RICK
ENGINEERING COMPANY

March 17, 2023

Town of Parker
20120 E. Mainstreet
Parker, Colorado 80138

SUBJECT: SUPPLEMENTAL DRAINAGE MEMO FOR CHAMBERS AND HESS FILING NO. 1 LOTS 8-10
(RICK ENGINEERING COMPANY JOB NUMBER D-01173)

To Whom It May Concern:

This memorandum has been prepared to supplement the previously approved Final Drainage Report for Chambers and Hess Filing No. 1, herein referred to as the "Final Drainage Report (FDR)". This memo has been prepared in support of the on-site drainage analyses/configurations for Lots 8-10 of Filing No.1 in particular.

Project Description:

The Chambers and Hess Filing No. 1 Lots 8-10 (herein referred to as the "project"), is within the Town of Parker, Douglas County, Colorado. The project is located towards the northeast corner of Chambers and Hess Filing No. 1. The project is bounded by Lot 11 to the North, Sliceroo Drive to the South and West, and Douglas 234 Filing No. 1 1st Amendment Block 2 to the East. Drainage analysis of the overall Filing No.1 was presented to the Town of Parker and was approved under the report titled "Final Drainage Report for Chambers and Hess Filing No.1," last revised January 25, 2021, prepared by Rick Engineering Company (Rick JN D-1173). This report addressed the overall drainage characteristics of the development including hydrology and hydraulics. However, the FDR referenced/referred to the drainage report titled, "Final Drainage Report for The Douglas 234 Subdivision", last revised April 29, 2003, prepared by CVL Consultants (herein referred to as the "Original Drainage Study") for detention. The following narrative addresses drainage characteristics specifically for Lots 8-10 while referring to the Original Drainage Study for detention.

Drainage Characteristics:

The site layout of the project maintains similar drainage characteristics to the FDR. However, the current design proposes grading changes to accommodate the proposed lot configuration for Lots 8-10. In the post-project condition, the project area is encompassed by three (3) basins – A5, A11, and A13, consistent with the FDR. The hydrology and hydraulics calculations pertaining to Basins A5, A11, and A13 were performed assuming the ultimate build out condition in the FDR. Please refer to Map Pocket 1 for the approved Post-Project Drainage Study Map from the FDR provided for reference purposes only.

The overall drainage area and land use per the current proposed design remains generally consistent with the previously approved values (percent imperviousness, acreage, etc.) in the FDR, with negligible differences. Delineations to the proposed design points have been performed and the relevant hydrology calculations are included in Appendix A. Rational method calculations

were performed using the latest Mile High Flood District's (MHFD) rational method spreadsheet (UD-Rational v2.0). Please refer to Map Pocket 2 at the end of this letter for the Post-Project Drainage Study Map.

The proposed storm drains for Lots 8-10 will tie into the existing Filing No.1 storm drain system, as previously approved with negligible differences. The proposed storm drains have been designed using the Hydraflow Storm Sewers Extension for AutoCAD Civil3D (v10.3). The project slightly modifies the flow rates at Design Point 5 with negligible differences (less than 1cfs) compared to the FDR. With respect to the previously approved report, flow rates at Design Point 5 increase by 2.7% (0.34cfs) from 12.7cfs to 13.04cfs for the 5-year storm, and 2.1% (0.61cfs) from 29.3cfs to 29.91cfs for the 100-year storm. Revised peak flow rates were increased by 30% to account for hydraulic losses prior to verifying the hydraulic adequacy of the downstream storm drain. The updated hydraulic analysis and results are included in Appendix B.

The Original Drainage Study addresses detention and water quality for the entire Filing No.1 including Lots 8-10 assuming ultimate build out condition. Detention calculation excerpts for the existing Extended Detention Pond A from the approved Original Drainage Study have been included in Appendix C for reference purposes.

Conclusion:

This memo has been prepared in support of the proposed drainage configuration of the project and has been provided to show the project is consistent with the FDR. All design and calculations were performed consistent with the approved drainage design criteria and design standards discussed in the FDR. Storm water runoff from a majority of the project will be released at rates no greater than the previously assumed flow rates from the FDR. The project peak flow from Design Point 5 is 0.61cfs more compared to the assumed flow rates per the FDR. This is considered negligible since the increase in peak flow is less than 1cfs. Moreover, the downstream storm drain capacity has been verified to account for the revised peak flow rate from Design Point 5. Therefore, adverse impacts to the downstream drainage facilities are not anticipated.

Please refer to Appendix A for Hydrologic calculations. Hydraulic calculations are included in Appendix B. Detention calculation excerpts for the existing Extended Detention Pond A from the approved Original Drainage Study have been included in Appendix C for reference purposes. Post-project drainage map from the FDR has been provided in Map Pocket 1 for reference purposes. Post-project drainage map for Lots 8-10 of Filing No. 1 has been provided in Map Pocket 2.

Please feel free to contact me if you have any questions and/or concerns at (303) 537-8020.

Sincerely,

RICK ENGINEERING COMPANY

Troy Bales, P.E.
Associate

Enclosures

Certification

This report for the final design of Chambers and Hess Filing No. 1 Lots 8-10 was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage and Environmental Criteria Manual. I understand that the Town of Parker and its designated town authority do not and will not assume liability for the drainage facilities designed by others.

_____

Troy Bales
Registered Professional Engineer
Date:

State of Colorado No.: 50961

APPENDIX A

Hydrologic Computations

Calculation of Peak Runoff using Rational Method

Designer: NAS
Company: Rick Engineering
Date: 3/17/2023
Project: Chambers & Hess Lots 8-10
Location: Town of Parker

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_i + t_t$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

Selected $t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =		1.39				2.60	
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A5	0.98	C	79.4	0.64	0.68	0.72	0.76	0.79	0.81	0.84	110.00			0.025	5.85	125.00			0.007	20	1.67	1.25	7.09	13.74	7.09		4.25				7.96			2.84					6.31	
A11	0.37	C	59.8	0.47	0.52	0.57	0.65	0.69	0.73	0.78	70.00			0.010	8.73	200.00			0.010	15	1.50	2.22	10.95	17.75	10.95		3.63				6.78			0.70					1.83	
A13	1.67	C	68.6	0.55	0.59	0.64	0.70	0.73	0.76	0.80	80.00			0.020	6.50	350.00			0.025	20	3.16	1.84	8.34	16.32	8.34		4.02				7.53			3.99					9.61	

APPENDIX B

Hydraulic Computations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Feb 17 2023

