FINAL DRAINAGE LETTER FOR
14160 STONE EAGLE PLACE
LOT 7 GLENEAGLE SUBDIVISION FILING NO. 2
EL PASO COUNTY
GLEN EAGLE, COLORADO

JANUARY 2022

Prepared For:
JAYDEN HOMES
Colorado Springs, Colorado
719.535-9030

Prepared By:

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Colorado Springs, CO 80904
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TNE Job No. 2199.17

PCD File No.: CDR-21-019

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GLEN EAGLE, COLORADO

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FINAL DRAINAGE LETTER FOR
14160 STONE EAGLE PLACE
LOT 7 GLENEAGLE SUBDIVISION FILING NO. 2
EL PASO COUNTY
GLEN EAGLE, COLORADO

DESIGN ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO LICENSED L DUCETT 32339 PROFESSIONAL ENGINEER

L Ducett 2/4/22

L Ducett, P.E. 32339 Date
On behalf of Terra Nova Engineering, Inc.

OWNER/DEVELOPER'S STATEMENT:

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

Authorized Signature Date: 1/26/22

Chris Palmer, Project Manager
Printed Name, Title

Construction by Genesis DBA: Jayden Homes
Business Name

P.O. Box 1982 Monument, CO 801
Address

EL PASO COUNTY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Jennifer Irvine, P.E.
County Engineer / ECM Administrator

Date

APPROVED
Engineering Department
02/04/2022 1:19:08 PM
dsdnijkamp
EPC Planning & Community Development Department

Conditions:

FINAL DRAINAGE LETTER FOR
14160 STONE EAGLE PLACE
LOT 7 GLENEAGLE SUBDIVISION FILING NO. 2
EL PASO COUNTY
GLEN EAGLE, COLORADO

PURPOSE AND JUSTIFICATION

The purpose of this Final Drainage Letter is to identify and analyze the existing drainage patterns, determine existing runoff quantities, and analyze the effects of the proposed home construction on drainage patterns. This parcel has previously been platted and has previously been studied in:

"Final Drainage Report for Gleneagle Golf Course Infill Development Filing No. 2", dated May 2019, prepared by RESPEC.

GENERAL DESCRIPTION

This Final Drainage Report for "14160 STONE EAGLE PLACE LOT 7 GLENEAGLE SUBDIVISION FILING NO. 2", located at 14160 Stone Eagle Place, is an analysis of an approximately 24,291 sf drainage basin. The site is platted as Lot 7 Gleneagle Subdivision Filing No. 2. This report is being required as part of the GEC at the county engineer's discretion as the lot has over 500 cy of fill for the proposed single family home.

The site is in the southeast quarter of Section 6, Township 12 South, Range 67 West of the 6th Principal Meridian within El Paso County. The lot is bounded to the north by Lot 8 to the south by Lot 6 to the west by Stone Eagle Place and to the east by an existing tract with a concrete drainage pan.

The site lies within the Black Forest Drainage Basin, with storm runoff draining from the lot to a newly constructed water quality pond south of the site.

The site consists of Peyton Pring complex and Pring Course sandy loam (hydrologic group "B") per the USDA, NRCS web soil survey. See map in the appendix.

No portion of this site is in the FEMA Floodplain per the FIRM panel 08041C0287F dated March 17, 1997.

The study area consists of one single family lot that is partially developed with some grading and an existing foundation in place. Slopes range from 2% to 33% on the site.

EXISTING DRAINAGE CONDITIONS

Prior to placement of the existing foundation, the site drained to the west with three onsite basins and one offsite basin from the north. See attached Existing Drainage Map in the appendix.

There are three onsite existing drainage basins, and one that is offsite. See attached Existing Drainage Map (in appendix).

Basin OS-1 is 0.16 acres and drains to Design Point A along the north side of the site. This is flow from Lot 8. Basin OS-1 has flows of Q_5 = 0.0 cfs and Q_{100} = 0.4 cfs.

Basin EXA is 0.09 acres and drains to Design Point A along the north side of the site. Basin EXA has flows of Q_5 = 0.0 cfs and Q_{100} = 0.2 cfs. These flows combine with the flows from OS1 to produce combined flows of Q_5 = 0.0 cfs and Q_{100} = 0.6 cfs at Design Point D. From here flows flow to the existing concrete lined swale in Tract A then to the existing water quality pond south of the site.

Basin EXB is 0.31 acres and drains to Design Point B along the east side of the site. This is flow flows to Tract A and then south in the existing concrete lined swale to the existing water quality pond south of the site. Basin EXB has flows of Q_5 = 0.1 cfs and Q_{100} = 0.7 cfs.

Basin EXC is 0.08 acres and drains to Design Point C along the south side of the site. Basin EXC has flows of Q_5 = 0.0 cfs and Q_{100} = 0.3 cfs. Per the previously approve drainage report entitled "Final Drainage Report for Gleneagle Golf Course Infill Development Filing No. 2", dated May 2019, prepared by RESPEC. This area is part of Basin A2C2 and is to drain to the south onto Lot 6 and then into the proposed water quality pond at Design Poing 5 from the previous report (see previous report in appendix.)

PROPOSED DRAINAGE CONDITIONS

In the proposed condition the site will drain primarily to the east and south east. All flow will be directed to the existing water quality pond south of the site. See attached Proposed Drainage Map in the appendix.

There are four onsite proposed drainage basins, and one that is offsite. See attached Proposed Drainage Map (in appendix).

Basin OS-1 is 0.16 acres and drains to Design Point 1 along the north side of the site. This is flow from Lot 8. Basin OS-1 has flows of Q_5 = 0.4 cfs and Q_{100} = 0.8 cfs.

Basin PRA is 0.09 acres and drains to Design Point 1 along the north side of the site. Basin PRA has flows of Q_5 = 0.2 cfs and Q_{100} = 0.5 cfs. These flows combine with the flows from OS1 to produce combined flows of Q_5 = 0.6 cfs and Q_{100} = 1.3 cfs at Design Point 5. These flows will flow in a proposed swale along the north property line. An existing 5' drainage easement is provided on each side of this lot line. Flows will reach a height of 0.41' in this swale spreading 1.25' either side of the property line. This is within the existing easement and will not cause any issues for either lot as long as the swale is properly vegetated. This swale will have a maximum velocity of 2.6 ft / sec and is not erosive. From here flows flow to the existing concrete lined swale in Tract A then to the existing water quality pond south of the site.

Basin PRB is 0.20 acres and drains to Design Point 4 along the east side of the site. This is flow flows to Tract A and then south in the existing concrete lined swale to the existing water quality pond south of the site. Basin PRB has flows of Q_5 = 0.2 cfs and Q_{100} = 0.9 cfs.

Basin PRC is 0.19 acres and drains to Design Point 2 along the south side of the site. Basin EXC has flows of Q_5 = 0.4 cfs and Q_{100} = 1.1 cfs. Per the previously approve drainage report entitled "Final Drainage Report for Gleneagle Golf Course Infill Development Filing No. 2", dated May

2019, prepared by RESPEC. This area is part of Basin A2C2 and is to drain to the south onto Lot 6 and then into the proposed water quality pond at Design Point 5 from the previous report (see previous report in appendix.)

Basin PRD is 0.08 acres and drains to Design Point 3 along the south side of the site. Basin PRD has flows of Q_5 = 0.2 cfs and Q_{100} = 0.4 cfs. Per the previously approve drainage report entitled "Final Drainage Report for Gleneagle Golf Course Infill Development Filing No. 2", dated May 2019, prepared by RESPEC. This area is part of Basin A2C2 and is to drain to the south onto Lot 6 and then into the proposed water quality pond at Design Point 5 from the previous report (see previous report in appendix.)

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County Storm Drainage Design Criteria Manual - Volumes 1 & 2, latest editions. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. The Urban Drainage Criteria Manual was used to calculate the detention and water quality volume.

HYDRAULIC CALCULATIONS

The proposed grass swale at the north edge of the site will adequately convey flows to the west. This channel will have a depth of approximately 0.41' in the 100 year event and flows will not overtop beyond the existing 5' easement on each lot. Total width at the top of the flow is 2.5' wide total. See cross section on the Proposed Drainage Map in the appendix and the calculation in the appendix.

WATER QUALITY

As no changes to the existing drainage conditions are proposed, no water quality treatment or flood control detention is required for this lot. Offsite water quality has been provided for the subdivision south of this site.

EROSION CONTROL

See separate grading and erosion control plan submitted under separate cover. Typical single family lot erosion control measures of silt fence and revegetation are proposed.

CONSTRUCTION COST OPINION

Not applicable.

DRAINAGE FEES

This site has previously been platted, and the proposed Lot 1 is already developed. No fees are required.

MAINTENANCE

The homeowners will be required to maintain their portion of the drainage easement between the lots, the HOA will maintain the concrete swale behind the lots and the existing water quality pond. The owner will be required to revegetate the site and mow the slopes. In addition the proposed walls will need to be constructed per the grading plan and they will need to be maintained by the homeowner.

SUMMARY

Building a home on this site will not adversely affect the surrounding development. The existing and proposed drainage conditions were previously studied and planned for development. No major deviations from the existing, approved reports are noted. Proposed grading will generally follow the intent of the previously approved drainage report and the GEC on file with the county. Water quality is managed offsite per the previously approved plans and drainage report for Gleneagle Subdivision filing No. 2.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

L Ducett, P.E.
President

Jobs//219917/Drainage/219917 Drainage Letter.docx

BIBLIOGRAPHY

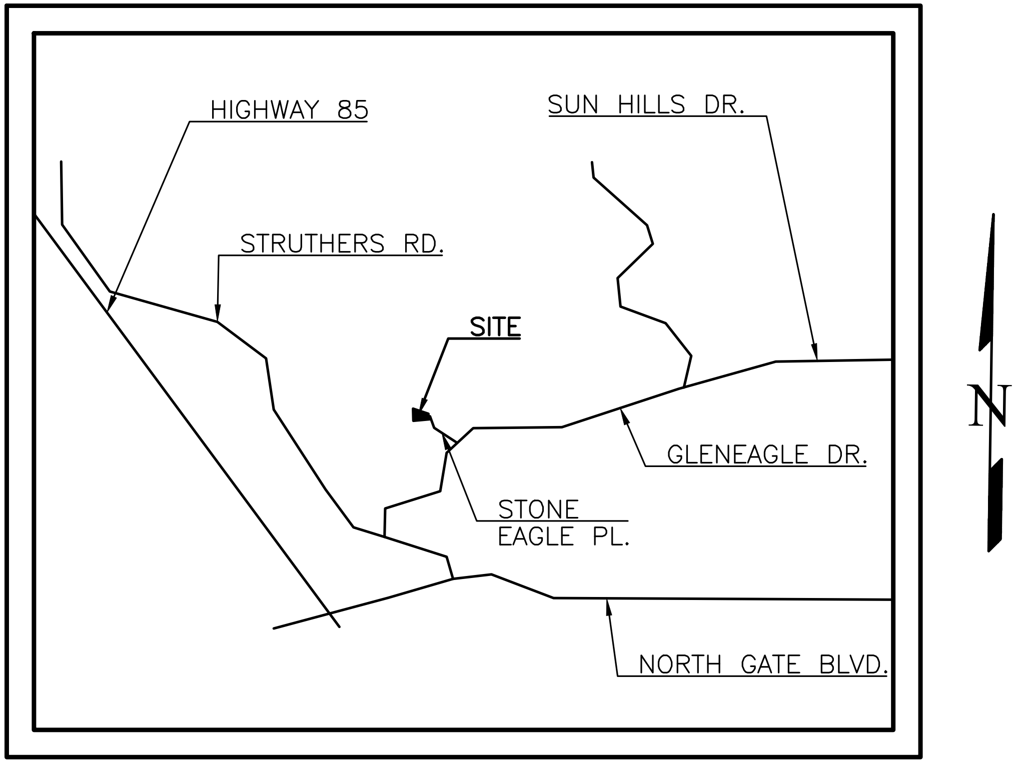
El Paso County Drainage Criteria Manual-Volumes 1 & 2, latest edition

El Paso County Board Resolution No 15-042 (Adoption of Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014, Hydrology and Full Spectrum Detention)

Final Drainage Report for Gleneagle Golf Course Residential Infill Development Filing No. 2 dated May 2019, prepared by RESPEC

Soil Survey of El Paso County Area, Colorado by USDA, NRCS.

VICINITY MAP



VICINITY MAP
N.T.S.

HYDROLOGIC CALCULATIONS

14160 STONE EAGLE PLACE
(Area Runoff Coefficient Summary)

EXISTING CONDITIONS

		STREETS / DEVELOPED			***OVERLAND / UNDEVELOPED***			***WEIGHTED***	
BASIN	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
OS1	0.16	0.00	0.45	0.59	0.16	0.08	0.35	0.08	0.35
EXA	0.09	0.00	0.20	0.44	0.09	0.08	0.35	0.08	0.35
EXB	0.31	0.00	0.30	0.50	0.31	0.08	0.35	0.08	0.35
EXC	0.08	0.00	0.12	0.39	0.08	0.08	0.35	0.08	0.35

PROPOSED CONDITIONS

		STREETS / DEVELOPED			***OVERLAND / UNDEVELOPED***			***WEIGHTED***	
BASIN	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
OS1	0.16	0.08	0.90	0.96	0.08	0.08	0.35	0.49	0.66
PRA	0.09	0.03	0.90	0.96	0.06	0.08	0.35	0.35	0.55
PRB	0.20	0.04	0.90	0.96	0.16	0.08	0.35	0.24	0.47
PRC	0.19	0.09	0.90	0.96	0.10	0.08	0.35	0.47	0.64
PRD	0.08	0.03	0.90	0.96	0.05	0.08	0.35	0.39	0.58

Calculated by: LD
Date: 12/17/2021
Checked by: LD

14160 STONE EAGLE PLACE
AREA DRAINAGE SUMMARY

EXISTING CONDITIONS

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	*INTENSITY*		*TOTAL FLOWS*	
BASIN	AREA TOTAL *(Acres)*	C_5	C_{100}	C_5	Length *(ft)*	Height *(ft)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	TOTAL *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		* For Calcs See Runoff Summary														
OS1	0.16	0.08	0.35	0.08	103	1.0	12.0	50	6.0%	3.7	0.2	12.0	3.8	6.5	**0.0**	**0.4**
EXA	0.09	0.08	0.35	0.08	103	1.0	12.0	40	6.0%	4.9	0.1	12.0	3.8	6.5	**0.0**	**0.2**
EXB	0.31	0.08	0.35	0.08	93	1.0	11.2	50	4.0%	1.0	0.8	11.0	3.9	6.8	**0.1**	**0.7**
EXC	0.08	0.08	0.35	0.08	32	1.0	5.1	15	6.0%	4.9	0.1	5.0	5.0	9.1	**0.0**	**0.3**

PROPOSED CONDITIONS

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	*INTENSITY*		*TOTAL FLOWS*	
BASIN	AREA TOTAL *(Acres)*	C_5	C_{100}	C_5	Length *(ft)*	Height *(ft)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	TOTAL *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		* For Calcs See Runoff Summary														
OS1	0.16	0.49	0.66	0.49	103	1.0	7.2	0	6.0%	3.7	0.0	7.2	4.5	8.0	**0.4**	**0.8**
PRA	0.09	0.35	0.55	0.35	32	6.0	2.1	0	6.0%	4.9	0.0	5.0	5.0	9.1	**0.2**	**0.5**
PRB	0.20	0.24	0.47	0.24	61	10.0	3.2	0	4.0%	1.0	0.0	5.0	5.0	9.1	**0.2**	**0.9**
PRC	0.19	0.47	0.64	0.47	100	10.0	3.4	0	6.0%	4.9	0.0	5.0	5.0	9.1	**0.4**	**1.1**
PRD	0.08	0.39	0.58	0.39	34	12.0	1.6	0	6.0%	4.9	0.0	5.0	5.0	9.1	**0.2**	**0.4**

