



November 10, 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 three (3) sub-basins, A4-1, A4-2, and A4-3. Together these three (3) 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. The assumed imperviousness for Basin A4 in the FDR was 75%, and the calculated imperviousness for Basin A4 with this study is 67%. 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 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

Calculation of Peak Runoff using Rational Method	
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$$\overline{Q(cfs)} = CIA$$
[illegible]

APPENDIX B

Hydraulic Computations

INLET MANAGEMENT

Worksheet Protected

INLET NAME	A4-1	A4-2	A4-3
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	AREA
Hydraulic Condition	On Grade	On Grade	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows			
Minor Q_{Known} (cfs)	0.9	1.4	0.0
Major Q_{Known} (cfs)	2.1	3.1	0.1
Bypass (Carry-Over) Flow from Upstream			
Receive Bypass Flow from:	No Bypass Flow Received	A4-1	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.2	0.0
Watershed Characteristics			
Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			
Watershed Profile			
Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			
Minor Storm Rainfall Input			
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			
Major Storm Rainfall Input			
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

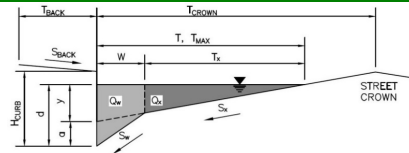
Minor Total Design Peak Flow, Q (cfs)	0.9	1.4	0.0
Major Total Design Peak Flow, Q (cfs)	2.1	3.3	0.1
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.2	0.0	0.0

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_o	=	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
	☐	☐	

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_o	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_{XTH} 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 DepthSlope-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_{XTH}	6.7	6.7	ft
E_o	0.538	0.538	
Q_{XTH}	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

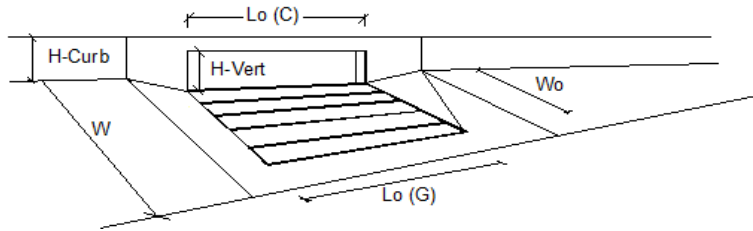
MAJOR STORM Allowable Capacity is based on Depth Criterion

	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)



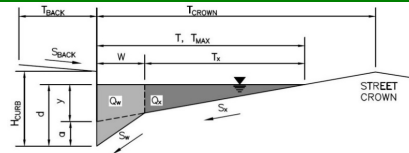
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit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

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}	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
	☐	☐	

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_{XTH} 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 DepthSlope-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_{XTH}	11.1	11.1	ft
E_o	0.411	0.411	
Q_{XTH}	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

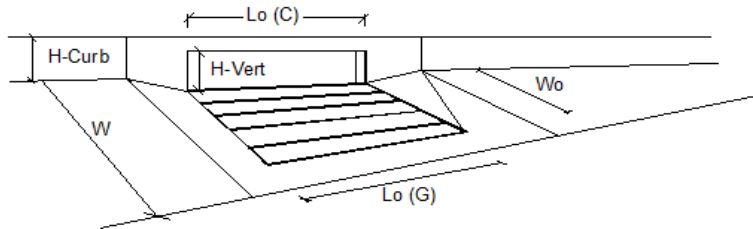
	Minor Storm	Major Storm	
Q_{allow}	14.5	14.5	cfs

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

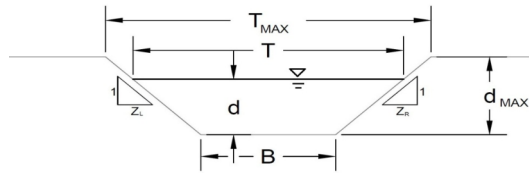
MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	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)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L _u =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W _u =	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 Inlet Management)		Q _d =	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 _g =	1.002	0.852	
Discharge outside the Gutter Section W _u , 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 _{G-GRATE} =	N/A	N/A	
Under No-Clogging Condition					
Minimum Velocity Where Grate Splash-Over Begins		V _o =	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 _o =	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 _d - Q _a (to be applied to curb opening or next d/s inlet)		Q _o =	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 _u)		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 _d (GRATE) - Q _a		Q _o =	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 _o =	0.0	0.0	cfs
Capture Percentage = Q _a /Q _d =		C% =	100	100	%

AREA INLET IN A SWALE

Dunkin Donuts - Chambers & Hess Lot 4
A4-3



This worksheet uses the NRCS vegetative retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)

Manning's n (Leave cell D16 blank to manually enter an n value)

Channel Invert Slope

Bottom Width

Left Side Slope

Right Side Slope

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

A, B, C, D, or E =

C

n = see details below

 S_0 = 0.0240 ft/ft

B = 0.00 ft

 Z_1 = 5.40 ft/ft Z_2 = 10.80 ft/ft

Choose One:

☐ Non-Cohesive☒ Cohesive☐ Paved

Maximum Allowable Top Width of Channel for Minor & Major Storm

Maximum Allowable Water Depth in Channel for Minor & Major Storm

	Minor Storm	Major Storm
T_{MAX} =	5.00	10.00
d_{MAX} =	0.25	0.70

Allowable Channel Capacity Based On Channel Geometry

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Top Width Criterion

	Minor Storm	Major Storm
Q_{allow} =	0.1	0.8
d_{allow} =	0.25	0.62

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow

Water Depth

	Minor Storm	Major Storm
Q_o =	0.0	0.1
d =	0.02	0.29

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 Design Information (Input)

Type of Inlet

CDOT Type C

Inlet Type =

CDOT Type C

Angle of Inclined Grate (must be ≤ 30 degrees)

Width of Grate

Length of Grate

Open Area Ratio

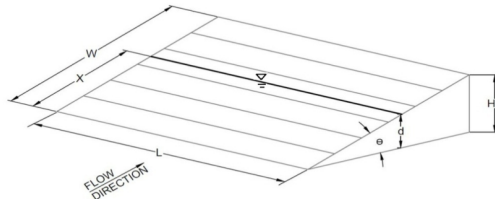
Height of Inclined Grate

Clogging Factor

Grate Discharge Coefficient

Orifice Coefficient

Weir Coefficient

 θ = 0.00 degrees

W = 3.00 ft

L = 3.00 ft

 A_{RATIO} = 0.70 H_B = 0.00 ft C_f = 0.50 C_d = 0.96 C_o = 0.64 C_w = 2.05

Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)