DP5-DP12 5yr

Circular

Diameter (ft)	= 2.00
Invert Elev (ft)	= 6046.32
Slope (%)	= 7.25
N-Value	= 0.013

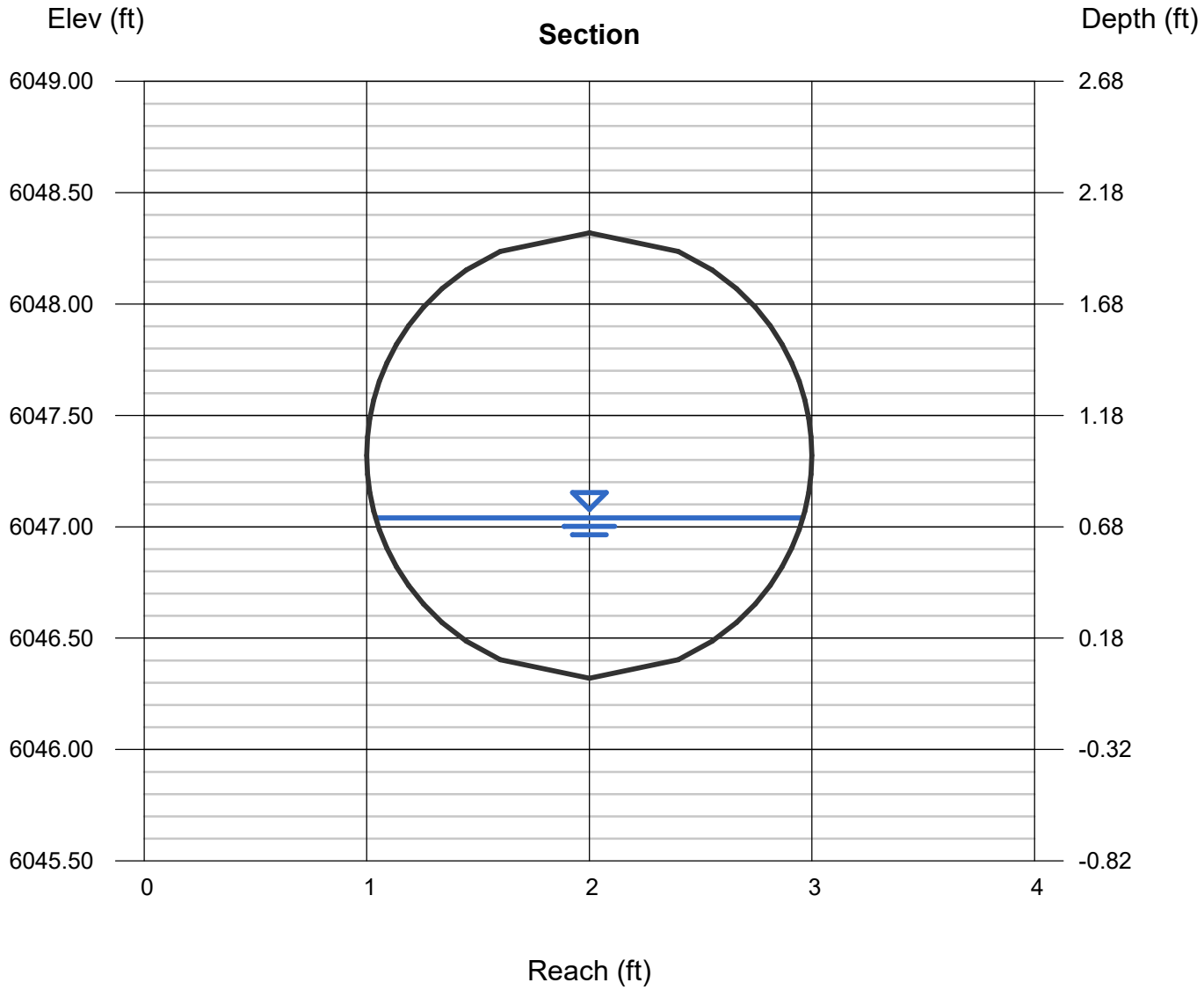
Calculations

Compute by:	Known Q
Known Q (cfs)	= 16.95

Highlighted

Depth (ft)	= 0.72
Q (cfs)	= 16.95
Area (sqft)	= 1.02
Velocity (ft/s)	= 16.56
Wetted Perim (ft)	= 2.58
Crit Depth, Yc (ft)	= 1.49
Top Width (ft)	= 1.92
EGL (ft)	= 4.98

