

Urban Drainage and Flood Control District



E-19 Survey



LENA @ NOLTE POND

ALERT ID: 1020

LID: NOLC2

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Introduction

HDR Engineering Inc. was contracted by the Urban Drainage and Flood Control District to survey and provide information about a flood warning stream gage site in a manner consistent with National Weather Service E-19 procedures. On March 8, 2005, HDR surveyed the Lena @ Nolte Pond gage site. On January 6, 2006, HDR personnel gathered additional survey to build a hydraulic model to establish a rating curve for the site. This report is a summary of the work done and information gathered for the Lena @ Nolte Pond gage on Lena Gulch. Included in this report are elevations of critical points in the vicinity of the site, estimates of stages causing flood damage in vicinity of the gage, and a revised rating curve.

Site

The stream gage is located north of West 18th Drive on Lena Gulch. The ALERT ID number for this Gage is 1020 while the National Weather Service LID is NOLC2 and is referred to as Lena @ Nolte Pond. The pond at the gage location can be drained by the home owner on the north side of Lena Gulch at the gage location exposing the inlet of the pressure transducer for the stream gage. This will affect the rating curve at lower flows. Potential flooding at the gage itself would consist of flooding of residential homes on the north side of the Gulch. Figure 1 shows the location of the site on the Jefferson County ALERT map.

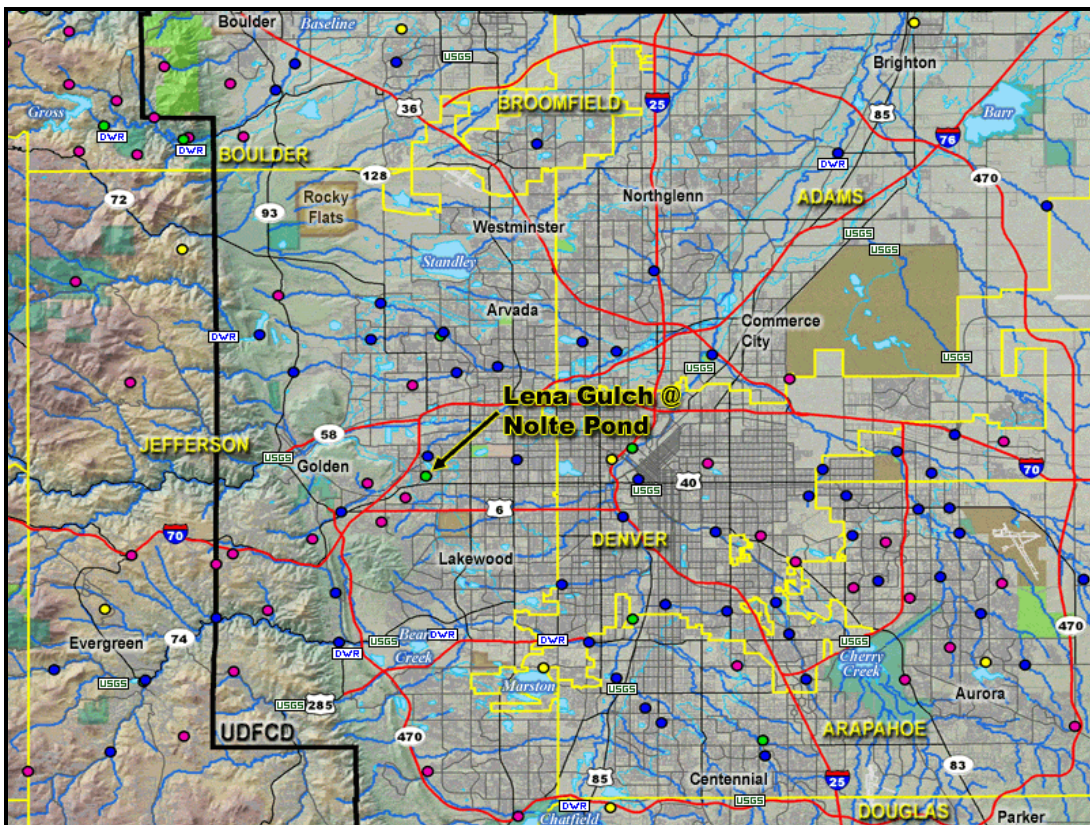


Figure 1 – Location Map

Surveyed locations

Ground elevations were surveyed along a cross section for a rating curve for the site. In addition, the elevations and locations of hazard locations, along with low flow channel water surface elevations up and downstream from the gage. Figure 2 shows locations of the surveyed points in the vicinity of the gage. The top of the ALERT transmitter was surveyed at an elevation of 100.00 for a temporary benchmark. The flow line elevation is 82.4 feet. The Nolte Pond will be full at 9.5 feet above the invert elevation. Water will impact the house on the north side of the channel at 14.9 feet above the invert elevation. Based on the water surface elevations in the low flow channel, the estimated channel energy slope is 4.6 percent.