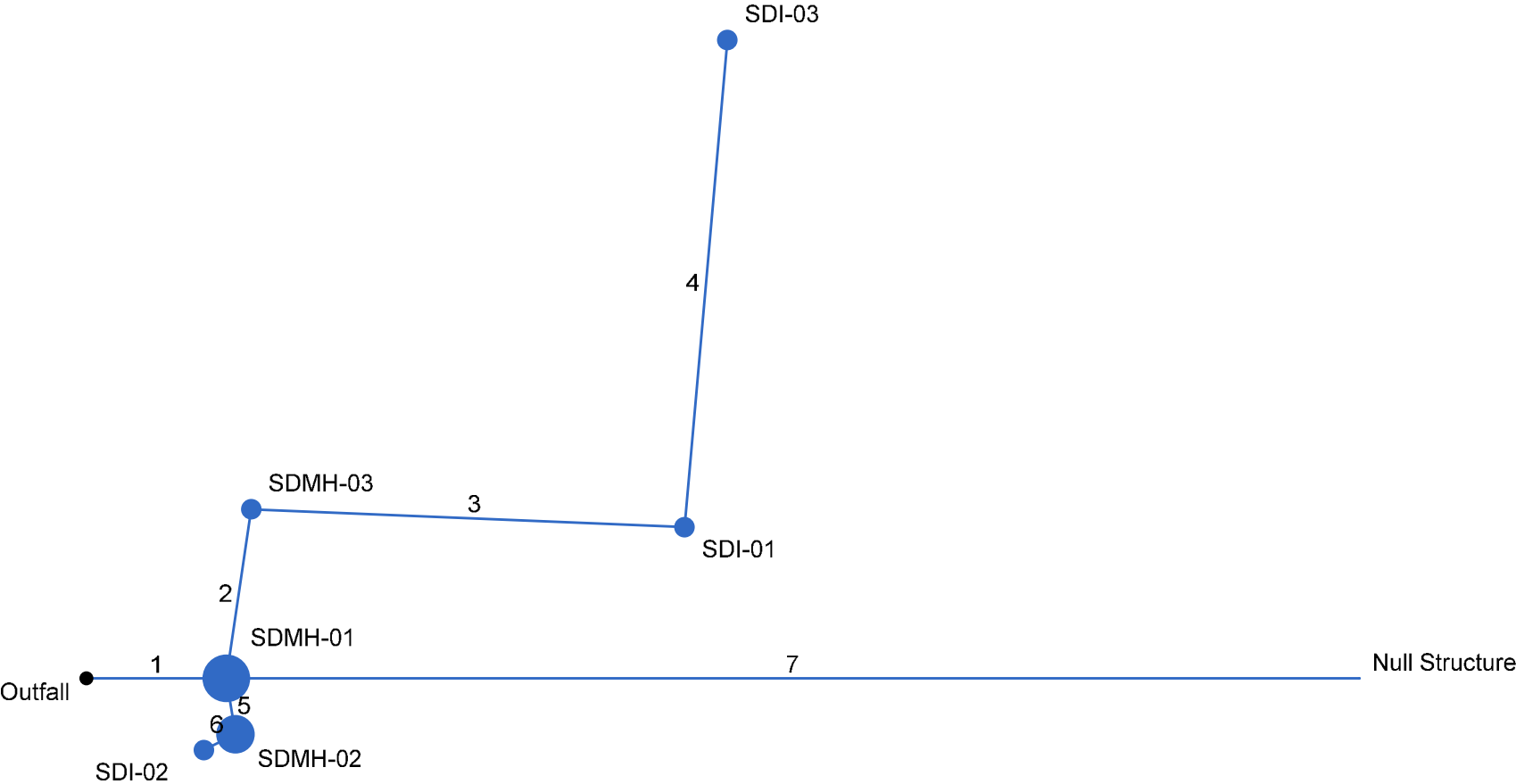
Total Inlet Interception Capacity (assumes clogged condition)

Bypassed Flow

Capture Percentage = Q_a/Q_o

	MINOR	MAJOR
d =	0.02	0.29
Q_a =	0.0	2.9
Q_b =	0.0	0.0
$C\%$ =	100	100

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



Line No.	Line ID	Known Q (cfs)	Line Size (in)	Line Length (ft)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	Flow Rate (cfs)	Capac Full (cfs)	HGL Up (ft)	HGL Dn (ft)	EGL Up (ft)	EGL Dn (ft)	Vel Ave (ft/s)	Vel Up (ft/s)	Vel Dn (ft/s)	J-Loss Coeff	
1	EX P8	0.00	24	15.680	3.38	6064.73	6064.20	6072.02	0.00	10.51	41.57	6065.89 j	6065.93	6066.37	6066.41	4.60	5.56	3.64	0.99 z	
2	P3	0.00	18	18.758	5.00	6066.37	6065.43	6073.21	6072.02	0.91	23.48	6066.73 j	6065.89	6066.85	6066.02	2.41	2.84	1.99	1.00 z	
3	P2	0.90	18	48.177	4.01	6068.50	6066.57	6074.44	6073.21	0.91	21.02	6068.86	6066.78	6068.98	6066.91	4.39	2.84	5.93	1.50 z	
4	P1	0.01	18	54.572	3.99	6070.88	6068.70	6075.00	6074.44	0.01	20.99	6070.92 j	6068.86	6070.93	6068.87	0.49	0.88	0.10	1.00 z	
5	P4	0.00	18	6.377	10.01	6065.87	6065.23	6071.45	6072.02	1.50	33.22	6066.33 j	6065.89	6066.49	6066.06	2.64	3.27	2.00	0.96 z	
6	P5	1.50	18	3.991	10.03	6066.47	6066.07	6071.70	6071.45	1.50	33.26	6066.93	6066.33	6067.10	6066.49	5.35	3.27	7.43	1.00 z	
7	EX P7	8.10	24	125.451	2.87	6068.53	6064.93	0.00	6072.02	8.10	38.31	6069.54	6065.89	6069.94	6066.29	5.25	5.07	5.43	1.00 z	

