



July 5, 2023

Town of Parker
20120 E. Mainstreet
Parker, Colorado 80138

SUBJECT: SUPPLEMENTAL DRAINAGE MEMO FOR DUNKIN' DONUTS -
CHAMBERS AND HESS FILING NO. 1 LOT 4
(RICK ENGINEERING COMPANY JOB NUMBER D-02243)

To Whom It May Concern:

This memorandum has been prepared to supplement the already 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 Lot 4 of Filing No.1 in particular.

Project Description:

The Chambers and Hess Filing No. 1 Lot 4 (herein referred to as the "project"), is within the Town of Parker, Douglas County, Colorado. The project is located towards the southwest corner of Chambers and Hess Filing No. 1. The project is bounded by Lot 3 to the North, Lot 5 to the South, Sliceroo Drive to the East, and South Chambers Road to the West. The project involves the development of a Dunkin' Donuts in Lot 4 of Filing No.1. Drainage analysis of the overall Filing No.1 was presented to the Town of Parker and was already 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). It 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 Lot 4 while referring to the Original Drainage Study for detention.

Drainage Characteristics:

The site layout of Dunkin' Donuts – Lot 4 maintains similar drainage characteristics to the FDR. However, the current design proposes grading changes to accommodate the proposed lot configuration for Dunkin' Donuts. In the post-project condition, the project area is encompassed by four (4) sub-basins, A4-1, A4-2, A4-3, and A4-4. Together these four (4) sub-basins make Basin A4 of the FDR. The hydrology and hydraulics calculations pertaining to Basin A4 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 remain consistent with the previously approved values (percent imperviousness, acreage, etc.) in the FDR. Delineation to all 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.

Street capacity and inlet sizing calculations for the proposed streets and inlets have also been performed and included in Appendix B using MHFD's latest inlet sizing spreadsheet (UD-Inlet v5.01). The proposed storm drains for Lot 4 will tie into the existing Filing No.1 storm drain system, as previously approved. The proposed storm drains have been designed using the Hydraflow Storm Sewers Extension for AutoCAD Civil3D (v10.3). Hydraulic Grade Line (HGL) elevations at the point of connection to the existing storm drain system from the FDR were used as the starting Water Surface Elevation (WSEL) for the proposed storm drains.

The Original Drainage Study addresses detention and water quality for the entire Filing No.1 including Lot 4 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 that project is consistent with what was assumed in the FDR. All design and calculations were performed consistent with the approved drainage design criteria and design standards discusses in the FDR. Storm water runoff from the project will be released at rates no greater than the previously assumed flow rates from the FDR and 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 Lot 4 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 Lot 4 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

APPENDIX B

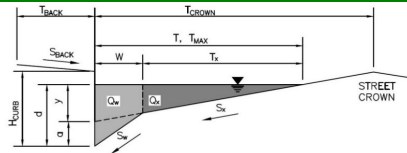
Hydraulic Computations

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Dunkin Donuts - Chambers & Hess Lot 4**

Inlet ID: **A4-1**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
 Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	0.0	ft
S_{BACK}		ft/ft
n_{BACK}	0.020	
H_{CURB}	6.00	inches
T_{CROWN}	15.0	ft
W	2.00	ft
S_X	0.050	ft/ft
S_W	0.083	ft/ft
S_0	0.020	ft/ft
n_{STREET}	0.016	

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	14.5	14.5	ft
d_{MAX}	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Maximum Capacity for 1/2 Street based On Allowable Spread

Water Depth without Gutter Depression (Eq. ST-2)
 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")
 Gutter Depression ($d_c - (W * S_x * 12)$)
 Water Depth at Gutter Flowline
 Allowable Spread for Discharge outside the Gutter Section $W (T - W)$
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Discharge outside the Gutter Section W , carried in Section T_x
 Discharge within the Gutter Section $W (Q_T - Q_x)$
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Maximum Flow Based On Allowable Spread
 Flow Velocity within the Gutter Section
 $V*d$ Product: Flow Velocity times Gutter Flowline Depth

	Minor Storm	Major Storm	
y	8.70	8.70	inches
d_c	2.0	2.0	inches
a	0.79	0.79	inches
d	9.49	9.49	inches
T_x	12.5	12.5	ft
E_0	0.345	0.345	
Q_x	28.3	28.3	cfs
Q_W	14.9	14.9	cfs
Q_{BACK}	0.0	0.0	cfs
Q_T	43.2	43.2	cfs
V	10.5	10.5	fps
$V*d$	8.3	8.3	

Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread
 Theoretical Spread for Discharge outside the Gutter Section $W (T - W)$
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Theoretical Discharge outside the Gutter Section W , carried in Section $T_{X,TH}$
 Actual Discharge outside the Gutter Section W , (limited by distance T_{CROWN})
 Discharge within the Gutter Section $W (Q_d - Q_x)$
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Total Discharge for Major & Minor Storm (Pre-Safety Factor)
 Average Flow Velocity Within the Gutter Section
 $V*d$ Product: Flow Velocity Times Gutter Flowline Depth
 Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \geq 6"$) Storm
 Max Flow Based on Allowable Depth (Safety Factor Applied)
 Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
 Resultant Flow Depth at Street Crown (Safety Factor Applied)

	Minor Storm	Major Storm	
T_{TH}	8.7	8.7	ft
$T_{X,TH}$	6.7	6.7	ft
E_0	0.538	0.538	
$Q_{X,TH}$	5.3	5.3	cfs
Q_x	5.3	5.3	cfs
Q_W	6.2	6.2	cfs
Q_{BACK}	0.0	0.0	cfs
Q	11.5	11.5	cfs
V	7.4	7.4	fps
$V*d$	3.7	3.7	
R	1.00	1.00	
Q_d	11.5	11.5	cfs
d	6.01	6.01	inches
d_{CROWN}	0.00	0.00	inches

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

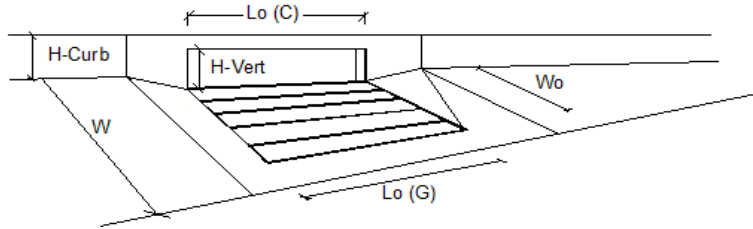
	Minor Storm	Major Storm	
Q_{allow}	11.5	11.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



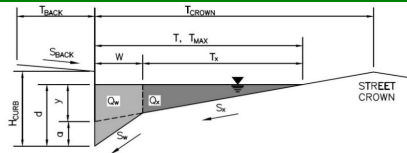
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Design Discharge for Half of Street (from <i>Inlet Management</i>)	0.9	2.1	cfs
Water Spread Width	2.8	4.3	ft
Water Depth at Flowline (outside of local depression)	2.5	3.4	inches
Water Depth at Street Crown (or at T _{MAX})	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	0.980	0.863	
Discharge outside the Gutter Section W, carried in Section T _x	0.0	0.3	cfs
Discharge within the Gutter Section W	0.9	1.8	cfs
Discharge Behind the Curb Face	0.0	0.0	cfs
Flow Area within the Gutter Section W	0.25	0.39	sq ft
Velocity within the Gutter Section W	3.6	4.6	fps
Water Depth for Design Condition	5.5	6.4	inches
Grate Analysis (Calculated)			
Total Length of Inlet Grate Opening	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	N/A	N/A	
Under No-Clogging Condition			
Minimum Velocity Where Grate Splash-Over Begins	N/A	N/A	fps
Interception Rate of Frontal Flow	N/A	N/A	
Interception Rate of Side Flow	N/A	N/A	
Interception Capacity	N/A	N/A	cfs
Under Clogging Condition			
Clogging Coefficient for Multiple-unit Grate Inlet	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	N/A	N/A	fps
Interception Rate of Frontal Flow	N/A	N/A	
Interception Rate of Side Flow	N/A	N/A	
Actual Interception Capacity	N/A	N/A	cfs
Carry-Over Flow = Q _c -Q _a (to be applied to curb opening or next d/s inlet)	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			
Equivalent Slope S _e (based on grate carry-over)	0.205	0.186	ft/ft
Required Length L _r to Have 100% Interception	3.99	6.43	ft
Under No-Clogging Condition			
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L _r)	3.99	5.00	ft
Interception Capacity	0.9	2.0	cfs
Under Clogging Condition			
Clogging Coefficient	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	0.10	0.10	
Effective (Unclogged) Length	4.50	4.50	ft
Actual Interception Capacity	0.9	1.9	cfs
Carry-Over Flow = Q _c (GRATE)-Q _a	0.0	0.2	cfs
Summary			
Total Inlet Interception Capacity	0.9	1.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.2	cfs
Capture Percentage = Q _a /Q _d =	100	89	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Dunkin Donuts - Chambers & Hess Lot 4**

Inlet ID: **A4-2**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

T_{BACK}	0.0	ft
S_{BACK}		ft/ft
n_{BACK}	0.020	

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

H_{CURB}	6.00	inches
T_{CROWN}	26.5	ft
W	2.00	ft
S_x	0.030	ft/ft
S_w	0.083	ft/ft
S_o	0.050	ft/ft
n_{STREET}	0.013	

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	26.5	26.5	ft
d_{MAX}	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Maximum Capacity for 1/2 Street based On Allowable Spread

Water Depth without Gutter Depression (Eq. ST-2)
 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")
 Gutter Depression ($d_c - (W * S_x * 12)$)
 Water Depth at Gutter Flowline
 Allowable Spread for Discharge outside the Gutter Section W (T - W)
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Discharge outside the Gutter Section W, carried in Section T_x
 Discharge within the Gutter Section W ($Q_T - Q_x$)
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Maximum Flow Based On Allowable Spread
 Flow Velocity within the Gutter Section
 V*d Product: Flow Velocity times Gutter Flowline Depth

	Minor Storm	Major Storm	
y	9.54	9.54	inches
d_c	2.0	2.0	inches
a	1.27	1.27	inches
d	10.81	10.81	inches
T_x	24.5	24.5	ft
E_o	0.207	0.207	
Q_x	141.3	141.3	cfs
Q_w	36.8	36.8	cfs
Q_{BACK}	0.0	0.0	cfs
Q_T	178.1	178.1	cfs
V	22.5	22.5	fps
V*d	20.3	20.3	

Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread
 Theoretical Spread for Discharge outside the Gutter Section W (T - W)
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X,TH}$
 Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})
 Discharge within the Gutter Section W ($Q_d - Q_x$)
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Total Discharge for Major & Minor Storm (Pre-Safety Factor)
 Average Flow Velocity Within the Gutter Section
 V*d Product: Flow Velocity Times Gutter Flowline Depth
 Slope-Based Depth Safety Reduction Factor for Major & Minor ($d \geq 6$ ") Storm
 Max Flow Based on Allowable Depth (Safety Factor Applied)
 Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
 Resultant Flow Depth at Street Crown (Safety Factor Applied)

	Minor Storm	Major Storm	
T_{TH}	13.1	13.1	ft
$T_{X,TH}$	11.1	11.1	ft
E_o	0.411	0.411	
$Q_{X,TH}$	17.2	17.2	cfs
Q_x	17.2	17.2	cfs
Q_w	12.0	12.0	cfs
Q_{BACK}	0.0	0.0	cfs
Q	29.3	29.3	cfs
V	14.4	14.4	fps
V*d	7.2	7.2	
R	0.49	0.49	
Q_d	14.5	14.5	cfs
d	4.81	4.81	inches
d_{CROWN}	0.00	0.00	inches