Figure 2 – Surveyed Points (Aerial - DRCOG 2004)

Rating Curve Development

Hydraulics for the existing bridge were evaluated using the HEC River Analysis System (HEC-RAS) program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center¹. HEC-RAS uses the standard step method to calculate water surface profiles. The following assumptions are used by HEC-RAS in computing water surface profiles:

- Steady flow;
- Gradually varied flow;
- One-dimensional flow;
- Channel slopes are small, less than 1:10

A rating curve was established for the gage using the surveyed cross-sections and the Army Corps of Engineers computer program HEC-RAS. The resulting rating curve from the analysis is in Table 1.

Q cfs	Depth ft	Comment
7800	22.72	500-YR DISCHARGE
4020	17.98	100-YR DISCHARGE
3050	16.41	50-YR DISCHARGE NORTH HOME FLOODED
1550	13.16	10-YR DISCHARGE
1000	11.56	
800	10.87	
600	10.08	BANK FULL
400	9.14	
200	7.92	
100	7.06	
50	6.41	
30	6.07	
20	5.88	
10	5.63	

Table 1 – Rating Curve

¹ U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS Water Surface Profiles, Computer Program, Davis, California, March 2001.

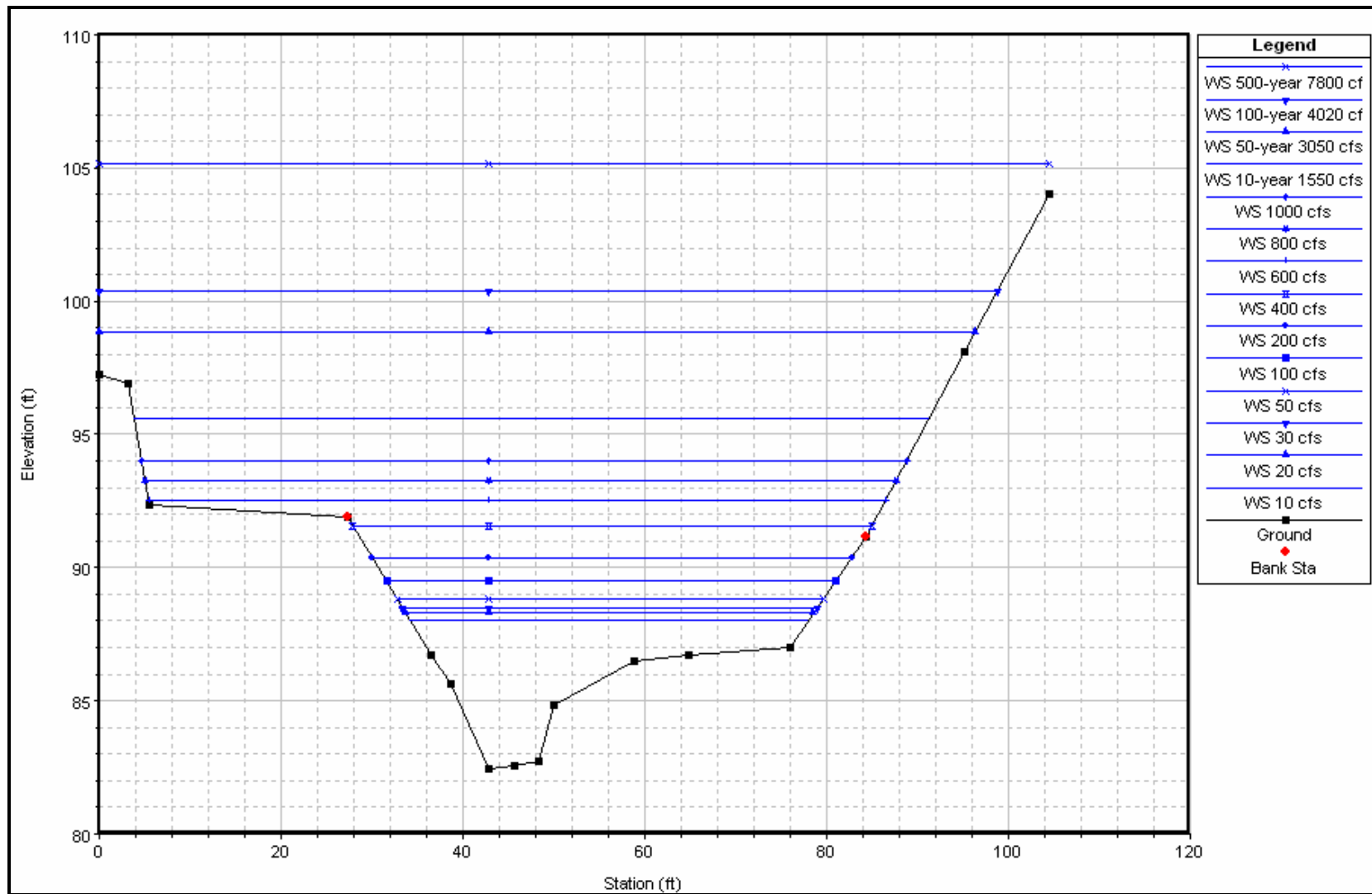