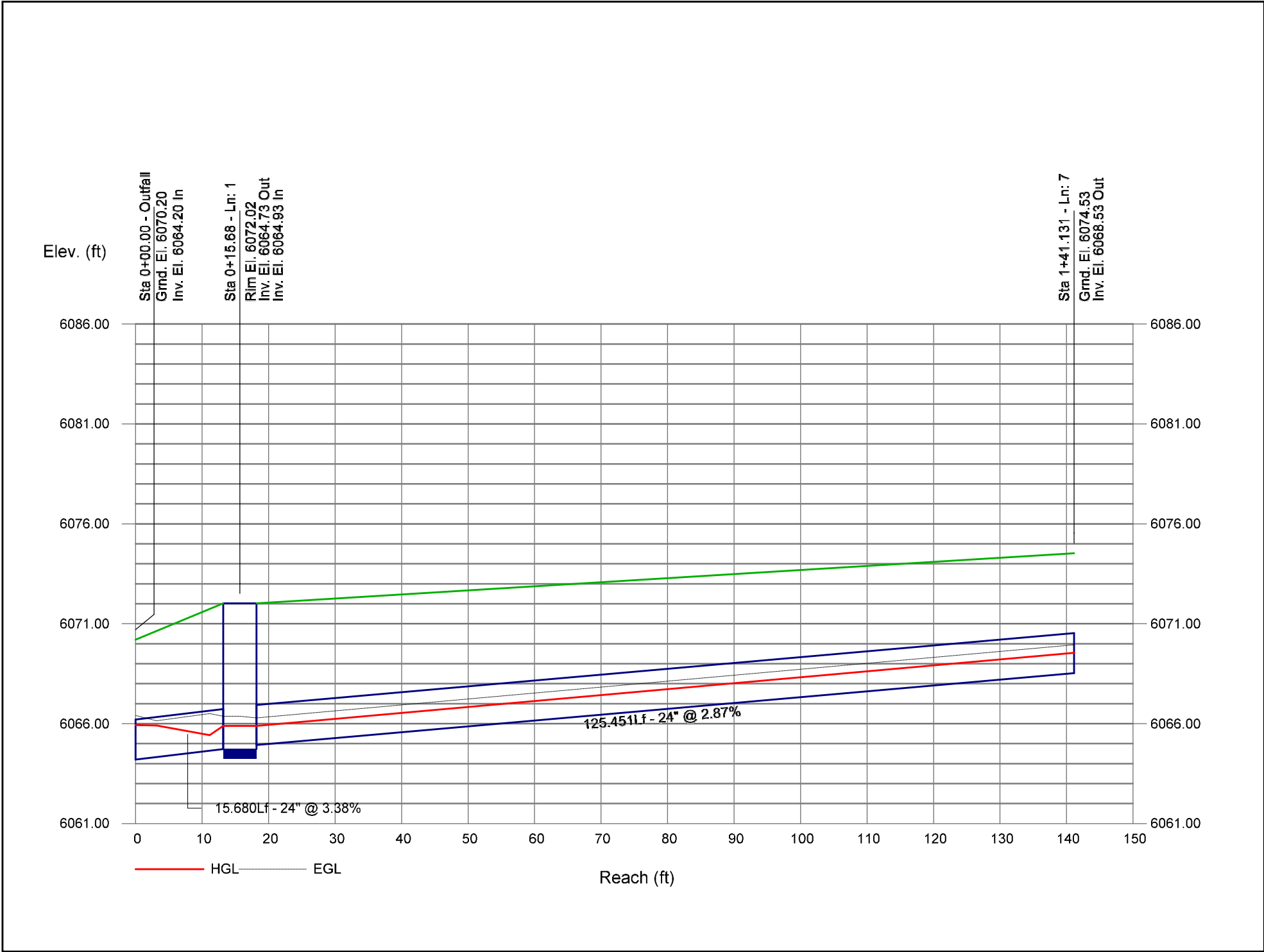
Project File: 2243_5year.stm

Number of lines: 7

Date: 11/3/2023

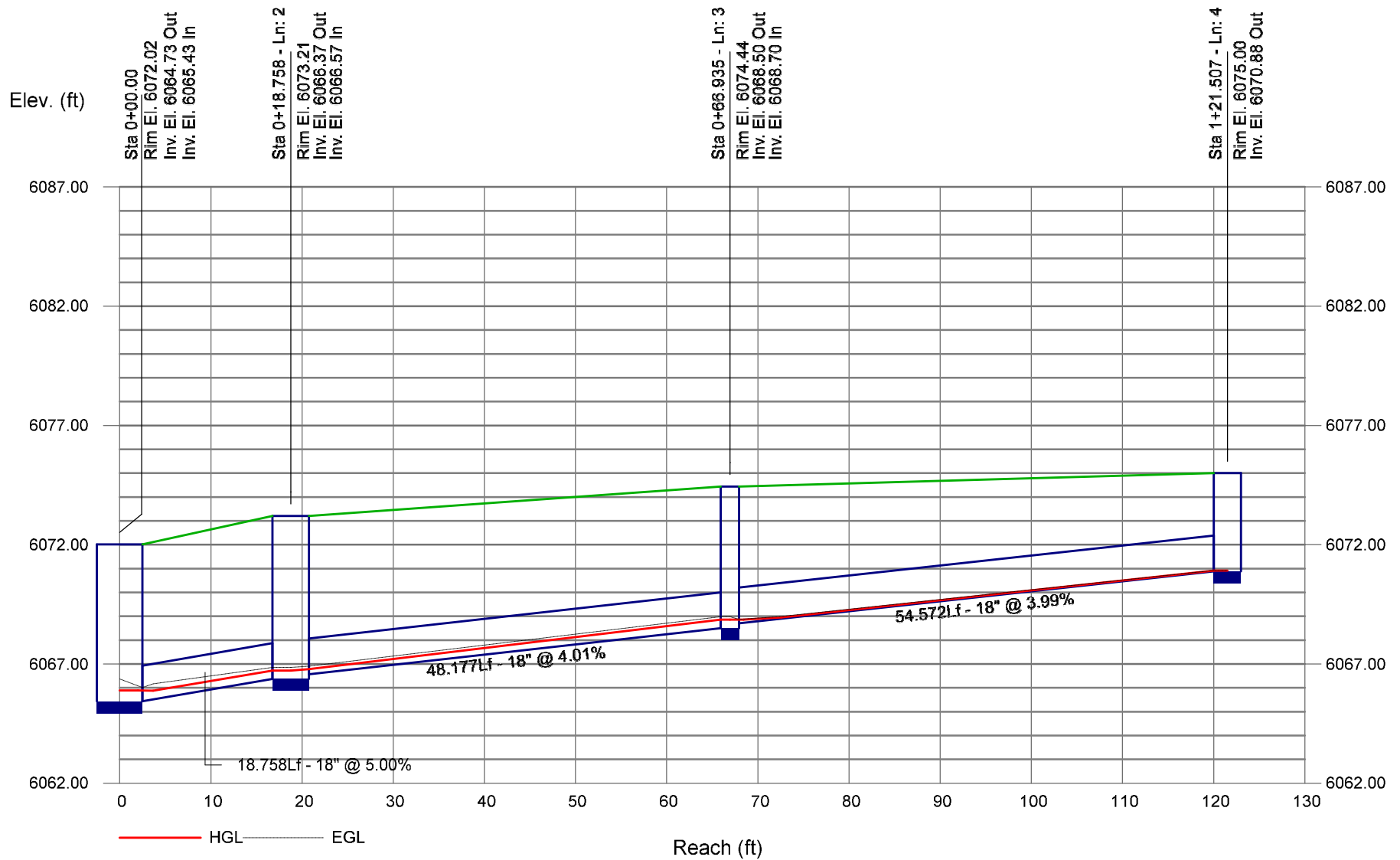
NOTES: ** Critical depth

Storm Sewer Profile

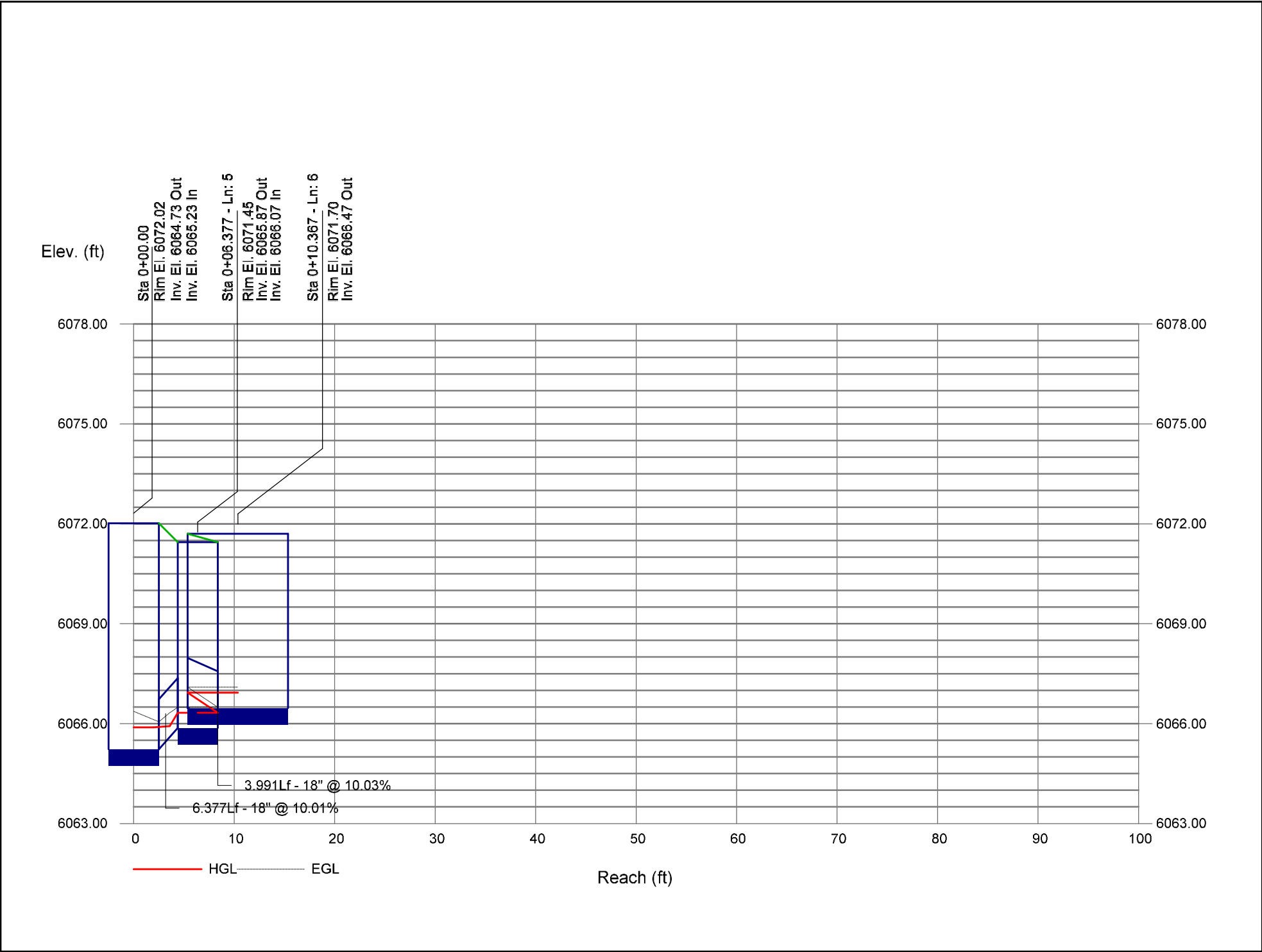


Storm Sewer Profile

Proj. file: 2243_5year.stm



Storm Sewer Profile



Line No.	Line ID	Known Q (cfs)	Line Size (in)	Line Length (ft)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim EI Up (ft)	Gnd/Rim EI Dn (ft)	Flow Rate (cfs)	Capac Full (cfs)	HGL Up (ft)	HGL Dn (ft)	EGL Up (ft)	EGL Dn (ft)	Vel Ave (ft/s)	Vel Up (ft/s)	Vel Dn (ft/s)	J-Loss Coeff	
1	EX P8	0.00	24	15.680	3.38	6064.73	6064.20	6072.02	0.00	24.00	41.57	6066.46	6065.93	6067.53	6067.00	8.29	8.29	8.29	0.99 z	
