Preliminary Drainage Report
Final Drainage Report
for

Estates at Rolling Hills Ranch Filing 2

at

Meridian Ranch

EL PASO COUNTY, COLORADO

September 2020
Revised September 2021

Prepared For:

GTL DEVELOPMENT, INC.
P.O. Box 80036
San Diego, CA 92138

Prepared By:
Tech Contractors
11886 Stapleton Drive
Falcon, CO 80831
719.495.7444

PCD Project No. PUDSP204
SF2018

CERTIFICATIONS

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.

Thomas A. Kerby, P.E. #31429

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.

Raul Guzman, Vice President
GTL Development, Inc.
P.O. Box 80036
San Diego, CA 92138

9/30/2021
Date

El Paso County:

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

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

Approved
by Jeff Rice
El Paso County Planning and Community Development
on behalf of Elizabeth Nijkamp, Engineering Review Manager
10/07/2021 1:58:07 PM

Date

Estates at Rolling Hills Ranch Filing 2
Preliminary/Final Drainage Report

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REVISION EXECUTIVE SUMMARY

The revision to the Preliminary Drainage Report/Final Drainage Report (PDR/FDR) is to present the changes to the drainage patterns as a result minor design changes to the approved improvement plans associated with the Estates at Rolling Hills Ranch Filing 2 at Meridian Ranch (ERHR F2) development. Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version) as amended by the El Paso County Engineering Criteria Manual (ECM).

The proposed revision is the elimination of the east leg of the intersection of Crescent Creek Dr. with Estate Ridge Dr. The original drainage pattern would have the flow from north of the intersection be directed to the east along the future extension of Crescent Creek Dr. Eliminating the east leg causes the surface runoff to continue southerly towards the proposed Inlet 8. The net result is a 1 CFS increase of the 100-year flow at the inlet to 14 CFS. The inlet is sized properly to collect the increased flow. The impact to the downstream pipe is negligible also with increase to the 100-year pipe flow from 187 CFS to 189 CFS.

Changes to the report include updates to the rational narrative on pages 17-19. Values associated with Area B11 and Future B11 have been revised and shown in red. Area E02 has been eliminated and is now shown in faded text. The calculations and the maps found in the appendix have been revised.

There are no significant changes to this report from the original, the conclusion of the report is that the project will not adversely affect downstream properties.

EXECUTIVE SUMMARY

The purpose of the following Preliminary Drainage Report/Final Drainage Report (PDR/FDR) is to present the changes to the drainage patterns as a result the Estates at Rolling Hills Ranch Filing 2 at Meridian Ranch (ERHR F2) development. Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version) as amended by the El Paso County Engineering Criteria Manual (ECM).

This report based on the current version of the Meridian Ranch Sketch Plan amendment as adopted by the El Paso County Board of Commissioners on March 13, 2018. Hydrologic calculations follow method outlined in Chapter 6 of the 2014 version of the City of Colorado Springs Drainage Criteria Manual (COSDCM) as adopted by the El Paso County Board of County Commissioners by Resolution 15-042. Chapter 6 addresses the hydrologic calculation methods and includes an updated hydrograph to be used with storm drainage runoff. The Board adopted by the same resolution, Section 3.2.1 of Chapter 13 of the COSDCM referencing Full Spectrum Detention; the concept "provides better control of the full range of runoff rates that pass through detention facilities than the convention multi-stage concept. This section of the COSDCM identifies the necessity to provide full spectrum detention but does not prescribe a methodology to reach such the detention requirements. This report includes hydrologic models from HEC-HMS for the historic, interim and future conditions for the 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr design storm frequencies. The interim and the future conditions include detention facilities sized and modeled such that *"frequent and infrequent inflows are released at rates approximating undeveloped conditions"*

ERHR F2 encompasses 117± acres and is located in Sections 19 and 20, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

Rolling Hills Ranch is located within Gieck Ranch Drainage Basin. The Gieck Ranch Basin has been studied, but has not received final approval from El Paso County. The developer has agreed to meet the requirements of the studied Gieck Ranch Basin but as yet to be approved Drainage Basin Study.

Based on the aforementioned design parameters the development of the project will not adversely affect downstream properties.

INTRODUCTION

Purpose

The purpose of the following Preliminary Drainage Report/Final Drainage Report (PDR/FDR) is to present proposed changes to the drainage patterns as a result of the development of ERHR F2. The report outlines the proposed drainage mitigation based on calculated developed flows in excess of allowable exiting runoff discharge.

Scope

The scope of this report includes:

- Location and description of the proposed development stating the proposed land use, density, acreage and adjacent features to the site.
- Calculations for design peak flows from all off-site tributary drainage areas.
- Calculations for design peak flows within the proposed project area for all drainage areas.
- Discussion of major drainage facilities required as a result of the development.
- Discussion and analysis of existing and proposed facilities.

Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and those portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version) adopted by Resolution 15-042 of the El Paso County Board of County Commissioners as amended by the El Paso County Engineering Criteria Manual (ECM).

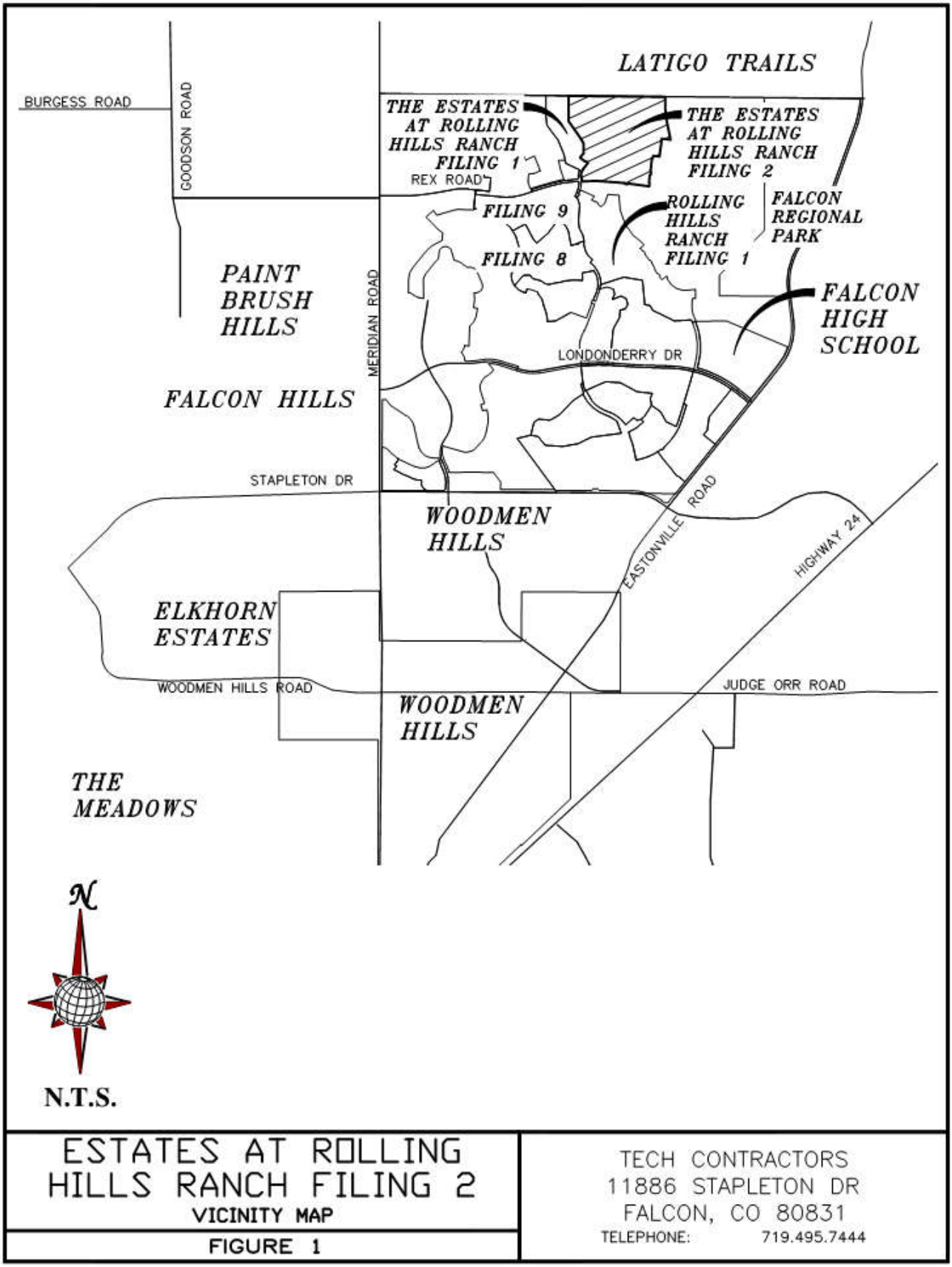
Background

On November 16, 2000 the El Paso County Board of County Commissioners approved the rezoning of the Meridian Ranch project (PUD-00-010) from A-35 to PUD with several conditions. Condition number seven stated in part that "drainage plans shall release and/or retain at approximately eight percent (80%) of historic rates." At the time of the initial approvals there were no drainage improvements downstream of the Meridian Ranch project and the existing natural channels were shallow and undefined.

The Sketch Plan Amendment (SKP-17-001) was processed and approved in 2018 by the El Paso County Board of County Commissioners by resolution 18-104 for Meridian Ranch. The resolution eliminated the required restriction of 80% of historic peak flow rates mentioned above. The detention pond proposed with this project will release at historic or less peak flow rates as per the current El Paso County stormwater requirements.

No development has occurred downstream of this project except for portions of the Falcon Regional Park providing sports fields, trails, dog park and associated parking. The Meridian Ranch MDDP and this report indicate the Eastonville Road culvert crossing located downstream of this project does not provide enough capacity for the historic flow rates. It is anticipated that this culvert will be upgraded at the time of the Eastonville Road construction.

Figure 1: Vicinity Map



Current calculations show the current design discharge of the existing Pond G to the Falcon Regional Park to be below historic flow rates at full build out for the full spectrum of design storms.

EXISTING CONDITIONS

General Location

Rolling Hills Ranch Estates project encompasses 117± acres and is located in Sections 19 and 20, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

Land Use

Historically, ranching dominated the area surrounding Meridian Ranch; however, currently urbanization has occurred in the general vicinity. Most notably, urbanization is occurring to the north with Latigo Trails, to the south in the Woodmen Hills Subdivision, to the east in Four Way Ranch, to the west in the Falcon Hills subdivision, and to the northwest in the Paint Brush Hills subdivision.

Climate

Mild summers and winter, light precipitation; high evaporation and moderately high wind velocities characterize the climate of the study area. The average annual monthly temperature is 48.4 F with an average monthly low of 30.3 F in the winter and an average monthly high of 68.1 F in the summer. Two years in ten will have maximum temperature higher than 98 F and a minimum temperature lower than –16 F. Precipitation averages 15.73" annually, with 80% of this occurring during the months of April through September. The average annual Class A pan evaporation is 45 inches. (Soil Survey of El Paso County Area, Colorado).

Topography and Floodplains

The topography of the site is typical of a high desert, short prairie grass with relatively flat slopes generally ranging from 2% to 4%. The project site drains generally from the northwest to southeast and is tributary to the Black Squirrel Creek.

The Flood Insurance Rate Maps (FIRM No. 08041C0552G dated 12/07/2018) indicates that the project is outside of any designated flood plain. Please see Figure 2: Estates at Rolling Hills Ranch Filing 2 Federal Emergency Management Agency (FEMA) Floodplain Map.

Geology

The National Resources Conservation Service (NRCS) soil survey records indicate that the service area is predominately covered by soils classified in the Stapleton series. This series is categorized as a Hydrological Soil Group B.

The Stapleton (83) sandy loam is a deep, non-calcareous, well-drained soil formed in alluvium derived from arkosic bedrock on uplands. Permeability of this soil is rapid. Available water capacity is moderate, surface runoff is slow, and the hazard of erosion and soil blowing is moderate. The Stapleton series is categorized as a Hydrological Soil Group B.

Figure 2: FEMA Floodplain Map

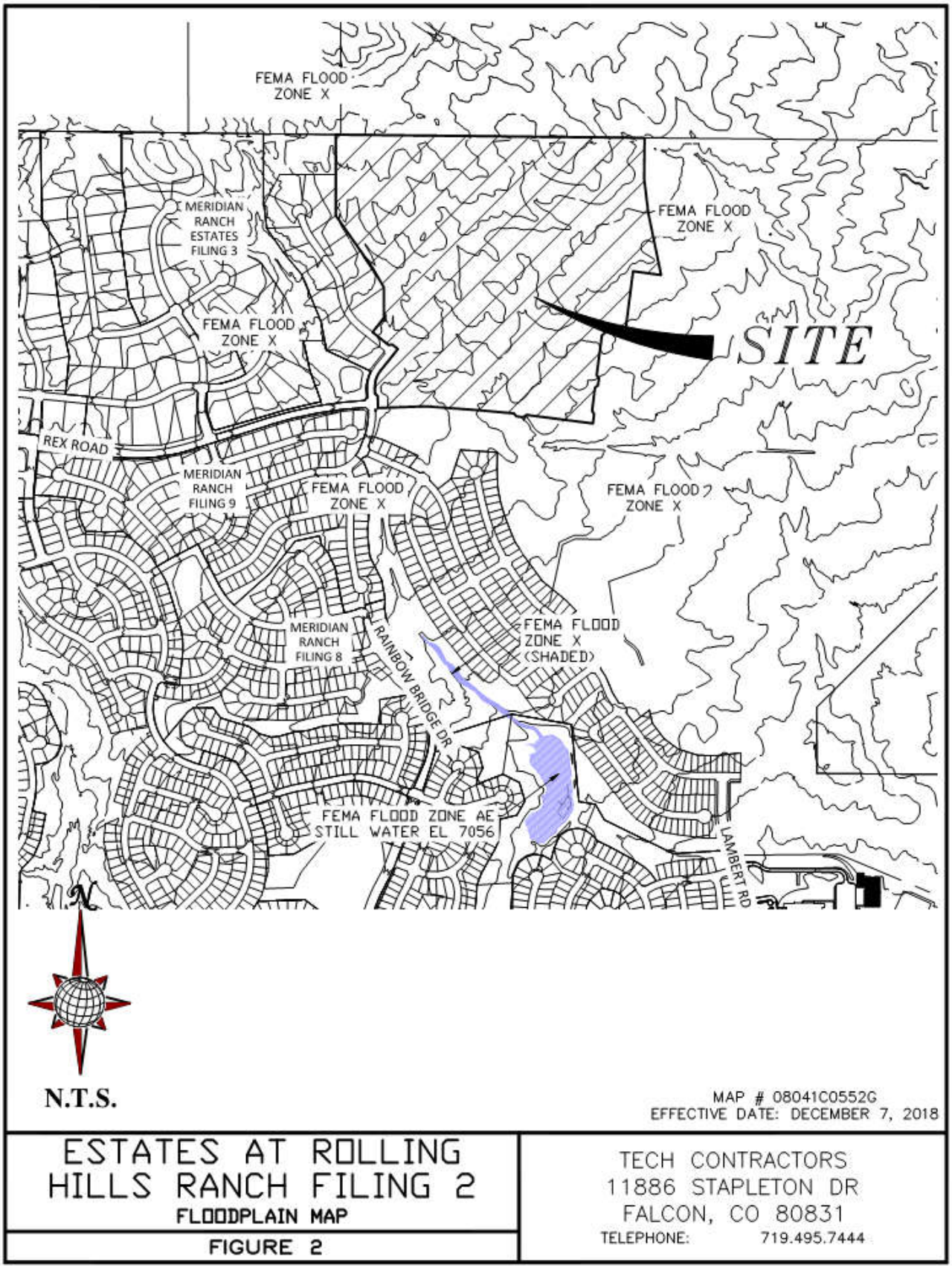
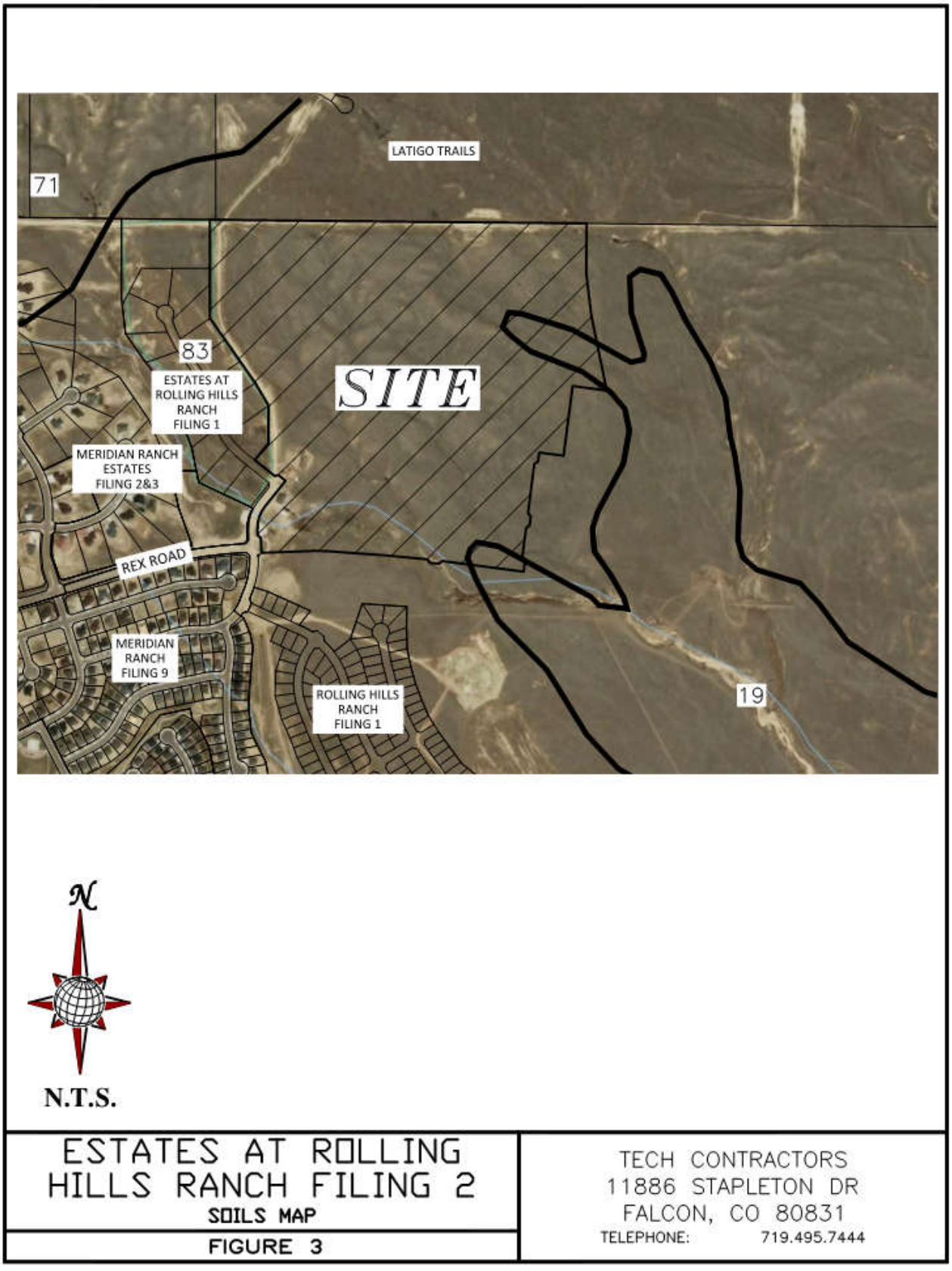


Figure 3: Soils Map



This soil is suited to habitat for open land and rangeland wildlife. The main limitation of this soil for urban development is frost-action potential.

Typically, these soils are well-drained, gravelly sandy loams that form on alluvial terraces and fans and exhibit high permeability and low available water capacity with depth to bedrock greater than 6 feet.

The Columbine (19) gravelly sandy loam is a deep, well-drained to excessively drained soil formed in coarse textured material on alluvial terraces, fans and flood plains. Permeability of this soil is very rapid. Available water capacity is low to moderate, surface runoff is slow, and the hazard of erosion is slight to moderate. The Columbine series is categorized as a Hydrological Soil Group A.

This soil is used mainly for grazing livestock, for wildlife habitat and for home sites. The main limitation of this soil for urban development is a hazard of flooding in some areas.
Note: (#) indicates Soil Conservation Survey soil classification number. See Figure 3 Estates at Rolling Hills Ranch Filing 2 – Soils Map.

Natural Hazards Analysis

Natural hazards analysis indicates that no unusual surface or subsurface hazards are located near the vicinity. However, because the soils are cohesionless, sloughing of steep banks during drilling and/or excavation could occur. By citing improvements in a manner that provides an opportunity to lay the banks of excavations back at a 1:1 slope during construction, the problems associated with sloughing soils can be minimized.

DRAINAGE BASINS AND SUB-BASINS

The site is near the top of the Gieck Ranch Drainage Basin and accepts flow from areas north of the project site within portions of the adjacent Antlers Ridge and Latigo developments.

Three different scenarios were analyzed for the drainage conditions for the project.

The first scenario analyzes the historic conditions for Meridian Ranch. This condition has all of Meridian Ranch in the pre-development state; where the entirety of Meridian Ranch is modeled in its undeveloped, undisturbed condition, alternatively called the historic condition.

The second scenario is the interim conditions scenario and it consists of the current existing conditions for all tributary areas whether developed or undeveloped/historic with the addition of Estates at Rolling Hills Ranch Filing 2 in the proposed developed condition. The current existing conditions assume all approved projects tributary to the Estates at Rolling Hills Ranch Filing 2 are at full buildout. This condition was analyzed to ensure the full spectrum of historic flow rates exiting the Meridian Ranch development are maintained after the development of Estates at Rolling Hills Ranch Filing 2 is completed.

The interim scenario was analyzed to ensure that the historic flow rates that leave the site upstream of and adjacent to the Falcon Regional Park are maintained.

The final scenario analyzes the future build out conditions for the entirety of Meridian Ranch to ensure the storm drain and future detention facilities located at the discharge point downstream of this project are able to properly attenuate the full spectrum of developed peak flow rates to historic peak flow rates as the storm water exits the Meridian Ranch project onto the adjacent Falcon Regional Park.

DRAINAGE DESIGN CRITERIA

SCS Hydrograph Procedure

The US Army Corp of Engineers HEC-HMS computer program was used to model the Soil Conservation Service (SCS) Hydrograph procedure to determine final design parameters for the major drainage facilities within the project. Onsite basin areas were calculated using aerial topography of the site and approved final design data. Times of concentration were estimated using the SCS procedures described in the DCM. Based upon the hydrologic soil type, the natural conditions found in the basins and the runoff curve numbers (CN) chart from Table 6-10 of the City of Colorado Springs DCM for Antecedent Runoff Condition II (ARC II), the following CN values were used for the given conditions.

Table 1: SCS Runoff Curve Numbers

Condition	CN*
Residential Lots (5 acre)	63
Residential Lots (2.5 acre)	66
Residential Lots (1 acre)	68
Residential Lots (1/2 acre)	70
Residential Lots (1/3 acre)	72
Residential Lots (1/4 acre)	75
Residential Lots (1/5 acre)	78
Residential Lots (1/6 acre)	80

School	80
Parks/Open Space	62
Commercial	85
Roadways	98
Graded	67
Golf Course	62
Latigo Undeveloped	65
Undeveloped	61

*Curve Numbers were interpolated and based on amount of impervious area per lot. The 24 hour storm precipitation values were selected from the NOAA Atlas 14, Volume 8, Version 2 for the Meridian Ranch location (Latitude 38.9783°, Longitude -104.5842°, Elevation 7054 ft). These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs. See the table for all the design storm events in Appendix A. These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs.

Full Spectrum Design

The City of Colorado Springs adopted a new Drainage Criteria Manual (DCM) in 2014 which incorporated the use of *Full Spectrum Design* for storm drainage analysis for projects located within the city limits. El Paso County adopted portions of the City's 2014 DCM by resolution in January 2015; the County resolution adopted Chapter 6 (Hydrology) and Section 3.2.1 of Chapter 13 (Full Spectrum Detention) for projects outside of the City of Colorado Springs establishing a 1 year review period to analyze the impacts of the Full Spectrum Design on the storm drainage analysis of projects. This report has incorporated the use of full spectrum in the analysis using the SCS Method to determine the size requirements for the detention pond during the interim and future conditions.

The idea behind full spectrum detention is to release the developed runoff flow rates that will approximate those of the pre-developed condition. The existing design of Pond G and the outlet control structure will meet or exceed the intent and spirit of the concept.

Table 2: Detention Pond Summary:

POND F				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
INTERIM CONDITIONS				
2-YEAR STORM	5.0	2.1	0.9	7130.1
5-YEAR STORM	22	7.7	1.8	7131.1
10-YEAR STORM	54	16	3.3	7132.6
50-YEAR STORM	200	121	6.7	7134.9
100-YEAR STORM	293	178	8.9	7136.0
FUTURE CONDITIONS				
2-YEAR STORM	5.0	2.1	0.9	7130.1
5-YEAR STORM	22	7.7	1.8	7131.1
10-YEAR STORM	54	16	3.3	7132.6
50-YEAR STORM	200	121	6.7	7134.9
100-YEAR STORM	293	178	8.9	7136.0

POND G				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
INTERIM CONDITIONS				
2-YEAR STORM	7.4	3.6	2.4	7026.0
5-YEAR STORM	33	9.8	6.7	7027.1
10-YEAR STORM	76	28	8.9	7027.5
50-YEAR STORM	333	206	17.0	7028.9
100-YEAR STORM	522	358	21.1	7029.6
FUTURE CONDITIONS				
2-YEAR STORM	26	5.1	4.7	7026.6
5-YEAR STORM	75	20	8.1	7027.4
10-YEAR STORM	141	53	10.8	7027.9
50-YEAR STORM	436	321	20.1	7029.5
100-YEAR STORM	668	472	25.3	7030.3

DRAINAGE CALCULATIONS

SCS General Overview

The project is located within the Gieck Ranch Drainage Basin; storm water runoff will be conveyed across the site overland and within proposed storm drain networks to the Pond G detention facility.

The Pond G detention facility has been adequately sized such that the developed flows detained and released will approximate the historic flow rates for the various design storm events for both the interim condition and in the future as the storm flow exits Meridian Ranch onto the Falcon Regional Park.

Figure 5: Meridian Ranch SCS Calculations – Historic Conditions Map, Figure 6: Meridian Ranch SCS Calculations – Interim Conditions Map and Figure 7: Meridian Ranch SCS Calculations – Future Conditions Map depict the historic, interim and future general drainage patterns for Estates at Rolling Hills Ranch Filing 2.

The purpose of this report is to show that the development of Estates at Rolling Hills Ranch Filing 2 will not adversely impact the existing drainage facilities adjacent to and downstream of the developed area and the existing Pond G is properly sized for all anticipated future development.

SCS Calculations

Historic Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics under Existing Conditions using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations - Historic Basin Map.

Table 3: Historic Drainage Basins – SCS

HISTORIC SCS (Full Spectrum)						
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	11.6	3.75	0.52
OS06-G02	0.1313	77	52	11	3.73	0.52
OS05	0.0578	39	26	5.64	1.79	0.23
OS05-G01	0.0578	38	25	5.49	1.74	0.23
HG01	0.0547	32	21	4.67	1.52	0.22
G01	0.1125	70	46	10	3.22	0.45
G01-G02	0.1125	68	46	10	3.16	0.45
HG02	0.0906	45	30	6.68	2.29	0.36
G02	0.3344	191	127	27	9	1.32
G02-G03	0.3344	190	125	27	8.97	1.32
HG03	0.1828	77	51	12	4.26	0.72
OS07	0.0328	25	17	4.49	1.7	0.26
OS07-G03	0.0328	24	17	4.27	1.68	0.26
G03	0.55	291	192	42	15	2.25
G03-G04	0.55	281	189	42	14	2.25
OS09	0.1547	91	63	19	8.34	1.9
OS09-G04	0.1547	90	62	18	8.29	1.9
HG04	0.0891	40	26	5.93	2.1	0.34
HG05	0.1125	49	32	7.35	2.6	0.43
OS08	0.0406	35	25	7.7	3.44	0.72
OS08-G04	0.0406	34	24	7.38	3.4	0.72
G04	0.9469	493	332	76	28	4.71
G04-G05	0.9469	488	318	76	27.34	4.69
HG06A	0.1375	49	32	7.58	2.85	0.51

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

HISTORIC SCS (Full Spectrum)						
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G05	1.0844	536	350	84	30	5.18
G05-G06	1.0844	520	348	83	30	5.16
HG06B	0.1031	33	22	5.27	2.04	0.37
G06	1.1875	551	369	88.47	32	5.52

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Interim Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the interim conditions using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations – Interim Basins Map

Table 4: Interim Drainage Basins-SCS

INTERIM SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9.2	2.5	0.9	0.1
OS07a-POND F	0.0170	13	9.0	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	6.5	3.9	1.7
FG21a	0.0095	7	5	1.3	0.5	0.1
FG21a-G7	0.0095	7	4.9	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1264	84	60	20.6	10.5	3.3
OS08	0.0394	34	24	7	3	0.7
OS08-G8	0.0394	33	23	7	3	0.7

INTERIM SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
FG23a	0.0231	16	11	3	1.0	0.2
OS07c	0.0156	15	10	3	1.0	0.1
OS07c-G8	0.0156	13	9	2	0.9	0.1
G8	0.6910	292	193	36.5	16.6	4.4
G7-G10	0.6910	292	192	36.3	16.4	4.2
OS09	0.1527	90	62	18	8	1.9
OS09-G10	0.1527	88	61	18	8	1.9
FG24	0.1405	74	49	12	4.1	0.7
G9	0.2932	154	105	28	12	2.5
G8-G10	0.2932	154	103	28	12	2.5
FG23b	0.0334	22	14	3.1	1.0	0.1
G10	1.0176	449	290	65.3	28.9	6.8
G10-G11	1.0176	447	288	64.9	28.6	6.7
FG23c	0.0070	5	3	1	0	0.0
G11	1.0246	449	289	65	29	6.8
FG25	0.1086	48	32	7	3	0.4
FG28	0.0688	33	21	5	2	0.3
POND G IN	1.2020	522	333	76	33	7.4
POND G	1.2020	358	206	28	10	3.6
G12	1.2020	358	206	28	10	3.6
G12-G06	1.2020	357	205	28	10	3.6
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	27	18	4	1	0.2
FG32-G06	0.0402	27	18	4	1	0.2
G06	1.3419	377	217	29	11	4.0

Future Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the future conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

Table 5: Future Drainage Basins-SCS

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9.2	2.5	0.9	0.1
OS07ab-POND F	0.0170	13	9.0	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	6.5	3.9	1.7
FG21a	0.0095	7.4	5.0	1.3	0.5	0.1
FG21a-G7	0.0095	7.4	4.9	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1309	89	64	22	12	3.8
OS08	0.0394	34	24	7.5	3.3	0.7
OS08-G8	0.0394	33	23	7.3	3.3	0.7
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07c	0.0156	15	10	2.6	1.0	0.1
OS07c-G7	0.0156	14	9.7	2.4	0.9	0.1
G8	0.6940	288	191	39	20	6.0
G8-G10	0.6940	286	189	38	20	6.0
OS09	0.1527	90	62	18	8.2	1.9
OS09-G10	0.1527	88	62	18	8.2	1.9
FG24	0.1517	118	85	30	16	4.9
G9	0.3044	193	134	41	18	4.9
G9-G10	0.3044	190	134	40	18	4.9
FG23b	0.0247	18	12	3	1.1	0.2
G10	1.0231	470	305	79	37	11
G10-G11	1.0231	470	304	78	37	11
FG23c	0.0122	12	8.7	3.0	1.5	0
G11	1.0353	474	306	79	38	11
FG25	0.1086	85	64	27	17	8
FG26	0.0863	78	58	22	12	5
FG26-POND G	0.0863	77	57	22	12	4
FG27	0.0500	52	40	17	11	5
FG28	0.0245	18	13	4.1	2.0	0.5
POND G IN	1.3047	668	436	141	75	25.61
POND G	1.3047	472	321	53	20	5.1
G12	1.3047	472	321	53	20	5.1
G12-G06	1.3047	472	320	53	20	5.09
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	72	57	29	20	11.14
FG32-G06	0.0402	69	54	27	18	10.5
G06	1.4446	498	338	58	22	10.5
FG34	0.0600	34	90	41	27	13
G14	0.0600	34	86	41	27	13
G14-G15	0.0600	34	67	31	20	10
FG35	0.0344	20	65	29	19	10
G15	0.0944	53	36	14	8	3

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G15-G08	0.0944	52	36	14	8	3
FG37	0.0797	41	31	12	7	3
FG36	0.0281	14	215	94	59	29
FG36-G08	0.0281	14	61	25	15	7
G16	0.2022	106	59	28	19	10

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Rational Calculations

The Rational Hydrologic Calculation Method was used to estimate the total runoff from the 5-year and the 100-year design storm and thus establish the storm drainage system design. Using the rational calculation methodology outlined in the Hydrology Section (Ch 6) of the COSDCM coupled with the El Paso County EPCDCM an effective storm drainage design for Estates at Rolling Hills Ranch Filing 2 has been designed. The storm drainage facilities have been designed such that the minor storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not overtop the curbs. The storm drainage facility has been designed such that the major storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not exceed the right-of-way widths for residential streets and the hydraulic grade line will be less than one foot below the surface.

The site is located within the Gieck Ranch Drainage Basin. The storm drain runoff will be collected by a series of inlets and storm drain pipe then conveyed through the project and discharge into an existing natural drainage course continuing into existing Pond G that is properly sized to safely convey the storm water flows away from the project without damaging adjacent property.

Rational Narrative

The following is a detailed narrative of the storm drainage system located in Estates at Rolling Hills Ranch Filing 2. These storm drainage systems meet the requirements of as found in the El Paso County Engineering Criteria Manual I.7.1.C.5. (ECM) for storm water quality and discharge into Waters of the State. The discharge point is located upstream of a Regional Detention Facility with WQCV incorporated into the design and construction. At least 20 percent of the upstream imperviousness within the catchment must be disconnected from the storm drainage system and drain though a pervious area that makes up at least 10 percent of the disconnected impervious area. The rooftops within this catchment make up more than 20 percent of the total impervious area of the catchment, is discharged via roof downspouts and drains across the front yard pervious areas equaling more than 10 percent of the rooftop area. Please see Appendix F for information and exhibits.

Storm Drain System A

- Basin OS7c (10.0 acres, Q_5= 4.1 CFS, Q_{100} = 22 CFS) contains off-site area north of Meridian Ranch within the Antler Ridge/Latigo Trails subdivision entering the project on the north side via an existing 30" RCP culvert at Design Point 1. The surface runoff is concentrated within an existing swale, directed southerly onto Meridian Ranch and drainage basin A01. The surface runoff is conveyed southerly via an existing swale toward an existing Type C Inlet located in Basin A01.

- Basin A01 (6.1 acres, Q_5= 2.3 CFS, Q_{100} = 13 CFS) contains rear portions of the lots on the east side of proposed Cypress Meadow Drive and open space. The surface runoff will sheet flow off of the open space, rear portions of the lots and be directed to the existing swale carrying the flow from Antler Ridge/Latigo Trails located to the existing Type C Inlet (ECB). All of the flow (Q_5= 5.0 CFS, Q_{100} = 27 CFS) is captured and conveyed downstream via a 24" RCP to outlet at OS1.

Storm Drain System B

- Basin B01 (11.3 acres, Q_5= 4.2 CFS, Q_{100} = 24 CFS) contains rear portions of the lots on the west side of proposed Cypress Meadow Drive, a portion of Latigo Trails and open space. The surface runoff will sheet flow off of the open space and be directed to an existing swale continuing to the proposed Type C Inlet (CB01). All of the flow (Q_5= 4.2 CFS, Q_{100} = 24 CFS) is captured and conveyed downstream via a 24" RCP to Storm Manhole J01 then to Storm Manhole J02.

- Basin B02 (8.3 acres, Q_5= 5.5 CFS, Q_{100} = 20 CFS) contains lots fronting along the east side of Cypress Meadow Drive, north side of Highland Crest Drive and west side of Sage Mesa Way. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I01. All of the 5-year flow is captured by this inlet (Q_5= 5.5 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 2.9 CFS) continuing downstream to Inlet I02. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J02.

- The total pipe flow conveyed to Storm Manhole J02 is Q_5= 9.5 CFS, Q_{100} = 40 CFS and is conveyed via a 30" RCP to Storm Manhole J03 continuing via 30" RCP to Storm Manhole J06.

- Basin OS8 (24.2 acres, Q_5= 10 CFS, Q_{100} = 43 CFS) contains off-site area north of Meridian Ranch within the Latigo Trails subdivision entering the project on the north side via an existing 30" RCP culvert at Design Point 2. The surface runoff is concentrated within an existing swale, directed southerly onto Meridian Ranch and drainage basin B03. The surface runoff is conveyed southerly via an existing swale toward a proposed Type D Inlet located in Basin B03.

- Basin B03 (10.5 acres, Q_5= 5.6 CFS, Q_{100} = 23 CFS) contains rear portions of the lots on the east side of proposed Sage Mesa Way, a portion of the future water tank site and open space. The surface runoff will sheet flow off of the open space, rear portions of the lots and be directed to the existing swale carrying the flow from Latigo Trails to the proposed Type D Inlet (CB02). All of the flow (Q_5= 13 CFS, Q_{100} = 56 CFS) is captured and conveyed downstream via a 36" RCP to Storm Manhole J04. The pipe flow continues via 36" RCP from Storm Manhole J04 to Storm Manhole J05 and Storm Manhole J05 to Storm Manhole J06.

- The total pipe flow conveyed to Storm Manhole J06 is Q_5= 20 CFS, Q_{100} = 85 CFS and is conveyed via a 42" RCP to Storm Manhole J07.

- Basin B04 (10.6 acres, Q_5= 7.4 CFS, Q_{100} = 26 CFS) contains lots fronting along the east side of Sage Mesa Way, north side of Highland Crest Drive, west side of Estate Ridge Drive and a portion of the future water tank site. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I02. All of the 5-year flow is captured by this inlet (Q_5= 7.4 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 8.8 CFS) continuing downstream to Inlet I05. The captured flow is conveyed downstream via a 24" RCP to Storm Manhole J07.

- The total pipe flow conveyed to Storm Manhole J07 is Q_5= 26 CFS, Q_{100} = 97 CFS and is conveyed via a 42" RCP to Storm Manhole J08 continuing via 42" RCP to Storm Manhole J09.

- Basin B05 (5.6 acres, Q_5= 4.0 CFS, Q_{100} = 13 CFS) contains lots fronting along the east side of Estate Ridge Drive, open space and a portion of the future water tank site. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R flow-by inlet located at I06. Most of the flow is captured (Q_5= 3.6 CFS, Q_{100} = 9.6 CFS) with the remaining flow (Q_5= 0.5 CFS, Q_{100} = 3.7 CFS) continuing east along future developed land via existing temporary swale to the existing temporary sedimentation pond 3 constructed with Rough Grading Plans for Rolling Hills Ranch at Meridian Ranch located along future Rex Road, before being discharged to an existing swale and then Pond G. The temporary sedimentation pond will be removed with the future development of the Estates at Rolling Hills Ranch and Rex Road. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J09.

- Basin B06 (1.5 acres, Q_5= 1.1 CFS, Q_{100} = 3.9 CFS) contains lots fronting along the south side of Sunrise Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 15' Type R sump inlet located at I04. All of the flow is captured along with cross street flow from Inlet I03 (Q_5= 1.1 CFS, Q_{100} = 21 CFS). The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J10.

- Basin B07 (7.4 acres, Q_5= 5.1 CFS, Q_{100} = 18 CFS) contains lots fronting along Cypress Meadow Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to cross pan at Design Point 3. The flow continues via curb and gutter through Basin B08 to a proposed 20' Type R sump inlet located at I03.

- Basin B08 (9.4 acres, Q_5= 6.9 CFS, Q_{100} = 24 CFS) contains rear lots fronting along the south side of Highland Crest Drive and lots fronting along the north side of Sunrise Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R sump inlet located at I03. Flow from B07 and B08 combine at I03 with all of the 5-year flow being captured by this inlet (Q_5= 10 CFS) and about half of the 100-yr storm flow captured (Q_{100} = 17 CFS), with the remaining flow (Q_{100} = 18 CFS) continuing across the street to Inlet I04. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J10.

- The total pipe flow conveyed to Storm Manhole J10 is Q_5= 11 CFS, Q_{100} = 38 CFS and is conveyed via a 30" RCP to Storm Manhole J11.

- Basin B09 (6.1 acres, Q_5= 4.1 CFS, Q_{100} = 14 CFS) contains lots fronting along the south side of Highland Crest Drive, west side of Estate Ridge Drive and lots fronting along the north side of Sunrise Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I05. All of the 5-year flow is captured by this inlet (Q_5= 4.1 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 4.7 CFS) continuing downstream to Inlet I07. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J09.

- The total pipe flow conveyed to Storm Manhole J09 is Q_5= 31 CFS, Q_{100} = 117 CFS and is conveyed via a 42" RCP to Storm Manhole J11. Pipe flow from Storm Manhole J09 and Storm Manhole J10 combine at Storm Manhole J11 for a total of Q_5= 41 CFS, Q_{100} = 149 CFS and is conveyed via a 42" RCP to Storm Manhole J12.

- Basin B10 (12.2 acres, Q_5= 8.6 CFS, Q_{100} = 30 CFS) contains lots fronting along the south side of Sunrise Ridge Drive, west side of Estate Ridge Drive and lots fronting along the north side of Crescent Creek Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I07. All of the 5-year flow is captured by this inlet (Q_5= 8.6 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 14 CFS) continuing downstream to Inlet I09. The captured flow is conveyed downstream via a 24" RCP to Storm Manhole J12.

- The total pipe flow conveyed to Storm Manhole J12 is Q_5= 47 CFS, Q_{100} = 163 CFS and is conveyed via a 48" RCP to Storm Manhole J13.

- Basin B11 (1.0 acres, Q_5= 1.7 CFS, Q_{100} = 4.1 CFS) contains lots along the east side of Estate Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 10' Type R sump inlet located at I08. All of the flow is captured along with cross street flow from Inlet I09 (Q_5= 1.7 CFS, Q_{100} = 5.1 CFS). The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- Basin B12 (3.3 acres, Q_5= 2.3 CFS, Q_{100} = 7.9 CFS) contains lots fronting along the south side of Crescent Creek Drive and lots along the west side of Estate Ridge Drive. The surface runoff will sheet flow off the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R sump inlet located at I09. All of the 5-year flow is captured by this inlet (Q_5= 2.3 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 2.6 CFS) continuing across the street to Inlet I08. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- The total pipe flow conveyed to Storm Manhole J13 is Q_5= 51 CFS, Q_{100} = 182 CFS and is conveyed via a 54" RCP to Storm to discharge at design point OS2. OS2 discharges to a rip-rap lined channel that connects to the existing sandy arroyo connecting to existing Pond G.

Ultimate Storm Drain System Design

With the full build out of Rex Road, Basin B12 will increase the area that flows to Inlet I09. Therefore the design and construction of the storm drain system will be based on the following future basins.

- Basin FB11 (0.4 acres, Q_5= 1.6 CFS, Q_{100} = 3.5 CFS) contains lots along the east side of Estate Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 10' Type R sump inlet located at I08. All of the flow is captured along with cross street flow from Inlet I09 (Q_5= 1.6 CFS, Q_{100} = 14 CFS). The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- Basin FB12 (6.2 acres, Q_5= 7.5 CFS, Q_{100} = 19 CFS) contains lots fronting along the south side of Crescent Creek Drive, lots along the west side of Estate Ridge Drive and the north side of Rex Road. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R sump inlet located at I09. All of the 5-year flow is captured by this inlet (Q_5= 7.5 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 12 CFS) continuing across the street to Inlet I08. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- The total pipe flow conveyed to Storm Manhole J13 is Q_5= 55 CFS, Q_{100} = 189 CFS and is conveyed via a 54" RCP to Storm to discharge at design point OS2. OS2 discharges to a rip-rap lined channel that connects to the existing sandy arroyo connecting to existing Pond G. The sandy arroyo was analyzed within the Rolling Hills Ranch Filing 1 Final Drainage Report for capacity and stability of the channel banks and bottom. The analysis indicates the future developed flow rate are anticipated to be lower than the historic flow rate and the channel to be stable. See the approved Final Drainage Report for Rolling Hills Ranch Filing 1 dated June 2020 for more information.

Storm Drain System C

- Basin C01 (12.0 acres, Q_5= 11 CFS, Q_{100} = 29 CFS) contains Rex Road and portions of the future Rolling Hills Ranch Filing 3. This area was first analyzed with the Rolling Hills Ranch 1-3 PUD and when fully developed will include single family residential lots, streets and storm drain. At this stage of development the area will remain in the as graded condition from the Rolling Hills Ranch Rough Grading operations. Rex Road and future development will sheet flow to a future sump location then be conveyed to a sedimentation pond located and the future storm drain outlet (OS1 from the Preliminary Drainage Report for Rolling Hills Ranch PUD). All of the flow will be discharged in the arroyo and conveyed downstream to the existing Pond G.

Storm Drain System D

- Basin D01 (9.6 acres, Q_5= 14 CFS, Q_{100} = 31 CFS) contains Rex Road Channel, the current site of the MSMD water filtration facility and future MSMD office and maintenance yard along with rear portions of lot located along Crescent Creek Drive. Any future improvements to the MSMD site will require a final drainage report to determine what if any additional drainage and water quality facilities are required at the time of design and construction. At this stage of development much of the MSMD area will remain in the as graded condition and developed will sheet flow to the adjacent rip-rap lined channel to the proposed box culvert crossing underneath Rex Road. All of the flow will be discharged in the arroyo and conveyed downstream to the existing Pond G.

Storm Drain System E

- Basin E01 (6.4 acres, Q_5= 4.8 CFS, Q_{100} = 15 CFS) contains the rear portion of lots along the east side of Estate Ridge Drive. The runoff from this area travels overland across undisturbed land to an existing temporary sedimentation pond then released to the arroyo channel and conveyed to Pond G in the interim condition. After development of Estates Filing 3 the area will travel overland across adjacent lots and collected by a storm drain system for discharge at the same location to be conveyed to Pond G.

- Basin E02 Eliminated, added to B11 & FB11 *(0.6 acres, Q_5= 1.2 CFS, Q_{100} = 2.8 CFS) contains the rear portion of lots along the east side of Estate Ridge Drive. The runoff from this area travels overland across undisturbed land to an existing temporary sedimentation pond then released to the arroyo channel and conveyed to Pond G in the interim condition. After development of Estates Filing 3 the area will travel along future Crescent Creek Drive and collected by a storm drain system for discharge at the same location to be conveyed to Pond G.*

- Basin E03 (2.6 acres, Q_5= 2.7 CFS, Q_{100} = 7.8 CFS) contains the rear portion of lots along the south side of Crescent Creek Drive, adjacent open space and portions of Rex Road. The runoff from this area travels overland across undisturbed land to an existing temporary sedimentation pond then released to the arroyo channel and conveyed to Pond G in the interim condition. After development of Estates Filing 3 the area will travel along future Rex Road and collected by a storm drain system for discharge at the same location to be conveyed to Pond G.

Existing Pond G was designed and constructed with this area anticipated to drain and be detained within it. Pond G contains a water quality component.

DETENTION POND

Pond G Detention Storage Criteria

Existing Detention Pond G was constructed with grading operations associated with the Rough Grading Plans for Rolling Hills Ranch at Meridian Ranch in anticipation of the future development of the Rolling Hills Ranch in accordance with the approved Sketch Plan. The pond is located within the Gieck Ranch Drainage Basin in the eastern portion of Rolling Hills Ranch adjacent to the Falcon Regional Park. The pond will be owned and maintained by the Meridian Service Metropolitan District (MSMD) and a maintenance agreement between the MSMD and El Paso County was recorded with the Rolling Hills Ranch Filing 1 final plat.

Pond G and the existing Pond F work in series such that the peak flow rates from the Meridian Ranch development do not adversely affect the drainage patterns downstream of the Meridian Ranch project. A permanent concrete control structure handles full build out of the tributary area and reduces the developed flows to approximate the historic peak flow rates for the full spectrum of design storms.

The existing concrete control structure the outlet of Pond G will attenuate the peak developed flow rates to approximately historic peak rates for the full spectrum of design storms as per the requirements set forth in Resolution 15-042 adopted by the Board of County Commissioners, County of El Paso. The control structure consists of a water quality control feature, a rectangular slotted orifice located on the front and a grated top to reduce the developed peak flow rates. Table 8 provides summary data for the various design storms for the completed development for all areas tributary to Pond G including Estates at Rolling Hills Ranch Filing 2. Pond G was designed and constructed to receive and discharge interim flow and the anticipated future developed flows and therefore there are no proposed changes to the existing pond or outlet structure.

Table 6: Pond G Summary Data

POND G				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
INTERIM CONDITIONS				
2-YEAR STORM	7.4	3.6	2.4	7026.0
5-YEAR STORM	33	9.8	6.7	7027.1
10-YEAR STORM	76	28	8.9	7027.5
50-YEAR STORM	333	206	17.0	7028.9
100-YEAR STORM	522	358	21.1	7029.6
FUTURE CONDITIONS				
2-YEAR STORM	26	5.1	4.7	7026.6
5-YEAR STORM	75	20	8.1	7027.4
10-YEAR STORM	141	53	10.8	7027.9
50-YEAR STORM	436	321	20.1	7029.5
100-YEAR STORM	668	472	25.3	7030.3

Downstream Analysis

The developed flow from this project will discharge at the westerly boundary of the Falcon Regional Park (G12), upstream of Eastonville Rd (DP G06). The discharge at this location during the interim period will be 358 CFS during the 100-yr storm event into an existing natural drainage course that traverses the regional park. The 100-year historical peak flow rate at the western boundary of the regional park is 536 CFS. The calculated 100-year developed flow rate will be 67% of the historic flow rate. See Table 7 for a complete comparative list of the peak flow rates for the key design points impacted by the development of the Estates at Rolling Hills Ranch Filing 2.

Table 7: Key Design Point Comparison – Interim SCS Model

MERIDIAN RANCH DISCHARGE KEY DESIGN POINTS (INTERIM)						
		PEAK DISCHARGE Q_{100} (CFS)	PEAK DISCHARGE Q_{50} (CFS)	PEAK DISCHARGE Q_{10} (CFS)	PEAK DISCHARGE Q_5 (CFS)	PEAK DISCHARGE Q_2 (CFS)
G12 - DISCHARGE POINT AT REGIONAL PARK (G05 - HISTORIC)	Historic	536	350	84	30	5
	Interim	358	206	28	10	4
	% of Historic	67%	59%	33%	33%	70%
G06 - EASTONVILLE ROAD[1]	Historic	551	369	88	32	6
	Interim	377	217	29	11	4
	% of Historic	68%	59%	33%	34%	72%

[1] Flow rate at Eastonville Rd. listed for reference only

The outlet (DP G12) for the Future Pond G will be located west of the Falcon Regional Park, upstream of Eastonville Rd (DP G06). At full buildout the discharge from Pond G will be 472 CFS during the 100-yr storm event into an existing natural drainage course that traverses

the regional park. The 100-year historical peak flow rate at the western boundary of the regional park is 536 CFS. The calculated 100-year developed flow rate will be 88% of the historic flow rate. The developed peak flow rate for the full spectrum of design storms are calculated to be below that of the corresponding historic peak flow rates. See Table 8 for a complete comparative list of the peak flow rates for the key design points impacted by the development of Rolling Hills Ranch.

Table 8: Key Design Point Comparison – Future SCS Model

MERIDIAN RANCH DISCHARGE KEY DESIGN POINTS (FUTURE)						
		PEAK DISCHARGE Q_{100} (CFS)	PEAK DISCHARGE Q_{50} (CFS)	PEAK DISCHARGE Q_{10} (CFS)	PEAK DISCHARGE Q_5 (CFS)	PEAK DISCHARGE Q_2 (CFS)
G12 - POND G OUTLET REGIONAL PARK (G05 - HISTORIC)	Historic	536	350	84	30	5
	Future	472	321	53	20	5
	% of Historic	88%	92%	64%	68%	98%
G06 - EASTONVILLE ROAD[1]	Historic	551	369	88	32	6
	Future	498	338	57.6	22	11
	% of Historic	90%	92%	65%	70%	190%

[1] Flow rate at Eastonville Rd. listed for reference only

REX ROAD BOX CULVERT

Rex Road will cross the channel connecting Pond F to Pond G, a 4'x 10' concrete box culvert is proposed for this crossing. The channel between the outlet of Pond F and the box culvert is rip-rap lined and downstream of the culvert the channel remains in the natural condition with some minor band and channel stabilization rip-rap placement as needed. All of the channel work was completed at with the Rough Grading Plans for Rolling Hills Ranch Filing 1-3. The channel analysis can be found in the Final Drainage Report for Rolling Hills Ranch Filing 1.

The box culvert is designed to convey the 100-year peak flow rate of 185 CFS safely under Rex Road and conveyed to Pond G.

DRAINAGE FEES

The proposed development falls in the Gieck Ranch Drainage Basin. The entire development occupies 117.21 acres of residential development of which 64.04 acres are residential development and 14.35 acres are designated as right-of-way, the remainder is open space.

The following is the imperviousness calculation:

	Acres	Assumed Imperviousness	Impervious Acres
Open Space	38.82	3%	1.16
Right-of-way	14.35	90%	12.91
Residential Lots	64.04	20% (98 Lots)	12.81
Total	117.21		26.88=22.93% imperv

GIECK RANCH FEES:

Drainage Fees: There are no drainage fees for this basin.

Bridge Fees: There are no bridge fees for this basin.

CONCLUSION

The rational and SCS based hydrologic calculation methods were used to estimate the historic and developed runoff values to determine the impact of this project on surrounding property. The resulting calculations were used to estimate the hydraulic impact on the existing and proposed facilities. Finally, the model storms were analyzed to simulate the impacts of storm events of various return periods on the existing detention pond and downstream facilities. Based on the aforementioned design parameters the development of the project will not adversely affect downstream properties.

EROSION CONTROL DESIGN

General Concept

Historically, erosion on this property has been held to a minimum by a variety of natural features and agricultural practices including:

- Substantial prairie grass growth
- Construction of drainage arresting berms
- Construction of multiple stock ponds along drainage courses

Existing temporary sediment ponds will also help to minimize erosion by reducing both the volume and velocity of the peak runoff.

During construction, best management practices (BMP) for erosion control will be employed based on El Paso county Criteria. BMP's will be utilized as deemed necessary by the contractor and/or engineer and are not limited to the measures shown on the construction drawing set. The contractor shall minimize the amount of area disturbed during all construction activities.

In general the following shall be applied in developing the sequence of major activities:

- Install down-slope and side-slope perimeter BMP's before the land disturbing activity occurs.
- Do not disturb an area until it is necessary for the construction activity to proceed
- Cover or stabilize as soon as possible.
- Time the construction activities to reduce the impacts from seasonal climatic changes or weather events.
- The construction of filtration BMP's should wait until the end of the construction project when upstream drainage areas have been stabilized.
- Do not remove the temporary perimeter controls until after all upstream areas are stabilized.

Four Step Process

The following four step process is recommended for selecting structural BMP's in developing urban areas:

Step 1: Employ Runoff Reduction Practices

This development incorporates wider rights-of-way than other developments, thus increasing the amount of pervious area within the right-of-way. With the rights-of-way within Meridian Ranch at 60 ft. instead of the normal 50 ft., the amount of pervious area per lineal foot is tripled from 5' wide to 15' wide.

The project has over thirty acres of open space, accounting for over 28% of the entire project, creating a lower density development.

Homeowners and builders are encouraged to direct roof drains to the sideyards where the runoff will travel overland to the streets and creating an opportunity to allow the runoff to infiltrate into the ground.

Step 2: Stabilize Drainageways

The drainage swale located adjacent and south of the project was designed to have a wide flat bottom and slope reducing the velocity of the concentrated flow traveling along the drainageway. The construction of the swale also included erosion control along the entire length of the swale.

Step 3: Provide Water Quality Capture Volume (WQCV)

An existing extended detention pond with water quality capture volume is located to the east of the project that was designed to accommodate the runoff from this development.

Step 4: Consider Need for Industrial and Commercial BMP's

This project is neither industrial nor commercial and therefore this section does not apply.

Detention Pond

The detention ponds will act as the primary water quality control for the areas within the project boundaries. Runoff will be collected by the proposed storm drainage system and diverted into the detention pond where practical. The pond will serve a dual purpose: first, by facilitating the settling of sediment in runoff during and after construction (by means of the WQCV) and, second, by maintaining runoff at or below existing levels.

Silt Fence

Silt fence will be place along downstream limits of disturbed areas. This will prevent suspended sediment from leaving the site during infrastructure construction. Silt fencing is to remain in place until vegetation is reestablished.

Erosion Bales

Erosion bales will be placed ten (10) feet from the inlet of all culverts during construction to prevent culverts from filling with sediment. Erosion bales will remain in place until vegetation is reestablished. Erosion bale checks will be used on slopes greater than 1 percent to reduce flow velocities until vegetation is reestablished.

Miscellaneous

Best erosion control practices will be utilized as deemed necessary by the Contractor or Engineer and are not limited to the measures described above.

REFERENCES

1. "City of Colorado Springs/El Paso County Drainage Criteria Manual" September 1987, Revised November 1991, Revised October 1994.

2. Chapter 6, Hydrology and Chapter 11, Storage, Section 3.2.1 of the "City of Colorado Springs Drainage Criteria Manual" May 2014.

3. "Volume 2, El Paso County/City of Colorado Springs Drainage Criteria Manual-Stormwater Quality Policies, Procedures and Best Management Practices" November 1, 2002.

4. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

5. Soils Survey of El Paso County area, Natural Resources Conservation Services of Colorado.

6. Master Development Drainage Plan Meridian Ranch. August 2000. Prepared by URS Corp.

7. Revision to Master Development Drainage Plan Meridian Ranch. May 2015. Prepared by Tech Contractors.

8. Master Development Drainage Plan Latigo Trails. October 2001. Prepared by URS Corp.

9. Final Drainage Report for Meridian Ranch Estates Filing 2. July 2013. Prepared by Tech Contractors.

10. Revision to Master Development Drainage Plan Meridian Ranch. July 2015. Prepared by Tech Contractors.

11. Final Drainage Report for Meridian Ranch Estates Filing 3. October 2015. Prepared by Tech Contractors.

12. Revision to Master Development Drainage Plan Meridian Ranch. January 2018. Prepared by Tech Contractors.

13. "Urban Storm Drainage Criteria Manual" September 1969, Revised January 2016.