Calculated by: ld
Date: 12/17/2021
Checked by: LD

14160 STONE EAGLE PLACE
PROPOSED SURFACE ROUTING SUMMARY

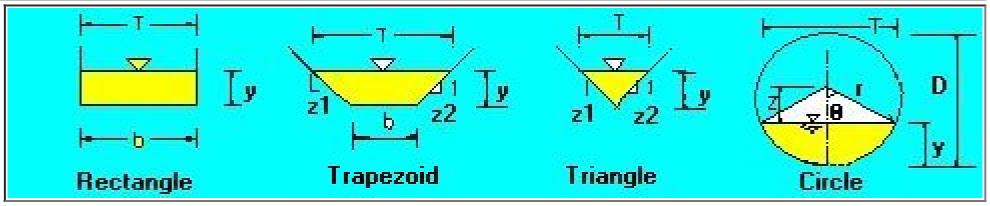
Design Point(s)	Contributing Basins	Area Ac	Flow	
			Q_5	Q_{100}
5	OS 1 AND PRA	0.25	0.6	1.3
D	EXA AND OS1	0.25	0.0	0.6

Calculated by: LD
Date: 12/17/2021
Checked by: LD

HYDRAULIC CALCULATIONS

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.1 ft/ft	Water depth(y): 0.41 ft	Bottom width(b) 0 ft
Flow velocity 2.557828 ft/s	LeftSlope (Z1): 3 to 1 (H:V)	RightSlope (Z2): 3 to 1 (H:V)
Flow discharge 1.3 ft^3/s	Input n value 0.06 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.6 ft	Flow area 0.51 ft^2	Top width(T) 2.47 ft
Specific energy 0.51 ft	Froude number 0.99	Flow status Subcritical flow
Critical depth 0.41 ft	Critical slope 0.0942 ft/ft	Velocity head 0.1 ft

PREVIOUS DRAINAGE REPORT FOR SUBDIVISION

FINAL DRAINAGE REPORT FOR GLENEAGLE GOLF COURSE RESIDENTIAL INFILL DEVELOPMENT FILING NO. 2

PREPARED BY
Michael A. Bartusek, P.E.
RESPEC
3520 Austin Bluffs Parkway, Suite 102
Colorado Springs, CO 80918
719-266-5212

PREPARED FOR
G&S DEVELOPMENT, INC.
9800 Pyramid Court, No. 340
Englewood, CO 80112

May 22, 2019
Project Number 03524

RESPEC

VR-18-018

RESPEC

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City/County for drainage reports, and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Michael A. Bartusek, P.E. #23329

COLORADO REGISTERED
MICHAEL A. BARTUSEK
23329
5/28/19
PROFESSIONAL ENGINEER

DEVELOPER'S STATEMENT:

I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

By: ____________________
Scott Gratrix

Title: President

Address: G&S Development, Inc.
9800 Pyramid Court, Suite 340
Englewood, CO 80112

Filed in accordance with the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

Approved
by Elizabeth Nijkamp
El Paso County Planning and Community Development
on behalf of Jennifer Irvine, County Engineer, ECM Administrator
06/04/2019 2:00:32 PM

Jennifer Irvine P.E. County Engineer/
ECM Administrator

Conditions:

FINAL DRAINAGE REPORT
GLENEAGLE GOLF COURSE RESIDENTIAL INFILL DEVELOPMENT
FILING NO. 2

GENERAL

The Gleneagle Subdivision Filing No. 2 consists of a total of 7.621 acres, of which 0.83 acre will be ROW which previously comprised the Gleneagle Golf Club. The area will be developed with 12 lots and a water quality/detention basin in the western part of the proposed subdivision. The project is located in northwestern El Paso County. It is situated in Sections 6, Township 12 South, Range 67 West of the 6th Principal Meridian, El Paso County, Colorado.

The proposed development was part of the Black Forest Drainage Basin Planning Study, prepared by Wilson and Company in May 1989. The study used storm intervals of ten and 100 years. Our study follows the current City/County Drainage Criteria Manual and uses the five- and 100-year storms.

SOILS

The Soil Conservation Service (NRCS) soil survey for El Paso County has identified three soil types in this study area. They are as follows:

Map Symbol No.	Soil Name	Hydrologic Soil Group
68	Peyton-Pring Complex	B
71	Pring Coarse Sandy Loam	B

FLOODPLAIN STATEMENT

None of the site is located within a 100 year floodplain as determined by FEMA on the Flood Insurance Rate Map (FIRM) Panel 08041 CO287F, dated March 17, 1997.

METHOD OF COMPUTATION

The methodology used for this report is in accordance with the *City/County Drainage Criteria Manual*. The Rational Method for computation of runoff was used for local basin design.

$$Q = cia$$

Where	Q	=	Maximum rate of runoff in cubic feet per second
	c	=	Runoff coefficient representing drainage area characteristics
	i	=	Average rainfall intensity, in inches per hour, for the duration required for the runoff to become established
	a	=	Drainage basin size in acres

WETLANDS

No identified wetlands occur within the project area according to the Natural Features and Wetland Report prepared by Ecosystem Services LLC in March 2016.

EXISTING PONDS

No existing ponds are located within the project area. There is a non-jurisdictional stormwater basin located within the western area of the site which is identified on the "Existing Conditions" drainage plan.

WATER QUALITY/DETENTION CONCEPTS

In accordance with current NPDES requirements, stormwater quality BMPs will be incorporated into the development of this project. Water quality facilities will be included in all proposed detention facilities. A water quality/detention basin will be built as part of this project. The new detention basin will be equipped with a 2.5' micro-pool per the DCM Volume 2.

EXISTING DRAINAGE CONDITIONS

As stated previously, the Gleneagle Subdivision Filing No. 2 encompasses approximately 7.62 acres. This study focuses on the development of the 12 lots in the southern part of this development.

This filing of the subdivision drains the southwest area of the Gleneagle Subdivision. This basin drains the area west of the large detention pond from Filing No. 1 and Huntington Beach Dr. and north of Gleneagle Dr.

The basin flows into an existing sump area before it drains overland through existing lots along Westchester Drive. **Basin A** has further been divided into several sub-basins.

Sub-Basin A1 drains the runoff from the homes on Gleneagle Drive just west of Huntington Beach Drive. It produces flows of 1.5 cfs for the five-year storm and 5.4 cfs for the 100-year storm. The runoff then flows into Sub-Basin A2. Some flows from this Sub-Basin enters the adjacent sub-basin through a roadside swale, while most just sheet flows from the street.

Sub-Basin A2 drains the area between the existing sump detention area and Westchester Drive. The mostly undeveloped area produces flows of 3.2 cfs for the five-year storm and 22.1 cfs for the 100-year storm. When combined with the flows from Sub-Basin 1 at **DP1** the resulting flows are 4.2 cfs and 25.7 cfs for the five- and 100-year storms, respectively. This runoff currently sheet flows through the existing lots 10 and 11, located mostly on lot 10. These flows continue to the existing ditches along Westchester Drive within Sub-Basin OS1. Calculations show that these flows will split with some flows continuing to the Westchester ditch and some flowing around the back of the house and onto lot 9.

Sub-Basin A3 is a very small area along Gleneagle Drive which sheet flows off of the street and then flows through a small ditch to Westchester Drive. This area produces flows of 1.4 cfs for the five-year storm and 3.9 cfs for the 100-year storm.

Sub-Basin OS1 drains the area southern south of the Westchester Drive culvert and north of the street. It produces flows of 6.9 cfs for the five-year storm and 21.8 cfs for the 100-year storm. These flows and flows from Sub-Basin A3 combine at **DP2** to produce flows of 6.7 cfs and 20.8 cfs for the five- and 100-year storms, respectively. These flows travel north to the existing 30-inch culvert.

Sub-Basin A4 drains the undeveloped area northwest of pond B. It produces flows of 0.3 cfs for the five-year storm and 2.3 cfs for the 100-year storm. These flows then travel along Westchester Drive into Sub-Basin OS2.

Sub-Basin OS2 drains a small area along Westchester Drive, producing flows of 1.3 cfs for the five-year storm and 4.3 cfs for the 100-year storm. These flows and flows from Sub-Basin A4 combine at **DP3** to produce flows of 1.5 cfs and 6.3 cfs for the five- and 100-year storms, respectively. These combined flows then travel south along the Westchester Drive ditch, joining with flows from DP3 at **DP4**. The total combined flows at DP4 are 8.0 cfs and 26.3 cfs for the five- and 100-year storms, respectively.

The combined, total runoff at the existing 30-inch CMP located under Westchester Drive (**DP5**) is 10.7 cfs for the five-year storm and 47.2 cfs for the 100-year storm.

The estimated runoff amounts produced for the project under existing conditions are shown in Table 1 below.

TABLE 1 – EXISTING CONDITIONS		
Sub-Basin	Q_5CFS	Q_{100} CFS
A1	1.5	5.4
A2	3.2	22.1
A3	1.4	3.9
A4	0.3	2.3
OS1	6.9	21.8
OS2	1.3	4.3
DP1(A1+A2)	4.2	25.7
DP2(A3+OS1)	6.7	20.8
DP3(A4+OS2)	1.5	6.3
DP4(DP2+DP3)	8.0	26.3
DP5(DP4+DP1)	10.7	47.2

DEVELOPED DRAINAGE CONDITIONS

A total of 12 lots are proposed within this portion of the previous golf course property. With the average lot size over one-half acre, the resultant increases in flows will be slight. However, a new detention facility will be used to keep flows below historic levels. New ditches and swales will also be added to further reduce the flows that currently flow toward the homes. As a result of the proposed detention basins and other drainage improvements no adverse impacts will result due to this project.

Sub-Basin A1 will remain unchanged and will produce flows of 1.5 cfs for the five-year storm and 5.4 cfs for the 100-year storm. These combined flows will then travel into Sub-Basin A2A.

Sub-Basin A2A will drain the area just west and south of existing Pond B. It will produce flows of 1.6 cfs for the five-year storm and 9.1 cfs for the 100-year storm event. These flows will travel in proposed Swale J. Flows from Sub-Basin A1 and A2A will combine at **DP1** and produce flows of 2.8 cfs and 13.5 cfs for the five- and 100-year storms, respectively.

Sub-Basin A2B1 will drain the area east of Stone Eagle Place. It will produce flows of 1.1 cfs for the five-year storm and 5.1 cfs for the 100-year storm. Flows from this sub-basin and DP1 will combine in a proposed swale at **DP2** to produce total flows of 3.7 cfs and 17.6 cfs for the five- and 100-year storms, respectively. These flows will be directed under Stone Eagle Place through a 24-inch RCP culvert.

Sub-Basin A2B2 will drain the east side of Stone Eagle Place. It will produce flows of 1.1 cfs for the five-year storm and 2.3 cfs for the 100-year storm. These flows will be intercepted at the low point of the street by a Denver Type 16 window inlet situated over the 24" RCP.

Sub-Basin A2C1 will drain the west side of Stone Eagle Place and be directed to a Denver Type 16 window inlet at the low point situated over the 24" RCP. It will produce flows of 1.4 cfs for the five-year storm and 2.9 cfs for the 100-year storm. Flows from this sub-basin will combine with the flows from Sub-Basin A2B2 and DP2 to produce a combined flow at **DP3** of 5.6 cfs and 21.4 cfs for the five- and 100-year storms, respectively.

Sub-Basin A2C2 will drain the area west of Stone Eagle Place and contains the proposed homes. It will produce flows of 1.3 cfs for the five-year storm and 4.2 cfs for the 100-year storm. Flows from this sub-basin and DP3 will combine at **DP4** to produce total flows of 6.6 cfs and 24.5 cfs for the five- and 100-year storms, respectively. These flows will then be directed into a new detention/water quality facility in Sub-Basin A2D.

Sub-Basin A2D will drain the back areas of the lots located along Stone Eagle Place and portions of the old golf course. It will produce flows of 1.7 cfs for the five-year storm and 9.7 cfs for the 100-year storm. These flows will travel through proposed Swale L with a 12" berm added where the swale makes a 90 degree bend. The combined, undetained flows at the new water quality/ detention basin C (**DP5**) will be 6.8 cfs and 28.9 cfs for the five- and 100-year storms, respectively. The outflow from this proposed detention basin will be 2.8 cfs and 18.0 cfs for the five- and 100-year storms, respectively. Flows from this detention basin will be directed to a proposed 24" private HDPE storm sewer which will be located within a private drainage easement on Lot 7. The easement will be owned and maintained by the Gleneagle Civic Association (GCA). In addition the detention overflow swale will also connect to this storm sewer which will discharge into an improved ditch along Westchester Drive by utilizing the Roadway and Utility Easement per Book 2767 Page 809 as a Public Drainage Easement for the 24" storm sewer. El Paso County will have access to this storm sewer through this easement.

Sub-Basin A3 is a very small area along Gleneagle Drive and flows through a small ditch to Westchester Drive in Sub-Basin OS4. This area produces flows of 1.4 cfs for the five-year storm and 3.9 cfs for the 100-year storm, which is less than existing conditions.

Sub-Basin OS1 drains the southern developed area of Westchester Drive. It produces flows of 4.5 cfs for the five-year storm and 15.1 cfs for the 100-year storm. These flows and flows from Sub-Basin A3 combine at **DP6** to produce flows of 4.8 cfs and 15.6 cfs for the five- and 100-year storms, respectively. These combined flows then travel north along the Westchester Drive ditch to the existing 30" CMP in Westchester Drive.

Sub-Basin A4 drains the undeveloped area northwest of Pond B. It produces flows of 0.3 cfs for the five-year storm and 2.3 cfs for the 100-year storm which flow toward the existing 30-inch CMP in Westchester Drive. These flows are less than existing conditions and travel along Westchester Drive into Sub-Basin OS2.

Sub-Basin OS2 drains the southern developed area of Westchester Drive and will remain unchanged, producing flows of 3.5 cfs for the five-year storm and 10.7 cfs for the 100-year storm. These flows and flows from Sub-Basin A4 combine at **DP7** to produce flows of 3.5 cfs and 12.0 cfs for the five- and 100-year storms, respectively. These combined flows then travel south along the Westchester Drive ditch to the existing 30" CMP in Westchester Drive. The combined flows at DP8 at the culvert will be 7.9 cfs and 26.1 cfs for the five- and 100-year storms, respectively.

Table 2 shows the estimated runoff produced for the project under developed conditions:

TABLE 2 – DEVELOPED CONDITIONS		
Sub-Basin	**Q_5CFS**	**Q_{100} CFS**
OS1	4.5	15.1
OS2	3.5	10.7
A1	1.5	5.4
A2A	1.6	9.1
A2B	1.9	6.6
A2C	2.7	7.2
A2D	1.7	9.7
A3	1.4	3.9
A4	0.3	2.3
DP1 (A1+A2A)	2.8	13.5
DP2 (DP1+A2B)	4.4	18.8
DP3 (DP2+A2B)	6.2	23.3
DP4 (DP3+A4B)	7.0	28.9
DP5 (OS1+A3)	4.8	15.6
DP6 (DP4+DP5)	10.9	41.6
DP7 (OS2+A4)	3.5	12.0

The water quality basin is designed in accordance with current NPDES requirements for extended detention basins. The basin will be constructed with a 2.5-foot permanent micro-pool. Design forms for these basins can be found in *Appendix B*. The design summary is below.

TABLE 3 –WATER QUALITY DESIGN SUMMARY				
Location	**Depth**	**Size (SF)**	**Depth (FT)**	**Size (SQ IN)**
Sub-Basin A2D Detention Basin C	2.66	21,400	0,0.34,0.69	0.86,0.86,0.86

DETENTION BASIN

Developed flows from this project will be reduced to historic levels or below by using detention facilities. The *UDFCD Design for Full Spectrum Detention Basins* is used for the basin design.

