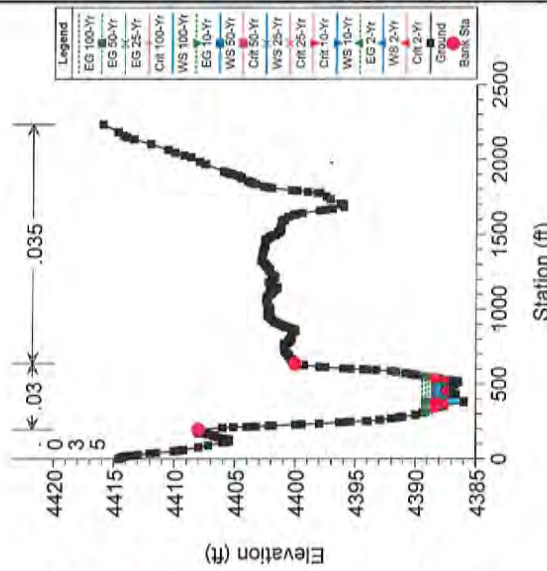
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ENGINEER | PLAN | SURVEY | MANAGE

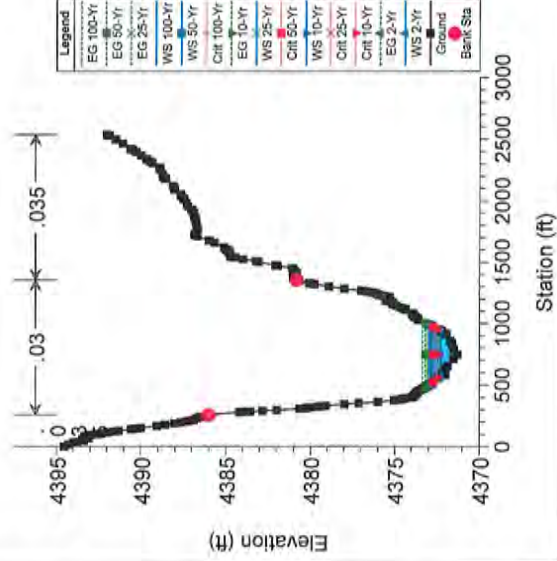
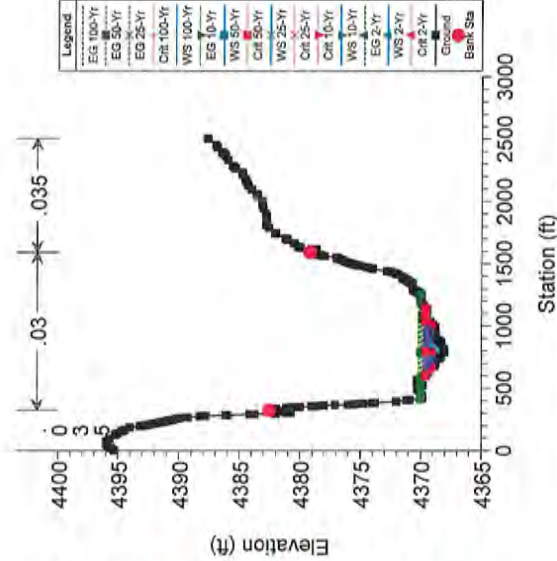
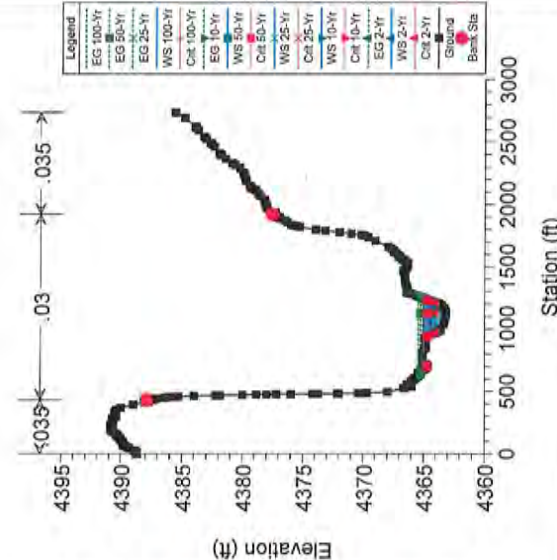
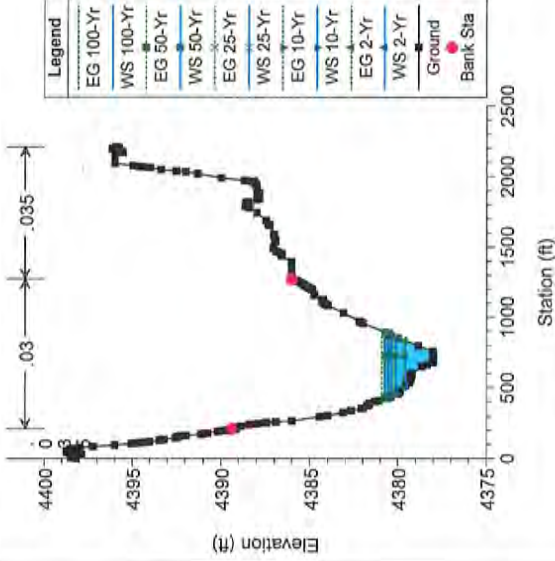
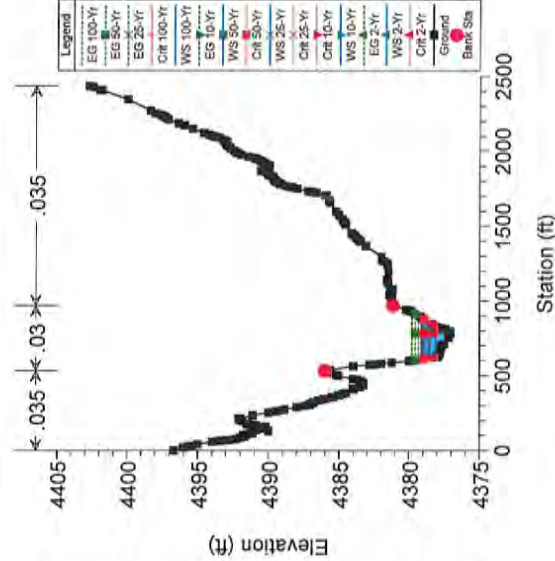
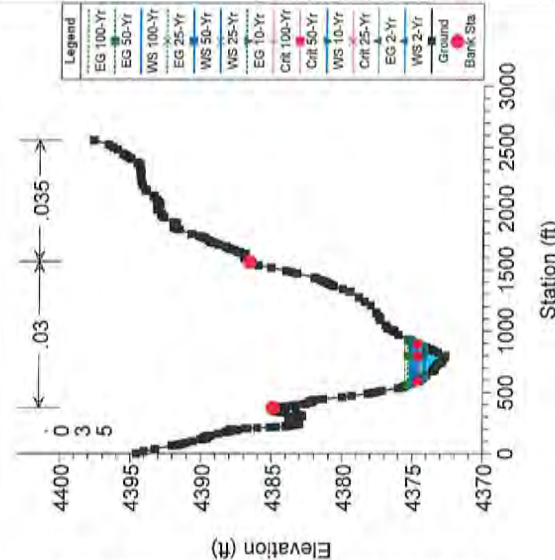
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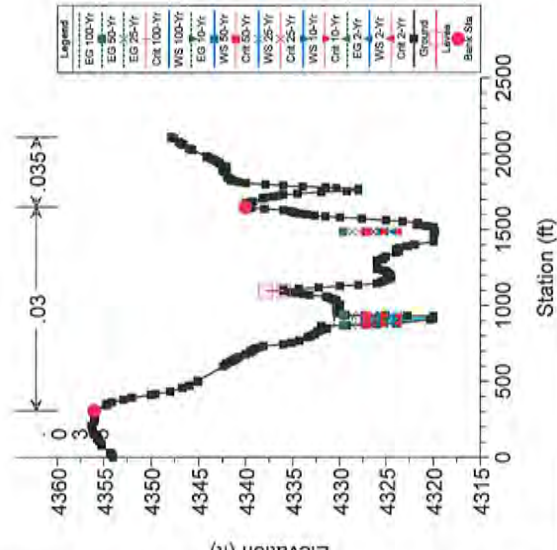
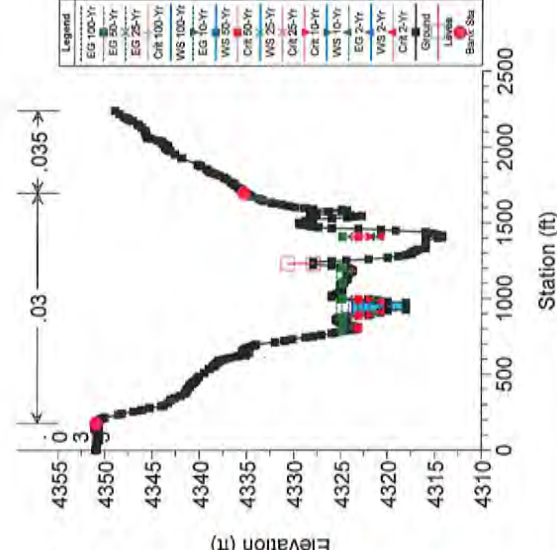
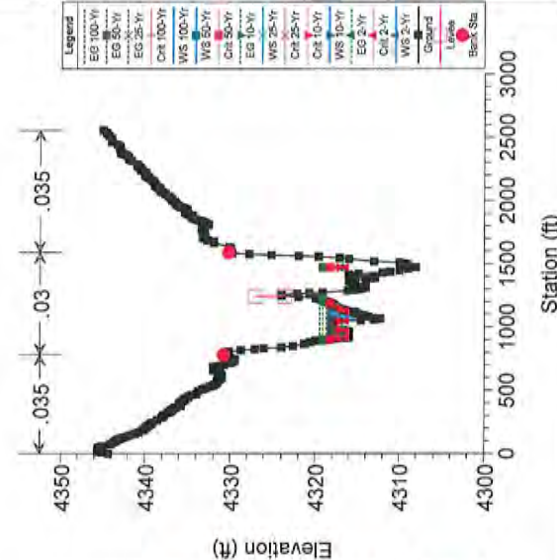
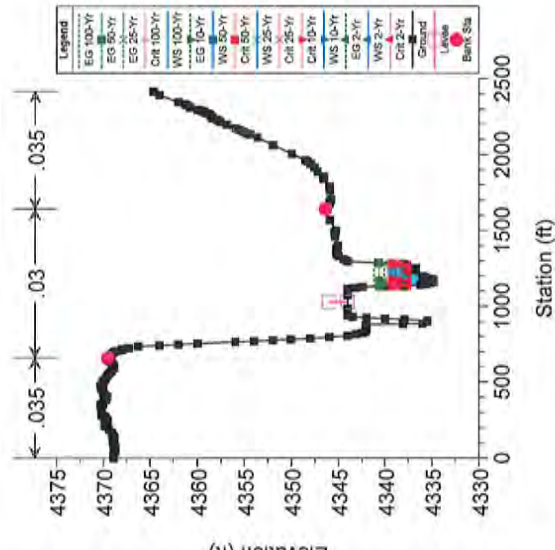
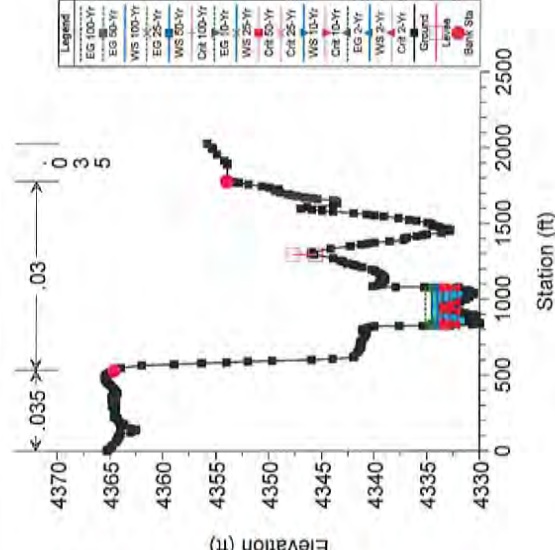
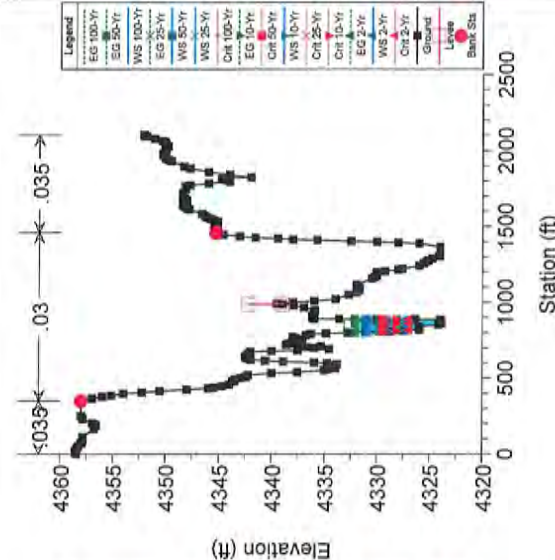
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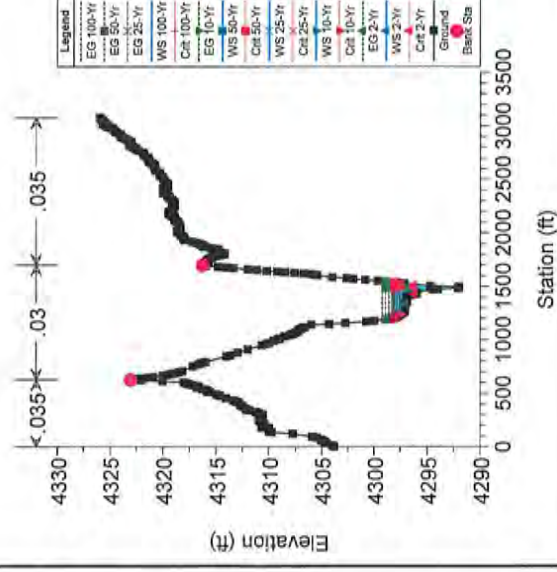
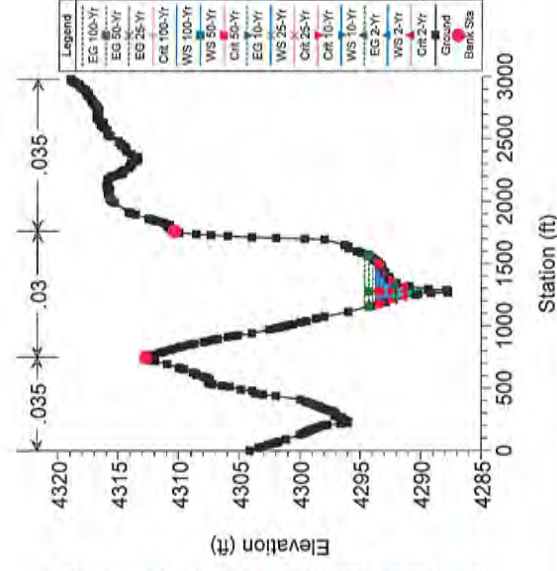
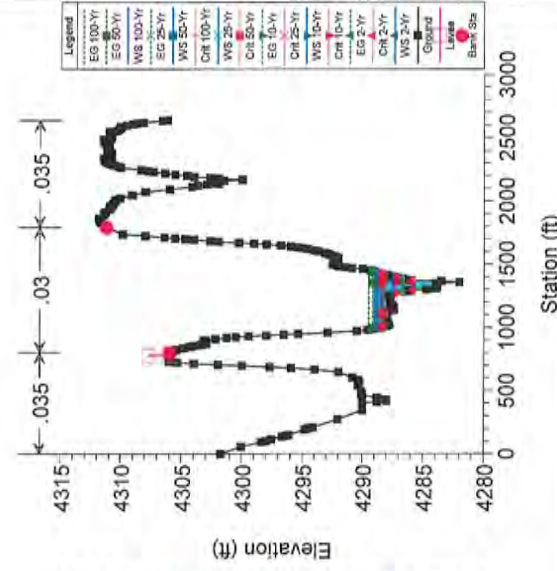
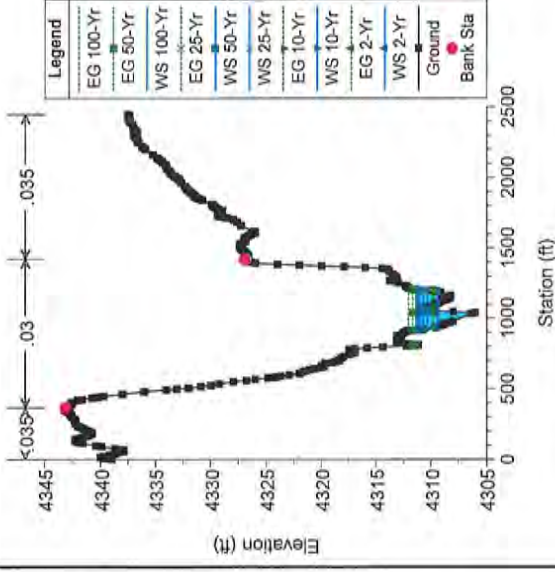
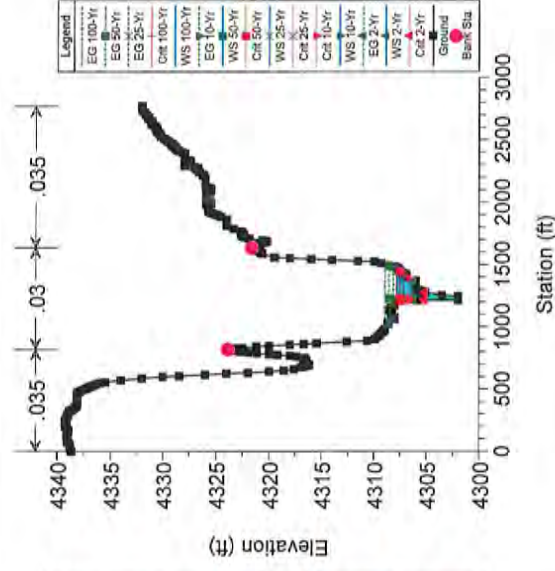
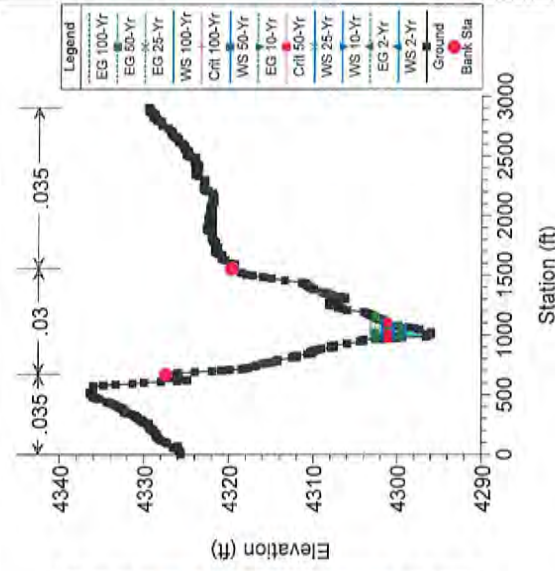
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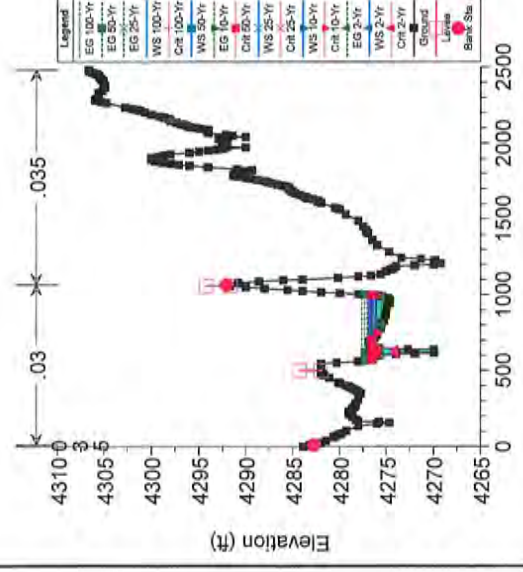
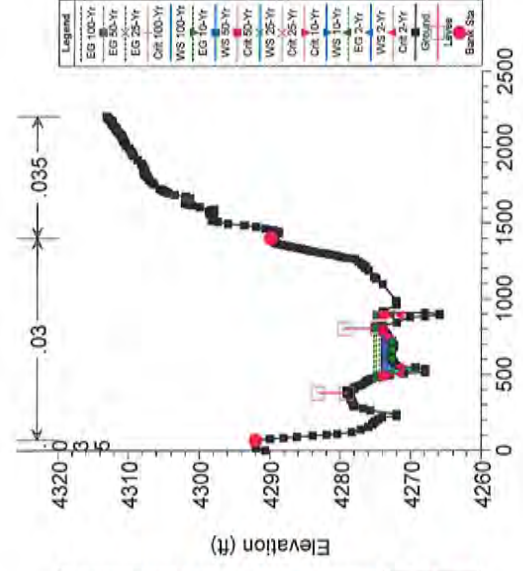
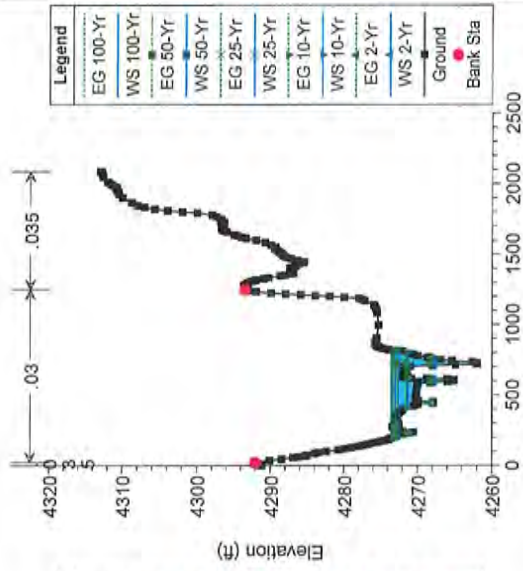
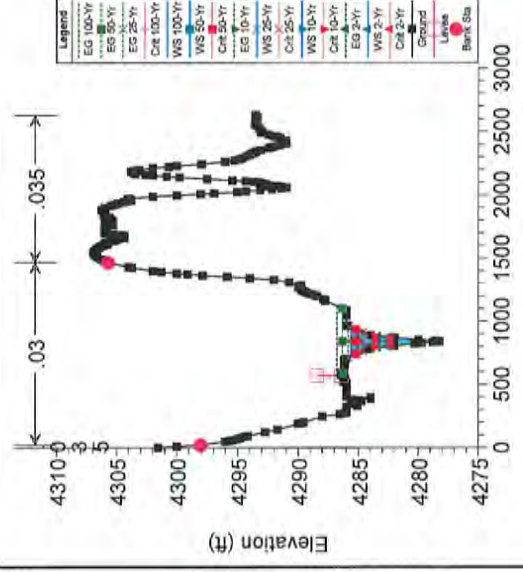
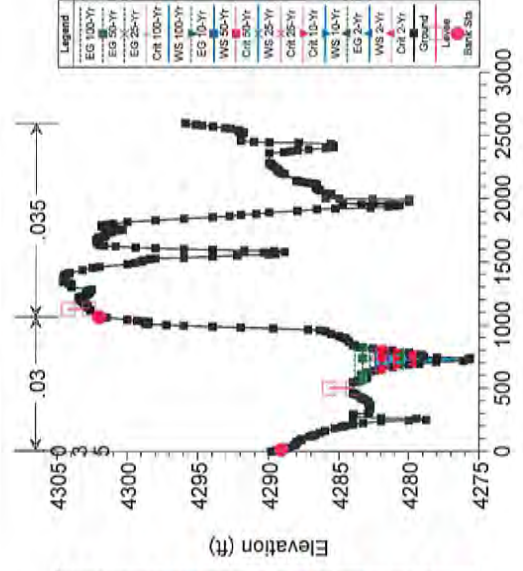
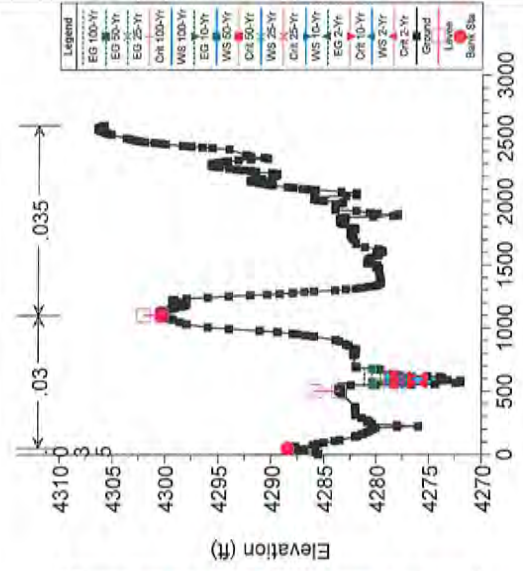
APPENDIX B
HEC-RAS MODEL
OUTPUT