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

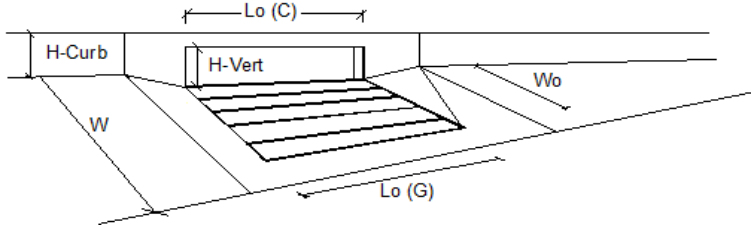
	Minor Storm	Major Storm	
Q_{allow}	14.5	14.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_0 = 2$	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_0 = 5.00$	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	$W_0 = N/A$	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Design Discharge for Half of Street (from <i>Inlet Management</i>)	$Q_0 = 1.4$	3.3	cfs
Water Spread Width	$T = 2.3$	5.0	ft
Water Depth at Flowline (outside of local depression)	$d = 2.1$	3.1	inches
Water Depth at Street Crown (or at T_{MAX})	$d_{CROWN} = 0.0$	0.0	inches
Ratio of Gutter Flow to Design Flow	$E_0 = 1.002$	0.852	
Discharge outside the Gutter Section W, carried in Section T_x	$Q_x = 0.0$	0.5	cfs
Discharge within the Gutter Section W	$Q_w = 1.4$	2.8	cfs
Discharge Behind the Curb Face	$Q_{BACK} = 0.0$	0.0	cfs
Flow Area within the Gutter Section W	$A_w = 0.18$	0.34	sq ft
Velocity within the Gutter Section W	$V_w = 7.6$	8.3	fps
Water Depth for Design Condition	$d_{LOCAL} = 5.1$	6.1	inches
Grate Analysis (Calculated)			
Total Length of Inlet Grate Opening	$L = N/A$	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{0-GRATE} = N/A$	N/A	
Under No-Clogging Condition			
Minimum Velocity Where Grate Splash-Over Begins	$V_0 = N/A$	N/A	fps
Interception Rate of Frontal Flow	$R_f = N/A$	N/A	
Interception Rate of Side Flow	$R_s = N/A$	N/A	
Interception Capacity	$Q_i = N/A$	N/A	cfs
Under Clogging Condition			
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef = N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog = N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	$L_e = N/A$	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	$V_0 = N/A$	N/A	fps
Interception Rate of Frontal Flow	$R_f = N/A$	N/A	
Interception Rate of Side Flow	$R_s = N/A$	N/A	
Actual Interception Capacity	$Q_a = N/A$	N/A	cfs
Carry-Over Flow = $Q_c - Q_a$ (to be applied to curb opening or next d/s inlet)	$Q_b = N/A$	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			
Equivalent Slope S_e (based on grate carry-over)	$S_e = 0.208$	0.181	ft/ft
Required Length L_r to Have 100% Interception	$L_r = 5.76$	9.56	ft
Under No-Clogging Condition			
Effective Length of Curb Opening or Slotted Inlet (minimum of L_r)	$L = 5.76$	9.56	ft
Interception Capacity	$Q_i = 1.4$	3.3	cfs
Under Clogging Condition			
Clogging Coefficient	CurbCoef = 1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog = 0.06	0.06	
Effective (Unclogged) Length	$L_e = 9.37$	9.37	ft
Actual Interception Capacity	$Q_a = 1.4$	3.3	cfs
Carry-Over Flow = $Q_{c(GRATE)} - Q_a$	$Q_b = 0.0$	0.0	cfs
Summary			
Total Inlet Interception Capacity	$Q = 1.4$	3.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	0.0	cfs
Capture Percentage = $Q_c/Q_0 =$	$C\% = 100$	100	%



Nyloplast Inlet Capacity Table

DISCLAIMER: SAFETY FACTORS ARE NOT INCLUDED IN THESE CALCULATIONS. ACTUAL CALCULATIONS SHOULD BE CARRIED OUT AND VERIFIED BY THE DESIGN ENGINEER TAKING INTO ACCOUNT ALL LOCAL CONDITIONS. NYLOPLAST RECOMMENDS USING A MINIMUM SAFETY FACTOR OF 1.25 FOR PAVED AREAS AND 2.0 FOR TURF AREAS. ADS/NYLOPLAST IS NOT RESPONSIBLE FOR MISUSE OF THIS TOOL.

Input	
Type of Grate	8" Standard
Head (ft)	0.5
Properties	
Orifice Flow Area (in)	18.77
Orifice Flow Area (ft)	0.13
Weir Flow Perimeter (in)	21.30
Weir Flow Perimeter (ft)	1.78
Solution	
Capacity (cfs)	0.44
Capacity (gpm)	197.82

$$Q_{weir} = CLH^{3/2}$$

$C = 3.33$ Weir Discharge Coefficient

$L =$ Perimeter of Grate Opening (ft)

$H =$ Flow Height of Water Surface Above Weir (ft)

$$Q_{orifice} = CA\sqrt{2gh}$$

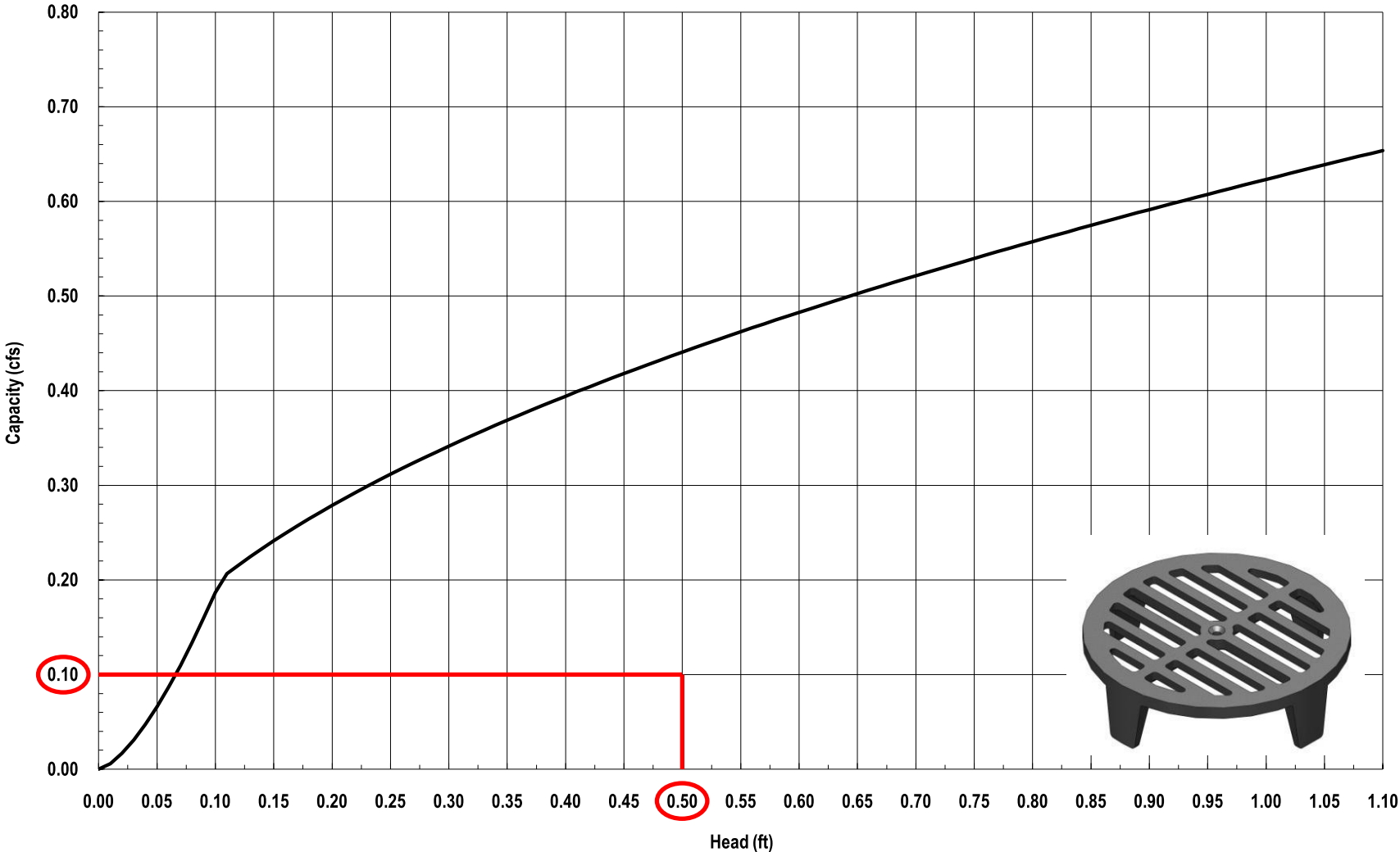
$C = 0.60$ Orifice Discharge Coefficient

$A =$ Area of the Orifice (ft²)

$g =$ Gravitational Constant $\left(32.2 \frac{ft}{s^2}\right)$

$H =$ Depth of Water Above Center of Orifice (ft)

Nyloplast 8" Standard Grate Inlet Capacity Chart





Nyloplast Inlet Capacity Table

DISCLAIMER: SAFETY FACTORS ARE NOT INCLUDED IN THESE CALCULATIONS. ACTUAL CALCULATIONS SHOULD BE CARRIED OUT AND VERIFIED BY THE DESIGN ENGINEER TAKING INTO ACCOUNT ALL LOCAL CONDITIONS. NYLOPLAST RECOMMENDS USING A MINIMUM SAFETY FACTOR OF 1.25 FOR PAVED AREAS AND 2.0 FOR TURF AREAS. ADS/NYLOPLAST IS NOT RESPONSIBLE FOR MISUSE OF THIS TOOL.

Input	
Type of Grate	8" Standard
Head (ft)	0.5
Properties	
Orifice Flow Area (in)	18.77
Orifice Flow Area (ft)	0.13
Weir Flow Perimeter (in)	21.30
Weir Flow Perimeter (ft)	1.78
Solution	
Capacity (cfs)	0.44
Capacity (gpm)	197.82

$$Q_{weir} = CLH^{3/2}$$

$C = 3.33$ Weir Discharge Coefficient

$L =$ Perimeter of Grate Opening (ft)

$H =$ Flow Height of Water Surface Above Weir (ft)

$$Q_{orifice} = CA\sqrt{2gh}$$

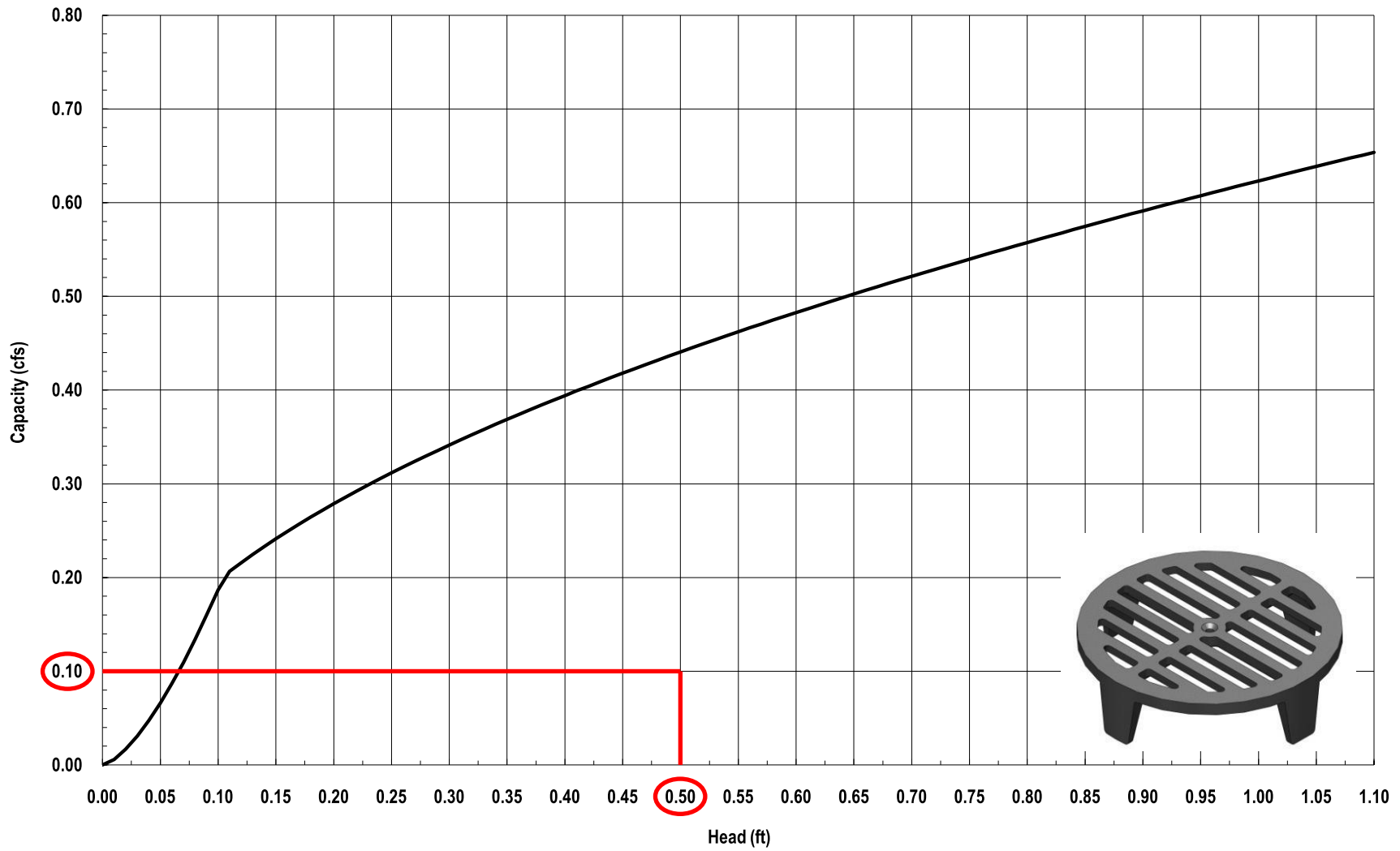
$C = 0.60$ Orifice Discharge Coefficient

$A =$ Area of the Orifice (ft²)

$g =$ Gravitational Constant $\left(32.2 \frac{ft}{s^2}\right)$

$H =$ Depth of Water Above Center of Orifice (ft)