14. Preliminary/Final Drainage Report for Estates at Rolling Hills Ranch Filing 1 at Meridian Ranch. March 2020. Prepared by Tech Contractors.

15. Preliminary Drainage Report for Rolling Hills Ranch PUD at Meridian Ranch. April 2020. Prepared by Tech Contractors.

16. Final Drainage Report for Rolling Hills Ranch Filing 1 at Meridian Ranch. June 2020. Prepared by Tech Contractors.

Appendices

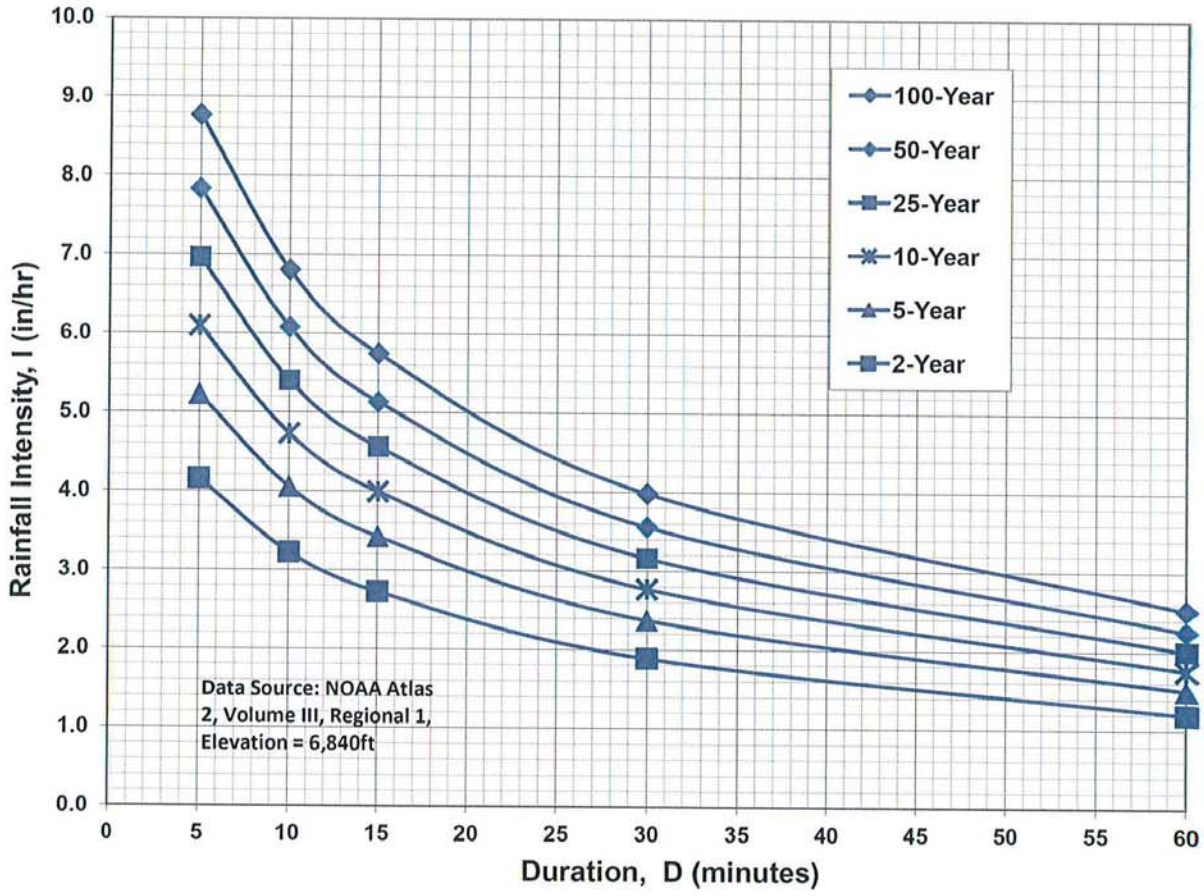
Appendix A – Rational Calculations

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	0.66	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	0.96	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 6-5. 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.

COMPOSITE 'C' FACTORS

PROJECT: **Estates at Rolling Hills Ranch Filing 2** 9/14/2021

BASIN DESIGNATION	AREA (AC.)											COMPOSITE FACTOR		Percent Impervious
	UNDEV	2.5 AC	1 DU/AC	2 DU/AC	3 DU/AC	GRADED	TANK SITE	STREETS	OPEN SPACE PARKS/GC LAWNS	COMM	TOTAL	5-year	100-year	
OS7c	5.9	4.1									10.0	**0.12**	**0.38**	**4.6%**
A01	4.7		1.4								6.1	**0.11**	**0.38**	**4.4%**
OS8	1.7	23.5									25.2	**0.16**	**0.40**	**10.3%**
B01	9.0		2.3								11.3	**0.11**	**0.38**	**4.0%**
B02	0.4		4.1	3.8							8.3	**0.20**	**0.45**	**21.5%**
B03	7.8		1.0				1.7				10.5	**0.16**	**0.41**	**13.2%**
B04	0.1		3.9	6.3			0.3				10.6	**0.22**	**0.46**	**24.1%**
B05	1.8		1.5	1.0			1.3				5.6	**0.23**	**0.46**	**25.9%**
B06				1.5							1.5	**0.22**	**0.46**	**25.0%**
B07			3.5	3.6					0.4		7.4	**0.21**	**0.45**	**21.5%**
B08				9.4							9.4	**0.22**	**0.46**	**25.0%**
B09				6.1							6.1	**0.22**	**0.46**	**25.0%**
B10				12.2							12.2	**0.22**	**0.46**	**25.0%**
B11	0.2							0.3	0.5		1.0	**0.40**	**0.56**	**30.4%**
B12				3.3							3.3	**0.22**	**0.46**	**25.0%**
C01						8.5		1.1	2.4		12.0	**0.27**	**0.45**	**9.6%**
D01				3.8					2.5	3.3	9.5	**0.44**	**0.59**	**43.3%**
E01	2.0					1.8		0.6	2.0		6.4	**0.24**	**0.44**	**9.3%**
E02														
E03	1.5			0.2				0.5	0.3		2.6	**0.29**	**0.50**	**23.7%**
											158.8	**Composite:**		**17.2%**
TOTAL	35.1	27.6	17.6	51.1	0.0	10.3	3.3	2.5	8.0	3.3	158.8	**0.21**	**0.44**	**17.2%**
FB11								0.3	0.5		0.7	**0.50**	**0.62**	**40.0%**
FB12				3.8				1.4	1.1		6.2	**0.38**	**0.56**	**38.0%**
FC01					3.7			1.0	1.5		6.2	**0.35**	**0.53**	**34.0%**
											146.7	**Composite:**		**21.2%**
TOTAL	31.4	27.6	17.6	51.3	3.7	0.0	3.3	2.7	5.9	6.6	150.0	**0.23**	**0.45**	**21.2%**

A01	4.7		1.4								6.1	**0.12**	**0.38**	**4.6%**
C01						8.5		1.1	2.4		12.0	**0.27**	**0.45**	**9.6%**

TIME OF CONCENTRATION

PROJECT: **Estates at Rolling Hills Ranch Filing 2** DATE: 9/14/2021

TIME OF CONCENTRATION																	
SUBBASIN DATA			INIT./OVERLAND TIME (T_i)				TRAVEL TIME (T_t)							TOTAL	Tc Check (Urbanized Basins)		FINAL T_c
BASIN DESIGNATION	C_5	AREA (AC)	LENGTH (FT)	ΔH	SLOPE %	Ti (Min.)*	LENGTH (FT)	ΔH	SLOPE %	CONVEYANCE TYPE	CONVEYANCE COEF.	VEL. (FPS)	Tt (Min.)**	Ti+Tt (Min.)	L (FT)	Tc = (L/180) + 10	(min)
OS7c	0.12	10.0	190	11.0	5.8%	13.8	890	50	5.6%	G	15	3.6	4.2	18.0	1080.00	16.0	**16.0**
A01	0.11	6.1	185	6.0	3.2%	16.6	1275	34	2.7%	L	7	1.1	18.6	35.2	1460.00	18.1	**18.1**
OS8	0.16	25.2	FROM APPROVED MERIDIAN RANCH FILING MDDP, JAN 2018														**26.6**
B01	0.11	11.3	230	9.0	3.9%	17.4	1050	31	3.0%	L	7	1.2	14.5	32.0	1280.00	17.1	**17.1**
B02	0.20	8.3	290	15.0	5.2%	16.2	1135	21	1.9%	P	20	2.7	7.0	23.1	1425.00	17.9	**17.9**
B03	0.16	10.5	300	7.0	2.3%	22.4	1120	37	3.3%	G	15	2.7	6.8	29.2	1420.00	17.9	**17.9**
B04	0.22	10.6	260	23.0	8.8%	12.6	1270	23	1.8%	P	20	2.7	7.9	20.5	1530.00	18.5	**18.5**
B05	0.23	5.6	300	20.0	6.7%	14.6	1500	42	2.8%	P	20	3.3	7.5	22.1	1800.00	20.0	**20.0**
B06	0.22	1.5	30	0.6	2.0%	7.0	1150	14	1.2%	P	20	2.2	8.7	15.7	1180.00	16.6	**15.7**
B07	0.21	7.4	300	12.0	4.0%	17.8	1080	25	2.3%	P	20	3.0	5.9	23.7	1380.00	17.7	**17.7**
B08	0.22	9.4	300	11.0	3.7%	18.1	890	8	0.9%	P	20	1.9	7.8	25.9	1190.00	16.6	**16.6**
B09	0.22	6.1	30	0.6	2.0%	7.0	2030	32	1.6%	P	20	2.5	13.5	20.5	2060.00	21.4	**20.5**
B10	0.22	12.2	300	14.0	4.7%	16.7	1230	25	2.0%	P	20	2.9	7.2	23.9	1530.00	18.5	**18.5**
B11	0.40	1.0	45	2.0	4.4%	5.2	595	15	2.5%	P	20	3.2	3.1	8.4	640.00	13.6	**8.4**
B12	0.22	3.3	195	13.0	6.7%	12.0	1480	29	2.0%	P	20	2.8	8.8	20.8	1675.00	19.3	**19.3**
C01	0.27	12.0	185	9.0	4.9%	12.2	1310	35	2.7%	B	10	1.6	13.4	25.5	1495.00	18.3	**18.3**
D01	0.44	9.5	100	2.0	2.0%	9.7	1200	37	3.1%	L	7	1.2	16.3	25.9	1300.00	17.2	**17.2**
E01	0.24	6.4	125	4.0	3.2%	12.0	375	6	1.6%	L	7	0.9	7.1	19.0	500.00		**19.0**
E02																	
E03	0.29	2.6	125	4.0	3.2%	11.3	595	13	2.2%	P	20	3.0	3.4	14.6	720.00	14.0	**14.0**
FB11	0.50	0.7	40	2.0	5.0%	5.0	595	15	2.5%	P	20	3.2	3.1	8.1	635.00	13.5	**8.1**
FB12	0.38	6.2	195	13.0	6.7%	9.8	1480	29	2.0%	P	20	2.8	8.8	18.7	1675.00	19.3	**18.7**
FC01	0.35	6.2	185	9.0	4.9%	11.0	985	25	2.5%	P	20	3.2	5.2	16.2	1170.00	16.5	**16.2**

Notes:

$$* Ti = \frac{* Ti = 0.395\,(1.1-C5)L^{0.5}}{S^{0.33}}$$

$$V = C_V S_W^{0.5}$$

** Tt = L x V

TYPE OF SURFACE		C_V
HEAVY MEADOW	H	2.5
TILLAGE/FIELD	T	5
RIPRAP (not buried)	R	6.5
SHORT PASTURE AND LAWNS	L	7
NEARLY BARE GROUND	B	10
GRASSED WATERWAY	G	15
PAVED AREAS	P	20

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
SURFACE ROUTING

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/14/2021

	DIRECT RUNOFF											TOTAL RUNOFF							OVERLAND TRAVEL TIME						
				I (in./ hr.)		COEFF. ©		CA		Q			I (in./ hr.)		CA		Q								
DESIGN POINT	BASIN	AREA (AC)	Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	DESTINATION DP	CONVEYANCE TYPE	COEFFICIENT C_V	SLOPE %	VEL. (FPS)	LENGTH (FT)	TRAVEL TIME Tt
DEVELOPED																									
DP1	OS7c	10.0	16.0	3.42	5.75	0.12	0.38	1.19	3.76	4.1	22						**4.1**	**22**	ECB	G	15.0	2.26%	2.3	1500	11.1
ECB	A01	6.1	18.1	3.24	5.44	0.11	0.38	0.70	2.30	2.3	13	27.1	2.63	4.42	1.89	6.06	**5.0**	**27**							
DP2	OS8	25.2	26.6	2.66	4.47	0.16	0.40	3.91	10.01	10.4	45						**10**	**45**	CB02	G	15.0	2.82%	2.5	780	5.2
CB01	B01	11.3	17.1	3.32	5.58	0.11	0.38	1.26	4.24	4.2	24						**4.2**	**24**							
I01	B02	8.3	17.9	3.25	5.46	0.20	0.45	1.69	3.68	5.5	20						**5.5**	**20**	I03	P	20.0	1.33%	2.3	900	6.5
CB02	B03	10.5	17.9	3.26	5.47	0.16	0.41	1.73	4.29	5.6	23	31.8	2.40	4.02	5.64	14.30	**14**	**57**							
I02	B04	10.6	18.5	3.21	5.38	0.22	0.46	2.32	4.84	7.4	26						**7.4**	**26**	I05	P	20.0	2.10%	2.9	565	3.2
I06	B05	5.6	20.0	3.09	5.19	0.23	0.46	1.31	2.57	4.0	13						**4.0**	**13**							
I04	B06	1.5	15.7	3.45	5.80	0.22	0.46	0.32	0.68	1.1	3.9	25.3	2.74	4.60	0.32	4.54	**1.1**	**21**							
DP3	B07	7.4	17.7	3.28	5.50	0.21	0.45	1.57	3.33	5.1	18						**5.1**	**18**	I03	P	20.0	1.00%	2.0	880	7.3
I03	B08	9.4	16.6	3.37	5.65	0.22	0.46	2.06	4.30	6.9	24	25.0	2.75	4.62	3.63	7.63	**10**	**35**	I04	P	20.0	1.00%	2.0	30	0.3
I05	B09	6.1	20.5	3.05	5.13	0.22	0.46	1.34	2.80	4.1	14	21.7	2.96	4.97	1.34	4.44	**4.1**	**22**	I07	P	20.0	2.80%	3.3	455	2.3
I07	B10	12.2	18.5	3.21	5.38	0.22	0.46	2.68	5.61	8.6	30	24.0	2.81	4.72	2.68	6.55	**8.6**	**31**	I09	P	20.0	2.00%	2.8	235	1.4
I08	B11	1.0	8.4	4.40	7.38	0.40	0.56	0.39	0.55	1.7	4.1	25.6	2.72	4.56	0.39	1.13	**1.7**	**5.1**							
I09	B12	3.3	19.3	3.14	5.27	0.22	0.46	0.72	1.50	2.3	7.9	25.4	2.73	4.58	0.72	4.37	**2.3**	**20**	I08	P	20.0	1.00%	2.0	30	0.3
DP4	C01	12.0	18.3	3.22	5.41	0.27	0.45	3.27	5.44	11	29						**11**	**29**							
DPG7	D01	9.5	17.2	3.31	5.56	0.44	0.59	4.16	5.65	14	31						**14**	**31**							
DP5	E01	6.4	19.0	3.16	5.31	0.24	0.44	1.52	2.80	4.8	15						**4.8**	**15**							
DP8	E03	2.6	14.0	3.62	6.08	0.29	0.50	0.74	1.28	2.7	7.8						**2.7**	**7.8**							
I08	FB11	0.7	8.1	4.44	7.46	0.50	0.62	0.37	0.47	1.6	3.5	25.6	2.72	4.56	0.37	3.06	**1.6**	**14**							
I09	FB12	6.2	18.7	3.19	5.36	0.38	0.56	2.35	3.52	7.5	19	25.4	2.73	4.58	2.35	6.39	**7.5**	**29**	I08	P	20.0	1.00%	2.0	30	0.3
	FC01	6.2	16.2	3.41	5.72	0.35	0.53	2.16	3.28	7.3	19						**7.3**	**19**							

STORM DRAINAGE SYSTEM DESIGN
INLET CALCULATIONS

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/14/2021

								Q_{Total}		$Q_{Capture}$				$Q_{Flow-by}$				DEPTH (max)		SPREAD	
DP	BASIN	Inlet size L(i)	Proposed or Existing	INLET TYPE	CROSS SLOPE	STREET SLOPE	T_c	Q_5 (cfs)	Q_{100} (cfs)	Q_5 (cfs)	Q_{100} (cfs)	$CA_{eqv.}$ (5-yr)	$CA_{eqv.}$ (100-yr)	Q_5 (cfs)	Q_{100} (cfs)	$CA_{eqv.}$ (5-yr)	$CA_{eqv.}$ (100-yr)	Q_5 (ft)	Q_{100} (ft)	Q_5 (ft)	Q_{100} (ft)
ECB	A01	Type C	PROP	SUMP	2.0%		27.1	5.0	27	5.0	27	1.89	6.06	-	-	-	-	0.42	2.2		
CB01	B01	Type C	PROP	SUMP	2.0%		17.1	4.2	24	4.2	24	1.26	4.24	-	-	-	-	0.39	1.7		
I01	B02	20	PROP	SUMP[1]	2.0%		17.9	5.5	20	5.5	17	1.69	3.16	-	2.9	-	0.52	0.47	0.47		
CB02	B03	Type D	PROP	SUMP	2.0%		31.8	14	57	13.5	57	5.64	14.30	-	-	-	-	0.53	1.7		
I02	B04	20	PROP	SUMP[1]	2.0%		18.5	7.4	26	7.4	17.3	2.32	3.21	-	8.8	-	1.64	0.47	0.47		
I03	B08	20	PROP	SUMP	2.0%		25.0	10	35	10.0	17.4	3.63	3.76	-	17.9	-	3.87	0.47	0.47		
I04	B06	15	PROP	SUMP	2.0%		25.3	1.1	21	1.1	20.9	0.41	4.54	-	-	-	-	0.50	0.67		
I05	B09	20	PROP	SUMP[1]	2.0%		21.7	4.1	22	4.1	17.4	1.38	3.50	-	4.7	-	0.94	0.47	0.47		
I06	B05	20	PROP	FLOW-BY	2.0%	1.0%	20.0	4.0	13	3.6	9.6	1.16	1.85	0.5	3.7	0.15	0.72	0.33	0.47	12.2	19.0
I07	B10	20	PROP	SUMP[1]	2.0%		24.0	8.6	31	8.6	17.4	3.06	3.68	-	14	-	2.87	0.47	0.47		
I08	B11	10	PROP	SUMP	2.0%		25.6	1.7	5.1	1.7	5.1	0.63	1.13	-	-	-	-	0.50	0.70		
I09	B12	20	PROP	SUMP	2.0%		25.4	2.3	20	2.3	17.4	0.83	3.80	-	2.6	-	0.58	0.47	0.47		
I08	FB11	10	PROP	SUMP	2.0%		25.6	1.6	14	1.6	13.9	0.61	3.06	-	-	-	-	0.50	0.70		
I09	FB12	20	PROP	SUMP	2.0%		25.4	7.5	29	7.5	17.4	2.74	3.80	-	12	-	2.59	0.47	0.47		

[1] Forced sump at intersection

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
PIPE ROUTING

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/14/2021

UPSTREAM DESIGN POINT	UPSTREAM BASIN	INLET FLOW							SYSTEM FLOW							TRAVEL TIME						
			I (in./ hr.)		CA		Q			I (in./ hr.)		CA		Q								
		Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	PIPE DIA	ROUGHNESS (n)	DESTINATION DP	SLOPE %	LENGTH (FT)	VEL. (FPS) (Estimate)*	TRAVEL TIME Tt
CB01	B01	17.1	3.32	5.58	1.26	4.24	4.2	24						**4.2**	**24**	24	0.013	J01	1.85%	256	10	0.4
J01									17.5	3.29	5.52	1.26	4.24	**4.1**	**23**	24	0.013	J02	1.65%	386	9	0.7
I01	B02	17.9	3.25	5.46	1.69	3.16	5.5	17						**5.5**	**17**	18	0.013	J02	0.99%	25	6	0.1
J02									18.2	3.23	5.42	2.95	7.40	**9.5**	**40**	30	0.013	J03	0.86%	411	8	0.9
J03									19.1	3.16	5.30	2.95	7.40	**9.3**	**39**	30	0.013	J06	2.54%	224	13	0.3
CB02	B03	31.8	2.40	4.02	5.64	14.30	13.5	57						**14**	**57**	36	0.013	J04	1.04%	169	10	0.3
J04									32.1	2.38	4.00	5.64	14.30	**13**	**57**	36	0.013	J05	2.45%	171	15	0.2
J05									32.2	2.37	3.98	5.64	14.30	**13**	**57**	36	0.013	J06	4.48%	29	20	0.0
J06									32.3	2.37	3.98	8.59	21.70	**20**	**86**	42	0.013	J07	1.11%	234	11	0.4
I02	B04	18.5	3.21	5.38	2.32	3.21	7.4	17						**7.4**	**17**	24	0.013	J07	2.14%	5	11	0.0
J07									32.6	2.36	3.95	10.91	24.91	**26**	**98**	42	0.013	J08	1.50%	37	13	0.0
J08									32.7	2.35	3.95	10.91	24.91	**26**	**98**	42	0.013	J09	2.45%	501	16	0.5
I03	B08	25.0	2.75	4.62	3.63	3.76	10.0	17						**10**	**17**	18	0.013	J10	0.99%	25	6	0.1
I04	B06	25.3	2.74	4.60	0.41	4.54	1.1	21						**1.1**	**21**	18	0.013	J10	4.83%	5	13	0.0
J10									25.3	2.74	4.60	4.04	8.31	**11**	**38**	30	0.013	J11	3.19%	459	15	0.5
I05	B09	21.7	2.96	4.97	1.38	3.50	4.1	17						**4.1**	**17**	18	0.013	J09	4.26%	25	12	0.0
I06	B05	20.0	3.09	5.19	1.16	1.85	3.6	10						**3.6**	**9.6**	18	0.013	J09	1.01%	45	6	0.1
J09									33.2	2.33	3.91	13.45	30.25	**31**	**118**	42	0.013	J11	1.98%	23	15	0.0
J11									33.2	2.33	3.91	17.48	38.56	**41**	**151**	42	0.013	J12	2.79%	404	18	0.4
I07	B10	24.0	2.81	4.72	3.06	3.68	8.6	17						**8.6**	**17**	24	0.013	J12	1.03%	24	7	0.1
J12									33.6	2.31	3.88	20.54	42.24	**47**	**164**	48	0.013	J13	1.87%	246	16	0.3
I08	B11	25.6	2.72	4.56	0.63	1.13	1.7	5.1						**1.7**	**5.1**	18	0.013	J13	1.03%	24	6	0.1
I09	B12	25.4	2.73	4.58	0.83	3.80	2.3	17						**2.3**	**17**	18	0.013	J13	5.99%	4	15	0.0
J13									33.9	2.30	3.86	22.00	47.17	**51**	**182**	54	0.013	OS2	1.27%	169	14	0.2
I08	FB11	25.6	2.72	4.56	0.61	3.06	1.6	14						**1.6**	**14**	18	0.013	J13	1.03%	24	6	0.1
I09	FB12	25.4	2.73	4.58	2.74	3.80	7.5	17						**7.5**	**17**	18	0.013	J13	5.99%	4	15	0.0
J13									33.9	2.30	3.86	23.89	49.10	**55**	**189**	54	0.013	OS2	1.27%	169	14	0.2
ECB	A01	27.1	2.63	4.42	1.89	6.06	5.0	27								24	0.013	OSJ01	1.02%	229	7	0.5
OSJ01									27.6	2.61	4.37	1.89	6.06	**4.9**	**27**	24	0.013	OSJ02	1.99%	396	10	0.6
OSJ02									28.3	2.57	4.31	1.89	6.06	**4.8**	**26**	24	0.013	OS1	4.67%	177	16	0.2

* Velocity estimated for calculation of travel time. Refer to Hydraulics for calculated velocity.

STORM DRAINAGE SYSTEM DESIGN

HYDRAULICS

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/27/2021

Label	Upstrm Node	Dnstrm Node	Intlet CA (acres)	Inlet Tc (min)	Inlet Flow (ft^3/s)	System CA (acres)	System Flow Time (min)	System Intensity (in/hr)	Length (ft)	Section Size (in)	Slope (%)	Capacity (Full Flow) (ft^3/s)	System Flow (ft^3/s)	Velocity (Ave) (ft/s)	Elevation Ground (Upstrm) (ft)	Hydraulic Grade Line (Upstrm) (ft)	Invert (Upstrm) (ft)	Elevation Ground (Dnstrm) (ft)	Hydraulic Grade Line (Dnstrm) (ft)	Invert (Dnstrm) (ft)
P01	CB01	J01	4.24	17.1	24	4.2	17.1	5.58	256	24	1.86%	31	24	11	7145.00	7143.5	7141.75	7142.84	7139.5	7137.00
P02	J01	J02				4.2	17.5	5.52	386	24	1.65%	29	24	10	7142.84	7138.7	7137.00	7135.99	7132.6	7130.65
P03	I01	J02	3.16	17.9	17	3.2	17.9	5.47	25	18	0.99%	11	17	9.9	7135.89	7134.0	7131.40	7135.99	7133.3	7131.15
P04	J02	J03				7.4	18.1	5.44	411	30	0.86%	38	41	8.7	7135.99	7132.4	7130.15	7131.83	7128.8	7126.60
P05	J03	J06				7.4	18.9	5.33	224	30	2.55%	65	40	14	7131.83	7128.7	7126.60	7126.14	7124.1	7120.90
P06	CB02	J04	14.30	31.8	58	14	31.8	4.02	169	36	1.04%	68	58	11	7132.00	7130.1	7127.65	7132.65	7129.2	7125.90
P07	J04	J05				14	32.1	4.00	171	36	2.45%	104	58	15	7132.65	7128.4	7125.90	7127.45	7124.9	7121.70
P08	J05	J06				14	32.3	3.98	29	36	4.48%	141	57	8.1	7127.45	7124.7	7121.70	7126.14	7124.5	7120.40
P09	J06	J07				22	32.3	3.98	234	42	1.11%	106	87	9.0	7126.14	7123.9	7119.90	7123.69	7122.2	7117.30
P10	I02	J07	3.21	18.5	17	3.2	18.5	5.38	4.7	24	2.14%	33	17	5.5	7123.89	7122.2	7118.90	7123.69	7122.2	7118.80
P11	J07	J08				25	32.7	3.94	37	42	1.50%	123	99	10	7123.69	7121.2	7117.30	7123.40	7120.8	7116.75
P12	J08	J09				25	32.8	3.94	501	42	2.45%	158	99	17	7123.40	7119.8	7116.75	7112.13	7108.3	7104.45
P13	I05	J09	3.50	21.7	18	3.5	21.7	4.98	25	18	4.26%	22	18	9.9	7112.04	7110.6	7107.50	7112.13	7110.0	7106.45
P14	I06	J09	1.85	20.0	9.7	1.9	20.0	5.19	45	18	1.01%	11	10	5.5	7111.44	7110.3	7106.90	7112.13	7110.0	7106.45
P15	J09	J11				30	33.3	3.90	23	42	1.99%	142	119	12	7112.13	7108.1	7104.45	7111.54	7107.8	7104.00
P16	I03	J10	3.76	25.0	18	3.8	25.0	4.62	25	18	0.99%	11	18	9.9	7125.43	7123.3	7120.90	7125.20	7122.6	7120.65
P17	I04	J10	4.54	25.3	21	4.5	25.3	4.59	5.2	18	4.84%	23	21	12	7125.43	7122.8	7120.90	7125.20	7122.6	7120.65
P18	J10	J11				8.3	25.3	4.59	459	30	3.19%	73	38	15	7125.20	7121.7	7119.65	7111.54	7110.4	7105.00
P19	J11	J12				39	33.3	3.90	404	42	2.79%	168	152	20	7111.54	7107.4	7104.00	7099.58	7096.2	7092.75
P20	I07	J12	3.68	24.0	18	3.7	24.0	4.73	24	24	1.03%	23	18	5.6	7099.49	7098.2	7094.50	7099.58	7098.0	7094.25
P21	J12	J13				42	33.7	3.87	246	48	1.87%	196	165	18	7099.58	7096.0	7092.25	7094.79	7090.5	7087.65
P22	I09	J13	3.80	25.4	18	3.8	25.4	4.58	4.2	18	6.00%	26	18	9.9	7094.94	7093.0	7090.40	7094.79	7092.9	7090.15
P23	I08	J13	3.06	25.6	14	3.1	25.6	4.56	24	18	1.03%	11	14	8.0	7094.94	7093.3	7090.40	7094.79	7092.9	7090.15
P24	J13	OS2				49	33.9	3.86	169	54	1.27%	222	191	16	7094.79	7091.1	7087.15	7091.00	7088.3	7085.00
P101	ECB	OSJ01	6.06	27.1	27	6.1	27.1	4.42	229	24	1.01%	23	27	8.6	7140.00	7139.6	7136.75	7139.93	7136.4	7134.45
P102	OSJ01	OSJ02				6.1	27.5	4.38	396	24	1.99%	32	27	11	7139.93	7136.3	7134.45	7132.00	7128.5	7126.55
P103	OSJ02	OS1				6.1	28.1	4.33	183	24	4.67%	49	26	16	7132.00	7128.4	7126.55	7121.00	7119.1	7118.00

Appendix B - HEC-HMS Data

Input Data

Estates at Rolling Hills Ranch Filing 2

BASIN	AREA (acre)	AREA (mi^2)	CURVE NO.	LAG TIME (min)
HISTORIC				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07	21	0.0328	63.1	15.4
OS08	26	0.0406	65.7	15.9
OS09	98	0.1527	65.0	29.5
HG01	35	0.0547	61.0	19.6
HG02	58	0.0906	61.0	25.4
HG03	117	0.1828	61.1	33.8
HG04	57	0.0891	61.0	30.7
HG05	72	0.1125	61.0	31.8
HG06A	88	0.1375	61.0	43.2
HG06B	66	0.1031	61.0	49.5
HG07	63	0.0984	61.0	28.3
HG08	85	0.1328	61.0	22.9
HG09	114	0.1781	61.0	35.6
HG10	88	0.1375	61.0	61.4
HG11	131	0.2047	61.0	40.4
HG12	83	0.1297	61.0	32.0
HG13	54	0.0844	63.1	21.2
HG14	147	0.2297	61.0	45.1
HG15	164	0.2563	61.0	65.1
HG18	21	0.0328	61.0	14.1
HG19	3	0.0047	61.0	6.1
HG20	1	0.0016	61.0	6.9
HG21	14	0.0219	61.0	13.8

BASIN	AREA (acre)	AREA (mi^2)	CURVE NO.	LAG TIME (min)
INTERIM				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07ab	11	0.0170	63.1	13.9
OS07c	10	0.0156	63.1	10.9
OS08	25	0.0394	65.7	15.9
OS09	98	0.1527	65.0	29.5
FG01	34	0.0538	66.4	33.8
FG02	25	0.0391	64.6	16.1
FG03	13	0.0203	68.0	11.6
FG04	11	0.0172	68.0	7.6
FG05	37	0.0580	70.1	28.4
FG06	43	0.0675	66.1	18.4
FG21a	6	0.0095	62.6	21.4
FG21b	10	0.0150	73.1	12.7
FG22	81	0.1264	68.0	27.6
FG23a	15	0.0231	62.7	18.0
FG23b	21	0.0334	61.0	16.5
FG23c	5	0.0070	61.0	14.0
FG24	90	0.1405	61.6	26.6
FG25	70	0.1086	61.0	42.6
FG28	44	0.0688	61.0	28.0
FG29	64	0.0997	61.0	19.1
FG32	26	0.0402	61.0	14.9

BASIN	AREA (acre)	AREA (mi^2)	CURVE	LAG
FUTURE				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07ab	11	0.0170	63.1	13.9
OS07c	10	0.0156	63.1	10.9
OS08	25	0.0394	65.7	15.9
OS09	98	0.1527	65.0	29.5
FG01	34	0.0538	66.4	33.8
FG02	25	0.0391	64.6	16.1
FG03	13	0.0203	68.0	11.6
FG04	11	0.0172	68.0	7.6
FG05	37	0.0580	70.1	28.4
FG06	43	0.0675	66.1	18.4
FG21a	6	0.0095	62.6	21.4
FG21b	10	0.0150	73.1	12.7
FG22	84	0.1309	68.5	20.3
FG23a	14	0.0216	68.6	18.0
FG23b	16	0.0247	62.4	16.5
FG23c	8	0.0122	67.3	14.0
FG24	97	0.1517	68.5	26.6
FG25	70	0.1086	74.1	36.6
FG26	55	0.0863	70.7	23.1
FG27	32	0.0500	74.7	23.9
FG28	16	0.0245	66.6	14.0
FG29	64	0.0997	61.0	19.1
FG32	26	0.0402	80.0	12.1

NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 38.9783°, Longitude: -104.5842°
Elevation: 7054.14 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.239 (0.190-0.301)	0.291 (0.232-0.367)	0.381 (0.302-0.482)	0.460 (0.363-0.585)	0.576 (0.442-0.764)	0.670 (0.501-0.899)	0.770 (0.556-1.06)	0.875 (0.606-1.23)	1.02 (0.680-1.48)	1.14 (0.737-1.66)
10-min	0.349 (0.278-0.441)	0.426 (0.339-0.538)	0.558 (0.443-0.706)	0.674 (0.532-0.857)	0.843 (0.647-1.12)	0.982 (0.734-1.32)	1.13 (0.814-1.55)	1.28 (0.888-1.80)	1.50 (0.996-2.16)	1.67 (1.08-2.44)
15-min	0.426 (0.340-0.538)	0.519 (0.413-0.656)	0.680 (0.540-0.861)	0.822 (0.648-1.04)	1.03 (0.789-1.36)	1.20 (0.895-1.61)	1.37 (0.993-1.89)	1.56 (1.08-2.20)	1.82 (1.22-2.64)	2.03 (1.31-2.97)
30-min	0.608 (0.485-0.768)	0.741 (0.590-0.936)	0.969 (0.769-1.23)	1.17 (0.923-1.49)	1.46 (1.12-1.94)	1.70 (1.27-2.28)	1.95 (1.41-2.68)	2.21 (1.53-3.12)	2.58 (1.72-3.73)	2.87 (1.86-4.20)
60-min	0.778 (0.620-0.982)	0.934 (0.744-1.18)	1.21 (0.962-1.54)	1.47 (1.16-1.86)	1.84 (1.42-2.46)	2.16 (1.62-2.91)	2.50 (1.81-3.44)	2.87 (1.99-4.05)	3.38 (2.26-4.91)	3.80 (2.46-5.56)
2-hr	0.948 (0.762-1.19)	1.13 (0.905-1.41)	1.46 (1.16-1.83)	1.76 (1.40-2.22)	2.23 (1.73-2.96)	2.62 (1.99-3.51)	3.05 (2.23-4.18)	3.52 (2.47-4.95)	4.19 (2.82-6.04)	4.73 (3.09-6.87)
3-hr	1.04 (0.839-1.29)	1.22 (0.986-1.52)	1.57 (1.26-1.96)	1.90 (1.51-2.38)	2.41 (1.90-3.21)	2.86 (2.18-3.83)	3.35 (2.47-4.59)	3.90 (2.75-5.47)	4.68 (3.18-6.75)	5.33 (3.50-7.71)
6-hr	1.21 (0.980-1.49)	1.40 (1.14-1.73)	1.78 (1.44-2.21)	2.16 (1.74-2.68)	2.76 (2.19-3.65)	3.29 (2.53-4.38)	3.88 (2.88-5.28)	4.53 (3.23-6.34)	5.49 (3.76-7.88)	6.29 (4.17-9.04)
12-hr	1.39 (1.14-1.70)	1.62 (1.33-1.98)	2.06 (1.68-2.53)	2.48 (2.02-3.06)	3.16 (2.53-4.14)	3.76 (2.92-4.96)	4.42 (3.31-5.97)	5.15 (3.70-7.14)	6.22 (4.30-8.85)	7.10 (4.75-10.1)
24-hr	1.61 (1.33-1.95)	1.88 (1.55-2.29)	2.39 (1.97-2.92)	2.88 (2.35-3.52)	3.63 (2.91-4.69)	4.27 (3.34-5.58)	4.98 (3.75-6.66)	5.75 (4.17-7.90)	6.87 (4.78-9.70)	7.79 (5.25-11.1)
2-day	1.86 (1.55-2.24)	2.19 (1.83-2.64)	2.79 (2.31-3.36)	3.33 (2.75-4.04)	4.15 (3.35-5.30)	4.85 (3.81-6.25)	5.59 (4.25-7.39)	6.40 (4.67-8.70)	7.55 (5.30-10.6)	8.49 (5.77-12.0)
3-day	2.04 (1.71-2.45)	2.41 (2.01-2.88)	3.05 (2.54-3.66)	3.63 (3.01-4.38)	4.51 (3.65-5.71)	5.24 (4.14-6.72)	6.03 (4.59-7.92)	6.87 (5.03-9.29)	8.07 (5.69-11.2)	9.04 (6.18-12.7)
4-day	2.20 (1.85-2.62)	2.58 (2.16-3.08)	3.25 (2.72-3.89)	3.86 (3.21-4.63)	4.77 (3.87-6.01)	5.53 (4.38-7.06)	6.34 (4.85-8.31)	7.22 (5.31-9.73)	8.46 (5.98-11.7)	9.46 (6.50-13.2)
7-day	2.60 (2.20-3.08)	3.00 (2.54-3.56)	3.71 (3.13-4.41)	4.36 (3.65-5.20)	5.33 (4.36-6.67)	6.14 (4.89-7.78)	7.00 (5.40-9.11)	7.93 (5.87-10.6)	9.26 (6.59-12.8)	10.3 (7.14-14.4)
10-day	2.96 (2.51-3.48)	3.39 (2.88-4.00)	4.16 (3.52-4.92)	4.85 (4.08-5.76)	5.88 (4.82-7.31)	6.73 (5.38-8.48)	7.63 (5.91-9.88)	8.61 (6.39-11.5)	9.97 (7.13-13.7)	11.1 (7.70-15.4)
20-day	3.95 (3.38-4.61)	4.55 (3.89-5.32)	5.57 (4.75-6.52)	6.44 (5.46-7.58)	7.68 (6.32-9.39)	8.67 (6.97-10.8)	9.69 (7.54-12.4)	10.8 (8.04-14.1)	12.2 (8.79-16.6)	13.3 (9.36-18.4)
30-day	4.75 (4.09-5.51)	5.49 (4.72-6.38)	6.70 (5.74-7.81)	7.72 (6.58-9.04)	9.12 (7.52-11.1)	10.2 (8.24-12.6)	11.3 (8.83-14.3)	12.4 (9.32-16.2)	13.9 (10.1-18.7)	15.0 (10.6-20.6)
45-day	5.73 (4.96-6.62)	6.62 (5.72-7.65)	8.05 (6.93-9.33)	9.21 (7.89-10.7)	10.8 (8.91-12.9)	12.0 (9.68-14.6)	13.1 (10.3-16.5)	14.3 (10.7-18.5)	15.8 (11.4-21.1)	16.9 (12.0-23.0)
60-day	6.56 (5.70-7.55)	7.55 (6.55-8.69)	9.12 (7.88-10.5)	10.4 (8.92-12.0)	12.1 (9.98-14.4)	13.3 (10.8-16.1)	14.5 (11.4-18.1)	15.6 (11.8-20.2)	17.1 (12.5-22.8)	18.2 (12.9-24.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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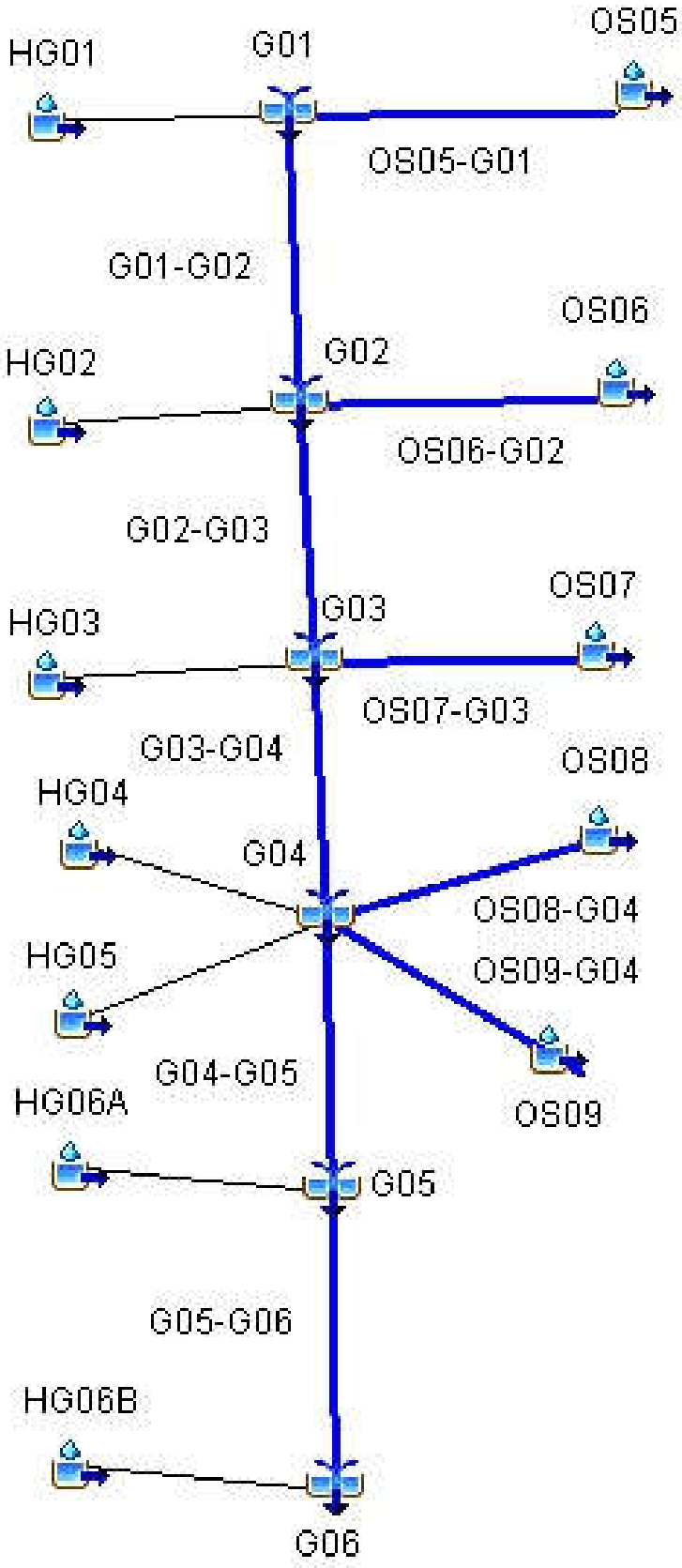
GIECK HISTORIC CONDITIONS



HISTORIC SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
OS06-G02	0.1313	77	01Jul2015, 12:24	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G01	0.0578	38	01Jul2015, 12:12	4.1
HG01	0.0547	32	01Jul2015, 12:12	3.9
G01	0.1125	70	01Jul2015, 12:12	7.9
G01-G02	0.1125	68	01Jul2015, 12:24	7.8
HG02	0.0906	45	01Jul2015, 12:24	6.4
G02	0.3344	191	01Jul2015, 12:24	23.4
G02-G03	0.3344	190	01Jul2015, 12:30	23.1
HG03	0.1828	77	01Jul2015, 12:30	12.9
OS07	0.0328	25	01Jul2015, 12:12	2.6
OS07-G03	0.0328	24	01Jul2015, 12:30	2.5
G03	0.5500	291	01Jul2015, 12:30	38.4
G03-G04	0.5500	281	01Jul2015, 12:30	38.0
OS09	0.1547	91	01Jul2015, 12:24	13.2
OS09-G04	0.1547	90	01Jul2015, 12:30	13.0
HG04	0.0891	40	01Jul2015, 12:30	6.3
HG05	0.1125	49	01Jul2015, 12:30	7.9
OS08	0.0406	35	01Jul2015, 12:12	3.6
OS08-G04	0.0406	34	01Jul2015, 12:30	3.5
G04	0.9469	493	01Jul2015, 12:30	68.7
G04-G05	0.9469	488	01Jul2015, 12:36	68.4
HG06A	0.1375	49	01Jul2015, 12:42	9.6
G05	1.0844	536	01Jul2015, 12:36	78.0
G05-G06	1.0844	520	01Jul2015, 12:36	77.6
HG06B	0.1031	33	01Jul2015, 12:48	7.2
G06	1.1875	551	01Jul2015, 12:42	84.7
HG14	0.2297	79	01Jul2015, 12:42	16.0
HG13	0.0844	54	01Jul2015, 12:18	6.6
G07	0.0844	54	01Jul2015, 12:18	6.6
G07-G08	0.0844	53	01Jul2015, 12:18	6.6
G16	0.3141	117	01Jul2015, 12:30	22.6

Highlighted green rows reference key design points (Typical all charts this section)

HISTORIC SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
OS06-G02	0.1313	52	01Jul2015, 12:24	6.4
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G01	0.0578	25	01Jul2015, 12:18	2.9
HG01	0.0547	21	01Jul2015, 12:18	2.7
G01	0.1125	46	01Jul2015, 12:18	5.6
G01-G02	0.1125	46	01Jul2015, 12:24	5.5
HG02	0.0906	30	01Jul2015, 12:24	4.5
G02	0.3344	127	01Jul2015, 12:24	16.4
G02-G03	0.3344	125	01Jul2015, 12:30	16.1
HG03	0.1828	51	01Jul2015, 12:30	9.1
OS07	0.0328	17	01Jul2015, 12:12	1.9
OS07-G03	0.0328	17	01Jul2015, 12:30	1.8
G03	0.5500	192	01Jul2015, 12:30	27.0
G03-G04	0.5500	189	01Jul2015, 12:36	26.7
OS09	0.1547	63	01Jul2015, 12:24	9.6
OS09-G04	0.1547	62	01Jul2015, 12:36	9.4
HG04	0.0891	26	01Jul2015, 12:30	4.4
HG05	0.1125	32	01Jul2015, 12:30	5.6
OS08	0.0406	25	01Jul2015, 12:12	2.6
OS08-G04	0.0406	24	01Jul2015, 12:36	2.5
G04	0.9469	332	01Jul2015, 12:36	48.6
G04-G05	0.9469	318	01Jul2015, 12:42	48.3
HG06A	0.1375	32	01Jul2015, 12:42	6.7
G05	1.0844	350	01Jul2015, 12:42	55.1
G05-G06	1.0844	348	01Jul2015, 12:42	54.7
HG06B	0.1031	22	01Jul2015, 12:54	5.0
G06	1.1875	369	01Jul2015, 12:42	59.8
HG14	0.2297	52	01Jul2015, 12:48	11.3
HG13	0.0844	37	01Jul2015, 12:18	4.7
G07	0.0844	37	01Jul2015, 12:18	4.7
G07-G08	0.0844	36	01Jul2015, 12:24	4.7
G16	0.3141	77	01Jul2015, 12:30	15.9

Highlighted green rows reference key design points (Typical all charts this section)

HISTORIC SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
OS06-G02	0.1313	11	01Jul2015, 12:30	2.1
OS05	0.0578	5.6	01Jul2015, 12:12	1.0
OS05-G01	0.0578	5.5	01Jul2015, 12:24	0.9
HG01	0.0547	4.7	01Jul2015, 12:18	0.9
G01	0.1125	10	01Jul2015, 12:24	1.9
G01-G02	0.1125	10	01Jul2015, 12:36	1.8
HG02	0.0906	6.7	01Jul2015, 12:30	1.5
G02	0.3344	27	01Jul2015, 12:36	5.4
G02-G03	0.3344	27	01Jul2015, 12:48	5.3
HG03	0.1828	12	01Jul2015, 12:42	3.0
OS07	0.0328	4.5	01Jul2015, 12:12	0.7
OS07-G03	0.0328	4.3	01Jul2015, 12:48	0.7
G03	0.5500	42	01Jul2015, 12:48	8.9
G03-G04	0.5500	42	01Jul2015, 12:54	8.8
OS09	0.1547	19	01Jul2015, 12:30	3.6
OS09-G04	0.1547	18	01Jul2015, 12:42	3.5
HG04	0.0891	5.9	01Jul2015, 12:36	1.5
HG05	0.1125	7.4	01Jul2015, 12:36	1.8
OS08	0.0406	7.7	01Jul2015, 12:12	1.0
OS08-G04	0.0406	7.4	01Jul2015, 12:48	1.0
G04	0.9469	76	01Jul2015, 12:54	16.6
G04-G05	0.9469	76	01Jul2015, 12:54	16.5
HG06A	0.1375	7.6	01Jul2015, 12:54	2.2
G05	1.0844	84	01Jul2015, 12:54	18.7
G05-G06	1.0844	83	01Jul2015, 13:00	18.5
HG06B	0.1031	5.3	01Jul2015, 13:00	1.7
G06	1.1875	88	01Jul2015, 13:00	20.2
HG14	0.2297	12.4	01Jul2015, 12:54	3.7
HG13	0.0844	9.5	01Jul2015, 12:18	1.7
G07	0.0844	9.5	01Jul2015, 12:18	1.7
G07-G08	0.0844	9.4	01Jul2015, 12:30	1.7
G16	0.3141	19.1	01Jul2015, 12:36	5.4

Highlighted green rows reference key design points (Typical all charts this section)

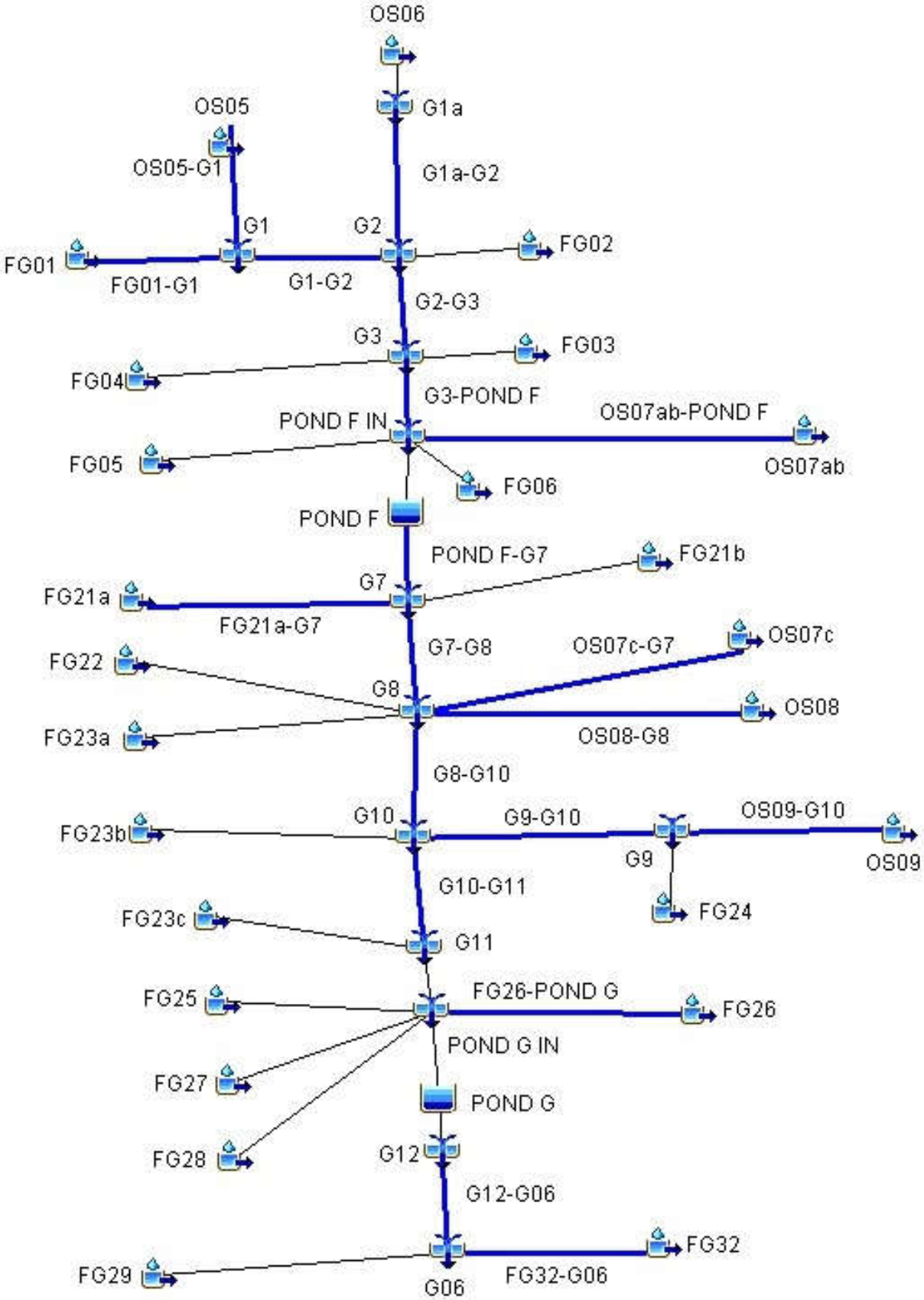
HISTORIC SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
OS06-G02	0.1313	3.7	01Jul2015, 12:42	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G01	0.0578	1.7	01Jul2015, 12:30	0.5
HG01	0.0547	1.5	01Jul2015, 12:24	0.5
G01	0.1125	3.2	01Jul2015, 12:30	1.0
G01-G02	0.1125	3.2	01Jul2015, 12:48	0.9
HG02	0.0906	2.3	01Jul2015, 12:36	0.8
G02	0.3344	9.0	01Jul2015, 12:42	2.8
G02-G03	0.3344	9.0	01Jul2015, 13:00	2.7
HG03	0.1828	4.3	01Jul2015, 12:48	1.6
OS07	0.0328	1.7	01Jul2015, 12:18	0.4
OS07-G03	0.0328	1.7	01Jul2015, 13:00	0.4
G03	0.5500	15	01Jul2015, 13:00	4.6
G03-G04	0.5500	14	01Jul2015, 13:12	4.5
OS09	0.1547	8.3	01Jul2015, 12:36	2.1
OS09-G04	0.1547	8.3	01Jul2015, 12:48	2.0
HG04	0.0891	2.1	01Jul2015, 12:42	0.8
HG05	0.1125	2.6	01Jul2015, 12:42	0.9
OS08	0.0406	3.4	01Jul2015, 12:12	0.6
OS08-G04	0.0406	3.4	01Jul2015, 13:00	0.6
G04	0.9469	28	01Jul2015, 13:12	8.7
G04-G05	0.9469	27	01Jul2015, 13:18	8.6
HG06A	0.1375	2.9	01Jul2015, 13:00	1.1
G05	1.0844	30	01Jul2015, 13:18	9.8
G05-G06	1.0844	30	01Jul2015, 13:24	9.6
HG06B	0.1031	2.0	01Jul2015, 13:12	0.9
G06	1.1875	32	01Jul2015, 13:24	10.5
HG14	0.2297	4.7	01Jul2015, 13:06	1.9
HG13	0.0844	3.8	01Jul2015, 12:24	0.9
G07	0.0844	3.8	01Jul2015, 12:24	0.9
G07-G08	0.0844	3.7	01Jul2015, 12:36	0.9
G16	0.3141	7.4	01Jul2015, 12:54	2.8

Highlighted green rows reference key design points (Typical all charts this section)

HISTORIC SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
OS06-G02	0.1313	0.5	01Jul2015, 14:00	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G01	0.0578	0.2	01Jul2015, 13:42	0.2
HG01	0.0547	0.2	01Jul2015, 13:36	0.1
G01	0.1125	0.5	01Jul2015, 13:36	0.3
G01-G02	0.1125	0.5	01Jul2015, 14:06	0.3
HG02	0.0906	0.4	01Jul2015, 13:42	0.2
G02	0.3344	1.3	01Jul2015, 14:00	0.8
G02-G03	0.3344	1.3	01Jul2015, 14:30	0.8
HG03	0.1828	0.7	01Jul2015, 13:54	0.5
OS07	0.0328	0.3	01Jul2015, 12:54	0.1
OS07-G03	0.0328	0.3	01Jul2015, 14:12	0.1
G03	0.5500	2.3	01Jul2015, 14:24	1.4
G03-G04	0.5500	2.3	01Jul2015, 14:42	1.3
OS09	0.1547	1.9	01Jul2015, 12:54	0.8
OS09-G04	0.1547	1.9	01Jul2015, 13:18	0.8
HG04	0.0891	0.3	01Jul2015, 13:48	0.2
HG05	0.1125	0.4	01Jul2015, 13:54	0.3
OS08	0.0406	0.7	01Jul2015, 12:24	0.2
OS08-G04	0.0406	0.7	01Jul2015, 13:36	0.2
G04	0.9469	4.7	01Jul2015, 14:36	2.8
G04-G05	0.9469	4.7	01Jul2015, 14:48	2.8
HG06A	0.1375	0.5	01Jul2015, 14:12	0.3
G05	1.0844	5.2	01Jul2015, 14:48	3.1
G05-G06	1.0844	5.2	01Jul2015, 15:00	3.0
HG06B	0.1031	0.4	01Jul2015, 14:24	0.3
G06	1.1875	5.5	01Jul2015, 15:00	3.3
HG14	0.2297	0.8	01Jul2015, 14:18	0.6
HG13	0.0844	0.7	01Jul2015, 13:00	0.3
G07	0.0844	0.7	01Jul2015, 13:00	0.3
G07-G08	0.0844	0.6	01Jul2015, 13:18	0.3
G16	0.3141	1.4	01Jul2015, 13:54	0.9