Figure 3 – HEC-RAS Cross Section with all Profiles

River	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
Lena Gulch		10	82.42	88.05	83.01	88.06	0.000000	0.10	103.92	43.93	0.01
Lena Gulch		20	82.42	88.30	83.26	88.30	0.000001	0.17	114.58	44.85	0.02
Lena Gulch		30	82.42	88.49	83.47	88.49	0.000001	0.24	123.57	45.61	0.03
Lena Gulch		50	82.42	88.83	83.81	88.83	0.000003	0.36	139.06	46.89	0.04
Lena Gulch		100	82.42	89.48	84.46	89.49	0.000006	0.59	170.60	49.40	0.06
Lena Gulch		200	82.42	90.34	85.49	90.35	0.000011	0.93	214.31	52.67	0.08
Lena Gulch		400	82.42	91.56	86.91	91.59	0.000020	1.42	281.46	57.14	0.11
Lena Gulch		600	82.42	92.50	87.43	92.55	0.000026	1.79	344.44	81.04	0.13
Lena Gulch		800	82.42	93.29	87.84	93.35	0.000030	2.09	408.83	82.68	0.14
Lena Gulch		1000	82.42	93.98	88.21	94.06	0.000033	2.34	466.62	84.12	0.15
Lena Gulch	10-YR	1550	82.42	95.58	89.12	95.71	0.000039	2.93	604.36	87.46	0.17
Lena Gulch	50-YR	3050	82.42	98.83	NA	99.07	0.000051	4.11	903.40	96.32	0.21
Lena Gulch	100-YR	4020	82.42	100.40	NA	100.72	0.000058	4.74	1056.40	98.81	0.23
Lena Gulch	500-YR	7800	82.42	105.14	95.05	105.77	0.000078	6.67	1541.88	104.58	0.27