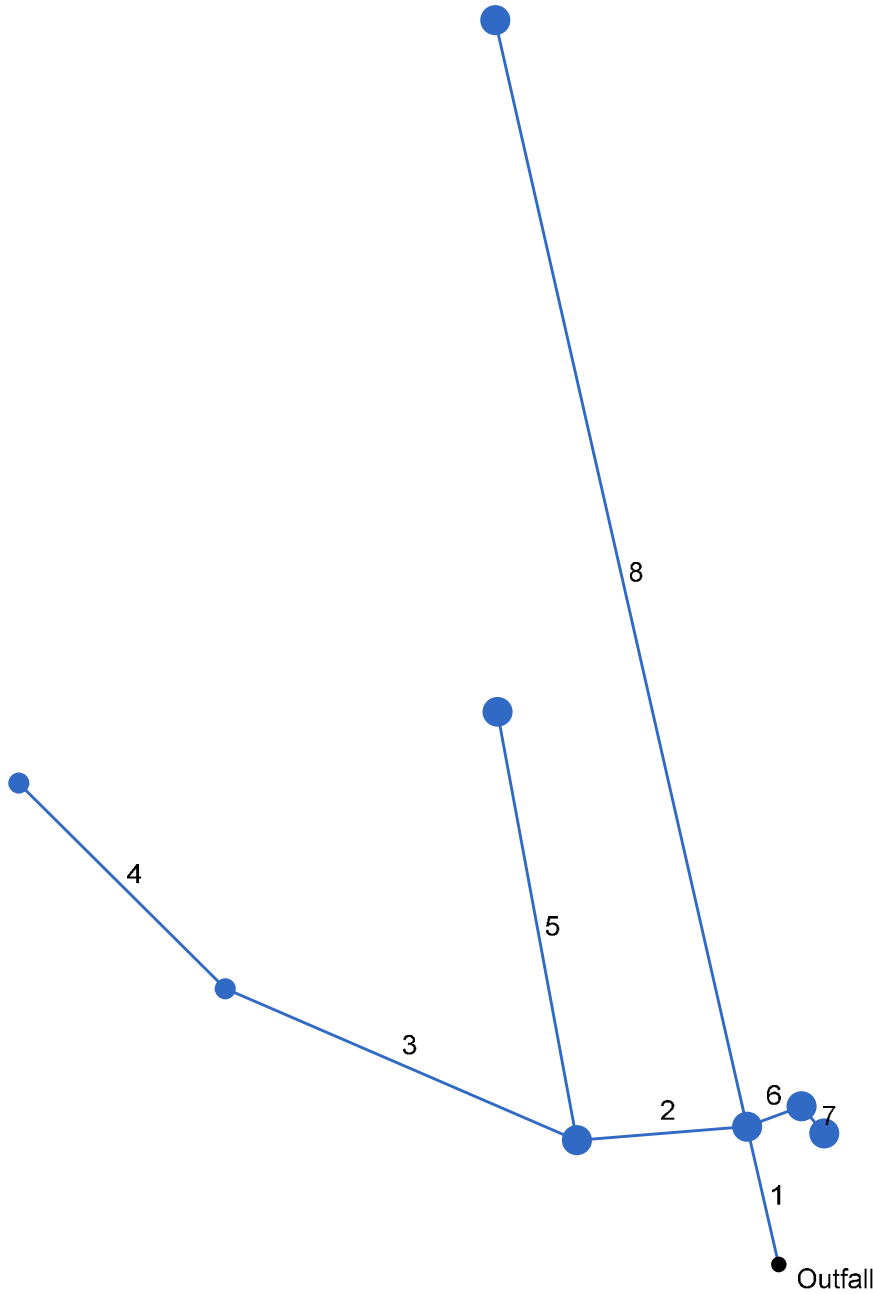
Nyloplast 8" Standard Grate Inlet Capacity Chart



Nyloplast[®]

3130 Verona Avenue • Buford, GA 30518
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Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 2243_100year.stm

Number of lines: 8

Date: 7/5/2023

MyReport

Line No.	Line ID	Line Size (in)	Line Slope (%)	Flow Rate (cfs)	Capac Full (cfs)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	EGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)	EGL Dn (ft)	J-Loss Coeff	Defl Ang (Deg)	Vel Ave (ft/s)	Vel Up (ft/s)	Vel Dn (ft/s)	Capac Full (cfs)
1	EX P8	24	3.38	24.00	41.57	6064.73	6064.20	6072.01	6066.46	6067.53	0.00	6065.93	6067.00	0.99 z	-102.743	8.30	8.29	8.31	41.57
2	P4	12	5.01	2.30	8.64	6066.67	6065.73	6073.23	6067.32 j	6067.60	6072.01	6066.46	6066.75	1.00 z	-82.171	4.00	4.27	3.72	8.64
3	P3	6	7.01	0.20	1.61	6070.14	6067.17	6075.10	6070.36	6070.45	6073.23	6067.32	6067.40	0.43 z	28.276	3.22	2.35	4.10	1.61
4	P2	6	6.99	0.10	1.61	6072.38	6070.14	6075.20	6072.54 j	6072.59	6075.10	6070.36	6070.42	1.00 z	21.962	1.54	1.91	1.18	1.61
5	P1	12	5.00	2.10	8.63	6069.28	6066.87	6074.44	6069.90	6070.16	6073.23	6067.32	6067.58	1.00 z	84.497	5.14	4.12	6.16	8.63
6	P5	12	5.02	3.10	8.64	6066.05	6065.73	6071.44	6066.80	6067.17	6072.01	6066.46	6066.83	0.96 z	82.169	4.95	4.88	5.02	8.64
7	P6	12	5.02	3.10	8.64	6066.45	6066.25	6071.78	6067.20	6067.57	6071.44	6066.80	6067.17	1.00 z	71.716	5.91	4.88	6.95	8.64
8	EX P7	24	2.87	18.60	38.31	6068.53	6064.93	0.00	6070.08	6070.87	6072.01	6066.46	6067.25	1.00 z	0.000	7.15	7.11	7.20	38.31

Project File: 2243_100year.stm

Number of lines: 8

Date: 7/5/2023

NOTES: ** Critical depth

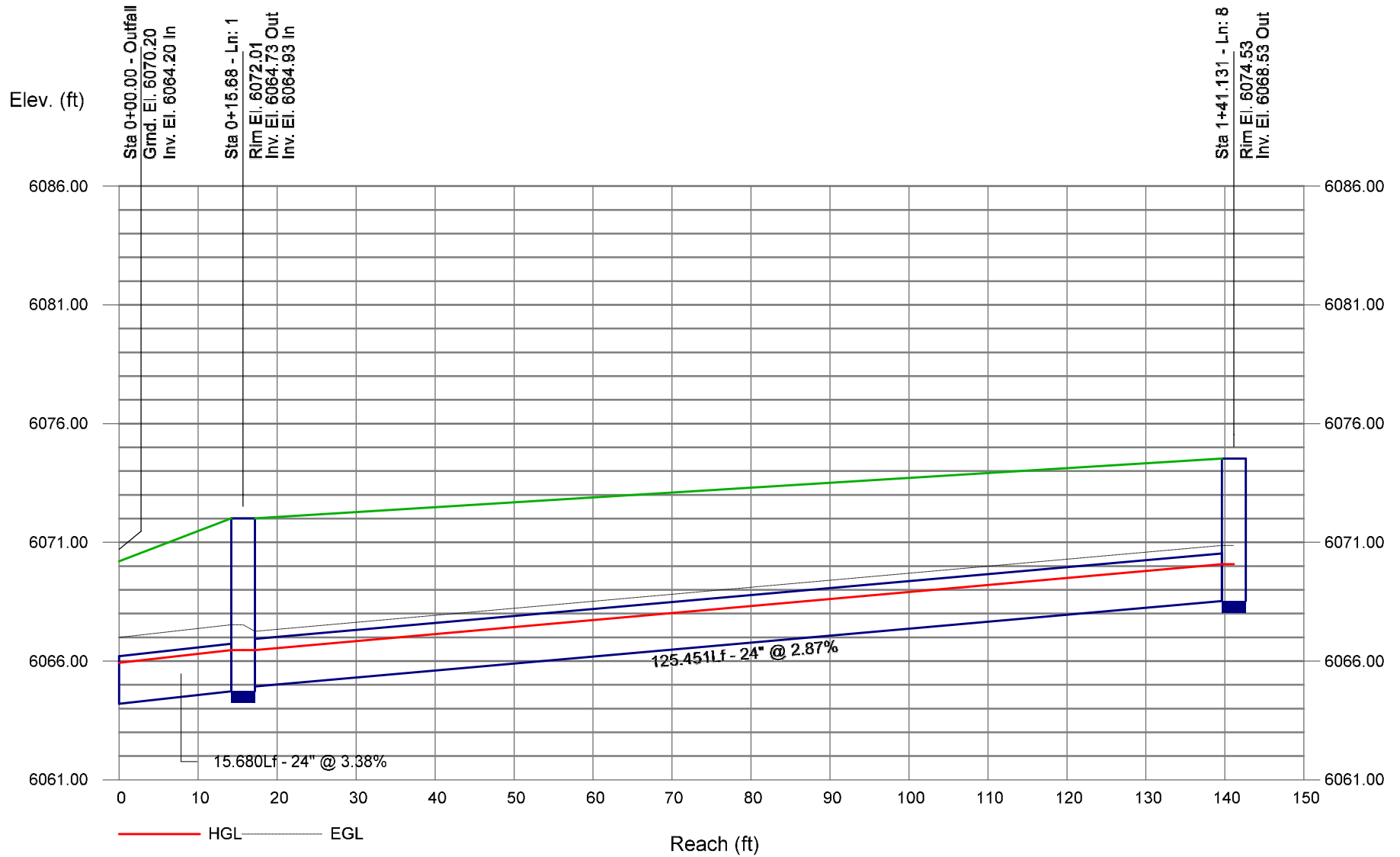
MyReport

DnStm Ln No	Line ID	Inlet ID	Known Q (cfs)	Line No.
Outfall	EX P8	SDMH-01	0.00	1
1	P4	SDMH-03	0.00	2
2	P3	SDI-04	0.10	3
3	P2	SDI-03	0.10	4
2	P1	SDI-01	2.10	5
1	P5	SDMH-02	0.00	6
6	P6	SDI-02	3.10	7
1	EX P7	Null Structure	18.60	8

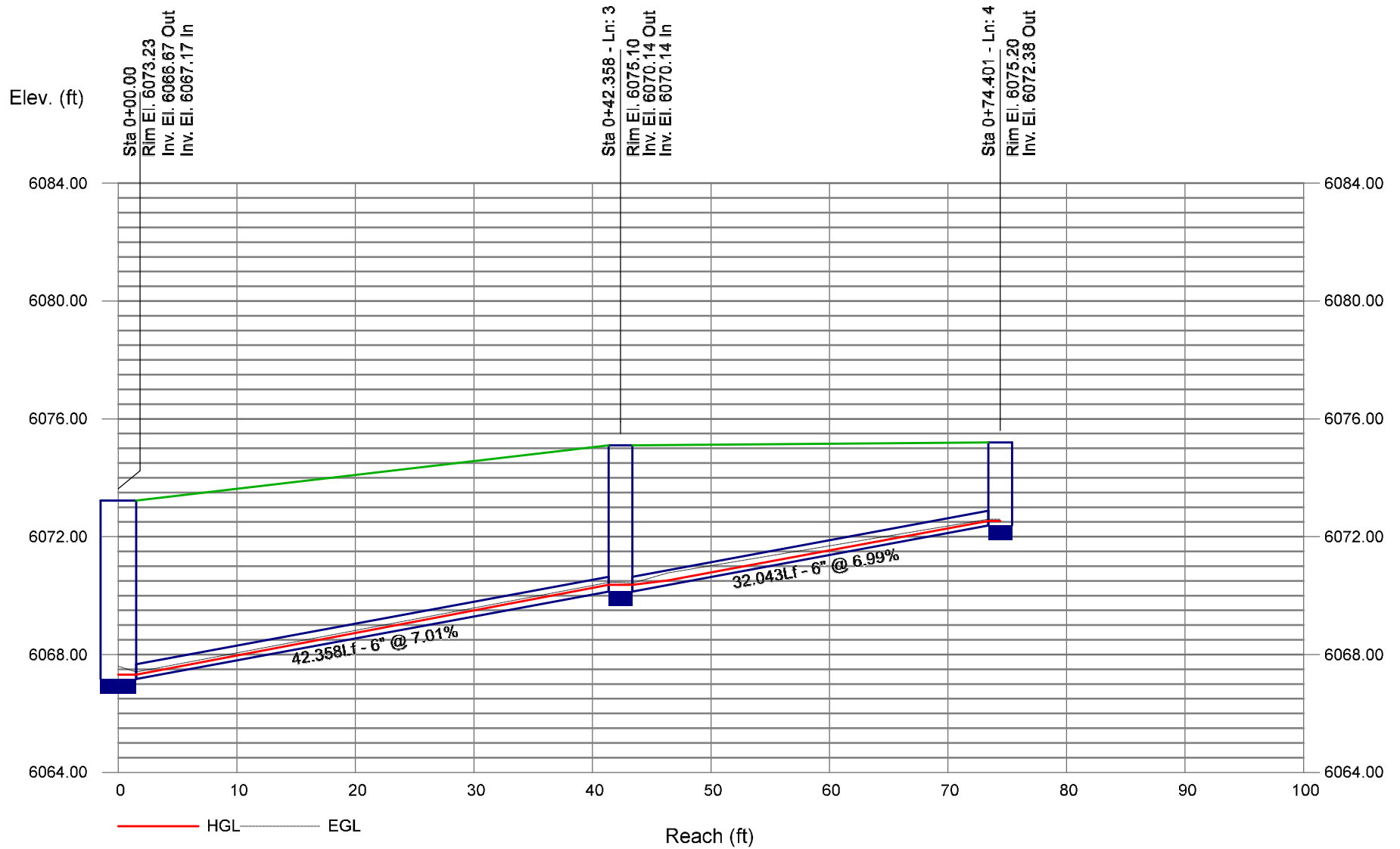
Project File: 2243_100year.stm	Number of lines: 8	Date: 7/5/2023
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NOTES: ** Critical depth