Highlighted green rows reference key design points (Typical all charts this section)

GIECK INTERIM CONDITIONS



INTERIM SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
G1a	0.1313	80	01Jul2015, 12:12	9.3
G1a-G2	0.1313	79	01Jul2015, 12:18	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G1	0.0578	39	01Jul2015, 12:12	4.1
FG01	0.0538	31	01Jul2015, 12:30	4.9
FG01-G1	0.0538	31	01Jul2015, 12:30	4.9
G1	0.1116	61	01Jul2015, 12:18	9.0
G1-G2	0.1116	61	01Jul2015, 12:18	9.0
FG02	0.0391	32	01Jul2015, 12:12	3.3
G2	0.2820	167	01Jul2015, 12:18	21.5
G2-G3	0.2820	163	01Jul2015, 12:18	21.3
FG03	0.0203	24	01Jul2015, 12:06	2.0
FG04	0.0172	22	01Jul2015, 12:00	1.7
G3	0.3195	185	01Jul2015, 12:18	25.0
G3-POND F	0.3195	183	01Jul2015, 12:18	25.0
FG06	0.0675	56	01Jul2015, 12:12	6.1
FG05	0.0580	45	01Jul2015, 12:24	6.1
OS07ab	0.0170	14	01Jul2015, 12:06	1.3
OS07a-POND F	0.0170	13	01Jul2015, 12:18	1.3
POND F IN	0.4620	293	01Jul2015, 12:18	38.5
POND F	0.4620	178	01Jul2015, 12:42	36.1
POND F-G7	0.4620	177	01Jul2015, 12:42	35.8
FG21b	0.0150	21	01Jul2015, 12:06	1.8
FG21a	0.0095	7	01Jul2015, 12:06	0.7
FG21a-G7	0.0095	7	01Jul2015, 12:18	0.7
G7	0.4865	185	01Jul2015, 12:42	38.3
G7-G8	0.4865	184	01Jul2015, 12:42	38.3
FG22	0.1264	84	01Jul2015, 12:24	12.3
OS08	0.0394	34	01Jul2015, 12:12	3.5
OS08-G8	0.0394	33	01Jul2015, 12:24	3.4
FG23a	0.0231	16	01Jul2015, 12:12	1.8
OS07c	0.0156	15	01Jul2015, 12:06	1.2
OS07c-G8	0.0156	13	01Jul2015, 12:24	1.2
G8	0.6910	292	01Jul2015, 12:36	56.9
G7-G10	0.6910	292	01Jul2015, 12:36	56.5
OS09	0.1527	90	01Jul2015, 12:24	13.0
OS09-G10	0.1527	88	01Jul2015, 12:30	12.9
FG24	0.1405	74	01Jul2015, 12:18	10.2
G9	0.2932	154	01Jul2015, 12:30	23.1
G8-G10	0.2932	154	01Jul2015, 12:30	23.0
FG23b	0.0334	22	01Jul2015, 12:12	2.4
G10	1.0176	449	01Jul2015, 12:36	81.9
G10-G11	1.0176	447	01Jul2015, 12:36	81.8
FG23c	0.0070	5	01Jul2015, 12:06	0.5

INTERIM SCS (100-YEAR)				
FG32-G06	0.0402	27	01Jul2015, 12:12	2.8
G11	1.0246	449	01Jul2015, 12:36	82.3
FG25	0.1086	48	01Jul2015, 12:30	7.6
FG28	0.0688	33	01Jul2015, 12:24	4.8
POND G IN	1.2020	522	01Jul2015, 12:36	94.7
POND G	1.2020	358	01Jul2015, 13:06	85.6
G12	1.2020	358	01Jul2015, 13:06	85.6
G12-G06	1.2020	357	01Jul2015, 13:06	85.0
FG29	0.0997	60	01Jul2015, 12:12	7.1
FG32	0.0402	27	01Jul2015, 12:12	2.9
FG32-G06	0.0402	27	01Jul2015, 12:12	2.8
G06	1.3419	377	01Jul2015, 13:06	94.9

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
G1a	0.1313	52	01Jul2015, 12:12	6.5
G1a-G2	0.1313	52	01Jul2015, 12:18	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G1	0.0578	25	01Jul2015, 12:12	2.9
FG01	0.0538	22	01Jul2015, 12:30	3.6
FG01-G1	0.0538	22	01Jul2015, 12:30	3.6
G1	0.1116	41	01Jul2015, 12:18	6.4
G1-G2	0.1116	41	01Jul2015, 12:18	6.4
FG02	0.0391	22	01Jul2015, 12:12	2.4
G2	0.2820	112	01Jul2015, 12:18	15.3
G2-G3	0.2820	109	01Jul2015, 12:24	15.2
FG03	0.0203	17	01Jul2015, 12:06	1.5
FG04	0.0172	16	01Jul2015, 12:00	1.3
G3	0.3195	123	01Jul2015, 12:18	17.9
G3-POND F	0.3195	121	01Jul2015, 12:18	17.9
FG06	0.0675	40	01Jul2015, 12:12	4.4
FG05	0.0580	33	01Jul2015, 12:24	4.6
OS07ab	0.0170	9	01Jul2015, 12:12	1.0
OS07a-POND F	0.0170	9	01Jul2015, 12:18	0.9
POND F IN	0.4620	200	01Jul2015, 12:18	27.9
POND F	0.4620	121	01Jul2015, 12:42	25.8
POND F-G7	0.4620	121	01Jul2015, 12:48	25.7
FG21b	0.0150	15.6	01Jul2015, 12:06	1.4
FG21a	0.0095	5	01Jul2015, 12:12	0.5
FG21a-G7	0.0095	5	01Jul2015, 12:18	0.5
G7	0.4865	126	01Jul2015, 12:48	27.5
G7-G8	0.4865	125	01Jul2015, 12:48	27.5
FG22	0.1264	60	01Jul2015, 12:24	9.1
OS08	0.0394	24	01Jul2015, 12:12	2.5
OS08-G8	0.0394	23	01Jul2015, 12:24	2.5
FG23a	0.0231	11	01Jul2015, 12:12	1.3
OS07c	0.0156	10	01Jul2015, 12:06	0.9
OS07c-G8	0.0156	9	01Jul2015, 12:24	0.9
G8	0.6910	193	01Jul2015, 12:42	41.2
G7-G10	0.6910	192	01Jul2015, 12:48	40.8
OS09	0.1527	62	01Jul2015, 12:24	9.4
OS09-G10	0.1527	61.4	01Jul2015, 12:36	9.3
FG24	0.1405	49	01Jul2015, 12:24	7.2
G9	0.2932	105	01Jul2015, 12:30	16.5
G8-G10	0.2932	103	01Jul2015, 12:30	16.4
FG23b	0.0334	14	01Jul2015, 12:12	1.7
G10	1.0176	290	01Jul2015, 12:42	59.0
G10-G11	1.0176	288	01Jul2015, 12:42	58.9
FG23c	0.0070	3	01Jul2015, 12:12	0.4

INTERIM SCS (50-YEAR)				
FG32-G06	0.0402	18	01Jul2015, 12:12	2.0
G11	1.0246	289	01Jul2015, 12:42	59.2
FG25	0.1086	32	01Jul2015, 12:30	5.4
FG28	0.0688	21	01Jul2015, 12:24	3.4
POND G IN	1.2020	333	01Jul2015, 12:42	68.0
POND G	1.2020	206	01Jul2015, 13:18	59.4
G12	1.2020	206	01Jul2015, 13:18	59.4
G12-G06	1.2020	205	01Jul2015, 13:24	58.9
FG29	0.0997	39	01Jul2015, 12:18	5.0
FG32	0.0402	18	01Jul2015, 12:12	2.0
FG32-G06	0.0402	18	01Jul2015, 12:12	2.0
G06	1.3419	217	01Jul2015, 13:18	65.9

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
G1a	0.1313	12	01Jul2015, 12:18	2.2
G1a-G2	0.1313	11	01Jul2015, 12:24	2.1
OS05	0.0578	6	01Jul2015, 12:12	1.0
OS05-G1	0.0578	6	01Jul2015, 12:18	1.0
FG01	0.0538	7	01Jul2015, 12:36	1.4
FG01-G1	0.0538	7	01Jul2015, 12:36	1.4
G1	0.1116	11	01Jul2015, 12:24	2.3
G1-G2	0.1116	11	01Jul2015, 12:30	2.3
FG02	0.0391	6	01Jul2015, 12:12	0.9
G2	0.2820	27	01Jul2015, 12:24	5.4
G2-G3	0.2820	27	01Jul2015, 12:30	5.3
FG03	0.0203	6	01Jul2015, 12:06	0.6
FG04	0.0172	6	01Jul2015, 12:06	0.5
G3	0.3195	31	01Jul2015, 12:30	6.4
G3-POND F	0.3195	31	01Jul2015, 12:30	6.4
FG06	0.0675	12	01Jul2015, 12:18	1.7
FG05	0.0580	12	01Jul2015, 12:24	2.0
OS07ab	0.0170	2	01Jul2015, 12:12	0.3
OS07a-POND F	0.0170	2	01Jul2015, 12:30	0.3
POND F IN	0.4620	54	01Jul2015, 12:30	10.4
POND F	0.4620	16	01Jul2015, 13:48	9.1
POND F-G7	0.4620	16	01Jul2015, 13:54	9.0
FG21b	0.0150	7	01Jul2015, 12:06	0.6
FG21a	0.0095	1.3	01Jul2015, 12:12	0.2
FG21a-G7	0.0095	1	01Jul2015, 12:30	0.2
G7	0.4865	17	01Jul2015, 13:48	9.8
G7-G8	0.4865	17.3	01Jul2015, 13:48	9.8
FG22	0.1264	21	01Jul2015, 12:30	3.7
OS08	0.0394	7	01Jul2015, 12:12	1.0
OS08-G8	0.0394	7	01Jul2015, 12:30	0.9
FG23a	0.0231	3	01Jul2015, 12:18	0.5
OS07c	0.0156	3	01Jul2015, 12:06	0.3
OS07c-G8	0.0156	2.3	01Jul2015, 12:36	0.3
G8	0.6910	36.5	01Jul2015, 12:36	15.1
G7-G10	0.6910	36	01Jul2015, 12:48	14.9
OS09	0.1527	18	01Jul2015, 12:30	3.5
OS09-G10	0.1527	18.2	01Jul2015, 12:42	3.5
FG24	0.1405	12	01Jul2015, 12:24	2.4
G9	0.2932	28	01Jul2015, 12:36	5.9
G8-G10	0.2932	27.6	01Jul2015, 12:42	5.9
FG23b	0.0334	3	01Jul2015, 12:18	0.6
G10	1.0176	65	01Jul2015, 12:42	21.3
G10-G11	1.0176	65	01Jul2015, 12:48	21.3
FG23c	0.0070	1	01Jul2015, 12:12	0.1

INTERIM SCS (10-YEAR)				
FG32-G06	0.0402	4	01Jul2015, 12:18	0.7
G11	1.0246	65	01Jul2015, 12:48	21.4
FG25	0.1086	7	01Jul2015, 12:36	1.8
FG28	0.0688	5	01Jul2015, 12:30	1.1
POND G IN	1.2020	76	01Jul2015, 12:42	24.3
POND G	1.2020	28	01Jul2015, 15:42	17.3
G12	1.2020	28	01Jul2015, 15:42	17.3
G12-G06	1.2020	28	01Jul2015, 15:54	17.0
FG29	0.0997	9	01Jul2015, 12:18	1.6
FG32	0.0402	4	01Jul2015, 12:12	0.7
FG32-G06	0.0402	4	01Jul2015, 12:18	0.7
G06	1.3419	29	01Jul2015, 15:48	19.3

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
G1a	0.1313	3.8	01Jul2015, 12:24	1.1
G1a-G2	0.1313	3.6	01Jul2015, 12:36	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G1	0.0578	1.7	01Jul2015, 12:24	0.5
FG01	0.0538	3.4	01Jul2015, 12:36	0.8
FG01-G1	0.0538	3.4	01Jul2015, 12:36	0.8
G1	0.1116	4.9	01Jul2015, 12:36	1.3
G1-G2	0.1116	4.8	01Jul2015, 12:36	1.3
FG02	0.0391	2.7	01Jul2015, 12:18	0.5
G2	0.2820	10	01Jul2015, 12:30	2.9
G2-G3	0.2820	10	01Jul2015, 12:42	2.9
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	3.1	01Jul2015, 12:06	0.3
G3	0.3195	11	01Jul2015, 12:36	3.3
G3-POND F	0.3195	11	01Jul2015, 12:42	3.3
FG06	0.0675	5.8	01Jul2015, 12:18	1.0
FG05	0.0580	6.7	01Jul2015, 12:30	1.2
OS07ab	0.0170	0.9	01Jul2015, 12:12	0.2
OS07a-POND F	0.0170	0.9	01Jul2015, 12:36	0.2
POND F IN	0.4620	22.3	01Jul2015, 12:36	5.7
POND F	0.4620	7.7	01Jul2015, 14:18	4.7
POND F-G7	0.4620	7.7	01Jul2015, 14:30	4.6
FG21b	0.0150	3.9	01Jul2015, 12:06	0.4
FG21a	0.0095	0.5	01Jul2015, 12:12	0.1
FG21a-G7	0.0095	0.5	01Jul2015, 12:42	0.1
G7	0.4865	8.2	01Jul2015, 14:24	5.1
G7-G8	0.4865	8.2	01Jul2015, 14:24	5.1
FG22	0.1264	10.5	01Jul2015, 12:30	2.2
OS08	0.0394	3.3	01Jul2015, 12:12	0.6
OS08-G8	0.0394	3.3	01Jul2015, 12:36	0.5
FG23a	0.0231	1.0	01Jul2015, 12:18	0.2
OS07c	0.0156	1.0	01Jul2015, 12:12	0.2
OS07c-G8	0.0156	0.9	01Jul2015, 12:42	0.2
G8	0.6910	16.6	01Jul2015, 12:36	8.3
G7-G10	0.6910	16	01Jul2015, 12:48	8.1
OS09	0.1527	8	01Jul2015, 12:36	2.0
OS09-G10	0.1527	8.2	01Jul2015, 12:48	2.0
FG24	0.1405	4	01Jul2015, 12:30	1.3
G9	0.2932	12	01Jul2015, 12:48	3.3
G8-G10	0.2932	11.8	01Jul2015, 12:54	3.2
FG23b	0.0334	1	01Jul2015, 12:18	0.3
G10	1.0176	29	01Jul2015, 12:48	11.6
G10-G11	1.0176	29	01Jul2015, 12:54	11.6
FG23c	0.0070	0	01Jul2015, 12:18	0.1

INTERIM SCS (5-YEAR)				
FG32-G06	0.0402	1	01Jul2015, 12:24	0.3
G11	1.0246	29	01Jul2015, 12:54	11.6
FG25	0.1086	3	01Jul2015, 12:42	0.9
FG28	0.0688	2	01Jul2015, 12:36	0.6
POND G IN	1.2020	33	01Jul2015, 12:54	13.1
POND G	1.2020	10	01Jul2015, 19:48	6.7
G12	1.2020	10	01Jul2015, 19:48	6.7
G12-G06	1.2020	10	01Jul2015, 20:00	6.5
FG29	0.0997	3	01Jul2015, 12:24	0.9
FG32	0.0402	1	01Jul2015, 12:18	0.3
FG32-G06	0.0402	1	01Jul2015, 12:24	0.3
G06	1.3419	11	01Jul2015, 19:48	7.7

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
G1a	0.1313	0.5	01Jul2015, 13:30	0.3
G1a-G2	0.1313	0.5	01Jul2015, 13:48	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G1	0.0578	0.2	01Jul2015, 13:30	0.2
FG01	0.0538	0.9	01Jul2015, 12:48	0.4
FG01-G1	0.0538	0.9	01Jul2015, 12:48	0.4
G1	0.1116	1.1	01Jul2015, 12:54	0.5
G1-G2	0.1116	1.1	01Jul2015, 13:00	0.5
FG02	0.0391	0.5	01Jul2015, 12:30	0.2
G2	0.2820	1.9	01Jul2015, 13:18	1.0
G2-G3	0.2820	1.9	01Jul2015, 13:30	1.0
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	0.9	01Jul2015, 12:06	0.1
G3	0.3195	2.4	01Jul2015, 13:24	1.3
G3-POND F	0.3195	2.4	01Jul2015, 13:30	1.3
FG06	0.0675	1.3	01Jul2015, 12:24	0.4
FG05	0.0580	2.4	01Jul2015, 12:30	0.6
OS07ab	0.0170	0.1	01Jul2015, 12:48	0.1
OS07a-POND F	0.0170	0.1	01Jul2015, 13:30	0.1
POND F IN	0.4620	5.0	01Jul2015, 12:48	2.4
POND F	0.4620	2.1	01Jul2015, 17:54	1.6
POND F-G7	0.4620	2.1	01Jul2015, 18:06	1.5
FG21b	0.0150	1.7	01Jul2015, 12:12	0.2
FG21a	0.0095	0.1	01Jul2015, 12:54	0.0
FG21a-G7	0.0095	0.1	01Jul2015, 13:42	0.0
G7	0.4865	2.3	01Jul2015, 17:48	1.8
G7-G8	0.4865	2.3	01Jul2015, 17:48	1.7
FG22	0.1264	3.3	01Jul2015, 12:42	1.0
OS08	0.0394	0.7	01Jul2015, 12:24	0.2
OS08-G8	0.0394	0.7	01Jul2015, 12:54	0.2
FG23a	0.0231	0.2	01Jul2015, 13:00	0.1
OS07c	0.0156	0.1	01Jul2015, 12:48	0.1
OS07c-G8	0.0156	0.1	01Jul2015, 13:42	0.1
G8	0.6910	4.4	01Jul2015, 12:54	3.1
G7-G10	0.6910	4.2	01Jul2015, 13:12	3.0
OS09	0.1527	1.9	01Jul2015, 12:54	0.8
OS09-G10	0.1527	1.9	01Jul2015, 13:18	0.8
FG24	0.1405	0.7	01Jul2015, 13:30	0.4
G9	0.2932	2.5	01Jul2015, 13:18	1.2
G8-G10	0.2932	2.5	01Jul2015, 13:24	1.2
FG23b	0.0334	0.1	01Jul2015, 13:30	0.1
G10	1.0176	6.8	01Jul2015, 13:12	4.3
G10-G11	1.0176	6.7	01Jul2015, 13:18	4.2
FG23c	0.0070	0.0	01Jul2015, 13:18	0.0

INTERIM SCS (2-YEAR)				
FG32-G06	0.0402	0	01Jul2015, 13:36	0.1
G11	1.0246	6.8	01Jul2015, 13:18	4.3
FG25	0.1086	0.4	01Jul2015, 13:48	0.3
FG28	0.0688	0.3	01Jul2015, 13:48	0.2
POND G IN	1.2020	7.4	01Jul2015, 13:18	4.7
POND G	1.2020	3.6	02Jul2015, 00:00	2.3
G12	1.2020	3.6	02Jul2015, 00:00	2.3
G12-G06	1.2020	3.6	02Jul2015, 00:00	2.2
FG29	0.0997	0.4	01Jul2015, 13:36	0.3
FG32	0.0402	0.2	01Jul2015, 13:24	0.1
FG32-G06	0.0402	0.2	01Jul2015, 13:36	0.1
G06	1.3419	4.0	01Jul2015, 23:48	2.6

Highlighted green rows reference key design points (Typical all charts this section)

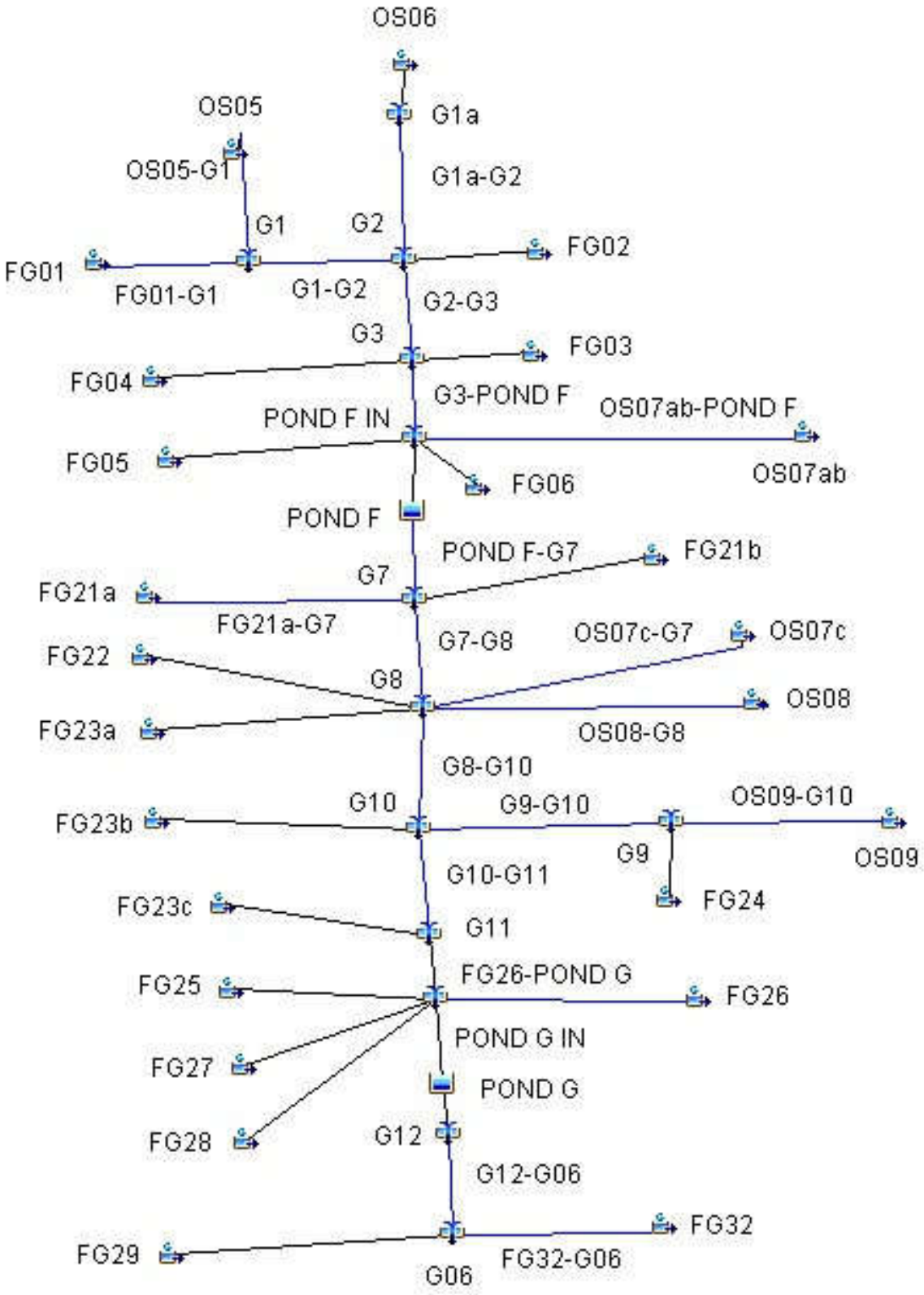
FUTURE SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
G1a	0.1313	80	01Jul2015, 12:12	9.3
G1a-G2	0.1313	79	01Jul2015, 12:18	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G1	0.0578	39	01Jul2015, 12:12	4.1
FG01	0.0538	31	01Jul2015, 12:30	4.9
FG01-G1	0.0538	31	01Jul2015, 12:30	4.9
G1	0.1116	61	01Jul2015, 12:18	9.0
G1-G2	0.1116	61	01Jul2015, 12:18	9.0
FG02	0.0391	32	01Jul2015, 12:12	3.3
G2	0.2820	167	01Jul2015, 12:18	21.5
G2-G3	0.2820	163	01Jul2015, 12:18	21.3
FG03	0.0203	24	01Jul2015, 12:06	2.0
FG04	0.0172	22	01Jul2015, 12:00	1.7
G3	0.3195	185	01Jul2015, 12:18	25.0
G3-POND F	0.3195	183	01Jul2015, 12:18	25.0
FG06	0.0675	56	01Jul2015, 12:12	6.1
FG05	0.0580	45	01Jul2015, 12:24	6.1
OS07ab	0.0170	14	01Jul2015, 12:06	1.3
OS07ab-POND F	0.0170	13	01Jul2015, 12:18	1.3
POND F IN	0.4620	293	01Jul2015, 12:18	38.5
POND F	0.4620	178	01Jul2015, 12:42	36.1
POND F-G7	0.4620	177	01Jul2015, 12:42	35.8
FG21b	0.0150	21	01Jul2015, 12:06	1.8
FG21a	0.0095	7	01Jul2015, 12:06	0.7
FG21a-G7	0.0095	7	01Jul2015, 12:18	0.7
G7	0.4865	185	01Jul2015, 12:42	38.3
G7-G8	0.4865	184	01Jul2015, 12:42	38.3
FG22	0.1309	89	01Jul2015, 12:24	13.0
OS08	0.0394	34	01Jul2015, 12:12	3.5
OS08-G8	0.0394	33	01Jul2015, 12:12	3.5
FG23a	0.0216	21	01Jul2015, 12:12	2.2
OS07c	0.0156	15	01Jul2015, 12:06	1.2
OS07c-G7	0.0156	14	01Jul2015, 12:12	1.2
G8	0.6940	288	01Jul2015, 12:36	58.1
G8-G10	0.6940	286	01Jul2015, 12:36	57.7
OS09	0.1527	90	01Jul2015, 12:24	13.0
OS09-G10	0.1527	88	01Jul2015, 12:36	12.8
FG24	0.1517	118	01Jul2015, 12:18	15.1
G9	0.3044	193	01Jul2015, 12:24	27.9
G9-G10	0.3044	190	01Jul2015, 12:30	27.8
FG23b	0.0247	18	01Jul2015, 12:12	1.9
G10	1.0231	470	01Jul2015, 12:36	87.4
G10-G11	1.0231	470	01Jul2015, 12:36	87.3
FG23c	0.0122	12	01Jul2015, 12:06	1.2

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
G11	1.0353	474	01Jul2015, 12:36	88.4
FG25	0.1086	85	01Jul2015, 12:30	13.3
FG26	0.0863	78	01Jul2015, 12:18	9.4
FG26-POND G	0.0863	77	01Jul2015, 12:18	9.4
FG27	0.0500	52	01Jul2015, 12:18	6.3
FG28	0.0245	18	01Jul2015, 12:18	2.3
POND G IN	1.3047	668	01Jul2015, 12:30	119.6
POND G	1.3047	472	01Jul2015, 13:00	110.0
G12	1.3047	472	01Jul2015, 13:00	110.0
G12-G06	1.3047	472	01Jul2015, 13:00	109.4
FG29	0.0997	60	01Jul2015, 12:12	7.1
FG32	0.0402	72	01Jul2015, 12:06	6.1
FG32-G06	0.0402	69	01Jul2015, 12:06	6.1
G06	1.4446	498	01Jul2015, 13:00	122.5
FG34	0.0600	34	01Jul2015, 12:18	4.5
G14	0.0600	34	01Jul2015, 12:18	4.5
G14-G15	0.0600	34	01Jul2015, 12:24	4.4
FG35	0.0344	20	01Jul2015, 12:24	2.7
G15	0.0944	53	01Jul2015, 12:24	7.1
G15-G08	0.0944	52	01Jul2015, 12:24	7.1
FG37	0.0797	41	01Jul2015, 12:18	5.6
FG36	0.0281	14	01Jul2015, 12:18	2.0
FG36-G08	0.0281	14	01Jul2015, 12:24	2.0
G16	0.2022	106	01Jul2015, 12:24	14.7

Highlighted green rows reference key design points (Typical all charts this section)

GIECK FUTURE CONDITIONS

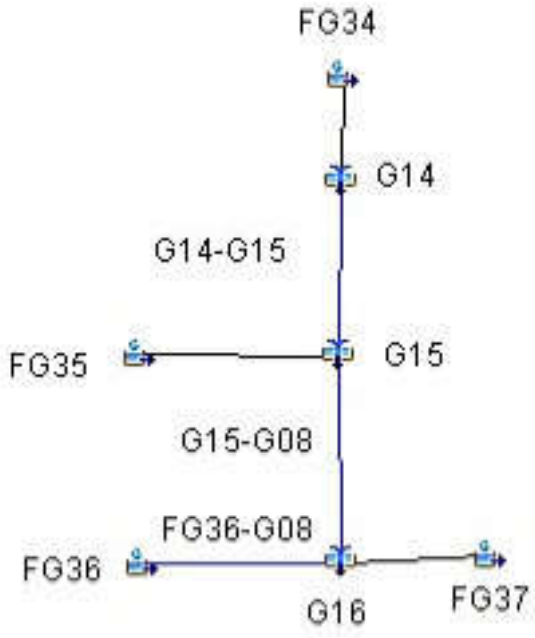


FUTURE SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
G1a	0.1313	52	01Jul2015, 12:12	6.5
G1a-G2	0.1313	52	01Jul2015, 12:18	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G1	0.0578	25	01Jul2015, 12:12	2.9
FG01	0.0538	22	01Jul2015, 12:30	3.6
FG01-G1	0.0538	22	01Jul2015, 12:30	3.6
G1	0.1116	41	01Jul2015, 12:18	6.4
G1-G2	0.1116	41	01Jul2015, 12:18	6.4
FG02	0.0391	22	01Jul2015, 12:12	2.4
G2	0.2820	112	01Jul2015, 12:18	15.3
G2-G3	0.2820	109	01Jul2015, 12:24	15.2
FG03	0.0203	17	01Jul2015, 12:06	1.5
FG04	0.0172	16	01Jul2015, 12:00	1.3
G3	0.3195	123	01Jul2015, 12:18	17.9
G3-POND F	0.3195	121	01Jul2015, 12:18	17.9
FG06	0.0675	40	01Jul2015, 12:12	4.4
FG05	0.0580	33	01Jul2015, 12:24	4.6
OS07ab	0.0170	9	01Jul2015, 12:12	1.0
OS07ab-POND F	0.0170	9	01Jul2015, 12:18	0.9
POND F IN	0.4620	200	01Jul2015, 12:18	27.9
POND F	0.4620	121	01Jul2015, 12:42	25.8
POND F-G7	0.4620	121	01Jul2015, 12:48	25.7
FG21b	0.0150	16	01Jul2015, 12:06	1.4
FG21a	0.0095	5	01Jul2015, 12:12	0.5
FG21a-G7	0.0095	5	01Jul2015, 12:18	0.5
G7	0.4865	126	01Jul2015, 12:48	27.5
G7-G8	0.4865	125	01Jul2015, 12:48	27.5
FG22	0.1309	64	01Jul2015, 12:24	9.6
OS08	0.0394	24	01Jul2015, 12:12	2.5
OS08-G8	0.0394	23	01Jul2015, 12:12	2.5
FG23a	0.0216	15	01Jul2015, 12:12	1.6
OS07c	0.0156	10	01Jul2015, 12:06	0.9
OS07c-G7	0.0156	10	01Jul2015, 12:12	0.9
G8	0.6940	191	01Jul2015, 12:42	42.1
G8-G10	0.6940	189	01Jul2015, 12:48	41.8
OS09	0.1527	62	01Jul2015, 12:24	9.4
OS09-G10	0.1527	62	01Jul2015, 12:36	9.3
FG24	0.1517	85	01Jul2015, 12:18	11.2
G9	0.3044	134	01Jul2015, 12:30	20.5
G9-G10	0.3044	133.8	01Jul2015, 12:30	20.4
FG23b	0.0247	12	01Jul2015, 12:12	1.3
G10	1.0231	305	01Jul2015, 12:42	63.5
G10-G11	1.0231	304	01Jul2015, 12:42	63.4
FG23c	0.0122	9	01Jul2015, 12:06	0.9

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
G11	1.0353	306	01Jul2015, 12:42	64.2
FG25	0.1086	64	01Jul2015, 12:30	10.2
FG26	0.0863	58	01Jul2015, 12:18	7.1
FG26-POND G	0.0863	57	01Jul2015, 12:18	7.0
FG27	0.0500	40	01Jul2015, 12:18	4.8
FG28	0.0245	13	01Jul2015, 12:18	1.7
POND G IN	1.3047	436	01Jul2015, 12:36	88.0
POND G	1.3047	321	01Jul2015, 13:00	79.0
G12	1.3047	321	01Jul2015, 13:00	79.0
G12-G06	1.3047	320	01Jul2015, 13:06	78.5
FG29	0.0997	39	01Jul2015, 12:18	5.0
FG32	0.0402	57	01Jul2015, 12:06	4.8
FG32-G06	0.0402	54	01Jul2015, 12:06	4.8
G06	1.4446	338	01Jul2015, 13:06	88.3
FG34	0.0600	23	01Jul2015, 12:18	3.2
G14	0.0600	23	01Jul2015, 12:18	3.2
G14-G15	0.0600	22	01Jul2015, 12:24	3.1
FG35	0.0344	13	01Jul2015, 12:24	2.0
G15	0.0944	36	01Jul2015, 12:24	5.1
G15-G08	0.0944	35	01Jul2015, 12:30	5.0
FG37	0.0797	27	01Jul2015, 12:24	4.0
FG36	0.0281	9	01Jul2015, 12:24	1.4
FG36-G08	0.0281	9	01Jul2015, 12:30	1.4
G16	0.2022	69	01Jul2015, 12:24	10.4

Highlighted green rows reference key design points (Typical all charts this section)



FUTURE SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
G1a	0.1313	12	01Jul2015, 12:18	2.2
G1a-G2	0.1313	11	01Jul2015, 12:24	2.1
OS05	0.0578	5.6	01Jul2015, 12:12	1.0
OS05-G1	0.0578	5.5	01Jul2015, 12:18	1.0
FG01	0.0538	7.0	01Jul2015, 12:36	1.4
FG01-G1	0.0538	7.0	01Jul2015, 12:36	1.4
G1	0.1116	11	01Jul2015, 12:24	2.3
G1-G2	0.1116	11	01Jul2015, 12:30	2.3
FG02	0.0391	6.4	01Jul2015, 12:12	0.9
G2	0.2820	27	01Jul2015, 12:24	5.4
G2-G3	0.2820	27	01Jul2015, 12:30	5.3
FG03	0.0203	5.9	01Jul2015, 12:06	0.6
FG04	0.0172	5.8	01Jul2015, 12:06	0.5
G3	0.3195	31	01Jul2015, 12:30	6.4
G3-POND F	0.3195	31	01Jul2015, 12:30	6.4
FG06	0.0675	12	01Jul2015, 12:18	1.7
FG05	0.0580	12.2	01Jul2015, 12:24	2.0
OS07ab	0.0170	2	01Jul2015, 12:12	0.3
OS07ab-POND F	0.0170	2	01Jul2015, 12:30	0.3
POND F IN	0.4620	54	01Jul2015, 12:30	10.4
POND F	0.4620	16.4	01Jul2015, 13:48	9.1
POND F-G7	0.4620	16.4	01Jul2015, 13:54	9.0
FG21b	0.0150	6.5	01Jul2015, 12:06	0.6
FG21a	0.0095	1	01Jul2015, 12:12	0.2
FG21a-G7	0.0095	1	01Jul2015, 12:30	0.2
G7	0.4865	17	01Jul2015, 13:48	9.8
G7-G8	0.4865	17.3	01Jul2015, 13:48	9.8
FG22	0.1309	22.4	01Jul2015, 12:30	4.0
OS08	0.0394	7.5	01Jul2015, 12:12	1.0
OS08-G8	0.0394	7	01Jul2015, 12:18	1.0
FG23a	0.0216	5	01Jul2015, 12:12	0.7
OS07c	0.0156	3	01Jul2015, 12:06	0.3
OS07c-G7	0.0156	2	01Jul2015, 12:12	0.3
G8	0.6940	39	01Jul2015, 12:18	15.7
G8-G10	0.6940	38	01Jul2015, 12:30	15.4
OS09	0.1527	18	01Jul2015, 12:30	3.5
OS09-G10	0.1527	18.1	01Jul2015, 12:42	3.5
FG24	0.1517	30	01Jul2015, 12:24	4.6
G9	0.3044	41	01Jul2015, 12:36	8.1
G9-G10	0.3044	40.1	01Jul2015, 12:36	8.0
FG23b	0.0247	3	01Jul2015, 12:12	0.5
G10	1.0231	79	01Jul2015, 12:36	23.9
G10-G11	1.0231	78	01Jul2015, 12:36	23.8
FG23c	0.0122	3	01Jul2015, 12:12	0.3

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
G11	1.0353	79	01Jul2015, 12:36	24.2
FG25	0.1086	27.1	01Jul2015, 12:36	4.7
FG26	0.0863	22	01Jul2015, 12:18	3.0
FG26-POND G	0.0863	22	01Jul2015, 12:24	3.0
FG27	0.0500	17	01Jul2015, 12:18	2.3
FG28	0.0245	4	01Jul2015, 12:18	0.7
POND G IN	1.3047	141	01Jul2015, 12:30	34.8
POND G	1.3047	53	01Jul2015, 14:00	27.4
G12	1.3047	53	01Jul2015, 14:00	27.4
G12-G06	1.3047	53	01Jul2015, 14:12	27.1
FG29	0.0997	9	01Jul2015, 12:18	1.6
FG32	0.0402	29	01Jul2015, 12:06	2.5
FG32-G06	0.0402	27	01Jul2015, 12:06	2.4
G06	1.4446	58	01Jul2015, 14:06	31.2
FG34	0.0600	5	01Jul2015, 12:24	1.1
G14	0.0600	5	01Jul2015, 12:24	1.1
G14-G15	0.0600	5	01Jul2015, 12:36	1.1
FG35	0.0344	4	01Jul2015, 12:30	0.7
G15	0.0944	9	01Jul2015, 12:36	1.8
G15-G08	0.0944	9	01Jul2015, 12:36	1.7
FG37	0.0797	6	01Jul2015, 12:24	1.3
FG36	0.0281	2	01Jul2015, 12:30	0.5
FG36-G08	0.0281	2	01Jul2015, 12:36	0.5
G16	0.2022	16	01Jul2015, 12:36	3.5

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
G1a	0.1313	3.8	01Jul2015, 12:24	1.1
G1a-G2	0.1313	3.6	01Jul2015, 12:36	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G1	0.0578	1.7	01Jul2015, 12:24	0.5
FG01	0.0538	3.4	01Jul2015, 12:36	0.8
FG01-G1	0.0538	3.4	01Jul2015, 12:36	0.8
G1	0.1116	4.9	01Jul2015, 12:36	1.3
G1-G2	0.1116	4.8	01Jul2015, 12:36	1.3
FG02	0.0391	2.7	01Jul2015, 12:18	0.5
G2	0.2820	10	01Jul2015, 12:30	2.9
G2-G3	0.2820	10	01Jul2015, 12:42	2.9
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	3.1	01Jul2015, 12:06	0.3
G3	0.3195	11	01Jul2015, 12:36	3.3
G3-POND F	0.3195	11	01Jul2015, 12:42	3.3
FG06	0.0675	5.8	01Jul2015, 12:18	1.0
FG05	0.0580	6.7	01Jul2015, 12:30	1.2
OS07ab	0.0170	0.9	01Jul2015, 12:12	0.2
OS07ab-POND F	0.0170	0.9	01Jul2015, 12:36	0.2
POND F IN	0.4620	22.3	01Jul2015, 12:36	5.7
POND F	0.4620	7.7	01Jul2015, 14:18	4.7
POND F-G7	0.4620	7.7	01Jul2015, 14:30	4.6
FG21b	0.0150	3.9	01Jul2015, 12:06	0.4
FG21a	0.0095	0.5	01Jul2015, 12:12	0.1
FG21a-G7	0.0095	0.5	01Jul2015, 12:42	0.1
G7	0.4865	8	01Jul2015, 14:24	5.1
G7-G8	0.4865	8.2	01Jul2015, 14:24	5.1
FG22	0.1309	11.7	01Jul2015, 12:30	2.4
OS08	0.0394	3.3	01Jul2015, 12:12	0.6
OS08-G8	0.0394	3	01Jul2015, 12:18	0.6
FG23a	0.0216	3	01Jul2015, 12:18	0.4
OS07c	0.0156	1.0	01Jul2015, 12:12	0.2
OS07c-G7	0.0156	0.9	01Jul2015, 12:18	0.2
G8	0.6940	20	01Jul2015, 12:24	8.6
G8-G10	0.6940	20	01Jul2015, 12:30	8.5
OS09	0.1527	8	01Jul2015, 12:36	2.0
OS09-G10	0.1527	8.2	01Jul2015, 12:48	2.0
FG24	0.1517	16	01Jul2015, 12:24	2.8
G9	0.3044	18	01Jul2015, 12:42	4.8
G9-G10	0.3044	18.3	01Jul2015, 12:48	4.7
FG23b	0.0247	1	01Jul2015, 12:18	0.3
G10	1.0231	37	01Jul2015, 12:42	13.5
G10-G11	1.0231	37.0	01Jul2015, 12:42	13.4
FG23c	0.0122	1.5	01Jul2015, 12:12	0.2

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
G11	1.0353	37.6	01Jul2015, 12:42	13.6
FG25	0.1086	16.7	01Jul2015, 12:36	3.1
FG26	0.0863	12	01Jul2015, 12:24	1.9
FG26-POND G	0.0863	12	01Jul2015, 12:24	1.9
FG27	0.0500	11	01Jul2015, 12:18	1.5
FG28	0.0245	2	01Jul2015, 12:24	0.4
POND G IN	1.3047	75	01Jul2015, 12:30	20.5
POND G	1.3047	20	01Jul2015, 15:36	13.7
G12	1.3047	20	01Jul2015, 15:36	13.7
G12-G06	1.3047	20	01Jul2015, 15:48	13.5
FG29	0.0997	3	01Jul2015, 12:24	0.9
FG32	0.0402	20	01Jul2015, 12:06	1.7
FG32-G06	0.0402	18	01Jul2015, 12:12	1.7
G06	1.4446	22	01Jul2015, 15:36	16.0
FG34	0.0600	2	01Jul2015, 12:30	0.6
G14	0.0600	2	01Jul2015, 12:30	0.6
G14-G15	0.0600	2	01Jul2015, 12:42	0.6
FG35	0.0344	1	01Jul2015, 12:30	0.4
G15	0.0944	3	01Jul2015, 12:42	0.9
G15-G08	0.0944	3	01Jul2015, 12:48	0.9
FG37	0.0797	2	01Jul2015, 12:36	0.7
FG36	0.0281	1	01Jul2015, 12:36	0.2
FG36-G08	0.0281	1	01Jul2015, 12:48	0.2
G16	0.2022	6	01Jul2015, 12:48	1.8

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
G1a	0.1313	0.5	01Jul2015, 13:30	0.3
G1a-G2	0.1313	0.5	01Jul2015, 13:48	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G1	0.0578	0.2	01Jul2015, 13:30	0.2
FG01	0.0538	0.9	01Jul2015, 12:48	0.4
FG01-G1	0.0538	0.9	01Jul2015, 12:48	0.4
G1	0.1116	1.1	01Jul2015, 12:54	0.5
G1-G2	0.1116	1.1	01Jul2015, 13:00	0.5
FG02	0.0391	0.5	01Jul2015, 12:30	0.2
G2	0.2820	1.9	01Jul2015, 13:18	1.0
G2-G3	0.2820	1.9	01Jul2015, 13:30	1.0
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	0.9	01Jul2015, 12:06	0.1
G3	0.3195	2.4	01Jul2015, 13:24	1.3
G3-POND F	0.3195	2.4	01Jul2015, 13:30	1.3
FG06	0.0675	1.3	01Jul2015, 12:24	0.4
FG05	0.0580	2.4	01Jul2015, 12:30	0.6
OS07ab	0.0170	0.1	01Jul2015, 12:48	0.1
OS07ab-POND F	0.0170	0.1	01Jul2015, 13:30	0.1
POND F IN	0.4620	5.0	01Jul2015, 12:48	2.4
POND F	0.4620	2.1	01Jul2015, 17:54	1.6
POND F-G7	0.4620	2.1	01Jul2015, 18:06	1.5
FG21b	0.0150	1.7	01Jul2015, 12:12	0.2
FG21a	0.0095	0.1	01Jul2015, 12:54	0.0
FG21a-G7	0.0095	0.1	01Jul2015, 13:42	0.0
G7	0.4865	2.3	01Jul2015, 17:48	1.8
G7-G8	0.4865	2.3	01Jul2015, 17:48	1.7
FG22	0.1309	3.8	01Jul2015, 12:42	1.1
OS08	0.0394	0.7	01Jul2015, 12:24	0.2
OS08-G8	0.0394	0.7	01Jul2015, 12:30	0.2
FG23a	0.0216	0.8	01Jul2015, 12:18	0.2
OS07c	0.0156	0.1	01Jul2015, 12:48	0.1
OS07c-G7	0.0156	0.1	01Jul2015, 13:00	0.1
G8	0.6940	6.0	01Jul2015, 12:30	3.3
G8-G10	0.6940	6.0	01Jul2015, 12:48	3.2
OS09	0.1527	1.9	01Jul2015, 12:54	0.8
OS09-G10	0.1527	1.9	01Jul2015, 13:18	0.8
FG24	0.1517	5	01Jul2015, 12:30	1.3
G9	0.3044	5	01Jul2015, 12:30	2.1
G9-G10	0.3044	4.9	01Jul2015, 13:12	2.0
FG23b	0.0247	0	01Jul2015, 13:00	0.1
G10	1.0231	10.7	01Jul2015, 12:42	5.4
G10-G11	1.0231	10.6	01Jul2015, 12:48	5.3
FG23c	0.0122	0.4	01Jul2015, 12:18	0.1

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
G11	1.0353	10.9	01Jul2015, 12:48	5.4
FG25	0.1086	7.5	01Jul2015, 12:36	1.7
FG26	0.0863	5	01Jul2015, 12:24	1.0
FG26-POND G	0.0863	4.5	01Jul2015, 12:30	0.9
FG27	0.0500	5.0	01Jul2015, 12:24	0.8
FG28	0.0245	0.5	01Jul2015, 12:30	0.2
POND G IN	1.3047	25.6	01Jul2015, 12:42	9.0
POND G	1.3047	5	02Jul2015, 00:00	4.3
G12	1.3047	5	02Jul2015, 00:00	4.3
G12-G06	1.3047	5	02Jul2015, 00:00	4.1
FG29	0.0997	0.4	01Jul2015, 13:36	0.3
FG32	0.0402	11	01Jul2015, 12:06	1.0
FG32-G06	0.0402	11	01Jul2015, 12:12	1.0
G06	1.4446	11	01Jul2015, 12:12	5.4
FG34	0.0600	0	01Jul2015, 13:18	0.2
G14	0.0600	0	01Jul2015, 13:18	0.2
G14-G15	0.0600	0	01Jul2015, 13:48	0.2
FG35	0.0344	0	01Jul2015, 13:06	0.1
G15	0.0944	1	01Jul2015, 13:36	0.3
G15-G08	0.0944	1	01Jul2015, 13:48	0.3
FG37	0.0797	0	01Jul2015, 13:42	0.2
FG36	0.0281	0	01Jul2015, 13:42	0.1
FG36-G08	0.0281	0	01Jul2015, 14:00	0.1
G16	0.2022	1	01Jul2015, 13:48	0.6

Highlighted green rows reference key design points (Typical all charts this section)

Appendix C - Detention Pond Information

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond F INTERIM CONDITION

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	285
embankment elev =	7138.5
spillway length =	87
spillway elevation =	7137.5
100 year storage elev.=	7136.0
100 year storage vol.=	8.9
100 year discharge=	178
5 year storage elev.=	7131.1
5 year storage vol.=	1.8
5 year discharge=	7.7
WQCV storage elev.=	7129.1
WQCV storage vol.=	0.3
1/2 WQCV storage elev.=	7128.6
1/2 WQCV storage vol.=	0.15

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0131	1.25		Area =	0.016	Elev to cl =	7128.45
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	7130.75
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	7129.20
None Selected	Orifice 4:					Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	3	Elev =	7133
Circ. Grate			dia.		Elev =	7133

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7126.6		7131.0		
Wall Thick.	5	in.			

50 year storage elev.=	7134.9
50 year storage vol.=	6.7
50 year discharge=	121
10 year storage elev.=	7132.6
10 year storage vol.=	3.3
10 year discharge=	16
2 year storage elev.=	7130.1
2 year storage vol.=	0.9
2 year discharge=	2.1

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
7127.7	0	0	0.00	0.00	0.00			-	-	-	-	-				
7128	0.3	2170	0.05	0.01	0.01	-	-	0.0	-	-	-	-	11		0.0	0.0
7129	1.3	17730	0.41	0.23	0.24	-	-	0.1	-	-	-	-	31		0.1	0.1
7130	2.3	33290	0.76	0.59	0.82	-	-	0.1	-	1.5	-	-	57		1.6	1.6
7131	3.3	39060	0.90	0.83	1.65	-	-	0.1	4.2	2.3	-	-	117		6.6	6.6
7132	4.3	44830	1.03	0.96	2.61	-	-	0.1	10.8	2.8	-	-	117		14	14
7133	5.3	55137.5	1.27	1.15	3.76	-	-	0.2	14.4	3.3	-	-	142		18	18
7134	6.3	65445	1.50	1.38	5.15	-	-	0.2	17.4	3.7	-	36	162		57	57
7135	7.3	79535	1.83	1.66	6.81	-	-	0.2	19.9	4.0	-	102	175		126	126
7136	8.3	93625	2.15	1.99	8.80	-	-	0.2	22.1	4.4	-	150	187		177	177
7137	9.3	111620	2.56	2.36	11.15	-	-	0.2	24.1	4.7	-	173	200		200	200
7138	10.3	129615	2.98	2.77	13.92	-	92.3	0.2	25.9	5.0	-	194	211		211	303
7138.5	10.8					-	261.0	0.3	26.8	5.1	-	203	211		-	261

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond G-INTERIM CONDITIONS (G12)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	500
embankment elev =	7033.5
spillway length =	130
spillway elevation =	7031.5
100 year storage elev.=	7029.6
100 year storage vol.=	21.1
100 year discharge=	358
5 year storage elev.=	7027.1
5 year storage vol.=	6.7
5 year discharge=	9.8
WQCV storage elev.=	7025.2
WQCV storage vol.=	0.9
1/2 WQCV storage elev.=	7024.9
1/2 WQCV storage vol.=	0.45

Data for outlet pipe and grate:

Type		H or V		Dimensions Width (ft.)	X Height (ft.)		Dia.(in)		(sqft)		
Circular	Orifice 1a:	V					1.75	Area =	0.017	Elev to cl =	7023.37
Circular	Orifice 1b:	V					1.75	Area =	0.017	Elev to cl =	7024.04
Circular	Orifice 1c:	V					1.75	Area =	0.017	Elev to cl =	7024.71
Rectangular	Orifice 2:	V	8.5			1.1		Area =	9.350	Elev to cl =	7027.55
Rectangular	Orifice 3:	V	2			0.43		Area =	0.860	Elev to cl =	7025.34
Rectangular	Orifice 4:	V	4			0.6		Area =	2.400	Elev to cl =	7027.80
Rectangular	Orifice 5:	V	8.5			1.1		Area =	9.350	Elev to cl =	7027.55

Stand Pipe Dimensions

Rec Grate		20	x	8			Elev =	7028.10
Circ. Grate			dia.				Elev =	7028.10

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)			Dia. (ft.)	Type
Outlet Culvert	10	x	4				**Rectangular**
Area	40.0		TOP				
Outlet I. E.	7022.5		7027.50				
Wall Thick.	12	in.					

50 year storage vol.=	17.0
50 year storage elev.=	7028.9
50 year discharge=	206
10 year storage vol.=	8.9
10 year storage elev.=	7027.5
10 year discharge=	28
2 year storage vol.=	2.4
2 year storage elev.=	7026.0
2 year discharge=	3.6

STAGE		STORAGE				DISCHARGE													
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE						(max outflow)	GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1a	1b	1c	2	3	4	5	**Rectangular**	1	2	OUTFLOW	FLOW
7023.3	0	0	0.00	0.0	0.00			-	-	-	-	-	-	-	-	12		-	-
7024	0.7	2232	0.05	0.0	0.02	-	-	0.06	0.01	-	-	-	-	-	-	51		0.1	0.07
7025	1.7	39917	0.92	0.5	0.50	-	-	0.10	0.08	0.04	-	-	-	-	-	111		0.2	0.22
7026	2.7	126469	2.90	1.9	2.41	-	-	0.13	0.11	0.09	-	3.4	-	-	-	184		3.7	3.7
7026.5	3.2	166675	3.83	3.6	4.06	-	-	0.14	0.13	0.11	-	4.5	-	-	-	224		4.8	4.8
7027	3.7	206880	4.75	2.1	6.20	-	-	0.15	0.14	0.12	-	5.3	-	-	-	268		5.8	5.8
7027.5	4.2	232032	5.33	4.6	8.64	-	-	0.16	0.15	0.13	9.0	6.1	-	9.0	-	304		25	25
7028	4.7	257183	5.90	5.3	11.5	-	-	0.17	0.16	0.15	25.5	6.8	4.2	25.5	-	337		62	62
7028.5	5.2	264196	6.07	5.7	14.3	-	-	0.18	0.17	0.16	43.9	7.4	9.7	43.9	27	373		133	133
7029	5.7	271209	6.23	6.1	17.6	-	-	0.19	0.18	0.17	54.2	7.9	12.7	54.2	92	406		222	222
7029.5	6.2	276106	6.34	11.7	20.3	-	-	0.21	0.19	0.18	62.9	8.5	15.1	62.9	179	436		329	329
7030	6.7	281003	6.45	9.4	23.7	-	-	0.21	0.20	0.19	70.5	8.9	17.1	70.5	283	464		450	450
7030.5	7.2	286003	6.57	6.5	26.8	-	-	0.21	0.20	0.19	77.3	9.4	19.0	77.3	402	491		491	491
7031	7.7	291002	6.68	6.6	30.3	-	-	0.22	0.21	0.20	83.6	9.9	20.7	83.6	533	516		516	516
7031.5	8.2	296443	6.81	6.7	33.4	-	-	0.23	0.22	0.21	89.5	10.3	22.2	89.5	677	540		540	540
7032	8.7	301883	6.93	3.4	36.9	137.9	137.9	0.24	0.23	0.22	95.0	10.7	23.7	95.0	832	563		563	701
7032.5	9.2	309236	7.10	7.0	40.4	390.0	390.0	0.24	0.23	0.22	100.2	11.1	25.1	100.2	997	586		586	976
7033	9.7	316589	7.27	3.6	44.0	716.5	716.5	0.25	0.24	0.23	105.1	11.5	26.4	105.1	1,171	607		607	1,323

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond F-FUTURE CONDITIONS

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	285
embankment elev =	7138.5
spillway length =	87
spillway elevation =	7137.5
100 year storage elev.=	7136.0
100 year storage vol.=	8.9
100 year discharge=	178
5 year storage elev.=	7131.1
5 year storage vol.=	1.8
5 year discharge=	7.7
WQCV storage elev.=	7129.1
WQCV storage vol.=	0.3

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.) X Height (ft.)		Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0131	1.25		Area =	0.016	Elev to cl =	7128.45
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	7130.75
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	7129.20
None Selected	Orifice 4:					Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	3	Elev =	7133
Circ. Grate			dia.		Elev =	7133

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7126.6		7131.0		
Wall Thick.	5	in.			

50 year storage elev.=	7134.9
50 year storage vol.=	6.7
50 year discharge=	121
10 year storage elev.=	7132.6
10 year storage vol.=	3.3
10 year discharge=	16
2 year storage elev.=	7130.1
2 year storage vol.=	0.9
2 year discharge=	2.1

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
7127.7	0	0	0.00	0.00	0.000			-	-	-	-	-				-
7128	0.3	2170	0.05	0.01	0.007	-	-	0.0	-	-	-	-	11		0.0	0.003
7129	1.3	17730	0.41	0.23	0.236	-	-	0.1	-	-	-	-	31		0.1	0.050
7130	2.3	33290	0.76	0.59	0.822	-	-	0.1	-	1.5	-	-	57		1.6	1.60
7131	3.3	39060	0.90	0.83	1.652	-	-	0.1	4.2	2.3	-	-	117		6.6	6.62
7132	4.3	44830	1.03	0.96	2.615	-	-	0.1	10.8	2.8	-	-	117		14	14
7133	5.3	55137.5	1.27	1.15	3.762	-	-	0.2	14.4	3.3	-	-	142		18	18
7134	6.3	65445	1.50	1.38	5.146	-	-	0.2	17.4	3.7	-	36	162		57	57
7135	7.3	79535	1.83	1.66	6.811	-	-	0.2	19.9	4.0	-	102	175		126	126
7136	8.3	93625	2.15	1.99	8.798	-	-	0.2	22.1	4.4	-	150	187		177	177
7137	9.3	111620	2.56	2.36	11.154	-	-	0.2	24.1	4.7	-	173	200		200	200
7138	10.3	129615	2.98	2.77	13.923	-	92.3	0.2	25.9	5.0	-	194	211		211	303
7138.5	10.8					-	261.0	0.3	26.8	5.1	-	203	211		-	261

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond G-FUTURE CONDITIONS (G12)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	500
embankment elev =	7033.5
spillway length =	130
spillway elevation =	7031.5
100 year storage elev.=	7030.3
100 year storage vol.=	25.3
100 year discharge=	472
5 year storage elev.=	7027.4
5 year storage vol.=	8.1
5 year discharge=	20
WQCV storage elev.=	7025.2
WQCV storage vol.=	0.9
1/2 WQCV storage elev.=	7024.9
1/2 WQCV storage vol.=	0.45

Data for outlet pipe and grate:

Type		H or V		Dimensions Width (ft.)	X Height (ft.)		Dia.(in)		(sqft)			
Circular	Orifice 1a:	V					1.75	Area =	0.017	Elev to cl =		7023.37
Circular	Orifice 1b:	V					1.75	Area =	0.017	Elev to cl =		7024.04
Circular	Orifice 1c:	V					1.75	Area =	0.017	Elev to cl =		7024.71
Rectangular	Orifice 2:	V	8.5			1.1		Area =	9.350	Elev to cl =		7027.55
Rectangular	Orifice 3:	V	2			0.43		Area =	0.860	Elev to cl =		7025.34
Rectangular	Orifice 4:	V	4			0.6		Area =	2.400	Elev to cl =		7027.80
Rectangular	Orifice 5:	V	8.5			1.1		Area =	9.350	Elev to cl =		7027.55

Stand Pipe Dimensions

Rec Grate		20	x	8			Elev =	7028.10
Circ. Grate			dia.				Elev =	7028.10

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)			Dia. (ft.)	Type
Outlet Culvert	10	x	4				**Rectangular**
Area	40.0		TOP				
Outlet I. E.	7022.5		7027.50				
Wall Thick.	12	in.					