TABLE 4 DETENTION BASIN DETAILS				
Location	**Size (AF)**	**Pipe Outlet**	**Outlet Structure**	**Riprap Weir Width**
A2D	0.817	24"	Typical Outlet Structure OS-2	13'

The above detention facility has been designed to reduce the total off-site flows to below historic levels. The facility will be maintained per the Private Detention/Stormwater Agreement, Rec No. 217097158.

PUBLIC DRAINAGE FACILITIES

Item	Unit	Quantity	Unit Cost	Total Cost
24" RCP FES	EA	2	$700	$ 1,400.00
24" RCP	LF	293.7	$84	$ 24,670.80
Denver Type 16 Inlet	EA	2	$3270	$6,540.00
Storm MH Type II	EA	3	$4575	$13,725.00
			Sub-Total	$46,335.80
			15% Contingency & Engineering	$ 6,950.37
			TOTAL	**$53,286.17**

PRIVATE DRAINAGE FACILITIES

Item	Unit	Quantity	Unit Cost	Total Cost
Saddle S Headwall	EA	1	$1,500	$1,500.00
24" HDPE FES	EA	1	$500	$ 500.00
24" HDPE	LF	512	$75	$38,400.00
Type C Inlet	EA	1	$3,270	$ 3,270.00
Riprap, d50 from 6" to 12"	CY	17	$98	$ 1,666.00
Detention Outlet Structure	EA	1	$8,000	$ 5,000.00
Emergency Spillway	EA	1	$1,500	$ 1,500.00
			Sub-Total	$51,360.00
			15% Contingency & Engineering	$ 7,775.40
			TOTAL	**$51,135.40**

DRAINAGE BASIN FEES

Although the Gleneagle Golf Course Residential Infill Development Filing No. 2 was previously platted under the original subdivision as Tract G, drainage fees must be paid on the impervious acreage of the subdivision.

7.62 Developed Acres x 23% impervious = 1.75 acres
2019 Drainage Fee = $18,350 per impervious acre x 1.75 = $32,112.50
2019 Bridge Fee = $500 per impervious acre x 1.75 = $875.00

Drainage basin fees for this development will be provided at the existing current fee rate when the final drainage report is submitted at the time of platting.

CONCLUSION

The proposed development and subsequent lot developments follow the "four Step Process" as mandated by the EPA as follows:

Step 1: Employ runoff reduction practices

Runoff has been reduced by disconnecting impervious areas where possible, eliminating "unnecessary" impervious areas and encouraging infiltration into suitable soils.

- Impervious areas have been directed to earth swales to encourage infiltration.
- Gravel will be used in portions of the lots to reduce the impervious of the areas.

Step 2: Stabilize drainageways

All drainageways, ditches and channels have been stabilized by the following methods:

- Tributaries have been left in their relatively natural state where possible.

- New drainageways and swales have been stabilized with either riprap or erosion control fabric depending on the erosion potential.
- No new roadside ditches are proposed for the development.

Step 3: Provide water quality capture volume (WQCV)

The proposed development will disturb approximately 7.6 acres, a WQCV of 0.121 ac-ft will be provided.

Step 4: Consider need for industrial and commercial BMP's.

The development of this project will not affect sensitive waters.

The development of this site will have little impact on downstream properties once the EDB is constructed.

The development of this site will have little impact on downstream properties once the water quality/detention basins are constructed.

REFERENCES

1. City of Colorado Springs and El Paso County (1994). ***Drainage Criteria Manual Volume 1*** (DCM).

2. City of Colorado Springs and El Paso County (1994). ***Drainage Criteria Manual Volume II*** (DCM).

3. Soil Survey of El Paso County Area, Colorado by USDA, NRCS.

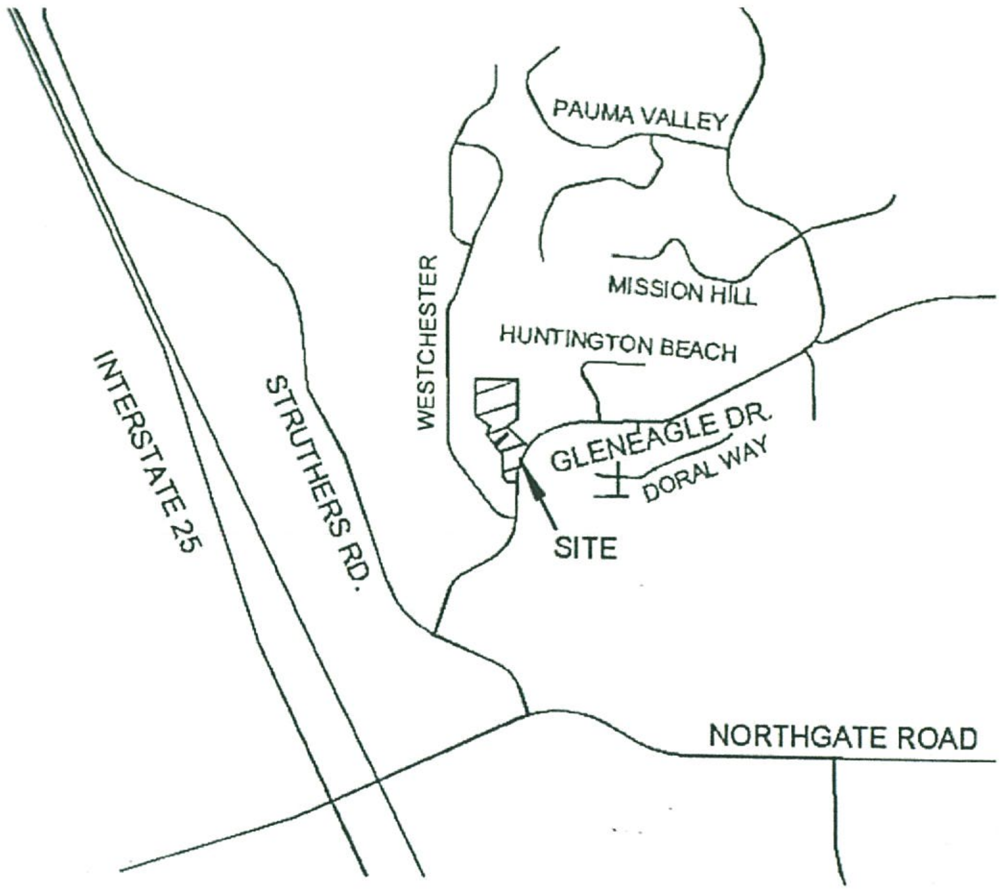
4. ***El Paso County (January 2006) Engineering Criteria Manual.***

5. Urban Drainage and Flood Control District (June 2011). ***Urban Storm Drainage Criteria Manual, Volume 1-3.***

6. Gleneagle Golf Course Residential Infill Development Preliminary/Final Drainage Report by Associated Design Professionals, Inc. dated July, 2017.

APPENDIX A

MAPS



N

VICINITY MAP

N.T.S.

RESPEC

3520 Austin Bluffs Pkwy, Suite 102 Colorado Springs, CO 80918
Phone: (719) 266-5212 Fax: (719) 266-5341

N

SOILS MAP

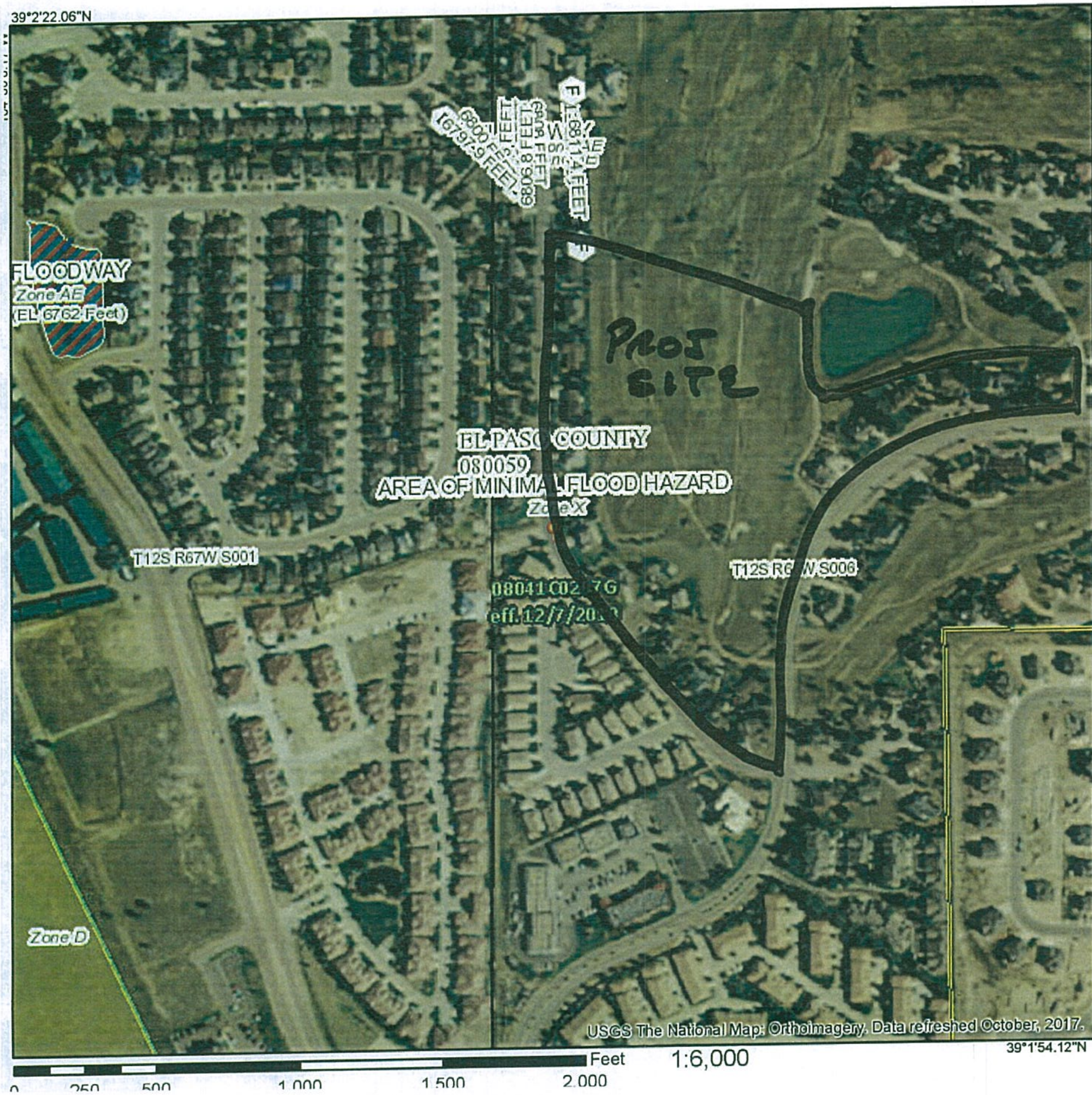
N.T.S.

RESPEC

3520 Austin Bluffs Pkwy, Suite 102 Colorado Springs, CO 80918
Phone: (719) 266-5212 Fax: (719) 266-5341

National Flood Hazard Layer FIRMette

FEMA



1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/22/2019 at 9:59:02 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX B

DESIGN CALCULATIONS

GLENEAGLE DEVELOPMENT FILING NO 2

C FACTOR CALCULATION SHEET

EXISTING CONDITIONS

RUNOFF COEFICIENT

TYPE A/B SOILS				
LAND USE			5 YR	100 YR
UNDEV			0.08	0.35
STREETS/DRIVES			0.9	0.96
ROOFS			0.73	0.81

	TOTAL	SURFACE CONDITION AREAS			CALCULATED C	
AREA	AREA	UNDEV	PAVED	ROOFS	5	100
			STREETS			
DESIG.	(acre)		& DRIVES		YR	YR
A1**	1.66	1.31	0.13	0.22	**0.23**	**0.46**
A2**	13.26	13.04		0.22	**0.09**	**0.36**
A3	1.07	0.75	0.32		**0.33**	**0.53**
A4	1.00	1.00			**0.08**	**0.35**
OS1*	6.35	4.76	0.84	0.75	**0.27**	**0.49**
OS2*	1.30	0.99	0.14	0.17	**0.25**	**0.48**

* Avg House = 2500 sf

** Avg House = 3200 sf

DEVELOPED CONDITIONS

RUNOFF COEFICIENT

TYPE A/B SOILS				
LAND USE			5 YR	100 YR
UNDEV			0.08	0.35
STREETS/DRIVES			0.9	0.96
ROOFS			0.73	0.81

Developed Conditions

	TOTAL	SURFACE CONDITION AREAS			CALCULATED C	
AREA	AREA	UNDEV	PAVED	ROOFS	5	100
			STREETS			
DESIG.	(acre)		& DRIVES		YR	YR
A1**	1.66	1.31	0.13	0.22	**0.23**	**0.46**
A2A**	4.27	4.05	0.00	0.22	**0.11**	**0.37**

A2B1**	2.35	2.05	0.00	0.30	**0.16**	**0.41**
A2B2	0.43	0.15	0.28	0.00	**0.61**	**0.75**
A2C1	0.55	0.19	0.36	0.00	**0.62**	**0.75**
A2C2**	1.27	0.90	0.00	0.37	**0.27**	**0.48**
A2D**	4.39	4.17	0.00	0.22	**0.11**	**0.37**
A3	1.07	0.75	0.32	0.00	**0.33**	**0.53**
A4	1.00	1.00	0.00	0.00	**0.08**	**0.35**
OS1*	4.55	3.49	0.60	0.46	**0.25**	**0.48**
OS2*	3.10	2.26	0.38	0.46	**0.28**	**0.49**
* Avg House = 2500 sf					**13.26**	**1.75**
** Avg House = 3200 sf						
	Sub Area		Impervious Acreage			
A2A-A2D	7.62		0.64	1.11		
	Imperviousness = (0.64+1.11)/7.62 = 0.23					