Q5 was increased by 30% to account for hydraulic losses.
Q5 = 13.04cfs



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Feb 17 2023

DP5-DP12 100yr

Circular

Diameter (ft)	= 2.00
Invert Elev (ft)	= 6046.32
Slope (%)	= 7.25
N-Value	= 0.013

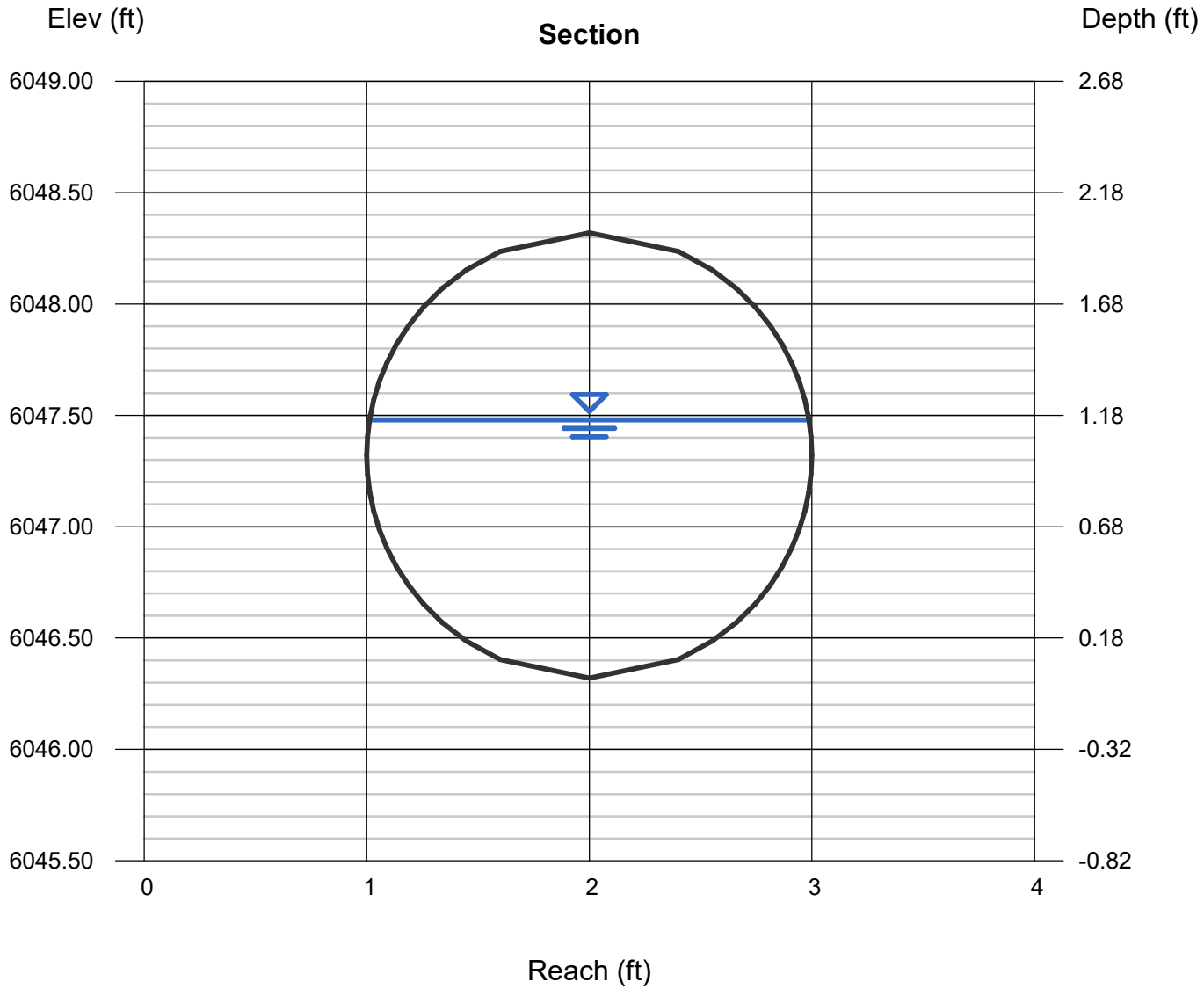
Calculations

Compute by:	Known Q
Known Q (cfs)	= 38.90

Highlighted

Depth (ft)	= 1.16
Q (cfs)	= 38.90
Area (sqft)	= 1.90
Velocity (ft/s)	= 20.51
Wetted Perim (ft)	= 3.47
Crit Depth, Yc (ft)	= 1.95
Top Width (ft)	= 1.97
EGL (ft)	= 7.70

Q100 was increased by 30% to account for hydraulic losses.
Q100 = 29.91cfs



APPENDIX C

FOR REFERENCE ONLY

Detention calculation excerpts for the existing Extended Detention Pond A from the approved Original Drainage Study

storm event flow. Emergency overflow spillways are designed for each of the ponds. They are sized to pass the developed 100-year flow, with one foot (1') of freeboard.

The developed site can be divided into four (4) major basins, being Basins A, B, C and D. Each of these major basins contains a proposed water quality/ detention pond area.

Basin A

Basin A is comprised of most of the eastern portion of the project, including the proposed commercial site, and contributes runoff to Pond A. The proposed detention pond for Basin A serves both the residential and commercial portions of the filing. This facility is located in the northeasterly corner of the site, adjacent to and immediately west of the southerly extension of Jordan Rd. Pond A will discharge easterly, under Jordan Road, to the existing drainageway to Cherry Creek. Basin A is subdivided into thirteen sub-basins, and generally corresponds to historic basins C-3, C-4, C-5 and a portion of historic basin C-2. Runoff within Basin A flows overland to the internal storm drainage system, and ultimately in Pond A.

Pond A is located in Tract F. Storm water will be directed to this pond via overland flow and Storm Drain Lines B and W. The pond is sized to hold the required volume for 100-year detention and water quality per the Town of Parker and UDFCD requirements. This needed 100 year volume is 4.38 Ac. Ft. The water quality volume required is 1.07 Ac.ft. The total volume, including 100-year detention and WQCV, is accumulated by elevation 5992.1. The weir structure will have a top elevation at 5995.0 and a bottom equal to the 100-year water surface elevation, 5991.2. A 1.61' diameter orifice plate will be installed on the outlet pipe to control to pond's allowable release rate, 37.76 cfs. The 10-year allowable release 10.22 cfs, will be controlled by a rectangular notch weir, cut into the face of the outlet box structure. Storm events that exceed the volume provided in Pond A will be routed through the pond by the emergency overflow spillway. Both pond exits, the spillway and the storm drain, will be protected by riprap.

During initial and interim construction phases, Pond A will have a temporary riser pipe, rather than the permanent outlet structure to allow it to function as a sediment control pond. Also, the spillway will not be cut out of the earth berm that surrounds the pond, so that the pond can have additional volume, which may be needed during the construction operations that typically produce additional sediment. During the final stages of construction, the pond will be modified to include the earth-weir. The perforated outlet pipe will be replaced by the concrete outlet structure.

Basin B

Basin B includes the north-central portion of the project, and directs runoff to detention Pond B. This facility is located adjacent to and immediately southwesterly of the proposed alignment of Chambers Road. Discharge of the computed release rate from Pond B will travel under Chambers Road via a 30' RCP (Storm Drain Line U), into the existing natural drainage-way at that location. The Antelope Heights project, immediately downstream from this discharge point, is coordinating engineering design to accommodate this historic runoff rate. Eventually, this pipe will be connected to the

CVL
CONSULTANTS, INC.
CIVIL ENGINEERING
LAND SURVEYING
LAND PLANNING

Project Name/Number Parker 234 / 01804102
Date: 2-3-03
Sheet 2 of 5

Telephone Log ☐
Meeting Record ☐
Calculations ☒
Other ☐

POND A

Area = 44.42 Ac.

# of homes = 126 avg. sq. footage = 1660 ft², 2 story

Area (park) = 1.88 Ac.

Area (lots) = 18.01 Ac.

Area (roads) = 8.96 Ac.

Area (open space) = 3.12 Ac.

Area (commercial) = 12.45 Ac.

126/1.88 = 7.00 dwellings/Ac. → 36% impervious per RO-5

$$\frac{1.88(5\%) + 18.01(36\%) + 8.96(100\%) + 3.12(0\%) + 12.45(95\%)}{44.42 \text{ Ac.}}$$

$$= 61.6\%$$

DETENTION REQUIREMENTS - ONSITE BASINS

Subdivision: Douglas 234
Location: Parker

Project Name: Douglas 234
Project No. 1804102
By: MEF
Checked By: KAL
Date: 03/31/03

SOIL GROUPS B/C

Q10R= 0.23
Q100R= 0.85

Note: Allowable release rates for type C soil groups is greater than type B soils, however, rates for type B soil was used for conservatism.

BASIN/LAND USE	DRAINAGE AREA (AC.)	% IMPERV.	V_{10} (AC. FT.)	V_{100} (AC. FT.)	Q_{10R} (CFS)	Q_{100R} (CFS)
Basin A	44.42	62	2.515	4.375	10.22	37.76
Basin B	59.88	54	2.958	5.193	13.77	50.90
Basin C	8.82	24	0.184	0.335	2.03	7.50
Basin D	34.41	26	0.785	1.423	7.91	29.25
SUM			6.442	11.327	33.9	125.4

DETENTION PONDING FORMULAS:

$V_{100} = K_{100} \times A$ $\quad K_{100} = (1.78I-0.002I^2-3.56)/1000$ $\quad Q_{100R} = Q100R \times A$

$V_{10} = K_{10} \times A$ $\quad K_{10} = (0.95I-1.90)/1000$ $\quad Q_{10R} = Q10R \times A$

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: MEF
Company: CVL Consultants
Date: March 31, 2003
Project: Parker 234
Location: Pond A