50 year storage vol.=	20.1
50 year storage elev.=	7029.5
50 year discharge=	321
10 year storage vol.=	10.8
10 year storage elev.=	7027.9
10 year discharge=	53
2 year storage vol.=	4.7
2 year storage elev.=	7026.6
2 year discharge=	5.1

STAGE		STORAGE				DISCHARGE													
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE							(max outflow)	GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1a	1b	1c	2	3	4	5	**Rectangular**		1	2	OUTFLOW	FLOW
7023.3	0	0	0.00	0.0	0.00			-	-	-	-	-	-	-	-		12		-	-
7024	0.7	2232	0.05	0.0	0.02	-	-	0.06	0.01	-	-	-	-	-	-		51		0.1	0.07
7025	1.7	39917	0.92	0.5	0.50	-	-	0.10	0.08	0.04	-	-	-	-	-		111		0.2	0.22
7026	2.7	126469	2.90	1.9	2.41	-	-	0.13	0.11	0.09	-	3.4	-	-	-		184		3.7	3.7
7026.5	3.2	166675	3.83	3.6	4.06	-	-	0.14	0.13	0.11	-	4.5	-	-	-		224		4.8	4.8
7027	3.7	206880	4.75	2.1	6.20	-	-	0.15	0.14	0.12	-	5.3	-	-	-		268		5.8	5.8
7027.5	4.2	232032	5.33	4.6	8.64	-	-	0.16	0.15	0.13	9.0	6.1	-	9.0	-		304		25	25
7028	4.7	257183	5.90	5.3	11.5	-	-	0.17	0.16	0.15	25.5	6.8	4.2	25.5	-		337		62	62
7028.5	5.2	264196	6.07	5.7	14.3	-	-	0.18	0.17	0.16	43.9	7.4	9.7	43.9	27		373		133	133
7029	5.7	271209	6.23	6.1	17.6	-	-	0.19	0.18	0.17	54.2	7.9	12.7	54.2	92		406		222	222
7029.5	6.2	276106	6.34	11.7	20.3	-	-	0.21	0.19	0.18	62.9	8.5	15.1	62.9	179		436		329	329
7030	6.7	281003	6.45	9.4	23.7	-	-	0.21	0.20	0.19	70.5	8.9	17.1	70.5	283		464		450	450
7030.5	7.2	286003	6.57	6.5	26.8	-	-	0.21	0.20	0.19	77.3	9.4	19.0	77.3	402		491		491	491
7031	7.7	291002	6.68	6.6	30.3	-	-	0.22	0.21	0.20	83.6	9.9	20.7	83.6	533		516		516	516
7031.5	8.2	296443	6.81	6.7	33.4	-	-	0.23	0.22	0.21	89.5	10.3	22.2	89.5	677		540		540	540
7032	8.7	301883	6.93	3.4	36.9	137.9	137.9	0.24	0.23	0.22	95.0	10.7	23.7	95.0	832		563		563	701
7032.5	9.2	309236	7.10	7.0	40.4	390.0	390.0	0.24	0.23	0.22	100.2	11.1	25.1	100.2	997		586		586	976
7033	9.7	316589	7.27	3.6	44.0	716.5	716.5	0.25	0.24	0.23	105.1	11.5	26.4	105.1	1,171		607		607	1,323

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

ROLLING HILLS RANCH ESTATES INTERIM CONDITION

Simulation Run: RH ESTATES FILING 2-100 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	293(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	178 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:42
Total Inflow:	38.5 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	36.1 (AC-FT)	Peak Elevation:	7136.0 (FT)

Simulation Run: RH ESTATES FILING 2-010 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	54 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	16 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:48
Total Inflow:	10.4 (AC-FT)	Peak Storage:	3.3 (AC-FT)
Total Outflow:	9.1 (AC-FT)	Peak Elevation:	7132.6 (FT)

Simulation Run: RH ESTATES FILING 2-100 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	522(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:36
Peak Outflow:	358 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:06
Total Inflow:	94.7 (AC-FT)	Peak Storage:	21.1 (AC-FT)
Total Outflow:	85.6 (AC-FT)	Peak Elevation:	7129.6 (FT)

Simulation Run: RH ESTATES FILING 2-010 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	76 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:42
Peak Outflow:	28 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 15:42
Total Inflow:	24.3 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	17.3 (AC-FT)	Peak Elevation:	7127.5 (FT)

Simulation Run: F-100 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	293 CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	178 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:42
Total Inflow:	38.5 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	36.1 (AC-FT)	Peak Elevation:	7136.0 (FT)

Simulation Run: F-010 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	54 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	16 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:48
Total Inflow:	10.4 (AC-FT)	Peak Storage:	3.3 (AC-FT)
Total Outflow:	9.1 (AC-FT)	Peak Elevation:	7132.6 (FT)

Simulation Run: F-100 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	668 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	472 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:00
Total Inflow:	119.6 (AC-FT)	Peak Storage:	25.4 (AC-FT)
Total Outflow:	110.0 (AC-FT)	Peak Elevation:	7030.3 (FT)

Simulation Run: F-010 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	141 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	53 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 14:00
Total Inflow:	34.8 (AC-FT)	Peak Storage:	10.9 (AC-FT)
Total Outflow:	27.4 (AC-FT)	Peak Elevation:	7027.9 (FT)

Appendix D – Outlet Protection Design

Again, enter Figure HS-19a using the smaller d/D (or d/H) ratio to find the A/A_{full} ratio. Then,

$$A = \left(A/A_{full}\right)A_{full} \qquad \text{(HS-16c)}$$

Finally,

$$V = Q/A \qquad \text{(HS-16d)}$$

In which for Equations 16a through 16d above:

A_{full} = cross-sectional area of the pipe (ft^2)

A = area of the design flow in the end of the pipe (ft^2)

n = Manning's n for the pipe full depth

Q_{full} = pipe full discharge at its slope (cfs)

R = hydraulic radius of the pipe flowing full, ft [$R_{full} = D/4$ for circular pipes, $R_{full} = A_{full}/(2H + 2w)$ for rectangular pipes, where D = diameter of a circular conduit, H = height of a rectangular conduit, and w = width of a rectangular conduit (ft)]

S_o = longitudinal slope of the pipe (ft/ft)

V = design flow velocity at the pipe outlet (ft/sec)

V_{full} = flow velocity of the pipe flowing full (ft/sec)

3.4.3.2 Riprap Size

For the design velocity, use Figure HS-20c to find the size and type of the riprap to use in the scour protection basin downstream of the pipe outlet (i.e., B18, H, M or L). First, calculate the riprap sizing design parameter, P_d , namely,

$$P_d = \left(V^2 + gd\right)^{1/2} \qquad \text{(HS-16e)}$$

in which:

V = design flow velocity at pipe outlet (ft/sec)

g = acceleration due to gravity = 32.2 ft/sec^2

d = design depth of flow at pipe outlet (ft)

necessary when the receiving or downstream channel may have little or no flow or tailwater at time when the pipe or culvert is in operation. Design criteria are provided in Figures HS-19a through HS-20c.

3.4.2 Objective

By providing a low tailwater basin at the end of a storm sewer conduit or culvert, the kinetic energy of the discharge is dissipated under controlled conditions without causing scour at the channel bottom. Photograph HS-12 shows a fairly large low tailwater basin.

3.4.3 Low Tailwater Basin Design

Low tailwater is defined as being equal to or less than ⅓ of the height of the storm sewer, that is:

$$y_t \le \frac{D}{3} \quad \text{or} \quad y_t \le \frac{H}{3}$$

in which:

y_t = tailwater depth at design

D = diameter of circular pipe (ft)

H = height of rectangular pipe (ft)

3.4.3.1 Finding Flow Depth and Velocity of Storm Sewer Outlet Pipe

The first step in the design of a scour protection basin at the outlet of a storm sewer is to find the depth and velocity of flow at the outlet. Pipe-full flow can be found using Manning's equation.

$$Q_{full} = \frac{1.49}{n} A_{full} \left(R_{full}\right)^{2/3} S_o^{1/2} \qquad \text{(HS-16a)}$$

Then and the pipe-full velocity can be found using the continuity equation.

$$V_{full} = Q_{full} / A_{full} \qquad \text{(HS-16a)}$$

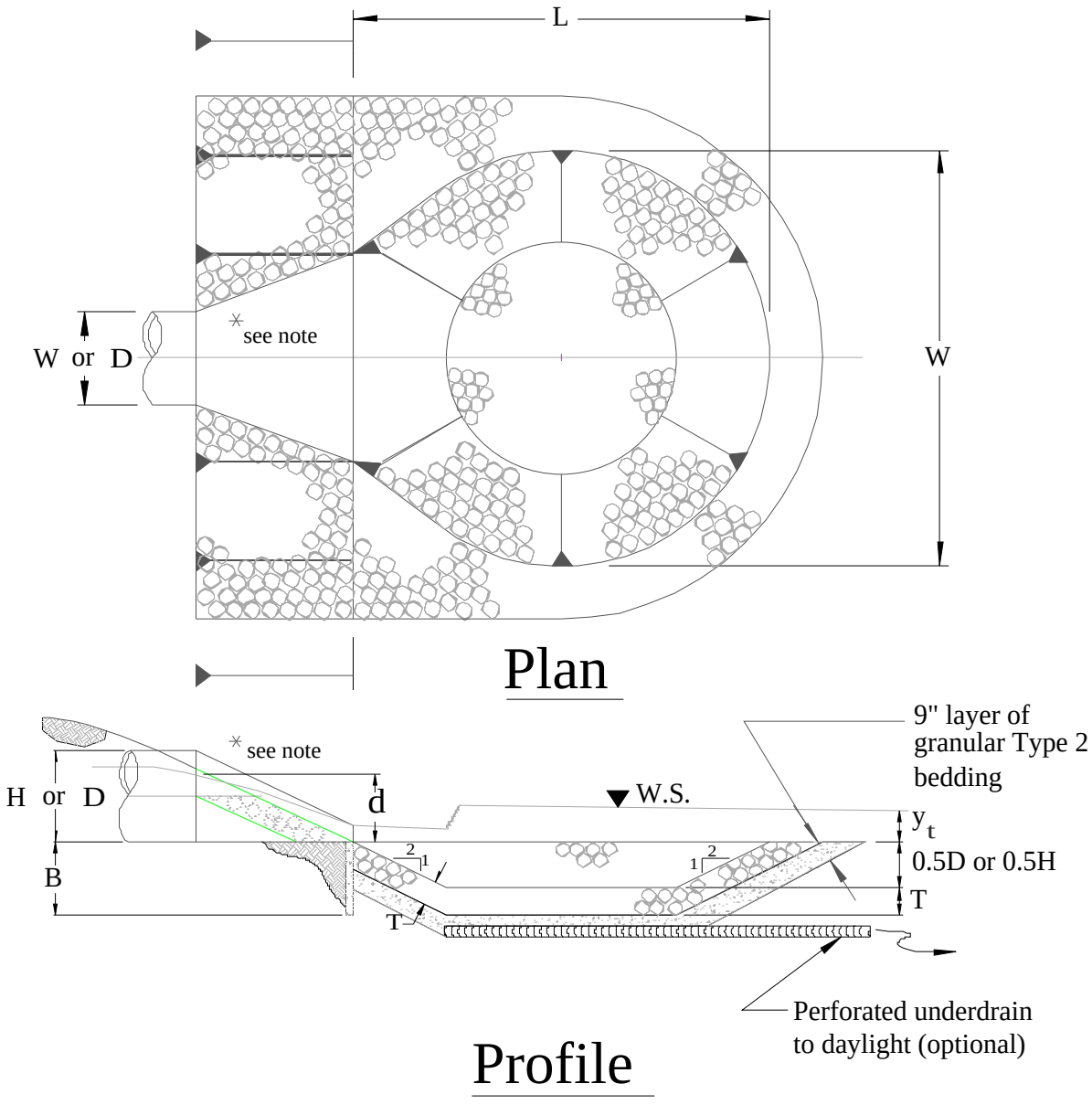
The normal depth of flow, d, and the velocity in a conduit can be found with the aid of Figure HS-20a and Figure HS-20b. Using the known design discharge, Q, and the calculated pipe-full discharge, Q_{full}, enter Figure HS-20a with the value of Q/Q_{full} and find d/D for a circular pipe of d/H for a rectangular pipe.

Compare the value of d/D (or d/H) with the one obtained from Figure HS-20b using the Froude parameter.

$$Q/D^{2.5} \quad \text{or} \quad Q/\left(wH^{1/5}\right) \qquad \text{(HS-16a)}$$

Choose the smaller of the two (d/D or d/H) ratios to calculate the flow depth at the end of the pipe.

$$d = D\left(d/D\right) \quad \text{or} \quad d = H\left(d/H\right) \qquad \text{(HS-16b)}$$



* Note: For rectangular conduits use a standard design for a headwall with wingwalls, paved bottom between the wingwalls, with an end cutoff wall extending to a minimum depth equal to B

Figure HS-19—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Low Tailwater Basin at Pipe Outlets
(Stevens and Urbonas 1996)

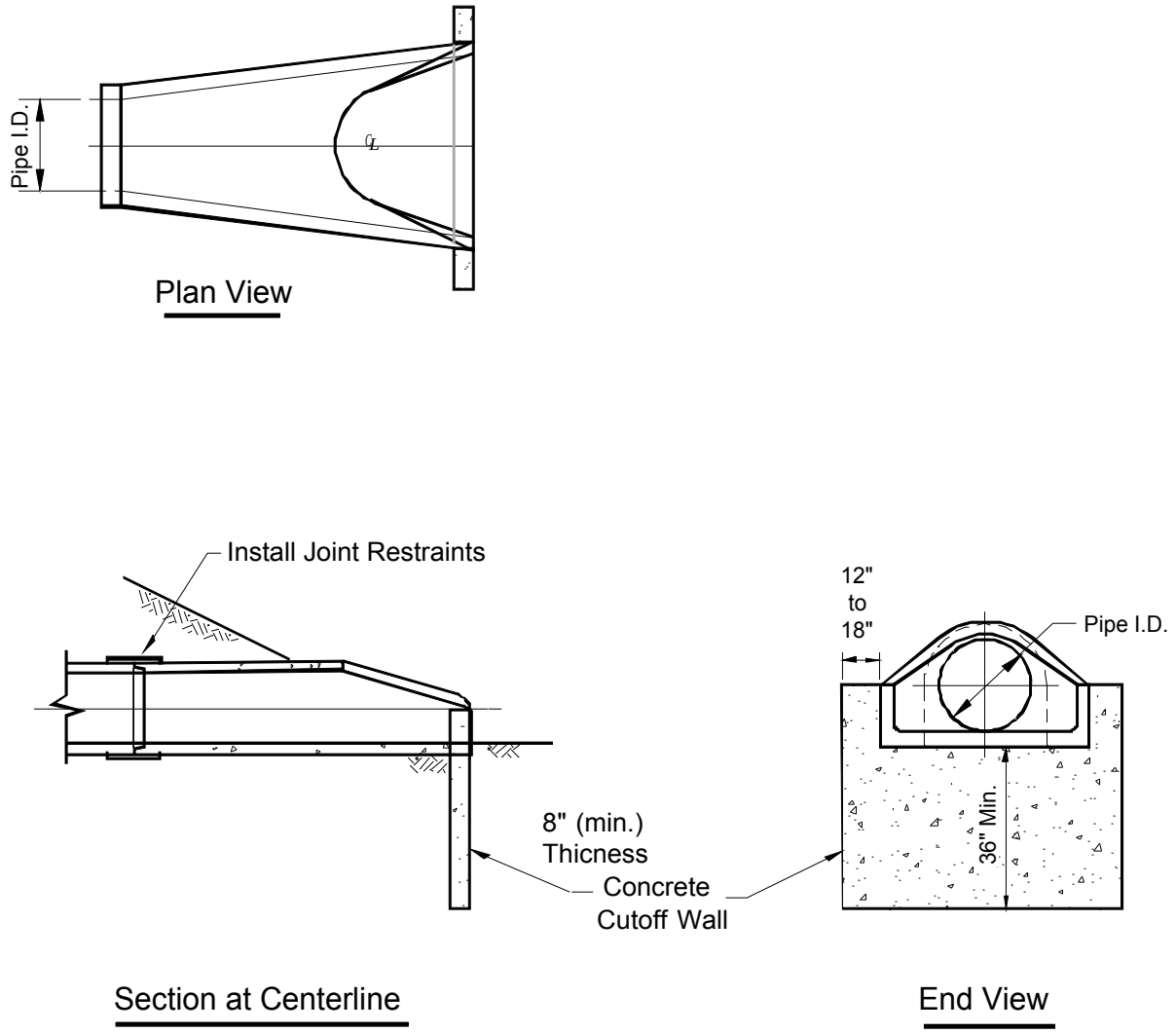


Figure HS-19a—Concrete Flared End Section with Cutoff Wall for all Pipe Outlets

Photograph HS-12—Upstream and downstream views of a low tailwater basin in Douglas County protecting downstream wetland area. Burying and revegetation of the rock would blend the structure better with the adjacent terrain.

When the riprap sizing design parameter indicates conditions that place the design above the Type H riprap line in Figure HS-20, use B18, or larger, grouted boulders. An alternative to a grouted boulder or loose riprap basin is to use the standard USBR Impact Basin VI or one of its modified versions, described earlier in this Chapter of the *Manual*.

After the riprap size has been selected, the minimum thickness of the riprap layer, T, in feet, in the basin is set at:

$$T = 1.75 D_{50} \qquad \text{(HS-17)}$$

in which:

D_{50} = the median size of the riprap (see Table HS-9.)

Table HS-9—Median (i.e., D_{50}) Size of District's Riprap/Boulder

Riprap Type	D_{50}—Median Rock Size (inches)
L	9
M	12
H	18
B18	18 (minimum dimension of grouted boulders)

3.4.3.3 Basin Length

The minimum length of the basin, L, in Figure HS-19, is defined as being the greater of the following:

for circular pipe: $L = 4D$ or $L = (D)^{1/2}\left(\frac{V}{2}\right)$ (HS-18)

for rectangular pipe: $L = 4H$ or $L = (H)^{1/2}\left(\frac{V}{2}\right)$ (HS-19)

in which:

L = basin length

H = height of rectangular conduit

V = design flow velocity at outlet

D = diameter of circular conduit

3.4.3.4 Basin Width

The minimum width, W, of the basin downstream of the pipe's flared end section is set as follows:

for circular pipes: $W = 4D$ (HS-20)

for rectangular pipe: $W = w + 4H$ (HS-21)

in which,

W = basin width (Figure HS-19)

D = diameter of circular conduit

w = width of rectangular conduit

3.4.3.5 Other Design Requirements

All slopes in the pre-shaped riprapped basin are 2H to 1V.

Provide pipe joint fasteners and a structural concrete cutoff wall at the end of the flared end section for a circular pipe or a headwall with wingwalls and a paved bottom between the walls, both with a cutoff wall that extends down to a depth of:

$B = \frac{D}{2} + T$ or $B = \frac{H}{2} + T$ (HS-22)

in which,

B = cutoff wall depth

D = diameter of circular conduit

T = Equation HS-17

The riprap must be extended up the outlet embankment's slope to the mid-pipe level.

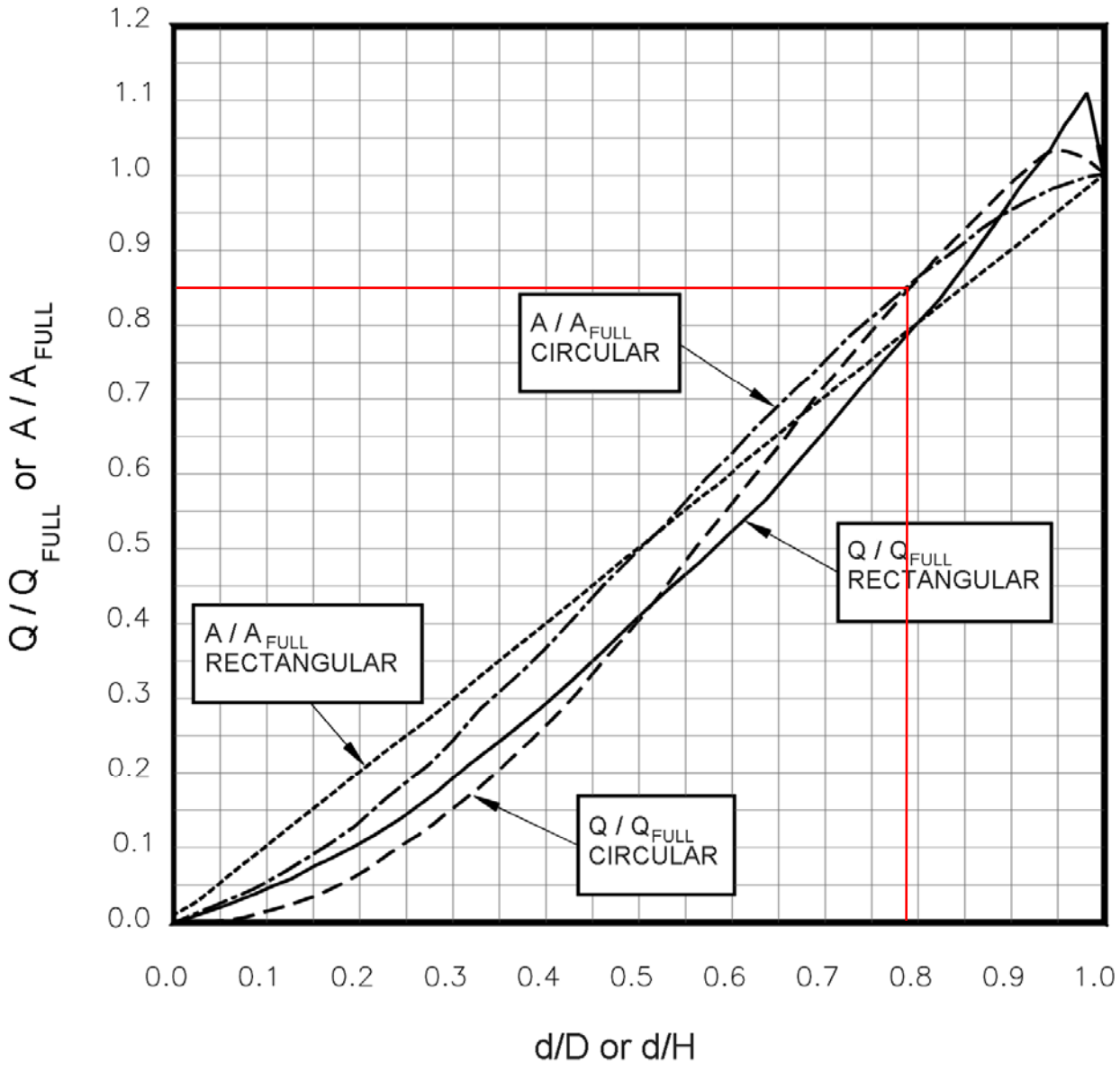


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's n Varying With Depth)
(Stevens and Urbonas 1996)

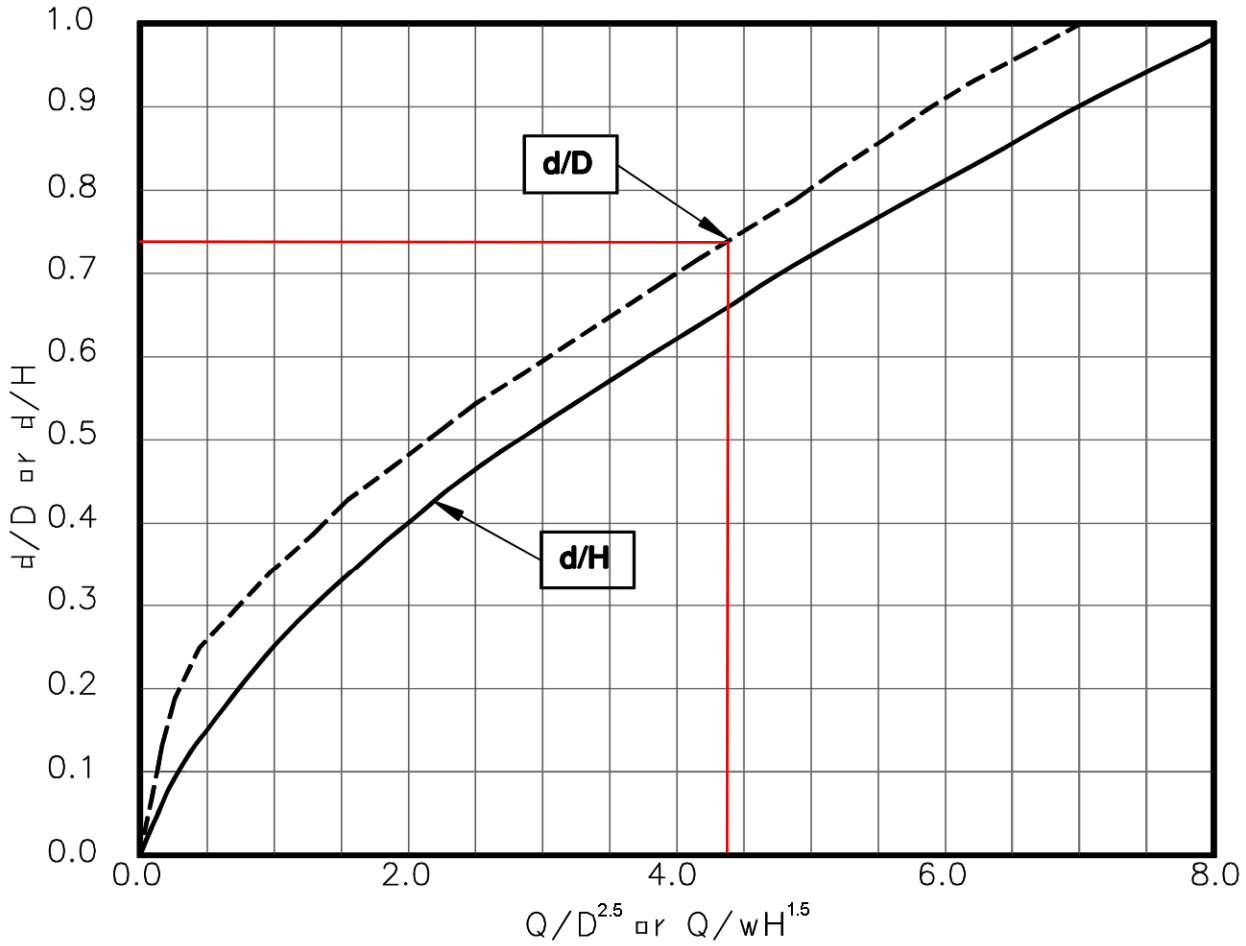


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

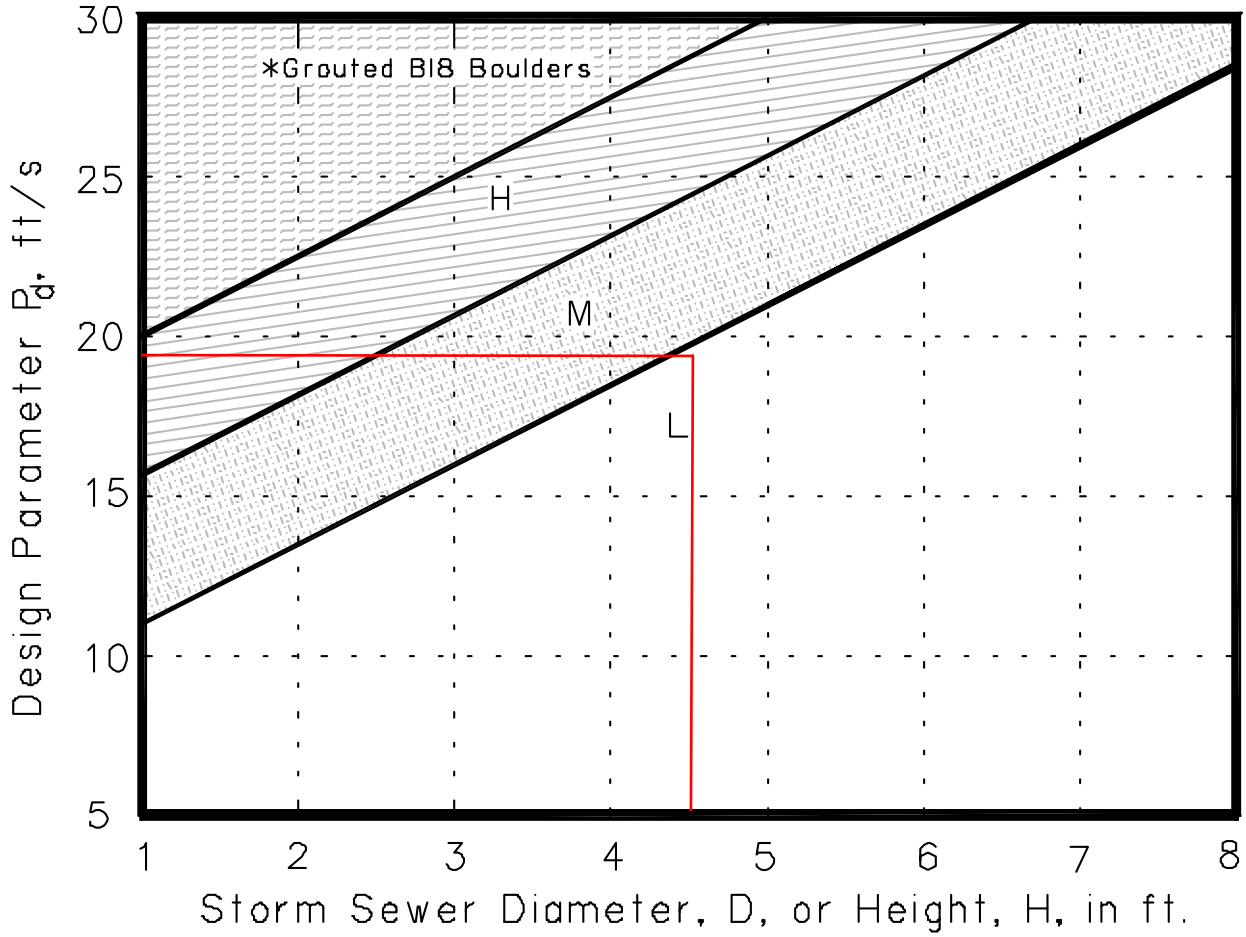


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

RIP RAP PLUNGE POOL

Urban Drainage & Flood Control District Pipe Outlet Design

Low Tailwater Design ($y_t \leq D/3$)

OUTLET # OS-2

Outlet Size (D) :	54	in.	Discharge (q):	189	CFS
Capacity (Q): (full flow)	222	CFS	Flow depth (d): (calculated)	40.0	in.

Q_{full} =	222 CFS	q/Q_{full} =	0.85
A_{full} =	15.9 SF		
V_{full} =	14.0 FPS	$Q/D^{2.5}$ =	4.4

d/D	0.78	from HS-20a using q/Q_{full}
d/D	0.74	from HS-20b using $Q/D^{2.5}$

A' (A/A_{full})	0.74	from HS-20a using smaller d/D from above	Flow Area ($a=A' \times A_{full}$)	11.8	SF

Outlet Velocity (V = q/a) 16.1 FPS

$P_d = (V^2 + gd)^{1/2}$ = 19

RIP-RAP SIZE: M from HS-20c

d_{50}= 12 in $T=1.75xd_{50}$ 1.75 ft

Basin Length (L)	18.0	FT.	Cutoff Wall Depth (B=D/2+T)	4	FT
Basin Width (W)	18.0	FT.			

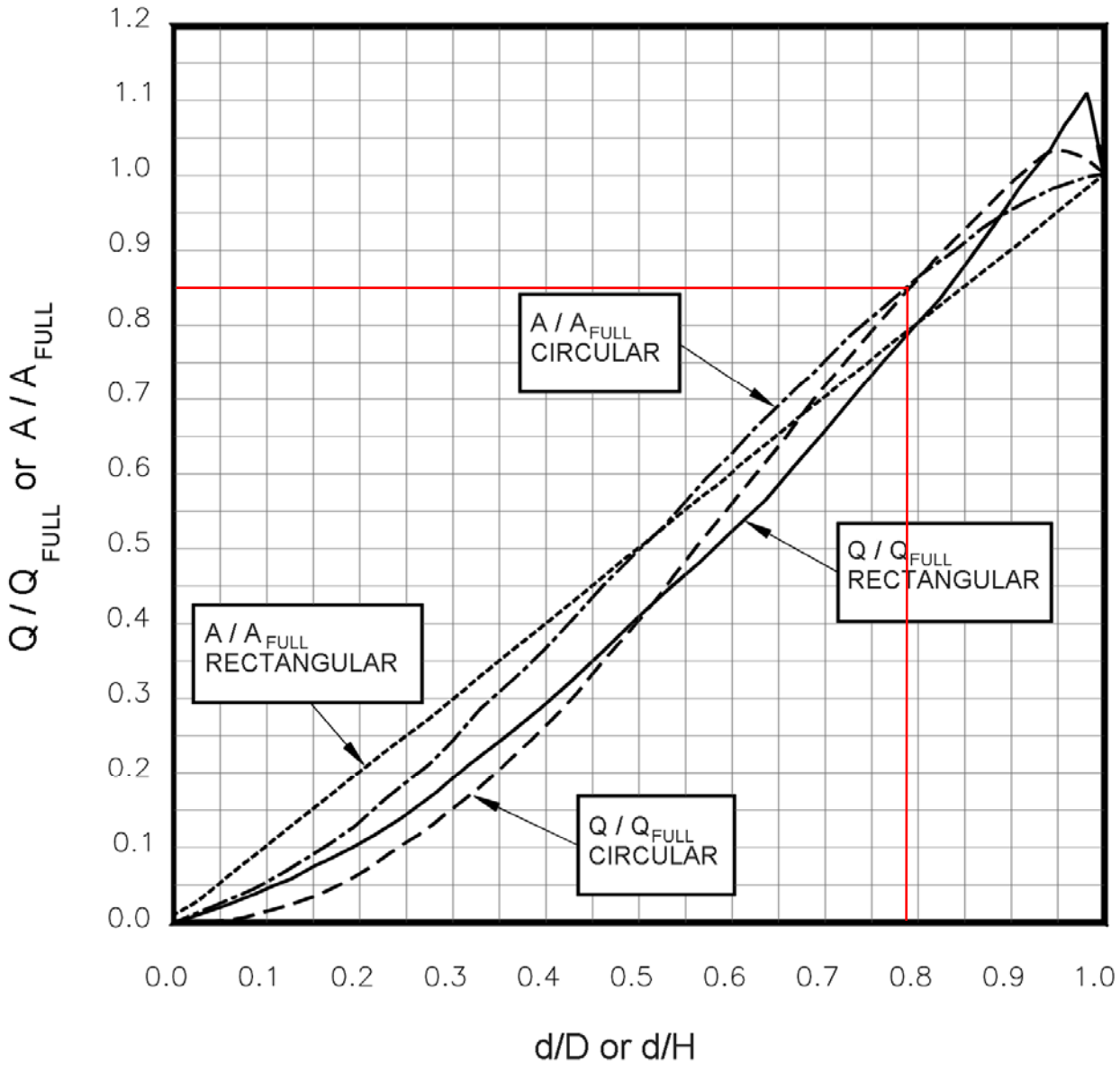


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's n Varying With Depth)
(Stevens and Urbonas 1996)

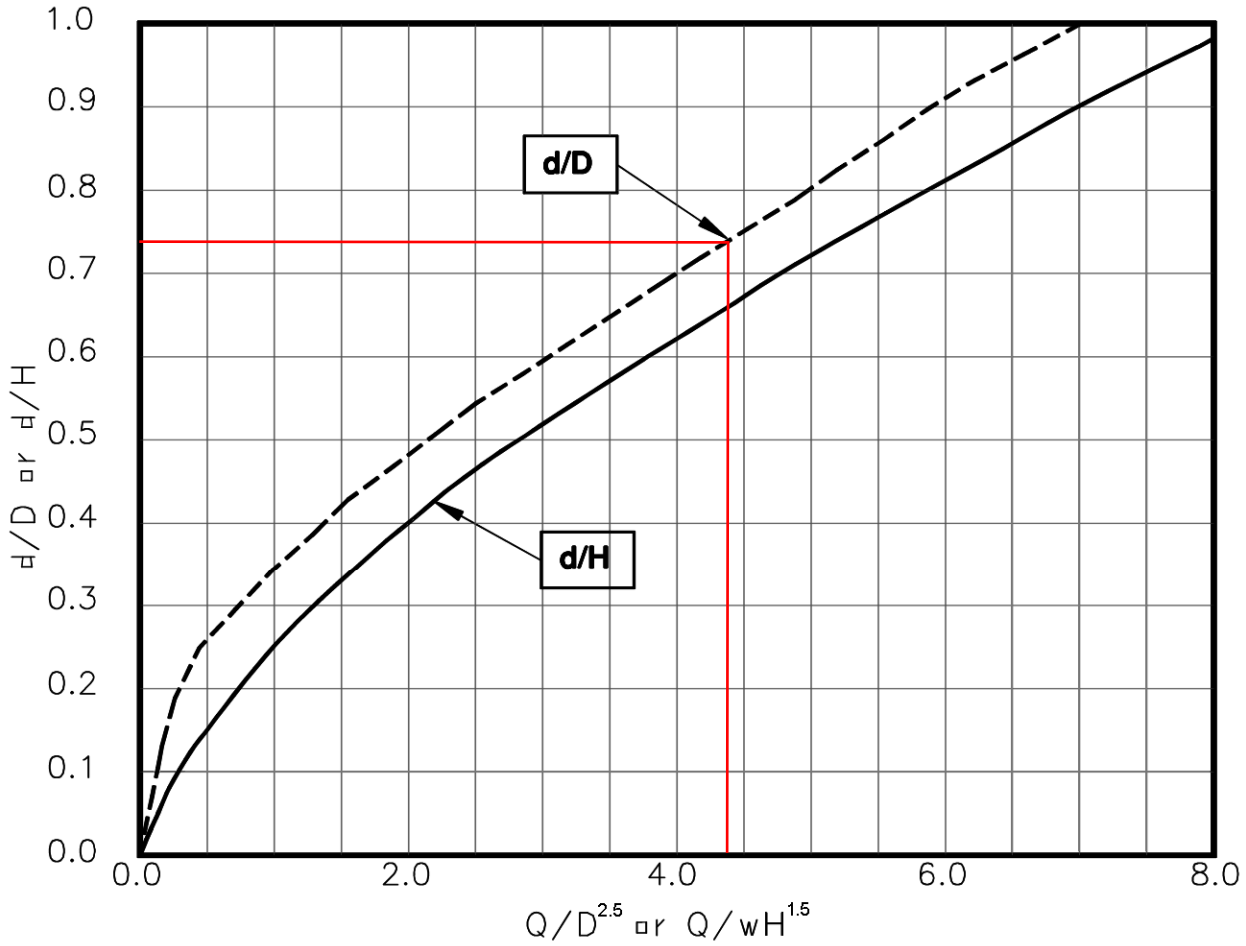


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

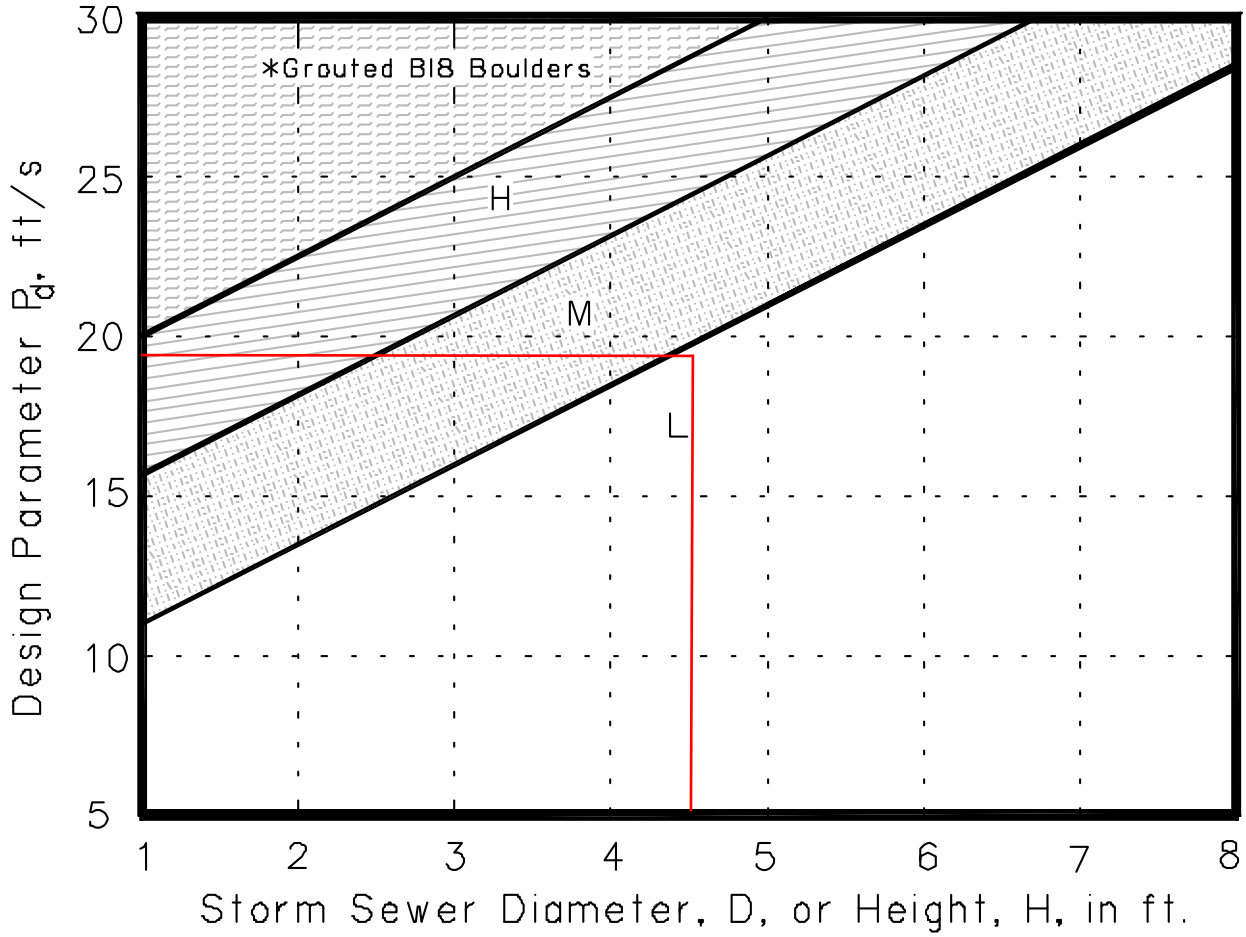


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

Appendix E – Street Flow

Worksheet for Ramp Full Street Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+13	-0.25
0+14	-0.75
0+15	-0.59
0+30	-0.29
0+45	-0.59
0+46	-0.75
0+48	-0.25
0+60	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+13, -0.25)	0.030
(0+13, -0.25)	(0+15, -0.59)	0.013
(0+15, -0.59)	(0+45, -0.59)	0.015
(0+45, -0.59)	(0+48, -0.25)	0.013
(0+48, -0.25)	(0+60, 0.00)	0.030
<None>	(0+60, 0.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Ramp Full Street Section

Results

Discharge		42.54	ft^3/s
Elevation Range	-0.75 to 0.00 ft		
Flow Area		19.32	ft^2
Wetted Perimeter		60.21	ft
Hydraulic Radius		0.32	ft
Top Width		60.00	ft
Normal Depth		0.75	ft
Critical Depth		0.66	ft
Critical Slope		0.01121	ft/ft
Velocity		2.20	ft/s
Velocity Head		0.08	ft
Specific Energy		0.83	ft
Froude Number		0.68	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01121	ft/ft

Cross Section for Ramp Full Street Section

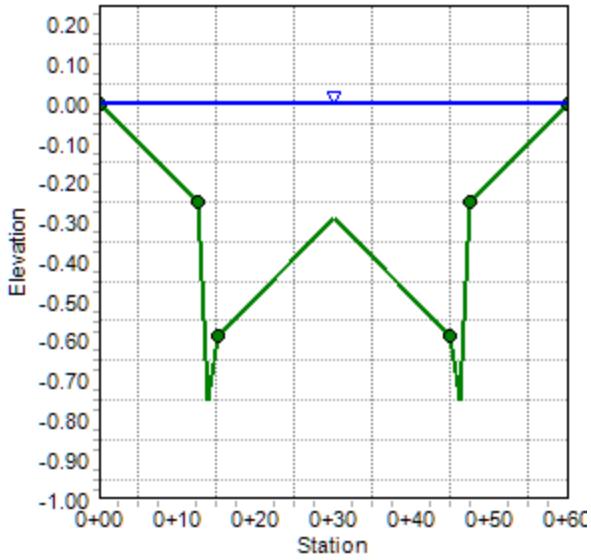
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft
Discharge	42.54	ft³/s

Cross Section Image



RESIDENTIAL STREET SECTION
RAMP CURB

5-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Top of Curb)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	19	2.5	7.45	35.2	35.0	9.4	2.5	3.7	17.5
0.0063	21	2.8	7.45	35.2	35.0	11	2.8	3.7	17.5
0.0075	23	3.1	7.45	35.2	35.0	12	3.1	3.7	17.5
0.0088	25	3.4	7.45	35.2	35.0	12	3.3	3.7	17.5
0.0100	27	3.6	7.45	35.2	35.0	13	3.6	3.7	17.5
0.0113	28	3.8	7.45	35.2	35.0	14	3.8	3.7	17.5
0.0125	30	4.0	7.45	35.2	35.0	15	4.0	3.7	17.5
0.0138	31	4.2	7.45	35.2	35.0	16	4.2	3.7	17.5
0.0150	33	4.4	7.45	35.2	35.0	16	4.4	3.7	17.5
0.0163	34	4.6	7.45	35.2	35.0	17	4.5	3.7	17.5
0.0175	35	4.7	7.45	35.2	35.0	18	4.7	3.7	17.5
0.0188	37	4.9	7.45	35.2	35.0	18	4.9	3.7	17.5
0.0200	38	5.1	7.45	35.2	35.0	19	5.0	3.7	17.5
0.0213	39	5.2	7.45	35.2	35.0	19	5.2	3.7	17.5
0.0225	40	5.4	7.45	35.2	35.0	20	5.4	3.7	17.5
0.0238	41	5.5	7.45	35.2	35.0	20	5.5	3.7	17.5
0.0250	42	5.7	7.45	35.2	35.0	21	5.6	3.7	17.5
0.0263	43	5.8	7.45	35.2	35.0	22	5.8	3.7	17.5
0.0275	44	5.9	7.45	35.2	35.0	22	5.9	3.7	17.5
0.0288	45	6.1	7.45	35.2	35.0	23	6.0	3.7	17.5
0.0300	46	6.2	7.45	35.2	35.0	23	6.2	3.7	17.5
0.0313	47	6.3	7.45	35.2	35.0	23	6.3	3.7	17.5
0.0325	48	6.5	7.45	35.2	35.0	24	6.4	3.7	17.5
0.0338	49	6.6	7.45	35.2	35.0	24	6.6	3.7	17.5
0.0350	50	6.7	7.45	35.2	35.0	25	6.7	3.7	17.5
0.0363	51	6.8	7.45	35.2	35.0	25	6.8	3.7	17.5
0.0375	52	6.9	7.45	35.2	35.0	26	6.9	3.7	17.5
0.0388	53	7.1	7.45	35.2	35.0	26	7.0	3.7	17.5
0.0400	53	7.2	7.45	35.2	35.0	27	7.1	3.7	17.5

100-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Right-of-Way)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	43	2.2	19.32	60.2	60.0	21	2.2	9.7	30
0.0063	48	2.5	19.32	60.2	60.0	24	2.4	9.7	30
0.0075	52	2.7	19.32	60.2	60.0	26	2.7	9.7	30
0.0088	56	2.9	19.32	60.2	60.0	28	2.9	9.7	30
0.0100	60	3.1	19.32	60.2	60.0	30	3.1	9.7	30
0.0113	64	3.3	19.32	60.2	60.0	32	3.3	9.7	30
0.0125	67	3.5	19.32	60.2	60.0	33	3.5	9.7	30
0.0138	71	3.7	19.32	60.2	60.0	35	3.6	9.7	30
0.0150	74	3.8	19.32	60.2	60.0	36	3.8	9.7	30
0.0163	77	4.0	19.32	60.2	60.0	38	3.9	9.7	30
0.0175	80	4.1	19.32	60.2	60.0	39	4.1	9.7	30
0.0188	82	4.3	19.32	60.2	60.0	41	4.2	9.7	30
0.0200	85	4.4	19.32	60.2	60.0	42	4.4	9.7	30
0.0213	88	4.5	19.32	60.2	60.0	43	4.5	9.7	30
0.0225	90	4.7	19.32	60.2	60.0	45	4.6	9.7	30
0.0238	93	4.8	19.32	60.2	60.0	46	4.8	9.7	30
0.0250	95	4.9	19.32	60.2	60.0	47	4.9	9.7	30
0.0263	97	5.0	19.32	60.2	60.0	48	5.0	9.7	30
0.0275	100	5.2	19.32	60.2	60.0	49	5.1	9.7	30
0.0288	102	5.3	19.32	60.2	60.0	50	5.2	9.7	30
0.0300	104	5.4	19.32	60.2	60.0	52	5.3	9.7	30
0.0313	106	5.5	19.32	60.2	60.0	53	5.5	9.7	30
0.0325	108	5.6	19.32	60.2	60.0	54	5.6	9.7	30
0.0338	111	5.7	19.32	60.2	60.0	55	5.7	9.7	30
0.0350	113	5.8	19.32	60.2	60.0	56	5.8	9.7	30
0.0363	115	5.9	19.32	60.2	60.0	57	5.9	9.7	30
0.0375	117	6.0	19.32	60.2	60.0	58	6.0	9.7	30
0.0388	118	6.1	19.32	60.2	60.0	59	6.1	9.7	30
0.0400	120	6.2	19.32	60.2	60.0	60	6.2	9.7	30

Street Flows Ramp Curb (Maximum Flow to Crown of Roadway)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	13	2.2	6.05	35.0	34.8	6.7	2.2	3.0	17.4
0.0063	15	2.5	6.05	35.0	34.8	7.5	2.5	3.0	17.4
0.0075	16	2.7	6.05	35.0	34.8	8.2	2.7	3.0	17.4
0.0088	18	2.9	6.05	35.0	34.8	8.9	2.9	3.0	17.4
0.0100	19	3.1	6.05	35.0	34.8	9.5	3.1	3.0	17.4
0.0113	20	3.3	6.05	35.0	34.8	10	3.3	3.0	17.4
0.0125	21	3.5	6.05	35.0	34.8	11	3.5	3.0	17.4
0.0138	22	3.7	6.05	35.0	34.8	11	3.7	3.0	17.4
0.0150	23	3.8	6.05	35.0	34.8	12	3.8	3.0	17.4
0.0163	24	4.0	6.05	35.0	34.8	12	4.0	3.0	17.4
0.0175	25	4.1	6.05	35.0	34.8	13	4.1	3.0	17.4
0.0188	26	4.3	6.05	35.0	34.8	13	4.3	3.0	17.4
0.0200	27	4.4	6.05	35.0	34.8	13	4.4	3.0	17.4
0.0213	28	4.6	6.05	35.0	34.8	14	4.6	3.0	17.4
0.0225	28	4.7	6.05	35.0	34.8	14	4.7	3.0	17.4
0.0238	29	4.8	6.05	35.0	34.8	15	4.8	3.0	17.4
0.0250	30	5.0	6.05	35.0	34.8	15	5.0	3.0	17.4
0.0263	31	5.1	6.05	35.0	34.8	15	5.1	3.0	17.4
0.0275	31	5.2	6.05	35.0	34.8	16	5.2	3.0	17.4
0.0288	32	5.3	6.05	35.0	34.8	16	5.3	3.0	17.4
0.0300	33	5.4	6.05	35.0	34.8	16	5.4	3.0	17.4
0.0313	34	5.5	6.05	35.0	34.8	17	5.5	3.0	17.4
0.0325	34	5.7	6.05	35.0	34.8	17	5.6	3.0	17.4
0.0338	35	5.8	6.05	35.0	34.8	17	5.8	3.0	17.4
0.0350	35	5.9	6.05	35.0	34.8	18	5.9	3.0	17.4
0.0363	36	6.0	6.05	35.0	34.8	18	6.0	3.0	17.4
0.0375	37	6.1	6.05	35.0	34.8	18	6.1	3.0	17.4
0.0388	37	6.2	6.05	35.0	34.8	19	6.2	3.0	17.4
0.0400	38	6.3	6.05	35.0	34.8	19	6.3	3.0	17.4

Worksheet for Vertical Full Street Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+13	-0.25
0+13	-0.25
0+13	-0.75
0+15	-0.58
0+30	-0.28
0+45	-0.58
0+47	-0.75
0+47	-0.25
0+48	-0.25
0+60	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+13, -0.25)	0.030
(0+13, -0.25)	(0+15, -0.58)	0.013
(0+15, -0.58)	(0+45, -0.58)	0.015
(0+45, -0.58)	(0+48, -0.25)	0.013
(0+48, -0.25)	(0+60, 0.00)	0.030
<None>	(0+60, 0.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method

Worksheet for Vertical Full Street Section

Options

Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge		41.33	ft^3/s
Elevation Range	-0.75 to 0.00 ft		
Flow Area		19.04	ft^2
Wetted Perimeter		61.02	ft
Hydraulic Radius		0.31	ft
Top Width		60.00	ft
Normal Depth		0.75	ft
Critical Depth		0.66	ft
Critical Slope		0.01143	ft/ft
Velocity		2.17	ft/s
Velocity Head		0.07	ft
Specific Energy		0.82	ft
Froude Number		0.68	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01143	ft/ft

Cross Section for Vertical Full Street Section

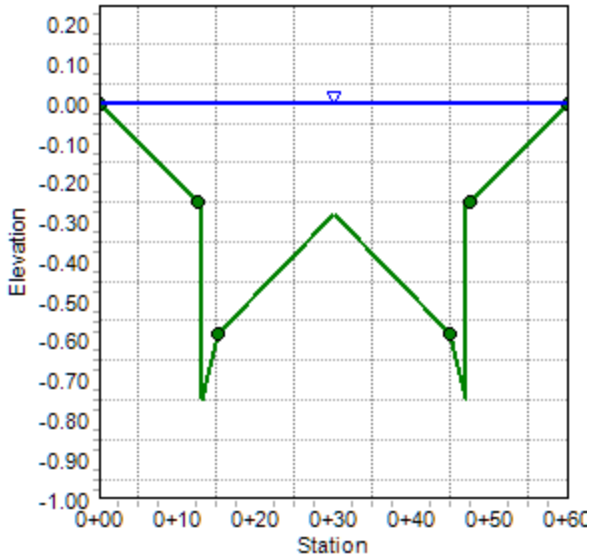
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft
Discharge	41.33	ft³/s

Cross Section Image



RESIDENTIAL STREET SECTION
VERTICAL CURB

5-Year Storm Event Maximum Allowable Street Flows
(Maximum Flow to Top of Curb)

Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	18	2.5	7.17	35.0	34.0	8.9	2.5	3.6	17
0.0063	20	2.8	7.17	35.0	34.0	9.9	2.8	3.6	17
0.0075	22	3.0	7.17	35.0	34.0	11	3.0	3.6	17
0.0088	23	3.3	7.17	35.0	34.0	12	3.3	3.6	17
0.0100	25	3.5	7.17	35.0	34.0	13	3.5	3.6	17
0.0113	27	3.7	7.17	35.0	34.0	13	3.7	3.6	17
0.0125	28	3.9	7.17	35.0	34.0	14	3.9	3.6	17
0.0138	29	4.1	7.17	35.0	34.0	15	4.1	3.6	17
0.0150	31	4.3	7.17	35.0	34.0	15	4.3	3.6	17
0.0163	32	4.5	7.17	35.0	34.0	16	4.5	3.6	17
0.0175	33	4.6	7.17	35.0	34.0	17	4.6	3.6	17
0.0188	34	4.8	7.17	35.0	34.0	17	4.8	3.6	17
0.0200	36	5.0	7.17	35.0	34.0	18	5.0	3.6	17
0.0213	37	5.1	7.17	35.0	34.0	18	5.1	3.6	17
0.0225	38	5.3	7.17	35.0	34.0	19	5.3	3.6	17
0.0238	39	5.4	7.17	35.0	34.0	19	5.4	3.6	17
0.0250	40	5.5	7.17	35.0	34.0	20	5.5	3.6	17
0.0263	41	5.7	7.17	35.0	34.0	20	5.7	3.6	17
0.0275	42	5.8	7.17	35.0	34.0	21	5.8	3.6	17
0.0288	43	5.9	7.17	35.0	34.0	21	5.9	3.6	17
0.0300	43	6.1	7.17	35.0	34.0	22	6.1	3.6	17
0.0313	44	6.2	7.17	35.0	34.0	22	6.2	3.6	17
0.0325	45	6.3	7.17	35.0	34.0	23	6.3	3.6	17
0.0338	46	6.4	7.17	35.0	34.0	23	6.4	3.6	17
0.0350	47	6.6	7.17	35.0	34.0	23	6.6	3.6	17
0.0363	48	6.7	7.17	35.0	34.0	24	6.7	3.6	17
0.0375	49	6.8	7.17	35.0	34.0	24	6.8	3.6	17
0.0388	49	6.9	7.17	35.0	34.0	25	6.9	3.6	17
0.0400	50	7.0	7.17	35.0	34.0	25	7.0	3.6	17

100-Year Storm Event Maximum Allowable Street Flows
(Maximum Flow to Right-of-Way)

Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	41	2.2	19.04	61.0	60.0	21	2.2	9.5	30
0.0063	46	2.4	19.04	61.0	60.0	23	2.4	9.5	30
0.0075	51	2.7	19.04	61.0	60.0	25	2.7	9.5	30
0.0088	55	2.9	19.04	61.0	60.0	27	2.9	9.5	30
0.0100	58	3.1	19.04	61.0	60.0	29	3.1	9.5	30
0.0113	62	3.3	19.04	61.0	60.0	31	3.2	9.5	30
0.0125	65	3.4	19.04	61.0	60.0	33	3.4	9.5	30
0.0138	69	3.6	19.04	61.0	60.0	34	3.6	9.5	30
0.0150	72	3.8	19.04	61.0	60.0	36	3.8	9.5	30
0.0163	75	3.9	19.04	61.0	60.0	37	3.9	9.5	30
0.0175	77	4.1	19.04	61.0	60.0	39	4.1	9.5	30
0.0188	80	4.2	19.04	61.0	60.0	40	4.2	9.5	30
0.0200	83	4.3	19.04	61.0	60.0	41	4.3	9.5	30
0.0213	85	4.5	19.04	61.0	60.0	42	4.5	9.5	30
0.0225	88	4.6	19.04	61.0	60.0	44	4.6	9.5	30
0.0238	90	4.7	19.04	61.0	60.0	45	4.7	9.5	30
0.0250	92	4.9	19.04	61.0	60.0	46	4.8	9.5	30
0.0263	95	5.0	19.04	61.0	60.0	47	5.0	9.5	30
0.0275	97	5.1	19.04	61.0	60.0	48	5.1	9.5	30
0.0288	99	5.2	19.04	61.0	60.0	49	5.2	9.5	30
0.0300	101	5.3	19.04	61.0	60.0	50	5.3	9.5	30
0.0313	103	5.4	19.04	61.0	60.0	51	5.4	9.5	30
0.0325	105	5.5	19.04	61.0	60.0	52	5.5	9.5	30
0.0338	107	5.6	19.04	61.0	60.0	53	5.6	9.5	30
0.0350	109	5.7	19.04	61.0	60.0	54	5.7	9.5	30
0.0363	111	5.8	19.04	61.0	60.0	55	5.8	9.5	30
0.0375	113	5.9	19.04	61.0	60.0	56	5.9	9.5	30
0.0388	115	6.0	19.04	61.0	60.0	57	6.0	9.5	30
0.0400	117	6.1	19.04	61.0	60.0	58	6.1	9.5	30

Street Flows Veritcal Curb (Maximum Flow to Crown of Roadway)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	14	2.2	6.15	35.0	34.0	6.7	2.2	3.0	17
0.0063	15	2.5	6.15	35.0	34.0	7.5	2.5	3.0	17
0.0075	17	2.7	6.15	35.0	34.0	8.2	2.7	3.0	17
0.0088	18	3.0	6.15	35.0	34.0	8.8	2.9	3.0	17
0.0100	19	3.2	6.15	35.0	34.0	9.4	3.1	3.0	17
0.0113	21	3.4	6.15	35.0	34.0	10	3.3	3.0	17
0.0125	22	3.5	6.15	35.0	34.0	11	3.5	3.0	17
0.0138	23	3.7	6.15	35.0	34.0	11	3.7	3.0	17
0.0150	24	3.9	6.15	35.0	34.0	12	3.8	3.0	17
0.0163	25	4.0	6.15	35.0	34.0	12	4.0	3.0	17
0.0175	26	4.2	6.15	35.0	34.0	12	4.1	3.0	17
0.0188	27	4.3	6.15	35.0	34.0	13	4.3	3.0	17
0.0200	28	4.5	6.15	35.0	34.0	13	4.4	3.0	17
0.0213	28	4.6	6.15	35.0	34.0	14	4.6	3.0	17
0.0225	29	4.8	6.15	35.0	34.0	14	4.7	3.0	17
0.0238	30	4.9	6.15	35.0	34.0	15	4.8	3.0	17
0.0250	31	5.0	6.15	35.0	34.0	15	4.9	3.0	17
0.0263	32	5.1	6.15	35.0	34.0	15	5.1	3.0	17
0.0275	32	5.3	6.15	35.0	34.0	16	5.2	3.0	17
0.0288	33	5.4	6.15	35.0	34.0	16	5.3	3.0	17
0.0300	34	5.5	6.15	35.0	34.0	16	5.4	3.0	17
0.0313	34	5.6	6.15	35.0	34.0	17	5.5	3.0	17
0.0325	35	5.7	6.15	35.0	34.0	17	5.6	3.0	17
0.0338	36	5.8	6.15	35.0	34.0	17	5.7	3.0	17
0.0350	36	5.9	6.15	35.0	34.0	18	5.9	3.0	17
0.0363	37	6.0	6.15	35.0	34.0	18	6.0	3.0	17
0.0375	38	6.1	6.15	35.0	34.0	18	6.1	3.0	17
0.0388	38	6.2	6.15	35.0	34.0	19	6.2	3.0	17
0.0400	39	6.3	6.15	35.0	34.0	19	6.3	3.0	17

Appendix F – Regional Stormwater Quality Analysis

Several Regional Detention Facilities are located within the Meridian Ranch, all the detention facilities have Water Quality Capture Volume incorporated into the design and construction. The facilities are owned and maintained by the Meridian Service Metropolitan District under the jurisdiction and authority of El Paso County. The design and construction of the facilities meet the minimum standards of the County as outlined in the Drainage Criteria Manual and Engineering Criteria Manual. The WQCV found in each of the detention facilities was designed to provide water quality for 100 percent of the tributary area for the facility. Regional Facilities are designed and are intended as flood control and water quality as the primary use.