GLENEAGLE DEVELOPMENT FILING NO 2

DRAINAGE CALCULATION SHEET

file:gleneagle II dr

02/14/19

AREA DESIG.	AREA (acre)	C5 (5 yr)	C100 (100 yr)	C5 X A	C100 X A	Initial Tcl L (ft)	Initial Tcl Slope (%)	ti (min)	Travel Time L (ft)	Travel Time Slope (%)	V (fps)	Tt (min)	TC (min)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)	length L (feet)	vel. V (fps)	^t (min)	AREA DESIG.
EXISTING CONDITIONS																					
A1	1.66	0.23	0.46	0.38	0.76	50	4.00	7.28	700	4.00	4.00	2.92	10.20	4.02	7.02	1.53	5.36				A1
A2	13.26	0.09	0.36	1.19	4.77	100	3.50	12.49	1350	4.00	2.00	11.25	23.74	2.65	4.63	3.17	22.12				A2
DP1	14.92			1.58	5.54								23.74	2.65	4.63	4.18	25.66				DP1
A3	1.07	0.33	0.53	0.35	0.57	30	2.00	6.27	500	4.00	2.00	4.17	10.44	3.98	6.95	1.40	3.94	600	1.70	5.88	A3
OS1	6.35	0.27	0.49	1.71	3.11	100	3.50	10.27	0	4.00	2.00	0.00	10.27	4.01	7.00	6.87	21.77				OS1
DP2	7.42			2.07	3.68								16.32	3.24	5.65	6.69	20.79				DP2
A4	1.00	0.08	0.35	0.08	0.35	50	3.50	8.92	300	3.50	1.85	2.70	11.62	3.80	6.63	0.30	2.32	100	1.85	0.90	A4
OS2	1.30	0.25	0.48	0.33	0.62	100	3.50	10.51	0	4.00	2.00	0.00	10.51	3.97	6.93	1.29	4.32				OS2
DP3	2.30			0.41	0.97								12.52	3.67	6.41	1.49	6.25				DP3
DP4	9.72			2.47	4.65								16.32	3.24	5.65	8.00	26.30				DP4
DP5	24.64			4.05	10.19								23.74	2.65	4.63	10.74	47.23				DP5
DEVELOPED CONDITIONS																					
A1	1.66	0.23	0.46	0.38	0.76	50	4.00	7.28	700	4.00	4.00	2.92	10.20	4.02	7.02	1.53	5.36				A1
A2A	4.27	0.11	0.37	0.47	1.58	50	5.00	7.70	950	4.00	2.00	7.92	15.61	3.31	5.78	1.55	9.13				A2A
DP1	5.93			0.85	2.34								15.61	3.31	5.78	2.82	13.54				DP1
A2B1	2.35	0.16	0.41	0.38	0.96	100	5.00	10.33	850	3.00	1.75	8.10	18.43	3.04	5.31	1.14	5.12				A2B1
DP2	8.28			1.23	3.31								18.43	3.04	5.31	3.73	17.57	49	10.00	0.08	DP2
A2B2	0.43	0.61	0.75	0.26	0.32	30	2.00	3.99	380	1.00	1.00	6.33	10.33	4.00	6.98	1.05	2.25				A2B2
A2C1	0.55	0.62	0.75	0.34	0.41	30	2.00	3.91	380	1.00	1.00	6.33	10.24	4.01	7.00	1.37	2.89				A2C1
DP3	9.26			1.83	4.04								18.51	3.03	5.30	5.56	21.43	100	10.00	0.17	DP3
A2C2	1.27	0.27	0.48	0.34	0.61	30	2.00	6.76	250	1.00	1.00	4.17	10.93	3.90	6.81	1.34	4.15				A2C2
DP4	10.53			2.17	4.65								18.68	3.02	5.28	6.57	24.54	220	3.00	1.22	DP4
A2D	4.39	0.11	0.37	0.48	1.62	50	3.50	8.66	350	1.00	1.00	5.83	14.49	3.43	5.99	1.66	9.73				A2D
DP5	13.65			2.31	5.67								19.90	2.92	5.10	6.76	28.91	100	1.85	0.90	DP5
	13.65			0.96	3.59	Adjusted C Factor for Detention Basin C							19.90	2.92	5.10	2.80	18.30	From Overflow Weir from UD-Det Calcs			
Overflow Pipe assuming clogged outlet structure				0.96	3.59																
A3	1.07	0.33	0.53	0.35	0.57	30	2.00	6.27	500	4.00	2.00	4.17	10.44	3.98	6.95	1.40	3.94	600	1.70	5.88	A3
OS1	4.55	0.25	0.48	1.14	2.18	100	3.50	10.51	0	4.00	2.00	0.00	10.51	3.97	6.93	4.51	15.13				OS1
DP6	5.62			1.49	2.75								16.32	3.24	5.65	4.82	15.55				DP6
A4	1.00	0.08	0.35	0.08	0.35	50	3.50	8.92	300	3.50	1.85	2.70	11.62	3.80	6.63	0.30	2.32	100	1.85	0.90	A4
OS2	3.10	0.28	0.49	0.87	1.52	100	3.50	10.14	0	4.00	2.00	0.00	10.14	4.03	7.03	3.49	10.68				OS2
DP7	4.10			0.95	1.87								12.52	3.67	6.41	3.48	11.99				DP7
DP8	9.72			2.44	4.62								16.32	3.24	5.65	7.89	26.11				DP8

FOREBAY CALCULATIONS	FOREBAY NOTCH CALCULATIONS
2% OF WQV	2% OF 100YR FLOW
0.02 X 0.121 = 0.0024 AF = 105 CF	0.02 X 28.9 = 0.58 CFS
	W =Q/(D^1.5XC)
	W=0.58/(1X3.0)=0.19 FT

GLENEAGLE DEVELOPMENT

DITCH CAPACITY CALCULATION SHEET

Swale Location	Q5 cfs	Q100 cfs	S %	B ft	Z	D ft	d100 ft	V fps	Froude #	Riprap Size	A sf	Tw ft
J	1.7	9.7	1.0	0.0	3:1	1.5	1.0	3.2	0.79		3.2	6.1
K	4.4	18.8	0.5	2.0	4:1	2.0	1.2	2.3	0.49	ECM	6.7	10.6
L	2.8	13.5	1.5	0.0	3:1	1.5	1.1	3.5	0.81		3.5	6.9
Overflow Spillway M	6.8	28.9	6.5	6.0	3:1	3.0	0.6	5.9	1.47	0.40	4.9	9.7

I* LEFT Z= 15:1, Right Z= 40:1

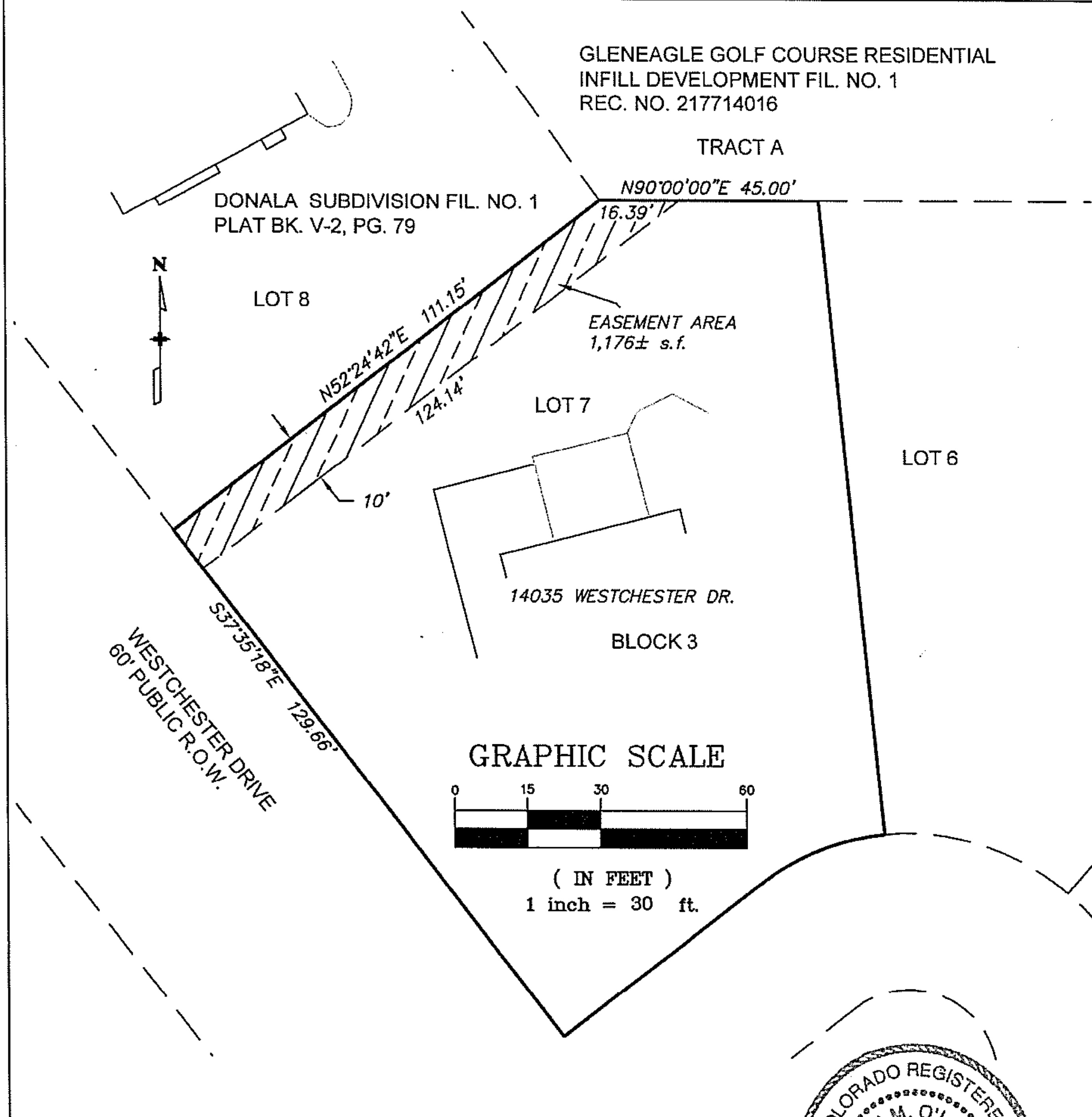
O* LEFT Z= 5:1, Right Z= 2:1

R* LEFT Z= 6:1, Right Z= 3:1

Riprap Size

D50=(((VS^0.17)/4.5(2.5-1)^0.66))^2

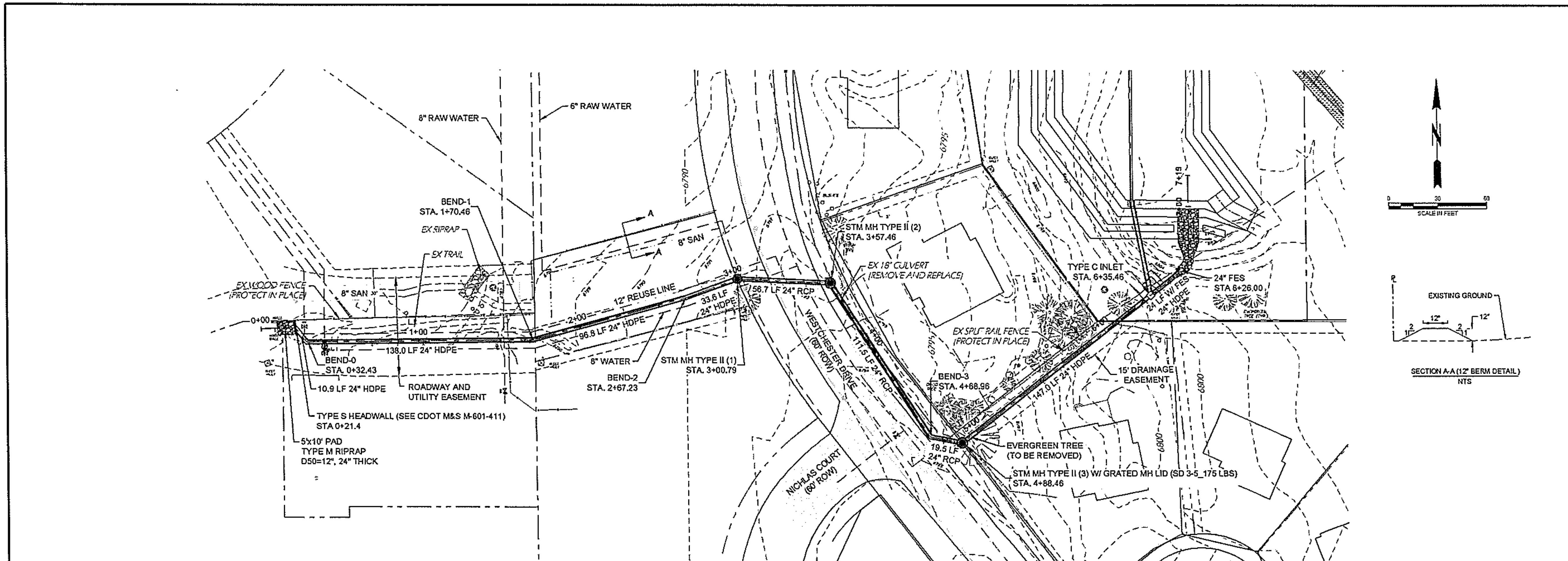
Note: In ditches with low velocities & flows but higher Froude Numbers, Erosion Control Mats used in lieu of riprap

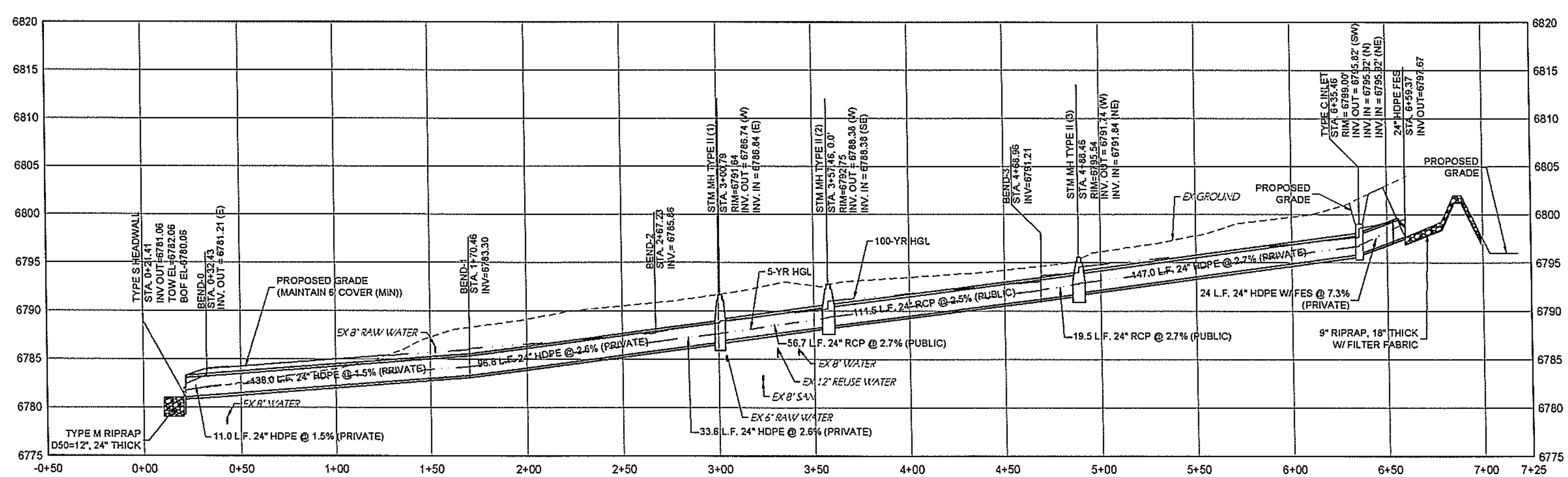


THE NORTHWESTERLY 10 FEET OF LOT 7, BLOCK 3, DONALA SUBDIVISION FILING NO. 1, AS SHOWN ON THE SUBDIVISION PLAT THEREOF RECORDED IN PLAT BOOK V-2 AT PAGE 79.

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR
KEVIN M. O'LEARY
28658
17 APRIL 2019

EASEMENT EXHIBIT LOT 7, BLOCK 3 DONALA SUB. NO. 1 14035 WESTCHESTER DR.	DWG: KERR SCALE: 1"=30' DATE: 4/17/19 DRAWN: KMO CHECKED: THK PROJECT: 15063	LWA LAND SURVEYING, INC. 953 E. FILLMORE STREET COLORADO SPRINGS, CO 80907 TELEPHONE (719) 636-5179 FAX (719) 636-5199	REVISIONS:





NAME: Z:\COLORADO SPRINGS OFFICE\03542_GLENEAGLE\CAD\SHEETS\03524-5-STM.DWG
PLOT DATE: May 22, 2019 11:01 AM, BY: CHRIS.MEEKS

REVISION

DESIGNED MAB
DRAWN CJM
CHECKED MAB
DATE 2/14/2019

RESPEC
720 S COLORADO BLVD
SUITE 410S
DENVER, CO 80246
PHONE (303) 757-3655

STAMP

811 Know what's below. Call before you dig.

PROJ NO. 03437
DWG NM. 03437-DEV

GUMAN & ASSOCIATES, LLC
731 N. WEBER ST., SUITE 10
COLORADO SPRINGS, CO 80903

GLENEAGLE
SUBDIVISION FIL #2

DETENTION BASIN
OUTFALL

DRAWING NUMBER:
C
SHEET 4

VR-18-018

Project Gleneagle Filing 2
By AJL
Date 4/24/2019

Description Used UDFCD UD-SEWER 2009 computer program to calculate HGL for Q100 and Q5.