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio (i = I_a / 100)	I_a = 61.60 % i = 0.62
B) Contributing Watershed Area (Area)	Area = 44.42 acres
C) Water Quality Capture Volume (WQCV) (WQCV =1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i))	WQCV = 0.24 watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = 1.073 acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	X Orifice Plate ___ Perforated Riser Pipe ___ Other: ___
B) Depth at Outlet Above Lowest Perforation (H)	H = 5.57 feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = 0.59 square inches
D) Perforation Dimensions **(enter one only)**: i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	D = 0.500 inches, **OR** W = ___ inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = 3 number
F) Actual Design Outlet Area per Row (A_o)	A_o = 0.59 square inches
G) Number of Rows (nr)	nr = 17 number
H) Total Outlet Area (A_{ot})	A_{ot} = 9.84 square inches
3. Trash Rack	
A) Needed Open Area: A_t = 0.5 * (Figure 7 Value) * A_{ot}	A_t = 356 square inches
B) Type of Outlet Opening (Check One)	X ≤ 2" Diameter **Round** ___ 2" High **Rectangular** ___ Other: ___
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = 9 inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = 97 inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: MEF
Company: CVL Consultants
Date: March 31, 2003
Project: Parker 234
Location: Pond A

iii) Type of Screen (Based on Depth H), Describe if "Other"	x S.S. #93 VEE Wire (US Filter) Other:
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) Other:
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	0.75 inches #156 VEE
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	3/8 in. x 1.0 in. flat bar
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
i) Width of Rectangular Opening (W)	W = inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = inches
v) Type of Screen (based on depth H) (Describe if "Other")	Klemp™ KPP Series Aluminum Other:
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	inches Other:
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	
4. Detention Basin length to width ratio	2.00 (L/W)
5 Pre-sedimentation Forebay Basin - Enter design values	
A) Volume (no less than 5% of Design Volume from 1D)	0.067 acre-feet
B) Surface Area	0.053 acres
C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)	6 inches
D) Paved/Hard Bottom and Sides	y yes/no

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: MEF
Company: CVL Consultants
Date: March 31, 2003
Project: Parker 234
Location: Pond A

6. Two-Stage Design - See Figure EDB-1	
A) Top Stage (Depth D_{WQ} = 2' Minimum)	D_{WQ} = 5.00 feet Storage= 1.570 acre-feet
B) Bottom Stage Depth (D_{BS} = 1.0' Minimum, 2.0' Maximum) Bottom Stage Storage (no less than 3% of Design Volume (0.0322003087988736 acre-fe	D_{BS} = 1.50 feet Storage= 0.082 acre-feet Surf. Area= 0.055 acres
C) Micro Pool (Minimum Depth = the Larger of 0.5 * Top Stage Depth (2.5 ') or 2.5 '	Depth= 2.50 feet Storage= 0.048 acre-feet Surf. Area= 0.019 acres
D) Total Volume: Vol_{tot} = Storage from 5A + 6A + 6B (Must be > Design Volume in 1D, or 1.07334362662912 acre-feet.)	Vol_{tot} = 1.719 acre-feet
7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 4, Flatter Preferred	Z = 4.00 (horizontal/vertical)
8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred	Z = 4.00 (horizontal/vertical)
9. Vegetation (Check the method or describe "Other")	_____ Native Grass x Irrigated Turf Grass _____ Other: _____

Notes:

Pond Volume
(FAA Method)

Subdivision Douglas 234
Location Parker

Project Name: Douglas 234
Project No. 1804102
By: MEF
Checked By: KAL
Date: 3/31/03