Below is the governing section from the ECM regarding the use of regional detention facilities with a WQCV component for reference:

Appendix I Stormwater Quality Policy and Procedures-revisions
I.7.1.C.5.

Applicable Development Site Draining to a Regional WQCV Facility The regional WQCV facility is designed to accept drainage from the Applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the applicable development site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. The control measure must be designed in accordance with a design manual identified by the permittee. In addition,
The stream channel between the discharge point of the applicable development site and the regional WQCV facility must be stabilized. The regional WQCV facility must meet the following requirements:

a. The regional WQCV facility must be implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.
b. The regional WQCV facility must be designed and maintained for 100% WQCV for its entire drainage area.
c. The regional WQCV facility must have capacity to accommodate the drainage from the applicable development site.
d. The regional WQCV facility must be designed and built to comply with all assumptions for the development activities planned by the County within its drainage area, including the imperviousness of its drainage area and the applicable development site.
e. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the facility. Consideration of drain time shall include maintaining vegetation necessary for operation of the facility (e.g., wetland vegetation).
f. The County shall require site plans and perform a site plan review consistent with the requirements of this ECM to ensure the regional WQCV facility and control measures for the applicable development site plans include:
    i. Design details for all structural control measures implemented to meet the requirements of Part I.E.4.
    ii. A narrative reference for all non-structural control measures for the site, if applicable. "Non-structural control measures" are control measures that are not

structural control measures and include, but are not limited to, control measures that preventor reduce pollutants being introduced to water or that prevent or reduce the generation of runoff or illicit discharges.

iii. Documentation of operation and maintenance procedures to ensure the long-term observation, maintenance, and operation of the control measures. The documentation shall include frequencies for routine inspections and maintenance activities.

iv. Documentation regarding easements or other legal means for access of the control measure sites for operation, maintenance, and inspection of control measures.

v. Confirmation that control measures meet the requirements of section I.7.C.

vi. Confirmation that site plans meet the requirements of County's Site plan review and approval requirements.

g. The regional WQCV facility must be subject to the County's authority consistent with requirements and actions for a Control Measure in accordance with a base design standard.

h. Regional Facilities must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered Regional Facilities. Water bodies listed by name in surface water quality classifications and standards regulations (5CCR1002-32 through 5CCR1002-38) may not be considered regional facilities.

See the exhibits on the following pages for impacted areas, calculations and more information.

The following exhibits show the typical lot types, general drainage areas and calculations for each area. Two locations will have individual water quality facilities when the sites/lots are developed. Three locations drain the rear yards and open spaces where there would be little to no impervious areas. The final two areas include the lots where the runoff will enter directly into a storm drain facility prior to reaching Pond G and receive water quality treatment.

The lots are all 0.5 acres or larger and will qualify for the exemption.

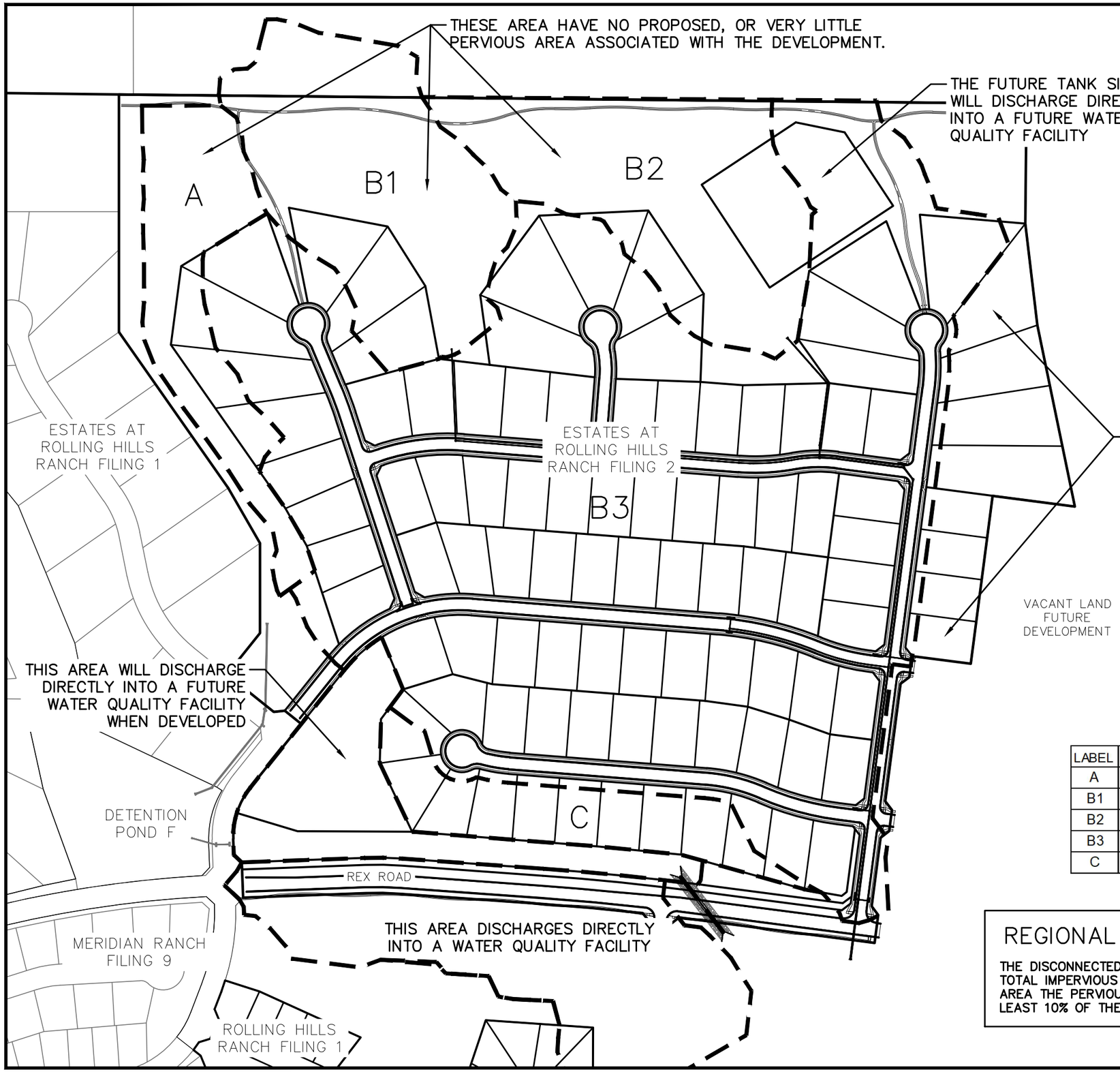
Areas A, B1, & B2 consist of open space and rear yard drainage tributary to storm drain systems. Any pervious areas would be relatively small compared to the large areas and would qualify for the exemption. Anticipated pervious areas could include a shed, RV garage, or sports court.

Two locations include areas where Meridian Service Metropolitan District build improvements. These improvements would likely require specialized water quality features, such as oil/water separators. These facilities would be necessary at the time of development of these areas.

The area draining overland easterly away from the development adjacent to Estate Ridge Drive will drain overland to a temporary sedimentation pond then into the arroyo. This area has tributary areas with little to no imperviousness. It is anticipated this area will qualify for the exemption upon development of the lands to the east.

Area B3 includes the main portion of the developed lots with surface drainage collected by the installed storm drain system. This area consists of 64.6 acres in total with an impervious factor of 24.1% based on the Rational Drainage Calculations. The total impervious area is estimated at 15.6 acres. Assuming the homes in the area will have footprint of 2,500 sf on average the total roof top area will be 4.1 acres or 26.3% of the total imperviousness of the area. The roof tops will discharge onto the surface from downspouts and surface drain overland to the streets and into the storm drain system. The estimated receiving pervious surface area is estimated to be approximately 6.3 acres of land or 153% of the total roof top area. The receiving pervious area consists of side yard and rear yard areas as the surface drainage is directed to the front yards onto the streets.

Area C includes the rear yards of lots along the south side of Crescent Creek Drive. These lots will surface discharge to the adjacent rip-rap lined channel then be conveyed to Pond G. The lots will have no direct impervious area and any indirect pervious area will discharge across the rear yards of the lots into the channel.



LABEL	AREA	#/HOMES	SPA	RPA	UIA	DCIA
A	6.1	0	6.1	0	0	0
B1	11.3	0	11.3	0	0	0
B2	11.4	0	11.4	0	0	0
B3	64.6	89	42.8	6.3	4.1	11.5
C	4.4	5	3.7	0.4	0.3	0

REGIONAL WATER QUALITY CALCULATION

THE DISCONNECTED IMPERVIOUS AREA IS GREATER THAN 20% OF THE TOTAL IMPERVIOUS AREA. THE FOOTPRINT OF THE RECEIVING PERVIOUS AREA THE PERVIOUS AREA IS PASSING THROUGH IS COMPRISED OF AT LEAST 10% OF THE TOTAL DISCONNECTED IMPERVIOUS AREA.

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

REGIONAL WATER QUALITY

OVERALL MAP

ROLLING HILLS RANCH FILING 1

Drawn by TAK | Checked by - | Date APR 2020

Scale N.T.S. | Sheet Number 1

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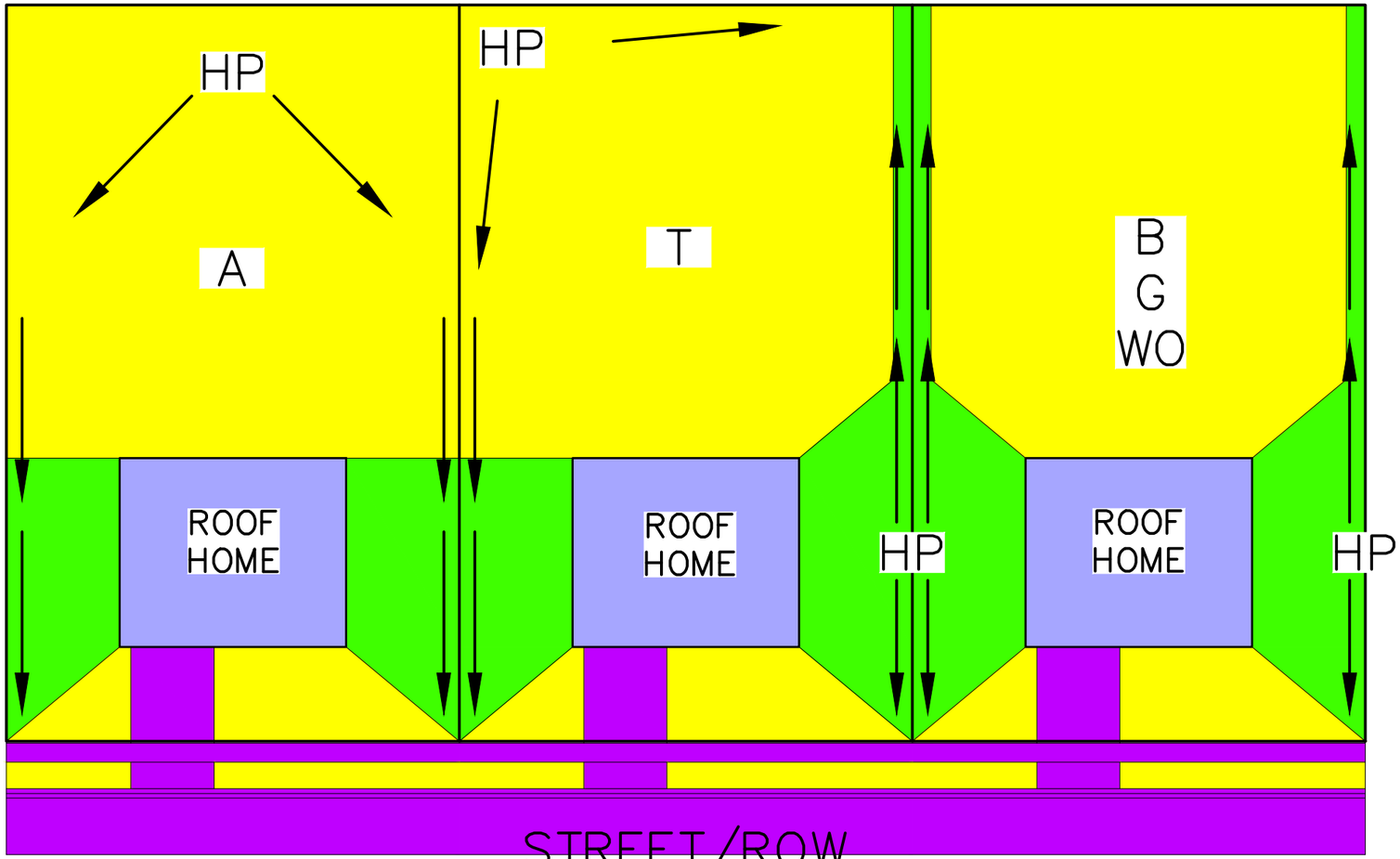

TYPICAL DRAINAGE PATTERN

NTS

REGIONAL WATER QUALITY CALCULATION
FOR TYPICAL LOT TYPES

AREA DESIGNATION	TYPE A LOTS		TYPE T LOTS		TYPE B, T, & WO	
SPA SEPARATE PERV AREAS	16786 SF		15926 SF		15065 SF	
RPA RECEIVING PERV AREAS (FRONT & SIDE YARDS)	3668 SF	146.7%	4279 SF	171.2%	5140 SF	205.6%
UIA UNCONNECTED IMPV AREAS (ROOFTOPS)	2500 SF	38.5%	2500 SF	38.5%	2500 SF	38.5%
DCIA DIRECT IMPV AREAS	3986 SF		3986 SF		3986 SF	

THE DISCONNECTED IMPERVIOUS AREA IS GREATER THAN 20% OF THE TOTAL IMPERVIOUS AREA. THE FOOTPRINT OF THE RECEIVING PERVIOUS AREA THE PERVIOUS AREA IS PASSING THROUGH IS COMPRISED OF AT LEAST 10% OF THE TOTAL DISCONNECTED IMPERVIOUS AREA. THE ABOVE FIGURES ARE BASED ON TYPICAL 0.5 ACRE LOTS WITH A 2,500 SF HOME FOOT PRINT.

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

REGIONAL WATER QUALITY
CATCHMENT AREA B2
ROLLING HILLS RANCH FILING 1

Drawn by	Checked by	Date
TAK	-	APR 2020

Scale	Sheet Number
N.T.S.	3

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Appendix G – Rex Road Box Culvert

Culvert Calculator Report
Rex Road Box Culvert

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,104.00	ft	Headwater Depth/Height	0.88	
Computed Headwater Elevation	7,101.60	ft	Discharge	185.00	cfs
Inlet Control HW Elev.	7,101.54	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	7,101.60	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	7,098.08	ft	Downstream Invert	7,096.03	ft
Length	204.00	ft	Constructed Slope	0.010049	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.52	ft
Slope Type	Steep		Normal Depth	1.48	ft
Flow Regime	Supercritical		Critical Depth	2.20	ft
Velocity Downstream	12.21	ft/s	Critical Slope	0.003079	ft/ft

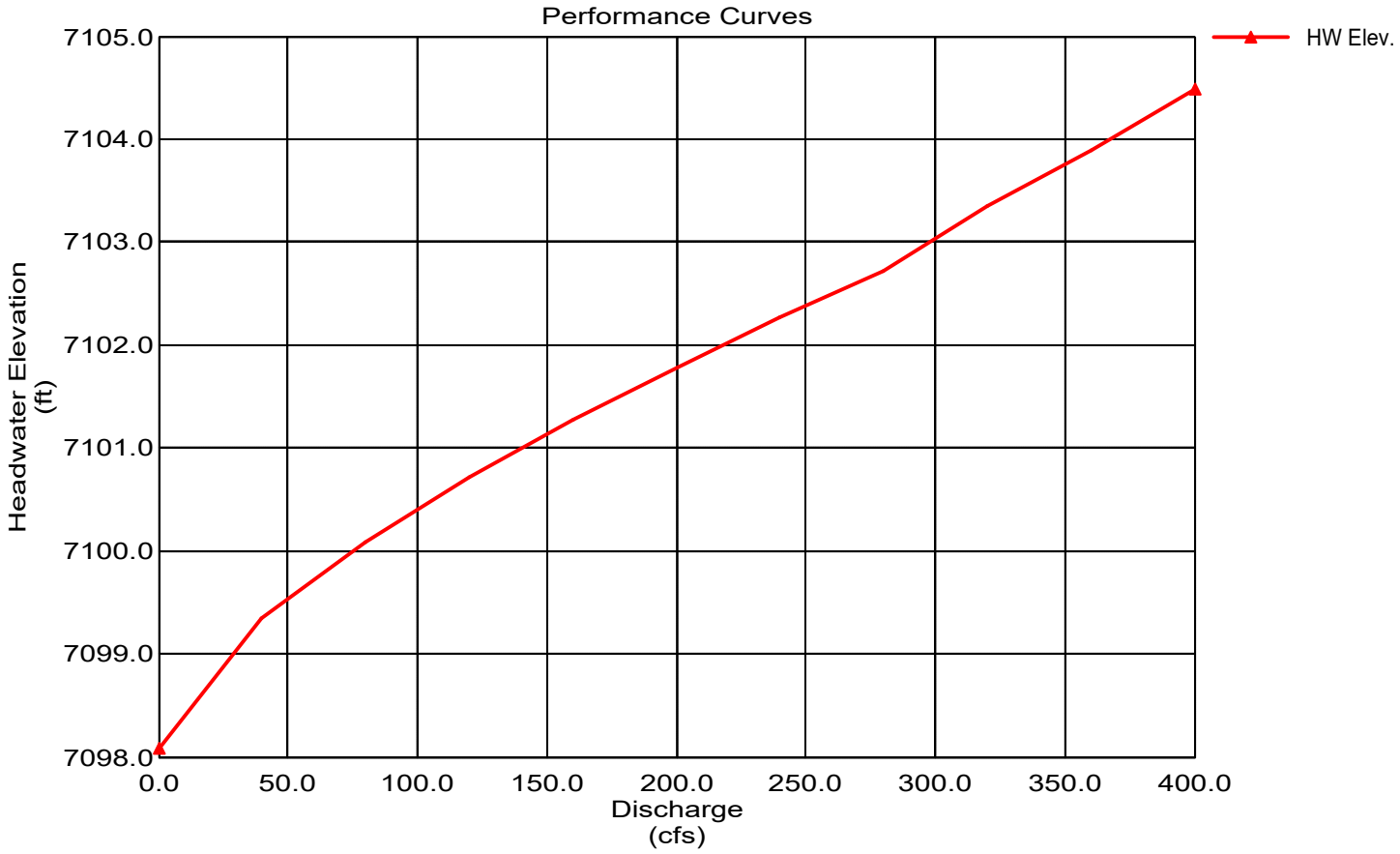
Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 4 ft		Rise	4.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	7,101.60	ft	Upstream Velocity Head	1.10	ft
Ke	0.20		Entrance Loss	0.22	ft

Inlet Control Properties					
Inlet Control HW Elev.	7,101.54	ft	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	40.0	ft²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Performance Curves Report
Rex Road Box Culvert

Range Data:				
	Minimum	Maximum	Increment	
Discharge	0.00	400.00	40.00	cfs



Appendix H – Soil Resource Report

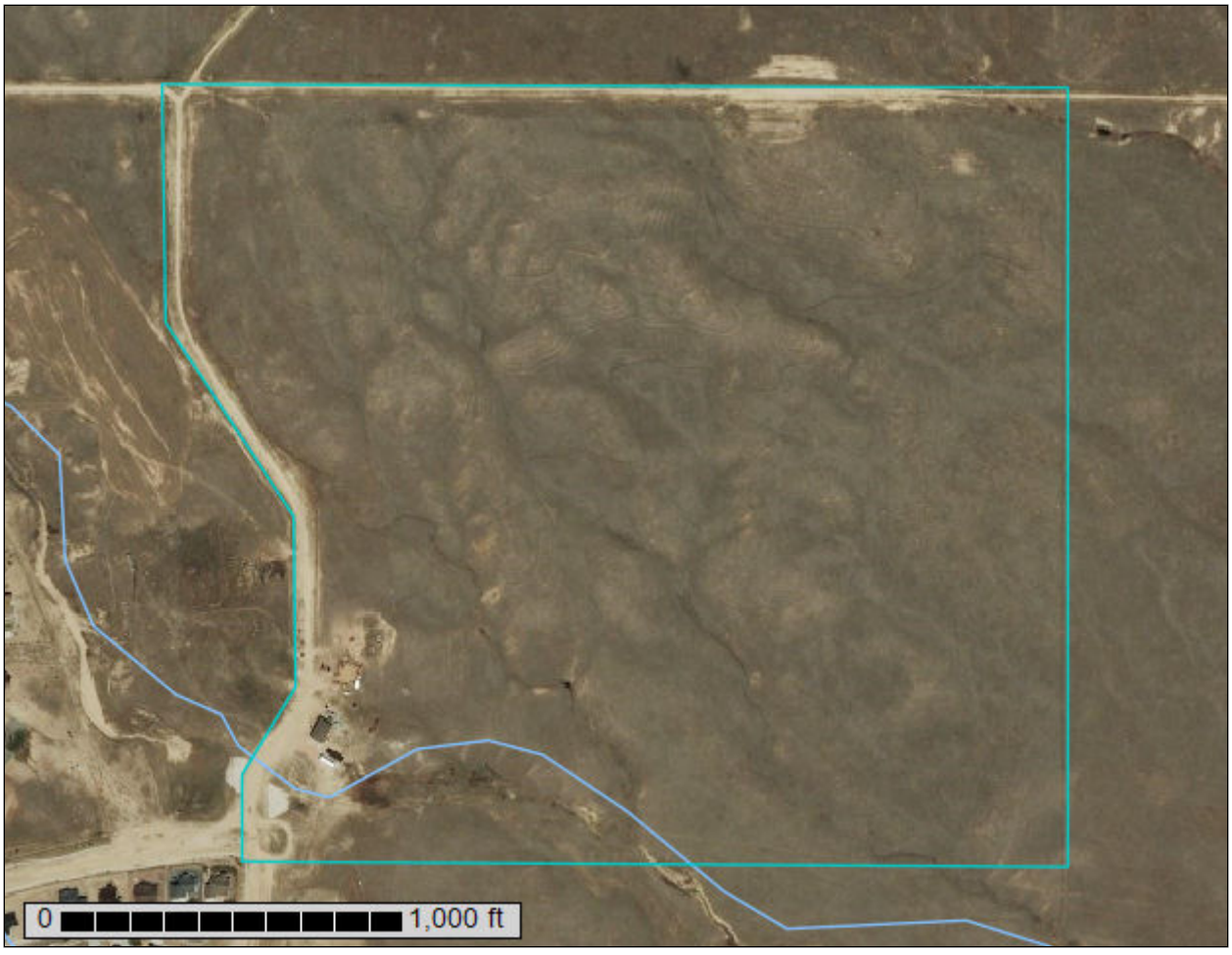
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



April 6, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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19—Columbine gravelly sandy loam, 0 to 3 percent slopes.....13
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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

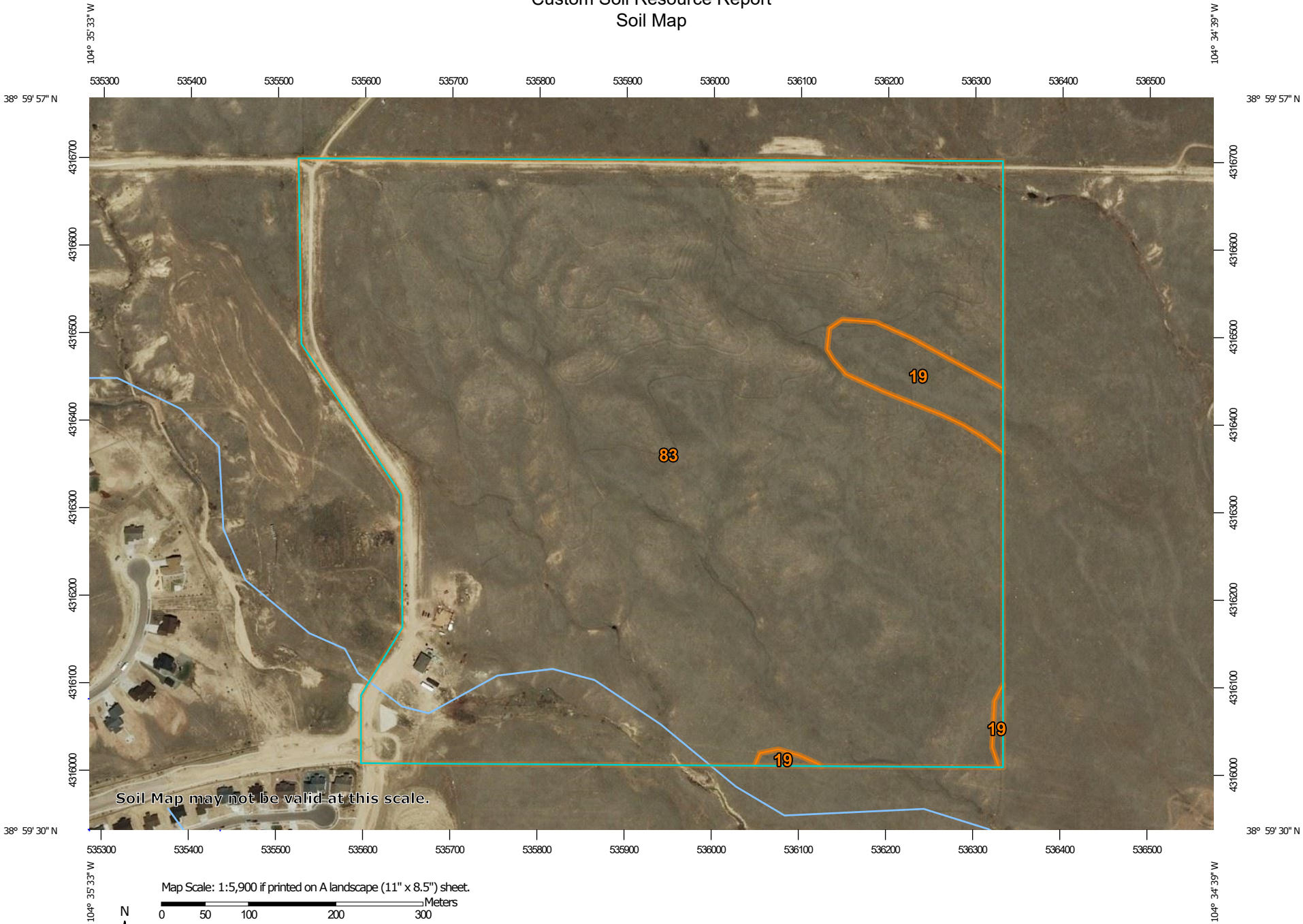
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	3.8	3.0%
83	Stapleton sandy loam, 3 to 8 percent slopes	124.6	97.0%
Totals for Area of Interest		**128.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

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Appendix I – Original Approved Final Drainage Report

Preliminary Drainage Report
Final Drainage Report
for

Estates at Rolling Hills Ranch Filing 2

at

Meridian Ranch

EL PASO COUNTY, COLORADO

September 2020

Prepared For:

GTL DEVELOPMENT, INC.
P.O. Box 80036
San Diego, CA 92138

Prepared By:
Tech Contractors
11886 Stapleton Drive
Falcon, CO 80831
719.495.7444

PCD Project No. PUDSP204
SF2018

CERTIFICATIONS

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 REGISTERED THOMAS A. KERBY 31429 PROFESSIONAL ENGINEER

Thomas A. Kerby, P.E. #31429

9-28-2020
Date

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.

Raul Guzman, Vice President
GTL Development, Inc.
P.O. Box 80036
San Diego, CA 92138

9/28/2020
Date

El Paso County:

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

APPROVED
Engineering Department
11/25/2020 10:24:26 AM
dsdnijkamp
EPC Planning & Community Development Department

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

Date

Estates at Rolling Hills Ranch Filing 2
Preliminary/Final Drainage Report

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EXECUTIVE SUMMARY

The purpose of the following Preliminary Drainage Report/Final Drainage Report (PDR/FDR) is to present the changes to the drainage patterns as a result the Estates at Rolling Hills Ranch Filing 2 at Meridian Ranch (ERHR F2) development. Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version) as amended by the El Paso County Engineering Criteria Manual (ECM).

This report based on the current version of the Meridian Ranch Sketch Plan amendment as adopted by the El Paso County Board of Commissioners on March 13, 2018. Hydrologic calculations follow method outlined in Chapter 6 of the 2014 version of the City of Colorado Springs Drainage Criteria Manual (COSDCM) as adopted by the El Paso County Board of County Commissioners by Resolution 15-042. Chapter 6 addresses the hydrologic calculation methods and includes an updated hydrograph to be used with storm drainage runoff. The Board adopted by the same resolution, Section 3.2.1 of Chapter 13 of the COSDCM referencing Full Spectrum Detention; the concept "provides better control of the full range of runoff rates that pass through detention facilities than the convention multi-stage concept. This section of the COSDCM identifies the necessity to provide full spectrum detention but does not prescribe a methodology to reach such the detention requirements. This report includes hydrologic models from HEC-HMS for the historic, interim and future conditions for the 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr design storm frequencies. The interim and the future conditions include detention facilities sized and modeled such that *"frequent and infrequent inflows are released at rates approximating undeveloped conditions"*

ERHR F2 encompasses 117± acres and is located in Sections 19 and 20, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

Rolling Hills Ranch is located within Gieck Ranch Drainage Basin. The Gieck Ranch Basin has been studied, but has not received final approval from El Paso County. The developer has agreed to meet the requirements of the studied Gieck Ranch Basin but as yet to be approved Drainage Basin Study.

Based on the aforementioned design parameters the development of the project will not adversely affect downstream properties.

INTRODUCTION

Purpose

The purpose of the following Preliminary Drainage Report/Final Drainage Report (PDR/FDR) is to present proposed changes to the drainage patterns as a result of the development of ERHR F2. The report outlines the proposed drainage mitigation based on calculated developed flows in excess of allowable exiting runoff discharge.

Scope

The scope of this report includes:

- Location and description of the proposed development stating the proposed land use, density, acreage and adjacent features to the site.
- Calculations for design peak flows from all off-site tributary drainage areas.
- Calculations for design peak flows within the proposed project area for all drainage areas.
- Discussion of major drainage facilities required as a result of the development.
- Discussion and analysis of existing and proposed facilities.

Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM) (1994 version) and those portions of the City of Colorado Springs Drainage Criteria Manual, Volume 1 (DCM-1) ((2014 version) adopted by Resolution 15-042 of the El Paso County Board of County Commissioners as amended by the El Paso County Engineering Criteria Manual (ECM).

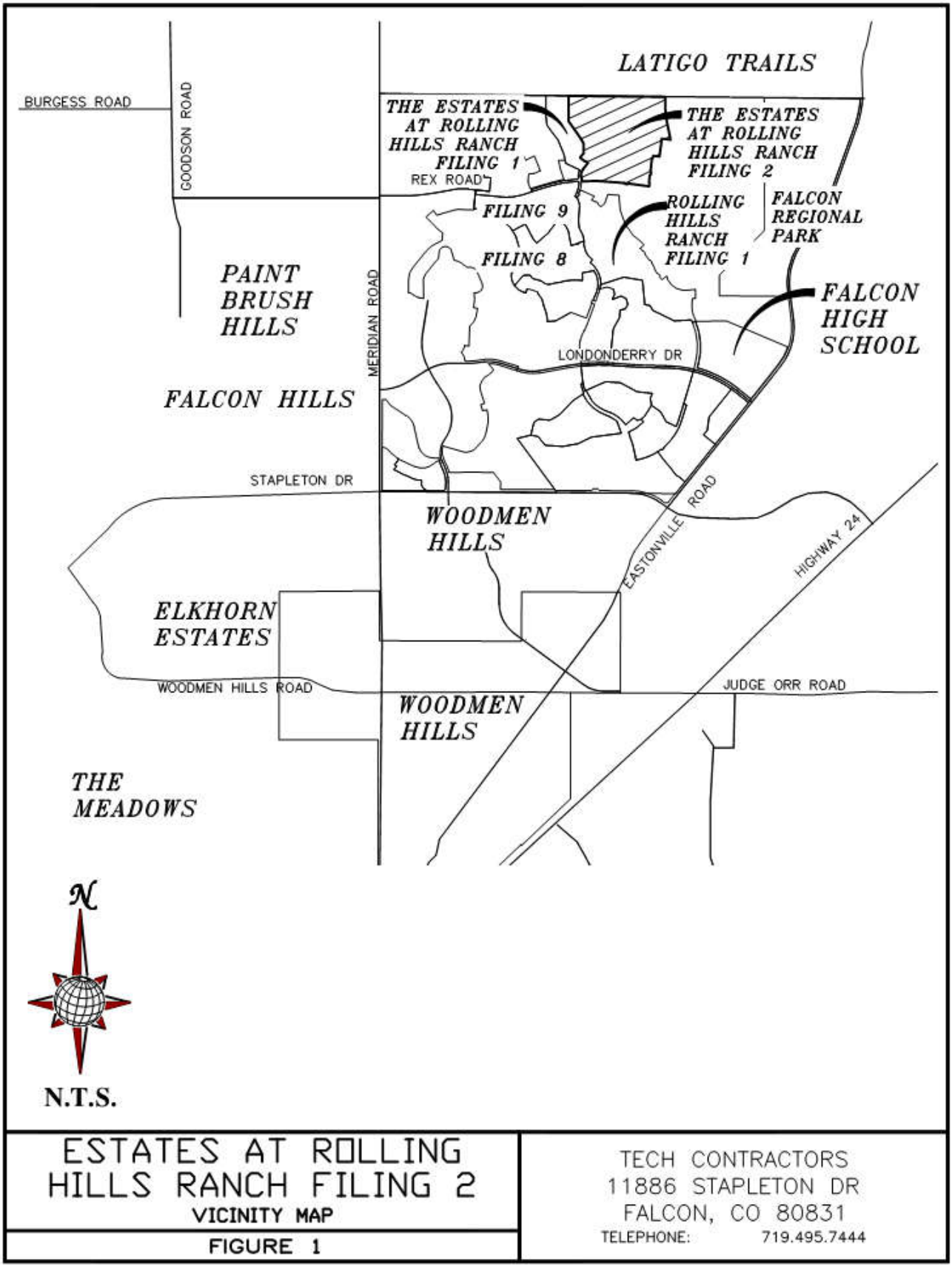
Background

On November 16, 2000 the El Paso County Board of County Commissioners approved the rezoning of the Meridian Ranch project (PUD-00-010) from A-35 to PUD with several conditions. Condition number seven stated in part that "drainage plans shall release and/or retain at approximately eight percent (80%) of historic rates." At the time of the initial approvals there were no drainage improvements downstream of the Meridian Ranch project and the existing natural channels were shallow and undefined.

The Sketch Plan Amendment (SKP-17-001) was processed and approved in 2018 by the El Paso County Board of County Commissioners by resolution 18-104 for Meridian Ranch. The resolution eliminated the required restriction of 80% of historic peak flow rates mentioned above. The detention pond proposed with this project will release at historic or less peak flow rates as per the current El Paso County stormwater requirements.

No development has occurred downstream of this project except for portions of the Falcon Regional Park providing sports fields, trails, dog park and associated parking. The Meridian Ranch MDDP and this report indicate the Eastonville Road culvert crossing located downstream of this project does not provide enough capacity for the historic flow rates. It is anticipated that this culvert will be upgraded at the time of the Eastonville Road construction.

Figure 1: Vicinity Map



Current calculations show the current design discharge of the existing Pond G to the Falcon Regional Park to be below historic flow rates at full build out for the full spectrum of design storms.

EXISTING CONDITIONS

General Location

Rolling Hills Ranch Estates project encompasses 117± acres and is located in Sections 19 and 20, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

Land Use

Historically, ranching dominated the area surrounding Meridian Ranch; however, currently urbanization has occurred in the general vicinity. Most notably, urbanization is occurring to the north with Latigo Trails, to the south in the Woodmen Hills Subdivision, to the east in Four Way Ranch, to the west in the Falcon Hills subdivision, and to the northwest in the Paint Brush Hills subdivision.

Climate

Mild summers and winter, light precipitation; high evaporation and moderately high wind velocities characterize the climate of the study area. The average annual monthly temperature is 48.4 F with an average monthly low of 30.3 F in the winter and an average monthly high of 68.1 F in the summer. Two years in ten will have maximum temperature higher than 98 F and a minimum temperature lower than –16 F. Precipitation averages 15.73" annually, with 80% of this occurring during the months of April through September. The average annual Class A pan evaporation is 45 inches. (Soil Survey of El Paso County Area, Colorado).

Topography and Floodplains

The topography of the site is typical of a high desert, short prairie grass with relatively flat slopes generally ranging from 2% to 4%. The project site drains generally from the northwest to southeast and is tributary to the Black Squirrel Creek.

The Flood Insurance Rate Maps (FIRM No. 08041C0552G dated 12/07/2018) indicates that the project is outside of any designated flood plain. Please see Figure 2: Estates at Rolling Hills Ranch Filing 2 Federal Emergency Management Agency (FEMA) Floodplain Map.

Geology

The National Resources Conservation Service (NRCS) soil survey records indicate that the service area is predominately covered by soils classified in the Stapleton series. This series is categorized as a Hydrological Soil Group B.

The Stapleton (83) sandy loam is a deep, non-calcareous, well-drained soil formed in alluvium derived from arkosic bedrock on uplands. Permeability of this soil is rapid. Available water capacity is moderate, surface runoff is slow, and the hazard of erosion and soil blowing is moderate. The Stapleton series is categorized as a Hydrological Soil Group B.

Figure 2: FEMA Floodplain Map

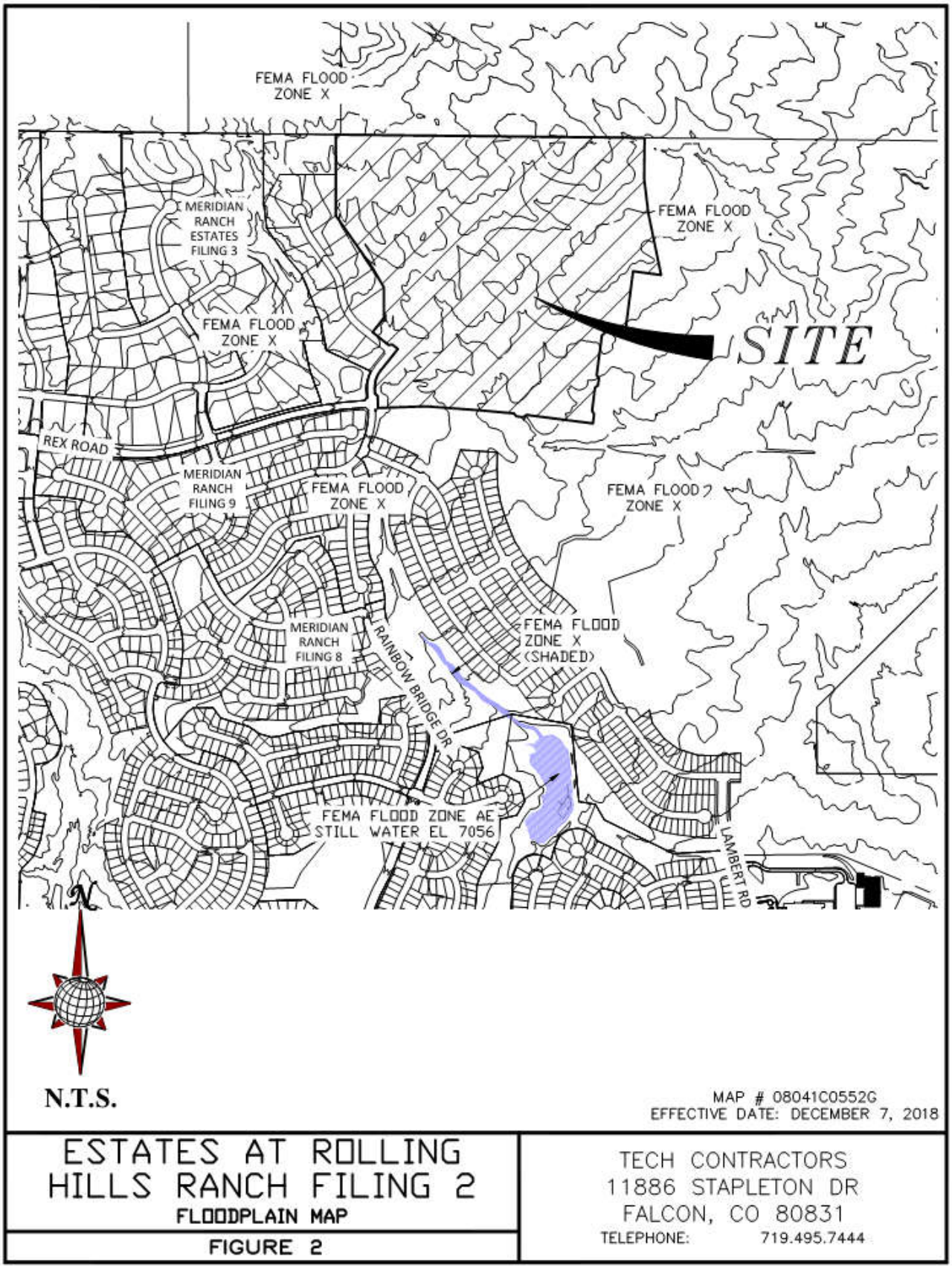
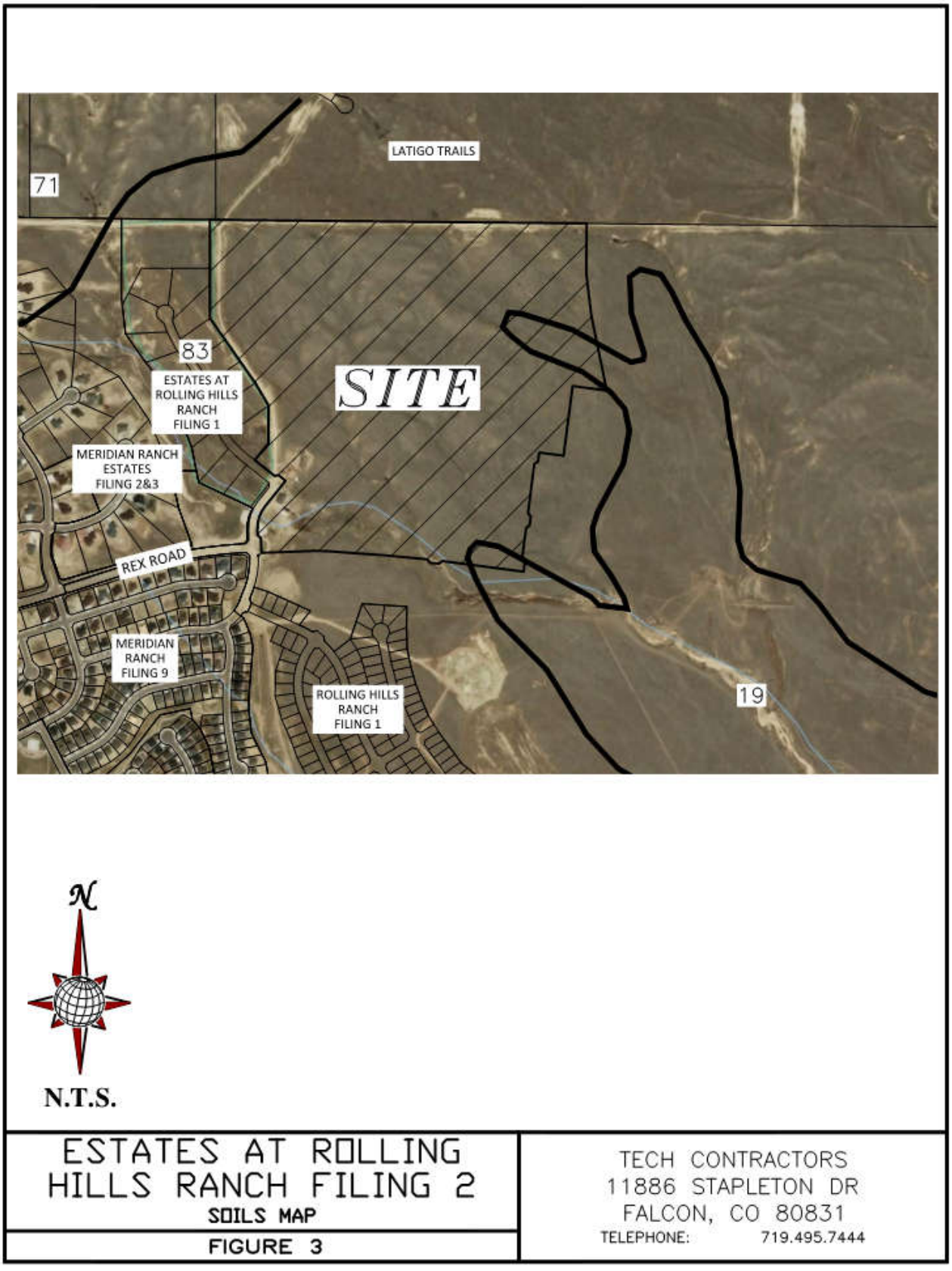


Figure 3: Soils Map



This soil is suited to habitat for open land and rangeland wildlife. The main limitation of this soil for urban development is frost-action potential.

Typically, these soils are well-drained, gravelly sandy loams that form on alluvial terraces and fans and exhibit high permeability and low available water capacity with depth to bedrock greater than 6 feet.

The Columbine (19) gravelly sandy loam is a deep, well-drained to excessively drained soil formed in coarse textured material on alluvial terraces, fans and flood plains. Permeability of this soil is very rapid. Available water capacity is low to moderate, surface runoff is slow, and the hazard of erosion is slight to moderate. The Columbine series is categorized as a Hydrological Soil Group A.

This soil is used mainly for grazing livestock, for wildlife habitat and for home sites. The main limitation of this soil for urban development is a hazard of flooding in some areas.
Note: (#) indicates Soil Conservation Survey soil classification number. See Figure 3 Estates at Rolling Hills Ranch Filing 2 – Soils Map.

Natural Hazards Analysis

Natural hazards analysis indicates that no unusual surface or subsurface hazards are located near the vicinity. However, because the soils are cohesionless, sloughing of steep banks during drilling and/or excavation could occur. By citing improvements in a manner that provides an opportunity to lay the banks of excavations back at a 1:1 slope during construction, the problems associated with sloughing soils can be minimized.

DRAINAGE BASINS AND SUB-BASINS

The site is near the top of the Gieck Ranch Drainage Basin and accepts flow from areas north of the project site within portions of the adjacent Antlers Ridge and Latigo developments.

Three different scenarios were analyzed for the drainage conditions for the project.

The first scenario analyzes the historic conditions for Meridian Ranch. This condition has all of Meridian Ranch in the pre-development state; where the entirety of Meridian Ranch is modeled in its undeveloped, undisturbed condition, alternatively called the historic condition.

The second scenario is the interim conditions scenario and it consists of the current existing conditions for all tributary areas whether developed or undeveloped/historic with the addition of Estates at Rolling Hills Ranch Filing 2 in the proposed developed condition. The current existing conditions assume all approved projects tributary to the Estates at Rolling Hills Ranch Filing 2 are at full buildout. This condition was analyzed to ensure the full spectrum of historic flow rates exiting the Meridian Ranch development are maintained after the development of Estates at Rolling Hills Ranch Filing 2 is completed.

The interim scenario was analyzed to ensure that the historic flow rates that leave the site upstream of and adjacent to the Falcon Regional Park are maintained.

The final scenario analyzes the future build out conditions for the entirety of Meridian Ranch to ensure the storm drain and future detention facilities located at the discharge point downstream of this project are able to properly attenuate the full spectrum of developed peak flow rates to historic peak flow rates as the storm water exits the Meridian Ranch project onto the adjacent Falcon Regional Park.

DRAINAGE DESIGN CRITERIA

SCS Hydrograph Procedure

The US Army Corp of Engineers HEC-HMS computer program was used to model the Soil Conservation Service (SCS) Hydrograph procedure to determine final design parameters for the major drainage facilities within the project. Onsite basin areas were calculated using aerial topography of the site and approved final design data. Times of concentration were estimated using the SCS procedures described in the DCM. Based upon the hydrologic soil type, the natural conditions found in the basins and the runoff curve numbers (CN) chart from Table 6-10 of the City of Colorado Springs DCM for Antecedent Runoff Condition II (ARC II), the following CN values were used for the given conditions.

Table 1: SCS Runoff Curve Numbers

Condition	CN*
Residential Lots (5 acre)	63
Residential Lots (2.5 acre)	66
Residential Lots (1 acre)	68
Residential Lots (1/2 acre)	70
Residential Lots (1/3 acre)	72
Residential Lots (1/4 acre)	75
Residential Lots (1/5 acre)	78
Residential Lots (1/6 acre)	80

School	80
Parks/Open Space	62
Commercial	85
Roadways	98
Graded	67
Golf Course	62
Latigo Undeveloped	65
Undeveloped	61

*Curve Numbers were interpolated and based on amount of impervious area per lot. The 24 hour storm precipitation values were selected from the NOAA Atlas 14, Volume 8, Version 2 for the Meridian Ranch location (Latitude 38.9783°, Longitude -104.5842°, Elevation 7054 ft). These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs. See the table for all the design storm events in Appendix A. These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs.

Full Spectrum Design

The City of Colorado Springs adopted a new Drainage Criteria Manual (DCM) in 2014 which incorporated the use of *Full Spectrum Design* for storm drainage analysis for projects located within the city limits. El Paso County adopted portions of the City's 2014 DCM by resolution in January 2015; the County resolution adopted Chapter 6 (Hydrology) and Section 3.2.1 of Chapter 13 (Full Spectrum Detention) for projects outside of the City of Colorado Springs establishing a 1 year review period to analyze the impacts of the Full Spectrum Design on the storm drainage analysis of projects. This report has incorporated the use of full spectrum in the analysis using the SCS Method to determine the size requirements for the detention pond during the interim and future conditions.

The idea behind full spectrum detention is to release the developed runoff flow rates that will approximate those of the pre-developed condition. The existing design of Pond G and the outlet control structure will meet or exceed the intent and spirit of the concept.

Table 2: Detention Pond Summary:

POND F				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
INTERIM CONDITIONS				
2-YEAR STORM	5.0	2.1	0.9	7130.1
5-YEAR STORM	22	7.7	1.8	7131.1
10-YEAR STORM	54	16	3.3	7132.6
50-YEAR STORM	200	121	6.7	7134.9
100-YEAR STORM	293	178	8.9	7136.0
FUTURE CONDITIONS				
2-YEAR STORM	5.0	2.1	0.9	7130.1
5-YEAR STORM	22	7.7	1.8	7131.1
10-YEAR STORM	54	16	3.3	7132.6
50-YEAR STORM	200	121	6.7	7134.9
100-YEAR STORM	293	178	8.9	7136.0

POND G				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
INTERIM CONDITIONS				
2-YEAR STORM	7.4	3.6	2.4	7026.0
5-YEAR STORM	33	9.8	6.7	7027.1
10-YEAR STORM	76	28	8.9	7027.5
50-YEAR STORM	333	206	17.0	7028.9
100-YEAR STORM	522	358	21.1	7029.6
FUTURE CONDITIONS				
2-YEAR STORM	26	5.1	4.7	7026.6
5-YEAR STORM	75	20	8.1	7027.4
10-YEAR STORM	141	53	10.8	7027.9
50-YEAR STORM	436	321	20.1	7029.5
100-YEAR STORM	668	472	25.3	7030.3

DRAINAGE CALCULATIONS

SCS General Overview

The project is located within the Gieck Ranch Drainage Basin; storm water runoff will be conveyed across the site overland and within proposed storm drain networks to the Pond G detention facility.

The Pond G detention facility has been adequately sized such that the developed flows detained and released will approximate the historic flow rates for the various design storm events for both the interim condition and in the future as the storm flow exits Meridian Ranch onto the Falcon Regional Park.

Figure 5: Meridian Ranch SCS Calculations – Historic Conditions Map, Figure 6: Meridian Ranch SCS Calculations – Interim Conditions Map and Figure 7: Meridian Ranch SCS Calculations – Future Conditions Map depict the historic, interim and future general drainage patterns for Estates at Rolling Hills Ranch Filing 2.

The purpose of this report is to show that the development of Estates at Rolling Hills Ranch Filing 2 will not adversely impact the existing drainage facilities adjacent to and downstream of the developed area and the existing Pond G is properly sized for all anticipated future development.

SCS Calculations

Historic Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics under Existing Conditions using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations - Historic Basin Map.