Table 2 – HEC-RAS Profile Output Table

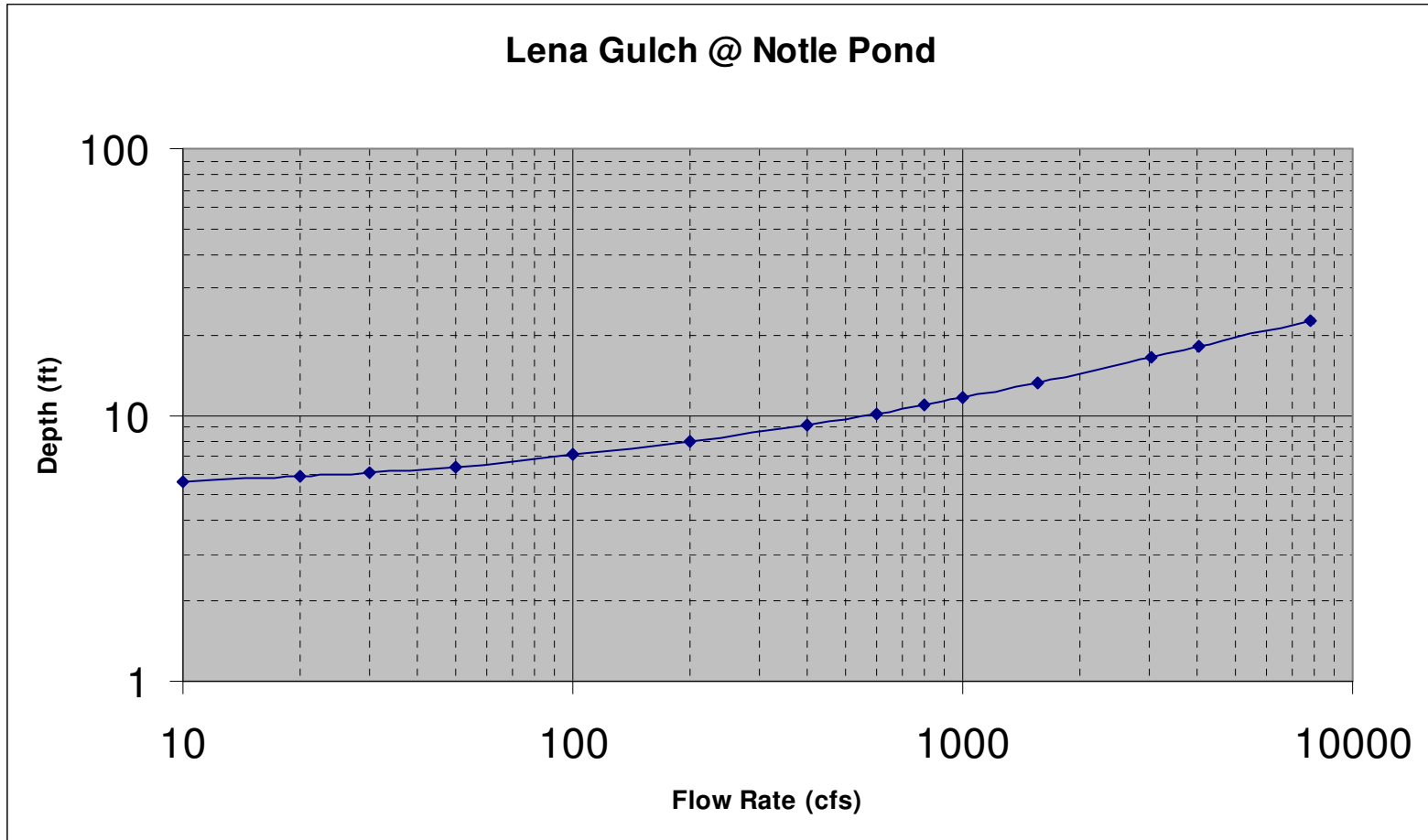


Figure 4 – HEC-RAS Log-Log Plot of Rating Table

Site photographs



Figure 5 – Looking Upstream at Pond Outlet



Figure 6 – Looking Upstream at Pond Inlet



Figure 7 – Looking Upstream at PT Tube



Figure 8 – Looking Downstream from Pond Outlet



Figure 9 – House Adjacent to Pond

Study Data

The following table includes estimates of the frequency-discharge data interpolated between two reporting stations in the FIS Summary of Discharges table:

Frequency	Peak Discharge (cfs)
10-year	1550
50-year	3050
100-year	4020
500-year	7800

Table 3 – Frequency/Discharge Table

Historic records

There is limited information available for this gage. Since the gage installation date, a peak stage of 50 feet above the invert with a flow rate of 700 cfs was recorded on June 8, 1987. This was based on an old rating curve.