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

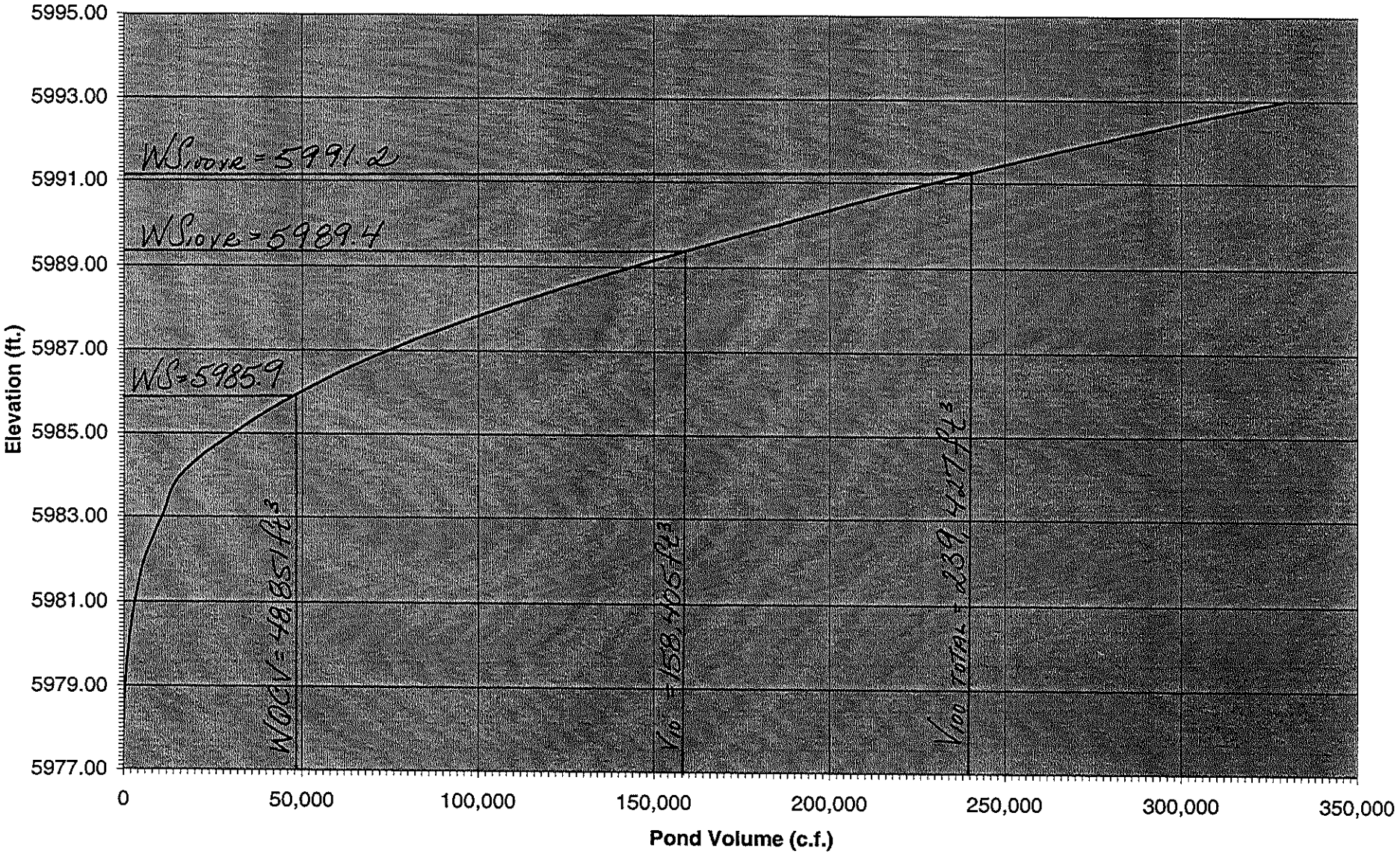
Project drains to Pond A

Pond A

Elevation	Surface Area (square feet)	A+B+(A*B)^0.5	1/3	Depth (feet)	Volume (cubic feet)	CumulativeVolume (cubic feet)
5978.00	579	579.0	193.0	0.00	0	0
5979.00	1,034	1034.0	344.7	1.00	345	345
5980.00	1,591	3129.8	1043.3	1.00	1,043	1,388
5980.50	1,907	4345.2	1448.4	0.50	724	2,112
5981.00	2,248	5730.2	1910.1	0.50	955	3,067
5982.00	3,005	7852.1	2617.4	1.00	2,617	5,685
5983.00	8,224	14771.7	4923.9	1.00	4,924	10,608
5984.00	12,604	15884.4	5294.8	1.00	5,295	15,903
5985.00	16,852	44030.0	14676.7	1.00	14,677	30,580
5986.00	21,585	57509.2	19169.7	1.00	19,170	49,750
5987.00	27,603	73597.2	24532.4	1.00	24,532	74,282
5988.00	35,789	94822.6	31607.5	1.00	31,608	105,890
5989.00	39,377	112706.2	37568.7	1.00	37,569	143,458
5990.00	42,820	123259.4	41086.5	1.00	41,086	184,545
5991.00	46,421	133825.2	44608.4	1.00	44,608	229,153
5992.00	50,185	144872.3	48290.8	1.00	48,291	277,444
5993.00	54,064	156337.4	52112.5	1.00	52,112	329,556

Project drains to Pond A

Pond A
Stage-Storage



Douglas 234-Pond A
Project No. 01804102
3/31/03
Drainage.xls

Emergency Spillway Weir Calculations

Project Name: Douglas 23
Project No. 1804102
Calculated By: MEF
Checked By: KAL
Date: 4/21/2003

Weir Equation:

$Q = C*L*(H)^{3/2}$

$C_d =$ 3.37 (trapezoidal weirs)

Note: Weirs are designed to pass the developed 100yr. tributary flow.
(Refer to SF-3 form)

Pond A Emergency Spillway

Flow Rate $Q_{100yr.}$ =	**163.0 cfs**	
Top of Berm Elevation =	**5995.00 feet**	**Freeboard = 1.00**
Emergency Spillway Elevation =	**5994.00 feet**	
100 yr. Water Surface Elevation =	**5991.20 feet**	
Height (H)=	**2.80** feet	
Length (D) =	10.33 feet	

← Project drains to Pond A

Pond B Emergency Spillway

Flow Rate $Q_{100yr.}$ =	**176.6 cfs**	
Top of Berm Elevation =	**6089.00 feet**	**Freeboard = 1.00**
Emergency Spillway Elevation =	**6088.00 feet**	
Bottom of Berm Elevation* =	**6086.00 feet**	**100 yr. W.S. Elevation = 6083.8 feet*
Height (H)=	**2.00** feet	
Length (D) =	18.54 feet	

Pond C Emergency Spillway

Flow Rate $Q_{100yr.}$ =	**30.1 cfs**	
Top of Berm Elevation =	**6120.00 feet**	**Freeboard = 1.00**
Emergency Spillway Elevation =	**6119.00 feet**	
100 yr. Water Surface Elevation =	**6118.50 feet**	
Height (H)=	**0.50** feet	
Length (D) =	25.29 feet	

Pond D Emergency Spillway

Flow Rate $Q_{100yr.}$ =	**80.0 cfs**	
Top of Berm Elevation =	**6050.50 feet**	**Freeboard = 1.00**
Emergency Spillway Elevation =	**6049.50 feet**	
100 yr. Water Surface Elevation =	**6048.50 feet**	
Height (H)=	**1.00** feet	
Length (D) =	23.77 feet	

10 year Orifice Design

Subdivision: Douglas 234
Location: Parker, CO

Project Name: Douglas 234
Project No. 1804102

Rectangular Sharp-crested Weir Equation
$Q = CL^{1.02}H^{1.47}$ C=3.10

	10 yr. W.S.	WQCV W. S.	Allowable $Q_{10yr.}$ (cfs)	H (ft)	L (ft)
Pond A	5989.4	5985.9	10.22	3.5	0.6
Pond B	6081.2	6076.6	13.77	4.6	0.5
Pond C	6118.0	6117.0	2.03	1.0	0.7
Pond D	6047.4	6045.8	7.91	1.6	1.3

Circular Orifice Sizing

Pond A

DATA:

Flow Rate ($Q_{100yr.}$) =	**37.76**	**cfs**
Water Surface Elevation =	**5991.20**	**feet**
Invert of Orifice =	**5977.84**	**feet**
Height of water surface = to invert of orifice (Y)	13.36	feet
Diameter of Orifice (D) =	1.61	feet
Height of water surface = to centroid of orifice (h)	13.36	feet
C_d =	0.65	for circular orifices
g =	32.20	ft/s^2

Project Name: Douglas 234
Project No. 1804102
Calculated By: MEF
Checked By: KAL
Date: 04/01/03

Orifice Equation:

$$Q = C_d*A*(2gh)^{1/2}$$

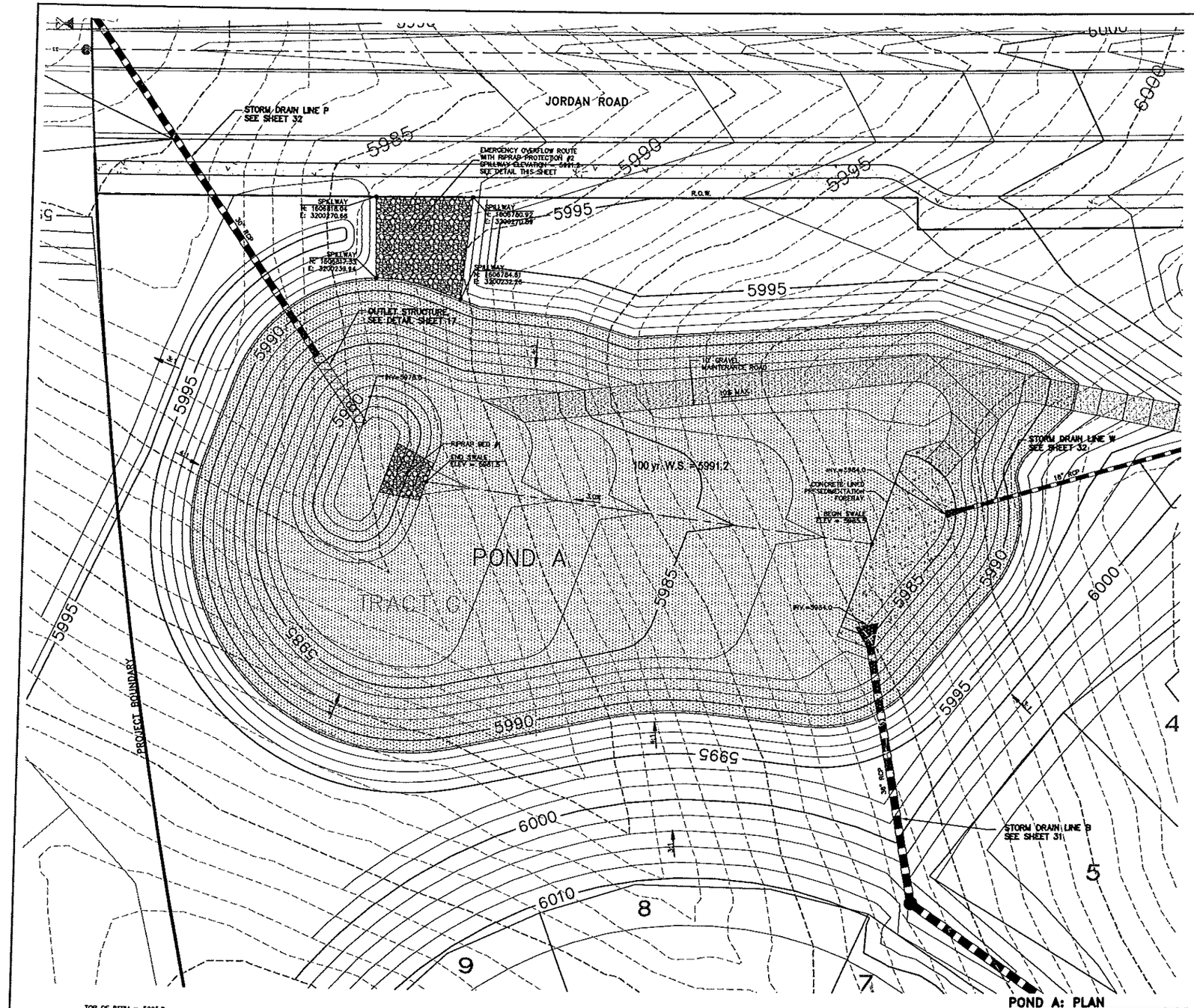
$$Q = C_d*3.1415*D^2/4*(2gh)^{1/2}$$

$$Q = 0.65*3.1415*D^2/4*(2*32.2*h)^{1/2}$$

$$D = (Q/(.5105*(64.4*h)^{1/2}))^{1/2}$$

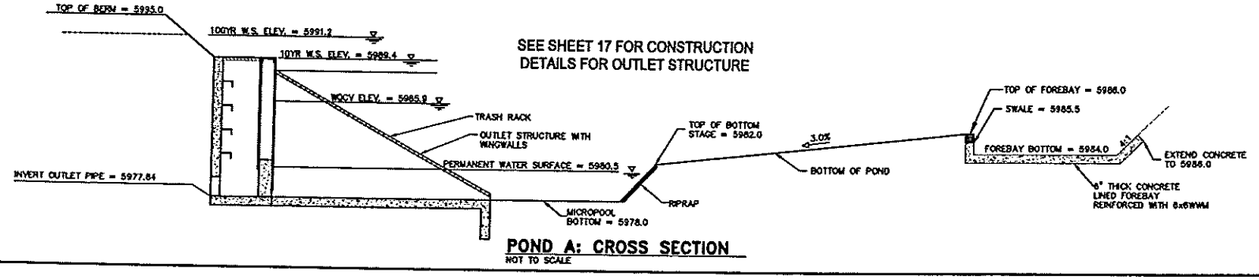
Calculation Table for Orifice Size

%	h = %*Y	Diam. (D)	Actual h	h/Y
98%	13.09	1.60	12.56	94%
97%	12.96	1.60	12.56	94%
96%	12.83	1.60	12.56	94%
95%	12.69	1.61	12.56	94%
94%	12.56	1.61	12.55	94%
93%	12.42	1.62	12.55	94%
92%	12.29	1.62	12.55	94%
91%	12.16	1.63	12.55	94%
90%	12.02	1.63	12.54	94%
89%	11.89	1.63	12.54	94%
88%	11.76	1.64	12.54	94%
87%	11.62	1.64	12.54	94%
86%	11.49	1.65	12.54	94%
85%	11.36	1.65	12.53	94%
84%	11.22	1.66	12.53	94%
83%	11.09	1.66	12.53	94%
82%	10.96	1.67	12.53	94%
81%	10.82	1.67	12.52	94%
80%	10.69	1.68	12.52	94%
79%	10.55	1.68	12.52	94%
78%	10.42	1.69	12.52	94%



POND A: PLAN

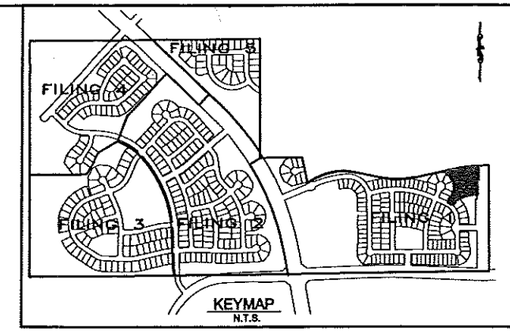
HORIZONTAL SCALE: 1" = 20'



SEE SHEET 17 FOR CONSTRUCTION DETAILS FOR OUTLET STRUCTURE

POND A: CROSS SECTION

NOT TO SCALE



20 10 0 20 40

SCALE: 1" = 20'

100 YR. WATER SURFACE

RIRAP SUMMARY TABLE

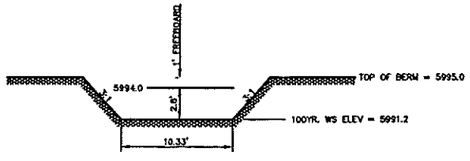
	RR#1	RR#2
LENGTH	16	33.1'
WIDTH	15, 20	40'
DEPTH	2.5'	1.5'
SIZE, d50	9"	12"
TYPE	L	M

* SEE DETAIL

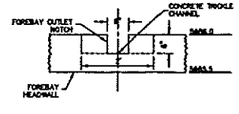
BURY TYPE L RIPRAP WITH 4" NATIVE TOPSOIL AND RESEED OR RESOD.