Table 3: Historic Drainage Basins – SCS

HISTORIC SCS (Full Spectrum)						
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	11.6	3.75	0.52
OS06-G02	0.1313	77	52	11	3.73	0.52
OS05	0.0578	39	26	5.64	1.79	0.23
OS05-G01	0.0578	38	25	5.49	1.74	0.23
HG01	0.0547	32	21	4.67	1.52	0.22
G01	0.1125	70	46	10	3.22	0.45
G01-G02	0.1125	68	46	10	3.16	0.45
HG02	0.0906	45	30	6.68	2.29	0.36
G02	0.3344	191	127	27	9	1.32
G02-G03	0.3344	190	125	27	8.97	1.32
HG03	0.1828	77	51	12	4.26	0.72
OS07	0.0328	25	17	4.49	1.7	0.26
OS07-G03	0.0328	24	17	4.27	1.68	0.26
G03	0.55	291	192	42	15	2.25
G03-G04	0.55	281	189	42	14	2.25
OS09	0.1547	91	63	19	8.34	1.9
OS09-G04	0.1547	90	62	18	8.29	1.9
HG04	0.0891	40	26	5.93	2.1	0.34
HG05	0.1125	49	32	7.35	2.6	0.43
OS08	0.0406	35	25	7.7	3.44	0.72
OS08-G04	0.0406	34	24	7.38	3.4	0.72
G04	0.9469	493	332	76	28	4.71
G04-G05	0.9469	488	318	76	27.34	4.69
HG06A	0.1375	49	32	7.58	2.85	0.51

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

HISTORIC SCS (Full Spectrum)						
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G05	1.0844	536	350	84	30	5.18
G05-G06	1.0844	520	348	83	30	5.16
HG06B	0.1031	33	22	5.27	2.04	0.37
G06	1.1875	551	369	88.47	32	5.52

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Interim Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the interim conditions using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations – Interim Basins Map

Table 4: Interim Drainage Basins-SCS

INTERIM SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9.2	2.5	0.9	0.1
OS07a-POND F	0.0170	13	9.0	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	6.5	3.9	1.7
FG21a	0.0095	7	5	1.3	0.5	0.1
FG21a-G7	0.0095	7	4.9	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1264	84	60	20.6	10.5	3.3
OS08	0.0394	34	24	7	3	0.7
OS08-G8	0.0394	33	23	7	3	0.7

INTERIM SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
FG23a	0.0231	16	11	3	1.0	0.2
OS07c	0.0156	15	10	3	1.0	0.1
OS07c-G8	0.0156	13	9	2	0.9	0.1
G8	0.6910	292	193	36.5	16.6	4.4
G7-G10	0.6910	292	192	36.3	16.4	4.2
OS09	0.1527	90	62	18	8	1.9
OS09-G10	0.1527	88	61	18	8	1.9
FG24	0.1405	74	49	12	4.1	0.7
G9	0.2932	154	105	28	12	2.5
G8-G10	0.2932	154	103	28	12	2.5
FG23b	0.0334	22	14	3.1	1.0	0.1
G10	1.0176	449	290	65.3	28.9	6.8
G10-G11	1.0176	447	288	64.9	28.6	6.7
FG23c	0.0070	5	3	1	0	0.0
G11	1.0246	449	289	65	29	6.8
FG25	0.1086	48	32	7	3	0.4
FG28	0.0688	33	21	5	2	0.3
POND G IN	1.2020	522	333	76	33	7.4
POND G	1.2020	358	206	28	10	3.6
G12	1.2020	358	206	28	10	3.6
G12-G06	1.2020	357	205	28	10	3.6
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	27	18	4	1	0.2
FG32-G06	0.0402	27	18	4	1	0.2
G06	1.3419	377	217	29	11	4.0

Future Drainage - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the future conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

Table 5: Future Drainage Basins-SCS

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9.2	2.5	0.9	0.1
OS07ab-POND F	0.0170	13	9.0	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	6.5	3.9	1.7
FG21a	0.0095	7.4	5.0	1.3	0.5	0.1
FG21a-G7	0.0095	7.4	4.9	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1309	89	64	22	12	3.8
OS08	0.0394	34	24	7.5	3.3	0.7
OS08-G8	0.0394	33	23	7.3	3.3	0.7
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07c	0.0156	15	10	2.6	1.0	0.1
OS07c-G7	0.0156	14	9.7	2.4	0.9	0.1
G8	0.6940	288	191	39	20	6.0
G8-G10	0.6940	286	189	38	20	6.0
OS09	0.1527	90	62	18	8.2	1.9
OS09-G10	0.1527	88	62	18	8.2	1.9
FG24	0.1517	118	85	30	16	4.9
G9	0.3044	193	134	41	18	4.9
G9-G10	0.3044	190	134	40	18	4.9
FG23b	0.0247	18	12	3	1.1	0.2
G10	1.0231	470	305	79	37	11
G10-G11	1.0231	470	304	78	37	11
FG23c	0.0122	12	8.7	3.0	1.5	0
G11	1.0353	474	306	79	38	11
FG25	0.1086	85	64	27	17	8
FG26	0.0863	78	58	22	12	5
FG26-POND G	0.0863	77	57	22	12	4
FG27	0.0500	52	40	17	11	5
FG28	0.0245	18	13	4.1	2.0	0.5
POND G IN	1.3047	668	436	141	75	25.61
POND G	1.3047	472	321	53	20	5.1
G12	1.3047	472	321	53	20	5.1
G12-G06	1.3047	472	320	53	20	5.09
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	72	57	29	20	11.14
FG32-G06	0.0402	69	54	27	18	10.5
G06	1.4446	498	338	58	22	10.5
FG34	0.0600	34	90	41	27	13
G14	0.0600	34	86	41	27	13
G14-G15	0.0600	34	67	31	20	10
FG35	0.0344	20	65	29	19	10
G15	0.0944	53	36	14	8	3

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
G15-G08	0.0944	52	36	14	8	3
FG37	0.0797	41	31	12	7	3
FG36	0.0281	14	215	94	59	29
FG36-G08	0.0281	14	61	25	15	7
G16	0.2022	106	59	28	19	10

See approved Meridian Ranch MDDP (EPC File SKP171) dated January 2018 for complete hydrologic calculations and maps.

Rational Calculations

The Rational Hydrologic Calculation Method was used to estimate the total runoff from the 5-year and the 100-year design storm and thus establish the storm drainage system design. Using the rational calculation methodology outlined in the Hydrology Section (Ch 6) of the COSDCM coupled with the El Paso County EPCDCM an effective storm drainage design for Estates at Rolling Hills Ranch Filing 2 has been designed. The storm drainage facilities have been designed such that the minor storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not overtop the curbs. The storm drainage facility has been designed such that the major storm will be captured by the inlets and conveyed by the storm drain pipes such that the street flow does not exceed the right-of-way widths for residential streets and the hydraulic grade line will be less than one foot below the surface.

The site is located within the Gieck Ranch Drainage Basin. The storm drain runoff will be collected by a series of inlets and storm drain pipe then conveyed through the project and discharge into an existing natural drainage course continuing into existing Pond G that is properly sized to safely convey the storm water flows away from the project without damaging adjacent property.

Rational Narrative

The following is a detailed narrative of the storm drainage system located in Estates at Rolling Hills Ranch Filing 2. These storm drainage systems meet the requirements of as found in the El Paso County Engineering Criteria Manual I.7.1.C.5. (ECM) for storm water quality and discharge into Waters of the State. The discharge point is located upstream of a Regional Detention Facility with WQCV incorporated into the design and construction. At least 20 percent of the upstream imperviousness within the catchment must be disconnected from the storm drainage system and drain though a pervious area that makes up at least 10 percent of the disconnected impervious area. The rooftops within this catchment make up more than 20 percent of the total impervious area of the catchment, is discharged via roof downspouts and drains across the front yard pervious areas equaling more than 10 percent of the rooftop area. Please see Appendix F for information and exhibits.

Storm Drain System A

- Basin OS7c (10.0 acres, Q_5= 4.1 CFS, Q_{100} = 22 CFS) contains off-site area north of Meridian Ranch within the Antler Ridge/Latigo Trails subdivision entering the project on the north side via an existing 30" RCP culvert at Design Point 1. The surface runoff is concentrated within an existing swale, directed southerly onto Meridian Ranch and drainage basin A01. The surface runoff is conveyed southerly via an existing swale toward an existing Type C Inlet located in Basin A01.

- Basin A01 (6.1 acres, Q_5= 2.3 CFS, Q_{100} = 13 CFS) contains rear portions of the lots on the east side of proposed Cypress Meadow Drive and open space. The surface runoff will sheet flow off of the open space, rear portions of the lots and be directed to the existing swale carrying the flow from Antler Ridge/Latigo Trails located to the existing Type C Inlet (ECB). All of the flow (Q_5= 5.0 CFS, Q_{100} = 27 CFS) is captured and conveyed downstream via a 24" RCP to outlet at OS1.

Storm Drain System B

- Basin B01 (11.3 acres, Q_5= 4.2 CFS, Q_{100} = 24 CFS) contains rear portions of the lots on the west side of proposed Cypress Meadow Drive, a portion of Latigo Trails and open space. The surface runoff will sheet flow off of the open space and be directed to an existing swale continuing to the proposed Type C Inlet (CB01). All of the flow (Q_5= 4.2 CFS, Q_{100} = 24 CFS) is captured and conveyed downstream via a 24" RCP to Storm Manhole J01 then to Storm Manhole J02.

- Basin B02 (8.3 acres, Q_5= 5.5 CFS, Q_{100} = 20 CFS) contains lots fronting along the east side of Cypress Meadow Drive, north side of Highland Crest Drive and west side of Sage Mesa Way. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I01. All of the 5-year flow is captured by this inlet (Q_5= 5.5 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 2.9 CFS) continuing downstream to Inlet I02. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J02.

- The total pipe flow conveyed to Storm Manhole J02 is Q_5= 9.5 CFS, Q_{100} = 40 CFS and is conveyed via a 30" RCP to Storm Manhole J03 continuing via 30" RCP to Storm Manhole J06.

- Basin OS8 (24.2 acres, Q_5= 10 CFS, Q_{100} = 43 CFS) contains off-site area north of Meridian Ranch within the Latigo Trails subdivision entering the project on the north side via an existing 30" RCP culvert at Design Point 2. The surface runoff is concentrated within an existing swale, directed southerly onto Meridian Ranch and drainage basin B03. The surface runoff is conveyed southerly via an existing swale toward a proposed Type D Inlet located in Basin B03.

- Basin B03 (10.5 acres, Q_5= 5.6 CFS, Q_{100} = 23 CFS) contains rear portions of the lots on the east side of proposed Sage Mesa Way, a portion of the future water tank site and open space. The surface runoff will sheet flow off of the open space, rear portions of the lots and be directed to the existing swale carrying the flow from Latigo Trails to the proposed Type D Inlet (CB02). All of the flow (Q_5= 13 CFS, Q_{100} = 56 CFS) is captured and conveyed downstream via a 36" RCP to Storm Manhole J04. The pipe flow continues via 36" RCP from Storm Manhole J04 to Storm Manhole J05 and Storm Manhole J05 to Storm Manhole J06.

- The total pipe flow conveyed to Storm Manhole J06 is Q_5= 20 CFS, Q_{100} = 85 CFS and is conveyed via a 42" RCP to Storm Manhole J07.

- Basin B04 (10.6 acres, Q_5= 7.4 CFS, Q_{100} = 26 CFS) contains lots fronting along the east side of Sage Mesa Way, north side of Highland Crest Drive, west side of Estate Ridge Drive and a portion of the future water tank site. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I02. All of the 5-year flow is captured by this inlet (Q_5= 7.4 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 8.8 CFS) continuing downstream to Inlet I05. The captured flow is conveyed downstream via a 24" RCP to Storm Manhole J07.

- The total pipe flow conveyed to Storm Manhole J07 is Q_5= 26 CFS, Q_{100} = 97 CFS and is conveyed via a 42" RCP to Storm Manhole J08 continuing via 42" RCP to Storm Manhole J09.

- Basin B05 (5.6 acres, Q_5= 4.0 CFS, Q_{100} = 13 CFS) contains lots fronting along the east side of Estate Ridge Drive, open space and a portion of the future water tank site. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R flow-by inlet located at I06. Most of the flow is captured (Q_5= 3.6 CFS, Q_{100} = 9.6 CFS) with the remaining flow (Q_5= 0.5 CFS, Q_{100} = 3.7 CFS) continuing east along future developed land via existing temporary swale to the existing temporary sedimentation pond 3 constructed with Rough Grading Plans for Rolling Hills Ranch at Meridian Ranch located along future Rex Road, before being discharged to an existing swale and then Pond G. The temporary sedimentation pond will be removed with the future development of the Estates at Rolling Hills Ranch and Rex Road. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J09.

- Basin B06 (1.5 acres, Q_5= 1.1 CFS, Q_{100} = 3.9 CFS) contains lots fronting along the south side of Sunrise Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 15' Type R sump inlet located at I04. All of the flow is captured along with cross street flow from Inlet I03 (Q_5= 1.1 CFS, Q_{100} = 21 CFS). The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J10.

- Basin B07 (7.4 acres, Q_5= 5.1 CFS, Q_{100} = 18 CFS) contains lots fronting along Cypress Meadow Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to cross pan at Design Point 3. The flow continues via curb and gutter through Basin B08 to a proposed 20' Type R sump inlet located at I03.

- Basin B08 (9.4 acres, Q_5= 6.9 CFS, Q_{100} = 24 CFS) contains rear lots fronting along the south side of Highland Crest Drive and lots fronting along the north side of Sunrise Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R sump inlet located at I03. Flow from B07 and B08 combine at I03 with all of the 5-year flow being captured by this inlet (Q_5= 10 CFS) and about half of the 100-yr storm flow captured (Q_{100} = 17 CFS), with the remaining flow (Q_{100} = 18 CFS) continuing across the street to Inlet I04. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J10.

- The total pipe flow conveyed to Storm Manhole J10 is Q_5= 11 CFS, Q_{100} = 38 CFS and is conveyed via a 30" RCP to Storm Manhole J11.

- Basin B09 (6.1 acres, Q_5= 4.1 CFS, Q_{100} = 14 CFS) contains lots fronting along the south side of Highland Crest Drive, west side of Estate Ridge Drive and lots fronting along the north side of Sunrise Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I05. All of the 5-year flow is captured by this inlet (Q_5= 4.1 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 4.7 CFS) continuing downstream to Inlet I07. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J09.

- The total pipe flow conveyed to Storm Manhole J09 is Q_5= 31 CFS, Q_{100} = 117 CFS and is conveyed via a 42" RCP to Storm Manhole J11. Pipe flow from Storm Manhole J09 and Storm Manhole J10 combine at Storm Manhole J11 for a total of Q_5= 41 CFS, Q_{100} = 149 CFS and is conveyed via a 42" RCP to Storm Manhole J12.

- Basin B10 (12.2 acres, Q_5= 8.6 CFS, Q_{100} = 30 CFS) contains lots fronting along the south side of Sunrise Ridge Drive, west side of Estate Ridge Drive and lots fronting along the north side of Crescent Creek Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R forced sump inlet located at I07. All of the 5-year flow is captured by this inlet (Q_5= 8.6 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 14 CFS) continuing downstream to Inlet I09. The captured flow is conveyed downstream via a 24" RCP to Storm Manhole J12.

- The total pipe flow conveyed to Storm Manhole J12 is Q_5= 47 CFS, Q_{100} = 163 CFS and is conveyed via a 48" RCP to Storm Manhole J13.

- Basin B11 (0.4 acres, Q_5= 0.4 CFS, Q_{100} = 1.2 CFS) contains lots along the west side of Estate Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 10' Type R sump inlet located at I08. All of the flow is captured along with cross street flow from Inlet I09 (Q_5= 0.4 CFS, Q_{100} = 3.4 CFS). The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- Basin B12 (3.3 acres, Q_5= 2.3 CFS, Q_{100} = 7.9 CFS) contains lots fronting along the south side of Crescent Creek Drive and lots along the west side of Estate Ridge Drive. The surface runoff will sheet flow off the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R sump inlet located at I09. All of the 5-year flow is captured by this inlet (Q_5= 2.3 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 2.6 CFS) continuing across the street to Inlet I08. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- The total pipe flow conveyed to Storm Manhole J13 is Q_5= 49 CFS, Q_{100} = 179 CFS and is conveyed via a 54" RCP to Storm to discharge at design point OS2. OS2 discharges to a rip-rap lined channel that connects to the existing sandy arroyo connecting to existing Pond G.

Ultimate Storm Drain System Design

With the full build out of Rex Road, Basin B12 will increase the area that flows to Inlet I09. Therefore the design and construction of the storm drain system will be based on the following future basins.

- Basin FB11 (0.4 acres, Q_5= 0.4 CFS, Q_{100} = 1.2 CFS) contains lots along the west side of Estate Ridge Drive. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 10' Type R sump inlet located at I08. All of the flow is captured along with cross street flow from Inlet I09 (Q_5= 0.4 CFS, Q_{100} = 13 CFS). The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- Basin FB12 (6.2 acres, Q_5= 7.5 CFS, Q_{100} = 19 CFS) contains lots fronting along the south side of Crescent Creek Drive, lots along the west side of Estate Ridge Drive and the north side of Rex Road. The surface runoff will sheet flow off of the residential lots and be directed to the street, where the flow will be directed downstream to a proposed 20' Type R sump inlet located at I09. All of the 5-year flow is captured by this inlet (Q_5= 7.5 CFS) and most of the 100-yr storm flow is captured (Q_{100} = 17 CFS) with the remaining flow (Q_{100} = 12 CFS) continuing across the street to Inlet I08. The captured flow is conveyed downstream via an 18" RCP to Storm Manhole J13.

- The total pipe flow conveyed to Storm Manhole J13 is Q_5= 54 CFS, Q_{100} = 187 CFS and is conveyed via a 54" RCP to Storm to discharge at design point OS2. OS2 discharges to a rip-rap lined channel that connects to the existing sandy arroyo connecting to existing Pond G. The sandy arroyo was analyzed within the Rolling Hills Ranch Filing 1 Final Drainage Report for capacity and stability of the channel banks and bottom. The analysis indicates the future developed flow rate are anticipated to be lower than the historic flow rate and the channel to be stable. See the approved Final Drainage Report for Rolling Hills Ranch Filing 1 dated June 2020 for more information.

Storm Drain System C

- Basin C01 (12.0 acres, Q_5= 11 CFS, Q_{100} = 29 CFS) contains Rex Road and portions of the future Rolling Hills Ranch Filing 3. This area was first analyzed with the Rolling Hills Ranch 1-3 PUD and when fully developed will include single family residential lots, streets and storm drain. At this stage of development the area will remain in the as graded condition from the Rolling Hills Ranch Rough Grading operations. Rex Road and future development will sheet flow to a future sump location then be conveyed to a sedimentation pond located and the future storm drain outlet (OS1 from the Preliminary Drainage Report for Rolling Hills Ranch PUD). All of the flow will be discharged in the arroyo and conveyed downstream to the existing Pond G.

Storm Drain System D

- Basin D01 (9.6 acres, Q_5= 14 CFS, Q_{100} = 31 CFS) contains Rex Road Channel, the current site of the MSMD water filtration facility and future MSMD office and maintenance yard along with rear portions of lot located along Crescent Creek Drive. Any future improvements to the MSMD site will require a final drainage report to determine what if any additional drainage and water quality facilities are required at the time of design and construction. At this stage of development much of the MSMD area will remain in the as graded condition and developed will sheet flow to the adjacent rip-rap lined channel to the proposed box culvert crossing underneath Rex Road. All of the flow will be discharged in the arroyo and conveyed downstream to the existing Pond G.

Storm Drain System E

- Basin E01 (6.4 acres, Q_5= 4.8 CFS, Q_{100} = 15 CFS) contains the rear portion of lots along the east side of Estate Ridge Drive. The runoff from this area travels overland across undisturbed land to an existing temporary sedimentation pond then released to the arroyo channel and conveyed to Pond G in the interim condition. After development of Estates Filing 3 the area will travel overland across adjacent lots and collected by a storm drain system for discharge at the same location to be conveyed to Pond G.

- Basin E02 (0.6 acres, Q_5= 1.2 CFS, Q_{100} = 2.8 CFS) contains the rear portion of lots along the east side of Estate Ridge Drive. The runoff from this area travels overland across undisturbed land to an existing temporary sedimentation pond then released to the arroyo channel and conveyed to Pond G in the interim condition. After development of Estates Filing 3 the area will travel along future Crescent Creek Drive and collected by a storm drain system for discharge at the same location to be conveyed to Pond G.

- Basin E03 (2.6 acres, Q_5= 2.7 CFS, Q_{100} = 7.8 CFS) contains the rear portion of lots along the south side of Crescent Creek Drive, adjacent open space and portions of Rex Road. The runoff from this area travels overland across undisturbed land to an existing temporary sedimentation pond then released to the arroyo channel and conveyed to Pond G in the interim condition. After development of Estates Filing 3 the area will travel along future Rex Road and collected by a storm drain system for discharge at the same location to be conveyed to Pond G.

Existing Pond G was designed and constructed with this area anticipated to drain and be detained within it. Pond G contains a water quality component.

DETENTION POND

Pond G Detention Storage Criteria

Existing Detention Pond G was constructed with grading operations associated with the Rough Grading Plans for Rolling Hills Ranch at Meridian Ranch in anticipation of the future development of the Rolling Hills Ranch in accordance with the approved Sketch Plan. The pond is located within the Gieck Ranch Drainage Basin in the eastern portion of Rolling Hills Ranch adjacent to the Falcon Regional Park. The pond will be owned and maintained by the Meridian Service Metropolitan District (MSMD) and a maintenance agreement between the MSMD and El Paso County was recorded with the Rolling Hills Ranch Filing 1 final plat.

Pond G and the existing Pond F work in series such that the peak flow rates from the Meridian Ranch development do not adversely affect the drainage patterns downstream of the Meridian Ranch project. A permanent concrete control structure handles full build out of the tributary area and reduces the developed flows to approximate the historic peak flow rates for the full spectrum of design storms.

The existing concrete control structure the outlet of Pond G will attenuate the peak developed flow rates to approximately historic peak rates for the full spectrum of design storms as per the requirements set forth in Resolution 15-042 adopted by the Board of County Commissioners, County of El Paso. The control structure consists of a water quality control feature, a rectangular slotted orifice located on the front and a grated top to reduce the developed peak flow rates. Table 8 provides summary data for the various design storms for the completed development for all areas tributary to Pond G including Estates at Rolling Hills Ranch Filing 2. Pond G was designed and constructed to receive and discharge interim flow and the anticipated future developed flows and therefore there are no proposed changes to the existing pond or outlet structure.

Table 6: Pond G Summary Data

POND G				
	PEAK INFLOW	PEAK OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	FT
INTERIM CONDITIONS				
2-YEAR STORM	7.4	3.6	2.4	7026.0
5-YEAR STORM	33	9.8	6.7	7027.1
10-YEAR STORM	76	28	8.9	7027.5
50-YEAR STORM	333	206	17.0	7028.9
100-YEAR STORM	522	358	21.1	7029.6
FUTURE CONDITIONS				
2-YEAR STORM	26	5.1	4.7	7026.6
5-YEAR STORM	75	20	8.1	7027.4
10-YEAR STORM	141	53	10.8	7027.9
50-YEAR STORM	436	321	20.1	7029.5
100-YEAR STORM	668	472	25.3	7030.3

Downstream Analysis

The developed flow from this project will discharge at the westerly boundary of the Falcon Regional Park (G12), upstream of Eastonville Rd (DP G06). The discharge at this location during the interim period will be 358 CFS during the 100-yr storm event into an existing natural drainage course that traverses the regional park. The 100-year historical peak flow rate at the western boundary of the regional park is 536 CFS. The calculated 100-year developed flow rate will be 67% of the historic flow rate. See Table 7 for a complete comparative list of the peak flow rates for the key design points impacted by the development of the Estates at Rolling Hills Ranch Filing 2.

Table 7: Key Design Point Comparison – Interim SCS Model

MERIDIAN RANCH DISCHARGE KEY DESIGN POINTS (INTERIM)						
		PEAK DISCHARGE Q_{100} (CFS)	PEAK DISCHARGE Q_{50} (CFS)	PEAK DISCHARGE Q_{10} (CFS)	PEAK DISCHARGE Q_5 (CFS)	PEAK DISCHARGE Q_2 (CFS)
G12 - DISCHARGE POINT AT REGIONAL PARK (G05 - HISTORIC)	Historic	536	350	84	30	5
	Interim	358	206	28	10	4
	% of Historic	67%	59%	33%	33%	70%
G06 - EASTONVILLE ROAD[1]	Historic	551	369	88	32	6
	Interim	377	217	29	11	4
	% of Historic	68%	59%	33%	34%	72%

[1] Flow rate at Eastonville Rd. listed for reference only

The outlet (DP G12) for the Future Pond G will be located west of the Falcon Regional Park, upstream of Eastonville Rd (DP G06). At full buildout the discharge from Pond G will be 472 CFS during the 100-yr storm event into an existing natural drainage course that traverses

the regional park. The 100-year historical peak flow rate at the western boundary of the regional park is 536 CFS. The calculated 100-year developed flow rate will be 88% of the historic flow rate. The developed peak flow rate for the full spectrum of design storms are calculated to be below that of the corresponding historic peak flow rates. See Table 8 for a complete comparative list of the peak flow rates for the key design points impacted by the development of Rolling Hills Ranch.

Table 8: Key Design Point Comparison – Future SCS Model

MERIDIAN RANCH DISCHARGE KEY DESIGN POINTS (FUTURE)						
		PEAK DISCHARGE Q_{100} (CFS)	PEAK DISCHARGE Q_{50} (CFS)	PEAK DISCHARGE Q_{10} (CFS)	PEAK DISCHARGE Q_5 (CFS)	PEAK DISCHARGE Q_2 (CFS)
G12 - POND G OUTLET REGIONAL PARK (G05 - HISTORIC)	Historic	536	350	84	30	5
	Future	472	321	53	20	5
	% of Historic	88%	92%	64%	68%	98%
G06 - EASTONVILLE ROAD[1]	Historic	551	369	88	32	6
	Future	498	338	57.6	22	11
	% of Historic	90%	92%	65%	70%	190%

[1] Flow rate at Eastonville Rd. listed for reference only

REX ROAD BOX CULVERT

Rex Road will cross the channel connecting Pond F to Pond G, a 4'x 10' concrete box culvert is proposed for this crossing. The channel between the outlet of Pond F and the box culvert is rip-rap lined and downstream of the culvert the channel remains in the natural condition with some minor band and channel stabilization rip-rap placement as needed. All of the channel work was completed at with the Rough Grading Plans for Rolling Hills Ranch Filing 1-3. The channel analysis can be found in the Final Drainage Report for Rolling Hills Ranch Filing 1.

The box culvert is designed to convey the 100-year peak flow rate of 185 CFS safely under Rex Road and conveyed to Pond G.

DRAINAGE FEES

The proposed development falls in the Gieck Ranch Drainage Basin. The entire development occupies 117.21 acres of residential development of which 64.04 acres are residential development and 14.35 acres are designated as right-of-way, the remainder is open space.

The following is the imperviousness calculation:

	Acres	Assumed Imperviousness	Impervious Acres
Open Space	38.82	3%	1.16
Right-of-way	14.35	90%	12.91
Residential Lots	64.04	20% (98 Lots)	12.81
Total	117.21		26.88=22.93% imperv

GIECK RANCH FEES:

Drainage Fees: There are no drainage fees for this basin.

Bridge Fees: There are no bridge fees for this basin.

CONCLUSION

The rational and SCS based hydrologic calculation methods were used to estimate the historic and developed runoff values to determine the impact of this project on surrounding property. The resulting calculations were used to estimate the hydraulic impact on the existing and proposed facilities. Finally, the model storms were analyzed to simulate the impacts of storm events of various return periods on the existing detention pond and downstream facilities. Based on the aforementioned design parameters the development of the project will not adversely affect downstream properties.

EROSION CONTROL DESIGN

General Concept

Historically, erosion on this property has been held to a minimum by a variety of natural features and agricultural practices including:

- Substantial prairie grass growth
- Construction of drainage arresting berms
- Construction of multiple stock ponds along drainage courses

Existing temporary sediment ponds will also help to minimize erosion by reducing both the volume and velocity of the peak runoff.

During construction, best management practices (BMP) for erosion control will be employed based on El Paso county Criteria. BMP's will be utilized as deemed necessary by the contractor and/or engineer and are not limited to the measures shown on the construction drawing set. The contractor shall minimize the amount of area disturbed during all construction activities.

In general the following shall be applied in developing the sequence of major activities:

- Install down-slope and side-slope perimeter BMP's before the land disturbing activity occurs.
- Do not disturb an area until it is necessary for the construction activity to proceed
- Cover or stabilize as soon as possible.
- Time the construction activities to reduce the impacts from seasonal climatic changes or weather events.
- The construction of filtration BMP's should wait until the end of the construction project when upstream drainage areas have been stabilized.
- Do not remove the temporary perimeter controls until after all upstream areas are stabilized.

Four Step Process

The following four step process is recommended for selecting structural BMP's in developing urban areas:

Step 1: Employ Runoff Reduction Practices

This development incorporates wider rights-of-way than other developments, thus increasing the amount of pervious area within the right-of-way. With the rights-of-way within Meridian Ranch at 60 ft. instead of the normal 50 ft., the amount of pervious area per lineal foot is tripled from 5' wide to 15' wide.

The project has over thirty acres of open space, accounting for over 28% of the entire project, creating a lower density development.

Homeowners and builders are encouraged to direct roof drains to the sideyards where the runoff will travel overland to the streets and creating an opportunity to allow the runoff to infiltrate into the ground.

Step 2: Stabilize Drainageways

The drainage swale located adjacent and south of the project was designed to have a wide flat bottom and slope reducing the velocity of the concentrated flow traveling along the drainageway. The construction of the swale also included erosion control along the entire length of the swale.

Step 3: Provide Water Quality Capture Volume (WQCV)

An existing extended detention pond with water quality capture volume is located to the east of the project that was designed to accommodate the runoff from this development.

Step 4: Consider Need for Industrial and Commercial BMP's

This project is neither industrial nor commercial and therefore this section does not apply.

Detention Pond

The detention ponds will act as the primary water quality control for the areas within the project boundaries. Runoff will be collected by the proposed storm drainage system and diverted into the detention pond where practical. The pond will serve a dual purpose: first, by facilitating the settling of sediment in runoff during and after construction (by means of the WQCV) and, second, by maintaining runoff at or below existing levels.

Silt Fence

Silt fence will be place along downstream limits of disturbed areas. This will prevent suspended sediment from leaving the site during infrastructure construction. Silt fencing is to remain in place until vegetation is reestablished.

Erosion Bales

Erosion bales will be placed ten (10) feet from the inlet of all culverts during construction to prevent culverts from filling with sediment. Erosion bales will remain in place until vegetation is reestablished. Erosion bale checks will be used on slopes greater than 1 percent to reduce flow velocities until vegetation is reestablished.

Miscellaneous

Best erosion control practices will be utilized as deemed necessary by the Contractor or Engineer and are not limited to the measures described above.

REFERENCES

1. "City of Colorado Springs/El Paso County Drainage Criteria Manual" September 1987, Revised November 1991, Revised October 1994.

2. Chapter 6, Hydrology and Chapter 11, Storage, Section 3.2.1 of the "City of Colorado Springs Drainage Criteria Manual" May 2014.

3. "Volume 2, El Paso County/City of Colorado Springs Drainage Criteria Manual-Stormwater Quality Policies, Procedures and Best Management Practices" November 1, 2002.

4. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

5. Soils Survey of El Paso County area, Natural Resources Conservation Services of Colorado.

6. Master Development Drainage Plan Meridian Ranch. August 2000. Prepared by URS Corp.

7. Revision to Master Development Drainage Plan Meridian Ranch. May 2015. Prepared by Tech Contractors.

8. Master Development Drainage Plan Latigo Trails. October 2001. Prepared by URS Corp.

9. Final Drainage Report for Meridian Ranch Estates Filing 2. July 2013. Prepared by Tech Contractors.

10. Revision to Master Development Drainage Plan Meridian Ranch. July 2015. Prepared by Tech Contractors.

11. Final Drainage Report for Meridian Ranch Estates Filing 3. October 2015. Prepared by Tech Contractors.

12. Revision to Master Development Drainage Plan Meridian Ranch. January 2018. Prepared by Tech Contractors.

13. "Urban Storm Drainage Criteria Manual" September 1969, Revised January 2016.

14. Preliminary/Final Drainage Report for Estates at Rolling Hills Ranch Filing 1 at Meridian Ranch. March 2020. Prepared by Tech Contractors.

15. Preliminary Drainage Report for Rolling Hills Ranch PUD at Meridian Ranch. April 2020. Prepared by Tech Contractors.

16. Final Drainage Report for Rolling Hills Ranch Filing 1 at Meridian Ranch. June 2020. Prepared by Tech Contractors.

Appendices

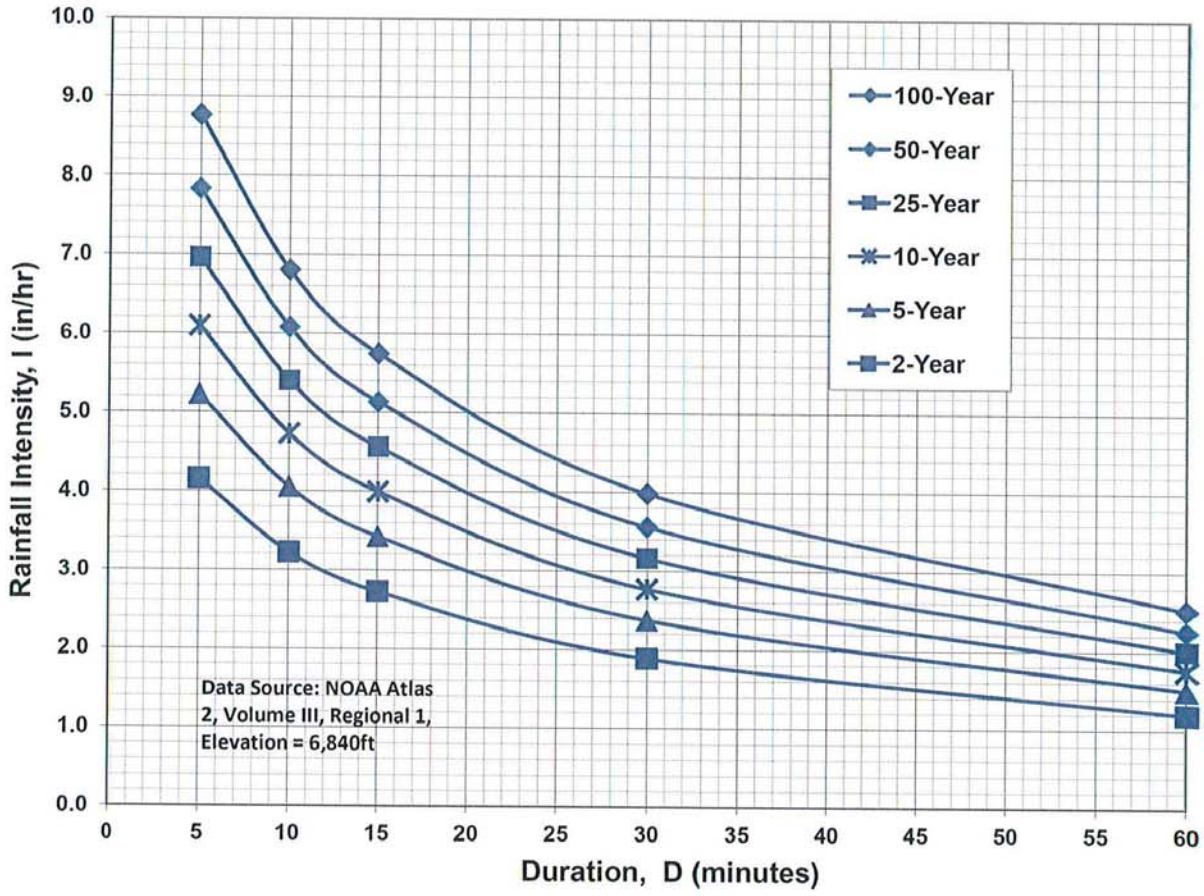
Appendix A – Rational Calculations

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	0.66	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	0.96	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 6-5. 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.

COMPOSITE 'C' FACTORS

PROJECT: **Estates at Rolling Hills Ranch Filing 2** 9/16/2020

BASIN DESIGNATION	AREA (AC.)											COMPOSITE FACTOR		Percent Impervious
	UNDEV	2.5 AC	1 DU/AC	2 DU/AC	3 DU/AC	GRADED	TANK SITE	STREETS	OPEN SPACE PARKS/GC LAWNS	COMM	TOTAL	5-year	100-year	
OS7c	5.9	4.1									10.0	**0.12**	**0.38**	**4.6%**
A01	4.7		1.4								6.1	**0.11**	**0.38**	**4.4%**
OS8	1.7	23.5									25.2	**0.16**	**0.40**	**10.3%**
B01	9.0		2.3								11.3	**0.11**	**0.38**	**4.0%**
B02	0.4		4.1	3.8							8.3	**0.20**	**0.45**	**21.5%**
B03	7.8		1.0				1.7				10.5	**0.16**	**0.41**	**13.2%**
B04	0.1		3.9	6.3			0.3				10.6	**0.22**	**0.46**	**24.1%**
B05	1.8		1.5	1.0			1.3				5.6	**0.23**	**0.46**	**25.9%**
B06				1.5							1.5	**0.22**	**0.46**	**25.0%**
B07			3.5	3.6					0.4		7.4	**0.21**	**0.45**	**21.5%**
B08				9.4							9.4	**0.22**	**0.46**	**25.0%**
B09				6.1							6.1	**0.22**	**0.46**	**25.0%**
B10				12.2							12.2	**0.22**	**0.46**	**25.0%**
B11				0.4							0.4	**0.22**	**0.46**	**25.0%**
B12				3.3							3.3	**0.22**	**0.46**	**25.0%**
C01						8.5		1.1	2.4		12.0	**0.27**	**0.45**	**9.6%**
D01				3.8					2.5	3.3	9.5	**0.44**	**0.59**	**43.3%**
E01	2.0					1.8		0.6	2.0		6.4	**0.24**	**0.44**	**9.3%**
E02	0.3							0.2	0.1		0.6	**0.40**	**0.58**	**35.1%**
E03	1.5			0.2				0.5	0.3		2.6	**0.29**	**0.50**	**23.7%**
											158.8		**Composite:**	**17.3%**
TOTAL	35.2	27.6	17.6	51.4	0.0	10.3	3.3	2.4	7.6	3.3	158.8	**0.21**	**0.44**	**17.3%**
FB11				0.4							0.4	**0.22**	**0.46**	**25.0%**
FB12				3.8				1.4	1.1		6.2	**0.38**	**0.56**	**38.0%**
FC01					3.7			1.0	1.5		6.2	**0.35**	**0.53**	**34.0%**
											146.3		**Composite:**	**21.1%**
TOTAL	31.4	27.6	17.6	51.7	3.7	0.0	3.3	2.4	5.4	6.6	149.6	**0.22**	**0.45**	**21.1%**

A01	4.7		1.4								6.1	**0.12**	**0.38**	**4.6%**
C01						8.5		1.1	2.4		12.0	**0.27**	**0.45**	**9.6%**

TIME OF CONCENTRATION

PROJECT: **Estates at Rolling Hills Ranch Filing 2** DATE: 9/16/2020

TIME OF CONCENTRATION																	
SUBBASIN DATA			INIT./OVERLAND TIME (T_i)				TRAVEL TIME (T_t)							TOTAL	Tc Check (Urbanized Basins)		FINAL T_c
BASIN DESIGNATION	C_5	AREA (AC)	LENGTH (FT)	ΔH	SLOPE %	Ti (Min.)*	LENGTH (FT)	ΔH	SLOPE %	CONVEYANCE TYPE	CONVEYANCE COEF.	VEL. (FPS)	Tt (Min.)**	Ti+Tt (Min.)	L (FT)	Tc = (L/180) + 10	(min)
OS7c	0.12	10.0	190	11.0	5.8%	13.8	890	50	5.6%	G	15	3.6	4.2	18.0	1080.00	16.0	**16.0**
A01	0.11	6.1	185	6.0	3.2%	16.6	1275	34	2.7%	L	7	1.1	18.6	35.2	1460.00	18.1	**18.1**
OS8	0.16	25.2	FROM APPROVED MERIDIAN RANCH FILING MDDP, JAN 2018														**26.6**
B01	0.11	11.3	230	9.0	3.9%	17.4	1050	31	3.0%	L	7	1.2	14.5	32.0	1280.00	17.1	**17.1**
B02	0.20	8.3	290	15.0	5.2%	16.2	1135	21	1.9%	P	20	2.7	7.0	23.1	1425.00	17.9	**17.9**
B03	0.16	10.5	300	7.0	2.3%	22.4	1120	37	3.3%	G	15	2.7	6.8	29.2	1420.00	17.9	**17.9**
B04	0.22	10.6	260	23.0	8.8%	12.6	1270	23	1.8%	P	20	2.7	7.9	20.5	1530.00	18.5	**18.5**
B05	0.23	5.6	300	20.0	6.7%	14.6	1500	42	2.8%	P	20	3.3	7.5	22.1	1800.00	20.0	**20.0**
B06	0.22	1.5	30	0.6	2.0%	7.0	1150	14	1.2%	P	20	2.2	8.7	15.7	1180.00	16.6	**15.7**
B07	0.21	7.4	300	12.0	4.0%	17.8	1080	25	2.3%	P	20	3.0	5.9	23.7	1380.00	17.7	**17.7**
B08	0.22	9.4	300	11.0	3.7%	18.1	890	8	0.9%	P	20	1.9	7.8	25.9	1190.00	16.6	**16.6**
B09	0.22	6.1	30	0.6	2.0%	7.0	2030	32	1.6%	P	20	2.5	13.5	20.5	2060.00	21.4	**20.5**
B10	0.22	12.2	300	14.0	4.7%	16.7	1230	25	2.0%	P	20	2.9	7.2	23.9	1530.00	18.5	**18.5**
B11	0.22	0.4	30	0.6	2.0%	7.0	170	4	2.4%	P	20	3.1	0.9	7.9	200.00	11.1	**7.9**
B12	0.22	3.3	195	13.0	6.7%	12.0	1480	29	2.0%	P	20	2.8	8.8	20.8	1675.00	19.3	**19.3**
C01	0.27	12.0	185	9.0	4.9%	12.2	1310	35	2.7%	B	10	1.6	13.4	25.5	1495.00	18.3	**18.3**
D01	0.44	9.5	100	2.0	2.0%	9.7	1200	37	3.1%	L	7	1.2	16.3	25.9	1300.00	17.2	**17.2**
E01	0.24	6.4	125	4.0	3.2%	12.0	375	6	1.6%	L	7	0.9	7.1	19.0	500.00		**19.0**
E02	0.40	0.6	45	2.0	4.4%	5.2	375	12	3.2%	P	20	3.6	1.7	7.0	420.00	12.3	**7.0**
E03	0.29	2.6	125	4.0	3.2%	11.3	595	13	2.2%	P	20	3.0	3.4	14.6	720.00	14.0	**14.0**
FB11	0.22	0.4	30	0.6	2.0%	7.0	170	4	2.4%	P	20	3.1	0.9	7.9	200.00	11.1	**7.9**
FB12	0.38	6.2	195	13.0	6.7%	9.8	1480	29	2.0%	P	20	2.8	8.8	18.7	1675.00	19.3	**18.7**
FC01	0.35	6.2	185	9.0	4.9%	11.0	985	25	2.5%	P	20	3.2	5.2	16.2	1170.00	16.5	**16.2**

Notes:

* $Ti = \frac{0.395\,(1.1-C5)L^{0.5}}{S^{0.33}}$

$V = C_V S_W^{0.5}$

** $Tt = L \times V$

TYPE OF SURFACE		C_V
HEAVY MEADOW	H	2.5
TILLAGE/FIELD	T	5
RIPRAP (not buried)	R	6.5
SHORT PASTURE AND LAWNS	L	7
NEARLY BARE GROUND	B	10
GRASSED WATERWAY	G	15
PAVED AREAS	P	20

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
SURFACE ROUTING

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/16/2020

	DIRECT RUNOFF											TOTAL RUNOFF							OVERLAND TRAVEL TIME						
				I (in./ hr.)		COEFF. ©		CA		Q			I (in./ hr.)		CA		Q								
DESIGN POINT	BASIN	AREA (AC)	Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	DESTINATION DP	CONVEYANCE TYPE	COEFFICIENT C_V	SLOPE %	VEL. (FPS)	LENGTH (FT)	TRAVEL TIME Tt
DEVELOPED																									
DP1	OS7c	10.0	16.0	3.42	5.75	0.12	0.38	1.19	3.76	4.1	22						**4.1**	**22**	ECB	G	15.0	2.26%	2.3	1500	11.1
ECB	A01	6.1	18.1	3.24	5.44	0.11	0.38	0.70	2.30	2.3	13	27.1	2.63	4.42	1.89	6.06	**5.0**	**27**							
DP2	OS8	25.2	26.6	2.66	4.47	0.16	0.40	3.91	10.01	10.4	45						**10**	**45**	CB02	G	15.0	2.82%	2.5	780	5.2
CB01	B01	11.3	17.1	3.32	5.58	0.11	0.38	1.26	4.24	4.2	24						**4.2**	**24**							
I01	B02	8.3	17.9	3.25	5.46	0.20	0.45	1.69	3.68	5.5	20						**5.5**	**20**	I03	P	20.0	1.33%	2.3	900	6.5
CB02	B03	10.5	17.9	3.26	5.47	0.16	0.41	1.73	4.29	5.6	23	31.8	2.40	4.02	5.64	14.30	**14**	**57**							
I02	B04	10.6	18.5	3.21	5.38	0.22	0.46	2.32	4.84	7.4	26						**7.4**	**26**	I05	P	20.0	2.10%	2.9	565	3.2
I06	B05	5.6	20.0	3.09	5.19	0.23	0.46	1.31	2.57	4.0	13.3						**4.0**	**13**							
I04	B06	1.5	15.7	3.45	5.80	0.22	0.46	0.32	0.68	1.1	3.9	25.3	2.74	4.60	0.32	4.54	**1.1**	**21**							
DP3	B07	7.4	17.7	3.28	5.50	0.21	0.45	1.57	3.33	5.1	18.3						**5.1**	**18**	I03	P	20.0	1.00%	2.0	880	7.3
I03	B08	9.4	16.6	3.37	5.65	0.22	0.46	2.06	4.30	6.9	24.3	25.0	2.75	4.62	3.63	7.63	**10**	**35**	I04	P	20.0	1.00%	2.0	30	0.3
I05	B09	6.1	20.5	3.05	5.13	0.22	0.46	1.34	2.80	4.1	14.4	21.7	2.96	4.97	1.34	4.44	**4.1**	**22**	I07	P	20.0	2.80%	3.3	455	2.3
I07	B10	12.2	18.5	3.21	5.38	0.22	0.46	2.68	5.61	8.6	30.2	24.0	2.81	4.72	2.68	6.55	**8.6**	**31**	I09	P	20.0	2.00%	2.8	235	1.4
I08	B11	0.4	7.9	4.48	7.51	0.22	0.46	0.08	0.17	0.4	1.2	25.6	2.72	4.56	0.08	0.74	**0.4**	**3.4**							
I09	B12	3.3	19.3	3.14	5.27	0.22	0.46	0.72	1.50	2.3	7.9	25.4	2.73	4.58	0.72	4.37	**2.3**	**20**	I08	P	20.0	1.00%	2.0	30	0.3
DP4	C01	12.0	18.3	3.22	5.41	0.27	0.45	3.27	5.44	10.5	29.4						**11**	**29**							
DPG7	D01	9.5	17.2	3.31	5.56	0.44	0.59	4.16	5.65	13.8	31.4						**14**	**31**							
DP5	E01	6.4	19.0	3.16	5.31	0.24	0.44	1.52	2.80	4.8	14.8						**4.8**	**15**							
DP6	E02	0.6	7.0	4.67	7.84	0.40	0.58	0.25	0.36	1.2	2.8						**1.2**	**2.8**							
DP8	E03	2.6	14.0	3.62	6.08	0.29	0.50	0.74	1.28	2.7	7.8						**2.7**	**7.8**							
I08	FB11	0.4	7.9	4.48	7.51	0.22	0.46	0.08	0.17	0.4	1.2	25.6	2.72	4.56	0.08	2.76	**0.4**	**13**							
I09	FB12	6.2	18.7	3.19	5.36	0.38	0.56	2.35	3.52	7.5	18.9	25.4	2.73	4.58	2.35	6.39	**7.5**	**29**	I08	P	20.0	1.00%	2.0	30	0.3
	FC01	6.2	16.2	3.41	5.72	0.35	0.53	2.16	3.28	7.3	18.7						**7.3**	**19**							

STORM DRAINAGE SYSTEM DESIGN
INLET CALCULATIONS

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/16/2020

								Q_{Total}		$Q_{Capture}$				$Q_{Flow-by}$				DEPTH (max)		SPREAD	
DP	BASIN	Inlet size L(i)	Proposed or Existing	INLET TYPE	CROSS SLOPE	STREET SLOPE	T_c	Q_5 (cfs)	Q_{100} (cfs)	Q_5 (cfs)	Q_{100} (cfs)	$CA_{eqv.}$ (5-yr)	$CA_{eqv.}$ (100-yr)	Q_5 (cfs)	Q_{100} (cfs)	$CA_{eqv.}$ (5-yr)	$CA_{eqv.}$ (100-yr)	Q_5 (ft)	Q_{100} (ft)	Q_5 (ft)	Q_{100} (ft)
ECB	A01	Type C	PROP	SUMP	2.0%		27.1	5.0	27	5.0	27	1.89	6.06	-	-	-	-	0.42	2.2		
CB01	B01	Type C	PROP	SUMP	2.0%		17.1	4.2	24	4.2	24	1.26	4.24	-	-	-	-	0.39	1.7		
I01	B02	20	PROP	SUMP[1]	2.0%		17.9	5.5	20	5.5	17	1.69	3.16	-	2.9	-	0.52	0.47	0.47		
CB02	B03	Type D	PROP	SUMP	2.0%		31.8	13.5	57	13.5	57	5.64	14.30	-	-	-	-	0.53	1.7		
I02	B04	20	PROP	SUMP[1]	2.0%		18.5	7.4	26.1	7.4	17.3	2.32	3.21	-	8.8	-	1.64	0.47	0.47		
I03	B08	20	PROP	SUMP	2.0%		25.0	10.0	35.3	10.0	17.4	3.63	3.76	-	17.9	-	3.87	0.47	0.47		
I04	B06	15	PROP	SUMP	2.0%		25.3	1.1	20.9	1.1	20.9	0.41	4.54	-	-	-	-	0.50	0.67		
I05	B09	20	PROP	SUMP[1]	2.0%		21.7	4.1	22.1	4.1	17.4	1.38	3.50	-	4.7	-	0.94	0.47	0.47		
I06	B05	20	PROP	FLOW-BY	2.0%	1.0%	20.0	4.0	13	3.6	9.6	1.16	1.85	0.5	3.7	0.15	0.72	0.33	0.47	12.2	19.0
I07	B10	20	PROP	SUMP[1]	2.0%		24.0	8.6	31.0	8.6	17.4	3.06	3.68	-	13.6	-	2.87	0.47	0.47		
I08	B11	10	PROP	SUMP	2.0%		25.6	0.4	3.4	0.4	3.4	0.13	0.74	-	-	-	-	0.50	0.70		
I09	B12	20	PROP	SUMP	2.0%		25.4	2.3	20.0	2.3	17.4	0.83	3.80	-	2.6	-	0.58	0.47	0.47		
I08	FB11	10	PROP	SUMP	2.0%		25.6	0.4	12.6	0.4	12.6	0.13	2.76	-	-	-	-	0.50	0.70		
I09	FB12	20	PROP	SUMP	2.0%		25.4	7.5	29.3	7.5	17.4	2.74	3.80	-	11.9	-	2.59	0.47	0.47		

[1] Forced sump at intersection

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
PIPE ROUTING

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/16/2020

UPSTREAM DESIGN POINT	UPSTREAM BASIN	INLET FLOW							SYSTEM FLOW							TRAVEL TIME						
			I (in./ hr.)		CA		Q			I (in./ hr.)		CA		Q								
		Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	PIPE DIA	ROUGHNESS (n)	DESTINATION DP	SLOPE %	LENGTH (FT)	VEL. (FPS) (Estimate)*	TRAVEL TIME Tt
CB01	B01	17.1	3.32	5.58	1.26	4.24	4.2	24						**4.2**	**24**	24	0.013	J01	1.85%	256	10	0.4
J01									17.5	3.29	5.52	1.26	4.24	**4.1**	**23**	24	0.013	J02	1.65%	386	9	0.7
I01	B02	17.9	3.25	5.46	1.69	3.16	5.5	17						**5.5**	**17**	18	0.013	J02	0.99%	25	6	0.1
J02									18.2	3.23	5.42	2.95	7.40	**9.5**	**40**	30	0.013	J03	0.86%	411	8	0.9
J03									19.1	3.16	5.30	2.95	7.40	**9.3**	**39**	30	0.013	J06	2.54%	224	13	0.3
CB02	B03	31.8	2.40	4.02	5.64	14.30	13.5	57						**14**	**57**	36	0.013	J04	1.04%	169	10	0.3
J04									32.1	2.38	4.00	5.64	14.30	**13**	**57**	36	0.013	J05	2.45%	171	15	0.2
J05									32.2	2.37	3.98	5.64	14.30	**13**	**57**	36	0.013	J06	4.48%	29	20	0.0
J06									32.3	2.37	3.98	8.59	21.70	**20**	**86**	42	0.013	J07	1.11%	234	11	0.4
I02	B04	18.5	3.21	5.38	2.32	3.21	7.4	17						**7.4**	**17**	24	0.013	J07	2.14%	5	11	0.0
J07									32.6	2.36	3.95	10.91	24.91	**26**	**98**	42	0.013	J08	1.50%	37	13	0.0
J08									32.7	2.35	3.95	10.91	24.91	**26**	**98**	42	0.013	J09	2.45%	501	16	0.5
I03	B08	25.0	2.75	4.62	3.63	3.76	10.0	17						**10**	**17**	18	0.013	J10	0.99%	25	6	0.1
I04	B06	25.3	2.74	4.60	0.41	4.54	1.1	21						**1.1**	**21**	18	0.013	J10	4.83%	5	13	0.0
J10									25.3	2.74	4.60	4.04	8.31	**11**	**38**	30	0.013	J11	3.19%	459	15	0.5
I05	B09	21.7	2.96	4.97	1.38	3.50	4.1	17						**4.1**	**17**	18	0.013	J09	4.26%	25	12	0.0
I06	B05	20.0	3.09	5.19	1.16	1.85	3.6	10						**3.6**	**9.6**	18	0.013	J09	1.01%	45	6	0.1
J09									33.2	2.33	3.91	13.45	30.25	**31**	**118**	42	0.013	J11	1.98%	23	15	0.0
J11									33.2	2.33	3.91	17.48	38.56	**41**	**151**	42	0.013	J12	2.79%	404	18	0.4
I07	B10	24.0	2.81	4.72	3.06	3.68	8.6	17						**8.6**	**17**	24	0.013	J12	1.03%	24	7	0.1
J12									33.6	2.31	3.88	20.54	42.24	**47**	**164**	48	0.013	J13	1.87%	246	16	0.3
I08	B11	25.6	2.72	4.56	0.13	0.74	0.4	3						**0.4**	**3.4**	18	0.013	J13	1.03%	24	6	0.1
I09	B12	25.4	2.73	4.58	0.83	3.80	2.3	17						**2.3**	**17**	18	0.013	J13	5.99%	4	15	0.0
J13									33.9	2.30	3.86	21.50	46.78	**49**	**181**	54	0.013	OS2	1.27%	169	14	0.2
I08	FB11	25.6	2.72	4.56	0.13	2.76	0.4	13						**0.4**	**13**	18	0.013	J13	1.03%	24	6	0.1
I09	FB12	25.4	2.73	4.58	2.74	3.80	7.5	17						**7.5**	**17**	18	0.013	J13	5.99%	4	15	0.0
J13									33.9	2.30	3.86	23.41	48.80	**54**	**188**	54	0.013	OS2	1.27%	169	14	0.2
ECB	A01	27.1	2.63	4.42	1.89	6.06	5.0	27								24	0.013	OSJ01	1.02%	229	7	0.5
OSJ01									27.6	2.61	4.37	1.89	6.06	**4.9**	**27**	24	0.013	OSJ02	1.99%	396	10	0.6
OSJ02									28.3	2.57	4.31	1.89	6.06	**4.8**	**26**	24	0.013	OS1	4.67%	177	16	0.2

* Velocity estimated for calculation of travel time. Refer to Hydraulics for calculated velocity.