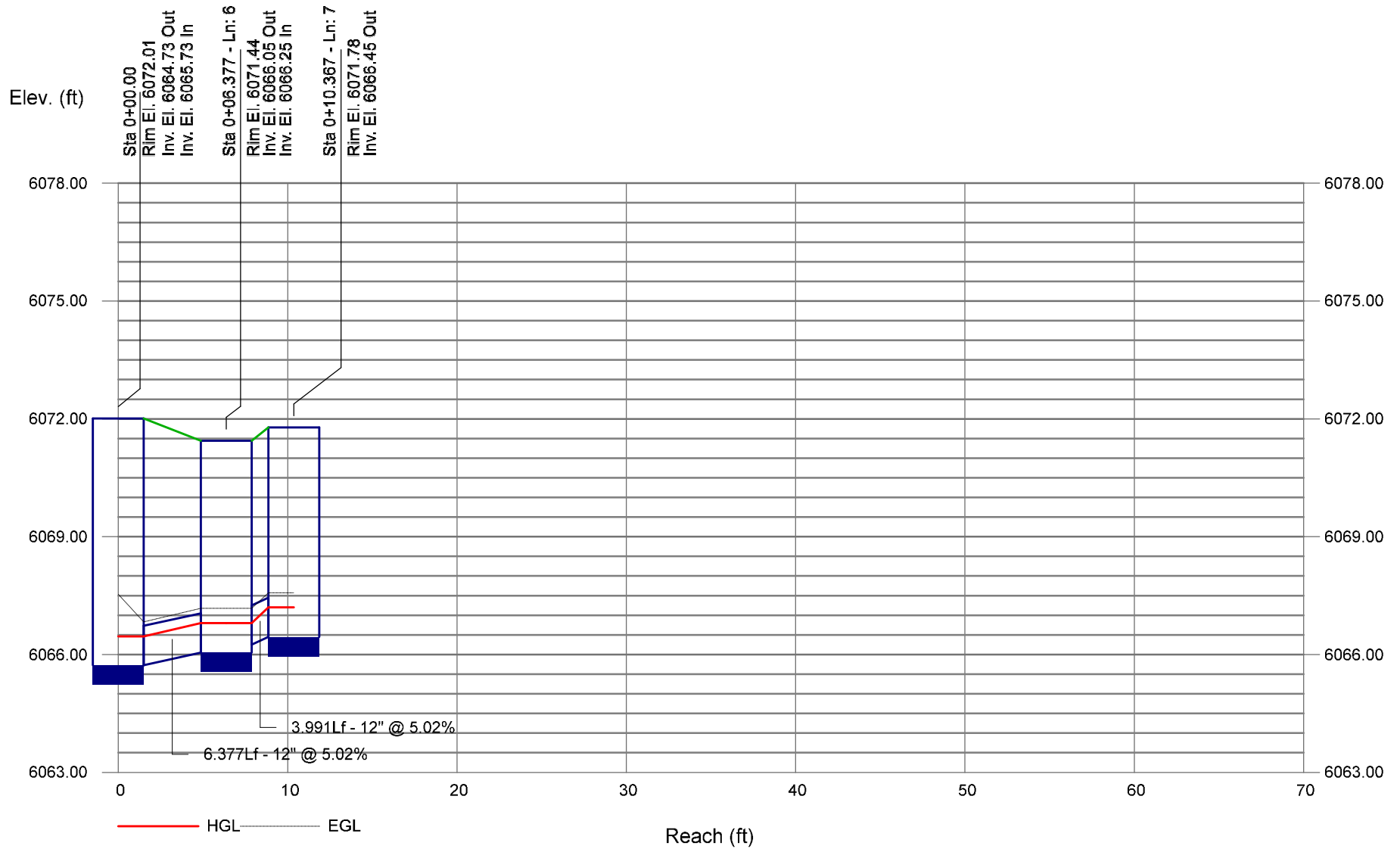
Storm Sewer Profile



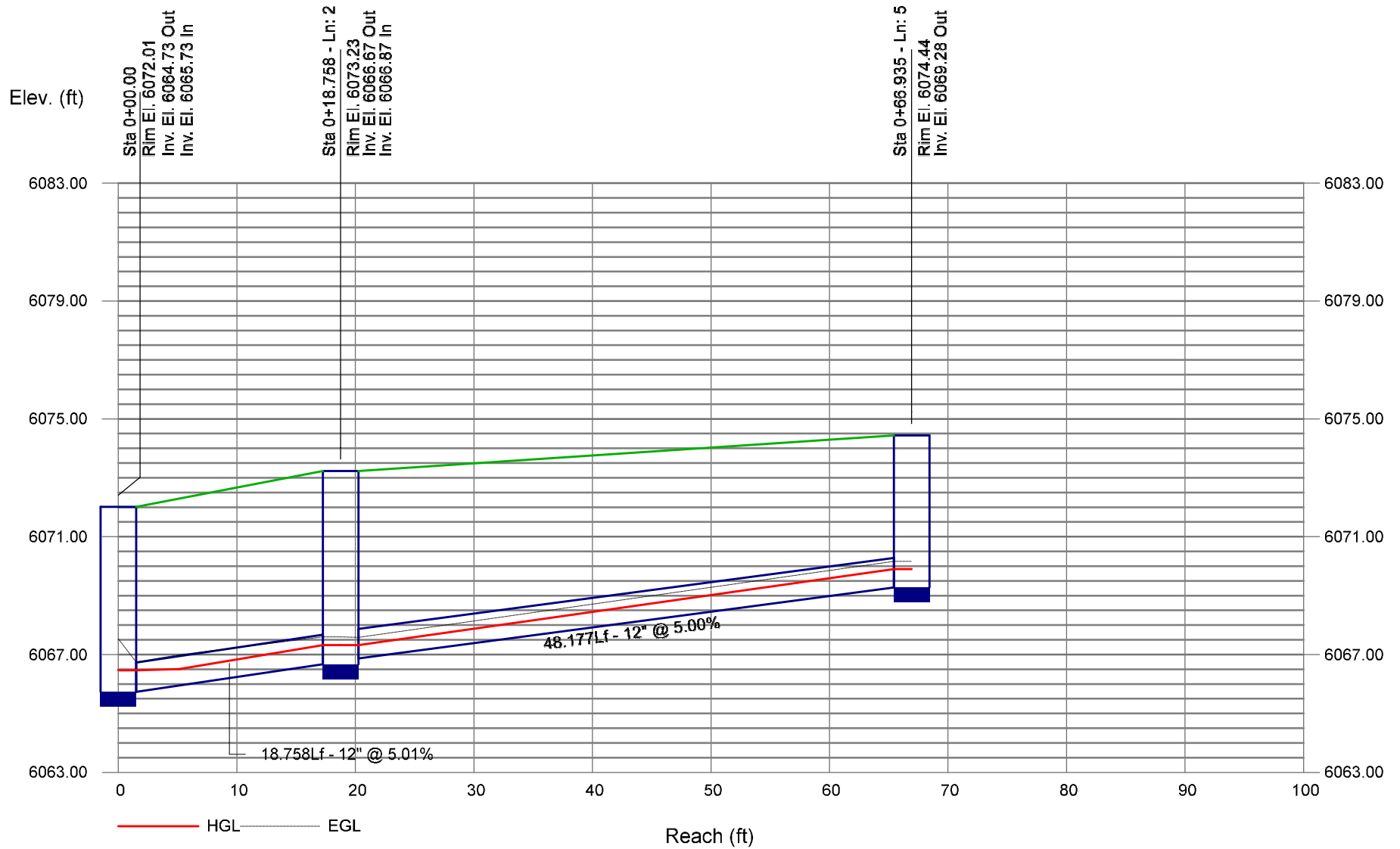
Storm Sewer Profile



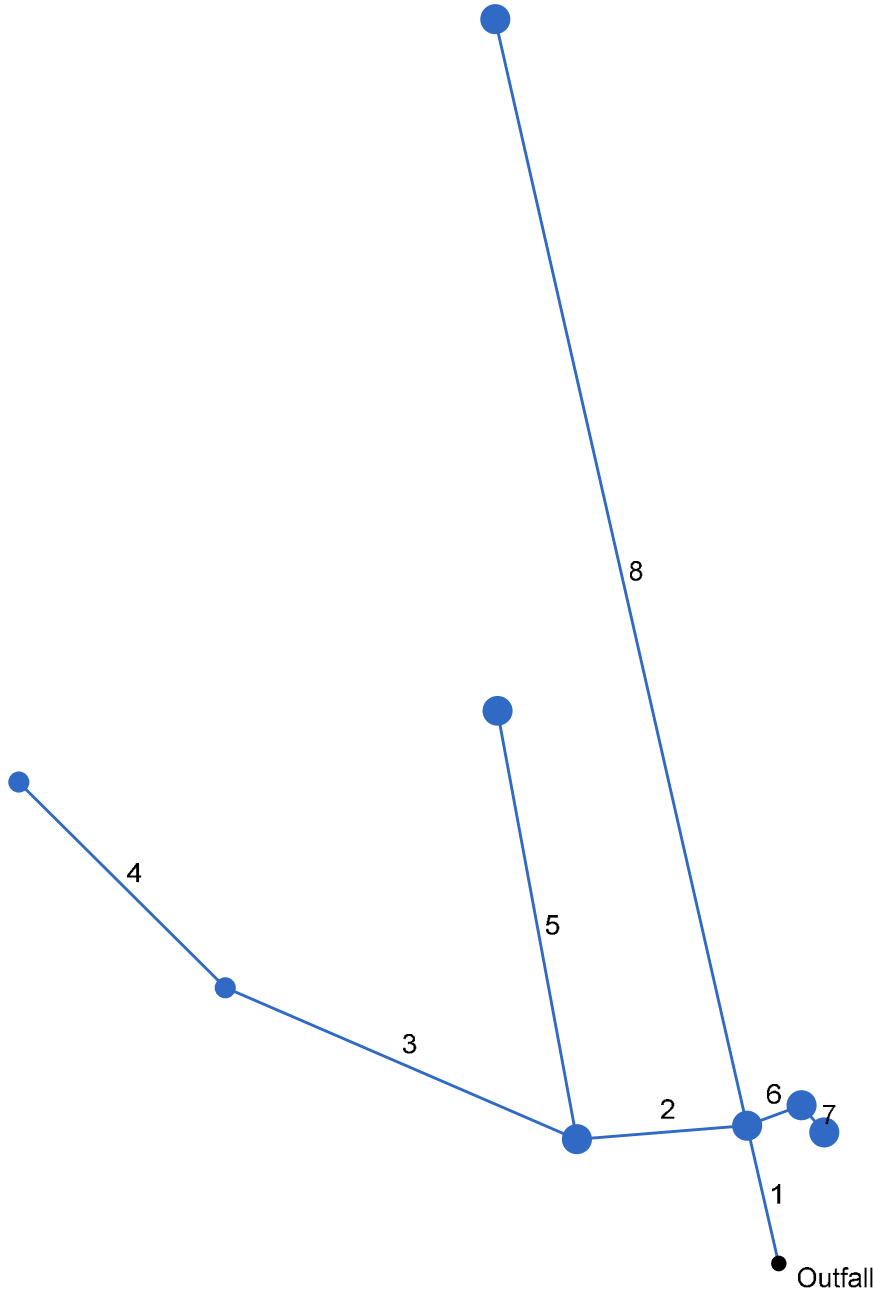
Storm Sewer Profile



Storm Sewer Profile



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 2243_5year.stm

Number of lines: 8

Date: 7/5/2023

MyReport

Line No.	Line ID	Line Size (in)	Line Slope (%)	Flow Rate (cfs)	Capac Full (cfs)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	HGL Up (ft)	EGL Up (ft)	Gnd/Rim El Dn (ft)	HGL Dn (ft)	EGL Dn (ft)	J-Loss Coeff	Defl Ang (Deg)	Vel Ave (ft/s)	Vel Up (ft/s)	Vel Dn (ft/s)	Capac Full (cfs)
1	EX P8	24	3.38	10.42	41.57	6064.73	6064.20	6072.01	6065.89 j	6066.36	0.00	6065.36	6065.84	0.99 z	-102.743	5.53	5.54	5.52	41.57
2	P4	12	5.01	0.92	8.64	6066.67	6065.73	6073.23	6067.07	6067.22	6072.01	6065.95	6066.10	1.00 z	-82.171	5.14	3.12	7.17	8.64
3	P3	6	7.01	0.02	1.61	6070.14	6067.17	6075.10	6070.21	6070.23	6073.23	6067.21	6067.23	0.43 z	28.276	2.02	1.23	2.81	1.61
4	P2	6	6.99	0.01	1.61	6072.38	6070.14	6075.20	6072.43 j	6072.45	6075.10	6070.21	6070.23	1.00 z	21.962	0.82	1.03	0.61	1.61
5	P1	12	5.00	0.90	8.63	6069.28	6066.87	6074.44	6069.68	6069.83	6073.23	6067.09	6067.24	1.00 z	84.497	5.10	3.09	7.10	8.63
6	P5	12	5.02	1.40	8.64	6066.05	6065.73	6071.44	6066.55	6066.75	6072.01	6066.00	6066.20	0.96 z	82.169	5.82	3.56	8.08	8.64
7	P6	12	5.02	1.40	8.64	6066.45	6066.25	6071.78	6066.95	6067.15	6071.44	6066.55	6066.75	1.00 z	71.716	5.31	3.56	7.06	8.64
8	EX P7	24	2.87	8.10	38.31	6068.53	6064.93	0.00	6069.54	6069.94	6072.01	6065.89	6066.29	1.00 z	0.000	5.27	5.07	5.47	38.31