Appendix

Survey 4-8-2005				
Point ID	Easting	Northing	Elevation	Desc
POINT_ID	EASTING	NORTHING	ELEV	DESC_
1000	9999.98	9999.98	90.91	
1001	10017.00	9999.98	89.53	BS
1002	10014.62	9983.83	85.06	PIPEOUT
1003	10004.62	9985.44	89.45	PONDOUT
1004	10004.86	9985.49	90.42	PONDOUTBRD
1005	9991.86	9971.87	81.04	PIPEINLET
1006	9992.55	9973.00	82.82	PIPINLETTOP
1007	9970.29	9934.02	99.17	HOUSE
1008	9968.29	9936.88	98.78	HOUSE
1009	9967.00	9939.13	94.27	GR
1010	9960.46	9960.23	93.77	GRTOPPOND
1011	9962.72	9969.86	88.60	GR
1012	9959.19	9971.45	87.54	GR
1013	9958.86	9975.69	84.32	GR
1014	9958.79	9978.53	84.44	GR
1015	9958.35	9981.07	84.63	GR
1016	9958.12	9982.83	86.74	GR
1017	9958.62	9991.74	88.39	GR
1018	9954.08	9997.19	88.61	GR
1019	9948.17	10007.29	88.92	GR
1020	9947.87	10007.72	89.28	PTTUBEIN
1021	9945.79	10012.07	91.89	PTTUBETOP
1022	9943.82	10015.46	93.06	GR
1023	9944.38	10026.48	100.00	BASETOW
1024	9939.22	10035.18	105.93	GR
1025	9944.44	10027.21	101.90	TOPBASETOW
1026	9914.51	9991.64	91.86	INPOND
1027	9910.32	9976.01	91.61	INPOND
Suvey 1-6-2006				
Point ID	Easting	Northing	elev	desc
1000	10000	10000	91.611	INST
1001	10023.19	10000	91.433	BS
1002	9999.5	10022.24	97.187	LOWHOUSEPOINT
1003	9978.86	10060.63	94.868	GR
1004	9972.82	10026.91	92.365	GR
1005	9958.98	10022.09	88.483	GR
1006	9951.09	10015.04	86.922	GR
1007	9946.08	10008.84	82.272	GR
1008	9941.84	10005.27	80.807	GR
1009	9939.31	10002.32	80.879	GR
1010	9937.4	10001.2	81.99	GR
1011	9931.7	10001.62	86.313	GR
1012	9932.57	9992.2	87.219	GR

1013	9930.24	9990.36	92.916	GR
1014	9926.87	9985.74	93.964	GR
1015	9922.22	9984.51	98.73	GR
1016	9970.97	9952.54	100.037	GR
1017	9974.02	9958.48	94.995	GR
1018	9976.04	9961.34	93.277	GR
1019	9978.23	9961.77	90.286	GR
1020	9980.06	9965.14	90.347	GR
1021	9980.36	9965.99	88.626	GR
1023	9984.25	9974.04	84.373	GR
1024	9984.47	9980.24	83.249	GR
1025	9984.93	9982.61	83.072	GR
1026	9984.78	9985.1	83.376	GR
1027	9985.62	9991.21	86.322	GR
1028	9986.14	9996	90.245	GR
1029	9986.25	9998.44	91.006	GR
1030	9992.9	10013.24	92.681	GR
1031	9993.74	10013.61	95.01	GR
1032	9995.82	9989.07	89.549	XSSPILL
1033	9996.9	9983.47	89.082	XSSPILL
1034	9997.14	9981.69	88.502	XSSPILL
1035	9997.6	9975.29	88.531	XSSPILLTOPBRD
1036	9997.85	9975.42	87.491	XSSPILLBOTBRD
1037	9998.68	9968.83	88.544	XSSPILLTOPBRD
1038	9998.71	9967.83	88.94	XSSPILL
1039	9998.96	9965.09	88.678	XSSPILL
1040	10000.24	9958.59	90.539	XSSPILL
1041	10001.66	9949.34	94.295	XSSPILL
1042	10001.73	9944.54	94.991	XSSPILL
1043	10003.51	9932.46	101.313	XSSPILL
1044	10050.83	9931.09	100	TOPTRANS
1045	10050.38	9950.29	87.668	ENTRANCEPTTUBE
1046	10087.85	9969.27	89.673	TOPSPILL
1047	10098.92	9964.72	89.594	INRT
1048	10110.36	9959.62	91.39	INVRT
1049	10128.45	9953.93	91.657	INVRT
1050	10130.17	9957.11	91.863	WALL
1051	10130.32	9957.61	95.428	WALL
1053	10112.3	9954.92	91.504	WALL
1054	10111.8	9954.72	95.184	WALL
1055	10124.01	9968.36	96.552	GR
1056	10126.38	9977.3	96.4	GR
1057	10123.79	9986.62	93.246	GR
1058	10119	10001.04	89.675	GR
1060	10117.08	10004.65	88.607	GR
1061	10104.33	10023.57	95.195	GR
1062	10107.93	9943.73	102.274	GR

Table 4 – Survey Data