2	P3	0.00	18	18.758	5.00	6066.37	6065.43	6073.21	6072.02	2.20	23.48	6066.93 j	6066.46	6067.14	6066.67	2.68	3.66	1.70	1.00 z	
3	P2	2.10	18	48.177	4.01	6068.50	6066.57	6074.44	6073.21	2.20	21.02	6069.06	6066.93	6069.27	6067.14	5.20	3.66	6.75	1.50 z	
4	P1	0.10	18	54.572	3.99	6070.88	6068.70	6075.00	6074.44	0.10	20.99	6071.00 j	6069.06	6071.04	6069.10	0.95	1.59	0.31	1.00 z	
5	P4	0.00	18	6.377	10.00	6065.87	6065.23	6071.45	6072.02	3.20	33.21	6066.55	6066.46	6066.81	6066.73	3.08	4.10	2.06	0.96 z	
6	P5	3.20	18	3.991	10.03	6066.47	6066.07	6071.70	6071.45	3.20	33.26	6067.15	6066.55	6067.41	6066.81	5.35	4.10	6.59	1.00 z	
7	EX P7	18.60	24	125.451	2.87	6068.53	6064.93	0.00	6072.02	18.60	38.31	6070.08	6066.46	6070.87	6067.25	7.15	7.11	7.20	1.00 z	