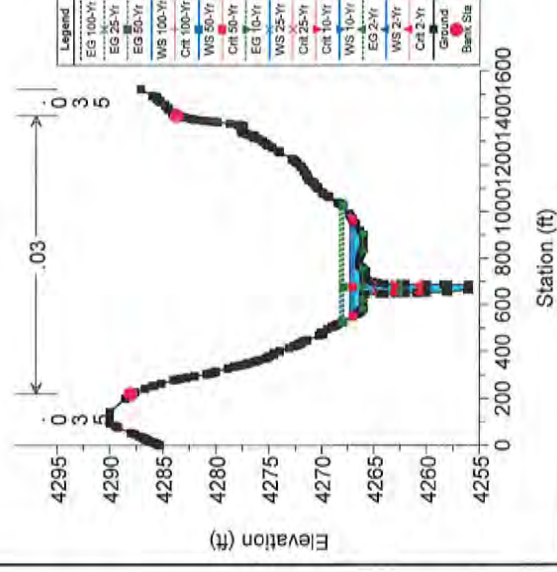
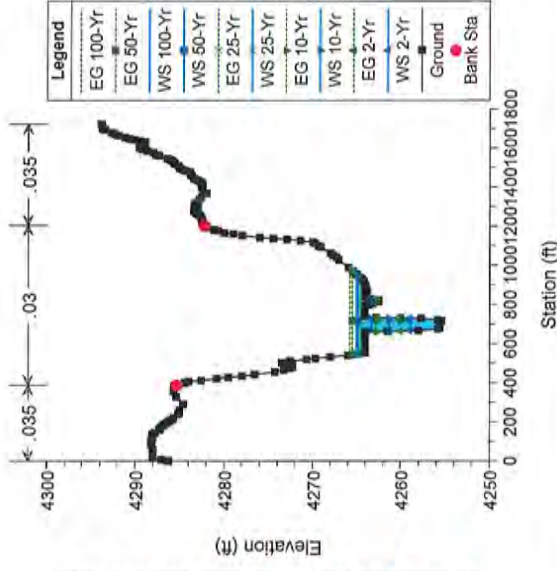
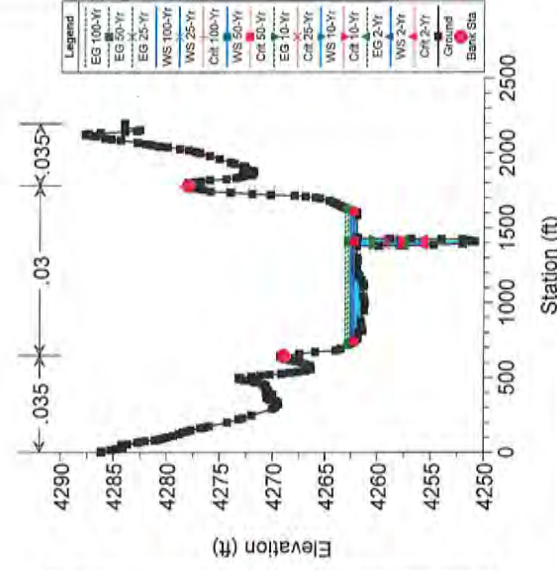
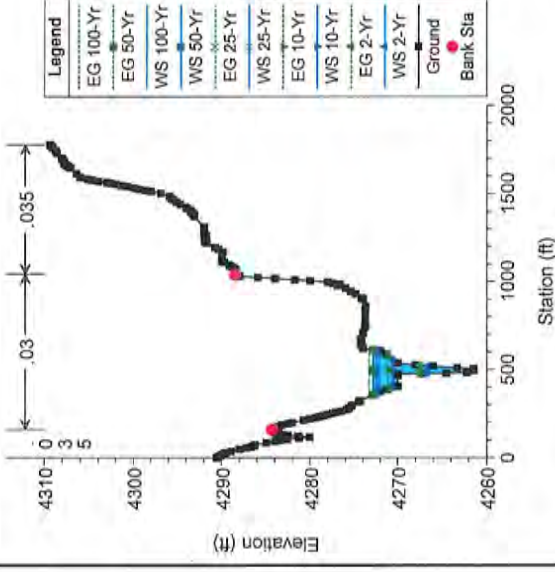
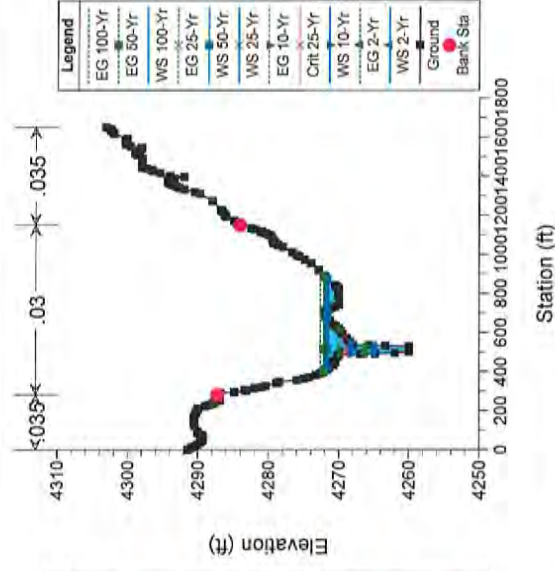
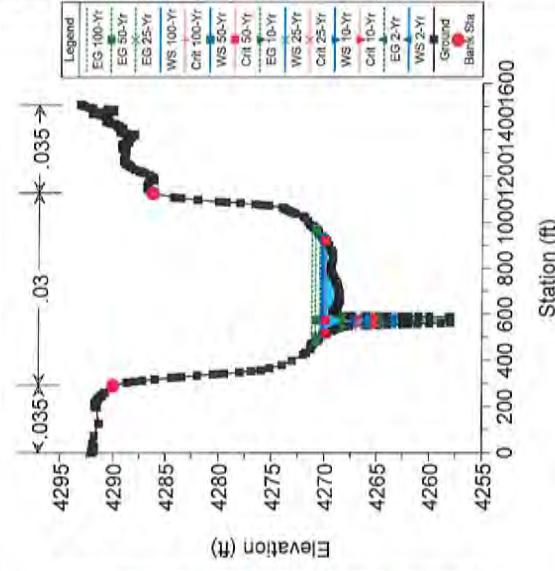


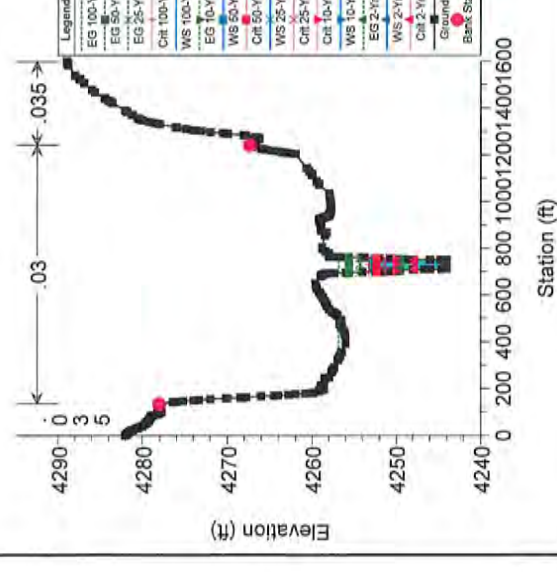
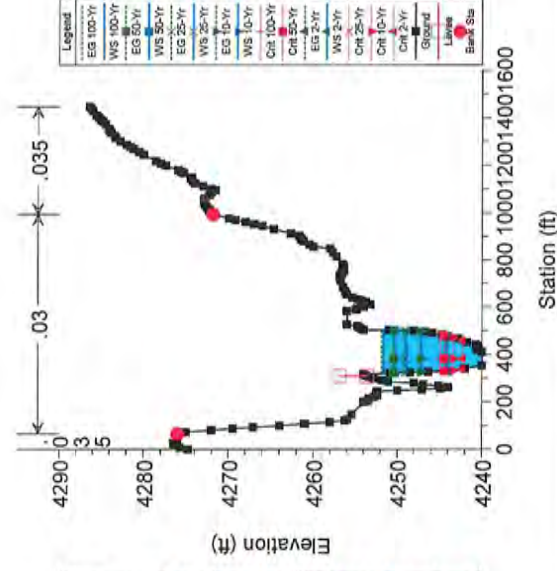
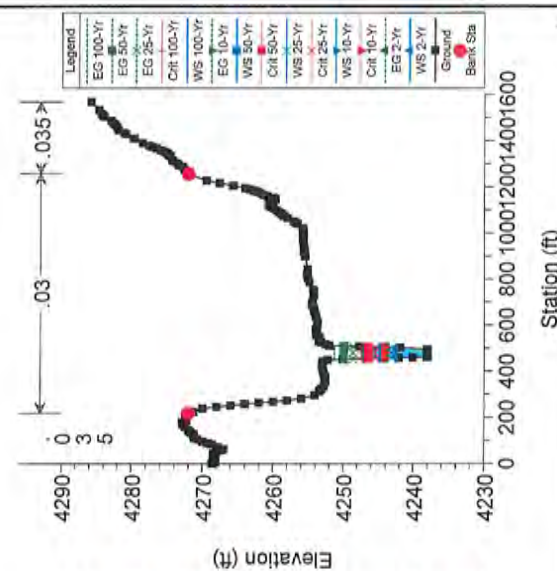
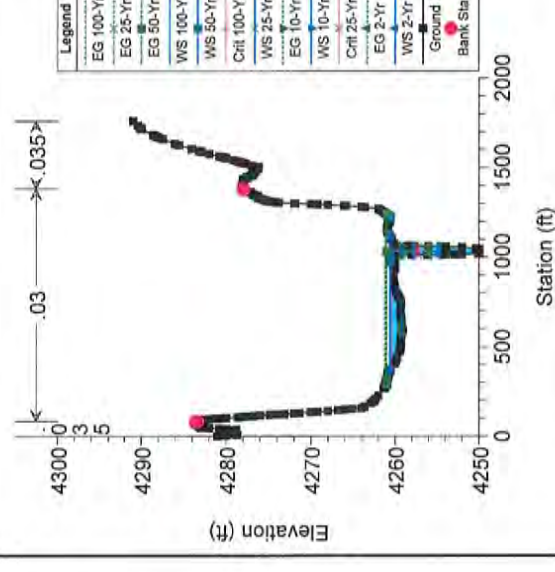
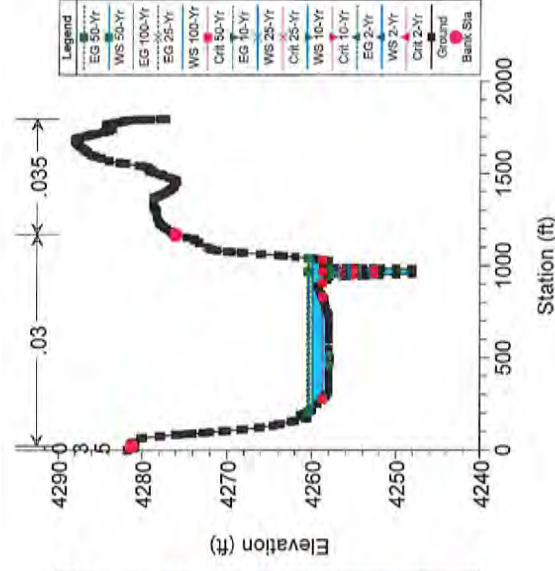
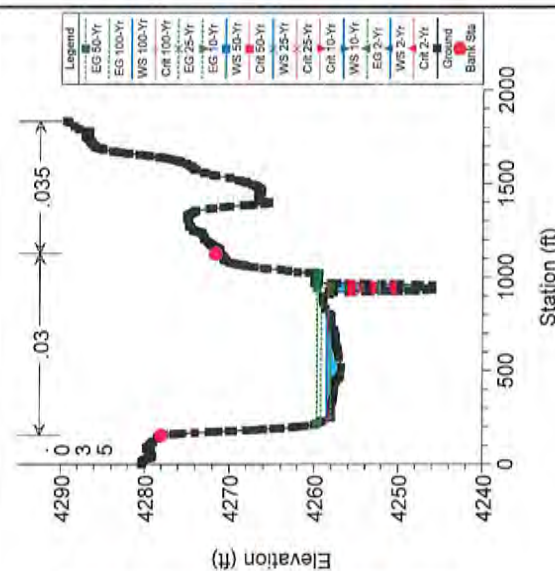