100-Year

Element	Q100	DS STA	US STA	DIA (IN)	Material	Manning's n	LENGTH (FT)	DS INV	US INV	Horizontal Bend DS	Bend Loss	Lateral Loss	DS HGL	US HGL	Slope
1-1	28.9	21.41	32.43	24	HDPE	0.012	11.0	6,781.00	6,781.21	56	0.03	1.00	6,782.42	6,783.38	0.019
2-1	28.9	32.43	170.46	24	HDPE	0.012	138.0	6,781.21	6,783.30	53	0.51	0.00	6,784.05	6,785.96	0.015
3-1	28.9	170.46	267.23	24	HDPE	0.012	96.8	6,783.30	6,785.86	15	0.08	0.00	6,786.07	6,787.70	0.026
4-1	28.9	267.23	300.79	24	HDPE	0.012	33.6	6,785.86	6,786.74	4	0.03	0.00	6,787.77	6,788.76	0.026
5-1	28.9	300.79	357.46	24	RCP	0.013	56.7	6,786.84	6,788.38	22	0.13	0.00	6,788.93	6,790.22	0.027
6-1	28.9	357.46	468.96	24	RCP	0.013	111.5	6,788.38	6,791.21	55	0.54	0.00	6,791.03	6,793.05	0.025
7-1	28.9	468.96	488.46	24	RCP	0.013	19.5	6,791.21	6,791.74	46	0.4	0.00	6,793.68	6,794.00	0.027
8-1	28.9	488.46	635.46	24	HDPE	0.012	147.0	6,791.84	6,795.82	49	0.44	0.00	6,794.57	6,797.66	0.027
9-1	28.9	635.46	659.37	24	HDPE	0.012	23.9	6795.92	6797.67	0	0.03	0.44	6,798.57	6,799.51	0.073

5-Year

Element	Q100	DS STA	US STA	DIA (IN)	Material	Manning's n	LENGTH (FT)	DS INV	US INV	Horizontal Bend DS	Bend Loss	Lateral Loss	DS HGL	US HGL	Slope
1-1	28.9	21.41	32.43	24	HDPE	0.012	11.0	6,781.00	6,781.21	56	0.03	1.00	6,781.73	6,782.13	0.019
2-1	28.9	32.43	170.46	24	HDPE	0.012	138.0	6,781.21	6,783.30	53	0.51	0.00	6,782.17	6,784.22	0.015
3-1	28.9	170.46	267.23	24	HDPE	0.012	96.8	6,783.30	6,785.86	15	0.08	0.00	6,784.23	6,786.78	0.026
4-1	28.9	267.23	300.79	24	HDPE	0.012	33.6	6,785.86	6,786.74	4	0.03	0.00	6,786.79	6,787.66	0.026
5-1	28.9	300.79	357.46	24	RCP	0.013	56.7	6,786.84	6,788.38	22	0.13	0.00	6,787.67	6,789.30	0.027
6-1	28.9	357.46	468.96	24	RCP	0.013	111.5	6,788.38	6,791.21	55	0.54	0.00	6,789.34	6,792.13	0.025
7-1	28.9	468.96	488.46	24	RCP	0.013	19.5	6,791.21	6,791.74	46	0.4	0.00	6,792.16	6,792.81	0.027
8-1	28.9	488.46	635.46	24	HDPE	0.012	147.0	6,791.84	6,795.82	49	0.44	0.00	6,792.85	6,796.74	0.027
9-1	28.9	635.46	659.37	24	HDPE	0.012	23.9	6795.92	6797.67	0	0.03	0.44	6,796.79	6,799.11	0.073

Gleneagle Filing No. 2 Spillway

100-Year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 1.25

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)

OUTFALL 1	6785.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 1 SWR 1 - 1	6785.00	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 2 SWR 2 - 1	6787.00	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 3 SWR 3 - 1	6790.00	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 4 SWR 4 - 1	6791.64	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 5 SWR 5 - 1	6792.75	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 6 SWR 6 - 1	6794.00	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 7 SWR 7 - 1	6795.54	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 8 SWR 8 - 1	6799.00	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 9 SWR 9 - 1	6804.00	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					**Total Design Flow**				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

MH 1 SWR 1 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 2 SWR 2 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 3 SWR 3 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 4 SWR 4 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 5 SWR 5 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 6 SWR 6 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 7 SWR 7 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 8 SWR 8 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	
MH 9 SWR 9 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
MH 1 SWR 1 - 1	11.00	6781.00	1.9	6781.21	0.012	0.56	1.00	CIRCULAR	24.00 in	24.00 in

MH 2 SWR 2 - 1	138.00	6781.21	1.5	6783.30	0.012	0.51	0.00	CIRCULAR	24.00 in	24.00 in
MH 3 SWR 3 - 1	96.80	6783.30	2.6	6785.86	0.012	0.08	0.00	CIRCULAR	24.00 in	24.00 in
MH 4 SWR 4 - 1	33.60	6785.87	2.6	6786.74	0.012	0.05	0.00	CIRCULAR	24.00 in	24.00 in
MH 5 SWR 5 - 1	56.70	6786.84	2.7	6788.38	0.013	0.13	0.00	CIRCULAR	24.00 in	24.00 in
MH 6 SWR 6 - 1	111.50	6788.38	2.5	6791.21	0.013	0.54	0.00	CIRCULAR	24.00 in	24.00 in
MH 7 SWR 7 - 1	19.50	6791.21	2.7	6791.74	0.013	0.40	0.00	CIRCULAR	24.00 in	24.00 in
MH 8 SWR 8 - 1	147.00	6791.84	2.7	6795.82	0.012	0.44	0.00	CIRCULAR	24.00 in	24.00 in
MH 9 SWR 9 - 1	23.90	6795.92	7.3	6797.67	0.012	0.05	0.44	CIRCULAR	24.00 in	24.00 in

Sewer Flow Summary:

	Full Flow Capacity		**Critical Flow**		**Normal Flow**						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
MH 1 SWR 1 - 1	33.87	10.78	22.13	9.54	17.05	12.11	1.86	Supercritical	28.90	0.00	
MH 2 SWR 2 - 1	30.24	9.63	22.13	9.54	18.78	10.96	1.53	Pressurized	28.90	138.00	

MH 3 SWR 3 - 1	39.96	12.72	22.13	9.54	15.12	13.86	2.35	Supercritical Jump	28.90	60.95	
MH 4 SWR 4 - 1	39.62	12.61	22.13	9.54	15.21	13.76	2.32	Supercritical	28.90	0.00	
MH 5 SWR 5 - 1	37.38	11.90	22.13	9.54	15.84	13.14	2.15	Supercritical Jump	28.90	8.48	
MH 6 SWR 6 - 1	36.14	11.50	22.13	9.54	16.23	12.78	2.05	Supercritical Jump	28.90	71.48	
MH 7 SWR 7 - 1	37.27	11.86	22.13	9.54	15.88	13.10	2.14	Pressurized	28.90	19.50	
MH 8 SWR 8 - 1	40.43	12.87	22.13	9.54	15.00	13.99	2.39	Supercritical Jump	28.90	55.47	
MH 9 SWR 9 - 1	66.49	21.17	22.13	9.54	11.06	20.42	4.27	Supercritical Jump	28.90	10.87	Velocity is Too High

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		**Calculated**		**Used**			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
MH 1 SWR 1 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 2 SWR 2 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 3 SWR 3 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	

MH 4 SWR 4 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 5 SWR 5 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 6 SWR 6 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 7 SWR 7 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 8 SWR 8 - 1	28.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
MH 9 SWR 9 - 1	28.90	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 1.25

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
MH 1 SWR 1 - 1	6781.00	6781.21	0.00	0.00	6782.42	6783.38	6784.70	0.00	6784.70
MH 2 SWR 2 - 1	6781.21	6783.30	0.67	0.00	6784.05	6785.96	6785.37	1.91	6787.28
MH 3 SWR 3 - 1	6783.30	6785.86	0.11	0.00	6786.07	6787.70	6787.38	1.74	6789.12

MH 4 SWR 4 - 1	6785.87	6786.74	0.07	0.00	6787.77	6788.76	6790.08	0.00	6790.08
MH 5 SWR 5 - 1	6786.84	6788.38	0.17	0.00	6788.93	6790.22	6790.25	1.39	6791.64
MH 6 SWR 6 - 1	6788.38	6791.21	0.71	0.00	6791.03	6793.05	6792.35	2.12	6794.47
MH 7 SWR 7 - 1	6791.21	6791.74	0.53	0.00	6793.68	6794.00	6794.99	0.32	6795.31
MH 8 SWR 8 - 1	6791.84	6795.82	0.58	0.00	6794.57	6797.66	6795.89	3.19	6799.08
MH 9 SWR 9 - 1	6795.92	6797.67	0.07	0.74	6798.57	6799.51	6799.88	1.05	6800.93

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
MH 1 SWR 1 - 1	11.00	3.00	4.00	5.50	7.00	4.58	1.75	6.58	4.37	1.54	10.21	Sewer Too Shallow

MH 2 SWR 2 - 1	138.00	3.00	4.00	5.50	6.58	4.37	1.54	6.40	4.28	1.45	122.93	Sewer Too Shallow
MH 3 SWR 3 - 1	96.80	3.00	4.00	5.50	6.40	4.28	1.45	7.28	4.72	1.89	90.58	Sewer Too Shallow
MH 4 SWR 4 - 1	33.60	3.00	4.00	5.50	7.27	4.72	1.88	8.80	5.48	2.65	37.09	Sewer Too Shallow
MH 5 SWR 5 - 1	56.70	3.00	4.00	5.50	8.60	5.38	2.55	7.74	4.95	2.12	63.53	
MH 6 SWR 6 - 1	111.50	3.00	4.00	5.50	7.74	4.95	2.12	5.50	3.37	0.54	91.02	Sewer Too Shallow
MH 7 SWR 7 - 1	19.50	3.00	4.00	5.50	0.00	3.37	0.54	6.60	4.38	1.55	14.44	Sewer Too Shallow
MH 8 SWR 8 - 1	147.00	3.00	4.00	5.50	6.40	4.28	1.45	5.50	3.76	0.93	107.10	Sewer Too Shallow
MH 9 SWR 9 - 1	23.90	3.00	4.00	5.50	0.00	3.66	0.83	11.66	6.91	4.08	27.92	Sewer Too Shallow

Total earth volume for sewer trenches = 565 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

5-year

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 0.99

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL 1	6785.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MH 1 SWR 1 - 1	6785.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 2 SWR 2 - 1	6787.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 3 SWR 3 - 1	6790.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 4 SWR 4 - 1	6791.64	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 5 SWR 5 - 1	6792.75	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 6 SWR 6 - 1	6794.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 7 SWR 7 - 1	6795.54	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 8 SWR 8 - 1	6799.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH 9 SWR 9 - 1	6804.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
OUTFALL 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

MH 1 SWR 1 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 2 SWR 2 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 3 SWR 3 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 4 SWR 4 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 5 SWR 5 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 6 SWR 6 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 7 SWR 7 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 8 SWR 8 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	
MH 9 SWR 9 - 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	

Sewer Input Summary:

		Elevation			**Loss Coefficients**			**Given Dimensions**		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
MH 1 SWR 1 - 1	11.00	6781.00	1.9	6781.21	0.012	0.56	1.00	CIRCULAR	24.00 in	24.00 in

MH 2 SWR 2 - 1	138.00	6781.21	1.5	6783.30	0.012	0.51	0.00	CIRCULAR	24.00 in	24.00 in
MH 3 SWR 3 - 1	96.80	6783.30	2.6	6785.86	0.012	0.08	0.00	CIRCULAR	24.00 in	24.00 in
MH 4 SWR 4 - 1	33.60	6785.86	2.6	6786.74	0.012	0.05	0.00	CIRCULAR	24.00 in	24.00 in
MH 5 SWR 5 - 1	56.70	6786.84	2.7	6788.38	0.013	0.13	0.00	CIRCULAR	24.00 in	24.00 in
MH 6 SWR 6 - 1	111.50	6788.38	2.5	6791.21	0.013	0.54	0.00	CIRCULAR	24.00 in	24.00 in
MH 7 SWR 7 - 1	19.50	6791.21	2.7	6791.74	0.013	0.40	0.00	CIRCULAR	24.00 in	24.00 in
MH 8 SWR 8 - 1	147.00	6791.84	2.7	6795.82	0.012	0.44	0.00	CIRCULAR	24.00 in	24.00 in
MH 9 SWR 9 - 1	23.90	6795.92	7.3	6797.67	0.012	0.05	0.44	CIRCULAR	24.00 in	24.00 in

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Sewer Flow Summary:

	Full Flow Capacity		**Critical Flow**		**Normal Flow**						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
MH 1 SWR 1 - 1	33.87	10.78	11.09	4.79	7.29	8.43	2.24	Supercritical	6.80	0.00	
MH 2 SWR 2 - 1	30.24	9.63	11.09	4.79	7.74	7.77	2.00	Supercritical	6.80	0.00	

MH 3 SWR 3 - 1	39.96	12.72	11.09	4.79	6.70	9.49	2.64	Supercritical	6.80	0.00	
MH 4 SWR 4 - 1	39.78	12.66	11.09	4.79	6.71	9.45	2.63	Supercritical	6.80	0.00	
MH 5 SWR 5 - 1	37.38	11.90	11.09	4.79	6.93	9.04	2.47	Supercritical	6.80	0.00	
MH 6 SWR 6 - 1	36.14	11.50	11.09	4.79	7.05	8.83	2.39	Supercritical	6.80	0.00	
MH 7 SWR 7 - 1	37.27	11.86	11.09	4.79	6.94	9.02	2.47	Supercritical	6.80	0.00	
MH 8 SWR 8 - 1	40.43	12.87	11.09	4.79	6.66	9.57	2.68	Supercritical	6.80	0.00	
MH 9 SWR 9 - 1	66.49	21.17	11.09	4.79	5.18	13.62	4.36	Supercritical	6.80	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
MH 1 SWR 1 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 2 SWR 2 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 3 SWR 3 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

MH 4 SWR 4 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 5 SWR 5 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 6 SWR 6 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 7 SWR 7 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 8 SWR 8 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	
MH 9 SWR 9 - 1	6.80	CIRCULAR	24.00 in	24.00 in	18.00 in	18.00 in	24.00 in	24.00 in	3.14	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 0.99

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
MH 1 SWR 1 - 1	6781.00	6781.21	0.00	0.00	6781.73	6782.13	6782.41	0.08	6782.49
MH 2 SWR 2 - 1	6781.21	6783.30	0.04	0.00	6782.17	6784.22	6782.79	1.79	6784.58
MH 3 SWR 3 - 1	6783.30	6785.86	0.01	0.00	6784.23	6786.78	6785.26	1.89	6787.14

MH 4 SWR 4 - 1	6785.86	6786.74	0.00	0.00	6786.79	6787.66	6787.81	0.21	6788.02
MH 5 SWR 5 - 1	6786.84	6788.38	0.01	0.00	6787.67	6789.30	6788.69	0.97	6789.66
MH 6 SWR 6 - 1	6788.38	6791.21	0.04	0.00	6789.34	6792.13	6790.18	2.31	6792.49
MH 7 SWR 7 - 1	6791.21	6791.74	0.03	0.00	6792.16	6792.81	6793.06	0.00	6793.06
MH 8 SWR 8 - 1	6791.84	6795.82	0.03	0.00	6792.85	6796.74	6793.82	3.28	6797.10
MH 9 SWR 9 - 1	6795.92	6797.67	0.00	0.04	6796.79	6799.11	6799.23	0.00	6799.23