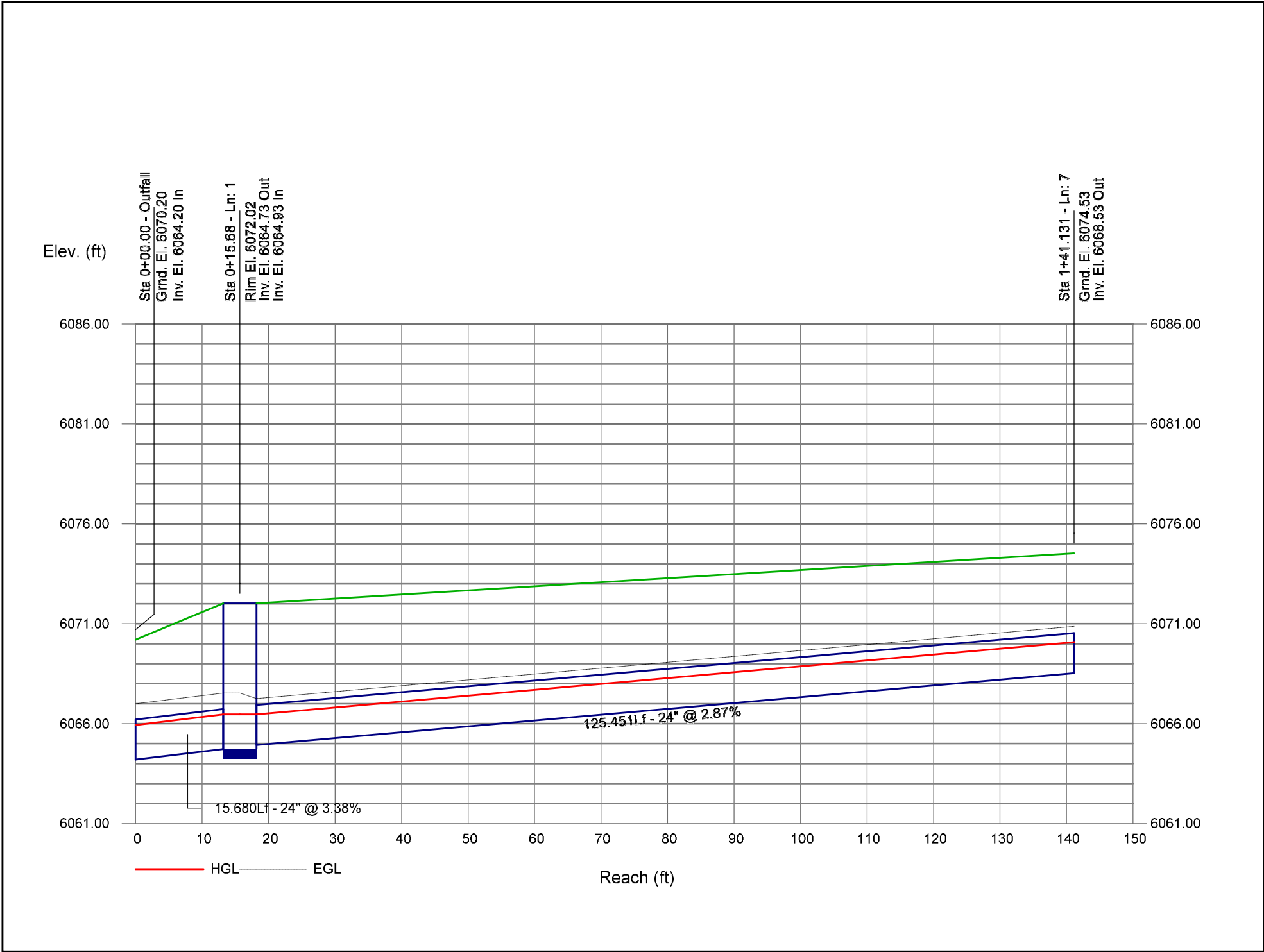
Project File: New.stm

Number of lines: 7

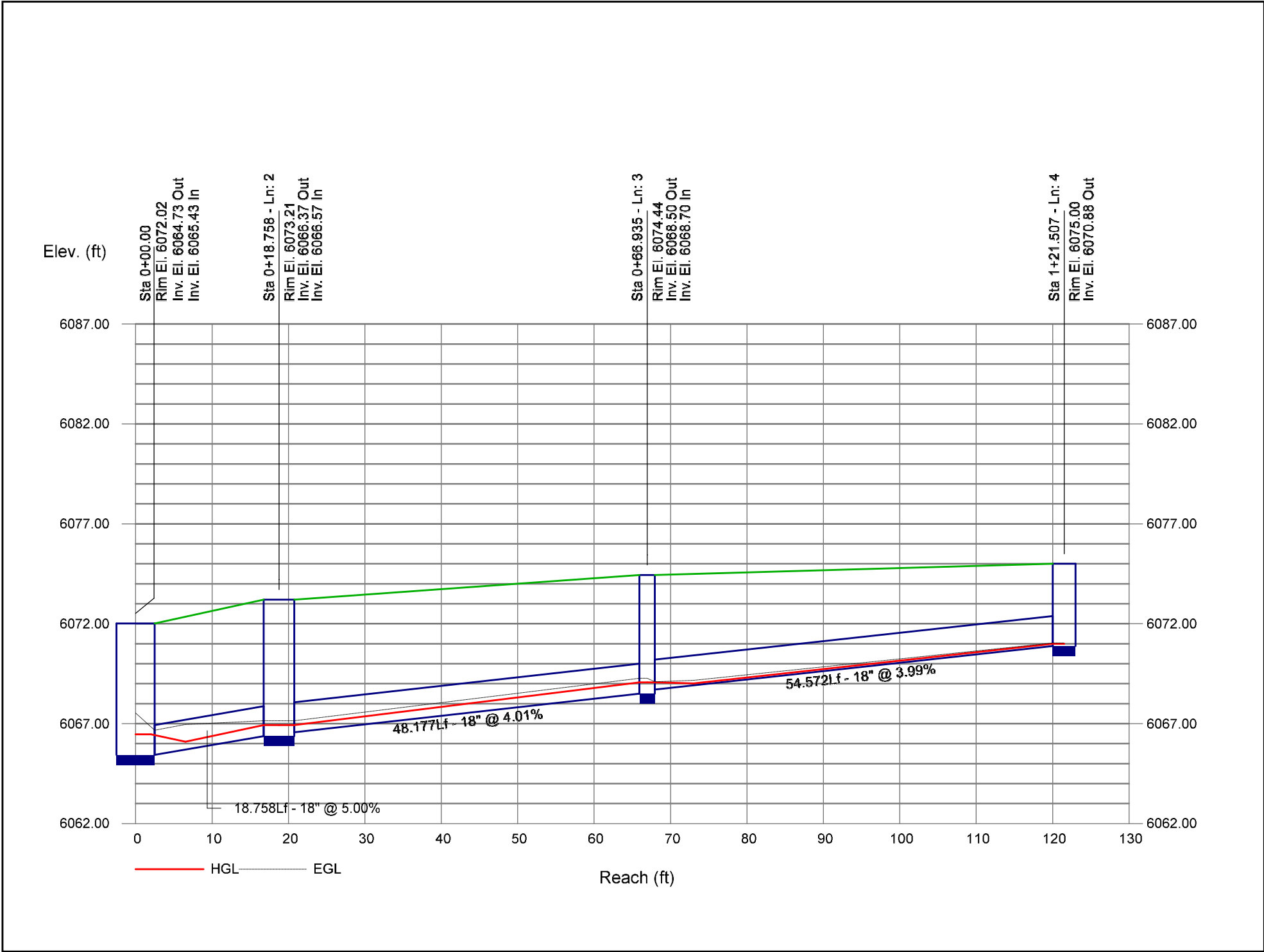
Date: 11/3/2023

NOTES: ** Critical depth

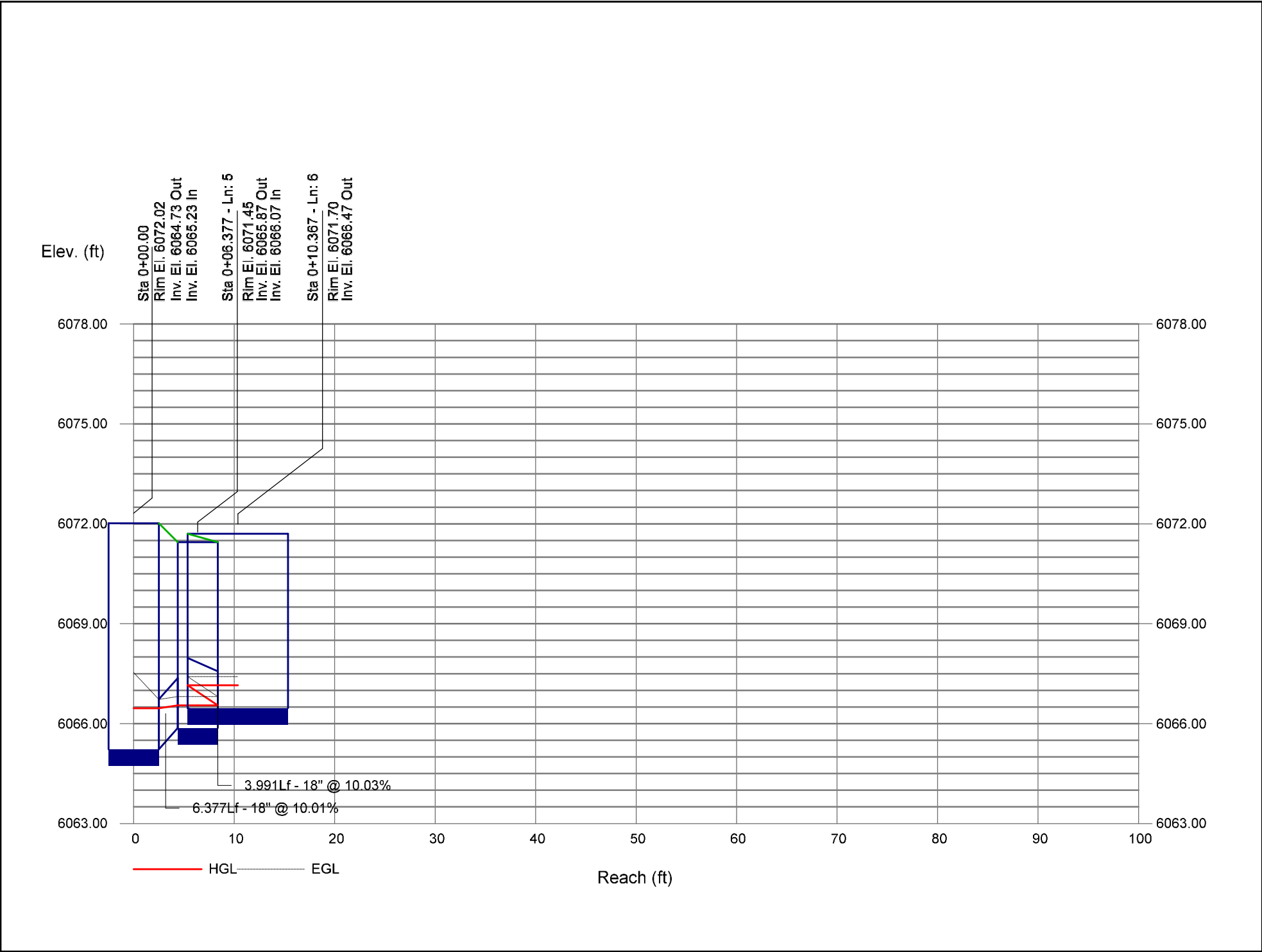
Storm Sewer Profile



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 RD-E

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

= 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

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

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

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

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

Sheet 3 of 3