Project File: 2243_5year.stm Number of lines: 8 Date: 7/5/2023

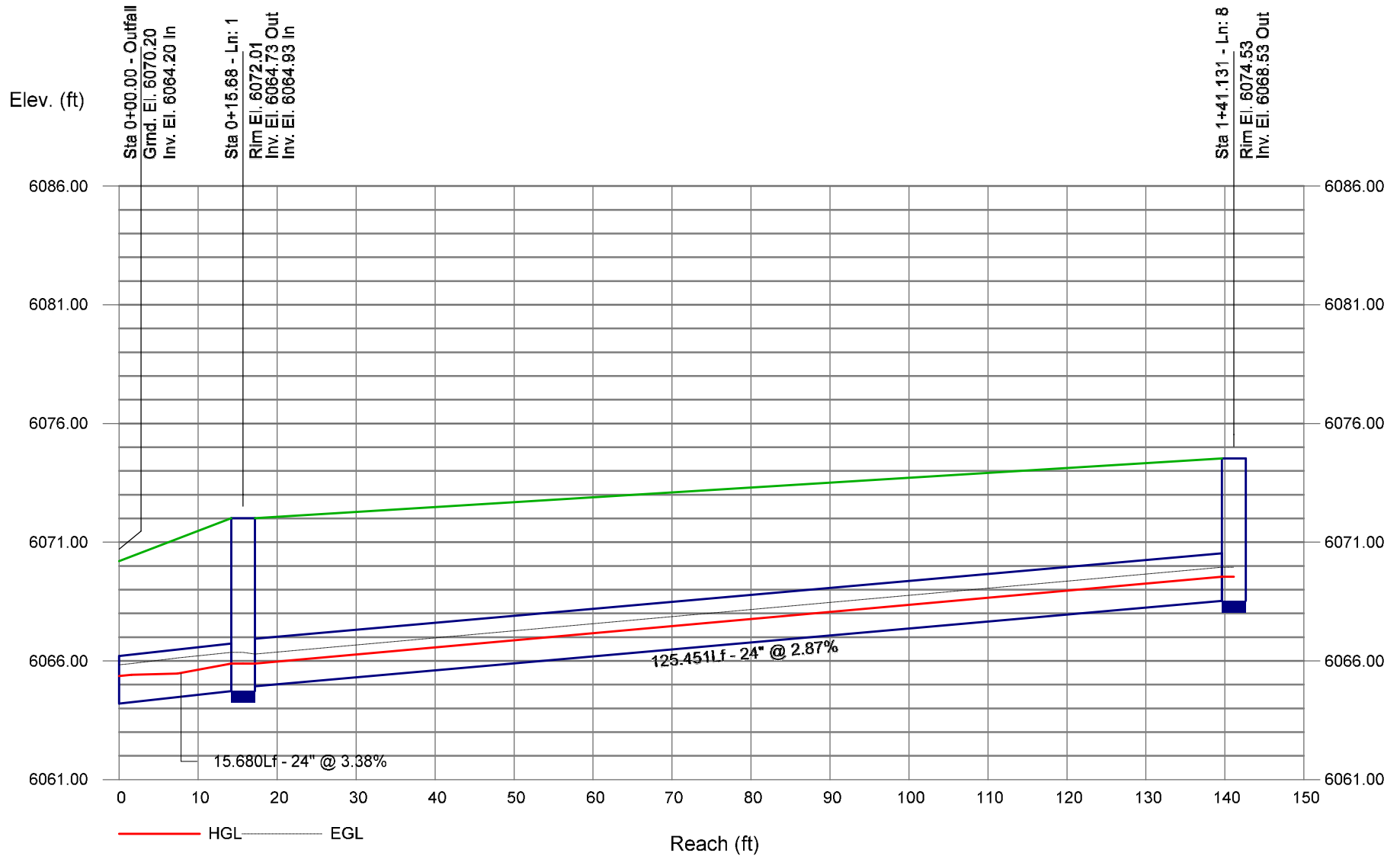
NOTES: ** Critical depth

DnStm Ln No	Line ID	Inlet ID	Known Q (cfs)	Line No.
Outfall	EX P8	SDMH-01	0.00	1
1	P4	SDMH-03	0.00	2
2	P3	SDI-04	0.01	3
3	P2	SDI-03	0.01	4
2	P1	SDI-01	0.90	5
1	P5	SDMH-02	0.00	6
6	P6	SDI-02	1.40	7
1	EX P7	Null Structure	8.10	8

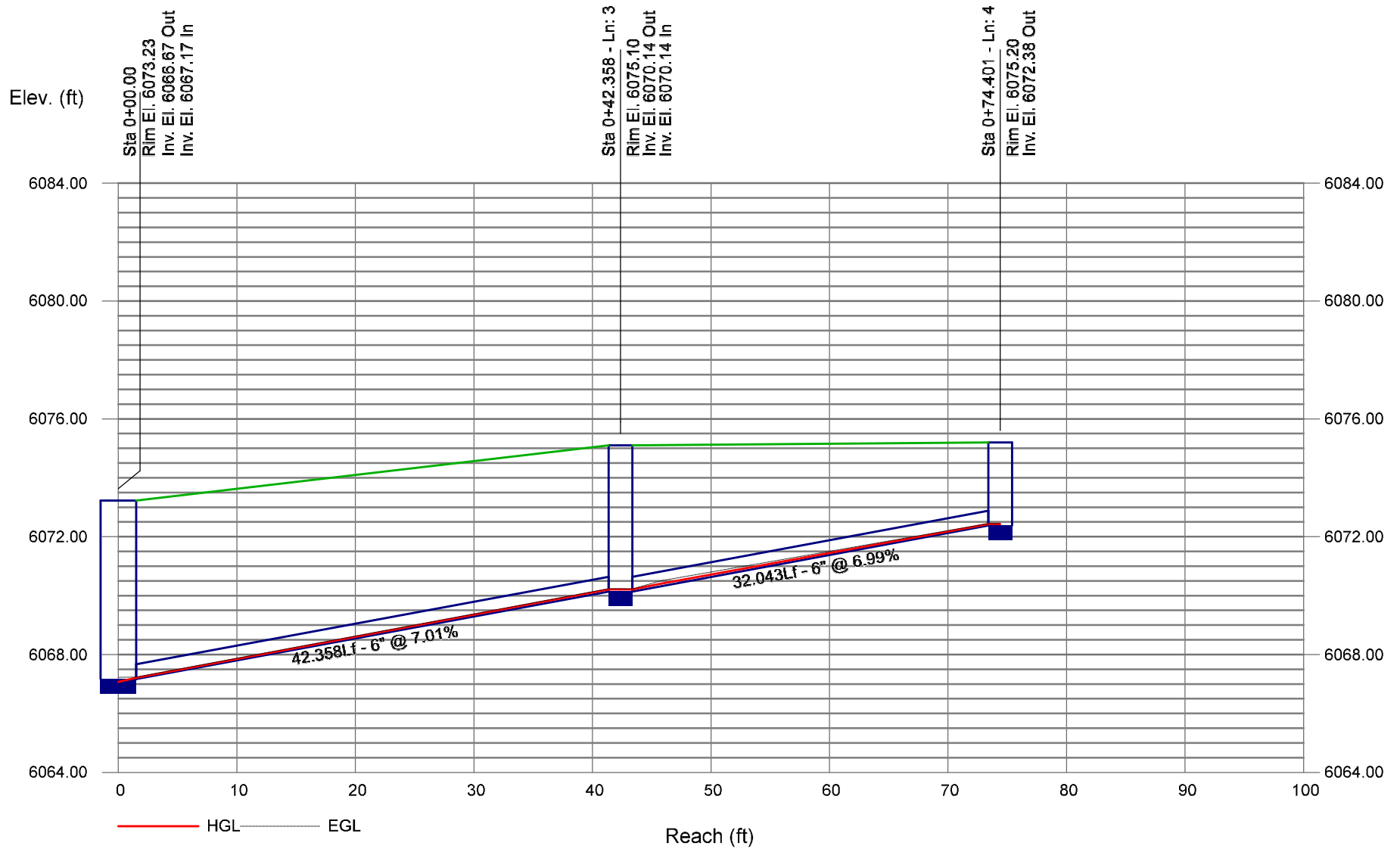
Project File: 2243_5year.stm	Number of lines: 8	Date: 7/5/2023
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NOTES: ** Critical depth