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
MH 1 SWR 1 - 1	11.00	3.00	4.00	5.50	7.00	4.58	1.75	6.58	4.37	1.54	10.21	Sewer Too Shallow

MH 2 SWR 2 - 1	138.00	3.00	4.00	5.50	6.58	4.37	1.54	6.40	4.28	1.45	122.93	Sewer Too Shallow
MH 3 SWR 3 - 1	96.80	3.00	4.00	5.50	6.40	4.28	1.45	7.28	4.72	1.89	90.58	Sewer Too Shallow
MH 4 SWR 4 - 1	33.60	3.00	4.00	5.50	7.28	4.72	1.89	8.80	5.48	2.65	37.12	Sewer Too Shallow
MH 5 SWR 5 - 1	56.70	3.00	4.00	5.50	8.60	5.38	2.55	7.74	4.95	2.12	63.53	
MH 6 SWR 6 - 1	111.50	3.00	4.00	5.50	7.74	4.95	2.12	5.50	3.37	0.54	91.02	Sewer Too Shallow
MH 7 SWR 7 - 1	19.50	3.00	4.00	5.50	0.00	3.37	0.54	6.60	4.38	1.55	14.44	Sewer Too Shallow
MH 8 SWR 8 - 1	147.00	3.00	4.00	5.50	6.40	4.28	1.45	5.50	3.76	0.93	107.10	Sewer Too Shallow
MH 9 SWR 9 - 1	23.90	3.00	4.00	5.50	0.00	3.66	0.83	11.66	6.91	4.08	27.92	Sewer Too Shallow

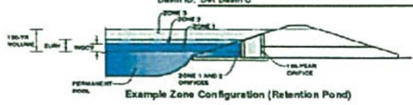
Total earth volume for sewer trenches = 565 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Gleneagle Golf Course Residential Infill Project Fil 2

Basin ID: Det Basin C



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	14.02	acres
Watershed Length =	1,450	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	15.90%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	UDFCD Default	
Water Quality Capture Volume (WQCV) =	0.121	acre-feet
Excess Urban Runoff Volume (EURV) =	0.231	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.173	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.431	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.704	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.186	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	1.537	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.949	acre-feet
500-yr Runoff Volume (P1 = 3.01 in.) =	2.637	acre-feet
Approximate 2-yr Detention Volume =	0.161	acre-feet
Approximate 5-yr Detention Volume =	0.354	acre-feet
Approximate 10-yr Detention Volume =	0.409	acre-feet
Approximate 25-yr Detention Volume =	0.452	acre-feet
Approximate 50-yr Detention Volume =	0.575	acre-feet
Approximate 100-yr Detention Volume =	0.817	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.01	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.121	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.110	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.586	acre-feet
Total Detention Basin Volume =	0.817	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	30	0.001		
	--	0.50	--	--	--	4,765	0.109	1,151	0.026
	--	1.00	--	--	--	9,525	0.219	4,676	0.107
	--	1.50	--	--	--	19,050	0.437	11,725	0.269
	--	2.00	--	--	--	20,255	0.465	21,539	0.494
	--	2.50	--	--	--	21,460	0.493	32,170	0.739
	--	3.00	--	--	--	22,665	0.520	43,201	0.992
	--	3.50	--	--	--	23,870	0.548	54,835	1.259
	--	4.00	--	--	--	25,075	0.576	67,071	1.540
	--	4.50	--	--	--	26,280	0.603	79,910	1.834
	--	5.00	--	--	--	27,485	0.631	93,351	2.143
	--	5.50	--	--	--	28,690	0.659	107,395	2.465
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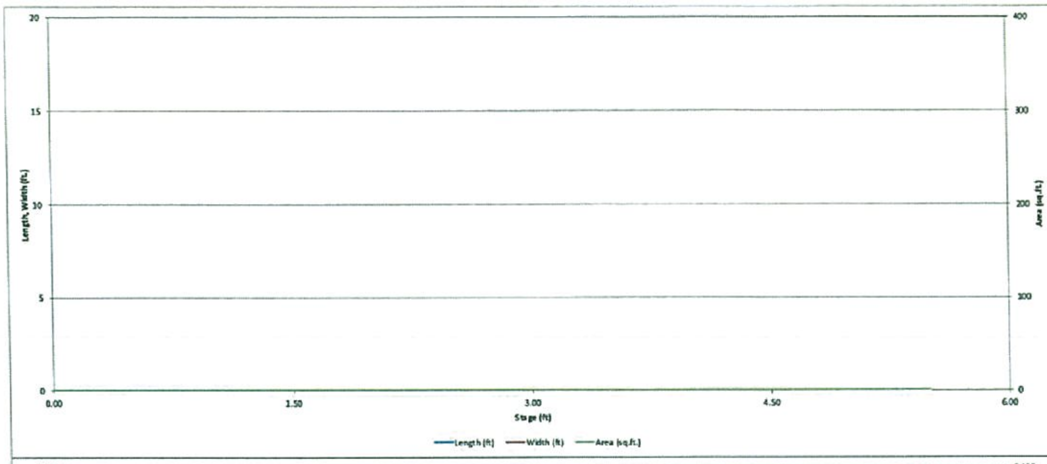
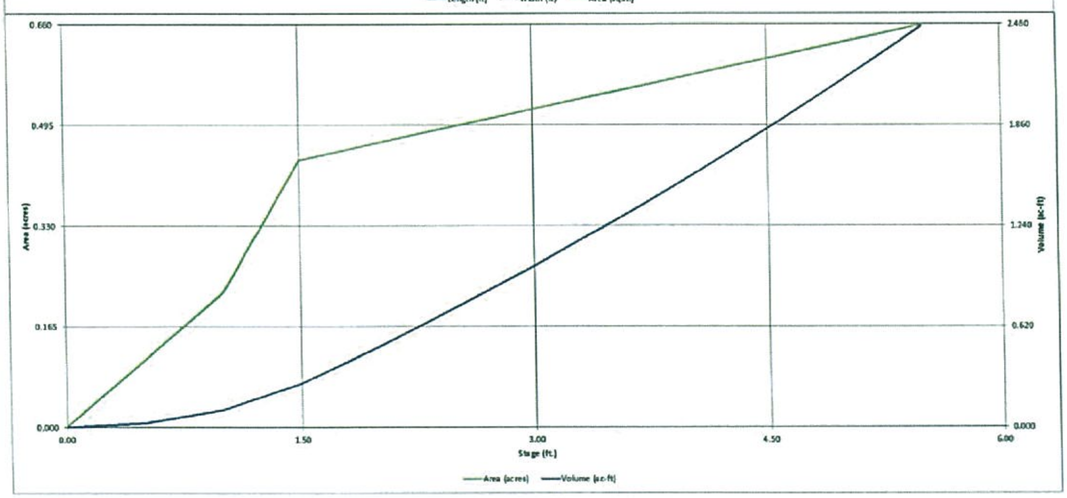
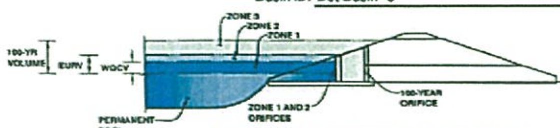
DETENTION BASIN STAGE-STORAGE TABLE BUILDER





Detention Basin Outlet Structure Design

Project: Gleneagle Golf Course Infill Project Fil 2
Basin ID: Det Basin C



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.06	0.121	Orifice Plate
Zone 2 (EURV)	1.40	0.110	Orifice Plate
Zone 3 (100-year)	2.66	0.586	Weir&Pipe (Restrict)
		0.817	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.03	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	4.10	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.34	0.69					
Orifice Area (sq. inches)	0.83	0.83	0.83					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.03	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.03	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	18.80	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	11.54	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.77	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.61	N/A	ft^2
Outlet Orifice Centroid =	0.29	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.05	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.70	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	13.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

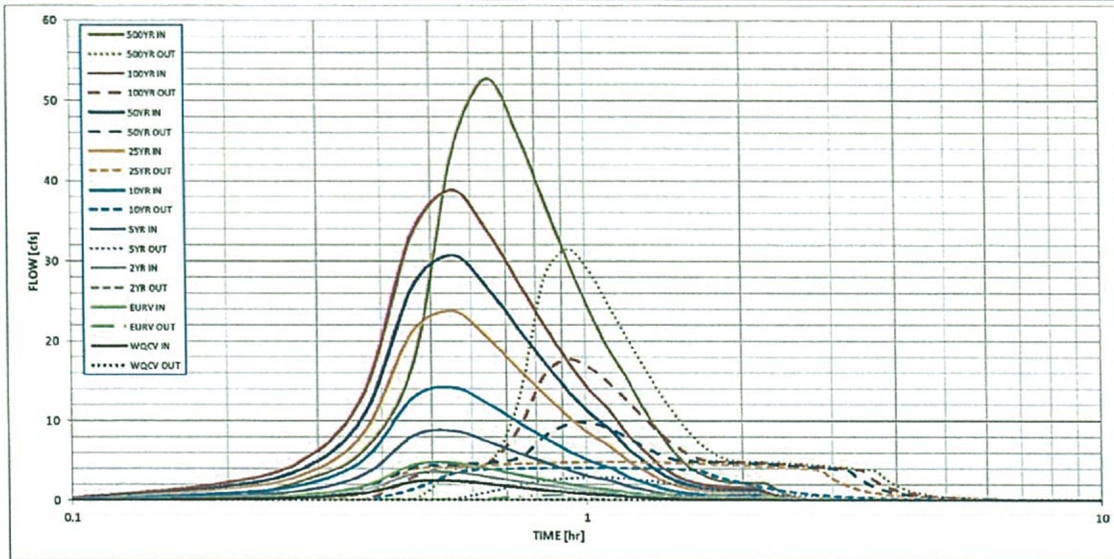
Calculated Parameters for Spillway

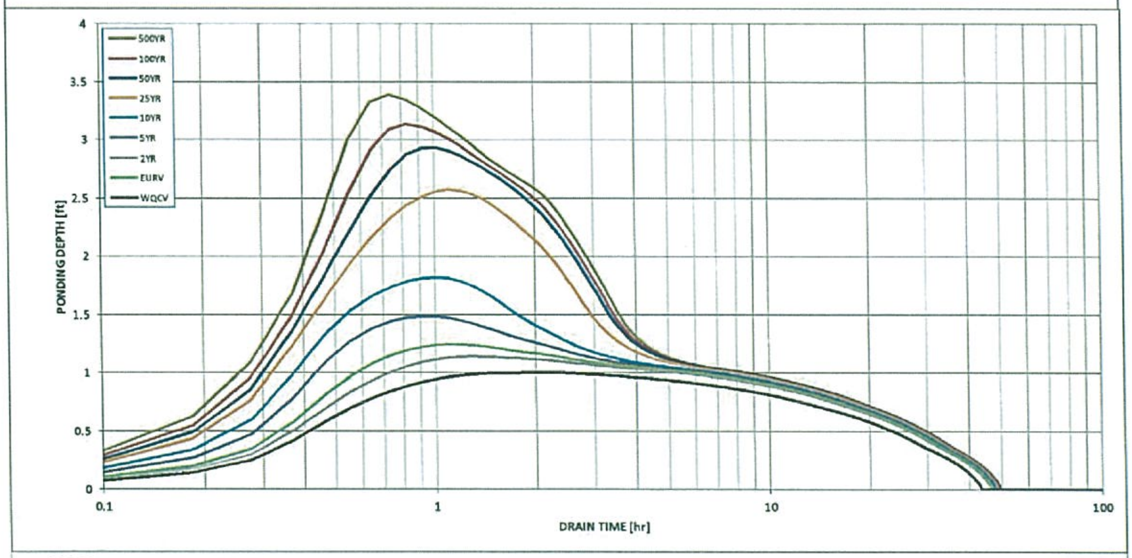
Spillway Design Flow Depth=	0.87	feet
Stage at Top of Freeboard =	4.57	feet
Basin Area at Top of Freeboard =	0.61	acres

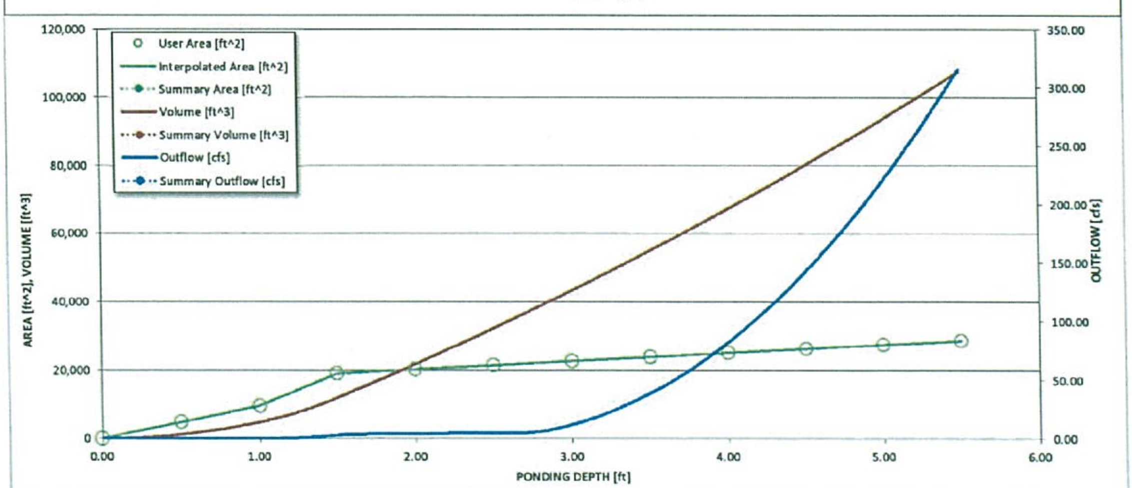
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.01
Calculated Runoff Volume (acre-ft) =	0.121	0.231	0.173	0.431	0.704	1.186	1.537	1.949	2.637
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.121	0.231	0.172	0.430	0.703	1.184	1.536	1.948	2.635
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.34	0.79	1.02	1.30	1.84
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	2.5	5.1	11.7	15.2	19.4	27.5
Peak Inflow Q (cfs) =	2.4	4.6	3.5	8.6	14.1	23.7	30.7	38.8	52.7
Peak Outflow Q (cfs) =	0.1	0.9	0.4	2.8	4.0	4.8	9.7	17.6	31.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	0.8	0.4	0.6	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.06	0.02	0.2	0.3	0.4	0.4	0.4	0.5
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	39	40	35	31	26	23	19	15
Time to Drain 99% of Inflow Volume (hours) =	41	43	44	42	40	37	35	33	30
Maximum Ponding Depth (ft) =	1.01	1.25	1.14	1.48	1.82	2.57	2.93	3.13	3.39
Area at Maximum Ponding Depth (acres) =	0.22	0.32	0.28	0.43	0.45	0.50	0.52	0.53	0.54
Maximum Volume Stored (acre-ft) =	0.110	0.175	0.144	0.265	0.412	0.768	0.955	1.060	1.193

Detention Basin Outlet Structure Design







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval
5.55 min
Hydrograph Constant
0.900