STORM DRAINAGE SYSTEM DESIGN

HYDRAULICS

PROJECT: **Estates at Rolling Hills Ranch Filing 2** Date: 9/16/2020

Label	Upstrm Node	Dnstrm Node	Intlet CA (acres)	Inlet Tc (min)	Inlet Flow (ft³/s)	System CA (acres)	System Flow Time (min)	System Intensity (in/hr)	Length (ft)	Section Size (in)	Slope (%)	Capacity (Full Flow) (ft³/s)	System Flow (ft³/s)	Velocity (Ave) (ft/s)	Elevation Ground (Upstrm) (ft)	Hydraulic Grade Line (Upstrm) (ft)	Invert (Upstrm) (ft)	Elevation Ground (Dnstrm) (ft)	Hydraulic Grade Line (Dnstrm) (ft)	Invert (Dnstrm) (ft)
P01	CB01	J01	4.24	17.1	24	4.24	17.1	5.58	256.0	24	1.86%	31	24	11	7145.00	7143.5	7141.75	7142.84	7139.5	7137.00
P02	J01	J02				4.24	17.5	5.52	385.7	24	1.65%	29	24	10	7142.84	7138.7	7137.00	7135.99	7132.6	7130.65
P03	I01	J02	3.16	17.9	17	3.16	17.9	5.47	25.2	18	0.99%	11	17	9.9	7135.89	7134.0	7131.40	7135.99	7133.3	7131.15
P04	J02	J03				7.40	18.1	5.44	411.4	30	0.86%	38	41	8.7	7135.99	7132.4	7130.15	7131.83	7128.8	7126.60
P05	J03	J06				7.40	18.9	5.33	223.9	30	2.55%	65	40	14	7131.83	7128.7	7126.60	7126.14	7124.1	7120.90
P06	CB02	J04	14.30	31.8	58	14.30	31.8	4.02	168.6	36	1.04%	68	58	11	7132.00	7130.1	7127.65	7132.65	7129.2	7125.90
P07	J04	J05				14.30	32.1	4.00	171.4	36	2.45%	104	58	15	7132.65	7128.4	7125.90	7127.45	7124.9	7121.70
P08	J05	J06				14.30	32.3	3.98	29.0	36	4.48%	141	57	8.1	7127.45	7124.7	7121.70	7126.14	7124.5	7120.40
P09	J06	J07				21.70	32.3	3.98	234.1	42	1.11%	106	87	9.0	7126.14	7123.9	7119.90	7123.69	7122.2	7117.30
P10	I02	J07	3.21	18.5	17	3.21	18.5	5.38	4.7	24	2.14%	33	17	5.5	7123.89	7122.2	7118.90	7123.69	7122.2	7118.80
P11	J07	J08				24.91	32.7	3.94	36.7	42	1.50%	123	99	10	7123.69	7121.2	7117.30	7123.40	7120.8	7116.75
P12	J08	J09				24.91	32.8	3.94	501.5	42	2.45%	158	99	17	7123.40	7119.8	7116.75	7112.13	7108.3	7104.45
P13	I05	J09	3.50	21.7	18	3.50	21.7	4.98	24.7	18	4.26%	22	18	9.9	7112.04	7110.6	7107.50	7112.13	7110.0	7106.45
P14	I06	J09	1.85	20.0	9.7	1.85	20.0	5.19	44.7	18	1.01%	11	10	5.5	7111.44	7110.3	7106.90	7112.13	7110.0	7106.45
P15	J09	J11				30.26	33.3	3.90	22.7	42	1.99%	142	119	12	7112.13	7108.1	7104.45	7111.54	7107.8	7104.00
P16	I03	J10	3.76	25.0	18	3.76	25.0	4.62	25.2	18	0.99%	11	18	9.9	7125.43	7123.3	7120.90	7125.20	7122.6	7120.65
P17	I04	J10	4.54	25.3	21	4.54	25.3	4.59	5.2	18	4.84%	23	21	12	7125.43	7122.8	7120.90	7125.20	7122.6	7120.65
P18	J10	J11				8.30	25.3	4.59	459.2	30	3.19%	73	38	15	7125.20	7121.7	7119.65	7111.54	7110.4	7105.00
P19	J11	J12				38.56	33.3	3.90	403.8	42	2.79%	168	152	20	7111.54	7107.4	7104.00	7099.58	7096.2	7092.75
P20	I07	J12	3.68	24.0	18	3.68	24.0	4.73	24.2	24	1.03%	23	18	5.6	7099.49	7098.2	7094.50	7099.58	7098.0	7094.25
P21	J12	J13				42.24	33.7	3.87	246.0	48	1.87%	196	165	18	7099.58	7096.0	7092.25	7094.79	7090.5	7087.65
P22	I09	J13	3.80	25.4	18	3.80	25.4	4.58	4.2	18	6.00%	26	18	9.9	7094.94	7093.0	7090.40	7094.79	7092.9	7090.15
P23	I08	J13	2.76	25.6	13	2.76	25.6	4.56	24.2	18	1.03%	11	13	7.2	7094.94	7093.2	7090.40	7094.79	7092.9	7090.15
P24	J13	OS2				48.80	33.9	3.86	169.0	54	1.27%	222	190	16	7094.79	7091.1	7087.15	7091.00	7088.3	7085.00
P101	ECB	OSJ01	6.06	27.1	27	6.06	27.1	4.42	228.6	24	1.01%	23	27	8.6	7140.00	7139.6	7136.75	7139.93	7136.4	7134.45
P102	OSJ01	OSJ02				6.06	27.5	4.38	396.0	24	1.99%	32	27	11	7139.93	7136.3	7134.45	7132.00	7128.5	7126.55
P103	OSJ02	OS1				6.06	28.1	4.33	183.0	24	4.67%	49	26	16	7132.00	7128.4	7126.55	7121.00	7119.1	7118.00

Appendix B - HEC-HMS Data

Input Data

Estates at Rolling Hills Ranch Filing 2

BASIN	AREA (acre)	AREA (mi^2)	CURVE NO.	LAG TIME (min)
HISTORIC				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07	21	0.0328	63.1	15.4
OS08	26	0.0406	65.7	15.9
OS09	98	0.1527	65.0	29.5
HG01	35	0.0547	61.0	19.6
HG02	58	0.0906	61.0	25.4
HG03	117	0.1828	61.1	33.8
HG04	57	0.0891	61.0	30.7
HG05	72	0.1125	61.0	31.8
HG06A	88	0.1375	61.0	43.2
HG06B	66	0.1031	61.0	49.5
HG07	63	0.0984	61.0	28.3
HG08	85	0.1328	61.0	22.9
HG09	114	0.1781	61.0	35.6
HG10	88	0.1375	61.0	61.4
HG11	131	0.2047	61.0	40.4
HG12	83	0.1297	61.0	32.0
HG13	54	0.0844	63.1	21.2
HG14	147	0.2297	61.0	45.1
HG15	164	0.2563	61.0	65.1
HG18	21	0.0328	61.0	14.1
HG19	3	0.0047	61.0	6.1
HG20	1	0.0016	61.0	6.9
HG21	14	0.0219	61.0	13.8

BASIN	AREA (acre)	AREA (mi^2)	CURVE NO.	LAG TIME (min)
INTERIM				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07ab	11	0.0170	63.1	13.9
OS07c	10	0.0156	63.1	10.9
OS08	25	0.0394	65.7	15.9
OS09	98	0.1527	65.0	29.5
FG01	34	0.0538	66.4	33.8
FG02	25	0.0391	64.6	16.1
FG03	13	0.0203	68.0	11.6
FG04	11	0.0172	68.0	7.6
FG05	37	0.0580	70.1	28.4
FG06	43	0.0675	66.1	18.4
FG21a	6	0.0095	62.6	21.4
FG21b	10	0.0150	73.1	12.7
FG22	81	0.1264	68.0	27.6
FG23a	15	0.0231	62.7	18.0
FG23b	21	0.0334	61.0	16.5
FG23c	5	0.0070	61.0	14.0
FG24	90	0.1405	61.6	26.6
FG25	70	0.1086	61.0	42.6
FG28	44	0.0688	61.0	28.0
FG29	64	0.0997	61.0	19.1
FG32	26	0.0402	61.0	14.9

BASIN	AREA (acre)	AREA (mi^2)	CURVE	LAG
FUTURE				
OS05	37	0.0578	61.0	15.2
OS06	84	0.1313	61.0	18.7
OS07ab	11	0.0170	63.1	13.9
OS07c	10	0.0156	63.1	10.9
OS08	25	0.0394	65.7	15.9
OS09	98	0.1527	65.0	29.5
FG01	34	0.0538	66.4	33.8
FG02	25	0.0391	64.6	16.1
FG03	13	0.0203	68.0	11.6
FG04	11	0.0172	68.0	7.6
FG05	37	0.0580	70.1	28.4
FG06	43	0.0675	66.1	18.4
FG21a	6	0.0095	62.6	21.4
FG21b	10	0.0150	73.1	12.7
FG22	84	0.1309	68.5	20.3
FG23a	14	0.0216	68.6	18.0
FG23b	16	0.0247	62.4	16.5
FG23c	8	0.0122	67.3	14.0
FG24	97	0.1517	68.5	26.6
FG25	70	0.1086	74.1	36.6
FG26	55	0.0863	70.7	23.1
FG27	32	0.0500	74.7	23.9
FG28	16	0.0245	66.6	14.0
FG29	64	0.0997	61.0	19.1
FG32	26	0.0402	80.0	12.1

NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 38.9783°, Longitude: -104.5842°
Elevation: 7054.14 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.239 (0.190-0.301)	0.291 (0.232-0.367)	0.381 (0.302-0.482)	0.460 (0.363-0.585)	0.576 (0.442-0.764)	0.670 (0.501-0.899)	0.770 (0.556-1.06)	0.875 (0.606-1.23)	1.02 (0.680-1.48)	1.14 (0.737-1.66)
10-min	0.349 (0.278-0.441)	0.426 (0.339-0.538)	0.558 (0.443-0.706)	0.674 (0.532-0.857)	0.843 (0.647-1.12)	0.982 (0.734-1.32)	1.13 (0.814-1.55)	1.28 (0.888-1.80)	1.50 (0.996-2.16)	1.67 (1.08-2.44)
15-min	0.426 (0.340-0.538)	0.519 (0.413-0.656)	0.680 (0.540-0.861)	0.822 (0.648-1.04)	1.03 (0.789-1.36)	1.20 (0.895-1.61)	1.37 (0.993-1.89)	1.56 (1.08-2.20)	1.82 (1.22-2.64)	2.03 (1.31-2.97)
30-min	0.608 (0.485-0.768)	0.741 (0.590-0.936)	0.969 (0.769-1.23)	1.17 (0.923-1.49)	1.46 (1.12-1.94)	1.70 (1.27-2.28)	1.95 (1.41-2.68)	2.21 (1.53-3.12)	2.58 (1.72-3.73)	2.87 (1.86-4.20)
60-min	0.778 (0.620-0.982)	0.934 (0.744-1.18)	1.21 (0.962-1.54)	1.47 (1.16-1.86)	1.84 (1.42-2.46)	2.16 (1.62-2.91)	2.50 (1.81-3.44)	2.87 (1.99-4.05)	3.38 (2.26-4.91)	3.80 (2.46-5.56)
2-hr	0.948 (0.762-1.19)	1.13 (0.905-1.41)	1.46 (1.16-1.83)	1.76 (1.40-2.22)	2.23 (1.73-2.96)	2.62 (1.99-3.51)	3.05 (2.23-4.18)	3.52 (2.47-4.95)	4.19 (2.82-6.04)	4.73 (3.09-6.87)
3-hr	1.04 (0.839-1.29)	1.22 (0.986-1.52)	1.57 (1.26-1.96)	1.90 (1.51-2.38)	2.41 (1.90-3.21)	2.86 (2.18-3.83)	3.35 (2.47-4.59)	3.90 (2.75-5.47)	4.68 (3.18-6.75)	5.33 (3.50-7.71)
6-hr	1.21 (0.980-1.49)	1.40 (1.14-1.73)	1.78 (1.44-2.21)	2.16 (1.74-2.68)	2.76 (2.19-3.65)	3.29 (2.53-4.38)	3.88 (2.88-5.28)	4.53 (3.23-6.34)	5.49 (3.76-7.88)	6.29 (4.17-9.04)
12-hr	1.39 (1.14-1.70)	1.62 (1.33-1.98)	2.06 (1.68-2.53)	2.48 (2.02-3.06)	3.16 (2.53-4.14)	3.76 (2.92-4.96)	4.42 (3.31-5.97)	5.15 (3.70-7.14)	6.22 (4.30-8.85)	7.10 (4.75-10.1)
24-hr	1.61 (1.33-1.95)	1.88 (1.55-2.29)	2.39 (1.97-2.92)	2.88 (2.35-3.52)	3.63 (2.91-4.69)	4.27 (3.34-5.58)	4.98 (3.75-6.66)	5.75 (4.17-7.90)	6.87 (4.78-9.70)	7.79 (5.25-11.1)
2-day	1.86 (1.55-2.24)	2.19 (1.83-2.64)	2.79 (2.31-3.36)	3.33 (2.75-4.04)	4.15 (3.35-5.30)	4.85 (3.81-6.25)	5.59 (4.25-7.39)	6.40 (4.67-8.70)	7.55 (5.30-10.6)	8.49 (5.77-12.0)
3-day	2.04 (1.71-2.45)	2.41 (2.01-2.88)	3.05 (2.54-3.66)	3.63 (3.01-4.38)	4.51 (3.65-5.71)	5.24 (4.14-6.72)	6.03 (4.59-7.92)	6.87 (5.03-9.29)	8.07 (5.69-11.2)	9.04 (6.18-12.7)
4-day	2.20 (1.85-2.62)	2.58 (2.16-3.08)	3.25 (2.72-3.89)	3.86 (3.21-4.63)	4.77 (3.87-6.01)	5.53 (4.38-7.06)	6.34 (4.85-8.31)	7.22 (5.31-9.73)	8.46 (5.98-11.7)	9.46 (6.50-13.2)
7-day	2.60 (2.20-3.08)	3.00 (2.54-3.56)	3.71 (3.13-4.41)	4.36 (3.65-5.20)	5.33 (4.36-6.67)	6.14 (4.89-7.78)	7.00 (5.40-9.11)	7.93 (5.87-10.6)	9.26 (6.59-12.8)	10.3 (7.14-14.4)
10-day	2.96 (2.51-3.48)	3.39 (2.88-4.00)	4.16 (3.52-4.92)	4.85 (4.08-5.76)	5.88 (4.82-7.31)	6.73 (5.38-8.48)	7.63 (5.91-9.88)	8.61 (6.39-11.5)	9.97 (7.13-13.7)	11.1 (7.70-15.4)
20-day	3.95 (3.38-4.61)	4.55 (3.89-5.32)	5.57 (4.75-6.52)	6.44 (5.46-7.58)	7.68 (6.32-9.39)	8.67 (6.97-10.8)	9.69 (7.54-12.4)	10.8 (8.04-14.1)	12.2 (8.79-16.6)	13.3 (9.36-18.4)
30-day	4.75 (4.09-5.51)	5.49 (4.72-6.38)	6.70 (5.74-7.81)	7.72 (6.58-9.04)	9.12 (7.52-11.1)	10.2 (8.24-12.6)	11.3 (8.83-14.3)	12.4 (9.32-16.2)	13.9 (10.1-18.7)	15.0 (10.6-20.6)
45-day	5.73 (4.96-6.62)	6.62 (5.72-7.65)	8.05 (6.93-9.33)	9.21 (7.89-10.7)	10.8 (8.91-12.9)	12.0 (9.68-14.6)	13.1 (10.3-16.5)	14.3 (10.7-18.5)	15.8 (11.4-21.1)	16.9 (12.0-23.0)
60-day	6.56 (5.70-7.55)	7.55 (6.55-8.69)	9.12 (7.88-10.5)	10.4 (8.92-12.0)	12.1 (9.98-14.4)	13.3 (10.8-16.1)	14.5 (11.4-18.1)	15.6 (11.8-20.2)	17.1 (12.5-22.8)	18.2 (12.9-24.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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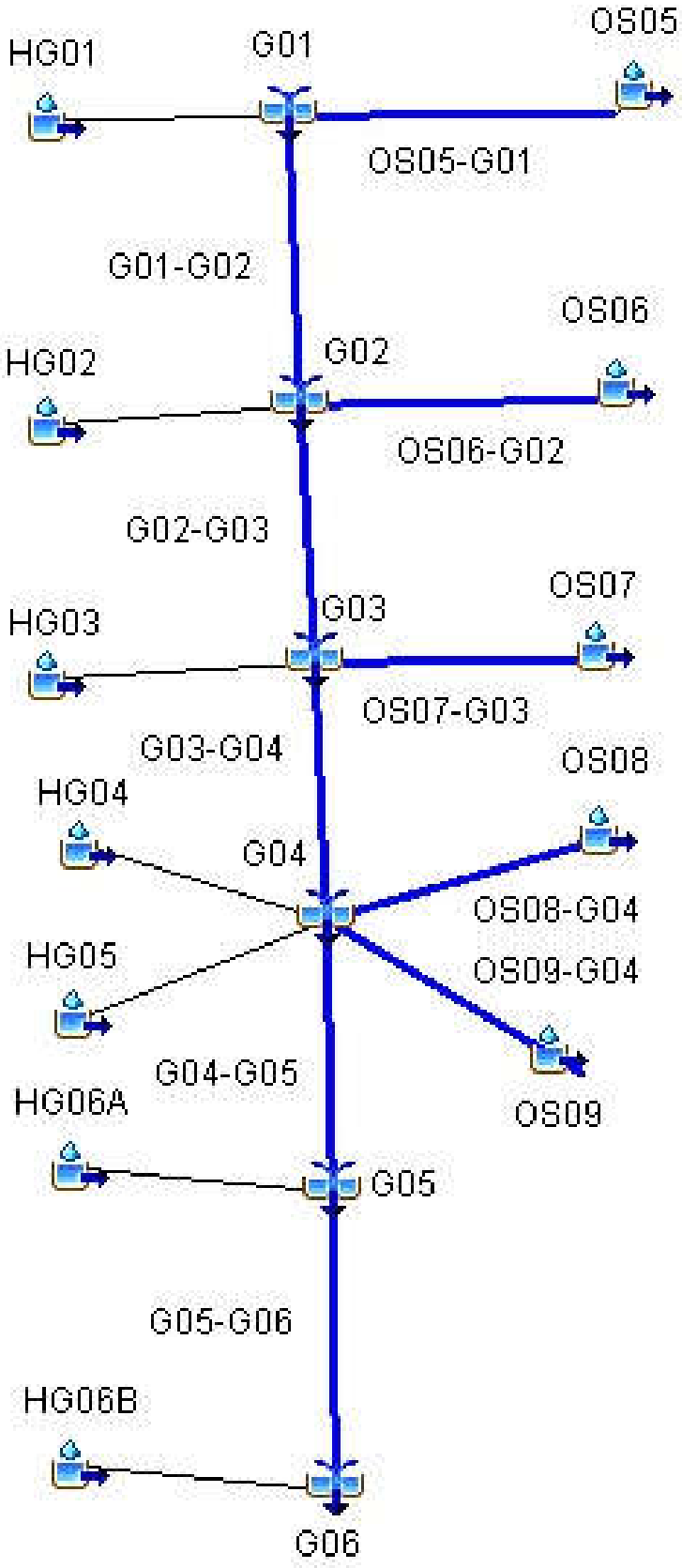
GIECK HISTORIC CONDITIONS



HISTORIC SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
OS06-G02	0.1313	77	01Jul2015, 12:24	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G01	0.0578	38	01Jul2015, 12:12	4.1
HG01	0.0547	32	01Jul2015, 12:12	3.9
G01	0.1125	70	01Jul2015, 12:12	7.9
G01-G02	0.1125	68	01Jul2015, 12:24	7.8
HG02	0.0906	45	01Jul2015, 12:24	6.4
G02	0.3344	191	01Jul2015, 12:24	23.4
G02-G03	0.3344	190	01Jul2015, 12:30	23.1
HG03	0.1828	77	01Jul2015, 12:30	12.9
OS07	0.0328	25	01Jul2015, 12:12	2.6
OS07-G03	0.0328	24	01Jul2015, 12:30	2.5
G03	0.5500	291	01Jul2015, 12:30	38.4
G03-G04	0.5500	281	01Jul2015, 12:30	38.0
OS09	0.1547	91	01Jul2015, 12:24	13.2
OS09-G04	0.1547	90	01Jul2015, 12:30	13.0
HG04	0.0891	40	01Jul2015, 12:30	6.3
HG05	0.1125	49	01Jul2015, 12:30	7.9
OS08	0.0406	35	01Jul2015, 12:12	3.6
OS08-G04	0.0406	34	01Jul2015, 12:30	3.5
G04	0.9469	493	01Jul2015, 12:30	68.7
G04-G05	0.9469	488	01Jul2015, 12:36	68.4
HG06A	0.1375	49	01Jul2015, 12:42	9.6
G05	1.0844	536	01Jul2015, 12:36	78.0
G05-G06	1.0844	520	01Jul2015, 12:36	77.6
HG06B	0.1031	33	01Jul2015, 12:48	7.2
G06	1.1875	551	01Jul2015, 12:42	84.7
HG14	0.2297	79	01Jul2015, 12:42	16.0
HG13	0.0844	54	01Jul2015, 12:18	6.6
G07	0.0844	54	01Jul2015, 12:18	6.6
G07-G08	0.0844	53	01Jul2015, 12:18	6.6
G16	0.3141	117	01Jul2015, 12:30	22.6

Highlighted green rows reference key design points (Typical all charts this section)

HISTORIC SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
OS06-G02	0.1313	52	01Jul2015, 12:24	6.4
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G01	0.0578	25	01Jul2015, 12:18	2.9
HG01	0.0547	21	01Jul2015, 12:18	2.7
G01	0.1125	46	01Jul2015, 12:18	5.6
G01-G02	0.1125	46	01Jul2015, 12:24	5.5
HG02	0.0906	30	01Jul2015, 12:24	4.5
G02	0.3344	127	01Jul2015, 12:24	16.4
G02-G03	0.3344	125	01Jul2015, 12:30	16.1
HG03	0.1828	51	01Jul2015, 12:30	9.1
OS07	0.0328	17	01Jul2015, 12:12	1.9
OS07-G03	0.0328	17	01Jul2015, 12:30	1.8
G03	0.5500	192	01Jul2015, 12:30	27.0
G03-G04	0.5500	189	01Jul2015, 12:36	26.7
OS09	0.1547	63	01Jul2015, 12:24	9.6
OS09-G04	0.1547	62	01Jul2015, 12:36	9.4
HG04	0.0891	26	01Jul2015, 12:30	4.4
HG05	0.1125	32	01Jul2015, 12:30	5.6
OS08	0.0406	25	01Jul2015, 12:12	2.6
OS08-G04	0.0406	24	01Jul2015, 12:36	2.5
G04	0.9469	332	01Jul2015, 12:36	48.6
G04-G05	0.9469	318	01Jul2015, 12:42	48.3
HG06A	0.1375	32	01Jul2015, 12:42	6.7
G05	1.0844	350	01Jul2015, 12:42	55.1
G05-G06	1.0844	348	01Jul2015, 12:42	54.7
HG06B	0.1031	22	01Jul2015, 12:54	5.0
G06	1.1875	369	01Jul2015, 12:42	59.8
HG14	0.2297	52	01Jul2015, 12:48	11.3
HG13	0.0844	37	01Jul2015, 12:18	4.7
G07	0.0844	37	01Jul2015, 12:18	4.7
G07-G08	0.0844	36	01Jul2015, 12:24	4.7
G16	0.3141	77	01Jul2015, 12:30	15.9

Highlighted green rows reference key design points (Typical all charts this section)

HISTORIC SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
OS06-G02	0.1313	11	01Jul2015, 12:30	2.1
OS05	0.0578	5.6	01Jul2015, 12:12	1.0
OS05-G01	0.0578	5.5	01Jul2015, 12:24	0.9
HG01	0.0547	4.7	01Jul2015, 12:18	0.9
G01	0.1125	10	01Jul2015, 12:24	1.9
G01-G02	0.1125	10	01Jul2015, 12:36	1.8
HG02	0.0906	6.7	01Jul2015, 12:30	1.5
G02	0.3344	27	01Jul2015, 12:36	5.4
G02-G03	0.3344	27	01Jul2015, 12:48	5.3
HG03	0.1828	12	01Jul2015, 12:42	3.0
OS07	0.0328	4.5	01Jul2015, 12:12	0.7
OS07-G03	0.0328	4.3	01Jul2015, 12:48	0.7
G03	0.5500	42	01Jul2015, 12:48	8.9
G03-G04	0.5500	42	01Jul2015, 12:54	8.8
OS09	0.1547	19	01Jul2015, 12:30	3.6
OS09-G04	0.1547	18	01Jul2015, 12:42	3.5
HG04	0.0891	5.9	01Jul2015, 12:36	1.5
HG05	0.1125	7.4	01Jul2015, 12:36	1.8
OS08	0.0406	7.7	01Jul2015, 12:12	1.0
OS08-G04	0.0406	7.4	01Jul2015, 12:48	1.0
G04	0.9469	76	01Jul2015, 12:54	16.6
G04-G05	0.9469	76	01Jul2015, 12:54	16.5
HG06A	0.1375	7.6	01Jul2015, 12:54	2.2
G05	1.0844	84	01Jul2015, 12:54	18.7
G05-G06	1.0844	83	01Jul2015, 13:00	18.5
HG06B	0.1031	5.3	01Jul2015, 13:00	1.7
G06	1.1875	88	01Jul2015, 13:00	20.2
HG14	0.2297	12.4	01Jul2015, 12:54	3.7
HG13	0.0844	9.5	01Jul2015, 12:18	1.7
G07	0.0844	9.5	01Jul2015, 12:18	1.7
G07-G08	0.0844	9.4	01Jul2015, 12:30	1.7
G16	0.3141	19.1	01Jul2015, 12:36	5.4

Highlighted green rows reference key design points (Typical all charts this section)

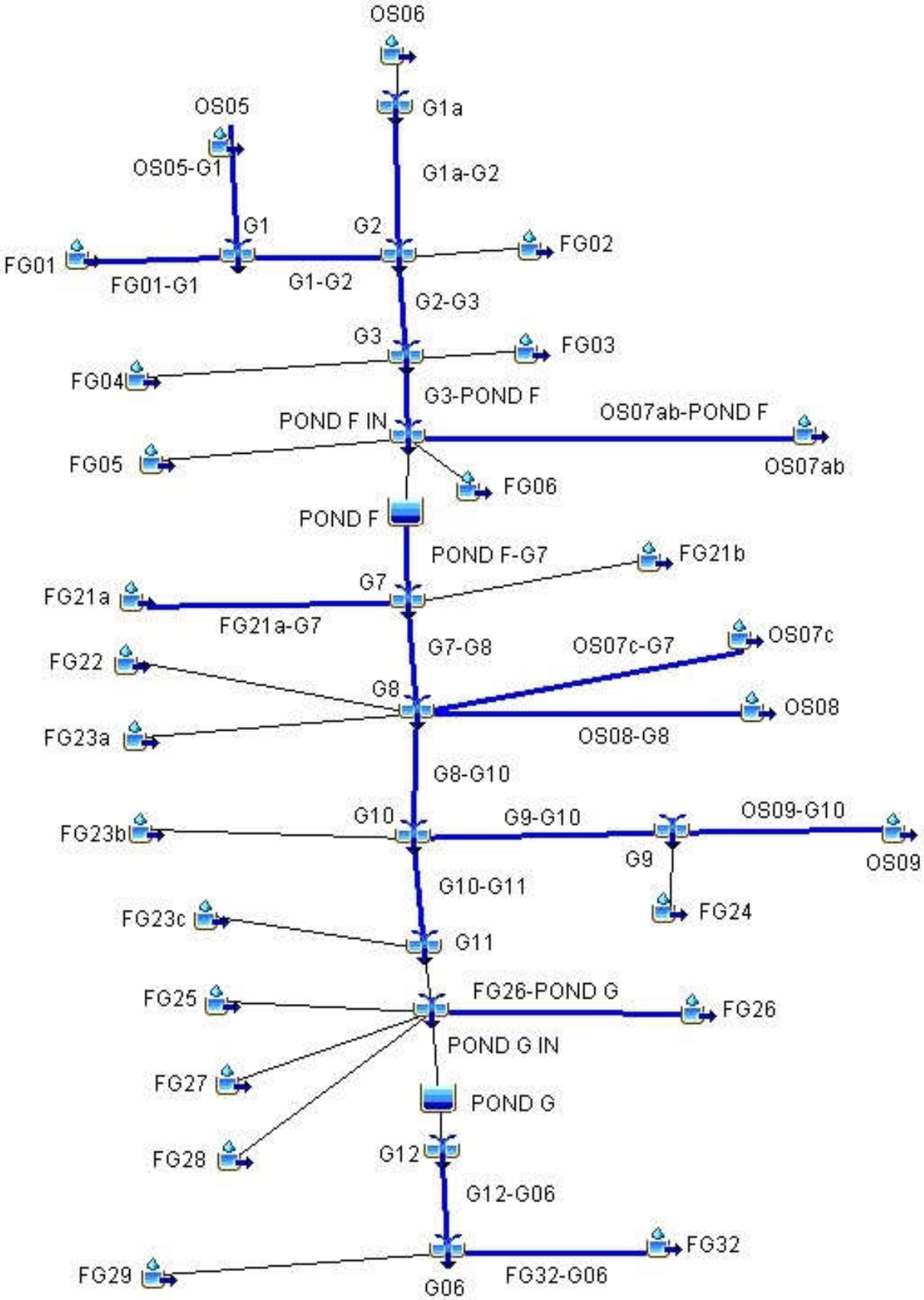
HISTORIC SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
OS06-G02	0.1313	3.7	01Jul2015, 12:42	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G01	0.0578	1.7	01Jul2015, 12:30	0.5
HG01	0.0547	1.5	01Jul2015, 12:24	0.5
G01	0.1125	3.2	01Jul2015, 12:30	1.0
G01-G02	0.1125	3.2	01Jul2015, 12:48	0.9
HG02	0.0906	2.3	01Jul2015, 12:36	0.8
G02	0.3344	9.0	01Jul2015, 12:42	2.8
G02-G03	0.3344	9.0	01Jul2015, 13:00	2.7
HG03	0.1828	4.3	01Jul2015, 12:48	1.6
OS07	0.0328	1.7	01Jul2015, 12:18	0.4
OS07-G03	0.0328	1.7	01Jul2015, 13:00	0.4
G03	0.5500	15	01Jul2015, 13:00	4.6
G03-G04	0.5500	14	01Jul2015, 13:12	4.5
OS09	0.1547	8.3	01Jul2015, 12:36	2.1
OS09-G04	0.1547	8.3	01Jul2015, 12:48	2.0
HG04	0.0891	2.1	01Jul2015, 12:42	0.8
HG05	0.1125	2.6	01Jul2015, 12:42	0.9
OS08	0.0406	3.4	01Jul2015, 12:12	0.6
OS08-G04	0.0406	3.4	01Jul2015, 13:00	0.6
G04	0.9469	28	01Jul2015, 13:12	8.7
G04-G05	0.9469	27	01Jul2015, 13:18	8.6
HG06A	0.1375	2.9	01Jul2015, 13:00	1.1
G05	1.0844	30	01Jul2015, 13:18	9.8
G05-G06	1.0844	30	01Jul2015, 13:24	9.6
HG06B	0.1031	2.0	01Jul2015, 13:12	0.9
G06	1.1875	32	01Jul2015, 13:24	10.5
HG14	0.2297	4.7	01Jul2015, 13:06	1.9
HG13	0.0844	3.8	01Jul2015, 12:24	0.9
G07	0.0844	3.8	01Jul2015, 12:24	0.9
G07-G08	0.0844	3.7	01Jul2015, 12:36	0.9
G16	0.3141	7.4	01Jul2015, 12:54	2.8

Highlighted green rows reference key design points (Typical all charts this section)

HISTORIC SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
OS06-G02	0.1313	0.5	01Jul2015, 14:00	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G01	0.0578	0.2	01Jul2015, 13:42	0.2
HG01	0.0547	0.2	01Jul2015, 13:36	0.1
G01	0.1125	0.5	01Jul2015, 13:36	0.3
G01-G02	0.1125	0.5	01Jul2015, 14:06	0.3
HG02	0.0906	0.4	01Jul2015, 13:42	0.2
G02	0.3344	1.3	01Jul2015, 14:00	0.8
G02-G03	0.3344	1.3	01Jul2015, 14:30	0.8
HG03	0.1828	0.7	01Jul2015, 13:54	0.5
OS07	0.0328	0.3	01Jul2015, 12:54	0.1
OS07-G03	0.0328	0.3	01Jul2015, 14:12	0.1
G03	0.5500	2.3	01Jul2015, 14:24	1.4
G03-G04	0.5500	2.3	01Jul2015, 14:42	1.3
OS09	0.1547	1.9	01Jul2015, 12:54	0.8
OS09-G04	0.1547	1.9	01Jul2015, 13:18	0.8
HG04	0.0891	0.3	01Jul2015, 13:48	0.2
HG05	0.1125	0.4	01Jul2015, 13:54	0.3
OS08	0.0406	0.7	01Jul2015, 12:24	0.2
OS08-G04	0.0406	0.7	01Jul2015, 13:36	0.2
G04	0.9469	4.7	01Jul2015, 14:36	2.8
G04-G05	0.9469	4.7	01Jul2015, 14:48	2.8
HG06A	0.1375	0.5	01Jul2015, 14:12	0.3
G05	1.0844	5.2	01Jul2015, 14:48	3.1
G05-G06	1.0844	5.2	01Jul2015, 15:00	3.0
HG06B	0.1031	0.4	01Jul2015, 14:24	0.3
G06	1.1875	5.5	01Jul2015, 15:00	3.3
HG14	0.2297	0.8	01Jul2015, 14:18	0.6
HG13	0.0844	0.7	01Jul2015, 13:00	0.3
G07	0.0844	0.7	01Jul2015, 13:00	0.3
G07-G08	0.0844	0.6	01Jul2015, 13:18	0.3
G16	0.3141	1.4	01Jul2015, 13:54	0.9

Highlighted green rows reference key design points (Typical all charts this section)

GIECK INTERIM CONDITIONS



INTERIM SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
G1a	0.1313	80	01Jul2015, 12:12	9.3
G1a-G2	0.1313	79	01Jul2015, 12:18	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G1	0.0578	39	01Jul2015, 12:12	4.1
FG01	0.0538	31	01Jul2015, 12:30	4.9
FG01-G1	0.0538	31	01Jul2015, 12:30	4.9
G1	0.1116	61	01Jul2015, 12:18	9.0
G1-G2	0.1116	61	01Jul2015, 12:18	9.0
FG02	0.0391	32	01Jul2015, 12:12	3.3
G2	0.2820	167	01Jul2015, 12:18	21.5
G2-G3	0.2820	163	01Jul2015, 12:18	21.3
FG03	0.0203	24	01Jul2015, 12:06	2.0
FG04	0.0172	22	01Jul2015, 12:00	1.7
G3	0.3195	185	01Jul2015, 12:18	25.0
G3-POND F	0.3195	183	01Jul2015, 12:18	25.0
FG06	0.0675	56	01Jul2015, 12:12	6.1
FG05	0.0580	45	01Jul2015, 12:24	6.1
OS07ab	0.0170	14	01Jul2015, 12:06	1.3
OS07a-POND F	0.0170	13	01Jul2015, 12:18	1.3
POND F IN	0.4620	293	01Jul2015, 12:18	38.5
POND F	0.4620	178	01Jul2015, 12:42	36.1
POND F-G7	0.4620	177	01Jul2015, 12:42	35.8
FG21b	0.0150	21	01Jul2015, 12:06	1.8
FG21a	0.0095	7	01Jul2015, 12:06	0.7
FG21a-G7	0.0095	7	01Jul2015, 12:18	0.7
G7	0.4865	185	01Jul2015, 12:42	38.3
G7-G8	0.4865	184	01Jul2015, 12:42	38.3
FG22	0.1264	84	01Jul2015, 12:24	12.3
OS08	0.0394	34	01Jul2015, 12:12	3.5
OS08-G8	0.0394	33	01Jul2015, 12:24	3.4
FG23a	0.0231	16	01Jul2015, 12:12	1.8
OS07c	0.0156	15	01Jul2015, 12:06	1.2
OS07c-G8	0.0156	13	01Jul2015, 12:24	1.2
G8	0.6910	292	01Jul2015, 12:36	56.9
G7-G10	0.6910	292	01Jul2015, 12:36	56.5
OS09	0.1527	90	01Jul2015, 12:24	13.0
OS09-G10	0.1527	88	01Jul2015, 12:30	12.9
FG24	0.1405	74	01Jul2015, 12:18	10.2
G9	0.2932	154	01Jul2015, 12:30	23.1
G8-G10	0.2932	154	01Jul2015, 12:30	23.0
FG23b	0.0334	22	01Jul2015, 12:12	2.4
G10	1.0176	449	01Jul2015, 12:36	81.9
G10-G11	1.0176	447	01Jul2015, 12:36	81.8
FG23c	0.0070	5	01Jul2015, 12:06	0.5

INTERIM SCS (100-YEAR)				
FG32-G06	0.0402	27	01Jul2015, 12:12	2.8
G11	1.0246	449	01Jul2015, 12:36	82.3
FG25	0.1086	48	01Jul2015, 12:30	7.6
FG28	0.0688	33	01Jul2015, 12:24	4.8
POND G IN	1.2020	522	01Jul2015, 12:36	94.7
POND G	1.2020	358	01Jul2015, 13:06	85.6
G12	1.2020	358	01Jul2015, 13:06	85.6
G12-G06	1.2020	357	01Jul2015, 13:06	85.0
FG29	0.0997	60	01Jul2015, 12:12	7.1
FG32	0.0402	27	01Jul2015, 12:12	2.9
FG32-G06	0.0402	27	01Jul2015, 12:12	2.8
G06	1.3419	377	01Jul2015, 13:06	94.9

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
G1a	0.1313	52	01Jul2015, 12:12	6.5
G1a-G2	0.1313	52	01Jul2015, 12:18	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G1	0.0578	25	01Jul2015, 12:12	2.9
FG01	0.0538	22	01Jul2015, 12:30	3.6
FG01-G1	0.0538	22	01Jul2015, 12:30	3.6
G1	0.1116	41	01Jul2015, 12:18	6.4
G1-G2	0.1116	41	01Jul2015, 12:18	6.4
FG02	0.0391	22	01Jul2015, 12:12	2.4
G2	0.2820	112	01Jul2015, 12:18	15.3
G2-G3	0.2820	109	01Jul2015, 12:24	15.2
FG03	0.0203	17	01Jul2015, 12:06	1.5
FG04	0.0172	16	01Jul2015, 12:00	1.3
G3	0.3195	123	01Jul2015, 12:18	17.9
G3-POND F	0.3195	121	01Jul2015, 12:18	17.9
FG06	0.0675	40	01Jul2015, 12:12	4.4
FG05	0.0580	33	01Jul2015, 12:24	4.6
OS07ab	0.0170	9	01Jul2015, 12:12	1.0
OS07a-POND F	0.0170	9	01Jul2015, 12:18	0.9
POND F IN	0.4620	200	01Jul2015, 12:18	27.9
POND F	0.4620	121	01Jul2015, 12:42	25.8
POND F-G7	0.4620	121	01Jul2015, 12:48	25.7
FG21b	0.0150	15.6	01Jul2015, 12:06	1.4
FG21a	0.0095	5	01Jul2015, 12:12	0.5
FG21a-G7	0.0095	5	01Jul2015, 12:18	0.5
G7	0.4865	126	01Jul2015, 12:48	27.5
G7-G8	0.4865	125	01Jul2015, 12:48	27.5
FG22	0.1264	60	01Jul2015, 12:24	9.1
OS08	0.0394	24	01Jul2015, 12:12	2.5
OS08-G8	0.0394	23	01Jul2015, 12:24	2.5
FG23a	0.0231	11	01Jul2015, 12:12	1.3
OS07c	0.0156	10	01Jul2015, 12:06	0.9
OS07c-G8	0.0156	9	01Jul2015, 12:24	0.9
G8	0.6910	193	01Jul2015, 12:42	41.2
G7-G10	0.6910	192	01Jul2015, 12:48	40.8
OS09	0.1527	62	01Jul2015, 12:24	9.4
OS09-G10	0.1527	61.4	01Jul2015, 12:36	9.3
FG24	0.1405	49	01Jul2015, 12:24	7.2
G9	0.2932	105	01Jul2015, 12:30	16.5
G8-G10	0.2932	103	01Jul2015, 12:30	16.4
FG23b	0.0334	14	01Jul2015, 12:12	1.7
G10	1.0176	290	01Jul2015, 12:42	59.0
G10-G11	1.0176	288	01Jul2015, 12:42	58.9
FG23c	0.0070	3	01Jul2015, 12:12	0.4

INTERIM SCS (50-YEAR)				
FG32-G06	0.0402	18	01Jul2015, 12:12	2.0
G11	1.0246	289	01Jul2015, 12:42	59.2
FG25	0.1086	32	01Jul2015, 12:30	5.4
FG28	0.0688	21	01Jul2015, 12:24	3.4
POND G IN	1.2020	333	01Jul2015, 12:42	68.0
POND G	1.2020	206	01Jul2015, 13:18	59.4
G12	1.2020	206	01Jul2015, 13:18	59.4
G12-G06	1.2020	205	01Jul2015, 13:24	58.9
FG29	0.0997	39	01Jul2015, 12:18	5.0
FG32	0.0402	18	01Jul2015, 12:12	2.0
FG32-G06	0.0402	18	01Jul2015, 12:12	2.0
G06	1.3419	217	01Jul2015, 13:18	65.9

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
G1a	0.1313	12	01Jul2015, 12:18	2.2
G1a-G2	0.1313	11	01Jul2015, 12:24	2.1
OS05	0.0578	6	01Jul2015, 12:12	1.0
OS05-G1	0.0578	6	01Jul2015, 12:18	1.0
FG01	0.0538	7	01Jul2015, 12:36	1.4
FG01-G1	0.0538	7	01Jul2015, 12:36	1.4
G1	0.1116	11	01Jul2015, 12:24	2.3
G1-G2	0.1116	11	01Jul2015, 12:30	2.3
FG02	0.0391	6	01Jul2015, 12:12	0.9
G2	0.2820	27	01Jul2015, 12:24	5.4
G2-G3	0.2820	27	01Jul2015, 12:30	5.3
FG03	0.0203	6	01Jul2015, 12:06	0.6
FG04	0.0172	6	01Jul2015, 12:06	0.5
G3	0.3195	31	01Jul2015, 12:30	6.4
G3-POND F	0.3195	31	01Jul2015, 12:30	6.4
FG06	0.0675	12	01Jul2015, 12:18	1.7
FG05	0.0580	12	01Jul2015, 12:24	2.0
OS07ab	0.0170	2	01Jul2015, 12:12	0.3
OS07a-POND F	0.0170	2	01Jul2015, 12:30	0.3
POND F IN	0.4620	54	01Jul2015, 12:30	10.4
POND F	0.4620	16	01Jul2015, 13:48	9.1
POND F-G7	0.4620	16	01Jul2015, 13:54	9.0
FG21b	0.0150	7	01Jul2015, 12:06	0.6
FG21a	0.0095	1.3	01Jul2015, 12:12	0.2
FG21a-G7	0.0095	1	01Jul2015, 12:30	0.2
G7	0.4865	17	01Jul2015, 13:48	9.8
G7-G8	0.4865	17.3	01Jul2015, 13:48	9.8
FG22	0.1264	21	01Jul2015, 12:30	3.7
OS08	0.0394	7	01Jul2015, 12:12	1.0
OS08-G8	0.0394	7	01Jul2015, 12:30	0.9
FG23a	0.0231	3	01Jul2015, 12:18	0.5
OS07c	0.0156	3	01Jul2015, 12:06	0.3
OS07c-G8	0.0156	2.3	01Jul2015, 12:36	0.3
G8	0.6910	36.5	01Jul2015, 12:36	15.1
G7-G10	0.6910	36	01Jul2015, 12:48	14.9
OS09	0.1527	18	01Jul2015, 12:30	3.5
OS09-G10	0.1527	18.2	01Jul2015, 12:42	3.5
FG24	0.1405	12	01Jul2015, 12:24	2.4
G9	0.2932	28	01Jul2015, 12:36	5.9
G8-G10	0.2932	27.6	01Jul2015, 12:42	5.9
FG23b	0.0334	3	01Jul2015, 12:18	0.6
G10	1.0176	65	01Jul2015, 12:42	21.3
G10-G11	1.0176	65	01Jul2015, 12:48	21.3
FG23c	0.0070	1	01Jul2015, 12:12	0.1

INTERIM SCS (10-YEAR)				
FG32-G06	0.0402	4	01Jul2015, 12:18	0.7
G11	1.0246	65	01Jul2015, 12:48	21.4
FG25	0.1086	7	01Jul2015, 12:36	1.8
FG28	0.0688	5	01Jul2015, 12:30	1.1
POND G IN	1.2020	76	01Jul2015, 12:42	24.3
POND G	1.2020	28	01Jul2015, 15:42	17.3
G12	1.2020	28	01Jul2015, 15:42	17.3
G12-G06	1.2020	28	01Jul2015, 15:54	17.0
FG29	0.0997	9	01Jul2015, 12:18	1.6
FG32	0.0402	4	01Jul2015, 12:12	0.7
FG32-G06	0.0402	4	01Jul2015, 12:18	0.7
G06	1.3419	29	01Jul2015, 15:48	19.3

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
G1a	0.1313	3.8	01Jul2015, 12:24	1.1
G1a-G2	0.1313	3.6	01Jul2015, 12:36	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G1	0.0578	1.7	01Jul2015, 12:24	0.5
FG01	0.0538	3.4	01Jul2015, 12:36	0.8
FG01-G1	0.0538	3.4	01Jul2015, 12:36	0.8
G1	0.1116	4.9	01Jul2015, 12:36	1.3
G1-G2	0.1116	4.8	01Jul2015, 12:36	1.3
FG02	0.0391	2.7	01Jul2015, 12:18	0.5
G2	0.2820	10	01Jul2015, 12:30	2.9
G2-G3	0.2820	10	01Jul2015, 12:42	2.9
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	3.1	01Jul2015, 12:06	0.3
G3	0.3195	11	01Jul2015, 12:36	3.3
G3-POND F	0.3195	11	01Jul2015, 12:42	3.3
FG06	0.0675	5.8	01Jul2015, 12:18	1.0
FG05	0.0580	6.7	01Jul2015, 12:30	1.2
OS07ab	0.0170	0.9	01Jul2015, 12:12	0.2
OS07a-POND F	0.0170	0.9	01Jul2015, 12:36	0.2
POND F IN	0.4620	22.3	01Jul2015, 12:36	5.7
POND F	0.4620	7.7	01Jul2015, 14:18	4.7
POND F-G7	0.4620	7.7	01Jul2015, 14:30	4.6
FG21b	0.0150	3.9	01Jul2015, 12:06	0.4
FG21a	0.0095	0.5	01Jul2015, 12:12	0.1
FG21a-G7	0.0095	0.5	01Jul2015, 12:42	0.1
G7	0.4865	8.2	01Jul2015, 14:24	5.1
G7-G8	0.4865	8.2	01Jul2015, 14:24	5.1
FG22	0.1264	10.5	01Jul2015, 12:30	2.2
OS08	0.0394	3.3	01Jul2015, 12:12	0.6
OS08-G8	0.0394	3.3	01Jul2015, 12:36	0.5
FG23a	0.0231	1.0	01Jul2015, 12:18	0.2
OS07c	0.0156	1.0	01Jul2015, 12:12	0.2
OS07c-G8	0.0156	0.9	01Jul2015, 12:42	0.2
G8	0.6910	16.6	01Jul2015, 12:36	8.3
G7-G10	0.6910	16	01Jul2015, 12:48	8.1
OS09	0.1527	8	01Jul2015, 12:36	2.0
OS09-G10	0.1527	8.2	01Jul2015, 12:48	2.0
FG24	0.1405	4	01Jul2015, 12:30	1.3
G9	0.2932	12	01Jul2015, 12:48	3.3
G8-G10	0.2932	11.8	01Jul2015, 12:54	3.2
FG23b	0.0334	1	01Jul2015, 12:18	0.3
G10	1.0176	29	01Jul2015, 12:48	11.6
G10-G11	1.0176	29	01Jul2015, 12:54	11.6
FG23c	0.0070	0	01Jul2015, 12:18	0.1

INTERIM SCS (5-YEAR)				
FG32-G06	0.0402	1	01Jul2015, 12:24	0.3
G11	1.0246	29	01Jul2015, 12:54	11.6
FG25	0.1086	3	01Jul2015, 12:42	0.9
FG28	0.0688	2	01Jul2015, 12:36	0.6
POND G IN	1.2020	33	01Jul2015, 12:54	13.1
POND G	1.2020	10	01Jul2015, 19:48	6.7
G12	1.2020	10	01Jul2015, 19:48	6.7
G12-G06	1.2020	10	01Jul2015, 20:00	6.5
FG29	0.0997	3	01Jul2015, 12:24	0.9
FG32	0.0402	1	01Jul2015, 12:18	0.3
FG32-G06	0.0402	1	01Jul2015, 12:24	0.3
G06	1.3419	11	01Jul2015, 19:48	7.7

Highlighted green rows reference key design points (Typical all charts this section)

INTERIM SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
G1a	0.1313	0.5	01Jul2015, 13:30	0.3
G1a-G2	0.1313	0.5	01Jul2015, 13:48	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G1	0.0578	0.2	01Jul2015, 13:30	0.2
FG01	0.0538	0.9	01Jul2015, 12:48	0.4
FG01-G1	0.0538	0.9	01Jul2015, 12:48	0.4
G1	0.1116	1.1	01Jul2015, 12:54	0.5
G1-G2	0.1116	1.1	01Jul2015, 13:00	0.5
FG02	0.0391	0.5	01Jul2015, 12:30	0.2
G2	0.2820	1.9	01Jul2015, 13:18	1.0
G2-G3	0.2820	1.9	01Jul2015, 13:30	1.0
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	0.9	01Jul2015, 12:06	0.1
G3	0.3195	2.4	01Jul2015, 13:24	1.3
G3-POND F	0.3195	2.4	01Jul2015, 13:30	1.3
FG06	0.0675	1.3	01Jul2015, 12:24	0.4
FG05	0.0580	2.4	01Jul2015, 12:30	0.6
OS07ab	0.0170	0.1	01Jul2015, 12:48	0.1
OS07a-POND F	0.0170	0.1	01Jul2015, 13:30	0.1
POND F IN	0.4620	5.0	01Jul2015, 12:48	2.4
POND F	0.4620	2.1	01Jul2015, 17:54	1.6
POND F-G7	0.4620	2.1	01Jul2015, 18:06	1.5
FG21b	0.0150	1.7	01Jul2015, 12:12	0.2
FG21a	0.0095	0.1	01Jul2015, 12:54	0.0
FG21a-G7	0.0095	0.1	01Jul2015, 13:42	0.0
G7	0.4865	2.3	01Jul2015, 17:48	1.8
G7-G8	0.4865	2.3	01Jul2015, 17:48	1.7
FG22	0.1264	3.3	01Jul2015, 12:42	1.0
OS08	0.0394	0.7	01Jul2015, 12:24	0.2
OS08-G8	0.0394	0.7	01Jul2015, 12:54	0.2
FG23a	0.0231	0.2	01Jul2015, 13:00	0.1
OS07c	0.0156	0.1	01Jul2015, 12:48	0.1
OS07c-G8	0.0156	0.1	01Jul2015, 13:42	0.1
G8	0.6910	4.4	01Jul2015, 12:54	3.1
G7-G10	0.6910	4.2	01Jul2015, 13:12	3.0
OS09	0.1527	1.9	01Jul2015, 12:54	0.8
OS09-G10	0.1527	1.9	01Jul2015, 13:18	0.8
FG24	0.1405	0.7	01Jul2015, 13:30	0.4
G9	0.2932	2.5	01Jul2015, 13:18	1.2
G8-G10	0.2932	2.5	01Jul2015, 13:24	1.2
FG23b	0.0334	0.1	01Jul2015, 13:30	0.1
G10	1.0176	6.8	01Jul2015, 13:12	4.3
G10-G11	1.0176	6.7	01Jul2015, 13:18	4.2
FG23c	0.0070	0.0	01Jul2015, 13:18	0.0

INTERIM SCS (2-YEAR)				
FG32-G06	0.0402	0	01Jul2015, 13:36	0.1
G11	1.0246	6.8	01Jul2015, 13:18	4.3
FG25	0.1086	0.4	01Jul2015, 13:48	0.3
FG28	0.0688	0.3	01Jul2015, 13:48	0.2
POND G IN	1.2020	7.4	01Jul2015, 13:18	4.7
POND G	1.2020	3.6	02Jul2015, 00:00	2.3
G12	1.2020	3.6	02Jul2015, 00:00	2.3
G12-G06	1.2020	3.6	02Jul2015, 00:00	2.2
FG29	0.0997	0.4	01Jul2015, 13:36	0.3
FG32	0.0402	0.2	01Jul2015, 13:24	0.1
FG32-G06	0.0402	0.2	01Jul2015, 13:36	0.1
G06	1.3419	4.0	01Jul2015, 23:48	2.6

Highlighted green rows reference key design points (Typical all charts this section)

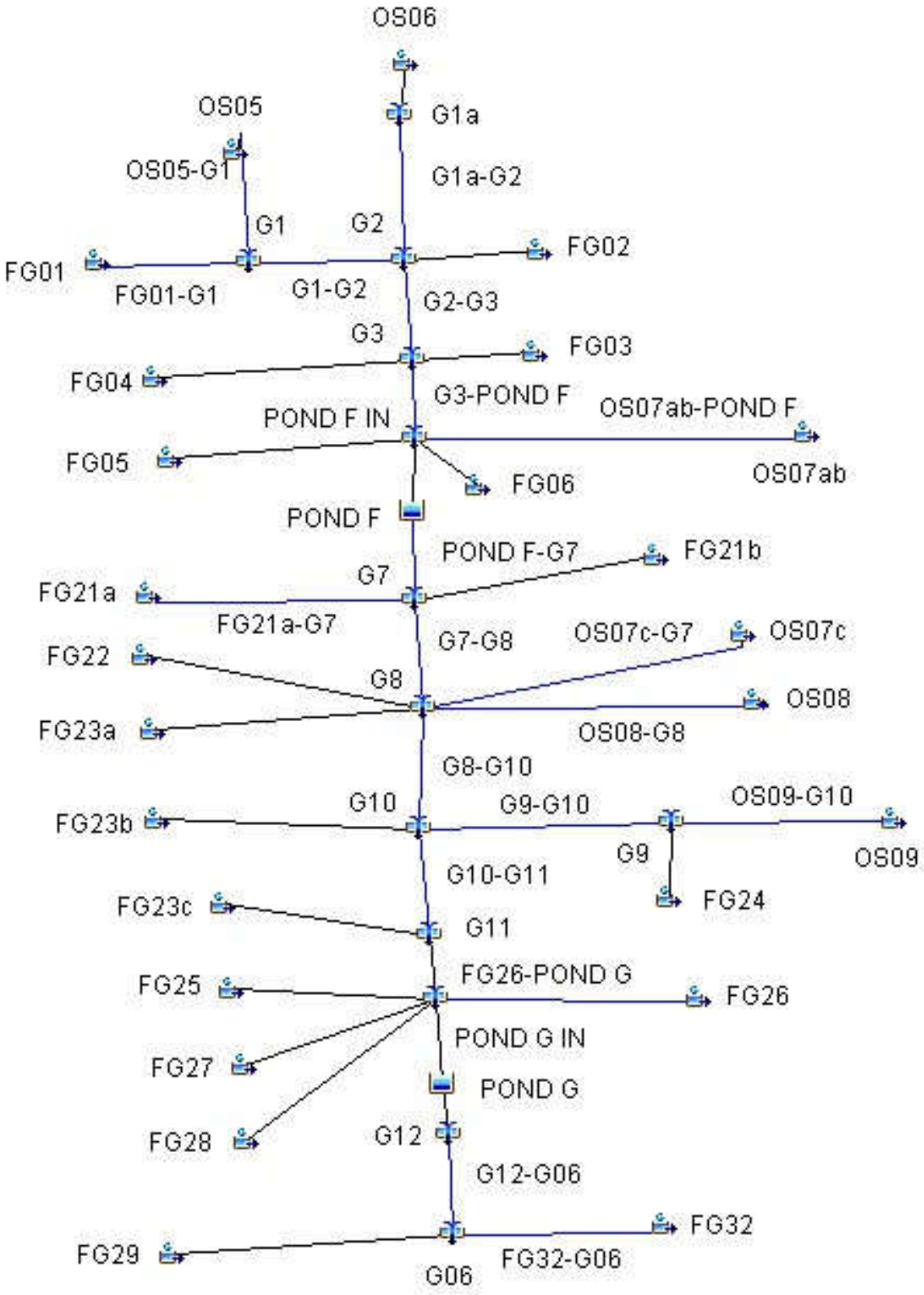
FUTURE SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
OS06	0.1313	80	01Jul2015, 12:12	9.3
G1a	0.1313	80	01Jul2015, 12:12	9.3
G1a-G2	0.1313	79	01Jul2015, 12:18	9.2
OS05	0.0578	39	01Jul2015, 12:12	4.1
OS05-G1	0.0578	39	01Jul2015, 12:12	4.1
FG01	0.0538	31	01Jul2015, 12:30	4.9
FG01-G1	0.0538	31	01Jul2015, 12:30	4.9
G1	0.1116	61	01Jul2015, 12:18	9.0
G1-G2	0.1116	61	01Jul2015, 12:18	9.0
FG02	0.0391	32	01Jul2015, 12:12	3.3
G2	0.2820	167	01Jul2015, 12:18	21.5
G2-G3	0.2820	163	01Jul2015, 12:18	21.3
FG03	0.0203	24	01Jul2015, 12:06	2.0
FG04	0.0172	22	01Jul2015, 12:00	1.7
G3	0.3195	185	01Jul2015, 12:18	25.0
G3-POND F	0.3195	183	01Jul2015, 12:18	25.0
FG06	0.0675	56	01Jul2015, 12:12	6.1
FG05	0.0580	45	01Jul2015, 12:24	6.1
OS07ab	0.0170	14	01Jul2015, 12:06	1.3
OS07ab-POND F	0.0170	13	01Jul2015, 12:18	1.3
POND F IN	0.4620	293	01Jul2015, 12:18	38.5
POND F	0.4620	178	01Jul2015, 12:42	36.1
POND F-G7	0.4620	177	01Jul2015, 12:42	35.8
FG21b	0.0150	21	01Jul2015, 12:06	1.8
FG21a	0.0095	7	01Jul2015, 12:06	0.7
FG21a-G7	0.0095	7	01Jul2015, 12:18	0.7
G7	0.4865	185	01Jul2015, 12:42	38.3
G7-G8	0.4865	184	01Jul2015, 12:42	38.3
FG22	0.1309	89	01Jul2015, 12:24	13.0
OS08	0.0394	34	01Jul2015, 12:12	3.5
OS08-G8	0.0394	33	01Jul2015, 12:12	3.5
FG23a	0.0216	21	01Jul2015, 12:12	2.2
OS07c	0.0156	15	01Jul2015, 12:06	1.2
OS07c-G7	0.0156	14	01Jul2015, 12:12	1.2
G8	0.6940	288	01Jul2015, 12:36	58.1
G8-G10	0.6940	286	01Jul2015, 12:36	57.7
OS09	0.1527	90	01Jul2015, 12:24	13.0
OS09-G10	0.1527	88	01Jul2015, 12:36	12.8
FG24	0.1517	118	01Jul2015, 12:18	15.1
G9	0.3044	193	01Jul2015, 12:24	27.9
G9-G10	0.3044	190	01Jul2015, 12:30	27.8
FG23b	0.0247	18	01Jul2015, 12:12	1.9
G10	1.0231	470	01Jul2015, 12:36	87.4
G10-G11	1.0231	470	01Jul2015, 12:36	87.3
FG23c	0.0122	12	01Jul2015, 12:06	1.2