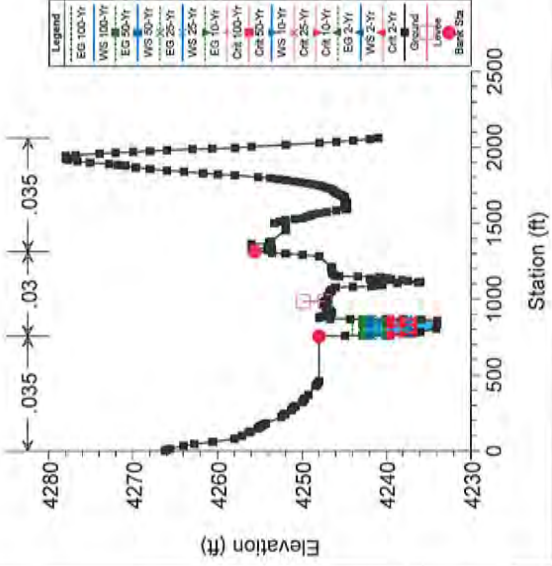
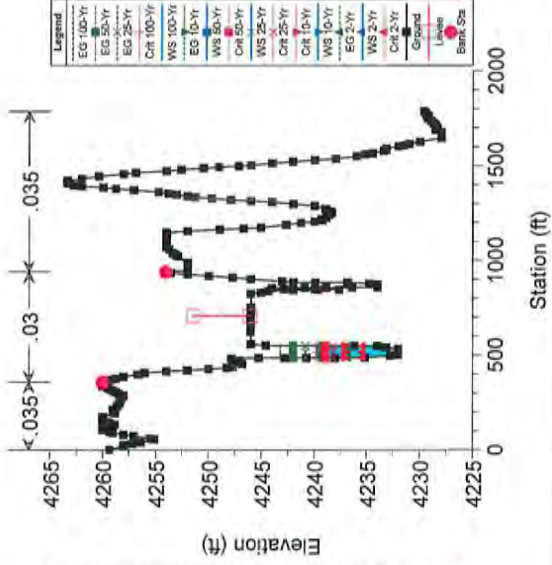
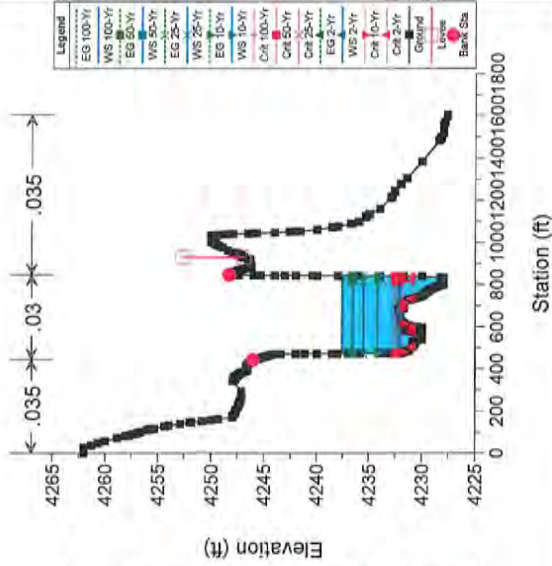
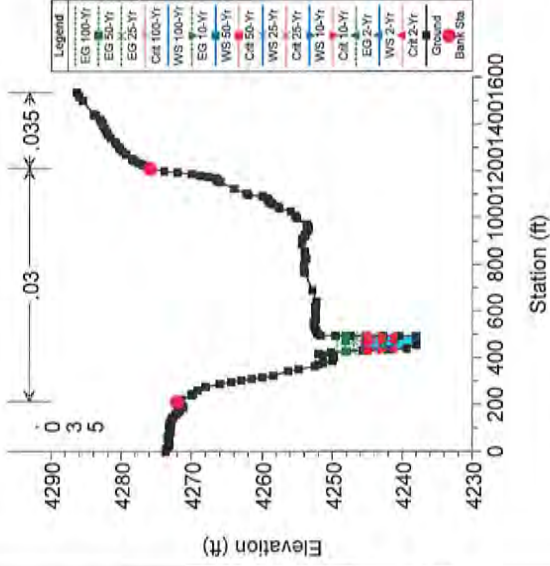
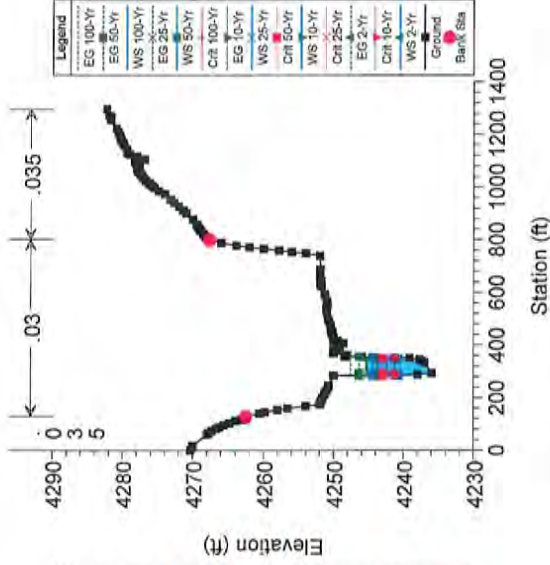
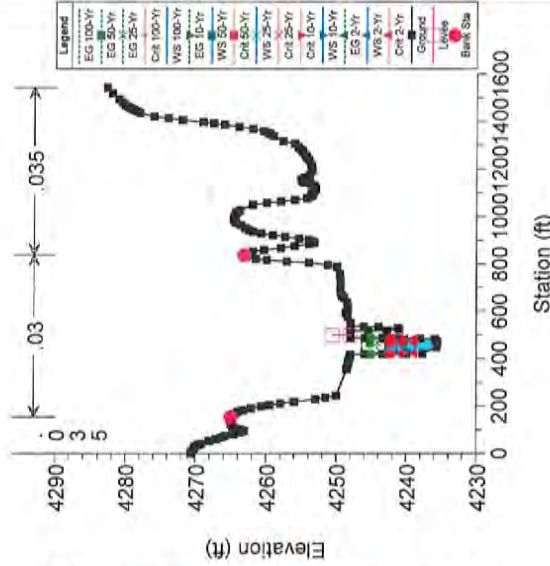


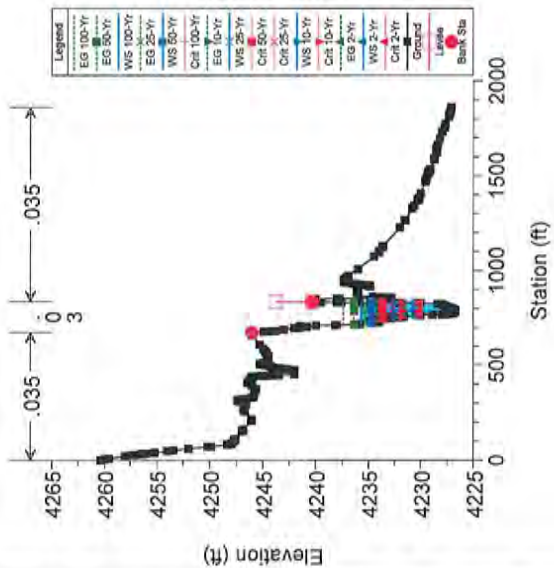
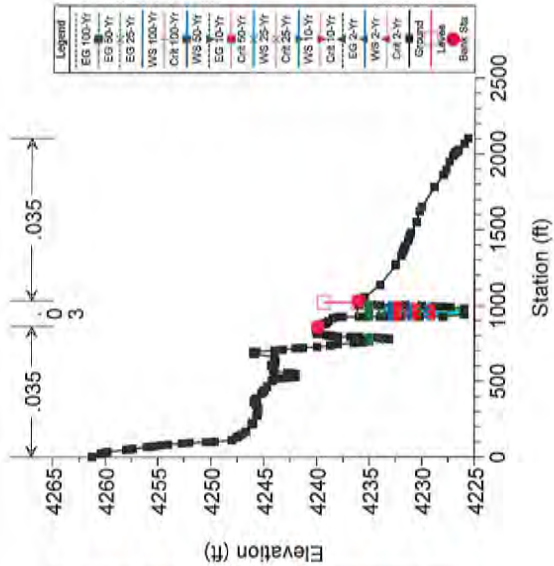




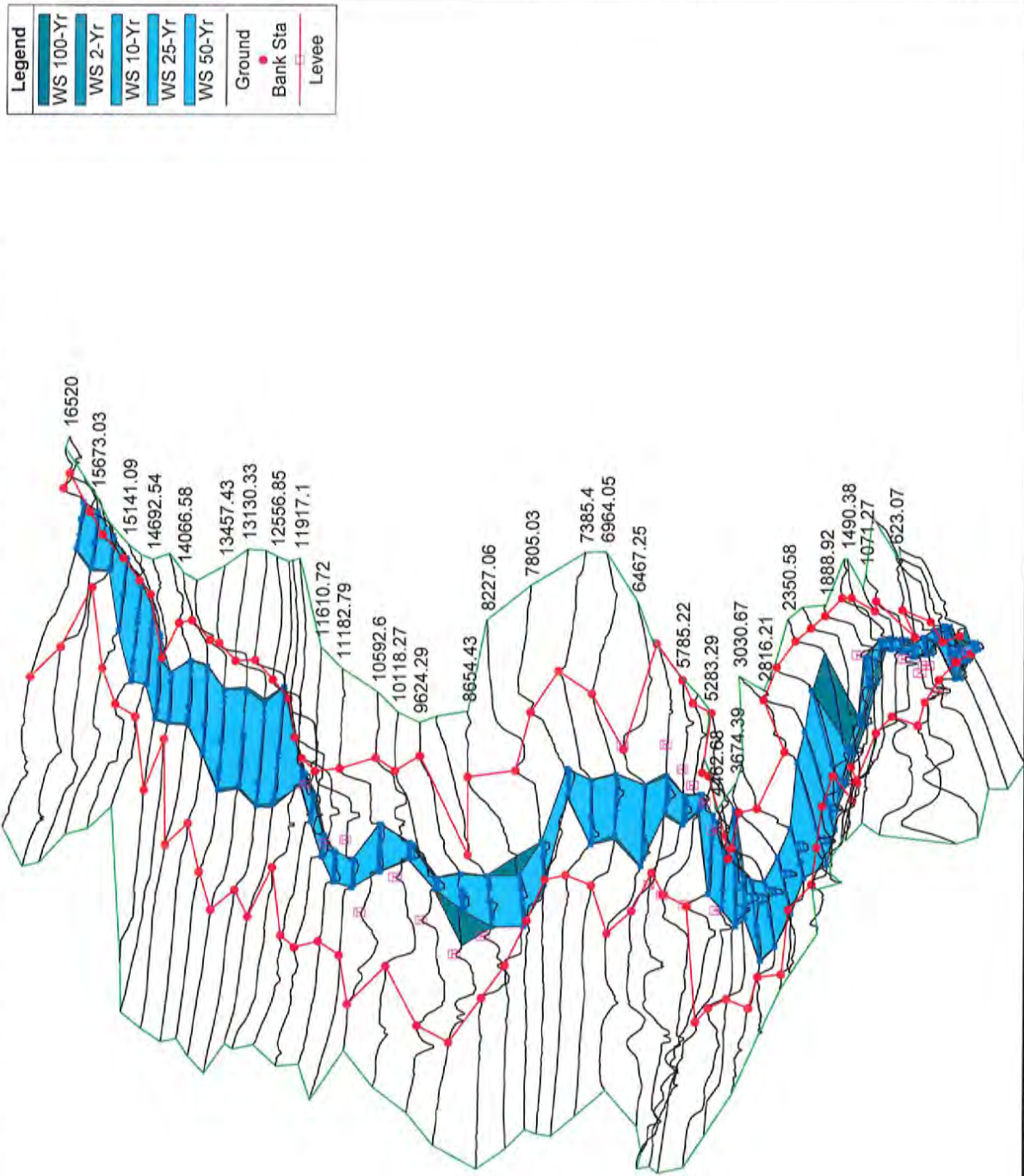




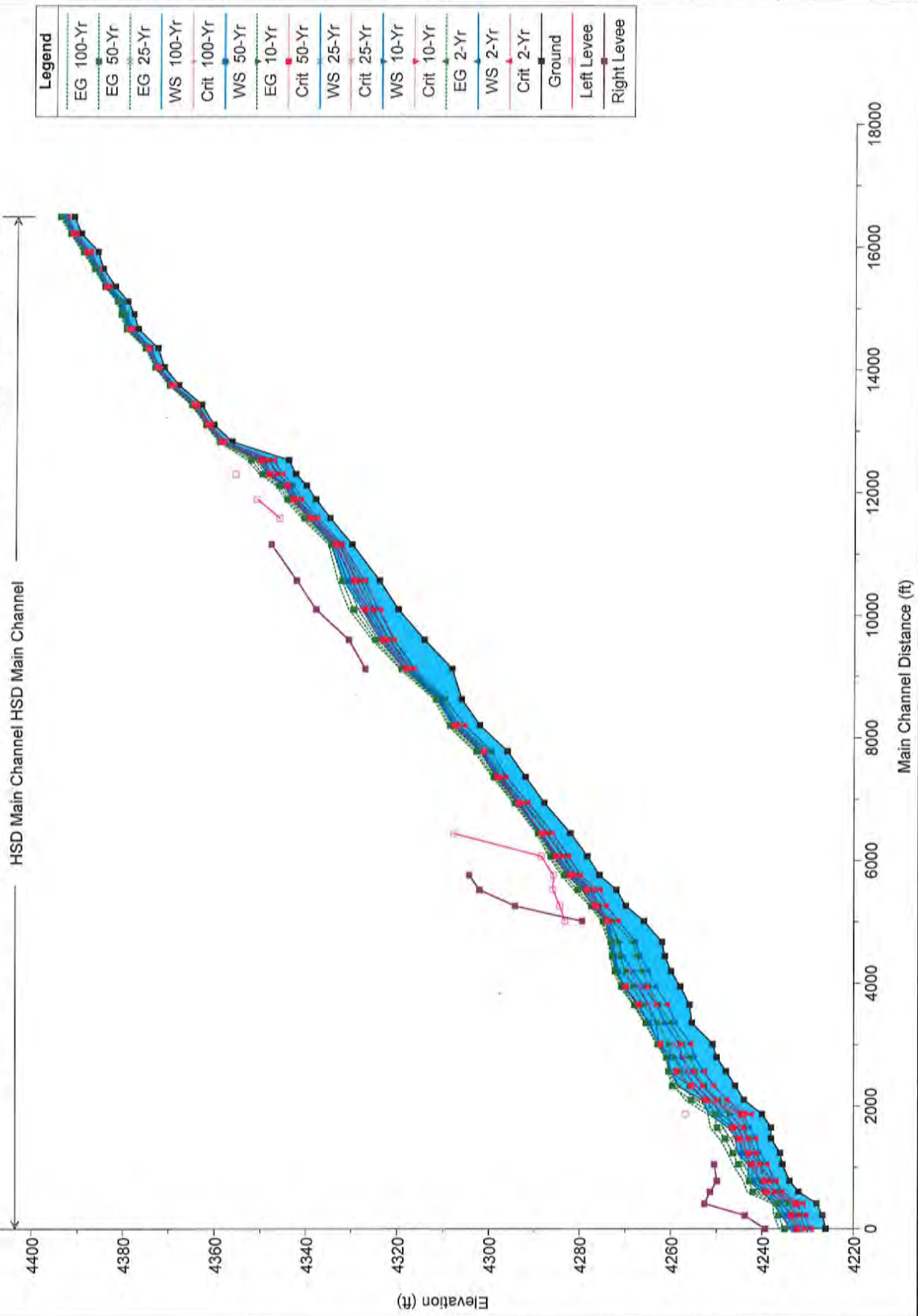




Horseshoe Draw Existing (Steady State) Plan: Horseshoe Draw Existing (Steady) 10/2/2015



Horseshoe Draw Existing (Steady State) Plan: Horseshoe Draw Existing (Steady) 10/2/2015



Legend	
EG 100-Yr	EG 50-Yr
EG 25-Yr	WS 100-Yr
Crit 100-Yr	WS 50-Yr
EG 10-Yr	Crit 50-Yr
WS 25-Yr	Crit 25-Yr
WS 10-Yr	Crit 10-Yr
EG 2-Yr	WS 2-Yr
Crit 2-Yr	Ground
Left Levee	Right Levee