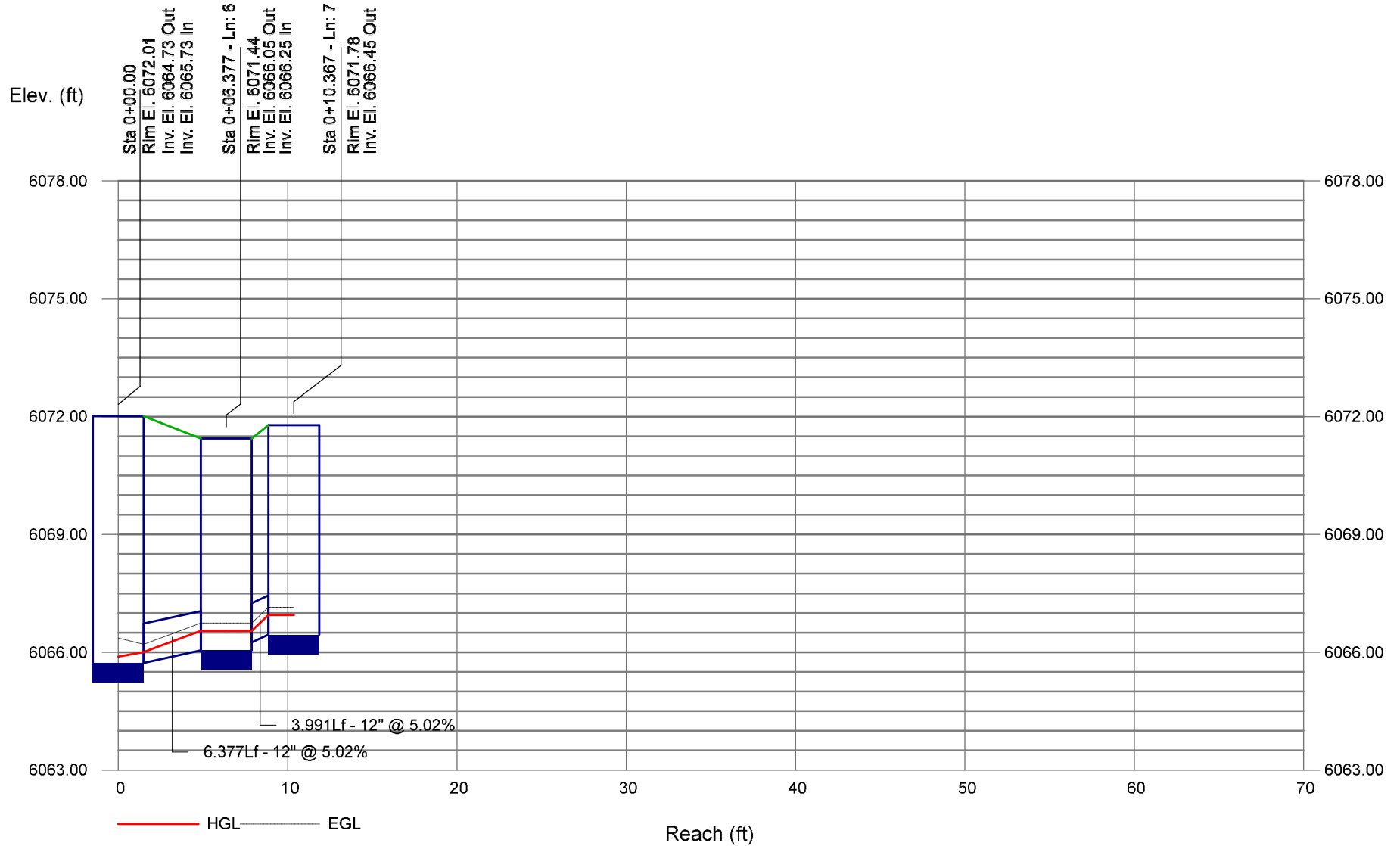
Storm Sewer Profile



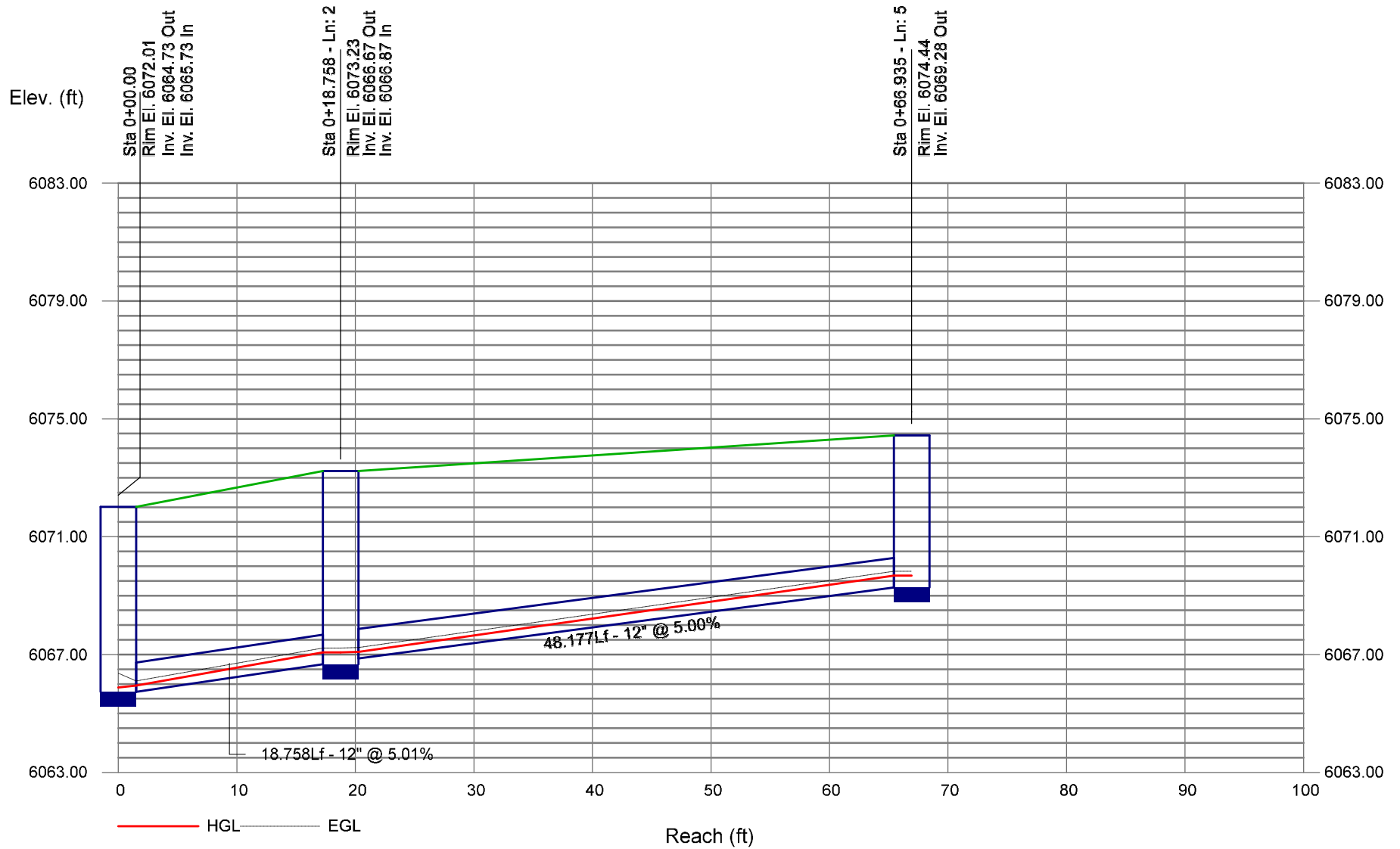
Storm Sewer Profile



Storm Sewer Profile



Storm Sewer Profile



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



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 R0-5

$$\frac{1.88(5\%) + 18.01(36\%) + 8.96(100\%) + 3.12(0\%) + 12.45(95\%)}{44.42 \text{ Ac.}} = 61.6\%$$

Detention (V=KA)

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:

$$V_{100} = K_{100} \times A$$

$$K_{100} = (1.78I - 0.002I^2 - 3.56) / 1000$$

$$Q_{100R} = Q_{100R} \times A$$

$$V_{10} = K_{10} \times A$$

$$K_{10} = (0.95I - 1.90) / 1000$$

$$Q_{10R} = Q_{10R} \times A$$

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

Sheet 1 of 3

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

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

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

Sheet 2 of 3

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

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

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

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

<p>6. Two-Stage Design - See Figure EDB-1</p> <p>A) Top Stage (Depth $D_{wo} = 2'$ Minimum)</p> <p>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-feet))</p> <p>C) Micro Pool (Minimum Depth = the Larger of $0.5 \times$ Top Stage Depth ($2.5'$) or $2.5'$)</p> <p>D) Total Volume: $Vol_{tot} =$ Storage from 5A + 6A + 6B (Must be $>$ Design Volume in 1D, or 1.07334362662912 acre-feet.)</p>	<p>$D_{wo} =$ <u>5.00</u> feet Storage = <u>1.570</u> acre-feet</p> <p>$D_{BS} =$ <u>1.50</u> feet Storage = <u>0.082</u> acre-feet Surf. Area = <u>0.055</u> acres</p> <p>Depth = <u>2.50</u> feet Storage = <u>0.048</u> acre-feet Surf. Area = <u>0.019</u> acres</p> <p>$Vol_{tot} =$ <u>1.719</u> acre-feet</p>
<p>7. Basin Side Slopes (Z, horizontal distance per unit vertical) Minimum Z = 4, Flatter Preferred</p>	<p>Z = <u>4.00</u> (horizontal/vertical)</p>
<p>8. Dam Embankment Side Slopes (Z, horizontal distance) per unit vertical) Minimum Z = 3, Flatter Preferred</p>	<p>Z = <u>4.00</u> (horizontal/vertical)</p>
<p>9. Vegetation (Check the method or describe "Other")</p>	<p><input type="checkbox"/> Native Grass <input checked="" type="checkbox"/> Irrigated Turf Grass <input type="checkbox"/> Other: _____</p>

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 = $\frac{1}{3} \times \text{Depth} \times (A+B+(A*B)^{0.5})$

A - Upper Surface

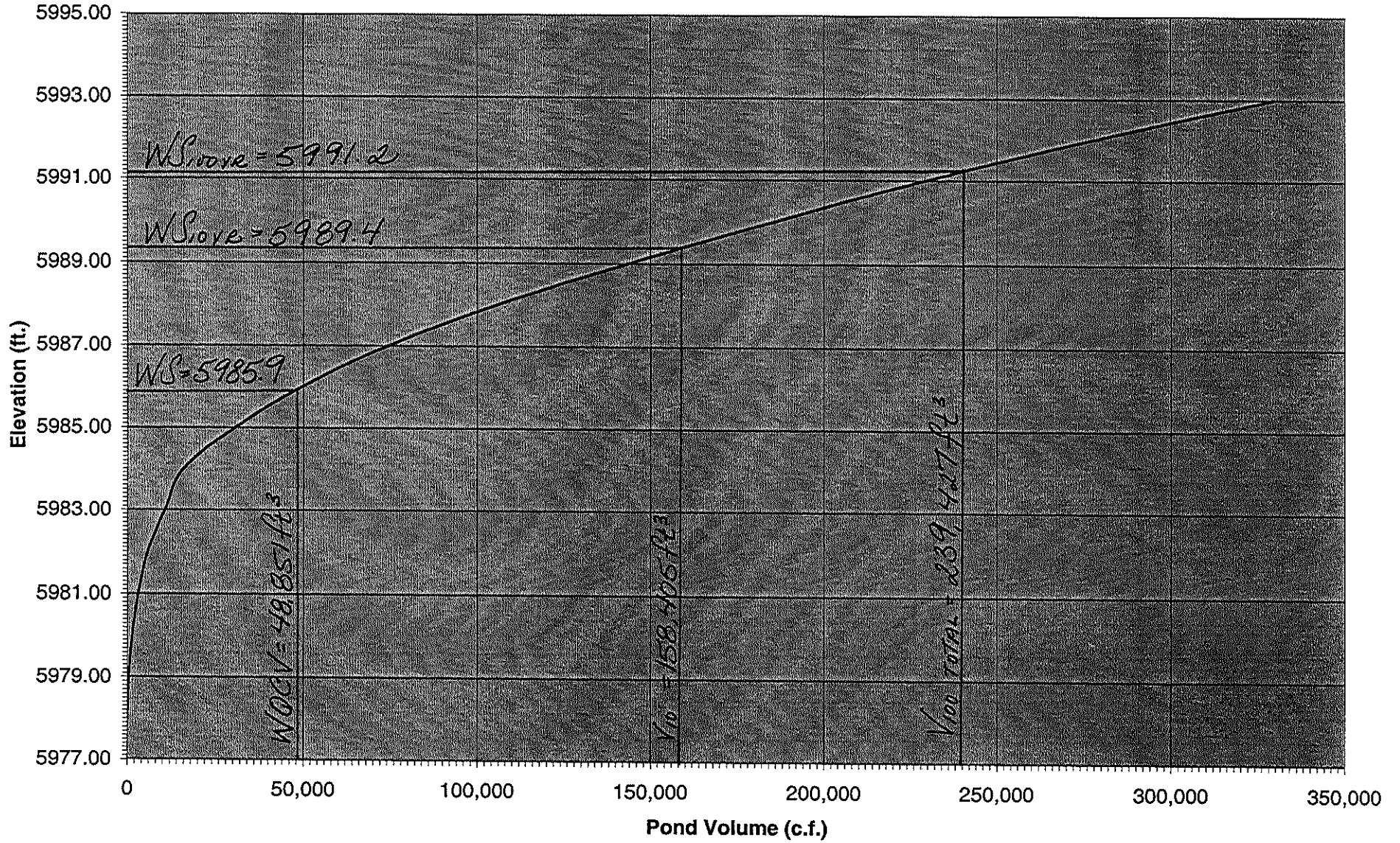
B - Lower Surface

Pond A ← Project drains to
Pond A

Elevation	Surface Area (square feet)	$A+B+(A*B)^{0.5}$	1/3	Depth (feet)	Volume (cubic feet)	Cumulative Volume (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

**Pond A
Stage-Storage**

Project drains to
Pond A



Emergency Spillway Weir Calculations

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

Weir Equation:

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

$C_d = 3.37$ (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

$$Q = CL^{1.02}H^{1.47} \quad C=3.10$$

	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 = 13.36 feet
 to invert of orifice (Y)
 Diameter of Orifice (D) = 1.61 feet
 Height of water surface = 13.36 feet
 to centroid of orifice (h)
 $C_d = 0.65$ for circular orifices
 $g = 32.20 \text{ ft/s}^2$

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

Orifice Equation:

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

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

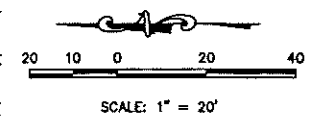
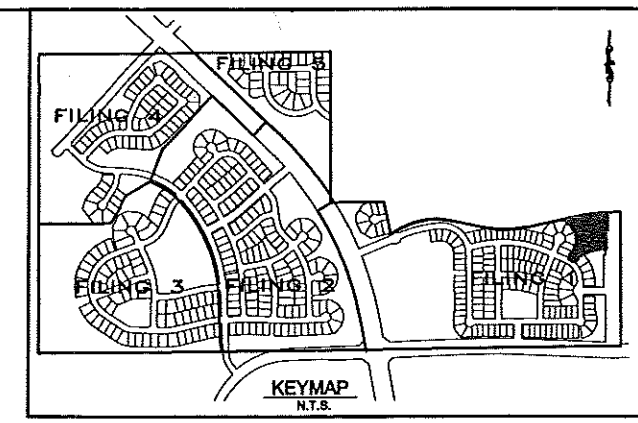
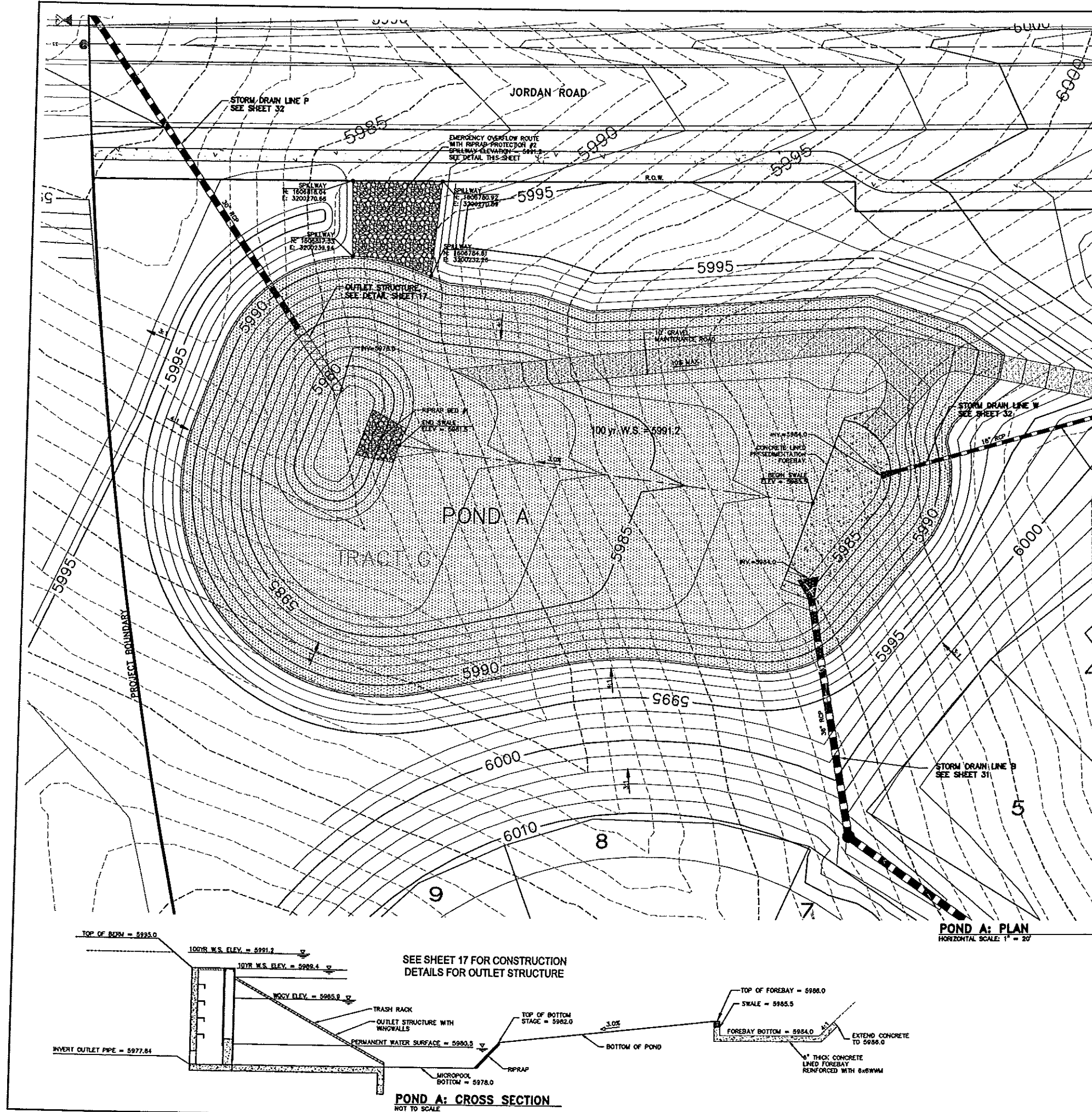
$$Q = 0.65 * 3.1415 * D^2 / 4 * (2 * 32.2 * h)^{1/2}$$

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

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%

N:\projects\102\dwg\6-P\6-P.dwg, 2/22/2003 11:46:44 AM, JAW



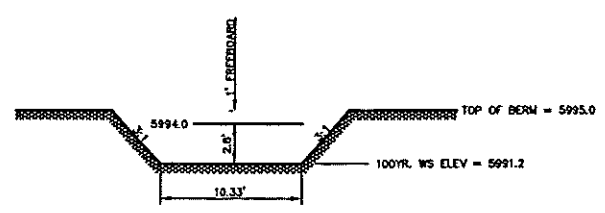
RIRAP SUMMARY TABLE

	RR#1	RR#2
LENGTH	16	33.1'
WIDTH	15, 20	40'
DEPTH	2.5'	1.5'
SIZE_d50	9"	12"
TYPE	L	M

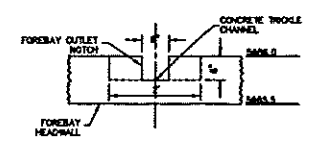
* SEE DETAIL.
BURY TYPE L RIRAP WITH 4" NATIVE TOPSOIL AND RESEED OR RESOD.

POND SUMMARY TABLE

	Q 10yr	Q 100yr
PEAK INFLOW (cfs)	127.4	163.0
PEAK OUTFLOW (cfs)	10.2	37.8
WOCV (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

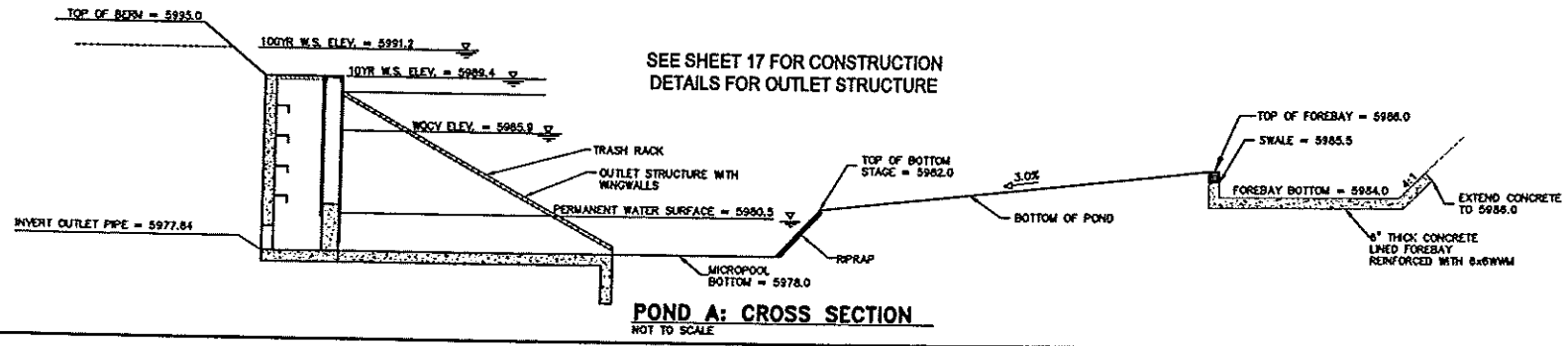


EMERGENCY SPILLWAY DETAIL



FOREBAY OUTLET NOTCH

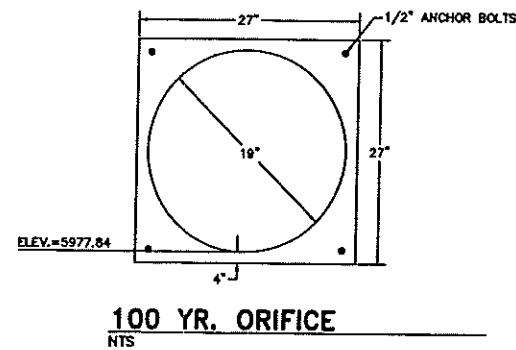
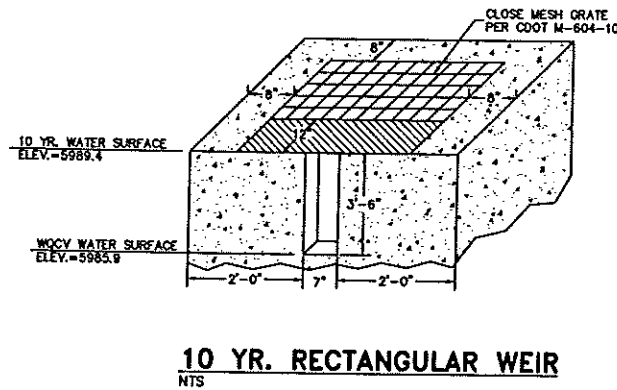
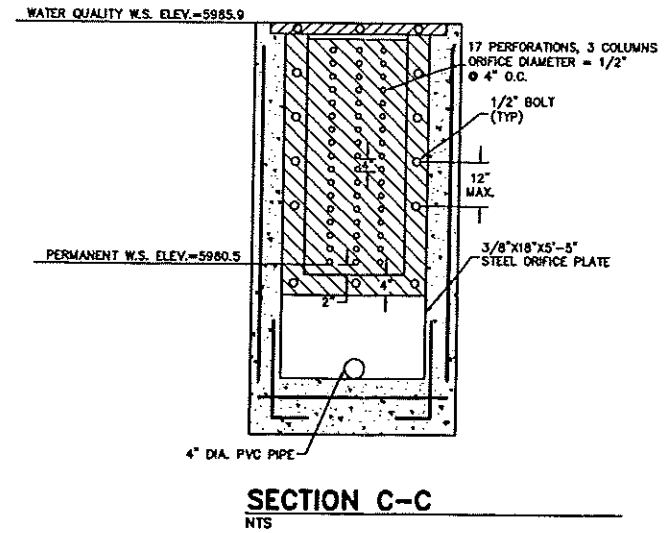
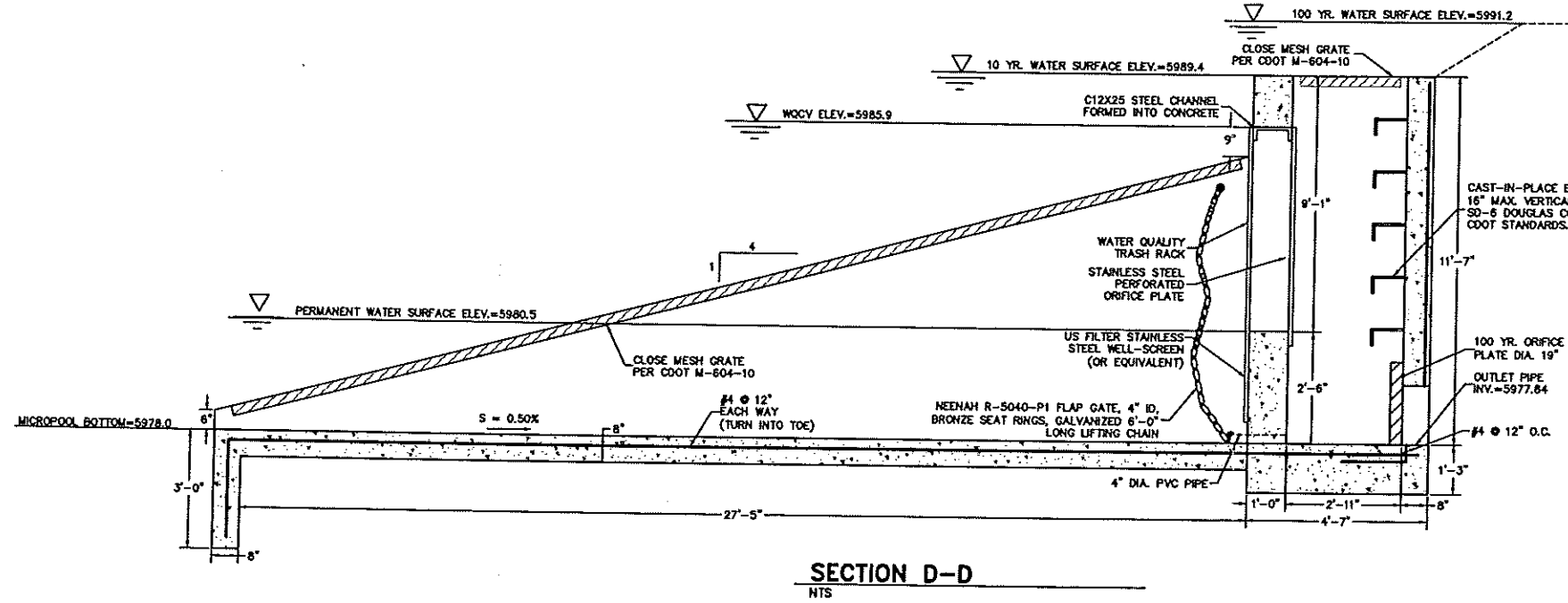
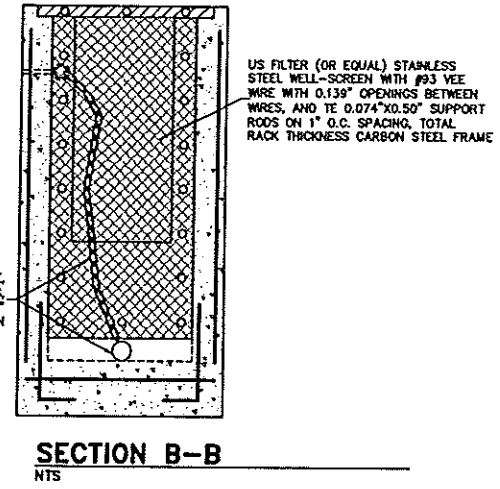
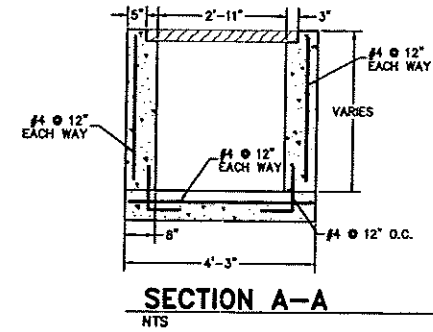
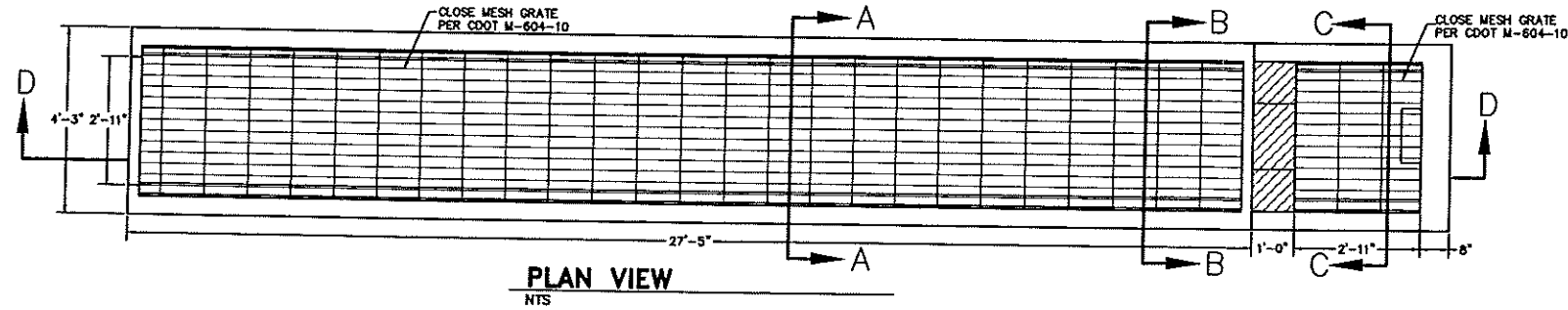
POND A: PLAN
HORIZONTAL SCALE: 1" = 20'