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) 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)) C) Micro Pool (Minimum Depth = the Larger of $0.5 \times$ Top Stage Depth (2.5') or 2.5') D) Total Volume: $Vol_{tot} = \text{Storage from 5A} + 6A + 6B$ (Must be $>$ Design Volume in 1D, or 1.07334362662912 acre-feet.)	$D_{WQ} = 5.00$ feet Storage = 1.570 acre-feet $D_{BS} = 1.50$ feet Storage = 0.082 acre-feet Surf. Area = 0.055 acres Depth = 2.50 feet Storage = 0.048 acre-feet Surf. Area = 0.019 acres $Vol_{tot} = 1.719$ 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 ☒ 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 = $\frac{1}{3} \times \text{Depth} \times (A+B+(A*B)^{0.5})$

A - Upper Surface

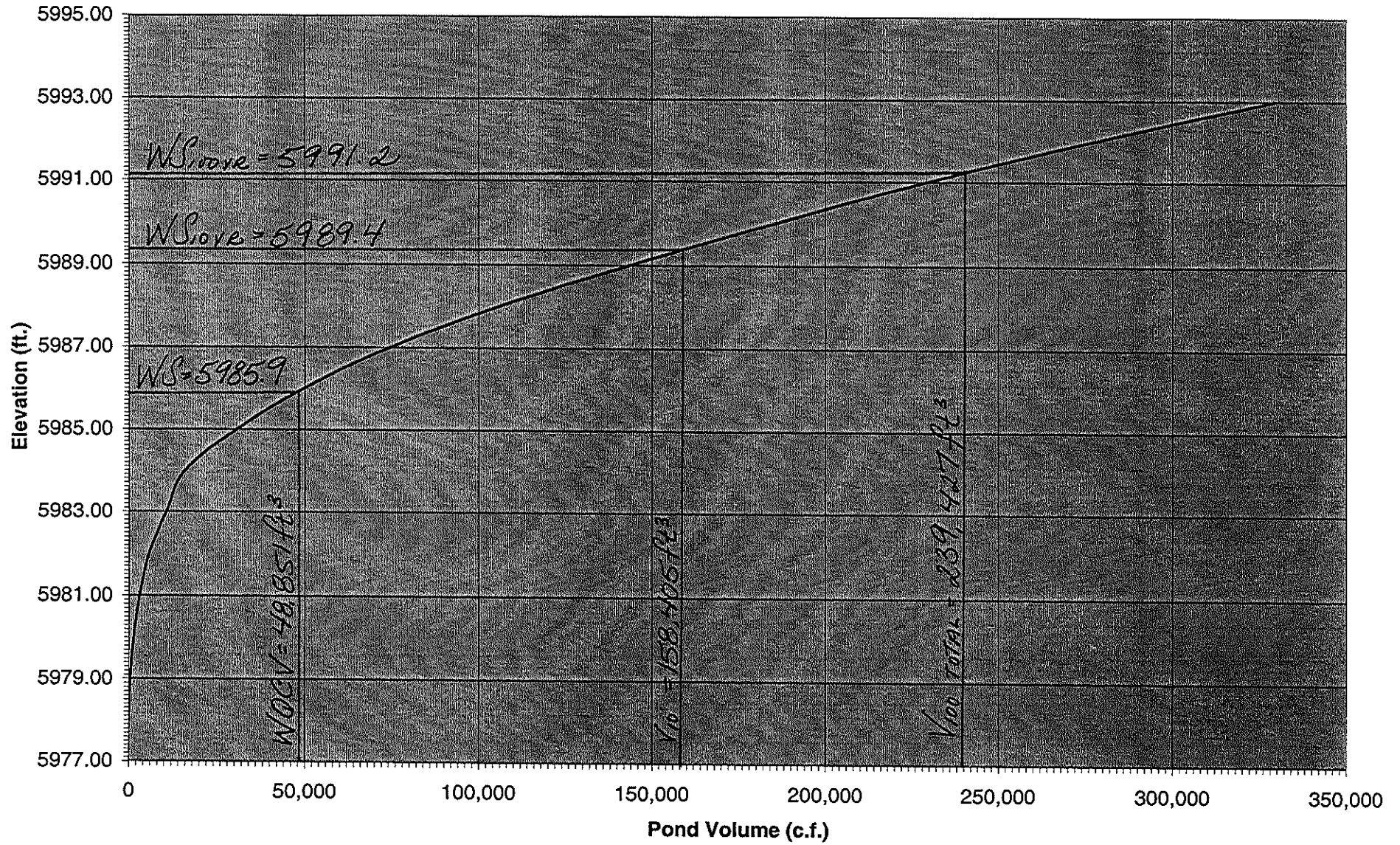
B - Lower Surface

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:

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

$C_d = 3.37$ (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 ft/s²

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

Orifice Equation:

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

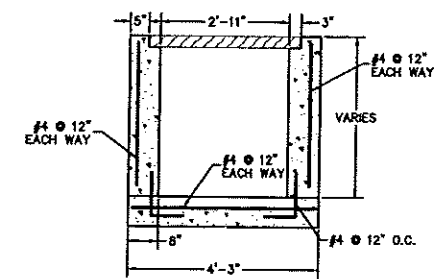
$$Q = C_d * 3.1415 * D^2 / 4 * (2gh)^{1/2}$$

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

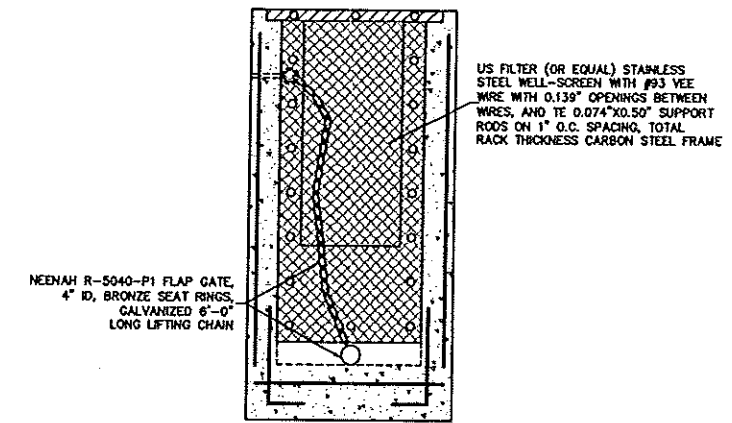
$$D = (Q / (.5105 * (64.4 * h)^{1/2}))^{1/2}$$

Calculation Table for Orifice Size

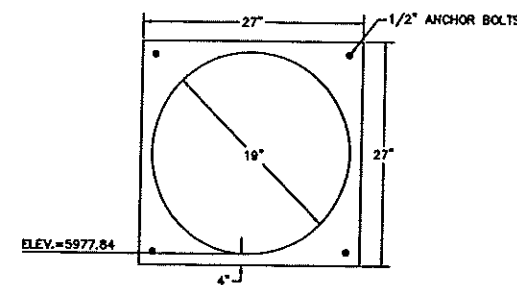
%	h = %*Y	Diam. (D)	Actual h	h/Y
98%	13.09	1.60	12.56	94%
97%	12.96	1.60	12.56	94%
96%	12.83	1.60	12.56	94%
95%	12.69	1.61	12.56	94%
94%	12.56	1.61	12.55	94%
93%	12.42	1.62	12.55	94%
92%	12.29	1.62	12.55	94%
91%	12.16	1.63	12.55	94%
90%	12.02	1.63	12.54	94%
89%	11.89	1.63	12.54	94%
88%	11.76	1.64	12.54	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%

[illegible]

SECTION A-A
NTS

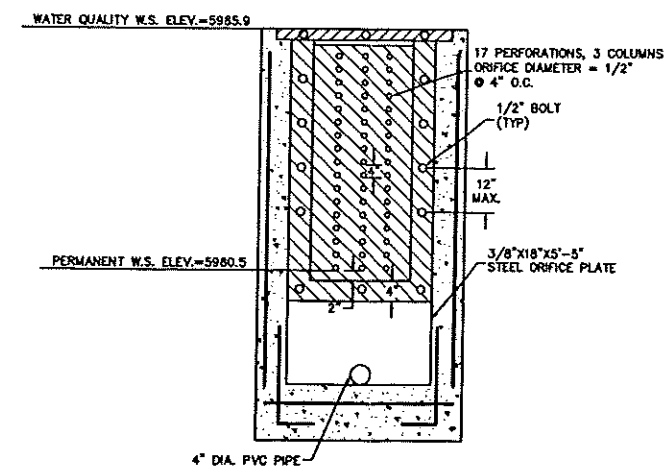


SECTION B-B
NTS



10 YR. RECTANGULAR WEIR
NTS

100 YR. ORIFICE
NTS



SECTION C-C
NTS

	7901 E. Bellview Avenue Suite 150 Englewood, CO 80111 Tel: (720) 452-9526 Fax: (720) 452-9546		No. Revisions		Date Date Appr. Date	
DOUGLAS 234 FILING 1 STREET AND DRAINAGE IMPROVEMENTS POND A OUTLET DETAILS			Continental Homes 7600 East Orchard Road, Ste. 165-S Greenwood Village, CO 80111			
SCALE AS SHOWN	CHECKED BY: MET	FILE NO: KAL	01804102			
DATE: APRIL 29, 2003						