**SUBCRITICAL
FLOW REGIME RESULTS**

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel

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
HSD Main Channel	16520	100-Yr	2409.00	4391.22	4393.88	4393.72	4394.40	0.008895	5.77	417.42	303.84	0.87
HSD Main Channel	16520	2-Yr	590.00	4391.22	4392.84	4392.58	4393.05	0.006434	3.62	162.79	196.68	0.68
HSD Main Channel	16520	10-Yr	1204.00	4391.22	4393.28		4393.63	0.008129	4.70	255.94	236.60	0.80
HSD Main Channel	16520	25-Yr	1641.00	4391.22	4393.54		4393.95	0.008369	5.13	320.04	265.75	0.82
HSD Main Channel	16520	50-Yr	2010.00	4391.22	4393.72		4394.18	0.008576	5.44	369.48	285.90	0.84
HSD Main Channel	16246.06	100-Yr	2409.00	4389.64	4391.74		4392.15	0.007372	5.15	467.57	350.60	0.79
HSD Main Channel	16246.06	2-Yr	590.00	4389.64	4390.70	4390.59	4390.91	0.009607	3.69	159.87	241.19	0.80
HSD Main Channel	16246.06	10-Yr	1204.00	4389.64	4391.16		4391.44	0.007699	4.28	281.19	287.50	0.76
HSD Main Channel	16246.06	25-Yr	1641.00	4389.64	4391.39		4391.73	0.007635	4.68	350.87	312.31	0.78
HSD Main Channel	16246.06	50-Yr	2010.00	4389.64	4391.56	4391.34	4391.94	0.007642	4.96	405.42	330.84	0.79
HSD Main Channel	15946.84	100-Yr	2409.00	4386.00	4388.59	4388.59	4389.39	0.011523	7.20	334.54	212.05	1.01
HSD Main Channel	15946.84	2-Yr	590.00	4386.00	4387.55	4387.45	4387.94	0.010824	4.35	135.54	174.45	0.87
HSD Main Channel	15946.84	10-Yr	1204.00	4386.00	4387.92	4387.92	4388.47	0.013057	5.98	201.20	164.90	1.01
HSD Main Channel	15946.84	25-Yr	1641.00	4386.00	4388.16	4388.18	4388.84	0.012323	6.52	251.85	195.04	1.01
HSD Main Channel	15946.84	50-Yr	2010.00	4386.00	4388.40	4388.40	4389.12	0.011650	6.82	294.52	204.00	1.00
HSD Main Channel	15673.03	100-Yr	2409.00	4384.82	4386.80		4386.89	0.005315	4.32	557.56	425.93	0.67
HSD Main Channel	15673.03	2-Yr	590.00	4384.82	4385.84	4385.61	4385.93	0.004655	2.44	242.29	396.06	0.55
HSD Main Channel	15673.03	10-Yr	1204.00	4384.82	4386.17		4386.33	0.004598	3.17	379.76	414.03	0.58
HSD Main Channel	15673.03	25-Yr	1641.00	4384.82	4386.34		4386.55	0.004908	3.64	450.27	418.23	0.62
HSD Main Channel	15673.03	50-Yr	2010.00	4384.82	4386.46		4386.71	0.005207	4.01	501.10	421.41	0.65
HSD Main Channel	15381.93	100-Yr	2409.00	4382.06	4384.10	4384.10	4384.51	0.013944	5.10	472.21	579.44	1.00
HSD Main Channel	15381.93	2-Yr	590.00	4382.06	4383.33	4383.33	4383.82	0.016344	4.26	138.47	250.71	1.01
HSD Main Channel	15381.93	10-Yr	1204.00	4382.06	4383.72	4383.72	4384.03	0.016447	4.41	272.88	471.16	1.02
HSD Main Channel	15381.93	25-Yr	1641.00	4382.06	4383.87	4383.87	4384.22	0.015215	4.72	347.52	511.24	1.01
HSD Main Channel	15381.93	50-Yr	2010.00	4382.06	4383.99	4383.99	4384.37	0.013964	4.91	409.71	533.71	0.99
HSD Main Channel	15141.09	100-Yr	2409.00	4379.34	4381.40		4381.72	0.006611	4.54	530.49	442.88	0.73
HSD Main Channel	15141.09	2-Yr	590.00	4379.34	4380.30		4380.47	0.007342	3.35	175.96	250.52	0.71
HSD Main Channel	15141.09	10-Yr	1204.00	4379.34	4380.75		4381.00	0.006436	4.07	295.51	284.53	0.70
HSD Main Channel	15141.09	25-Yr	1641.00	4379.34	4381.01		4381.30	0.006878	4.33	379.03	350.18	0.73
HSD Main Channel	15141.09	50-Yr	2010.00	4379.34	4381.21		4381.52	0.006649	4.44	452.26	391.66	0.73
HSD Main Channel	14931.77	100-Yr	2409.00	4377.97	4380.75		4380.91	0.002304	3.23	746.95	472.64	0.45
HSD Main Channel	14931.77	2-Yr	590.00	4377.97	4379.58		4379.65	0.002310	2.15	274.45	319.79	0.41
HSD Main Channel	14931.77	10-Yr	1204.00	4377.97	4380.08		4380.19	0.002379	2.83	457.55	402.47	0.44
HSD Main Channel	14931.77	25-Yr	1641.00	4377.97	4380.34		4380.47	0.002341	2.90	565.30	424.02	0.44
HSD Main Channel	14931.77	50-Yr	2010.00	4377.97	4380.55		4380.70	0.002336	3.06	657.46	455.53	0.45
HSD Main Channel	14692.54	100-Yr	2409.00	4377.03	4379.12	4379.12	4379.79	0.012196	6.56	367.33	279.73	1.01
HSD Main Channel	14692.54	2-Yr	590.00	4377.03	4378.15	4378.15	4378.47	0.015799	4.55	129.81	208.07	1.01
HSD Main Channel	14692.54	10-Yr	1204.00	4377.03	4378.54	4378.54	4379.02	0.013873	5.53	217.90	236.34	1.01
HSD Main Channel	14692.54	25-Yr	1641.00	4377.03	4378.78	4378.78	4379.33	0.013032	5.97	275.10	253.83	1.01
HSD Main Channel	14692.54	50-Yr	2010.00	4377.03	4378.95	4378.95	4379.56	0.012581	6.27	320.36	266.85	1.01
HSD Main Channel	14379.42	100-Yr	2409.00	4372.65	4375.15	4374.78	4375.50	0.005597	4.72	510.52	355.23	0.69
HSD Main Channel	14379.42	2-Yr	590.00	4372.65	4374.12		4374.26	0.004789	2.99	197.65	243.15	0.58
HSD Main Channel	14379.42	10-Yr	1204.00	4372.65	4374.59		4374.80	0.005151	3.71	324.27	304.20	0.63
HSD Main Channel	14379.42	25-Yr	1641.00	4372.65	4374.81	4374.46	4375.08	0.005396	4.15	395.61	324.50	0.66
HSD Main Channel	14379.42	50-Yr	2010.00	4372.65	4374.96	4374.62	4375.29	0.005502	4.45	451.63	338.69	0.66
HSD Main Channel	14066.58	100-Yr	2409.00	4371.27	4373.01	4372.84	4373.35	0.008512	4.70	512.58	491.45	0.81
HSD Main Channel	14066.58	2-Yr	590.00	4371.27	4372.31		4372.43	0.007312	2.84	207.46	377.04	0.68
HSD Main Channel	14066.58	10-Yr	1204.00	4371.27	4372.60	4372.43	4372.82	0.007949	3.70	325.57	424.83	0.74
HSD Main Channel	14066.58	25-Yr	1641.00	4371.27	4372.78	4372.60	4373.04	0.008106	4.08	401.94	458.81	0.77
HSD Main Channel	14066.58	50-Yr	2010.00	4371.27	4372.89	4372.73	4373.19	0.008329	4.40	457.09	476.35	0.79
HSD Main Channel	13772.72	100-Yr	2409.00	4368.04	4369.73	4369.73	4370.16	0.014161	5.26	457.99	542.04	1.01
HSD Main Channel	13772.72	2-Yr	590.00	4368.04	4369.01	4369.01	4369.24	0.017775	3.85	153.05	343.14	1.02
HSD Main Channel	13772.72	10-Yr	1204.00	4368.04	4369.30	4369.30	4369.63	0.015490	4.64	259.40	367.00	1.01
HSD Main Channel	13772.72	25-Yr	1641.00	4368.04	4369.45	4369.45	4369.86	0.015100	5.12	320.58	415.60	1.03
HSD Main Channel	13772.72	50-Yr	2010.00	4368.04	4369.51	4369.51	4370.01	0.014602	5.07	396.54	508.75	1.01
HSD Main Channel	13457.43	100-Yr	2409.00	4363.18	4365.01	4365.00	4365.47	0.013406	5.48	439.42	470.08	1.00
HSD Main Channel	13457.43	2-Yr	590.00	4363.18	4364.05	4364.00	4364.29	0.012509	3.95	149.20	247.38	0.90
HSD Main Channel	13457.43	10-Yr	1204.00	4363.18	4364.40	4364.35	4364.79	0.011925	4.99	241.09	271.71	0.93
HSD Main Channel	13457.43	25-Yr	1641.00	4363.18	4364.57	4364.56	4365.07	0.012979	5.70	287.67	283.00	1.00
HSD Main Channel	13457.43	50-Yr	2010.00	4363.18	4364.75	4364.73	4365.29	0.012666	5.91	339.84	310.90	1.00
HSD Main Channel	13130.33	100-Yr	2409.00	4360.46	4362.01		4362.27	0.007211	4.12	584.48	602.51	0.74
HSD Main Channel	13130.33	2-Yr	590.00	4360.46	4361.28	4361.11	4361.39	0.006437	2.89	218.99	392.30	0.64
HSD Main Channel	13130.33	10-Yr	1204.00	4360.46	4361.59	4361.40	4361.77	0.007045	3.37	357.67	490.87	0.70
HSD Main Channel	13130.33	25-Yr	1641.00	4360.46	4361.78	4361.56	4361.99	0.006845	3.80	455.37	552.18	0.70
HSD Main Channel	13130.33	50-Yr	2010.00	4360.46	4361.89	4361.67	4362.12	0.007218	3.92	512.33	569.10	0.73
HSD Main Channel	12856.26	100-Yr	4820.00	4356.52	4358.84	4358.84	4359.42	0.012621	6.11	798.85	685.36	1.00

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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/n)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
HSD Main Channel	12856.26	2-Yr	1154.00	4356.52	4357.85	4357.95	4358.25	0.016504	4.38	264.82	467.54	1.02
HSD Main Channel	12856.26	10-Yr	2368.00	4356.52	4358.34	4358.34	4358.74	0.014456	5.06	467.82	596.82	1.01
HSD Main Channel	12856.26	25-Yr	3256.00	4356.52	4358.53	4358.53	4359.01	0.014081	5.54	587.37	641.07	1.02
HSD Main Channel	12856.26	50-Yr	4006.00	4356.52	4358.69	4358.69	4359.21	0.013048	5.83	687.59	657.80	1.00
HSD Main Channel	12556.85	100-Yr	4820.00	4344.00	4350.90	4350.90	4353.03	0.008933	11.71	411.56	97.67	1.01
HSD Main Channel	12556.85	2-Yr	1154.00	4344.00	4347.36	4347.04	4348.23	0.006875	7.49	153.98	61.35	0.83
HSD Main Channel	12556.85	10-Yr	2368.00	4344.00	4348.57	4348.48	4350.19	0.008420	10.21	232.03	67.25	0.97
HSD Main Channel	12556.85	25-Yr	3256.00	4344.00	4349.39	4349.35	4351.37	0.008442	11.28	288.55	71.81	0.99
HSD Main Channel	12556.85	50-Yr	4006.00	4344.00	4349.98	4349.98	4352.24	0.008518	12.08	332.14	75.12	1.01
HSD Main Channel	12329.17	100-Yr	4820.00	4342.48	4348.65	4348.65	4350.39	0.008868	10.58	455.45	129.12	0.99
HSD Main Channel	12329.17	2-Yr	1154.00	4342.48	4345.28	4345.28	4346.31	0.010400	8.16	141.45	67.76	1.00
HSD Main Channel	12329.17	10-Yr	2368.00	4342.48	4346.59	4346.59	4348.21	0.008026	10.21	231.91	70.30	0.99
HSD Main Channel	12329.17	25-Yr	3256.00	4342.48	4347.76	4347.76	4349.16	0.009454	9.50	342.80	120.68	0.99
HSD Main Channel	12329.17	50-Yr	4006.00	4342.48	4348.22	4348.22	4349.78	0.008083	10.00	400.74	126.42	0.99
HSD Main Channel	12141.33	100-Yr	4820.00	4340.05	4345.03	4344.80	4346.70	0.007237	10.38	464.30	118.25	0.92
HSD Main Channel	12141.33	2-Yr	1154.00	4340.05	4342.99	4342.99	4343.38	0.003914	5.01	230.11	111.19	0.61
HSD Main Channel	12141.33	10-Yr	2368.00	4340.05	4343.93	4343.93	4344.70	0.004930	7.05	336.91	115.33	0.73
HSD Main Channel	12141.33	25-Yr	3256.00	4340.05	4344.39	4344.39	4345.47	0.005812	8.37	389.17	116.64	0.81
HSD Main Channel	12141.33	50-Yr	4006.00	4340.05	4344.71	4344.35	4346.08	0.005556	9.39	426.55	117.44	0.87
HSD Main Channel	11917.1	100-Yr	4820.00	4338.00	4343.36	4343.36	4344.82	0.009078	9.69	497.59	166.50	0.99
HSD Main Channel	11917.1	2-Yr	1154.00	4338.00	4341.16	4341.16	4341.96	0.011208	7.18	160.74	99.02	0.99
HSD Main Channel	11917.1	10-Yr	2368.00	4338.00	4342.21	4342.21	4343.13	0.010411	7.70	307.66	161.79	0.98
HSD Main Channel	11917.1	25-Yr	3256.00	4338.00	4342.66	4342.66	4343.80	0.009927	8.55	380.67	164.72	0.99
HSD Main Channel	11917.1	50-Yr	4006.00	4338.00	4343.02	4343.02	4344.31	0.009402	9.11	439.65	165.86	0.99
HSD Main Channel	11610.72	100-Yr	4820.00	4334.81	4339.61	4339.61	4341.16	0.009825	10.00	481.87	151.34	0.99
HSD Main Channel	11610.72	2-Yr	1154.00	4334.81	4337.51	4337.51	4338.19	0.011683	6.62	174.41	126.60	0.99
HSD Main Channel	11610.72	10-Yr	2368.00	4334.81	4338.37	4338.37	4339.36	0.010240	7.98	298.85	147.15	0.99
HSD Main Channel	11610.72	25-Yr	3256.00	4334.81	4338.85	4338.85	4340.07	0.009663	8.86	367.57	148.77	0.99
HSD Main Channel	11610.72	50-Yr	4006.00	4334.81	4339.22	4339.22	4340.61	0.009245	9.48	423.63	150.03	0.99
HSD Main Channel	11182.79	100-Yr	4820.00	4330.00	4334.52	4333.70	4335.12	0.003585	6.21	775.23	253.05	0.63
HSD Main Channel	11182.79	2-Yr	1154.00	4330.00	4332.17	4332.07	4332.59	0.009354	5.21	221.34	194.28	0.86
HSD Main Channel	11182.79	10-Yr	2368.00	4330.00	4332.90	4332.73	4333.52	0.009317	6.31	375.17	225.88	0.86
HSD Main Channel	11182.79	25-Yr	3256.00	4330.00	4333.45	4333.13	4334.09	0.006675	6.45	505.02	249.21	0.80
HSD Main Channel	11182.79	50-Yr	4006.00	4330.00	4333.84	4333.44	4334.57	0.004959	6.37	628.90	252.35	0.71
HSD Main Channel	10592.6	100-Yr	4820.00	4323.90	4331.86	4330.11	4333.09	0.003130	8.87	543.17	88.16	0.63
HSD Main Channel	10592.6	2-Yr	1154.00	4323.90	4327.27	4326.91	4327.99	0.006510	6.82	169.23	73.31	0.79
HSD Main Channel	10592.6	10-Yr	2368.00	4323.90	4329.01	4328.20	4329.96	0.004512	7.80	303.88	80.56	0.71
HSD Main Channel	10592.6	25-Yr	3256.00	4323.90	4330.17	4328.98	4331.21	0.003647	8.16	398.82	83.30	0.66
HSD Main Channel	10592.6	50-Yr	4006.00	4323.90	4331.01	4329.51	4332.14	0.003350	8.54	468.99	85.28	0.64
HSD Main Channel	10118.27	100-Yr	4820.00	4319.86	4327.72	4327.72	4330.62	0.008416	13.67	352.69	61.79	1.01
HSD Main Channel	10118.27	2-Yr	1154.00	4319.86	4324.20	4323.62	4325.07	0.005774	7.52	153.44	51.35	0.77
HSD Main Channel	10118.27	10-Yr	2368.00	4319.86	4325.69	4325.31	4327.29	0.006532	10.14	233.43	55.85	0.87
HSD Main Channel	10118.27	25-Yr	3256.00	4319.86	4326.37	4326.31	4328.60	0.008220	11.98	271.84	57.68	0.97
HSD Main Channel	10118.27	50-Yr	4006.00	4319.86	4327.04	4327.04	4329.61	0.008366	12.87	311.25	59.71	0.99
HSD Main Channel	9624.29	100-Yr	4820.00	4314.16	4323.77	4323.77	4325.44	0.006855	10.39	464.00	137.68	1.00
HSD Main Channel	9624.29	2-Yr	1154.00	4314.16	4320.83	4320.66	4321.65	0.006368	7.26	158.95	77.69	0.89
HSD Main Channel	9624.29	10-Yr	2368.00	4314.16	4322.00	4322.00	4323.25	0.009428	8.97	263.97	102.82	0.99
HSD Main Channel	9624.29	25-Yr	3256.00	4314.16	4322.61	4322.61	4324.14	0.009023	9.91	328.67	106.46	0.99
HSD Main Channel	9624.29	50-Yr	4006.00	4314.16	4323.11	4323.11	4324.82	0.006685	10.47	382.64	110.84	0.99
HSD Main Channel	9149.64	100-Yr	4820.00	4308.08	4318.46	4318.46	4319.46	0.010094	8.01	601.71	292.70	0.98
HSD Main Channel	9149.64	2-Yr	1154.00	4308.08	4316.27	4316.27	4316.92	0.011797	6.46	178.63	134.78	0.99
HSD Main Channel	9149.64	10-Yr	2368.00	4308.08	4317.15	4317.15	4318.05	0.010493	7.62	310.65	167.27	0.99
HSD Main Channel	9149.64	25-Yr	3256.00	4308.08	4317.63	4317.63	4318.68	0.010006	8.21	396.39	184.00	0.99
HSD Main Channel	9149.64	50-Yr	4006.00	4308.08	4318.20	4318.20	4319.10	0.010617	7.63	525.09	285.40	0.99
HSD Main Channel	8654.43	100-Yr	4820.00	4306.00	4311.38	4311.38	4312.04	0.005152	6.54	737.11	294.35	0.73
HSD Main Channel	8654.43	2-Yr	1154.00	4306.00	4309.46	4309.46	4309.78	0.006314	4.60	250.77	197.68	0.72
HSD Main Channel	8654.43	10-Yr	2368.00	4306.00	4310.33	4310.33	4310.76	0.005150	5.26	450.21	249.19	0.69
HSD Main Channel	8654.43	25-Yr	3256.00	4306.00	4310.76	4310.76	4311.28	0.005122	5.78	563.29	269.51	0.70
HSD Main Channel	8654.43	50-Yr	4006.00	4306.00	4311.08	4311.08	4311.67	0.005199	6.18	650.60	298.30	0.72
HSD Main Channel	8227.06	100-Yr	4820.00	4301.98	4307.81	4307.81	4308.92	0.010790	8.46	569.70	267.81	1.02
HSD Main Channel	8227.06	2-Yr	1154.00	4301.98	4305.19	4305.19	4306.26	0.010605	8.31	138.81	65.11	1.00
HSD Main Channel	8227.06	10-Yr	2368.00	4301.98	4306.65	4306.65	4307.54	0.011587	7.57	312.99	182.92	1.02
HSD Main Channel	8227.06	25-Yr	3256.00	4301.98	4307.15	4307.15	4308.12	0.011166	7.89	412.78	220.89	1.02
HSD Main Channel	8227.06	50-Yr	4006.00	4301.98	4307.47	4307.47	4308.53	0.010643	8.26	485.14	233.90	1.01
HSD Main Channel	7805.03	100-Yr	4820.00	4296.00	4301.77	4301.55	4303.18	0.007712	9.61	506.72	155.49	0.93
HSD Main Channel	7805.03	2-Yr	1154.00	4296.00	4299.27	4299.27	4299.74	0.003625	5.47	211.07	89.46	0.63