POND SUMMARY TABLE

	Q 10yr.	Q 100yr.
PEAK INFLOW (cfs)	127.4	163.0
PEAK OUTFLOW (cfs)	10.2	37.8
WQCV (Ac.Ft.)	1.07	
10 yr. REQUIRED VOL. (Ac.Ft.)	2.52	
100 yr. REQUIRED VOL. (Ac.Ft.)	4.38	
DETENTION CAPACITY (Ac.Ft.)	5.50	
AVAILABLE FREEBOARD (ft.)	1.0	



EMERGENCY SPILLWAY DETAIL



FOREBAY OUTLET NOTCH

CALL UNCC
TWO WORKING DAYS
BEFORE YOU DIG
1-800-922-1987
534-6700 METRO DENVER AREA
UTILITY NOTIFICATION CENTER OF COLORADO

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					
-					

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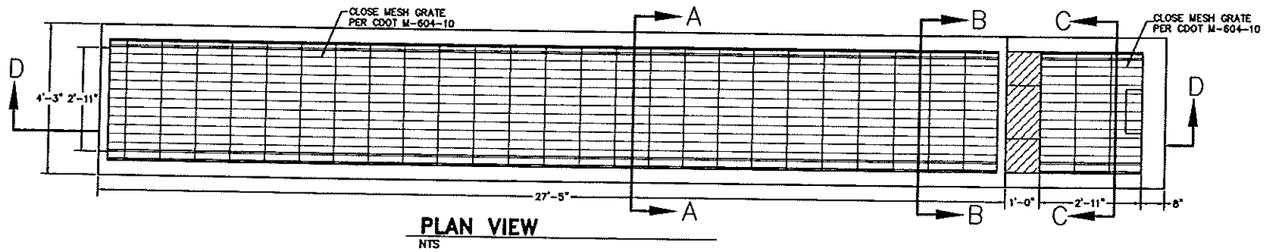
Continental Homes
7600 East Orchard Road, Ste. 165-S
Greenwood Village, CO 80111

DOUGLAS 234
FILING 1
STREET AND DRAINAGE IMPROVEMENTS
POND A

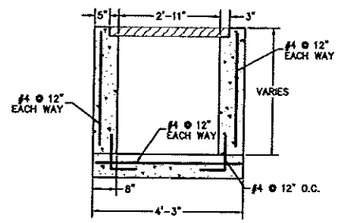
SCALE: AS SHOWN
FILE NO: 01804102
DRAWN BY: JAM
CHECKED BY: KAL
DATE: APRIL 29, 2003
SHEET NUMBER 16

N:\Projects\01804102\...\Pre... ...dwg, ...22/2... 11:4... AM, JAM
6-P... ...Pal
...aryLF... 1\To ...Pal

POND A DETAILS



PLAN VIEW
NTS



SECTION A-A
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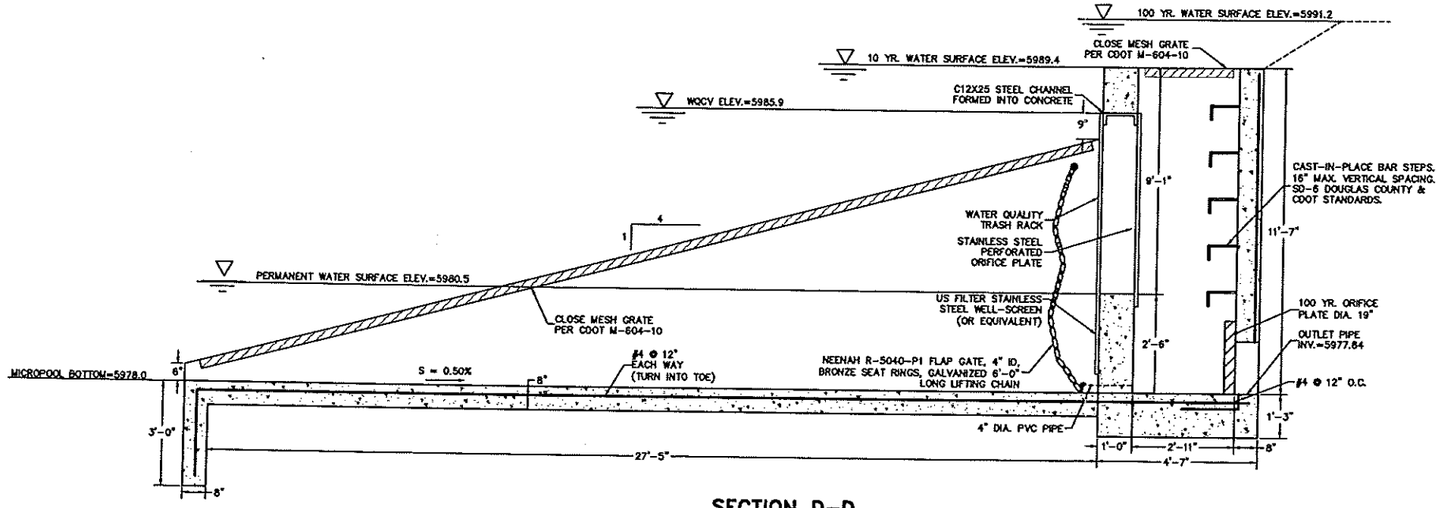

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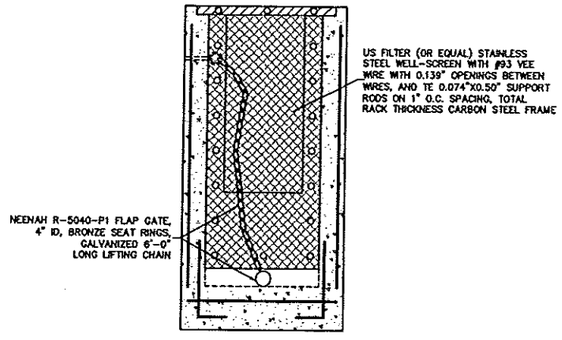
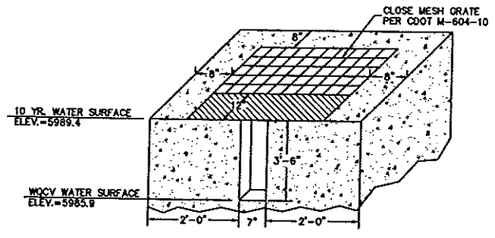
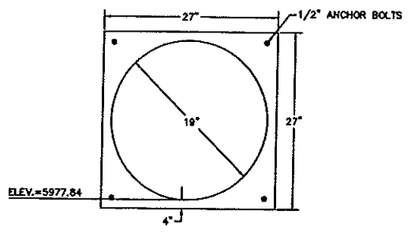
NTS