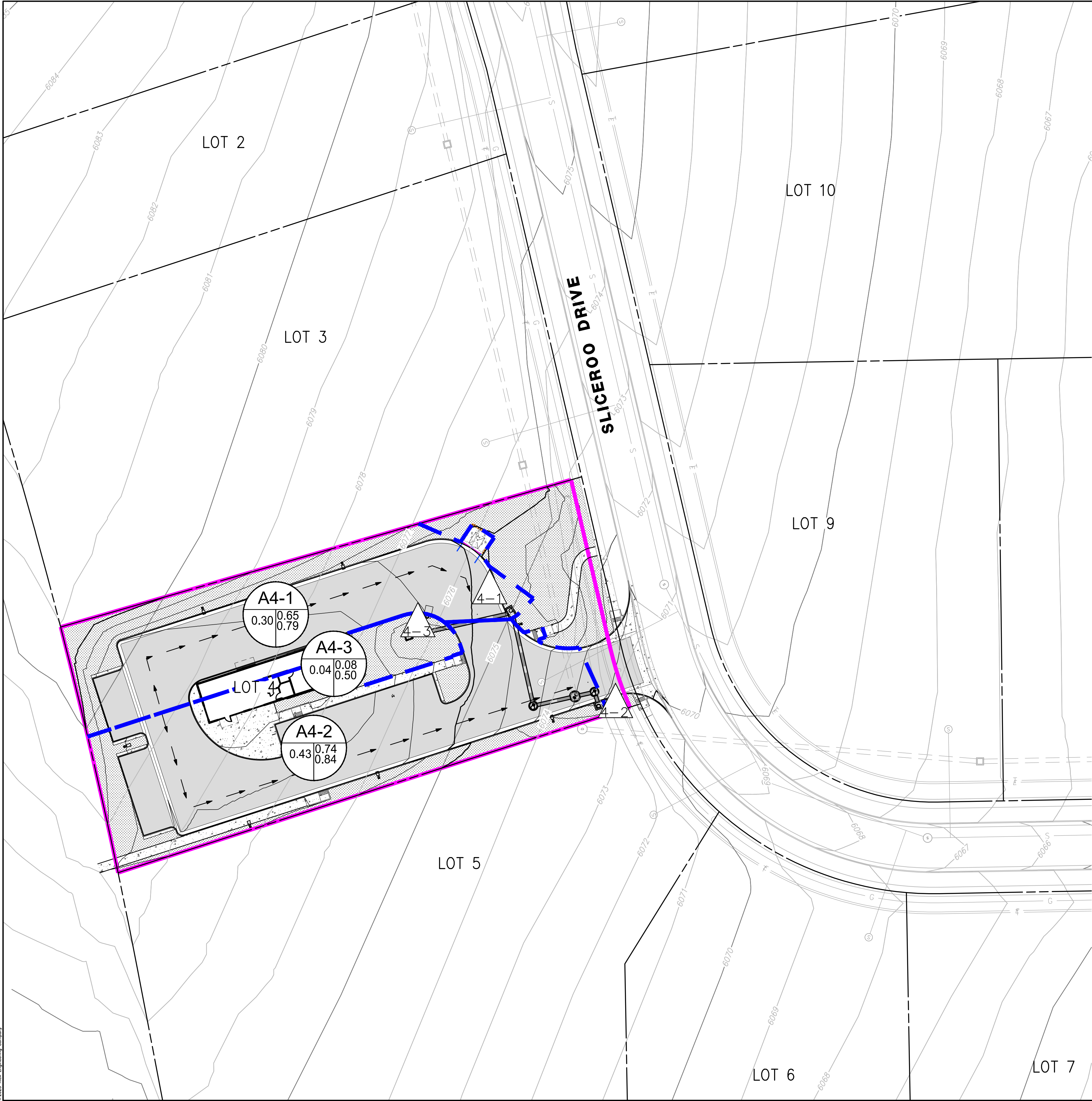
MAP POCKET 1

FOR REFERENCE ONLY

Post-Project Drainage Study Map for Chambers and Hess Filing No. 1
from the approved Final Drainage Report

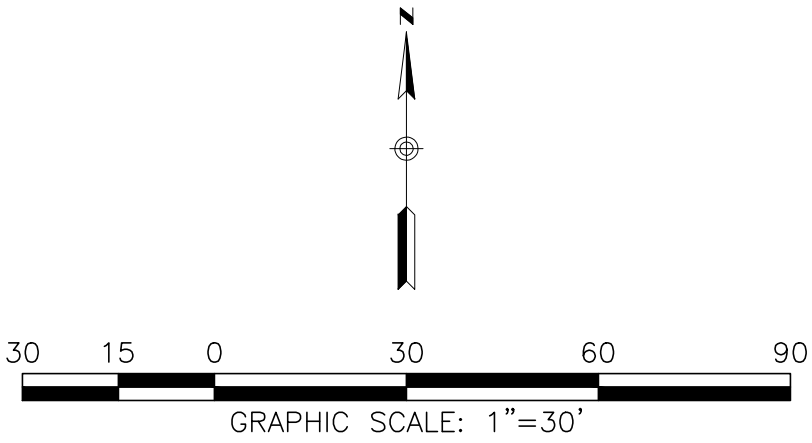
MAP POCKET 2

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

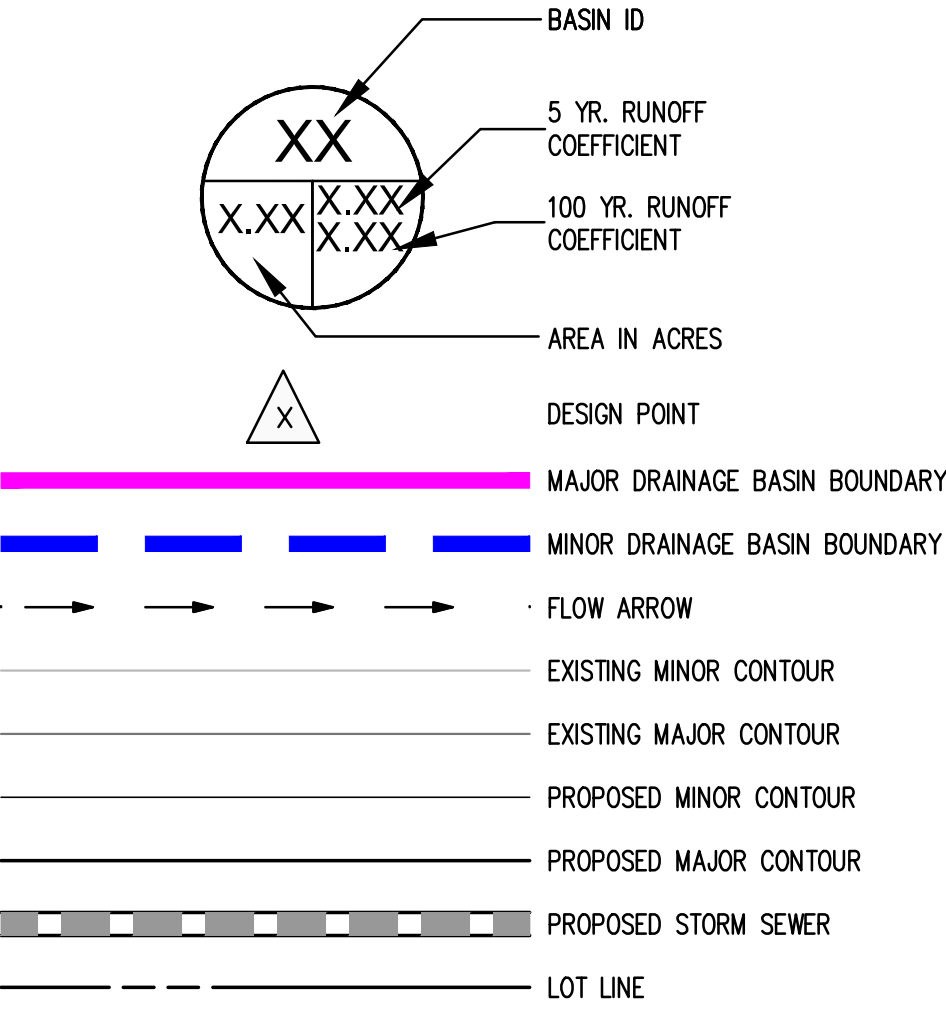


RUNOFF SUMMARY TABLE

Design Point /	Area (acres)	Q5 (cfs)	Q100 (cfs)
A4-1	0.31	0.9	2.1
A4-2	0.43	1.4	3.1
A4-3	0.04	0.0	0.1



LEGEND



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

DATE: NOVEMBER 10, 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