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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
HSD Main Channel	7805.03	10-Yr	2368.00	4296.00	4300.52		4301.29	0.005011	7.04	336.18	117.08	0.73
HSD Main Channel	7805.03	25-Yr	3256.00	4296.00	4301.07		4302.07	0.006074	8.03	405.30	133.92	0.81
HSD Main Channel	7805.03	50-Yr	4006.00	4296.00	4301.41	4301.07	4302.63	0.007026	8.85	452.72	144.36	0.88
HSD Main Channel	7385.4	100-Yr	4820.00	4291.98	4298.32	4296.29	4299.24	0.010724	7.67	628.46	342.58	1.00
HSD Main Channel	7385.4	2-Yr	1154.00	4291.98	4296.24	4296.24	4297.10	0.011225	7.41	155.75	91.82	1.00
HSD Main Channel	7385.4	10-Yr	2368.00	4291.98	4297.55	4297.50	4298.16	0.011782	6.29	376.22	295.89	0.98
HSD Main Channel	7385.4	25-Yr	3256.00	4291.98	4297.87	4297.82	4298.60	0.011282	6.82	477.71	322.83	0.99
HSD Main Channel	7385.4	50-Yr	4006.00	4291.98	4298.12	4298.09	4298.92	0.010605	7.15	560.03	336.15	0.98
HSD Main Channel	6964.05	100-Yr	4820.00	4287.78	4293.70	4293.70	4294.63	0.011182	7.70	625.63	349.68	1.02
HSD Main Channel	6964.05	2-Yr	1154.00	4287.78	4291.32	4291.30	4292.13	0.011116	7.22	158.81	97.81	1.00
HSD Main Channel	6964.05	10-Yr	2368.00	4287.78	4292.47	4292.47	4293.40	0.010708	7.72	306.65	165.30	1.00
HSD Main Channel	6964.05	25-Yr	3256.00	4287.78	4293.11	4293.11	4293.96	0.010711	7.38	441.25	254.96	0.99
HSD Main Channel	6964.05	50-Yr	4006.00	4287.78	4293.45	4293.45	4294.30	0.011288	7.42	539.59	321.48	1.01
HSD Main Channel	6467.25	100-Yr	4820.00	4282.00	4288.89	4288.56	4289.47	0.005296	5.58	863.84	447.40	0.71
HSD Main Channel	6467.25	2-Yr	1154.00	4282.00	4285.83	4285.83	4286.76	0.010454	7.74	149.15	78.04	0.99
HSD Main Channel	6467.25	10-Yr	2368.00	4282.00	4287.31	4287.15	4288.28	0.008468	7.91	299.55	130.10	0.92
HSD Main Channel	6467.25	25-Yr	3256.00	4282.00	4288.44	4288.17	4288.86	0.006585	5.20	625.83	423.81	0.75
HSD Main Channel	6467.25	50-Yr	4006.00	4282.00	4288.72	4288.35	4289.17	0.005791	5.37	745.36	436.61	0.73
HSD Main Channel	6090.97	100-Yr	4820.00	4278.26	4285.60	4285.60	4286.78	0.009561	8.70	554.19	229.55	0.99
HSD Main Channel	6090.97	2-Yr	1154.00	4278.26	4282.51	4282.28	4283.31	0.007673	7.16	161.13	75.46	0.86
HSD Main Channel	6090.97	10-Yr	2368.00	4278.26	4283.66	4283.64	4284.95	0.009043	9.15	258.73	94.87	0.98
HSD Main Channel	6090.97	25-Yr	3256.00	4278.26	4284.62	4284.62	4285.83	0.009536	8.85	367.87	147.90	0.99
HSD Main Channel	6090.97	50-Yr	4006.00	4278.26	4285.17	4285.17	4286.34	0.009657	8.67	461.87	193.45	0.99
HSD Main Channel	5785.22	100-Yr	4820.00	4275.65	4282.43	4282.43	4283.86	0.009038	9.58	502.93	171.82	0.99
HSD Main Channel	5785.22	2-Yr	1154.00	4275.65	4279.65	4279.65	4280.96	0.010590	7.65	150.81	80.82	0.99
HSD Main Channel	5785.22	10-Yr	2368.00	4275.65	4280.90	4280.90	4282.02	0.009892	8.50	278.66	121.70	0.99
HSD Main Channel	5785.22	25-Yr	3256.00	4275.65	4281.53	4281.53	4282.79	0.009556	9.00	361.82	141.47	0.99
HSD Main Channel	5785.22	50-Yr	4006.00	4275.65	4281.94	4281.94	4283.34	0.009700	9.48	422.62	154.67	1.01
HSD Main Channel	5546.66	100-Yr	4820.00	4271.99	4279.14	4279.14	4281.13	0.008477	11.32	425.80	106.49	0.99
HSD Main Channel	5546.66	2-Yr	1154.00	4271.99	4276.47	4275.39	4276.93	0.002742	5.40	213.56	69.57	0.54
HSD Main Channel	5546.66	10-Yr	2368.00	4271.99	4277.41	4276.73	4278.52	0.005010	8.47	279.71	72.38	0.76
HSD Main Channel	5546.66	25-Yr	3256.00	4271.99	4277.74	4277.55	4279.52	0.007312	10.70	304.29	73.34	0.93
HSD Main Channel	5546.66	50-Yr	4006.00	4271.99	4278.30	4278.30	4280.37	0.008361	11.55	346.99	82.41	0.99
HSD Main Channel	5283.29	100-Yr	4820.00	4269.93	4276.93	4276.76	4277.60	0.008786	6.57	733.36	432.10	0.89
HSD Main Channel	5283.29	2-Yr	1154.00	4269.93	4273.99	4273.99	4275.59	0.009479	10.15	113.65	34.78	0.99
HSD Main Channel	5283.29	10-Yr	2368.00	4269.93	4276.06	4275.96	4276.59	0.008235	5.69	415.88	314.73	0.87
HSD Main Channel	5283.29	25-Yr	3256.00	4269.93	4276.43	4276.31	4277.01	0.008205	6.10	534.19	364.56	0.89
HSD Main Channel	5283.29	50-Yr	4006.00	4269.93	4276.88	4276.55	4277.31	0.009081	6.34	631.40	401.23	0.89
HSD Main Channel	5034.86	100-Yr	4820.00	4265.95	4274.18	4274.18	4275.17	0.010698	7.96	605.73	311.22	1.01
HSD Main Channel	5034.86	2-Yr	1154.00	4265.95	4271.39	4271.39	4272.89	0.009534	9.15	126.08	47.24	0.99
HSD Main Channel	5034.86	10-Yr	2368.00	4265.95	4273.32	4273.32	4274.00	0.011581	6.63	357.36	266.25	0.99
HSD Main Channel	5034.86	25-Yr	3256.00	4265.95	4273.68	4273.68	4274.48	0.011196	7.16	455.06	283.66	1.00
HSD Main Channel	5034.86	50-Yr	4006.00	4265.95	4273.96	4273.96	4274.83	0.010848	7.49	535.17	304.55	1.00
HSD Main Channel	4695.55	100-Yr	4820.00	4262.00	4273.47		4273.58	0.009718	2.68	1801.27	821.18	0.28
HSD Main Channel	4695.55	2-Yr	1154.00	4262.00	4267.74		4268.23	0.003144	5.56	207.41	69.80	0.57
HSD Main Channel	4695.55	10-Yr	2368.00	4262.00	4271.37		4271.51	0.001036	2.93	809.25	317.81	0.32
HSD Main Channel	4695.55	25-Yr	3256.00	4262.00	4272.61		4272.71	0.000703	2.50	1303.19	488.41	0.27
HSD Main Channel	4695.55	50-Yr	4006.00	4262.00	4273.04		4273.15	0.000779	2.60	1542.26	590.49	0.28
HSD Main Channel	4462.68	100-Yr	4820.00	4261.39	4272.84		4273.28	0.002145	5.30	909.19	254.26	0.49
HSD Main Channel	4462.68	2-Yr	1154.00	4261.39	4266.72		4267.44	0.003391	6.82	169.13	43.66	0.61
HSD Main Channel	4462.68	10-Yr	2368.00	4261.39	4270.56		4271.06	0.003633	5.57	425.19	162.48	0.61
HSD Main Channel	4462.68	25-Yr	3256.00	4261.39	4272.14		4272.44	0.001750	4.41	737.80	232.91	0.44
HSD Main Channel	4462.68	50-Yr	4006.00	4261.39	4272.47		4272.84	0.001991	4.90	817.52	243.07	0.47
HSD Main Channel	4219.43	100-Yr	6592.00	4259.99	4272.08		4272.56	0.003942	5.55	1188.53	482.75	0.62
HSD Main Channel	4219.43	2-Yr	1572.00	4259.99	4264.96		4266.28	0.005735	9.22	170.56	41.13	0.80
HSD Main Channel	4219.43	10-Yr	3257.00	4259.99	4268.28		4269.90	0.004921	10.21	319.04	57.64	0.76
HSD Main Channel	4219.43	25-Yr	4475.00	4259.99	4271.50	4269.14	4271.85	0.003117	4.79	933.88	402.71	0.55
HSD Main Channel	4219.43	50-Yr	5490.00	4259.99	4271.71		4272.16	0.003720	5.36	1023.89	426.33	0.61
HSD Main Channel	3967.44	100-Yr	6592.00	4258.00	4270.28	4270.12	4271.13	0.006891	7.40	891.41	429.60	0.91
HSD Main Channel	3967.44	2-Yr	1572.00	4258.00	4263.34		4264.80	0.005948	9.67	162.50	35.36	0.80
HSD Main Channel	3967.44	10-Yr	3257.00	4258.00	4265.93	4265.25	4266.38	0.006851	12.54	259.71	39.66	0.86
HSD Main Channel	3967.44	25-Yr	4475.00	4258.00	4267.28	4266.78	4270.42	0.007347	14.23	314.49	41.97	0.92
HSD Main Channel	3967.44	50-Yr	5490.00	4258.00	4270.07	4269.86	4270.80	0.008171	6.81	806.02	419.35	0.87
HSD Main Channel	3674.39	100-Yr	6592.00	4256.00	4267.28	4267.28	4268.25	0.011042	7.90	834.48	437.62	1.01
HSD Main Channel	3674.39	2-Yr	1572.00	4256.00	4260.67	4260.65	4262.58	0.009462	11.09	141.77	36.84	1.00
HSD Main Channel	3674.39	10-Yr	3257.00	4256.00	4263.13	4263.13	4266.08	0.008922	13.78	236.30	40.17	1.00

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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
HSD Main Channel	3674.39	25-Yr	4475.00	4256.00	4264.92	4264.92	4268.08	0.008747	14.25	313.99	50.16	1.00
HSD Main Channel	3674.39	50-Yr	5490.00	4256.00	4267.01	4267.01	4267.92	0.011784	7.66	716.38	412.33	1.03
HSD Main Channel	3379.1	100-Yr	6592.00	4255.47	4265.01		4265.75	0.006300	6.87	959.11	408.15	0.79
HSD Main Channel	3379.1	2-Yr	1572.00	4255.47	4258.99		4260.02	0.006508	8.17	192.41	64.19	0.83
HSD Main Channel	3379.1	10-Yr	3257.00	4255.47	4261.33		4262.69	0.004404	9.37	347.45	68.15	0.73
HSD Main Channel	3379.1	25-Yr	4475.00	4255.47	4263.33		4264.57	0.004100	8.95	500.23	99.37	0.70
HSD Main Channel	3379.1	50-Yr	5490.00	4255.47	4264.90		4265.46	0.005044	6.00	914.34	403.24	0.70
HSD Main Channel	3030.67	100-Yr	6592.00	4250.87	4262.57	4262.45	4263.07	0.009061	5.63	1170.59	888.44	0.86
HSD Main Channel	3030.67	2-Yr	1572.00	4250.87	4255.65	4255.56	4257.36	0.008689	10.47	150.07	41.51	0.97
HSD Main Channel	3030.67	10-Yr	3257.00	4250.87	4258.05	4257.84	4260.59	0.007635	12.78	254.78	45.40	0.95
HSD Main Channel	3030.67	25-Yr	4475.00	4250.87	4262.55	4259.19	4262.78	0.004424	3.89	1149.78	887.02	0.60
HSD Main Channel	3030.67	50-Yr	5490.00	4250.87	4262.32	4262.28	4262.84	0.012317	5.78	950.33	873.79	0.98
HSD Main Channel	2816.21	100-Yr	6592.00	4250.00	4260.62	4260.41	4261.16	0.008708	5.92	1114.00	758.14	0.86
HSD Main Channel	2816.21	2-Yr	1572.00	4250.00	4254.82		4255.85	0.004471	8.14	193.01	46.58	0.71
HSD Main Channel	2816.21	10-Yr	3257.00	4250.00	4257.66		4259.17	0.003770	9.84	330.88	49.60	0.67
HSD Main Channel	2816.21	25-Yr	4475.00	4250.00	4259.25	4257.28	4261.01	0.015911	10.64	420.53	179.56	1.23
HSD Main Channel	2816.21	50-Yr	5490.00	4250.00	4260.81		4260.99	0.006153	4.97	1103.69	751.06	0.72
HSD Main Channel	2587.35	100-Yr	6592.00	4248.00	4259.94		4260.17	0.002232	3.82	1724.90	817.45	0.46
HSD Main Channel	2587.35	2-Yr	1572.00	4248.00	4252.91	4252.57	4254.51	0.007289	10.14	155.04	38.27	0.89
HSD Main Channel	2587.35	10-Yr	3257.00	4248.00	4255.46	4255.00	4257.93	0.006947	12.59	258.71	42.99	0.90
HSD Main Channel	2587.35	25-Yr	4475.00	4248.00	4257.07	4256.43	4259.94	0.006550	13.60	328.93	44.98	0.89
HSD Main Channel	2587.35	50-Yr	5490.00	4248.00	4260.40	4258.73	4260.90	0.000820	2.61	2101.18	831.48	0.29
HSD Main Channel	2350.58	100-Yr	6592.00	4245.98	4258.52	4258.40	4259.17	0.009457	6.47	1019.06	642.90	0.91
HSD Main Channel	2350.58	2-Yr	1572.00	4245.98	4250.56	4250.56	4252.52	0.009436	11.21	140.22	36.34	1.01
HSD Main Channel	2350.58	10-Yr	3257.00	4245.98	4253.04	4253.04	4256.03	0.008768	13.86	234.97	39.70	1.00
HSD Main Channel	2350.58	25-Yr	4475.00	4245.98	4254.50	4254.50	4258.10	0.008509	15.22	294.04	41.21	1.00
HSD Main Channel	2350.58	50-Yr	5490.00	4245.98	4255.61	4255.61	4259.85	0.008526	16.14	340.23	42.47	1.01
HSD Main Channel	2118.63	100-Yr	6592.00	4243.99	4253.22	4253.22	4256.81	0.008431	15.20	433.67	61.03	1.01
HSD Main Channel	2118.63	2-Yr	1572.00	4243.99	4247.70	4247.70	4249.47	0.010113	10.69	147.07	41.90	1.01
HSD Main Channel	2118.63	10-Yr	3257.00	4243.99	4250.09	4250.08	4252.58	0.009314	12.96	257.28	51.85	1.00
HSD Main Channel	2118.63	25-Yr	4475.00	4243.99	4251.34	4251.34	4254.30	0.008870	13.79	324.53	55.15	1.00
HSD Main Channel	2118.63	50-Yr	5490.00	4243.99	4252.28	4252.28	4255.56	0.008663	14.53	377.87	58.25	1.01
HSD Main Channel	1888.92	100-Yr	6592.00	4240.00	4251.62	4244.98	4251.84	0.000298	3.76	1751.11	182.60	0.21
HSD Main Channel	1888.92	2-Yr	1572.00	4240.00	4244.16	4242.23	4244.33	0.000951	3.32	473.88	147.49	0.33
HSD Main Channel	1888.92	10-Yr	3257.00	4240.00	4247.07	4243.37	4247.26	0.000510	3.48	941.62	171.23	0.26
HSD Main Channel	1888.92	25-Yr	4475.00	4240.00	4248.90	4243.99	4249.09	0.000386	3.55	1260.77	177.57	0.23
HSD Main Channel	1888.92	50-Yr	5490.00	4240.00	4250.26	4244.50	4250.46	0.000331	3.65	1503.69	179.82	0.22
HSD Main Channel	1688.12	100-Yr	6592.00	4238.00	4247.37	4247.37	4251.29	0.007959	15.68	415.08	53.08	1.00
HSD Main Channel	1688.12	2-Yr	1572.00	4238.00	4242.70		4243.83	0.005032	8.52	184.50	45.45	0.75
HSD Main Channel	1688.12	10-Yr	3257.00	4238.00	4244.43	4244.11	4246.76	0.007216	12.25	265.89	48.56	0.92
HSD Main Channel	1688.12	25-Yr	4475.00	4238.00	4245.40	4245.40	4248.56	0.008329	14.26	313.72	50.04	1.00
HSD Main Channel	1688.12	50-Yr	5490.00	4238.00	4246.39	4246.39	4249.83	0.008096	15.08	383.97	51.55	1.00
HSD Main Channel	1490.38	100-Yr	6592.00	4236.00	4245.83	4245.83	4249.34	0.008262	15.04	438.18	62.95	1.01
HSD Main Channel	1490.38	2-Yr	1572.00	4236.00	4241.34	4241.19	4242.66	0.008607	9.22	170.49	56.41	0.94
HSD Main Channel	1490.38	10-Yr	3257.00	4236.00	4243.07	4243.03	4245.33	0.008801	12.07	289.91	58.92	0.99
HSD Main Channel	1490.38	25-Yr	4475.00	4236.00	4244.16	4244.16	4246.93	0.008556	13.35	335.14	60.52	1.00
HSD Main Channel	1490.38	50-Yr	5490.00	4236.00	4244.99	4244.99	4248.13	0.008409	14.23	385.70	61.73	1.00
HSD Main Channel	1255.37	100-Yr	6592.00	4236.00	4245.40	4243.76	4247.54	0.004177	11.72	562.24	70.42	0.73
HSD Main Channel	1255.37	2-Yr	1572.00	4236.00	4240.50		4241.22	0.003672	6.78	232.01	65.72	0.64
HSD Main Channel	1255.37	10-Yr	3257.00	4236.00	4242.42	4241.21	4243.70	0.003979	9.08	358.83	66.78	0.69
HSD Main Channel	1255.37	25-Yr	4475.00	4236.00	4243.59	4242.21	4245.22	0.004052	10.23	437.50	67.23	0.71
HSD Main Channel	1255.37	50-Yr	5490.00	4236.00	4244.48	4242.99	4246.37	0.004138	11.02	498.33	68.82	0.72
HSD Main Channel	1071.27	100-Yr	6592.00	4235.51	4243.05	4243.05	4246.38	0.008124	14.64	450.41	66.49	0.99
HSD Main Channel	1071.27	2-Yr	1572.00	4235.51	4238.77	4238.77	4240.10	0.010109	9.25	169.92	64.78	1.01
HSD Main Channel	1071.27	10-Yr	3257.00	4235.51	4240.46	4240.46	4242.57	0.008785	11.63	279.97	65.45	0.99
HSD Main Channel	1071.27	25-Yr	4475.00	4235.51	4241.46	4241.46	4244.07	0.008575	12.97	345.14	65.85	1.00
HSD Main Channel	1071.27	50-Yr	5490.00	4235.51	4242.25	4242.25	4245.21	0.008315	13.82	397.28	66.17	0.99
HSD Main Channel	800.36	100-Yr	6592.00	4233.98	4243.08	4240.08	4244.02	0.001763	7.81	843.98	107.68	0.49
HSD Main Channel	800.36	2-Yr	1572.00	4233.98	4237.32	4236.69	4237.94	0.004525	6.32	248.54	93.72	0.68
HSD Main Channel	800.36	10-Yr	3257.00	4233.98	4239.48	4238.07	4240.25	0.002885	7.05	461.67	103.76	0.59
HSD Main Channel	800.36	25-Yr	4475.00	4233.98	4240.87	4238.83	4241.71	0.002286	7.36	608.27	105.99	0.54
HSD Main Channel	800.36	50-Yr	5490.00	4233.98	4241.95	4239.49	4242.85	0.001980	7.59	723.72	106.44	0.51
HSD Main Channel	623.07	100-Yr	6592.00	4232.00	4239.76	4239.76	4243.20	0.008016	14.87	443.28	63.97	1.00
HSD Main Channel	623.07	2-Yr	1572.00	4232.00	4235.39	4235.39	4236.74	0.009509	9.33	168.55	61.17	0.99
HSD Main Channel	623.07	10-Yr	3257.00	4232.00	4237.12	4237.12	4239.29	0.008575	11.82	275.65	62.73	0.99
HSD Main Channel	623.07	25-Yr	4475.00	4232.00	4238.18	4238.18	4240.83	0.008194	13.05	342.78	63.54	0.99