POND A: CROSS SECTION
NOT TO SCALE

DATE	APRIL 29, 2003	DATE	
APPROVED		DATE	
DESIGNED		DATE	
CHECKED		DATE	
DRAWN		DATE	
SCALE	AS SHOWN	FILE NO.	01804102
DOUGLAS 234 FILING 1 STREET AND DRAINAGE IMPROVEMENTS POND A			
Continental Homes 7600 East Orchard Road, Ste. 165-S Greenwood Village, CO 80111			
CALL UNCC TWO WORKING DAYS BEFORE YOU DIG 1-800-922-1987 534-8700 METRO DENVER AREA UTILITY NOTIFICATION CENTER OF COLORADO			
16		SHEET NUMBER	

POND A DETAILS



7901 E. Bellview Avenue Englewood, CO 80150 Tel: (720) 482-9335 Fax: (720) 482-9546	Revisions	Date
CYL CONSULTANTS OF COLORADO, INC. CIVIL ENGINEERING • LAND SURVEYING	No.	Appr.
Continental Homes 7600 East Orchard Road, Ste. 165-S Greenwood Village, CO 80111		
DOUGLAS 234 FILING 1 STREET AND DRAINAGE IMPROVEMENTS POND A OUTLET DETAILS		
SCALE: AS SHOWN	DRAWN BY: MEF	CHECKED BY: KAL
FILE NO: 01804102	DATE: APRIL 29, 2003	
SHEET NUMBER 17		

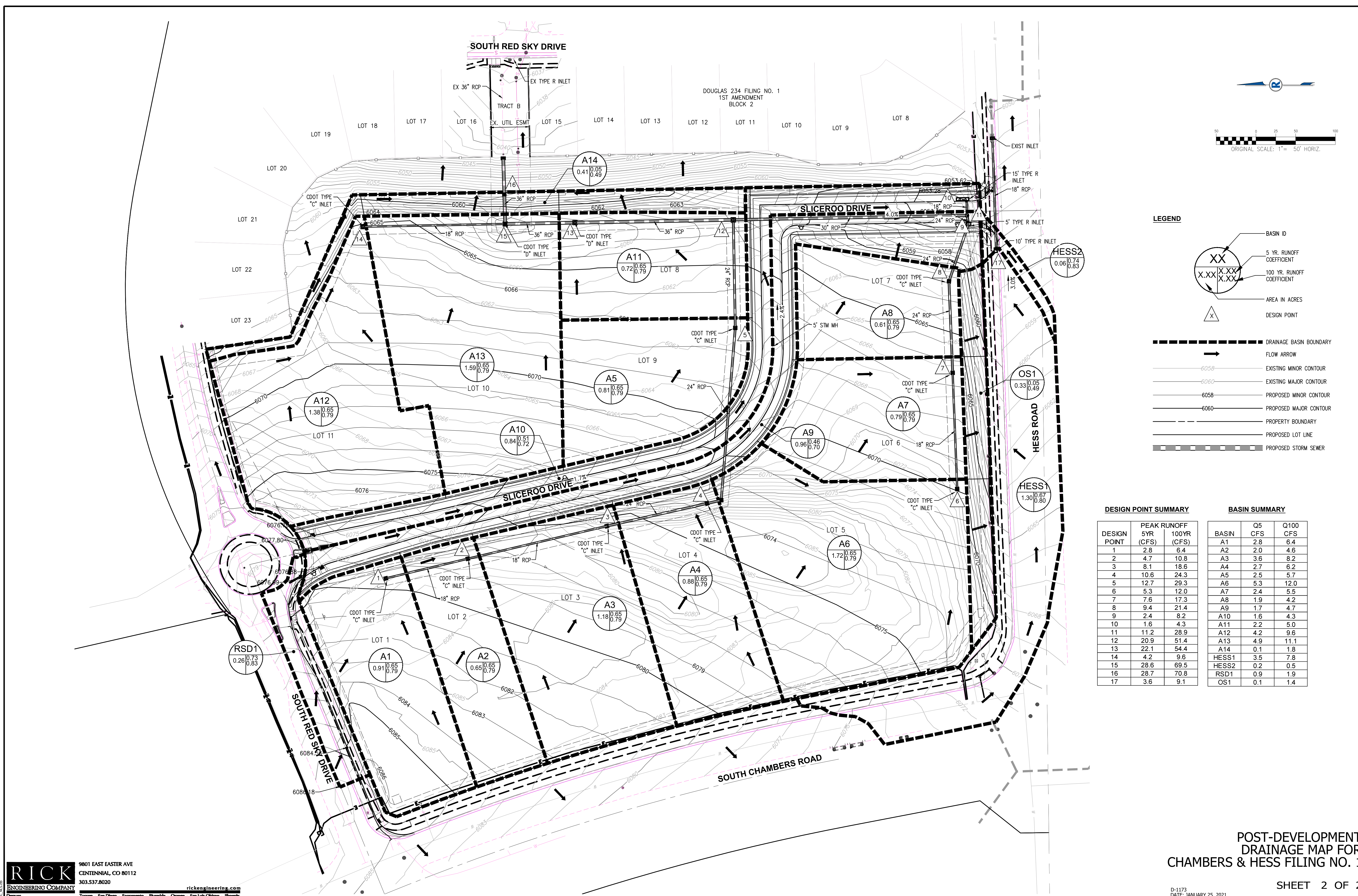
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MAP POCKET 1

FOR REFERENCE ONLY

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

from the approved Final Drainage Report



LEGEND

- XX BASIN ID
- X.XX 5 YR. RUNOFF COEFFICIENT
- X.XX 100 YR. RUNOFF COEFFICIENT
- X.XX AREA IN ACRES
- X 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)	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	Q	
	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

RICK ENGINEERING COMPANY
 9801 EAST EASTER AVE
 CENTENNIAL, CO 80112
 303.537.8020
 rickengineering.com

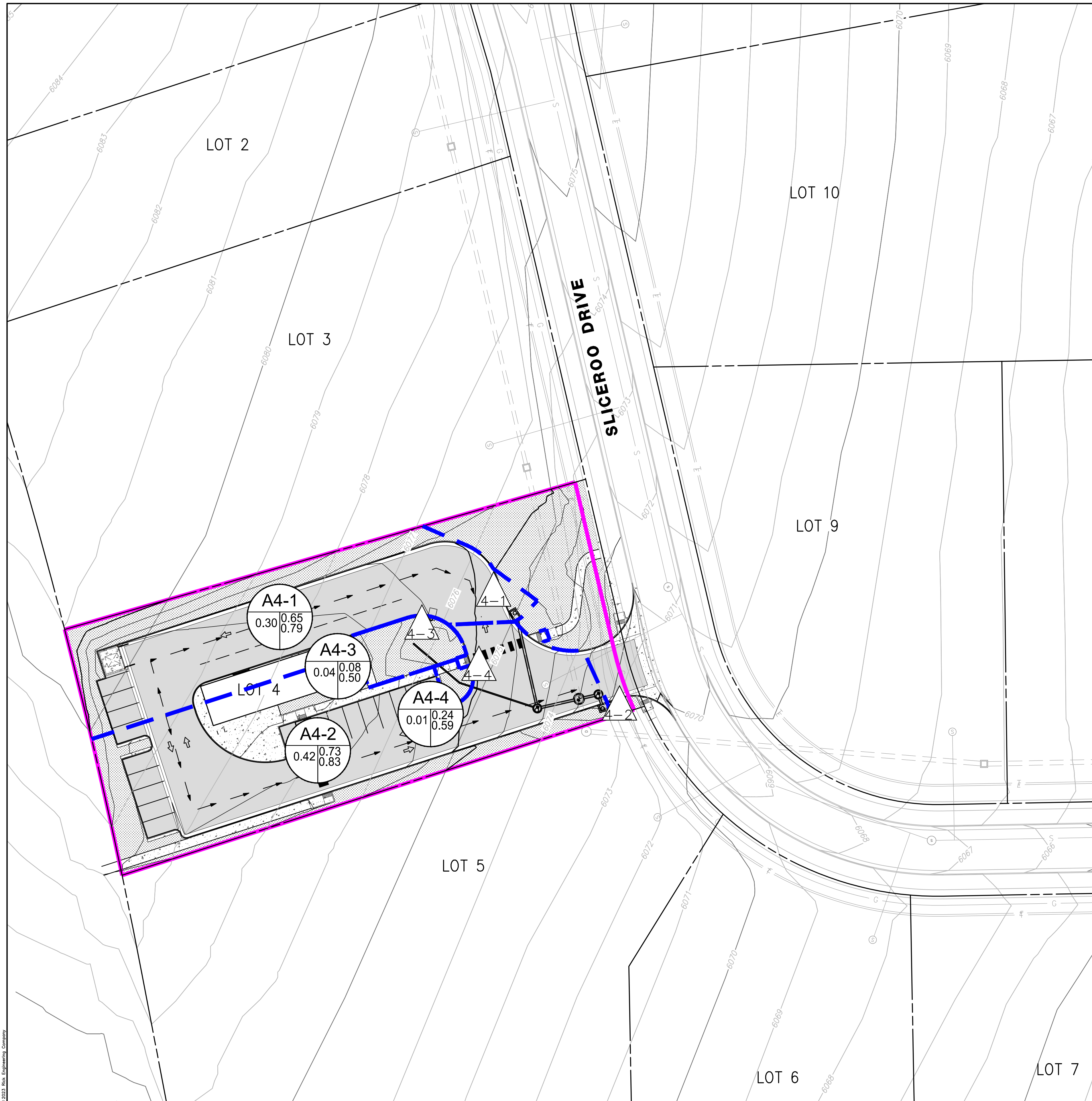
D-1173
 DATE: JANUARY 25, 2021

SHEET 2 OF 2

NOT FOR CONSTRUCTION – EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

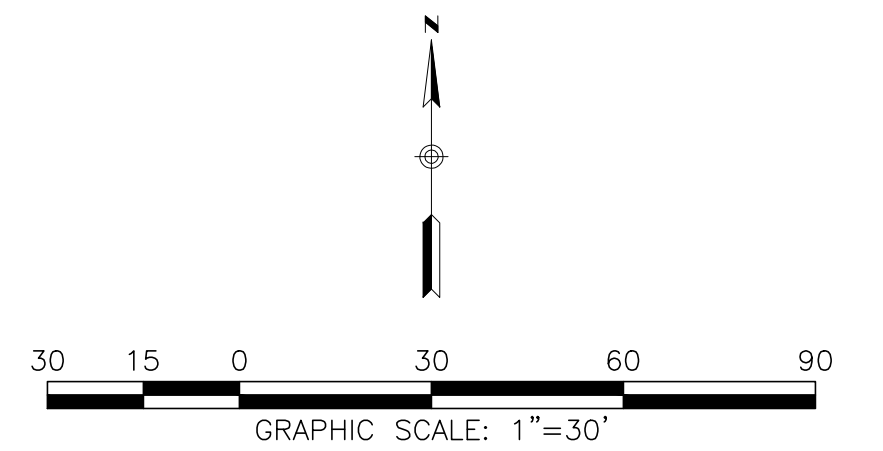
MAP POCKET 2

Post-Project Drainage Study Map for Dunkin Donuts - Chambers & Hess Filing No. 1 Lot 4



RUNOFF SUMMARY TABLE

Design Point /	Area (acres)	Q5 (cfs)	Q100 (cfs)
A4-1	0.30	0.9	2.1
A4-2	0.42	1.4	3.1
A4-3	0.04	0.0	0.1
A4-4	0.01	0.0	0.1



LEGEND

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

**DRAINAGE STUDY MAP
FOR
DUNKIN DONUTS - CHAMBERS & HESS FILING NO.1 LOT 4
(POST-PROJECT)**

DATE: JUNE 30, 2023
SCALE: 1" = 30'

JOB NO. D02243
SHEET: 1 OF 1

RICK
ENGINEERING COMPANY
8678 CONCORD CENTER DR
UNIT 200
ENGLEWOOD, CO 80112
303.537.8020
rickengineering.com