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:33	0.00	0.01	0.01	0.02	0.02	0.04	0.05	0.06	0.08
0:11:06	0.14	0.27	0.20	0.48	0.75	1.21	1.52	1.86	2.39
0:16:39	0.34	0.64	0.48	1.16	1.85	3.03	3.86	4.81	6.35
0:22:12	0.94	1.76	1.32	3.21	5.11	8.32	10.58	13.15	17.26
0:27:45	2.35	4.42	3.32	8.07	12.87	21.02	26.76	33.30	43.85
0:33:18	2.44	4.65	3.46	8.65	14.09	23.69	30.68	38.85	52.71
0:38:51	2.03	3.90	2.90	7.30	12.00	20.38	26.56	33.85	46.15
0:44:24	1.62	3.12	2.32	5.87	9.68	16.53	21.60	27.59	37.67
0:49:57	1.30	2.51	1.86	4.71	7.76	13.24	17.29	22.07	30.11
0:55:30	1.01	1.96	1.45	3.69	6.10	10.43	13.64	17.44	23.82
1:01:03	0.80	1.55	1.15	2.92	4.84	8.27	10.81	13.81	18.84
1:06:36	0.67	1.29	0.96	2.43	3.99	6.78	8.82	11.23	15.27
1:12:09	0.47	0.91	0.68	1.73	2.86	4.91	6.43	8.24	11.31
1:17:42	0.36	0.69	0.51	1.30	2.15	3.67	4.80	6.14	8.38
1:23:15	0.24	0.47	0.35	0.90	1.49	2.57	3.37	4.32	5.94
1:28:48	0.18	0.35	0.26	0.65	1.08	1.86	2.43	3.11	4.24
1:34:21	0.14	0.27	0.20	0.51	0.84	1.44	1.88	2.40	3.28
1:39:54	0.12	0.22	0.17	0.42	0.69	1.18	1.53	1.95	2.66
1:45:27	0.10	0.20	0.15	0.38	0.62	1.04	1.35	1.72	2.33
1:51:00	0.10	0.19	0.14	0.36	0.59	0.99	1.29	1.64	2.22
1:56:33	0.10	0.19	0.14	0.35	0.58	0.97	1.26	1.60	2.17
2:02:06	0.10	0.19	0.14	0.35	0.58	0.97	1.26	1.60	2.17
2:07:39	0.10	0.19	0.14	0.35	0.58	0.97	1.26	1.60	2.17
2:13:12	0.06	0.12	0.09	0.22	0.37	0.64	0.85	1.09	1.51
2:18:45	0.03	0.07	0.05	0.13	0.22	0.38	0.50	0.64	0.89
2:24:18	0.02	0.04	0.03	0.07	0.12	0.21	0.28	0.37	0.51
2:29:51	0.01	0.02	0.02	0.04	0.07	0.12	0.15	0.20	0.28
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2:46:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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3:08:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:14:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:19:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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3:42:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:47:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:53:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:58:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:04:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:09:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:26:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:31:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:37:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:43:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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4:54:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:59:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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5:55:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:06:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:11:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:17:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:22:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:28:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:34:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:39:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

APPENDIX C

DESIGN CHARTS

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.65	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.95	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Figure 6-25. Estimate of Average Concentrated Shallow Flow

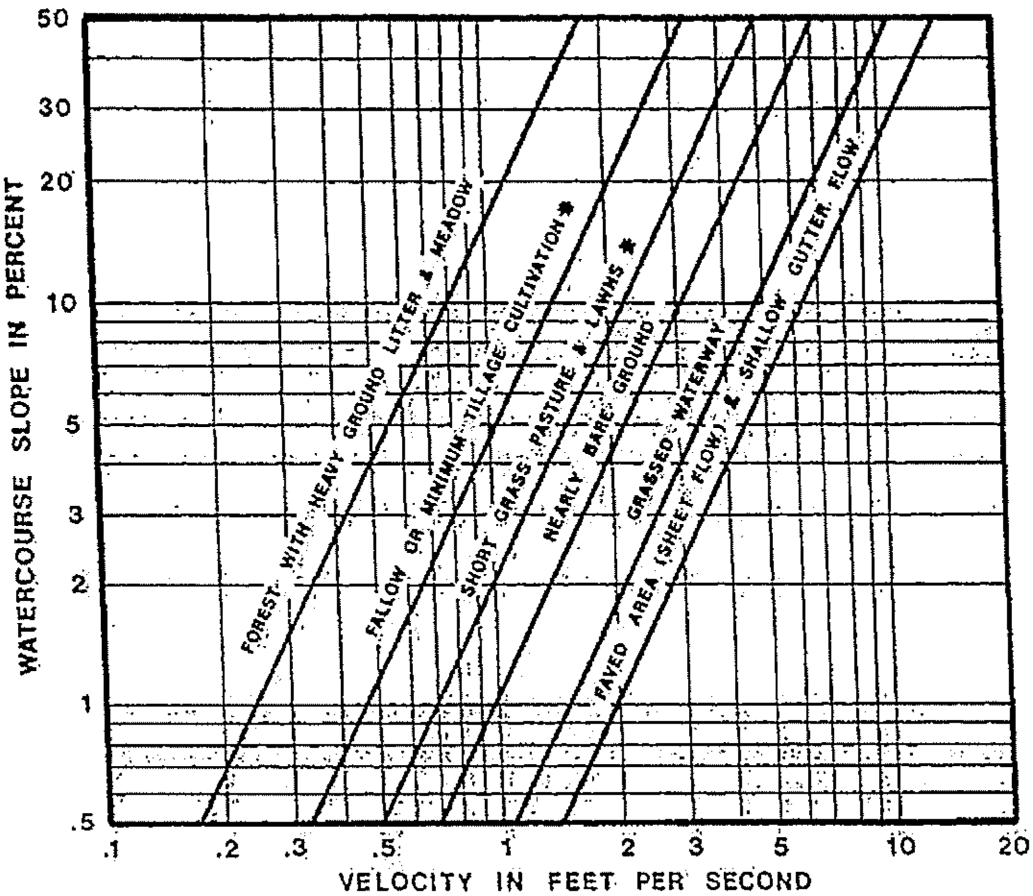
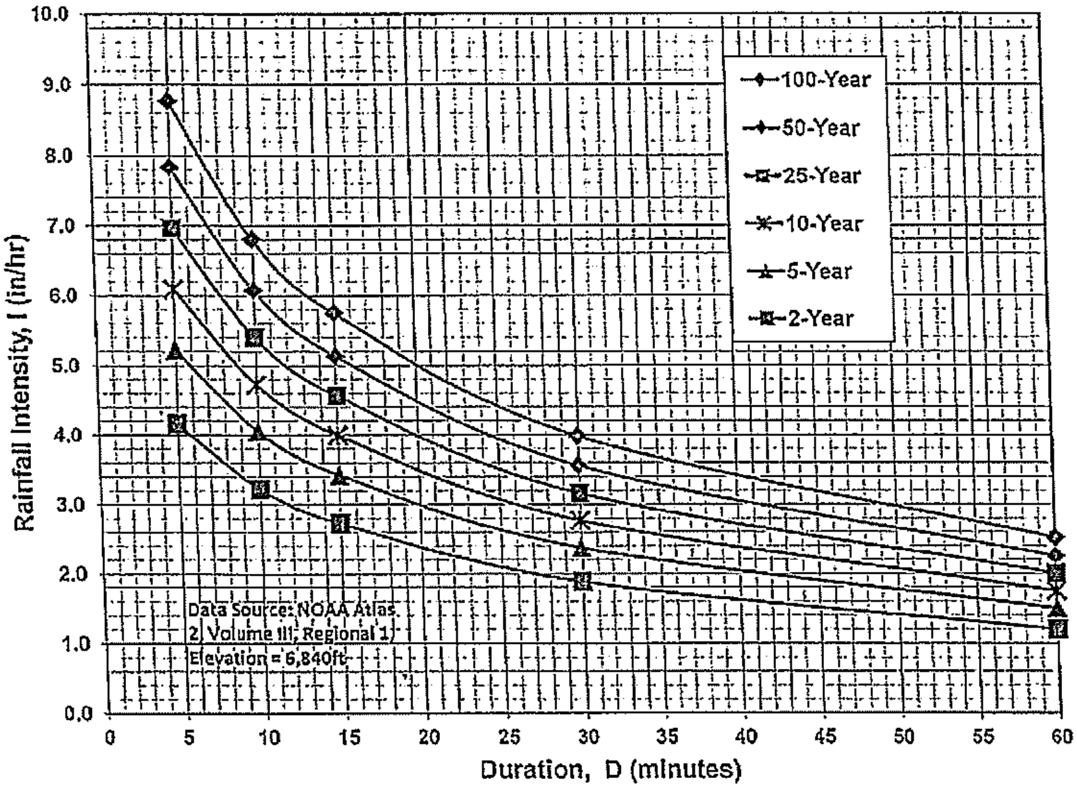


Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

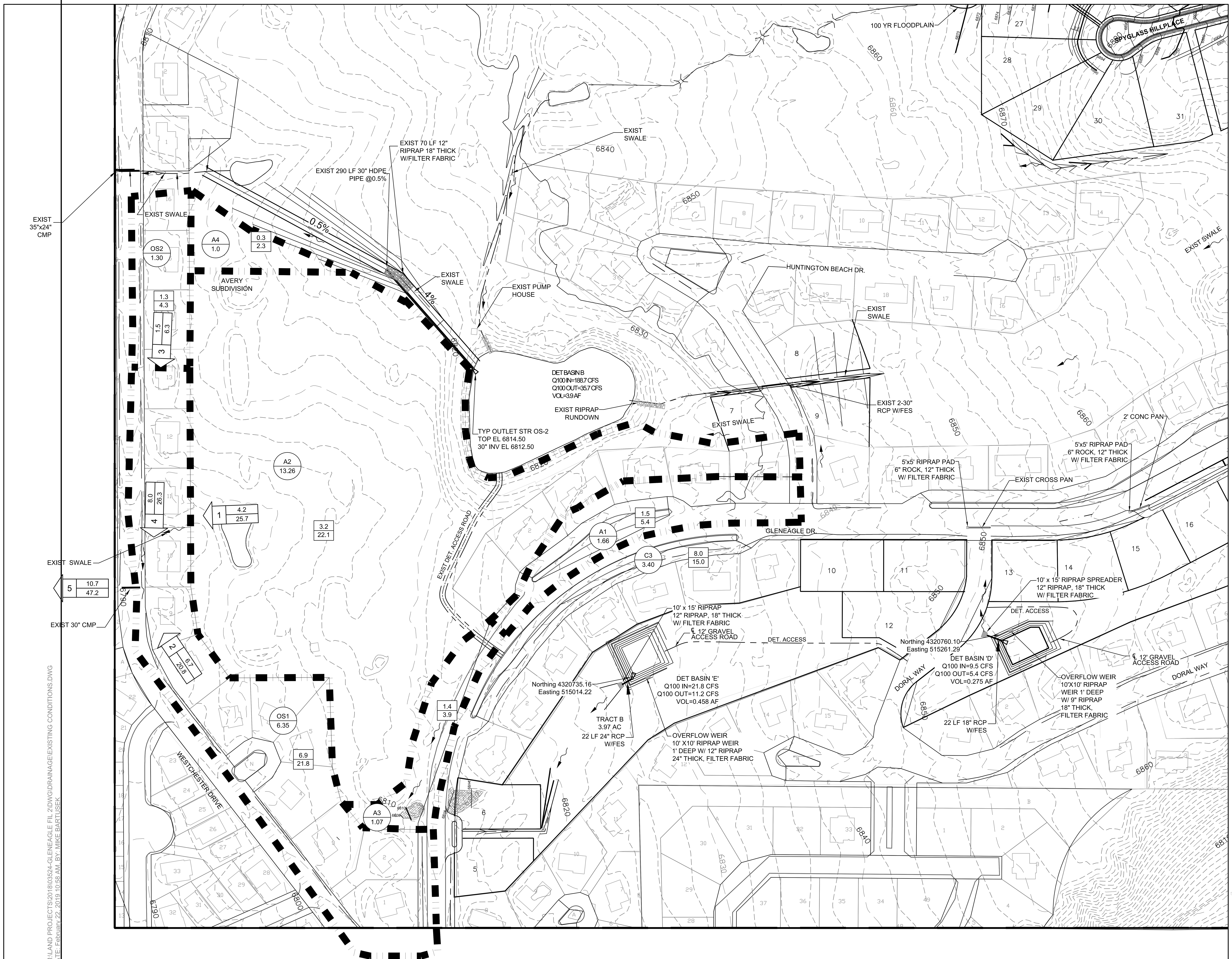


TABLE 1 – EXISTING CONDITIONS

Sub-Basin	Q5CFS	Q100 CFS
A1	1.5	5.4
A2	3.2	22.1
A3	1.4	3.9
A4	0.3	2.3
OS1	6.9	21.8
OS2	1.3	4.3
DP1(A1+A2)	4.2	25.7
DP2(A3+OS1)	6.7	20.8
DP3(A4+OS2)	1.5	6.3
DP4(DP2+DP3)	8	26.3
DP5(DP4+DP1)	10.7	47.2

NAME: M:\LAND PROJECTS\2018\03524-GLENEAGLE FIL 2\DWG\DRAINAGE\EXISTING CONDITIONS.DWG
PLOT DATE: February 22, 2019 10:58 AM, BY: MIKE BARTUSEK

REVISION

DESIGNED MAB
DRAWN HJG
CHECKED MAB
DATE 11/26/18

RESPEC
3520 AUSTIN BLUFFS PARKWAY
SUITE 102
COLORADO SPRINGS, CO 80918
PHONE (719) 266-5212

STAMP

811 Know what's **below.** **Call** before you dig.

PROJ NO. 03524
DWG NM. 03524-Dev-Fil2

Guman & Associates, LLC
731 N Weber St, Suite 10
COLORADO SPRINGS, CO. 80903

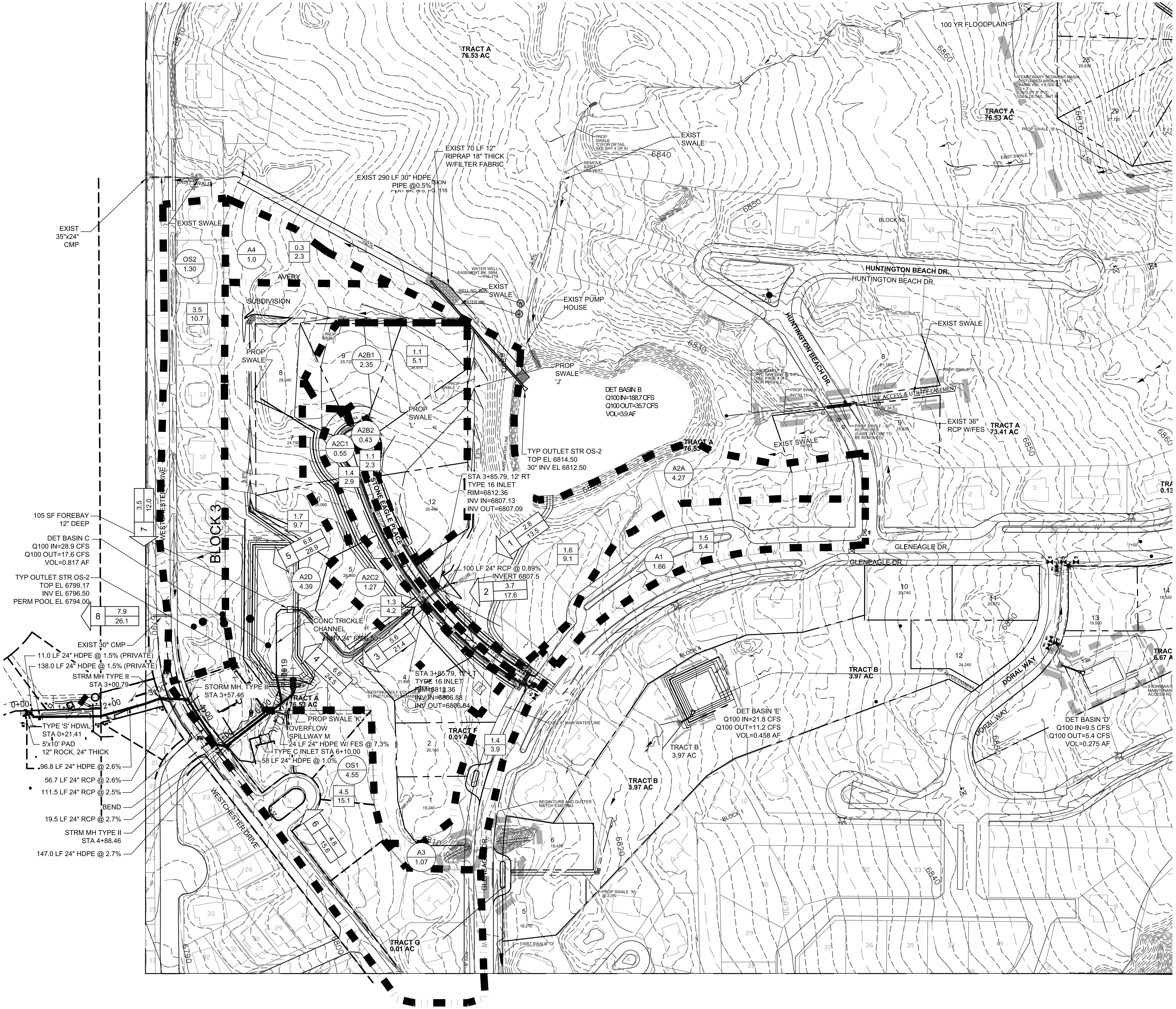
GLENEAGLE SUBDIVISION, FIL #2

EXISTING CONDITIONS

DRAWING NUMBER:

C

SHEET 1



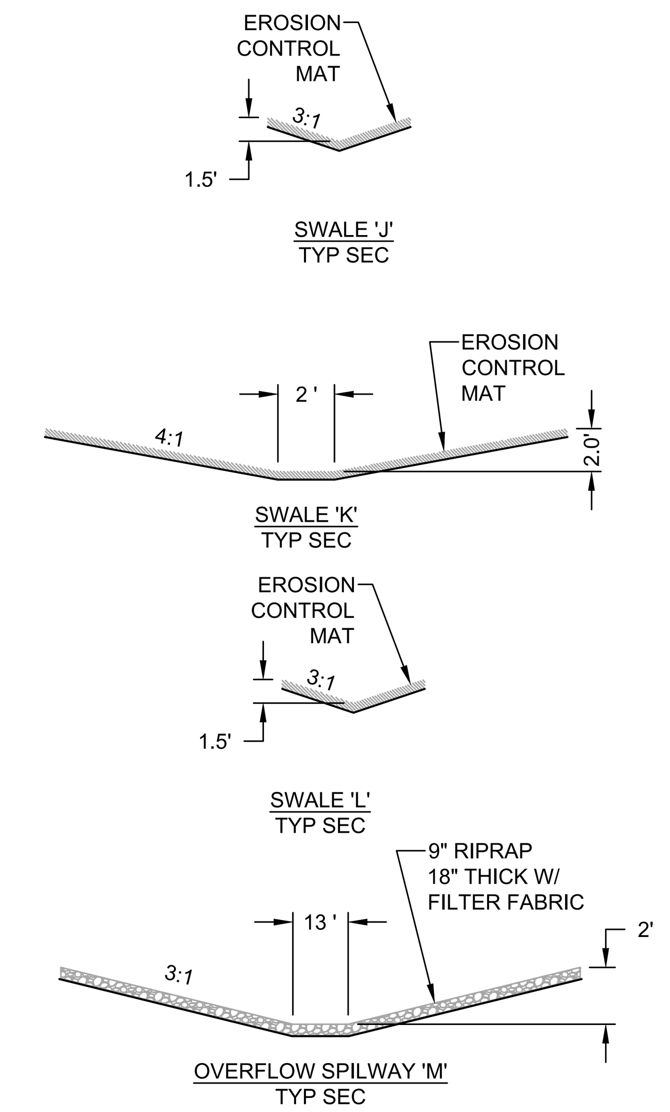
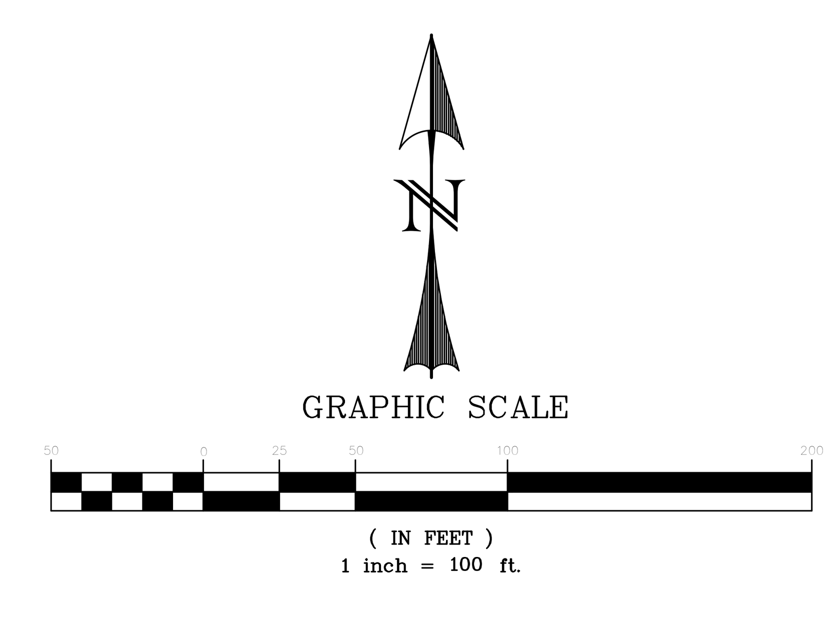


TABLE 2 – DEVELOPED CONDITIONS		
Sub-Basin	Q5CFS	Q100 CFS
OS1	4.5	15.1
OS2	3.5	10.7
A1	1.5	5.4
A2A	1.6	9.1
A2B1	1.1	5.1
A2B2	1.1	2.3
A2C1	1.4	2.9
A2C2	1.3	4.2
A2D	1.7	9.7
A3	1.4	3.9
A4	0.3	2.3
DP1 (A1+A2A)	2.8	13.5
DP2 (DP1+A2B1)	3.7	17.6
DP3 (DP2+A2B2+A2C1)	5.6	21.4
DP4(DP3+A2C2)	6.6	24.5
DP5 (DP4+A4B)	6.8	28.9
DP6 (OS1+A3)	4.8	15.6
DP7 (OS2+A4)	3.5	12
DP8 (DP6+DP7)	7.9	26.1



REVISION

DESIGNED	MAB
DRAWN	HJG
CHECKED	MAB
DATE	11/26/18

RESPEC
3520 AUSTIN BLUFFS PARKWAY
SUITE 102
COLORADO SPRINGS, CO 80918
PHONE (719) 266-5212

STAMP

811 Know what's below. Call before you dig.

PROJ NO. 03524
DWG NM. 03524-Dev-Fil2

Guman & Associates, LLC
731 N Weber St, Suite 10
COLORADO SPRINGS, CO. 80903

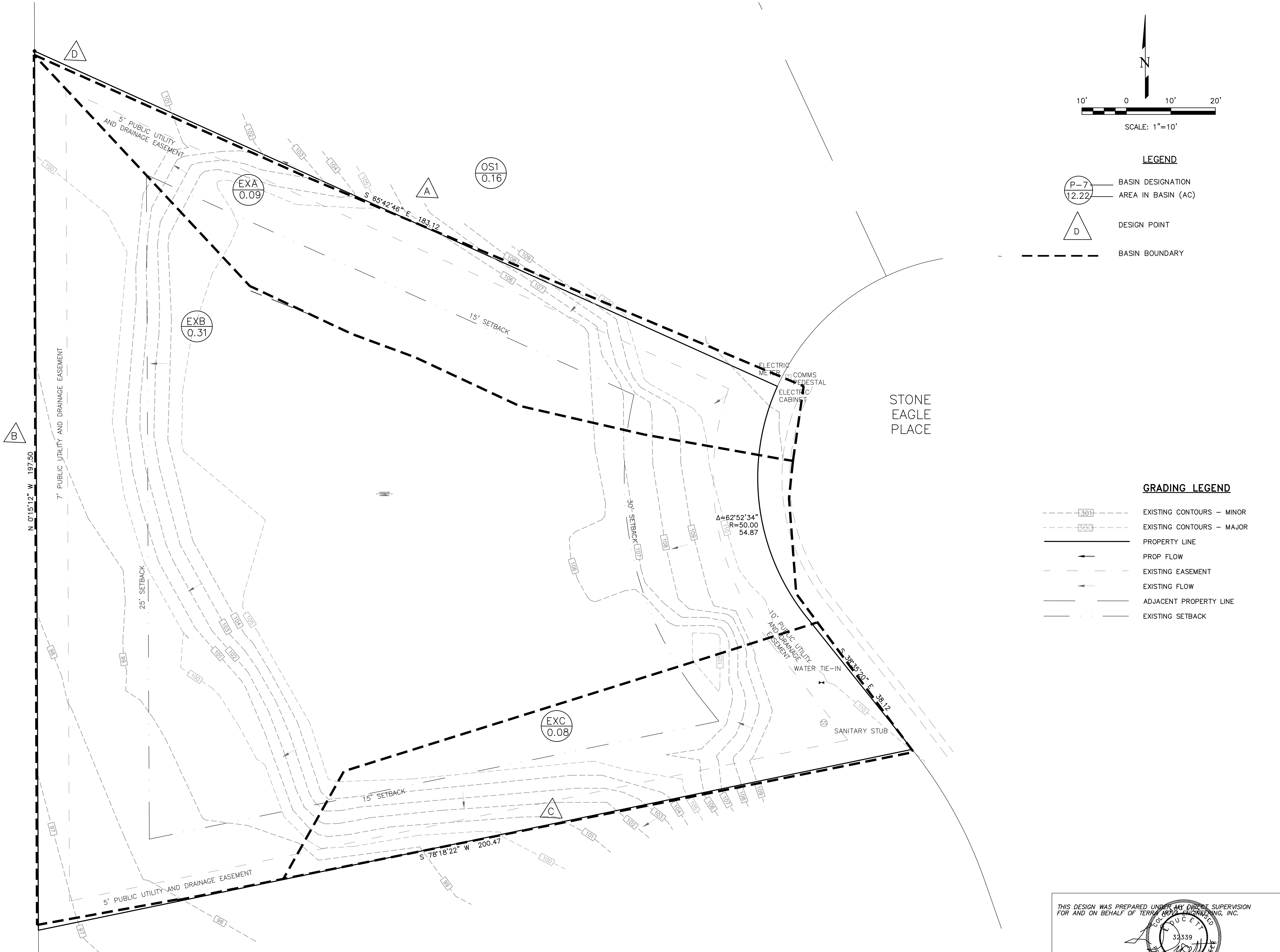
GLENEAGLE SUBDIVISION, FIL #2

DEVELOPED CONDITIONS

DRAWING NUMBER:
C
SHEET 2

NAME: Z:\COLORADO SPRINGS OFFICE\03524-GLENEAGLE FIL 2\DWG\DRAINAGE\DEVELOPED CONDITIONS.DWG
PLOT DATE: May 22, 2019 12:44 PM BY: JIM GILL

DRAINAGE MAPS



THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

L DUCETT, P.E.
COLORADO P.E. NO. 32339
12/17/2021

COLORADO LICENSED PROFESSIONAL ENGINEER L DUCETT 32339

REVISIONS		
NO.	DESCRIPTION	DATE

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PREPARED FOR:
JAYDEN HOMES
ATTN:
(719) 535-9030

Terra Nova Engineering, Inc.
"Creative Civil Engineering Solutions"
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

14160 STONE EAGLE PLACE

EXISTING CONDITIONS DRAINAGE MAP

DESIGNED BY LD
DRAWN BY JF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE NA
JOB NO. 2199.17
DATE ISSUED 12/17/21
SHEET NO. 1 OF 2

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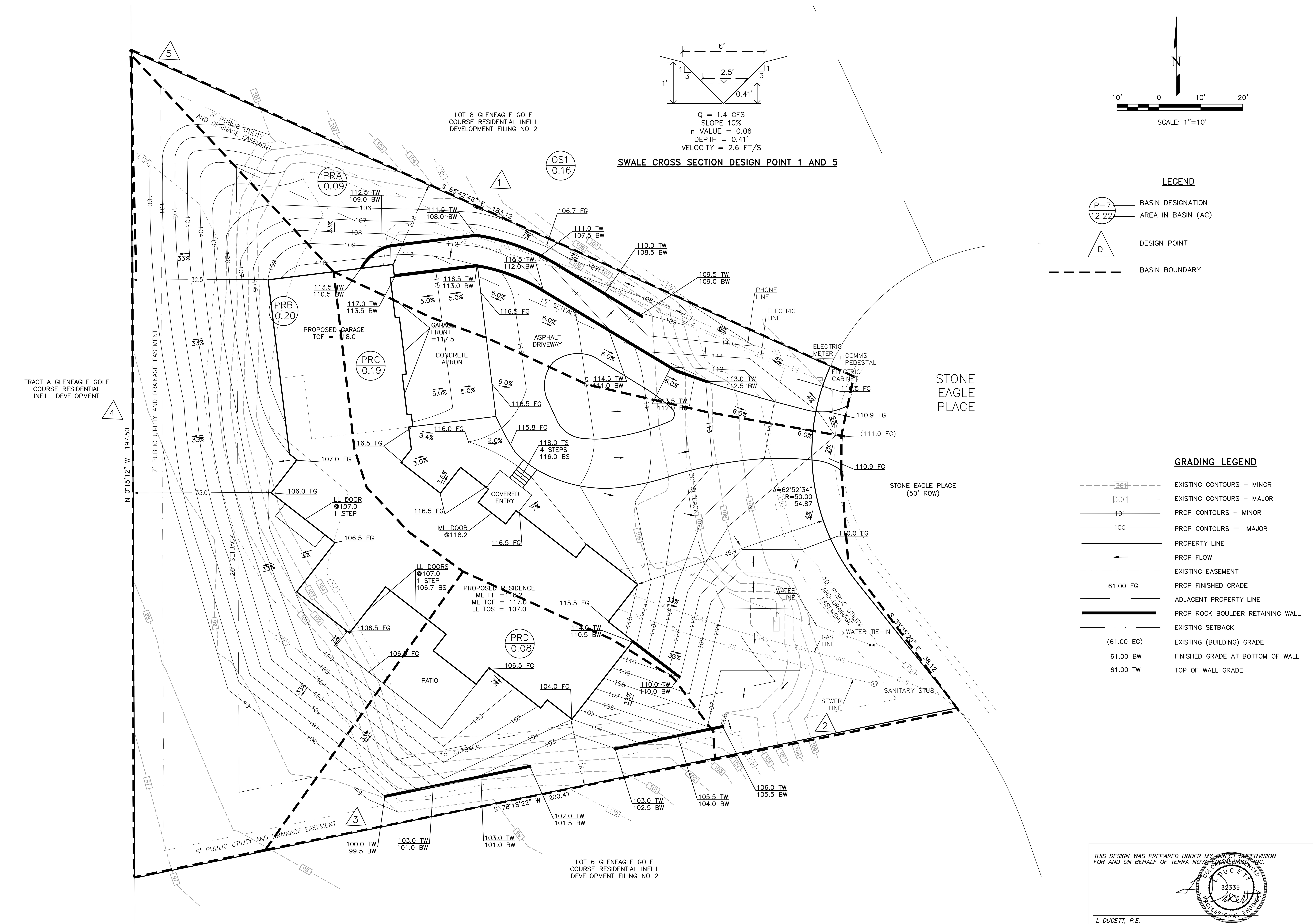

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
JAYDEN HOMES
ATTN:
(719) 535-9030

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tneinc.com

14160 STONE EAGLE PLACE

PROPOSED DRAIANGE MAP

DESIGNED BY LD
DRAWN BY JF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE NA
JOB NO. 2199.17
DATE ISSUED 12/17//21
SHEET NO. 2 OF 2

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