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
HSD Main Channel	623.07	50-Yr	5490.00	4232.00	4238.97	4238.97	4242.00	0.008084	13.98	382.63	83.76	0.99
HSD Main Channel	432.97	100-Yr	6592.00	4228.00	4237.51	4232.73	4237.62	0.000217	2.59	2542.46	369.11	0.17
HSD Main Channel	432.97	2-Yr	1572.00	4228.00	4232.09	4230.89	4232.22	0.001830	2.86	548.85	347.24	0.40
HSD Main Channel	432.97	10-Yr	3257.00	4228.00	4234.18	4231.77	4234.27	0.000468	2.48	1312.89	367.79	0.23
HSD Main Channel	432.97	25-Yr	4475.00	4228.00	4235.52	4232.28	4235.61	0.000308	2.48	1806.73	368.29	0.20
HSD Main Channel	432.97	50-Yr	5490.00	4228.00	4236.55	4232.52	4236.65	0.000247	2.51	2186.91	368.68	0.18
HSD Main Channel	239.99	100-Yr	6592.00	4226.73	4235.73	4234.52	4237.35	0.004491	10.21	645.38	113.52	0.76
HSD Main Channel	239.99	2-Yr	1572.00	4226.73	4230.71	4230.12	4231.58	0.005298	7.49	209.85	88.45	0.75
HSD Main Channel	239.99	10-Yr	3257.00	4226.73	4232.53	4231.86	4233.93	0.005332	9.47	344.03	78.13	0.80
HSD Main Channel	239.99	25-Yr	4475.00	4226.73	4233.67	4232.85	4235.31	0.005227	10.28	435.52	85.54	0.80
HSD Main Channel	239.99	50-Yr	5490.00	4226.73	4234.73	4233.65	4236.37	0.005195	10.26	534.84	104.49	0.80
HSD Main Channel	20.29	100-Yr	6692.00	4226.00	4233.69	4233.04	4236.13	0.005007	12.79	516.85	85.22	0.86
HSD Main Channel	20.29	2-Yr	1572.00	4226.00	4229.42	4229.01	4230.34	0.008010	7.72	203.66	69.60	0.80
HSD Main Channel	20.29	10-Yr	3257.00	4226.00	4231.13	4230.62	4232.67	0.006003	9.97	326.72	74.33	0.84
HSD Main Channel	20.29	25-Yr	4475.00	4226.00	4232.12	4231.60	4234.05	0.005011	11.13	402.04	76.62	0.86
HSD Main Channel	20.29	50-Yr	5490.00	4226.00	4232.85	4232.33	4235.08	0.006008	11.98	458.08	77.13	0.87

MIXED
FLOW REGIME RESULTS

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel

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
HSD Main Channel	16520	100-Yr	2409.00	4391.22	4393.86	4393.72	4394.40	0.008895	5.77	417.42	303.84	0.87
HSD Main Channel	16520	2-Yr	590.00	4391.22	4392.84	4392.58	4393.05	0.006434	3.62	162.78	186.68	0.88
HSD Main Channel	16520	10-Yr	1204.00	4391.22	4393.28	4393.09	4393.63	0.008129	4.70	255.94	236.60	0.80
HSD Main Channel	16520	25-Yr	1641.00	4391.22	4393.54	4393.35	4393.95	0.008369	5.13	320.04	285.75	0.82
HSD Main Channel	16520	50-Yr	2010.00	4391.22	4393.72	4393.54	4394.18	0.008576	5.44	369.48	285.90	0.84
HSD Main Channel	16246.06	100-Yr	2409.00	4389.64	4391.74		4392.15	0.007372	5.15	467.57	350.60	0.79
HSD Main Channel	16246.06	2-Yr	590.00	4389.64	4390.70	4390.58	4390.91	0.006607	3.69	159.87	241.19	0.80
HSD Main Channel	16246.06	10-Yr	1204.00	4389.64	4391.16		4391.44	0.007699	4.28	281.19	287.50	0.76
HSD Main Channel	16246.06	25-Yr	1641.00	4389.64	4391.39		4391.73	0.007635	4.68	350.87	312.31	0.78
HSD Main Channel	16246.06	50-Yr	2010.00	4389.64	4391.56	4391.34	4391.94	0.007642	4.96	405.42	330.84	0.79
HSD Main Channel	15946.84	100-Yr	2409.00	4386.00	4388.59	4388.59	4389.39	0.011523	7.20	334.54	212.05	1.01
HSD Main Channel	15946.84	2-Yr	590.00	4386.00	4387.55	4387.45	4387.84	0.010824	4.35	135.54	174.45	0.87
HSD Main Channel	15946.84	10-Yr	1204.00	4386.00	4387.92	4387.92	4388.47	0.013057	5.98	201.20	184.90	1.01
HSD Main Channel	15946.84	25-Yr	1641.00	4386.00	4389.18	4389.18	4388.84	0.012323	6.52	251.85	195.04	1.01
HSD Main Channel	15946.84	50-Yr	2010.00	4386.00	4389.40	4389.40	4389.12	0.011650	6.82	294.52	204.00	1.00
HSD Main Channel	15673.03	100-Yr	2409.00	4384.82	4386.60	4386.27	4386.89	0.005315	4.32	557.56	425.93	0.67
HSD Main Channel	15673.03	2-Yr	590.00	4384.82	4385.84	4385.61	4385.93	0.004655	2.44	242.29	396.06	0.85
HSD Main Channel	15673.03	10-Yr	1204.00	4384.82	4386.17	4385.89	4386.33	0.004598	3.17	379.76	414.03	0.88
HSD Main Channel	15673.03	25-Yr	1641.00	4384.82	4386.34	4386.04	4386.55	0.004909	3.64	450.27	419.23	0.82
HSD Main Channel	15673.03	50-Yr	2010.00	4384.82	4386.46	4386.16	4386.71	0.005207	4.01	501.10	421.41	0.85
HSD Main Channel	15381.93	100-Yr	2409.00	4382.06	4384.10	4384.10	4384.51	0.013944	5.10	472.21	579.44	1.00
HSD Main Channel	15381.93	2-Yr	590.00	4382.06	4383.33	4383.33	4383.62	0.016344	4.26	138.47	250.71	1.01
HSD Main Channel	15381.93	10-Yr	1204.00	4382.06	4383.72	4383.72	4384.03	0.016447	4.41	272.68	471.16	1.02
HSD Main Channel	15381.93	25-Yr	1641.00	4382.06	4383.87	4383.87	4384.22	0.015215	4.72	347.52	511.24	1.01
HSD Main Channel	15381.93	50-Yr	2010.00	4382.06	4383.99	4383.99	4384.37	0.013964	4.91	409.71	533.71	0.99
HSD Main Channel	15141.09	100-Yr	2409.00	4379.34	4381.40	4381.06	4381.72	0.006611	4.54	530.49	442.88	0.73
HSD Main Channel	15141.09	2-Yr	590.00	4379.34	4380.30	4380.14	4380.47	0.007342	3.35	175.96	250.52	0.71
HSD Main Channel	15141.09	10-Yr	1204.00	4379.34	4380.75	4380.50	4381.00	0.006436	4.07	295.51	284.53	0.70
HSD Main Channel	15141.09	25-Yr	1641.00	4379.34	4381.01	4380.71	4381.30	0.006878	4.33	379.03	350.18	0.73
HSD Main Channel	15141.09	50-Yr	2010.00	4379.34	4381.21	4380.90	4381.52	0.006649	4.44	452.26	391.66	0.73
HSD Main Channel	14931.77	100-Yr	2409.00	4377.97	4380.75		4380.91	0.002304	3.23	746.95	472.64	0.45
HSD Main Channel	14931.77	2-Yr	590.00	4377.97	4379.58		4379.65	0.002310	2.15	274.45	319.78	0.41
HSD Main Channel	14931.77	10-Yr	1204.00	4377.97	4380.08		4380.19	0.002379	2.63	457.55	402.47	0.44
HSD Main Channel	14931.77	25-Yr	1641.00	4377.97	4380.34		4380.47	0.002341	2.90	565.30	424.02	0.44
HSD Main Channel	14931.77	50-Yr	2010.00	4377.97	4380.55		4380.70	0.002336	3.06	657.46	455.53	0.45
HSD Main Channel	14692.54	100-Yr	2409.00	4377.03	4379.12	4379.12	4379.79	0.012196	6.56	367.33	279.73	1.01
HSD Main Channel	14692.54	2-Yr	590.00	4377.03	4378.15	4378.15	4378.47	0.015799	4.55	129.81	208.07	1.01
HSD Main Channel	14692.54	10-Yr	1204.00	4377.03	4378.54	4378.54	4379.02	0.013873	5.53	217.90	236.34	1.01
HSD Main Channel	14692.54	25-Yr	1641.00	4377.03	4378.78	4378.78	4379.33	0.013032	5.97	275.10	253.83	1.01
HSD Main Channel	14692.54	50-Yr	2010.00	4377.03	4378.95	4378.95	4379.56	0.012581	6.27	320.36	266.85	1.01
HSD Main Channel	14379.42	100-Yr	2409.00	4372.65	4375.15	4374.78	4375.50	0.005597	4.72	510.52	355.23	0.69
HSD Main Channel	14379.42	2-Yr	590.00	4372.65	4374.12	4373.81	4374.26	0.004789	2.99	197.65	243.15	0.58
HSD Main Channel	14379.42	10-Yr	1204.00	4372.65	4374.59	4374.23	4374.80	0.005161	3.71	324.27	304.20	0.63
HSD Main Channel	14379.42	25-Yr	1641.00	4372.65	4374.81	4374.46	4375.08	0.005386	4.15	395.61	324.50	0.66
HSD Main Channel	14379.42	50-Yr	2010.00	4372.65	4374.96	4374.62	4375.29	0.005502	4.45	451.63	358.69	0.68
HSD Main Channel	14066.58	100-Yr	2409.00	4371.27	4373.01	4372.84	4373.35	0.008512	4.70	512.58	481.45	0.81
HSD Main Channel	14066.58	2-Yr	590.00	4371.27	4372.31		4372.43	0.007312	2.84	207.46	377.04	0.68
HSD Main Channel	14066.58	10-Yr	1204.00	4371.27	4372.60	4372.43	4372.82	0.007949	3.70	325.57	424.83	0.74
HSD Main Channel	14066.58	25-Yr	1641.00	4371.27	4372.78	4372.60	4373.04	0.008106	4.08	401.94	458.81	0.77
HSD Main Channel	14066.58	50-Yr	2010.00	4371.27	4372.89	4372.73	4373.19	0.008329	4.40	457.09	476.35	0.79
HSD Main Channel	13772.72	100-Yr	2409.00	4368.04	4369.73	4369.73	4370.16	0.014181	5.26	457.59	542.04	1.01
HSD Main Channel	13772.72	2-Yr	590.00	4368.04	4369.01	4369.01	4369.24	0.017775	3.85	153.05	343.14	1.02
HSD Main Channel	13772.72	10-Yr	1204.00	4368.04	4369.30	4369.30	4369.63	0.015490	4.64	259.40	397.00	1.01
HSD Main Channel	13772.72	25-Yr	1641.00	4368.04	4369.45	4369.45	4369.88	0.015100	5.12	320.58	415.60	1.03
HSD Main Channel	13772.72	50-Yr	2010.00	4368.04	4369.61	4369.61	4370.01	0.014602	5.07	396.54	508.75	1.01
HSD Main Channel	13457.43	100-Yr	2409.00	4363.18	4364.90	4365.00	4365.48	0.015494	6.11	394.57	400.36	1.08
HSD Main Channel	13457.43	2-Yr	590.00	4363.18	4364.05	4364.00	4364.29	0.012509	3.95	149.20	247.38	0.90
HSD Main Channel	13457.43	10-Yr	1204.00	4363.18	4364.40	4364.35	4364.79	0.011925	4.99	241.09	271.71	0.93
HSD Main Channel	13457.43	25-Yr	1641.00	4363.18	4364.52	4364.56	4365.08	0.015134	6.00	273.39	279.59	1.07
HSD Main Channel	13457.43	50-Yr	2010.00	4363.18	4364.65	4364.73	4365.30	0.015202	6.43	312.39	288.81	1.09
HSD Main Channel	13130.33	100-Yr	2409.00	4360.46	4362.01	4361.80	4362.27	0.007211	4.12	584.48	602.51	0.74
HSD Main Channel	13130.33	2-Yr	590.00	4360.46	4361.28	4361.11	4361.39	0.006437	2.69	218.99	392.30	0.64
HSD Main Channel	13130.33	10-Yr	1204.00	4360.46	4361.59	4361.40	4361.77	0.007045	3.37	357.67	490.87	0.70
HSD Main Channel	13130.33	25-Yr	1641.00	4360.46	4361.78	4361.56	4361.99	0.006845	3.60	455.37	552.18	0.70
HSD Main Channel	13130.33	50-Yr	2010.00	4360.46	4361.89	4361.67	4362.12	0.007218	3.92	512.33	569.10	0.73
HSD Main Channel	12856.26	100-Yr	4820.00	4356.52	4358.84	4358.84	4359.42	0.012621	6.11	788.85	685.36	1.00