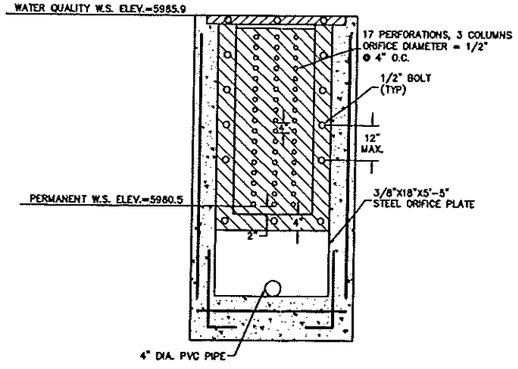
SECTION B-B
NTS



10 YR. RECTANGULAR WEIR
NTS



100 YR. ORIFICE
NTS



SECTION C-C
NTS

No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					

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Greenwood Village, CO 80111

DOUGLAS 234
FILING 1
STREET AND DRAINAGE IMPROVEMENTS
POND A OUTLET DETAILS

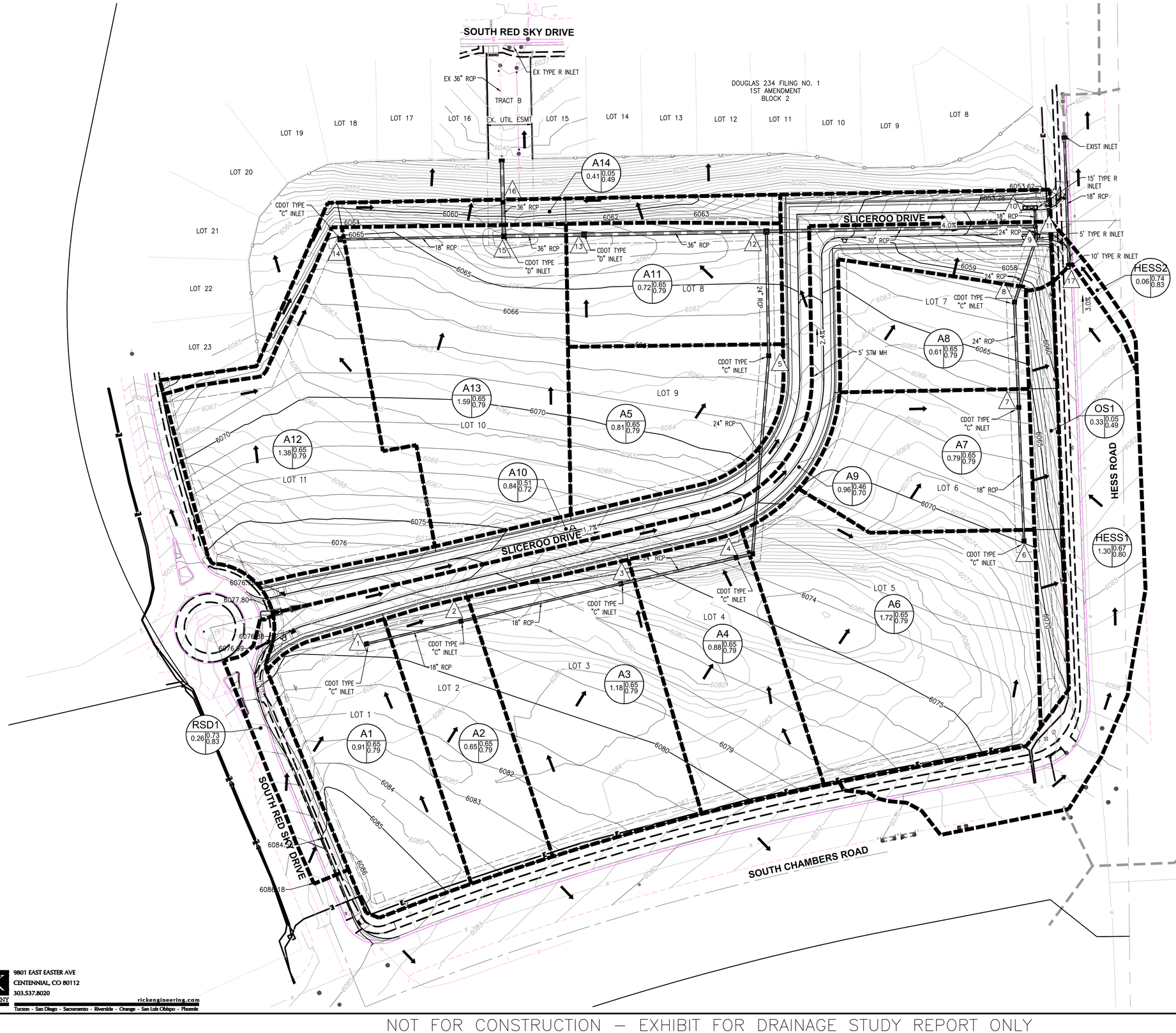
SCALE: AS SHOWN
FILE NO: 01804102
DRAWN BY: MEF
CHECKED BY: KAL
DATE: APRIL 29, 2003
SHEET NUMBER: 17
DRAWING: 17-PONDS-OUT

MAP POCKET 1

FOR REFERENCE ONLY

Post-Project Drainage Study Map for Chambers and Hess Filing No. 1

from the approved Final Drainage Report



ORIGINAL SCALE: 1"= 50' HORIZ.

LEGEND

- BASIN ID
- 5 YR. RUNOFF COEFFICIENT
- 100 YR. RUNOFF COEFFICIENT
- AREA IN ACRES
- DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- FLOW ARROW
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPERTY BOUNDARY
- PROPOSED LOT LINE
- PROPOSED STORM SEWER

DESIGN POINT SUMMARY

DESIGN POINT	PEAK RUNOFF 5YR (CFS)	PEAK RUNOFF 100YR (CFS)
1	2.8	6.4
2	4.7	10.8
3	8.1	18.6
4	10.6	24.3
5	12.7	29.3
6	5.3	12.0
7	7.6	17.3
8	9.4	21.4
9	2.4	8.2
10	1.6	4.3
11	11.2	28.9
12	20.9	51.4
13	22.1	54.4
14	4.2	9.6
15	28.6	69.5
16	28.7	70.8
17	3.6	9.1

BASIN SUMMARY

BASIN	Q5 CFS	Q100 CFS
A1	2.8	6.4
A2	2.0	4.6
A3	3.6	8.2
A4	2.7	6.2
A5	2.5	5.7
A6	5.3	12.0
A7	2.4	5.5
A8	1.9	4.2
A9	1.7	4.7
A10	1.6	4.3
A11	2.2	5.0
A12	4.2	9.6
A13	4.9	11.1
A14	0.1	1.8
HESS1	3.5	7.8
HESS2	0.2	0.5
RSD1	0.9	1.9
OS1	0.1	1.4

POST-DEVELOPMENT DRAINAGE MAP FOR CHAMBERS & HESS FILING NO. 1

SHEET 2 OF 2

D-1173
DATE: JANUARY 25, 2021

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9801 EAST EASTER AVE
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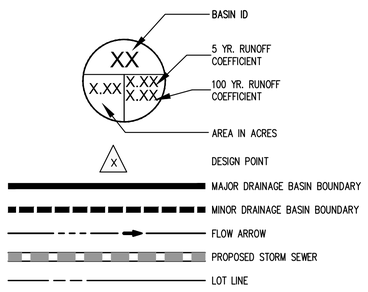
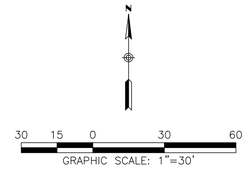
NOT FOR CONSTRUCTION – EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

MAP POCKET 2

Post-Project Drainage Study Map for Chambers & Hess Filing No. 1 Lots 8-10

LEGEND





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UNIT 200
ENGLEWOOD, CO 80112
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POST-PROJECT DRAINAGE MAP

CHAMBERS & HESS LOTS 8-10
DOUGLAS COUNTY, CO

PROJECT NO:	01173	SCALE:	1"=30'
DRAWN BY:	NAS/AP	DATE:	3/17/2023

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