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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
HSD Main Channel	12856.26	2-Yr	1154.00	4358.52	4357.95	4357.95	4358.25	0.016504	4.36	264.82	467.54	1.02
HSD Main Channel	12856.26	10-Yr	2368.00	4356.52	4358.34	4358.34	4358.74	0.014468	5.06	487.82	596.82	1.01
HSD Main Channel	12856.26	25-Yr	3256.00	4358.52	4358.53	4358.53	4359.01	0.014081	5.54	587.37	641.07	1.02
HSD Main Channel	12856.26	50-Yr	4006.00	4356.52	4358.69	4358.69	4359.21	0.013048	5.83	687.59	657.80	1.00
HSD Main Channel	12556.85	100-Yr	4820.00	4344.00	4349.14	4350.91	4354.06	0.022180	17.79	271.01	70.42	1.60
HSD Main Channel	12556.85	2-Yr	1154.00	4344.00	4346.04	4347.04	4349.52	0.058864	14.98	77.05	54.92	2.23
HSD Main Channel	12556.85	10-Yr	2368.00	4344.00	4347.11	4348.48	4351.82	0.039552	17.03	139.03	60.15	1.98
HSD Main Channel	12556.85	25-Yr	3256.00	4344.00	4347.86	4349.36	4352.67	0.031325	17.59	185.11	63.77	1.82
HSD Main Channel	12556.85	50-Yr	4006.00	4344.00	4348.47	4350.00	4353.39	0.026389	17.80	225.07	66.75	1.71
HSD Main Channel	12329.17	100-Yr	4820.00	4342.48	4348.65	4348.65	4350.39	0.008868	10.58	455.45	129.12	0.99
HSD Main Channel	12329.17	2-Yr	1154.00	4342.48	4345.28	4345.28	4346.31	0.010400	8.18	141.45	67.76	1.00
HSD Main Channel	12329.17	10-Yr	2368.00	4342.48	4346.59	4346.59	4348.21	0.009026	10.21	231.91	70.30	0.99
HSD Main Channel	12329.17	25-Yr	3256.00	4342.48	4347.76	4347.76	4349.16	0.009454	9.50	342.80	120.66	0.99
HSD Main Channel	12329.17	50-Yr	4006.00	4342.48	4348.22	4348.22	4349.78	0.009083	10.00	400.74	126.42	0.99
HSD Main Channel	12141.33	100-Yr	4820.00	4340.05	4343.68	4344.80	4347.49	0.026963	15.88	307.77	114.25	1.68
HSD Main Channel	12141.33	2-Yr	1154.00	4340.05	4342.89	4342.89	4343.38	0.030914	5.01	230.11	111.19	0.61
HSD Main Channel	12141.33	10-Yr	2368.00	4340.05	4342.57	4343.34	4345.15	0.034088	12.89	183.65	109.32	1.75
HSD Main Channel	12141.33	25-Yr	3256.00	4340.05	4343.01	4343.93	4346.07	0.030327	14.03	232.97	111.27	1.71
HSD Main Channel	12141.33	50-Yr	4006.00	4340.05	4343.34	4344.36	4346.79	0.028688	14.91	268.76	112.72	1.70
HSD Main Channel	11917.1	100-Yr	4820.00	4338.00	4343.36	4343.38	4344.82	0.009078	9.69	497.59	166.50	0.99
HSD Main Channel	11917.1	2-Yr	1154.00	4338.00	4341.16	4341.16	4341.96	0.011209	7.18	160.74	99.02	0.99
HSD Main Channel	11917.1	10-Yr	2368.00	4338.00	4342.21	4342.21	4343.13	0.010411	7.70	307.66	161.79	0.98
HSD Main Channel	11917.1	25-Yr	3256.00	4338.00	4342.86	4342.66	4343.80	0.008927	8.55	380.67	164.72	0.99
HSD Main Channel	11917.1	50-Yr	4006.00	4338.00	4343.02	4343.02	4344.31	0.009402	9.11	439.65	165.86	0.99
HSD Main Channel	11610.72	100-Yr	4820.00	4334.81	4339.15	4339.61	4341.27	0.014845	11.70	411.89	149.77	1.24
HSD Main Channel	11610.72	2-Yr	1154.00	4334.81	4337.44	4337.51	4338.19	0.013458	6.99	165.04	122.82	1.06
HSD Main Channel	11610.72	10-Yr	2368.00	4334.81	4338.17	4338.37	4339.39	0.014276	8.83	288.10	146.49	1.15
HSD Main Channel	11610.72	25-Yr	3256.00	4334.81	4338.56	4338.85	4340.12	0.014455	10.03	324.71	147.79	1.19
HSD Main Channel	11610.72	50-Yr	4006.00	4334.81	4338.84	4339.22	4340.70	0.014702	10.92	366.99	148.75	1.23
HSD Main Channel	11182.79	100-Yr	4820.00	4330.00	4334.52	4333.70	4335.12	0.003585	6.21	776.23	253.05	0.63
HSD Main Channel	11182.79	2-Yr	1154.00	4330.00	4332.17	4332.07	4332.59	0.009354	5.21	221.34	194.28	0.86
HSD Main Channel	11182.79	10-Yr	2368.00	4330.00	4332.90	4332.73	4333.52	0.008317	6.31	375.17	225.88	0.86
HSD Main Channel	11182.79	25-Yr	3256.00	4330.00	4333.45	4333.13	4334.09	0.008675	6.45	505.02	249.21	0.80
HSD Main Channel	11182.79	50-Yr	4006.00	4330.00	4333.94	4333.44	4334.57	0.004959	6.37	628.90	252.35	0.71
HSD Main Channel	10592.6	100-Yr	4820.00	4323.90	4331.86	4330.11	4333.09	0.003130	8.87	543.17	89.16	0.63
HSD Main Channel	10592.6	2-Yr	1154.00	4323.90	4327.27	4326.91	4327.99	0.006510	6.82	189.23	73.31	0.79
HSD Main Channel	10592.6	10-Yr	2368.00	4323.90	4329.01	4328.20	4329.96	0.004512	7.80	303.66	80.56	0.71
HSD Main Channel	10592.6	25-Yr	3256.00	4323.90	4330.17	4328.98	4331.21	0.003647	8.16	396.82	83.30	0.68
HSD Main Channel	10592.6	50-Yr	4006.00	4323.90	4331.01	4329.51	4332.14	0.003350	8.54	468.99	85.28	0.64
HSD Main Channel	10118.27	100-Yr	4820.00	4319.86	4327.72	4327.72	4330.82	0.008418	13.67	352.69	61.79	1.01
HSD Main Channel	10118.27	2-Yr	1154.00	4319.86	4324.20	4323.62	4325.07	0.005774	7.52	153.44	51.35	0.77
HSD Main Channel	10118.27	10-Yr	2368.00	4319.86	4325.69	4325.31	4327.29	0.006832	10.14	233.43	56.55	0.87
HSD Main Channel	10118.27	25-Yr	3256.00	4319.86	4326.37	4326.31	4328.80	0.008220	11.98	271.84	57.66	0.97
HSD Main Channel	10118.27	50-Yr	4006.00	4319.86	4327.04	4327.04	4329.61	0.008366	12.87	311.25	59.71	0.99
HSD Main Channel	9624.29	100-Yr	4820.00	4314.16	4323.27	4323.77	4325.52	0.011931	12.02	401.09	119.89	1.18
HSD Main Channel	9624.29	2-Yr	1154.00	4314.16	4320.83	4320.86	4321.85	0.008368	7.26	158.95	77.89	0.89
HSD Main Channel	9624.29	10-Yr	2368.00	4314.16	4322.00	4322.00	4323.25	0.009428	8.97	263.97	102.82	0.99
HSD Main Channel	9624.29	25-Yr	3256.00	4314.16	4322.61	4322.61	4324.14	0.009023	9.91	328.87	106.46	0.99
HSD Main Channel	9624.29	50-Yr	4006.00	4314.16	4322.90	4323.11	4324.83	0.010384	11.15	359.22	108.11	1.08
HSD Main Channel	9149.64	100-Yr	4820.00	4308.08	4318.34	4318.46	4319.47	0.012134	8.50	566.76	289.32	1.07
HSD Main Channel	9149.64	2-Yr	1154.00	4308.08	4316.27	4316.27	4316.92	0.011797	6.48	178.63	134.78	0.99
HSD Main Channel	9149.64	10-Yr	2368.00	4308.08	4317.03	4317.15	4318.06	0.012500	8.12	291.77	163.09	1.07
HSD Main Channel	9149.64	25-Yr	3256.00	4308.08	4317.38	4317.63	4318.73	0.014581	9.38	347.00	175.04	1.17
HSD Main Channel	9149.64	50-Yr	4006.00	4308.08	4317.83	4318.20	4319.16	0.012984	9.24	433.46	205.07	1.12
HSD Main Channel	8654.43	100-Yr	4820.00	4306.00	4311.38	4310.82	4312.04	0.005152	6.54	737.11	294.35	0.73
HSD Main Channel	8654.43	2-Yr	1154.00	4306.00	4309.46	4309.10	4309.78	0.008314	4.80	250.77	197.68	0.72
HSD Main Channel	8654.43	10-Yr	2368.00	4306.00	4310.33	4309.88	4310.76	0.005150	5.26	450.21	249.19	0.69
HSD Main Channel	8654.43	25-Yr	3256.00	4306.00	4310.78	4310.25	4311.28	0.005122	5.78	563.29	269.51	0.70
HSD Main Channel	8654.43	50-Yr	4006.00	4306.00	4311.08	4310.54	4311.67	0.005199	6.16	650.60	286.30	0.72
HSD Main Channel	8227.06	100-Yr	4820.00	4301.98	4307.81	4307.81	4308.92	0.010790	8.46	589.70	267.81	1.02
HSD Main Channel	8227.06	2-Yr	1154.00	4301.98	4305.19	4305.19	4306.26	0.010606	8.31	138.81	65.11	1.00
HSD Main Channel	8227.06	10-Yr	2368.00	4301.98	4306.65	4306.65	4307.54	0.011587	7.57	312.89	182.92	1.02
HSD Main Channel	8227.06	25-Yr	3256.00	4301.98	4307.15	4307.15	4308.12	0.011186	7.89	412.78	220.89	1.02
HSD Main Channel	8227.06	50-Yr	4006.00	4301.98	4307.47	4307.47	4308.53	0.010643	8.28	485.14	233.90	1.01
HSD Main Channel	7805.03	100-Yr	4820.00	4296.00	4300.88	4301.55	4303.37	0.015498	12.67	390.42	128.11	1.30
HSD Main Channel	7805.03	2-Yr	1154.00	4296.00	4299.27	4298.56	4299.74	0.003925	5.47	211.07	89.46	0.83

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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 # Chi
HSD Main Channel	7805.03	10-Yr	2368.00	4296.00	4300.52	4299.75	4301.29	0.005011	7.04	336.18	117.08	0.73
HSD Main Channel	7805.03	25-Yr	3256.00	4296.00	4299.83	4300.52	4302.22	0.016970	12.40	262.55	97.64	1.33
HSD Main Channel	7805.03	50-Yr	4006.00	4296.00	4300.31	4301.07	4302.87	0.017005	12.63	312.33	110.67	1.35
HSD Main Channel	7385.4	100-Yr	4820.00	4291.98	4298.29	4298.29	4299.24	0.011302	7.80	617.94	341.60	1.02
HSD Main Channel	7385.4	2-Yr	1154.00	4291.98	4296.24	4296.24	4297.10	0.011225	7.41	155.75	91.82	1.00
HSD Main Channel	7385.4	10-Yr	2368.00	4291.98	4297.55	4297.50	4298.16	0.011782	6.29	376.22	295.89	0.98
HSD Main Channel	7385.4	25-Yr	3256.00	4291.98	4297.87	4297.86	4298.60	0.011282	6.82	477.71	322.83	0.99
HSD Main Channel	7385.4	50-Yr	4006.00	4291.98	4298.12	4298.07	4298.92	0.010608	7.15	560.03	336.15	0.98
HSD Main Channel	6964.05	100-Yr	4820.00	4287.78	4293.70	4293.70	4294.63	0.011162	7.70	625.63	349.68	1.02
HSD Main Channel	6964.05	2-Yr	1154.00	4287.78	4291.24	4291.30	4292.13	0.012397	7.57	152.49	94.39	1.05
HSD Main Channel	6964.05	10-Yr	2368.00	4287.78	4292.47	4292.47	4293.40	0.010708	7.72	306.65	165.30	1.00
HSD Main Channel	6964.05	25-Yr	3256.00	4287.78	4293.11	4293.11	4293.96	0.010711	7.38	441.25	254.96	0.99
HSD Main Channel	6964.05	50-Yr	4006.00	4287.78	4293.45	4293.45	4294.30	0.011288	7.42	539.59	321.48	1.01
HSD Main Channel	6467.25	100-Yr	4820.00	4282.00	4288.99	4288.56	4289.47	0.005296	5.58	863.84	447.40	0.71
HSD Main Channel	6467.25	2-Yr	1154.00	4282.00	4285.83	4285.83	4286.76	0.010454	7.74	149.15	78.04	0.99
HSD Main Channel	6467.25	10-Yr	2368.00	4282.00	4287.31	4287.15	4288.28	0.008468	7.91	299.55	130.10	0.92
HSD Main Channel	6467.25	25-Yr	3256.00	4282.00	4288.44	4288.17	4288.86	0.006585	5.20	625.83	423.61	0.75
HSD Main Channel	6467.25	50-Yr	4006.00	4282.00	4288.72	4288.35	4289.17	0.005791	5.37	745.36	436.61	0.73
HSD Main Channel	6090.97	100-Yr	4820.00	4278.28	4285.80	4285.60	4286.78	0.009561	8.70	554.19	229.55	0.99
HSD Main Channel	6090.97	2-Yr	1154.00	4278.28	4282.51	4282.28	4283.31	0.007673	7.16	161.13	75.46	0.86
HSD Main Channel	6090.97	10-Yr	2368.00	4278.28	4283.66	4283.64	4284.96	0.009043	9.15	258.73	94.67	0.98
HSD Main Channel	6090.97	25-Yr	3256.00	4278.28	4284.62	4284.62	4285.83	0.009536	8.85	367.87	147.90	0.99
HSD Main Channel	6090.97	50-Yr	4006.00	4278.28	4285.17	4285.17	4286.34	0.009657	8.67	461.87	193.45	0.98
HSD Main Channel	5785.22	100-Yr	4820.00	4275.65	4282.39	4282.43	4283.86	0.009367	9.72	495.83	170.31	1.00
HSD Main Channel	5785.22	2-Yr	1154.00	4275.65	4279.65	4279.65	4280.56	0.010590	7.65	150.81	60.82	0.99
HSD Main Channel	5785.22	10-Yr	2368.00	4275.65	4280.90	4280.90	4282.02	0.009892	8.50	278.66	121.70	0.99
HSD Main Channel	5785.22	25-Yr	3256.00	4275.65	4281.45	4281.53	4282.79	0.010335	9.28	350.94	138.98	1.03
HSD Main Channel	5785.22	50-Yr	4006.00	4275.65	4281.93	4281.94	4283.34	0.009826	9.53	420.51	154.22	1.02
HSD Main Channel	5546.66	100-Yr	4820.00	4271.99	4278.43	4279.14	4281.25	0.011545	13.47	357.88	85.97	1.16
HSD Main Channel	5546.66	2-Yr	1154.00	4271.99	4276.47	4275.39	4276.93	0.002742	5.40	213.56	69.57	0.54
HSD Main Channel	5546.66	10-Yr	2368.00	4271.99	4278.00	4276.73	4278.66	0.019218	13.07	181.17	67.79	1.41
HSD Main Channel	5546.66	25-Yr	3256.00	4271.99	4276.87	4277.55	4279.70	0.014950	13.49	241.32	70.85	1.29
HSD Main Channel	5546.66	50-Yr	4006.00	4271.99	4277.55	4278.30	4280.51	0.012832	13.81	289.99	72.79	1.22
HSD Main Channel	5283.29	100-Yr	4820.00	4269.93	4276.93	4276.76	4277.60	0.008786	6.57	733.36	432.10	0.89
HSD Main Channel	5283.29	2-Yr	1154.00	4269.93	4273.99	4273.99	4275.59	0.009479	10.15	113.85	34.78	0.99
HSD Main Channel	5283.29	10-Yr	2368.00	4269.93	4276.08	4275.96	4276.59	0.009235	5.69	415.98	314.73	0.87
HSD Main Channel	5283.29	25-Yr	3256.00	4269.93	4276.43	4276.31	4277.01	0.009205	6.10	534.19	364.56	0.89
HSD Main Channel	5283.29	50-Yr	4006.00	4269.93	4276.68	4276.55	4277.31	0.009061	6.34	631.40	401.23	0.89
HSD Main Channel	5034.86	100-Yr	4820.00	4265.95	4274.18	4274.18	4275.17	0.010896	7.96	605.73	311.22	1.01
HSD Main Channel	5034.86	2-Yr	1154.00	4265.95	4271.05	4271.39	4272.75	0.013941	10.46	110.37	45.08	1.18
HSD Main Channel	5034.86	10-Yr	2368.00	4265.95	4273.32	4273.32	4274.00	0.011581	6.83	357.36	256.25	0.99
HSD Main Channel	5034.86	25-Yr	3256.00	4265.95	4273.66	4273.68	4274.48	0.011196	7.16	455.06	263.66	1.00
HSD Main Channel	5034.86	50-Yr	4006.00	4265.95	4273.96	4273.96	4274.83	0.010848	7.49	535.17	304.55	1.00
HSD Main Channel	4695.55	100-Yr	4820.00	4262.00	4273.47	4270.81	4273.58	0.000718	2.68	1801.27	621.18	0.28
HSD Main Channel	4695.55	2-Yr	1154.00	4262.00	4267.74	4268.58	4268.23	0.003144	5.56	207.41	69.80	0.57
HSD Main Channel	4695.55	10-Yr	2368.00	4262.00	4271.37	4268.23	4271.51	0.001036	2.93	809.26	317.81	0.32
HSD Main Channel	4695.55	25-Yr	3256.00	4262.00	4272.61	4269.09	4272.71	0.000703	2.50	1303.19	468.41	0.27
HSD Main Channel	4695.55	50-Yr	4006.00	4262.00	4273.04	4270.32	4273.15	0.000779	2.60	1542.26	590.49	0.28
HSD Main Channel	4462.68	100-Yr	4820.00	4261.39	4272.84		4273.28	0.002145	5.30	909.19	254.26	0.49
HSD Main Channel	4462.68	2-Yr	1154.00	4261.39	4266.72		4267.44	0.003391	6.82	169.13	43.66	0.61
HSD Main Channel	4462.68	10-Yr	2368.00	4261.39	4270.58		4271.06	0.003633	5.57	425.19	162.48	0.61
HSD Main Channel	4462.68	25-Yr	3256.00	4261.39	4272.14		4272.44	0.001750	4.41	737.80	232.91	0.44
HSD Main Channel	4462.68	50-Yr	4006.00	4261.39	4272.47		4272.94	0.001991	4.90	817.52	243.07	0.47
HSD Main Channel	4219.43	100-Yr	6592.00	4259.99	4272.08		4272.56	0.003842	5.55	1188.53	482.73	0.62
HSD Main Channel	4219.43	2-Yr	1572.00	4259.99	4264.96		4266.28	0.005735	9.22	170.56	41.13	0.80
HSD Main Channel	4219.43	10-Yr	3257.00	4259.99	4268.28		4269.90	0.004921	10.21	319.04	57.54	0.76
HSD Main Channel	4219.43	25-Yr	4475.00	4259.99	4271.50	4269.14	4271.85	0.003117	4.79	933.88	402.71	0.55
HSD Main Channel	4219.43	50-Yr	5490.00	4259.99	4271.71		4272.16	0.003720	5.36	1023.89	426.33	0.61
HSD Main Channel	3967.44	100-Yr	6592.00	4258.00	4270.26	4270.12	4271.13	0.006691	7.40	891.41	429.60	0.91
HSD Main Channel	3967.44	2-Yr	1572.00	4258.00	4263.34		4264.80	0.005948	9.67	162.50	35.36	0.80
HSD Main Channel	3967.44	10-Yr	3257.00	4258.00	4265.93	4265.25	4266.38	0.006651	12.54	259.71	39.66	0.86
HSD Main Channel	3967.44	25-Yr	4475.00	4258.00	4267.26	4266.78	4270.42	0.007347	14.23	314.49	41.97	0.92
HSD Main Channel	3967.44	50-Yr	5490.00	4258.00	4270.07	4269.86	4270.60	0.006171	6.81	806.02	419.36	0.87
HSD Main Channel	3674.39	100-Yr	6592.00	4256.00	4267.28	4267.28	4268.25	0.011042	7.90	834.48	437.62	1.01
HSD Main Channel	3674.39	2-Yr	1572.00	4256.00	4260.67	4260.65	4262.58	0.009462	11.09	141.77	36.84	1.00
HSD Main Channel	3674.39	10-Yr	3257.00	4256.00	4263.13	4263.13	4266.06	0.008922	13.78	236.30	40.17	1.00

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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
HSD Main Channel	3674.39	25-Yr	4475.00	4256.00	4264.92	4264.92	4268.08	0.008747	14.26	313.99	50.18	1.00
HSD Main Channel	3674.39	50-Yr	5490.00	4256.00	4267.01	4267.01	4267.92	0.011784	7.66	716.38	412.33	1.03
HSD Main Channel	3379.1	100-Yr	6592.00	4256.47	4265.01	4264.61	4265.75	0.006300	6.87	959.11	408.15	0.79
HSD Main Channel	3379.1	2-Yr	1572.00	4256.47	4258.99		4260.02	0.006508	8.17	192.41	64.19	0.83
HSD Main Channel	3379.1	10-Yr	3257.00	4256.47	4261.33	4260.32	4262.89	0.004404	9.37	347.45	88.15	0.73
HSD Main Channel	3379.1	25-Yr	4475.00	4256.47	4263.33	4261.34	4264.57	0.004100	8.95	500.23	99.37	0.70
HSD Main Channel	3379.1	50-Yr	5490.00	4256.47	4264.90	4262.07	4265.46	0.005044	6.00	914.34	403.24	0.70
HSD Main Channel	3030.67	100-Yr	6592.00	4250.87	4262.57	4262.45	4263.07	0.009061	5.63	1170.59	888.44	0.86
HSD Main Channel	3030.67	2-Yr	1572.00	4250.87	4255.65	4255.56	4257.36	0.008689	10.47	150.07	41.51	0.97
HSD Main Channel	3030.67	10-Yr	3257.00	4250.87	4258.05	4257.84	4260.59	0.007635	12.78	254.78	45.40	0.95
HSD Main Channel	3030.67	25-Yr	4475.00	4250.87	4262.56	4259.19	4262.78	0.004424	3.89	1149.78	887.02	0.80
HSD Main Channel	3030.67	50-Yr	5490.00	4250.87	4262.32	4262.28	4262.84	0.012317	5.78	950.33	873.78	0.98
HSD Main Channel	2816.21	100-Yr	6592.00	4250.00	4260.62	4260.41	4261.16	0.008708	5.92	1114.00	758.14	0.86
HSD Main Channel	2816.21	2-Yr	1572.00	4250.00	4254.82		4255.85	0.004471	8.14	193.01	46.58	0.71
HSD Main Channel	2816.21	10-Yr	3257.00	4250.00	4257.66		4259.17	0.003770	9.84	330.88	49.60	0.87
HSD Main Channel	2816.21	25-Yr	4475.00	4250.00	4259.25	4257.28	4261.01	0.015911	10.64	420.53	179.56	1.23
HSD Main Channel	2816.21	50-Yr	5490.00	4250.00	4260.61		4260.99	0.006153	4.97	1103.69	751.06	0.72
HSD Main Channel	2587.35	100-Yr	6592.00	4248.00	4259.94		4260.17	0.002232	3.82	1724.90	817.45	0.46
HSD Main Channel	2587.35	2-Yr	1572.00	4248.00	4252.91	4252.57	4254.51	0.007289	10.14	155.04	39.27	0.89
HSD Main Channel	2587.35	10-Yr	3257.00	4248.00	4255.46	4255.00	4257.93	0.006947	12.59	258.71	42.59	0.90
HSD Main Channel	2587.35	25-Yr	4475.00	4248.00	4257.07	4256.43	4259.94	0.006550	13.60	328.93	44.88	0.89
HSD Main Channel	2587.35	50-Yr	5490.00	4248.00	4260.40	4258.73	4260.90	0.000820	2.61	2101.18	831.48	0.29
HSD Main Channel	2350.58	100-Yr	6592.00	4245.98	4258.52	4258.40	4259.17	0.009457	6.47	1019.06	642.80	0.91
HSD Main Channel	2350.58	2-Yr	1572.00	4245.98	4250.56	4250.56	4252.52	0.009436	11.21	140.22	36.34	1.01
HSD Main Channel	2350.58	10-Yr	3257.00	4245.98	4253.04	4253.04	4256.03	0.008768	13.86	234.97	39.70	1.00
HSD Main Channel	2350.58	25-Yr	4475.00	4245.98	4254.80	4254.50	4258.10	0.008609	15.22	294.04	41.21	1.00
HSD Main Channel	2350.58	50-Yr	5490.00	4245.98	4255.61	4255.61	4259.65	0.008526	16.14	340.23	42.47	1.01
HSD Main Channel	2118.63	100-Yr	6592.00	4243.99	4253.22	4253.22	4256.81	0.008431	15.20	433.67	61.03	1.01
HSD Main Channel	2118.63	2-Yr	1572.00	4243.99	4247.17	4247.70	4249.62	0.016621	12.55	125.27	41.30	1.27
HSD Main Channel	2118.63	10-Yr	3257.00	4243.99	4248.90	4250.08	4253.05	0.016581	16.34	199.37	45.59	1.38
HSD Main Channel	2118.63	25-Yr	4475.00	4243.99	4249.86	4251.33	4255.03	0.020043	18.24	245.34	50.74	1.46
HSD Main Channel	2118.63	50-Yr	5490.00	4243.99	4250.50	4252.28	4256.52	0.020824	19.67	279.09	53.00	1.51
HSD Main Channel	1888.92	100-Yr	6592.00	4240.00	4251.82	4244.98	4251.84	0.000296	3.76	1751.11	182.60	0.21
HSD Main Channel	1888.92	2-Yr	1572.00	4240.00	4244.16	4242.23	4244.33	0.000951	3.32	473.88	147.49	0.33
HSD Main Channel	1888.92	10-Yr	3257.00	4240.00	4247.07	4243.37	4247.26	0.000510	3.46	841.62	171.23	0.26
HSD Main Channel	1888.92	25-Yr	4475.00	4240.00	4248.90	4243.99	4249.09	0.000386	3.55	1260.77	177.57	0.23
HSD Main Channel	1888.92	50-Yr	5490.00	4240.00	4250.26	4244.50	4250.46	0.000331	3.65	1503.69	179.82	0.22
HSD Main Channel	1668.12	100-Yr	6592.00	4238.00	4247.37	4247.37	4251.29	0.007959	15.88	415.08	53.06	1.00
HSD Main Channel	1668.12	2-Yr	1572.00	4238.00	4242.70		4243.83	0.005032	8.52	184.50	45.45	0.75
HSD Main Channel	1668.12	10-Yr	3257.00	4238.00	4244.43	4244.11	4246.76	0.007216	12.25	265.89	48.55	0.92
HSD Main Channel	1668.12	25-Yr	4475.00	4238.00	4245.40	4245.40	4248.56	0.008329	14.26	313.72	50.04	1.00
HSD Main Channel	1668.12	50-Yr	5490.00	4238.00	4246.39	4246.39	4249.93	0.008096	15.08	383.97	51.55	1.00
HSD Main Channel	1490.38	100-Yr	6592.00	4238.00	4245.02	4245.83	4249.51	0.011932	17.00	387.75	61.77	1.20
HSD Main Channel	1490.38	2-Yr	1572.00	4238.00	4241.34	4241.19	4242.86	0.008607	9.22	170.49	56.41	0.94
HSD Main Channel	1490.38	10-Yr	3257.00	4238.00	4243.07	4243.03	4245.33	0.008801	12.07	289.91	58.92	0.99
HSD Main Channel	1490.38	25-Yr	4475.00	4238.00	4244.02	4244.16	4246.93	0.009219	13.88	327.03	60.32	1.04
HSD Main Channel	1490.38	50-Yr	5490.00	4238.00	4244.43	4244.98	4248.22	0.011136	15.62	351.54	60.91	1.15
HSD Main Channel	1255.37	100-Yr	6592.00	4236.00	4245.40	4243.76	4247.54	0.004177	11.72	562.24	70.42	0.73
HSD Main Channel	1255.37	2-Yr	1572.00	4236.00	4240.50		4241.22	0.003672	6.78	232.01	65.72	0.84
HSD Main Channel	1255.37	10-Yr	3257.00	4236.00	4242.42	4241.21	4243.70	0.003979	9.08	358.83	66.78	0.89
HSD Main Channel	1255.37	25-Yr	4475.00	4236.00	4243.59	4242.20	4245.22	0.004052	10.23	437.50	67.23	0.71
HSD Main Channel	1255.37	50-Yr	5490.00	4236.00	4244.48	4242.99	4246.37	0.004138	11.02	498.33	68.82	0.72
HSD Main Channel	1071.27	100-Yr	6592.00	4235.51	4243.05	4243.05	4246.38	0.008124	14.64	450.41	66.49	0.99
HSD Main Channel	1071.27	2-Yr	1572.00	4235.51	4238.77	4238.77	4240.10	0.010109	9.25	169.82	64.78	1.01
HSD Main Channel	1071.27	10-Yr	3257.00	4235.51	4240.46	4240.46	4242.57	0.008785	11.63	279.97	65.45	0.99
HSD Main Channel	1071.27	25-Yr	4475.00	4235.51	4241.46	4241.46	4244.07	0.008575	12.97	345.14	65.85	1.00
HSD Main Channel	1071.27	50-Yr	5490.00	4235.51	4242.25	4242.25	4245.21	0.008315	13.82	397.29	66.17	0.99
HSD Main Channel	800.36	100-Yr	6592.00	4233.98	4243.08	4240.08	4244.02	0.001793	7.81	843.98	107.68	0.49
HSD Main Channel	800.36	2-Yr	1572.00	4233.98	4237.32	4236.69	4237.94	0.004525	6.32	248.54	93.72	0.68
HSD Main Channel	800.36	10-Yr	3257.00	4233.98	4239.48	4238.07	4240.25	0.002885	7.05	461.67	103.76	0.59
HSD Main Channel	800.36	25-Yr	4475.00	4233.98	4240.87	4238.83	4241.71	0.002286	7.36	608.27	105.99	0.54
HSD Main Channel	800.36	50-Yr	5490.00	4233.98	4241.95	4239.49	4242.85	0.001980	7.59	723.72	106.44	0.51
HSD Main Channel	623.07	100-Yr	6592.00	4232.00	4239.76	4239.76	4243.20	0.008016	14.87	443.28	63.97	1.00
HSD Main Channel	623.07	2-Yr	1572.00	4232.00	4235.39	4235.39	4236.74	0.009509	9.33	168.56	61.17	0.99
HSD Main Channel	623.07	10-Yr	3257.00	4232.00	4237.12	4237.12	4239.29	0.006575	11.82	275.65	62.73	0.99
HSD Main Channel	623.07	25-Yr	4475.00	4232.00	4238.18	4238.18	4240.83	0.008194	13.05	342.78	63.54	0.99

HEC-RAS Plan: Steady State River: HSD Main Channel Reach: HSD Main Channel (Continued)

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
HSD Main Channel	623.07	50-Yr	5490.00	4232.00	4238.97	4238.97	4242.00	0.008084	13.98	382.63	63.76	0.99
HSD Main Channel	432.97	100-Yr	5592.00	4228.00	4237.51	4232.73	4237.82	0.000217	2.59	2542.46	369.11	0.17
HSD Main Channel	432.97	2-Yr	1572.00	4228.00	4232.09	4230.89	4232.22	0.001830	2.86	548.65	347.24	0.40
HSD Main Channel	432.97	10-Yr	3257.00	4228.00	4234.18	4231.77	4234.27	0.000468	2.48	1312.71	387.79	0.23
HSD Main Channel	432.97	25-Yr	4475.00	4228.00	4235.52	4232.28	4235.61	0.000308	2.48	1806.37	368.29	0.20
HSD Main Channel	432.97	50-Yr	5490.00	4228.00	4236.55	4232.52	4236.65	0.000247	2.51	2187.99	366.68	0.18
HSD Main Channel	239.99	100-Yr	6592.00	4226.73	4235.73	4234.52	4237.35	0.004491	10.21	645.38	113.52	0.76
HSD Main Channel	239.99	2-Yr	1572.00	4226.73	4230.71	4230.12	4231.58	0.005301	7.49	209.81	88.45	0.75
HSD Main Channel	239.99	10-Yr	3257.00	4226.73	4232.53	4231.86	4233.93	0.005338	9.47	343.92	78.12	0.80
HSD Main Channel	239.99	25-Yr	4475.00	4226.73	4233.66	4232.85	4235.30	0.005236	10.28	435.26	85.52	0.80
HSD Main Channel	239.99	50-Yr	5490.00	4226.73	4234.74	4233.65	4236.37	0.005180	10.25	535.81	104.74	0.80
HSD Main Channel	20.29	100-Yr	5592.00	4226.00	4233.59	4233.04	4236.13	0.006007	12.79	516.85	85.22	0.88
HSD Main Channel	20.29	2-Yr	1572.00	4226.00	4229.42	4229.01	4230.34	0.006010	7.72	203.66	89.60	0.80
HSD Main Channel	20.29	10-Yr	3257.00	4226.00	4231.13	4230.62	4232.67	0.006003	9.97	326.72	74.33	0.84
HSD Main Channel	20.29	25-Yr	4475.00	4226.00	4232.12	4231.60	4234.05	0.006011	11.13	402.04	76.62	0.86
HSD Main Channel	20.29	50-Yr	5490.00	4226.00	4232.85	4232.33	4235.08	0.006008	11.98	458.09	77.13	0.87

APPENDIX C
EXCERPTS FROM
VOLUME 1, HYDROLOGY REPORT



***HORSESHOE DRAW FLOOD CONTROL, RESTORATION
AND EROSION MITIGATION STUDY AND DESIGN PROJECT***

**VOLUME 1
EXISTING CONDITIONS HYDROLOGIC STUDY
COCHISE COUNTY, ARIZONA**

Prepared for:

**Hereford Natural Resource
Conservation District
2136 N. Truman Rd.
Huachuca City, AZ 85616**

Prepared by:

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May 2015
HilgartWilson Project No. 1472



VOLUME 1
EXISTING CONDITIONS HYDROLOGIC STUDY

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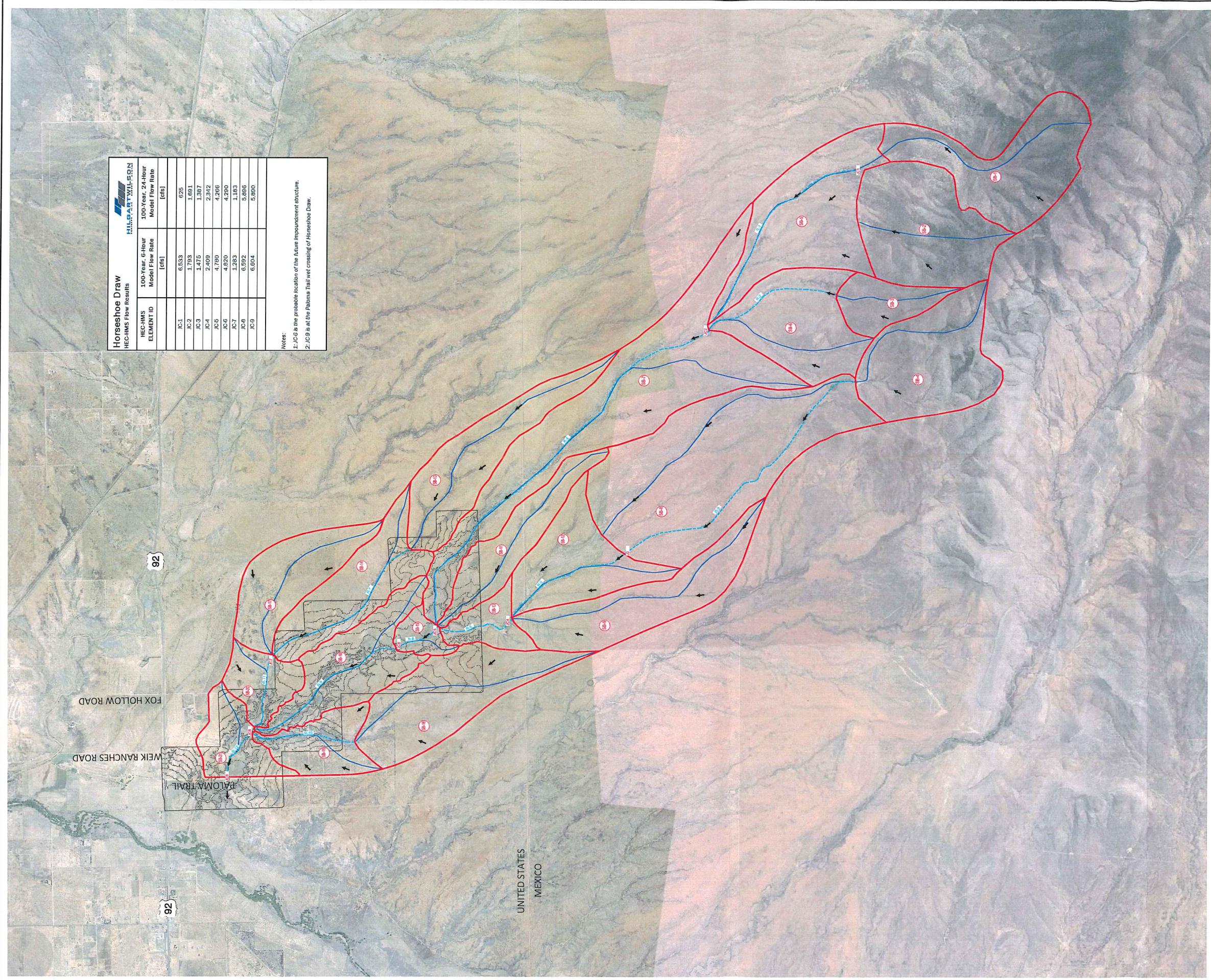
- A. FIGURES
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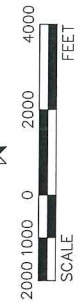
Horseshoe Draw
HEC-HMS Flow Results

HEC-HMS ELEMENT ID	100-Year, 6-Hour Model Flow Rate [cfs]	100-Year, 24-Hour Model Flow Rate [cfs]
JC-1	6,833	926
JC-2	1,793	1,891
JC-3	1,475	1,367
JC-4	2,409	2,342
JC-5	4,700	4,266
JC-6	4,070	4,280
JC-7	1,283	1,183
JC-8	6,592	5,886
JC-9	6,604	5,890

Notes:
 1. JC-8 is the probable location of the future Impoundment structure.
 2. JC-9 is at the Paloma Trail wet crossing of Horseshoe Draw.

LEGEND

- SUB BASIN BOUNDARY
- SUB BASIN LABEL
- LONGEST FLOW PATH
- ROUTING
- FLOW ARROW
- JUNCTION
- 100-YEAR FLOWRATE



HILGARTWILSON	
PROJ NO.: 1472	DATE: APR. 2015
DWG. NO.	SCALE: 1" = 2000'
DRAWN: JM	DESIGNED: HW
APPROVED: AT	

HORSESHOE DRAW	
COCHISE COUNTY, ARIZONA	
FIG 3. HYDROLOGY EXHIBIT	

HILGARTWILSON	
ENGINEER PLAN SURVEY MANAGE	
2141 E. HIGHLAND AVE., STE. 250 P: 602.490.0535 / F: 602.368.2436	
PHOENIX, AZ 85016 www.hilgartwilson.com	

Horseshoe Draw

HEC-HMS Flow Results



HEC-HMS ELEMENT ID	2-Year, 6-Hour Model Flow Rate	10-Year, 6-Hour Model Flow Rate	25-Year, 6-Hour Model Flow Rate	50-Year, 6-Hour Model Flow Rate	100-Year, 6-Hour Model Flow Rate	100-Year, 24-Hour Model Flow Rate
	[cfs]	[cfs]	[cfs]	[cfs]	[cfs]	[cfs]
JC-1	69	235	376	506	653	625
JC-2	342	799	1151	1455	1,793	1,691
JC-3	341	714	990	1221	1,475	1,387
JC-4	590	1204	1641	2010	2,409	2,342
JC-5	1147	2349	3231	3971	4,780	4,266
JC-6	1154	2368	3256	4003	4,820	4,290
JC-7	297	628	868	1066	1,283	1,183
JC-8	1572	3257	4475	5490	6,592	5,896
JC-9	1574	3263	4481	5499	6,604	5,890

Notes:

1: JC-6 is the probable location of the future impoundment structure.

2: JC-9 is at the Paloma Trail wet crossing of Horseshoe Draw.