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (100-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	TIME OF PEAK	TOTAL VOLUME Q100 (AC. FT.)
G11	1.0353	474	01Jul2015, 12:36	88.4
FG25	0.1086	85	01Jul2015, 12:30	13.3
FG26	0.0863	78	01Jul2015, 12:18	9.4
FG26-POND G	0.0863	77	01Jul2015, 12:18	9.4
FG27	0.0500	52	01Jul2015, 12:18	6.3
FG28	0.0245	18	01Jul2015, 12:18	2.3
POND G IN	1.3047	668	01Jul2015, 12:30	119.6
POND G	1.3047	472	01Jul2015, 13:00	110.0
G12	1.3047	472	01Jul2015, 13:00	110.0
G12-G06	1.3047	472	01Jul2015, 13:00	109.4
FG29	0.0997	60	01Jul2015, 12:12	7.1
FG32	0.0402	72	01Jul2015, 12:06	6.1
FG32-G06	0.0402	69	01Jul2015, 12:06	6.1
G06	1.4446	498	01Jul2015, 13:00	122.5
FG34	0.0600	34	01Jul2015, 12:18	4.5
G14	0.0600	34	01Jul2015, 12:18	4.5
G14-G15	0.0600	34	01Jul2015, 12:24	4.4
FG35	0.0344	20	01Jul2015, 12:24	2.7
G15	0.0944	53	01Jul2015, 12:24	7.1
G15-G08	0.0944	52	01Jul2015, 12:24	7.1
FG37	0.0797	41	01Jul2015, 12:18	5.6
FG36	0.0281	14	01Jul2015, 12:18	2.0
FG36-G08	0.0281	14	01Jul2015, 12:24	2.0
G16	0.2022	106	01Jul2015, 12:24	14.7

Highlighted green rows reference key design points (Typical all charts this section)

GIECK FUTURE CONDITIONS



FUTURE SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
OS06	0.1313	52	01Jul2015, 12:12	6.5
G1a	0.1313	52	01Jul2015, 12:12	6.5
G1a-G2	0.1313	52	01Jul2015, 12:18	6.5
OS05	0.0578	26	01Jul2015, 12:12	2.9
OS05-G1	0.0578	25	01Jul2015, 12:12	2.9
FG01	0.0538	22	01Jul2015, 12:30	3.6
FG01-G1	0.0538	22	01Jul2015, 12:30	3.6
G1	0.1116	41	01Jul2015, 12:18	6.4
G1-G2	0.1116	41	01Jul2015, 12:18	6.4
FG02	0.0391	22	01Jul2015, 12:12	2.4
G2	0.2820	112	01Jul2015, 12:18	15.3
G2-G3	0.2820	109	01Jul2015, 12:24	15.2
FG03	0.0203	17	01Jul2015, 12:06	1.5
FG04	0.0172	16	01Jul2015, 12:00	1.3
G3	0.3195	123	01Jul2015, 12:18	17.9
G3-POND F	0.3195	121	01Jul2015, 12:18	17.9
FG06	0.0675	40	01Jul2015, 12:12	4.4
FG05	0.0580	33	01Jul2015, 12:24	4.6
OS07ab	0.0170	9	01Jul2015, 12:12	1.0
OS07ab-POND F	0.0170	9	01Jul2015, 12:18	0.9
POND F IN	0.4620	200	01Jul2015, 12:18	27.9
POND F	0.4620	121	01Jul2015, 12:42	25.8
POND F-G7	0.4620	121	01Jul2015, 12:48	25.7
FG21b	0.0150	16	01Jul2015, 12:06	1.4
FG21a	0.0095	5	01Jul2015, 12:12	0.5
FG21a-G7	0.0095	5	01Jul2015, 12:18	0.5
G7	0.4865	126	01Jul2015, 12:48	27.5
G7-G8	0.4865	125	01Jul2015, 12:48	27.5
FG22	0.1309	64	01Jul2015, 12:24	9.6
OS08	0.0394	24	01Jul2015, 12:12	2.5
OS08-G8	0.0394	23	01Jul2015, 12:12	2.5
FG23a	0.0216	15	01Jul2015, 12:12	1.6
OS07c	0.0156	10	01Jul2015, 12:06	0.9
OS07c-G7	0.0156	10	01Jul2015, 12:12	0.9
G8	0.6940	191	01Jul2015, 12:42	42.1
G8-G10	0.6940	189	01Jul2015, 12:48	41.8
OS09	0.1527	62	01Jul2015, 12:24	9.4
OS09-G10	0.1527	62	01Jul2015, 12:36	9.3
FG24	0.1517	85	01Jul2015, 12:18	11.2
G9	0.3044	134	01Jul2015, 12:30	20.5
G9-G10	0.3044	133.8	01Jul2015, 12:30	20.4
FG23b	0.0247	12	01Jul2015, 12:12	1.3
G10	1.0231	305	01Jul2015, 12:42	63.5
G10-G11	1.0231	304	01Jul2015, 12:42	63.4
FG23c	0.0122	9	01Jul2015, 12:06	0.9

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (50-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q50 (CFS)	TIME OF PEAK	TOTAL VOLUME Q50 (AC. FT.)
G11	1.0353	306	01Jul2015, 12:42	64.2
FG25	0.1086	64	01Jul2015, 12:30	10.2
FG26	0.0863	58	01Jul2015, 12:18	7.1
FG26-POND G	0.0863	57	01Jul2015, 12:18	7.0
FG27	0.0500	40	01Jul2015, 12:18	4.8
FG28	0.0245	13	01Jul2015, 12:18	1.7
POND G IN	1.3047	436	01Jul2015, 12:36	88.0
POND G	1.3047	321	01Jul2015, 13:00	79.0
G12	1.3047	321	01Jul2015, 13:00	79.0
G12-G06	1.3047	320	01Jul2015, 13:06	78.5
FG29	0.0997	39	01Jul2015, 12:18	5.0
FG32	0.0402	57	01Jul2015, 12:06	4.8
FG32-G06	0.0402	54	01Jul2015, 12:06	4.8
G06	1.4446	338	01Jul2015, 13:06	88.3
FG34	0.0600	23	01Jul2015, 12:18	3.2
G14	0.0600	23	01Jul2015, 12:18	3.2
G14-G15	0.0600	22	01Jul2015, 12:24	3.1
FG35	0.0344	13	01Jul2015, 12:24	2.0
G15	0.0944	36	01Jul2015, 12:24	5.1
G15-G08	0.0944	35	01Jul2015, 12:30	5.0
FG37	0.0797	27	01Jul2015, 12:24	4.0
FG36	0.0281	9	01Jul2015, 12:24	1.4
FG36-G08	0.0281	9	01Jul2015, 12:30	1.4
G16	0.2022	69	01Jul2015, 12:24	10.4

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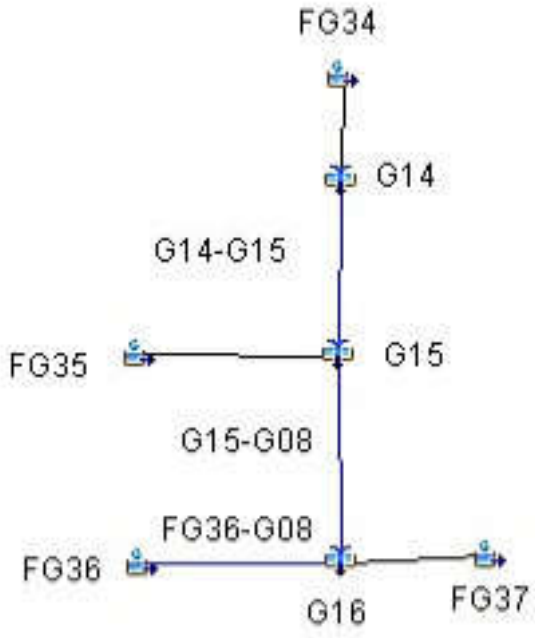


FUTURE SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
OS06	0.1313	12	01Jul2015, 12:18	2.2
G1a	0.1313	12	01Jul2015, 12:18	2.2
G1a-G2	0.1313	11	01Jul2015, 12:24	2.1
OS05	0.0578	5.6	01Jul2015, 12:12	1.0
OS05-G1	0.0578	5.5	01Jul2015, 12:18	1.0
FG01	0.0538	7.0	01Jul2015, 12:36	1.4
FG01-G1	0.0538	7.0	01Jul2015, 12:36	1.4
G1	0.1116	11	01Jul2015, 12:24	2.3
G1-G2	0.1116	11	01Jul2015, 12:30	2.3
FG02	0.0391	6.4	01Jul2015, 12:12	0.9
G2	0.2820	27	01Jul2015, 12:24	5.4
G2-G3	0.2820	27	01Jul2015, 12:30	5.3
FG03	0.0203	5.9	01Jul2015, 12:06	0.6
FG04	0.0172	5.8	01Jul2015, 12:06	0.5
G3	0.3195	31	01Jul2015, 12:30	6.4
G3-POND F	0.3195	31	01Jul2015, 12:30	6.4
FG06	0.0675	12	01Jul2015, 12:18	1.7
FG05	0.0580	12.2	01Jul2015, 12:24	2.0
OS07ab	0.0170	2	01Jul2015, 12:12	0.3
OS07ab-POND F	0.0170	2	01Jul2015, 12:30	0.3
POND F IN	0.4620	54	01Jul2015, 12:30	10.4
POND F	0.4620	16.4	01Jul2015, 13:48	9.1
POND F-G7	0.4620	16.4	01Jul2015, 13:54	9.0
FG21b	0.0150	6.5	01Jul2015, 12:06	0.6
FG21a	0.0095	1	01Jul2015, 12:12	0.2
FG21a-G7	0.0095	1	01Jul2015, 12:30	0.2
G7	0.4865	17	01Jul2015, 13:48	9.8
G7-G8	0.4865	17.3	01Jul2015, 13:48	9.8
FG22	0.1309	22.4	01Jul2015, 12:30	4.0
OS08	0.0394	7.5	01Jul2015, 12:12	1.0
OS08-G8	0.0394	7	01Jul2015, 12:18	1.0
FG23a	0.0216	5	01Jul2015, 12:12	0.7
OS07c	0.0156	3	01Jul2015, 12:06	0.3
OS07c-G7	0.0156	2	01Jul2015, 12:12	0.3
G8	0.6940	39	01Jul2015, 12:18	15.7
G8-G10	0.6940	38	01Jul2015, 12:30	15.4
OS09	0.1527	18	01Jul2015, 12:30	3.5
OS09-G10	0.1527	18.1	01Jul2015, 12:42	3.5
FG24	0.1517	30	01Jul2015, 12:24	4.6
G9	0.3044	41	01Jul2015, 12:36	8.1
G9-G10	0.3044	40.1	01Jul2015, 12:36	8.0
FG23b	0.0247	3	01Jul2015, 12:12	0.5
G10	1.0231	79	01Jul2015, 12:36	23.9
G10-G11	1.0231	78	01Jul2015, 12:36	23.8
FG23c	0.0122	3	01Jul2015, 12:12	0.3

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (10-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q10 (CFS)	TIME OF PEAK	TOTAL VOLUME Q10 (AC. FT.)
G11	1.0353	79	01Jul2015, 12:36	24.2
FG25	0.1086	27.1	01Jul2015, 12:36	4.7
FG26	0.0863	22	01Jul2015, 12:18	3.0
FG26-POND G	0.0863	22	01Jul2015, 12:24	3.0
FG27	0.0500	17	01Jul2015, 12:18	2.3
FG28	0.0245	4	01Jul2015, 12:18	0.7
POND G IN	1.3047	141	01Jul2015, 12:30	34.8
POND G	1.3047	53	01Jul2015, 14:00	27.4
G12	1.3047	53	01Jul2015, 14:00	27.4
G12-G06	1.3047	53	01Jul2015, 14:12	27.1
FG29	0.0997	9	01Jul2015, 12:18	1.6
FG32	0.0402	29	01Jul2015, 12:06	2.5
FG32-G06	0.0402	27	01Jul2015, 12:06	2.4
G06	1.4446	58	01Jul2015, 14:06	31.2
FG34	0.0600	5	01Jul2015, 12:24	1.1
G14	0.0600	5	01Jul2015, 12:24	1.1
G14-G15	0.0600	5	01Jul2015, 12:36	1.1
FG35	0.0344	4	01Jul2015, 12:30	0.7
G15	0.0944	9	01Jul2015, 12:36	1.8
G15-G08	0.0944	9	01Jul2015, 12:36	1.7
FG37	0.0797	6	01Jul2015, 12:24	1.3
FG36	0.0281	2	01Jul2015, 12:30	0.5
FG36-G08	0.0281	2	01Jul2015, 12:36	0.5
G16	0.2022	16	01Jul2015, 12:36	3.5

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
OS06	0.1313	3.8	01Jul2015, 12:24	1.1
G1a	0.1313	3.8	01Jul2015, 12:24	1.1
G1a-G2	0.1313	3.6	01Jul2015, 12:36	1.1
OS05	0.0578	1.8	01Jul2015, 12:18	0.5
OS05-G1	0.0578	1.7	01Jul2015, 12:24	0.5
FG01	0.0538	3.4	01Jul2015, 12:36	0.8
FG01-G1	0.0538	3.4	01Jul2015, 12:36	0.8
G1	0.1116	4.9	01Jul2015, 12:36	1.3
G1-G2	0.1116	4.8	01Jul2015, 12:36	1.3
FG02	0.0391	2.7	01Jul2015, 12:18	0.5
G2	0.2820	10	01Jul2015, 12:30	2.9
G2-G3	0.2820	10	01Jul2015, 12:42	2.9
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	3.1	01Jul2015, 12:06	0.3
G3	0.3195	11	01Jul2015, 12:36	3.3
G3-POND F	0.3195	11	01Jul2015, 12:42	3.3
FG06	0.0675	5.8	01Jul2015, 12:18	1.0
FG05	0.0580	6.7	01Jul2015, 12:30	1.2
OS07ab	0.0170	0.9	01Jul2015, 12:12	0.2
OS07ab-POND F	0.0170	0.9	01Jul2015, 12:36	0.2
POND F IN	0.4620	22.3	01Jul2015, 12:36	5.7
POND F	0.4620	7.7	01Jul2015, 14:18	4.7
POND F-G7	0.4620	7.7	01Jul2015, 14:30	4.6
FG21b	0.0150	3.9	01Jul2015, 12:06	0.4
FG21a	0.0095	0.5	01Jul2015, 12:12	0.1
FG21a-G7	0.0095	0.5	01Jul2015, 12:42	0.1
G7	0.4865	8	01Jul2015, 14:24	5.1
G7-G8	0.4865	8.2	01Jul2015, 14:24	5.1
FG22	0.1309	11.7	01Jul2015, 12:30	2.4
OS08	0.0394	3.3	01Jul2015, 12:12	0.6
OS08-G8	0.0394	3	01Jul2015, 12:18	0.6
FG23a	0.0216	3	01Jul2015, 12:18	0.4
OS07c	0.0156	1.0	01Jul2015, 12:12	0.2
OS07c-G7	0.0156	0.9	01Jul2015, 12:18	0.2
G8	0.6940	20	01Jul2015, 12:24	8.6
G8-G10	0.6940	20	01Jul2015, 12:30	8.5
OS09	0.1527	8	01Jul2015, 12:36	2.0
OS09-G10	0.1527	8.2	01Jul2015, 12:48	2.0
FG24	0.1517	16	01Jul2015, 12:24	2.8
G9	0.3044	18	01Jul2015, 12:42	4.8
G9-G10	0.3044	18.3	01Jul2015, 12:48	4.7
FG23b	0.0247	1	01Jul2015, 12:18	0.3
G10	1.0231	37	01Jul2015, 12:42	13.5
G10-G11	1.0231	37.0	01Jul2015, 12:42	13.4
FG23c	0.0122	1.5	01Jul2015, 12:12	0.2

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (5-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q5 (CFS)	TIME OF PEAK	TOTAL VOLUME Q5 (AC. FT.)
G11	1.0353	37.6	01Jul2015, 12:42	13.6
FG25	0.1086	16.7	01Jul2015, 12:36	3.1
FG26	0.0863	12	01Jul2015, 12:24	1.9
FG26-POND G	0.0863	12	01Jul2015, 12:24	1.9
FG27	0.0500	11	01Jul2015, 12:18	1.5
FG28	0.0245	2	01Jul2015, 12:24	0.4
POND G IN	1.3047	75	01Jul2015, 12:30	20.5
POND G	1.3047	20	01Jul2015, 15:36	13.7
G12	1.3047	20	01Jul2015, 15:36	13.7
G12-G06	1.3047	20	01Jul2015, 15:48	13.5
FG29	0.0997	3	01Jul2015, 12:24	0.9
FG32	0.0402	20	01Jul2015, 12:06	1.7
FG32-G06	0.0402	18	01Jul2015, 12:12	1.7
G06	1.4446	22	01Jul2015, 15:36	16.0
FG34	0.0600	2	01Jul2015, 12:30	0.6
G14	0.0600	2	01Jul2015, 12:30	0.6
G14-G15	0.0600	2	01Jul2015, 12:42	0.6
FG35	0.0344	1	01Jul2015, 12:30	0.4
G15	0.0944	3	01Jul2015, 12:42	0.9
G15-G08	0.0944	3	01Jul2015, 12:48	0.9
FG37	0.0797	2	01Jul2015, 12:36	0.7
FG36	0.0281	1	01Jul2015, 12:36	0.2
FG36-G08	0.0281	1	01Jul2015, 12:48	0.2
G16	0.2022	6	01Jul2015, 12:48	1.8

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
OS06	0.1313	0.5	01Jul2015, 13:30	0.3
G1a	0.1313	0.5	01Jul2015, 13:30	0.3
G1a-G2	0.1313	0.5	01Jul2015, 13:48	0.3
OS05	0.0578	0.2	01Jul2015, 13:24	0.2
OS05-G1	0.0578	0.2	01Jul2015, 13:30	0.2
FG01	0.0538	0.9	01Jul2015, 12:48	0.4
FG01-G1	0.0538	0.9	01Jul2015, 12:48	0.4
G1	0.1116	1.1	01Jul2015, 12:54	0.5
G1-G2	0.1116	1.1	01Jul2015, 13:00	0.5
FG02	0.0391	0.5	01Jul2015, 12:30	0.2
G2	0.2820	1.9	01Jul2015, 13:18	1.0
G2-G3	0.2820	1.9	01Jul2015, 13:30	1.0
FG03	0.0203	0.8	01Jul2015, 12:12	0.2
FG04	0.0172	0.9	01Jul2015, 12:06	0.1
G3	0.3195	2.4	01Jul2015, 13:24	1.3
G3-POND F	0.3195	2.4	01Jul2015, 13:30	1.3
FG06	0.0675	1.3	01Jul2015, 12:24	0.4
FG05	0.0580	2.4	01Jul2015, 12:30	0.6
OS07ab	0.0170	0.1	01Jul2015, 12:48	0.1
OS07ab-POND F	0.0170	0.1	01Jul2015, 13:30	0.1
POND F IN	0.4620	5.0	01Jul2015, 12:48	2.4
POND F	0.4620	2.1	01Jul2015, 17:54	1.6
POND F-G7	0.4620	2.1	01Jul2015, 18:06	1.5
FG21b	0.0150	1.7	01Jul2015, 12:12	0.2
FG21a	0.0095	0.1	01Jul2015, 12:54	0.0
FG21a-G7	0.0095	0.1	01Jul2015, 13:42	0.0
G7	0.4865	2.3	01Jul2015, 17:48	1.8
G7-G8	0.4865	2.3	01Jul2015, 17:48	1.7
FG22	0.1309	3.8	01Jul2015, 12:42	1.1
OS08	0.0394	0.7	01Jul2015, 12:24	0.2
OS08-G8	0.0394	0.7	01Jul2015, 12:30	0.2
FG23a	0.0216	0.8	01Jul2015, 12:18	0.2
OS07c	0.0156	0.1	01Jul2015, 12:48	0.1
OS07c-G7	0.0156	0.1	01Jul2015, 13:00	0.1
G8	0.6940	6.0	01Jul2015, 12:30	3.3
G8-G10	0.6940	6.0	01Jul2015, 12:48	3.2
OS09	0.1527	1.9	01Jul2015, 12:54	0.8
OS09-G10	0.1527	1.9	01Jul2015, 13:18	0.8
FG24	0.1517	5	01Jul2015, 12:30	1.3
G9	0.3044	5	01Jul2015, 12:30	2.1
G9-G10	0.3044	4.9	01Jul2015, 13:12	2.0
FG23b	0.0247	0	01Jul2015, 13:00	0.1
G10	1.0231	10.7	01Jul2015, 12:42	5.4
G10-G11	1.0231	10.6	01Jul2015, 12:48	5.3
FG23c	0.0122	0.4	01Jul2015, 12:18	0.1

Highlighted green rows reference key design points (Typical all charts this section)

FUTURE SCS (2-YEAR)				
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q2 (CFS)	TIME OF PEAK	TOTAL VOLUME Q2 (AC. FT.)
G11	1.0353	10.9	01Jul2015, 12:48	5.4
FG25	0.1086	7.5	01Jul2015, 12:36	1.7
FG26	0.0863	5	01Jul2015, 12:24	1.0
FG26-POND G	0.0863	4.5	01Jul2015, 12:30	0.9
FG27	0.0500	5.0	01Jul2015, 12:24	0.8
FG28	0.0245	0.5	01Jul2015, 12:30	0.2
POND G IN	1.3047	25.6	01Jul2015, 12:42	9.0
POND G	1.3047	5	02Jul2015, 00:00	4.3
G12	1.3047	5	02Jul2015, 00:00	4.3
G12-G06	1.3047	5	02Jul2015, 00:00	4.1
FG29	0.0997	0.4	01Jul2015, 13:36	0.3
FG32	0.0402	11	01Jul2015, 12:06	1.0
FG32-G06	0.0402	11	01Jul2015, 12:12	1.0
G06	1.4446	11	01Jul2015, 12:12	5.4
FG34	0.0600	0	01Jul2015, 13:18	0.2
G14	0.0600	0	01Jul2015, 13:18	0.2
G14-G15	0.0600	0	01Jul2015, 13:48	0.2
FG35	0.0344	0	01Jul2015, 13:06	0.1
G15	0.0944	1	01Jul2015, 13:36	0.3
G15-G08	0.0944	1	01Jul2015, 13:48	0.3
FG37	0.0797	0	01Jul2015, 13:42	0.2
FG36	0.0281	0	01Jul2015, 13:42	0.1
FG36-G08	0.0281	0	01Jul2015, 14:00	0.1
G16	0.2022	1	01Jul2015, 13:48	0.6

Highlighted green rows reference key design points (Typical all charts this section)

Appendix C - Detention Pond Information

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond F INTERIM CONDITION

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	285
embankment elev =	7138.5
spillway length =	87
spillway elevation =	7137.5
100 year storage elev.=	7136.0
100 year storage vol.=	8.9
100 year discharge=	178
5 year storage elev.=	7131.1
5 year storage vol.=	1.8
5 year discharge=	7.7
WQCV storage elev.=	7129.1
WQCV storage vol.=	0.3
1/2 WQCV storage elev.=	7128.6
1/2 WQCV storage vol.=	0.15

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0131	1.25		Area =	0.016	Elev to cl =	7128.45
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	7130.75
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	7129.20
None Selected	Orifice 4:					Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	3	Elev =	7133
Circ. Grate			dia.		Elev =	7133

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7126.6		7131.0		
Wall Thick.	5	in.			

50 year storage elev.=	7134.9
50 year storage vol.=	6.7
50 year discharge=	121
10 year storage elev.=	7132.6
10 year storage vol.=	3.3
10 year discharge=	16
2 year storage elev.=	7130.1
2 year storage vol.=	0.9
2 year discharge=	2.1

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
7127.7	0	0	0.00	0.00	0.00			-	-	-	-	-				
7128	0.3	2170	0.05	0.01	0.01	-	-	0.0	-	-	-	-	11		0.0	0.0
7129	1.3	17730	0.41	0.23	0.24	-	-	0.1	-	-	-	-	31		0.1	0.1
7130	2.3	33290	0.76	0.59	0.82	-	-	0.1	-	1.5	-	-	57		1.6	1.6
7131	3.3	39060	0.90	0.83	1.65	-	-	0.1	4.2	2.3	-	-	117		6.6	6.6
7132	4.3	44830	1.03	0.96	2.61	-	-	0.1	10.8	2.8	-	-	117		14	14
7133	5.3	55137.5	1.27	1.15	3.76	-	-	0.2	14.4	3.3	-	-	142		18	18
7134	6.3	65445	1.50	1.38	5.15	-	-	0.2	17.4	3.7	-	36	162		57	57
7135	7.3	79535	1.83	1.66	6.81	-	-	0.2	19.9	4.0	-	102	175		126	126
7136	8.3	93625	2.15	1.99	8.80	-	-	0.2	22.1	4.4	-	150	187		177	177
7137	9.3	111620	2.56	2.36	11.15	-	-	0.2	24.1	4.7	-	173	200		200	200
7138	10.3	129615	2.98	2.77	13.92	-	92.3	0.2	25.9	5.0	-	194	211		211	303
7138.5	10.8					-	261.0	0.3	26.8	5.1	-	203	211		-	261

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond G-INTERIM CONDITIONS (G12)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	500
embankment elev =	7033.5
spillway length =	130
spillway elevation =	7031.5
100 year storage elev.=	7029.6
100 year storage vol.=	21.1
100 year discharge=	358
5 year storage elev.=	7027.1
5 year storage vol.=	6.7
5 year discharge=	9.8
WQCV storage elev.=	7025.2
WQCV storage vol.=	0.9
1/2 WQCV storage elev.=	7024.9
1/2 WQCV storage vol.=	0.45

Data for outlet pipe and grate:

Type		H or V		Dimensions Width (ft.)	X Height (ft.)		Dia.(in)		(sqft)		
Circular	Orifice 1a:	V					1.75	Area =	0.017	Elev to cl =	7023.37
Circular	Orifice 1b:	V					1.75	Area =	0.017	Elev to cl =	7024.04
Circular	Orifice 1c:	V					1.75	Area =	0.017	Elev to cl =	7024.71
Rectangular	Orifice 2:	V	8.5			1.1		Area =	9.350	Elev to cl =	7027.55
Rectangular	Orifice 3:	V	2			0.43		Area =	0.860	Elev to cl =	7025.34
Rectangular	Orifice 4:	V	4			0.6		Area =	2.400	Elev to cl =	7027.80
Rectangular	Orifice 5:	V	8.5			1.1		Area =	9.350	Elev to cl =	7027.55

Stand Pipe Dimensions

Rec Grate		20	x	8			Elev =	7028.10
Circ. Grate			dia.				Elev =	7028.10

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)			Dia. (ft.)	Type
Outlet Culvert	10	x	4				**Rectangular**
Area	40.0		TOP				
Outlet I. E.	7022.5		7027.50				
Wall Thick.	12	in.					

50 year storage vol.=	17.0
50 year storage elev.=	7028.9
50 year discharge=	206
10 year storage vol.=	8.9
10 year storage elev.=	7027.5
10 year discharge=	28
2 year storage vol.=	2.4
2 year storage elev.=	7026.0
2 year discharge=	3.6

STAGE		STORAGE				DISCHARGE													
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE						(max outflow)	GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1a	1b	1c	2	3	4	5	**Rectangular**	1	2	OUTFLOW	FLOW
7023.3	0	0	0.00	0.0	0.00			-	-	-	-	-	-	-	-	12		-	-
7024	0.7	2232	0.05	0.0	0.02	-	-	0.06	0.01	-	-	-	-	-	-	51		0.1	0.07
7025	1.7	39917	0.92	0.5	0.50	-	-	0.10	0.08	0.04	-	-	-	-	-	111		0.2	0.22
7026	2.7	126469	2.90	1.9	2.41	-	-	0.13	0.11	0.09	-	3.4	-	-	-	184		3.7	3.7
7026.5	3.2	166675	3.83	3.6	4.06	-	-	0.14	0.13	0.11	-	4.5	-	-	-	224		4.8	4.8
7027	3.7	206880	4.75	2.1	6.20	-	-	0.15	0.14	0.12	-	5.3	-	-	-	268		5.8	5.8
7027.5	4.2	232032	5.33	4.6	8.64	-	-	0.16	0.15	0.13	9.0	6.1	-	9.0	-	304		25	25
7028	4.7	257183	5.90	5.3	11.5	-	-	0.17	0.16	0.15	25.5	6.8	4.2	25.5	-	337		62	62
7028.5	5.2	264196	6.07	5.7	14.3	-	-	0.18	0.17	0.16	43.9	7.4	9.7	43.9	27	373		133	133
7029	5.7	271209	6.23	6.1	17.6	-	-	0.19	0.18	0.17	54.2	7.9	12.7	54.2	92	406		222	222
7029.5	6.2	276106	6.34	11.7	20.3	-	-	0.21	0.19	0.18	62.9	8.5	15.1	62.9	179	436		329	329
7030	6.7	281003	6.45	9.4	23.7	-	-	0.21	0.20	0.19	70.5	8.9	17.1	70.5	283	464		450	450
7030.5	7.2	286003	6.57	6.5	26.8	-	-	0.21	0.20	0.19	77.3	9.4	19.0	77.3	402	491		491	491
7031	7.7	291002	6.68	6.6	30.3	-	-	0.22	0.21	0.20	83.6	9.9	20.7	83.6	533	516		516	516
7031.5	8.2	296443	6.81	6.7	33.4	-	-	0.23	0.22	0.21	89.5	10.3	22.2	89.5	677	540		540	540
7032	8.7	301883	6.93	3.4	36.9	137.9	137.9	0.24	0.23	0.22	95.0	10.7	23.7	95.0	832	563		563	701
7032.5	9.2	309236	7.10	7.0	40.4	390.0	390.0	0.24	0.23	0.22	100.2	11.1	25.1	100.2	997	586		586	976
7033	9.7	316589	7.27	3.6	44.0	716.5	716.5	0.25	0.24	0.23	105.1	11.5	26.4	105.1	1,171	607		607	1,323

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond F-FUTURE CONDITIONS

Geick Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	285
embankment elev =	7138.5
spillway length =	87
spillway elevation =	7137.5
100 year storage elev.=	7136.0
100 year storage vol.=	8.9
100 year discharge=	178
5 year storage elev.=	7131.1
5 year storage vol.=	1.8
5 year discharge=	7.7
WQCV storage elev.=	7129.1
WQCV storage vol.=	0.3

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.) X Height (ft.)		Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0131	1.25		Area =	0.016	Elev to cl =	7128.45
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	7130.75
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	7129.20
None Selected	Orifice 4:					Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		6	x	3	Elev =	7133
Circ. Grate			dia.		Elev =	7133

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7126.6		7131.0		
Wall Thick.	5	in.			

50 year storage elev.=	7134.9
50 year storage vol.=	6.7
50 year discharge=	121
10 year storage elev.=	7132.6
10 year storage vol.=	3.3
10 year discharge=	16
2 year storage elev.=	7130.1
2 year storage vol.=	0.9
2 year discharge=	2.1

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
7127.7	0	0	0.00	0.00	0.000			-	-	-	-	-				-
7128	0.3	2170	0.05	0.01	0.007	-	-	0.0	-	-	-	-	11		0.0	0.003
7129	1.3	17730	0.41	0.23	0.236	-	-	0.1	-	-	-	-	31		0.1	0.050
7130	2.3	33290	0.76	0.59	0.822	-	-	0.1	-	1.5	-	-	57		1.6	1.60
7131	3.3	39060	0.90	0.83	1.652	-	-	0.1	4.2	2.3	-	-	117		6.6	6.62
7132	4.3	44830	1.03	0.96	2.615	-	-	0.1	10.8	2.8	-	-	117		14	14
7133	5.3	55137.5	1.27	1.15	3.762	-	-	0.2	14.4	3.3	-	-	142		18	18
7134	6.3	65445	1.50	1.38	5.146	-	-	0.2	17.4	3.7	-	36	162		57	57
7135	7.3	79535	1.83	1.66	6.811	-	-	0.2	19.9	4.0	-	102	175		126	126
7136	8.3	93625	2.15	1.99	8.798	-	-	0.2	22.1	4.4	-	150	187		177	177
7137	9.3	111620	2.56	2.36	11.154	-	-	0.2	24.1	4.7	-	173	200		200	200
7138	10.3	129615	2.98	2.77	13.923	-	92.3	0.2	25.9	5.0	-	194	211		211	303
7138.5	10.8					-	261.0	0.3	26.8	5.1	-	203	211		-	261

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond G-FUTURE CONDITIONS (G12)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	500
embankment elev =	7033.5
spillway length =	130
spillway elevation =	7031.5
100 year storage elev.=	7030.3
100 year storage vol.=	25.3
100 year discharge=	472
5 year storage elev.=	7027.4
5 year storage vol.=	8.1
5 year discharge=	20
WQCV storage elev.=	7025.2
WQCV storage vol.=	0.9
1/2 WQCV storage elev.=	7024.9
1/2 WQCV storage vol.=	0.45

Data for outlet pipe and grate:

Type		H or V		Dimensions Width (ft.)	X Height (ft.)		Dia.(in)		(sqft)			
Circular	Orifice 1a:	V					1.75	Area =	0.017	Elev to cl =		7023.37
Circular	Orifice 1b:	V					1.75	Area =	0.017	Elev to cl =		7024.04
Circular	Orifice 1c:	V					1.75	Area =	0.017	Elev to cl =		7024.71
Rectangular	Orifice 2:	V	8.5			1.1		Area =	9.350	Elev to cl =		7027.55
Rectangular	Orifice 3:	V	2			0.43		Area =	0.860	Elev to cl =		7025.34
Rectangular	Orifice 4:	V	4			0.6		Area =	2.400	Elev to cl =		7027.80
Rectangular	Orifice 5:	V	8.5			1.1		Area =	9.350	Elev to cl =		7027.55

Stand Pipe Dimensions

Rec Grate		20	x	8			Elev =	7028.10
Circ. Grate			dia.				Elev =	7028.10

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)			Dia. (ft.)	Type
Outlet Culvert	10	x	4				**Rectangular**
Area	40.0		TOP				
Outlet I. E.	7022.5		7027.50				
Wall Thick.	12	in.					

50 year storage vol.=	20.1
50 year storage elev.=	7029.5
50 year discharge=	321
10 year storage vol.=	10.8
10 year storage elev.=	7027.9
10 year discharge=	53
2 year storage vol.=	4.7
2 year storage elev.=	7026.6
2 year discharge=	5.1

STAGE		STORAGE				DISCHARGE													
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE							(max outflow)	GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1a	1b	1c	2	3	4	5	**Rectangular**		1	2	OUTFLOW	FLOW
7023.3	0	0	0.00	0.0	0.00			-	-	-	-	-	-	-	-		12		-	-
7024	0.7	2232	0.05	0.0	0.02	-	-	0.06	0.01	-	-	-	-	-	-		51		0.1	0.07
7025	1.7	39917	0.92	0.5	0.50	-	-	0.10	0.08	0.04	-	-	-	-	-		111		0.2	0.22
7026	2.7	126469	2.90	1.9	2.41	-	-	0.13	0.11	0.09	-	3.4	-	-	-		184		3.7	3.7
7026.5	3.2	166675	3.83	3.6	4.06	-	-	0.14	0.13	0.11	-	4.5	-	-	-		224		4.8	4.8
7027	3.7	206880	4.75	2.1	6.20	-	-	0.15	0.14	0.12	-	5.3	-	-	-		268		5.8	5.8
7027.5	4.2	232032	5.33	4.6	8.64	-	-	0.16	0.15	0.13	9.0	6.1	-	9.0	-		304		25	25
7028	4.7	257183	5.90	5.3	11.5	-	-	0.17	0.16	0.15	25.5	6.8	4.2	25.5	-		337		62	62
7028.5	5.2	264196	6.07	5.7	14.3	-	-	0.18	0.17	0.16	43.9	7.4	9.7	43.9	27		373		133	133
7029	5.7	271209	6.23	6.1	17.6	-	-	0.19	0.18	0.17	54.2	7.9	12.7	54.2	92		406		222	222
7029.5	6.2	276106	6.34	11.7	20.3	-	-	0.21	0.19	0.18	62.9	8.5	15.1	62.9	179		436		329	329
7030	6.7	281003	6.45	9.4	23.7	-	-	0.21	0.20	0.19	70.5	8.9	17.1	70.5	283		464		450	450
7030.5	7.2	286003	6.57	6.5	26.8	-	-	0.21	0.20	0.19	77.3	9.4	19.0	77.3	402		491		491	491
7031	7.7	291002	6.68	6.6	30.3	-	-	0.22	0.21	0.20	83.6	9.9	20.7	83.6	533		516		516	516
7031.5	8.2	296443	6.81	6.7	33.4	-	-	0.23	0.22	0.21	89.5	10.3	22.2	89.5	677		540		540	540
7032	8.7	301883	6.93	3.4	36.9	137.9	137.9	0.24	0.23	0.22	95.0	10.7	23.7	95.0	832		563		563	701
7032.5	9.2	309236	7.10	7.0	40.4	390.0	390.0	0.24	0.23	0.22	100.2	11.1	25.1	100.2	997		586		586	976
7033	9.7	316589	7.27	3.6	44.0	716.5	716.5	0.25	0.24	0.23	105.1	11.5	26.4	105.1	1,171		607		607	1,323

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

ROLLING HILLS RANCH ESTATES INTERIM CONDITION

Simulation Run: RH ESTATES FILING 2-100 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	293(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	178 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:42
Total Inflow:	38.5 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	36.1 (AC-FT)	Peak Elevation:	7136.0 (FT)

Simulation Run: RH ESTATES FILING 2-010 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	54 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	16 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:48
Total Inflow:	10.4 (AC-FT)	Peak Storage:	3.3 (AC-FT)
Total Outflow:	9.1 (AC-FT)	Peak Elevation:	7132.6 (FT)

Simulation Run: RH ESTATES FILING 2-100 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	522(CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:36
Peak Outflow:	358 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:06
Total Inflow:	94.7 (AC-FT)	Peak Storage:	21.1 (AC-FT)
Total Outflow:	85.6 (AC-FT)	Peak Elevation:	7129.6 (FT)

Simulation Run: RH ESTATES FILING 2-010 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	RH Estates Filing 2
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	76 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:42
Peak Outflow:	28 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 15:42
Total Inflow:	24.3 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	17.3 (AC-FT)	Peak Elevation:	7127.5 (FT)

Simulation Run: F-100 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	293 CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:18
Peak Outflow:	178 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 12:42
Total Inflow:	38.5 (AC-FT)	Peak Storage:	8.9 (AC-FT)
Total Outflow:	36.1 (AC-FT)	Peak Elevation:	7136.0 (FT)

Simulation Run: F-010 YR Reservoir: POND F

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	54 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	16 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:48
Total Inflow:	10.4 (AC-FT)	Peak Storage:	3.3 (AC-FT)
Total Outflow:	9.1 (AC-FT)	Peak Elevation:	7132.6 (FT)

Simulation Run: F-100 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 100YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	668 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	472 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 13:00
Total Inflow:	119.6 (AC-FT)	Peak Storage:	25.4 (AC-FT)
Total Outflow:	110.0 (AC-FT)	Peak Elevation:	7030.3 (FT)

Simulation Run: F-010 YR Reservoir: POND G

Start of Run:	01Jul2015, 00:00	Basin Model:	Future SCS
End of Run:	02Jul2015, 00:00	Meteorologic Model:	SCS TYPE IIA 005YR
		Control Specifications:	24 HR-2 MIN.
		Volume Units:	AC-FT

Computed Results:

Peak Inflow:	141 (CFS)	Date/Time of Peak Inflow:	01Jul2015, 12:30
Peak Outflow:	53 (CFS)	Date/Time of Peak Outflow:	01Jul2015, 14:00
Total Inflow:	34.8 (AC-FT)	Peak Storage:	10.9 (AC-FT)
Total Outflow:	27.4 (AC-FT)	Peak Elevation:	7027.9 (FT)

Appendix D – Outlet Protection Design

Again, enter Figure HS-19a using the smaller d/D (or d/H) ratio to find the A/A_{full} ratio. Then,

$$A = \left(A/A_{full}\right)A_{full} \qquad \text{(HS-16c)}$$

Finally,

$$V = Q/A \qquad \text{(HS-16d)}$$

In which for Equations 16a through 16d above:

A_{full} = cross-sectional area of the pipe (ft^2)

A = area of the design flow in the end of the pipe (ft^2)

n = Manning's n for the pipe full depth

Q_{full} = pipe full discharge at its slope (cfs)

R = hydraulic radius of the pipe flowing full, ft [$R_{full} = D/4$ for circular pipes, $R_{full} = A_{full}/(2H + 2w)$ for rectangular pipes, where D = diameter of a circular conduit, H = height of a rectangular conduit, and w = width of a rectangular conduit (ft)]

S_o = longitudinal slope of the pipe (ft/ft)

V = design flow velocity at the pipe outlet (ft/sec)

V_{full} = flow velocity of the pipe flowing full (ft/sec)

3.4.3.2 Riprap Size

For the design velocity, use Figure HS-20c to find the size and type of the riprap to use in the scour protection basin downstream of the pipe outlet (i.e., B18, H, M or L). First, calculate the riprap sizing design parameter, P_d , namely,

$$P_d = \left(V^2 + gd\right)^{1/2} \qquad \text{(HS-16e)}$$

in which:

V = design flow velocity at pipe outlet (ft/sec)

g = acceleration due to gravity = 32.2 ft/sec^2

d = design depth of flow at pipe outlet (ft)

necessary when the receiving or downstream channel may have little or no flow or tailwater at time when the pipe or culvert is in operation. Design criteria are provided in Figures HS-19a through HS-20c.

3.4.2 Objective

By providing a low tailwater basin at the end of a storm sewer conduit or culvert, the kinetic energy of the discharge is dissipated under controlled conditions without causing scour at the channel bottom. Photograph HS-12 shows a fairly large low tailwater basin.

3.4.3 Low Tailwater Basin Design

Low tailwater is defined as being equal to or less than ⅓ of the height of the storm sewer, that is:

$$y_t \le \frac{D}{3} \quad \text{or} \quad y_t \le \frac{H}{3}$$

in which:

y_t = tailwater depth at design

D = diameter of circular pipe (ft)

H = height of rectangular pipe (ft)

3.4.3.1 Finding Flow Depth and Velocity of Storm Sewer Outlet Pipe

The first step in the design of a scour protection basin at the outlet of a storm sewer is to find the depth and velocity of flow at the outlet. Pipe-full flow can be found using Manning's equation.

$$Q_{full} = \frac{1.49}{n} A_{full} \left(R_{full}\right)^{2/3} S_o^{1/2} \qquad \text{(HS-16a)}$$

Then and the pipe-full velocity can be found using the continuity equation.

$$V_{full} = Q_{full} / A_{full} \qquad \text{(HS-16a)}$$

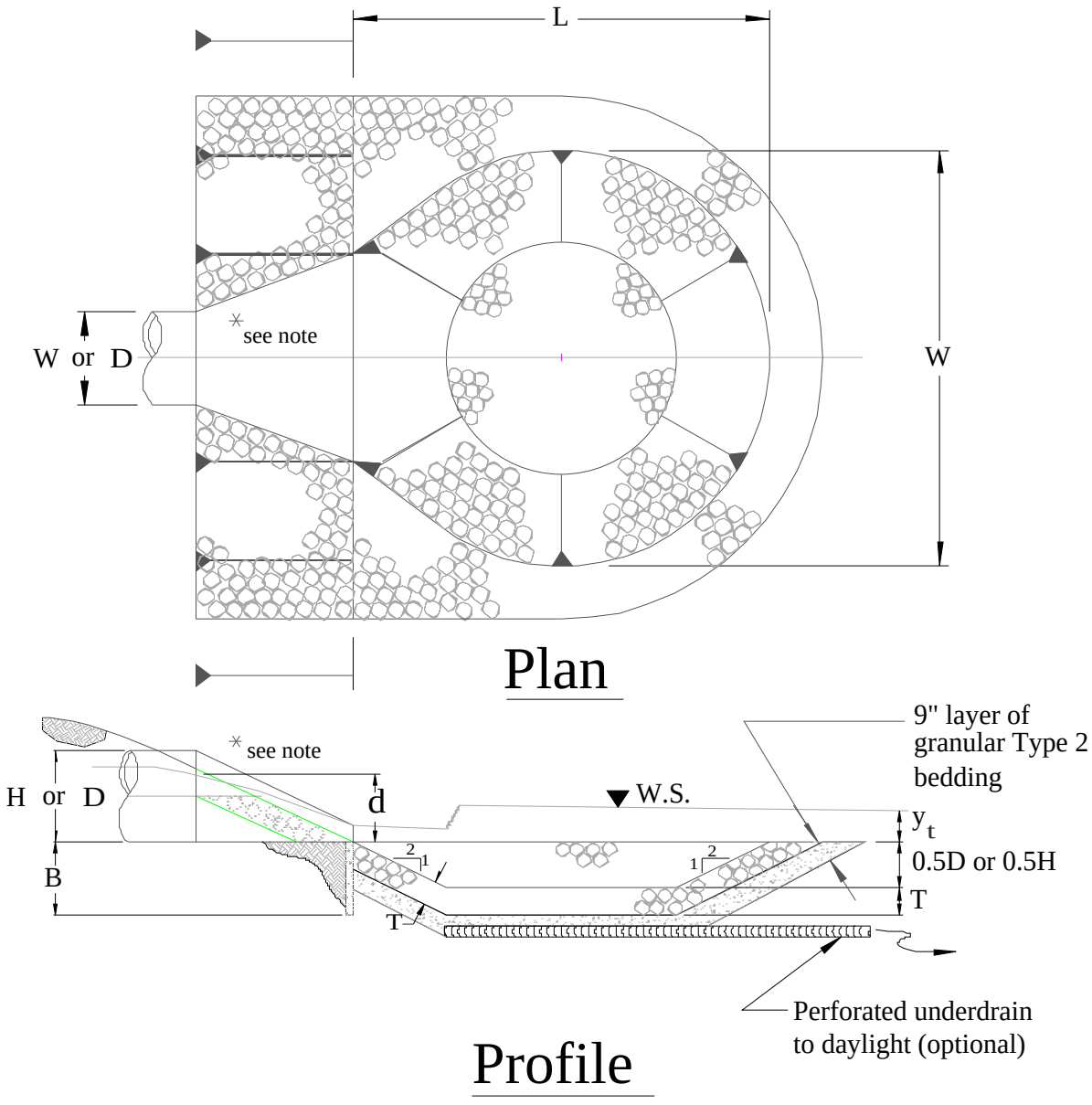
The normal depth of flow, d, and the velocity in a conduit can be found with the aid of Figure HS-20a and Figure HS-20b. Using the known design discharge, Q, and the calculated pipe-full discharge, Q_{full}, enter Figure HS-20a with the value of Q/Q_{full} and find d/D for a circular pipe of d/H for a rectangular pipe.

Compare the value of d/D (or d/H) with the one obtained from Figure HS-20b using the Froude parameter.

$$Q/D^{2.5} \quad \text{or} \quad Q/\left(wH^{1/5}\right) \qquad \text{(HS-16a)}$$

Choose the smaller of the two (d/D or d/H) ratios to calculate the flow depth at the end of the pipe.

$$d = D\left(d/D\right) \quad \text{or} \quad d = H\left(d/H\right) \qquad \text{(HS-16b)}$$



* Note: For rectangular conduits use a standard design for a headwall with wingwalls, paved bottom between the wingwalls, with an end cutoff wall extending to a minimum depth equal to B

Figure HS-19—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Low Tailwater Basin at Pipe Outlets
(Stevens and Urbonas 1996)

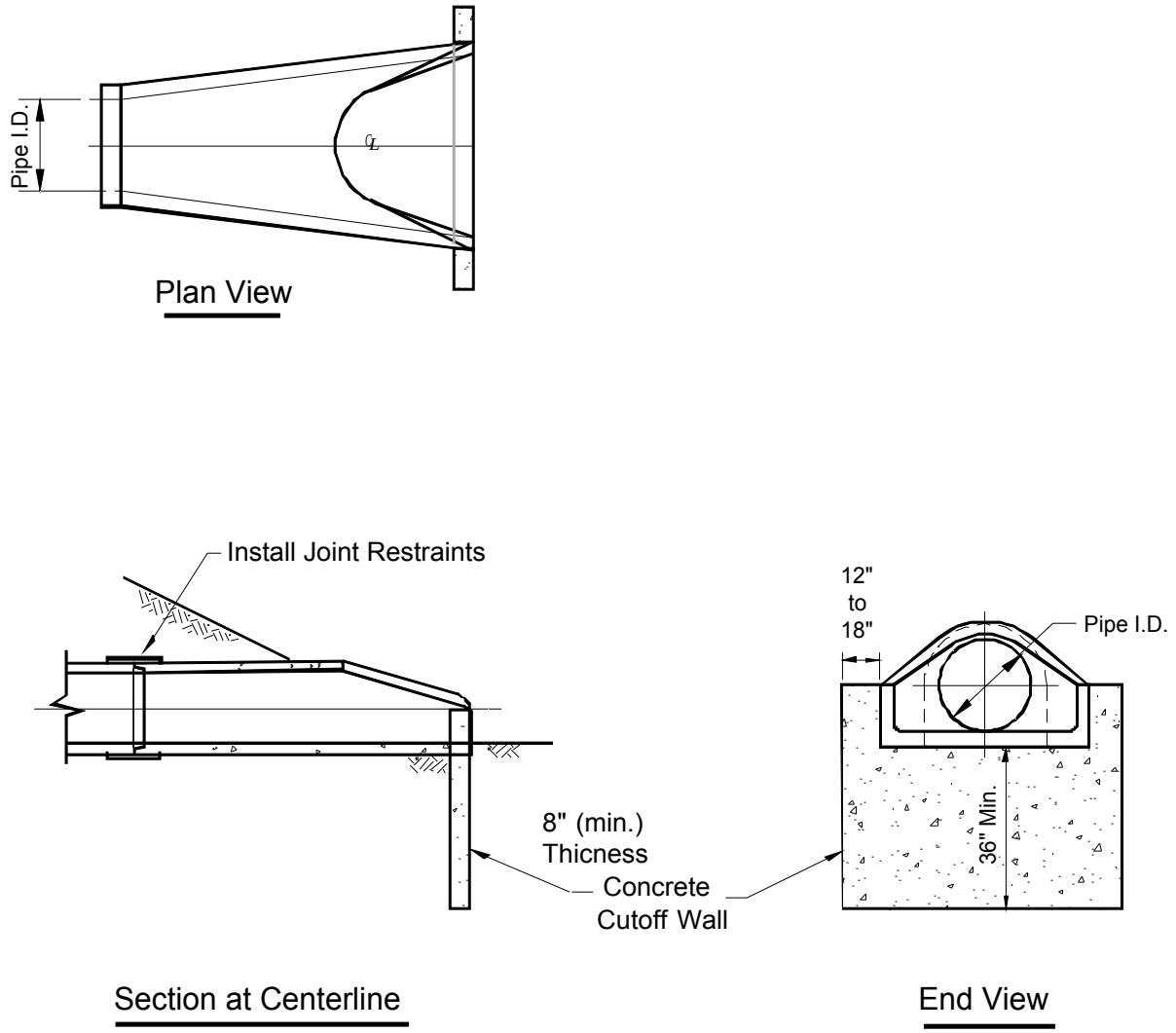


Figure HS-19a—Concrete Flared End Section with Cutoff Wall for all Pipe Outlets

Photograph HS-12—Upstream and downstream views of a low tailwater basin in Douglas County protecting downstream wetland area. Burying and revegetation of the rock would blend the structure better with the adjacent terrain.

When the riprap sizing design parameter indicates conditions that place the design above the Type H riprap line in Figure HS-20, use B18, or larger, grouted boulders. An alternative to a grouted boulder or loose riprap basin is to use the standard USBR Impact Basin VI or one of its modified versions, described earlier in this Chapter of the *Manual*.

After the riprap size has been selected, the minimum thickness of the riprap layer, T, in feet, in the basin is set at:

$$T = 1.75 D_{50} \qquad \text{(HS-17)}$$

in which:

D_{50} = the median size of the riprap (see Table HS-9.)

Table HS-9—Median (i.e., D_{50}) Size of District's Riprap/Boulder

Riprap Type	D_{50}—Median Rock Size (inches)
L	9
M	12
H	18
B18	18 (minimum dimension of grouted boulders)

3.4.3.3 Basin Length

The minimum length of the basin, L, in Figure HS-19, is defined as being the greater of the following:

for circular pipe: $L = 4D$ or $L = (D)^{1/2}\left(\frac{V}{2}\right)$ (HS-18)

for rectangular pipe: $L = 4H$ or $L = (H)^{1/2}\left(\frac{V}{2}\right)$ (HS-19)

in which:

L = basin length

H = height of rectangular conduit

V = design flow velocity at outlet

D = diameter of circular conduit

3.4.3.4 Basin Width

The minimum width, W, of the basin downstream of the pipe's flared end section is set as follows:

for circular pipes: $W = 4D$ (HS-20)

for rectangular pipe: $W = w + 4H$ (HS-21)

in which,

W = basin width (Figure HS-19)

D = diameter of circular conduit

w = width of rectangular conduit

3.4.3.5 Other Design Requirements

All slopes in the pre-shaped riprapped basin are 2H to 1V.

Provide pipe joint fasteners and a structural concrete cutoff wall at the end of the flared end section for a circular pipe or a headwall with wingwalls and a paved bottom between the walls, both with a cutoff wall that extends down to a depth of:

$B = \frac{D}{2} + T$ or $B = \frac{H}{2} + T$ (HS-22)

in which,

B = cutoff wall depth

D = diameter of circular conduit

T = Equation HS-17

The riprap must be extended up the outlet embankment's slope to the mid-pipe level.

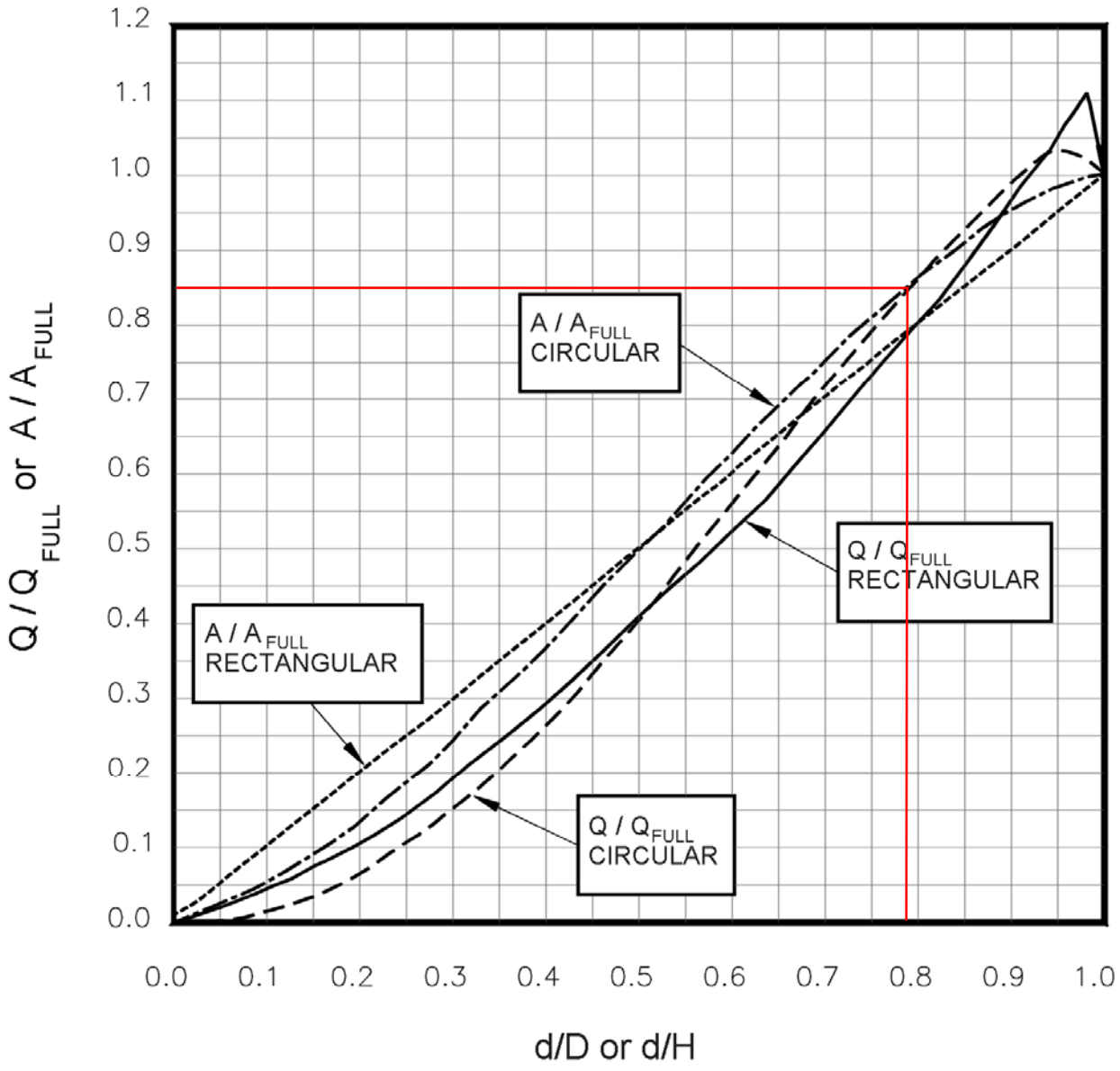


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's n Varying With Depth)
(Stevens and Urbonas 1996)

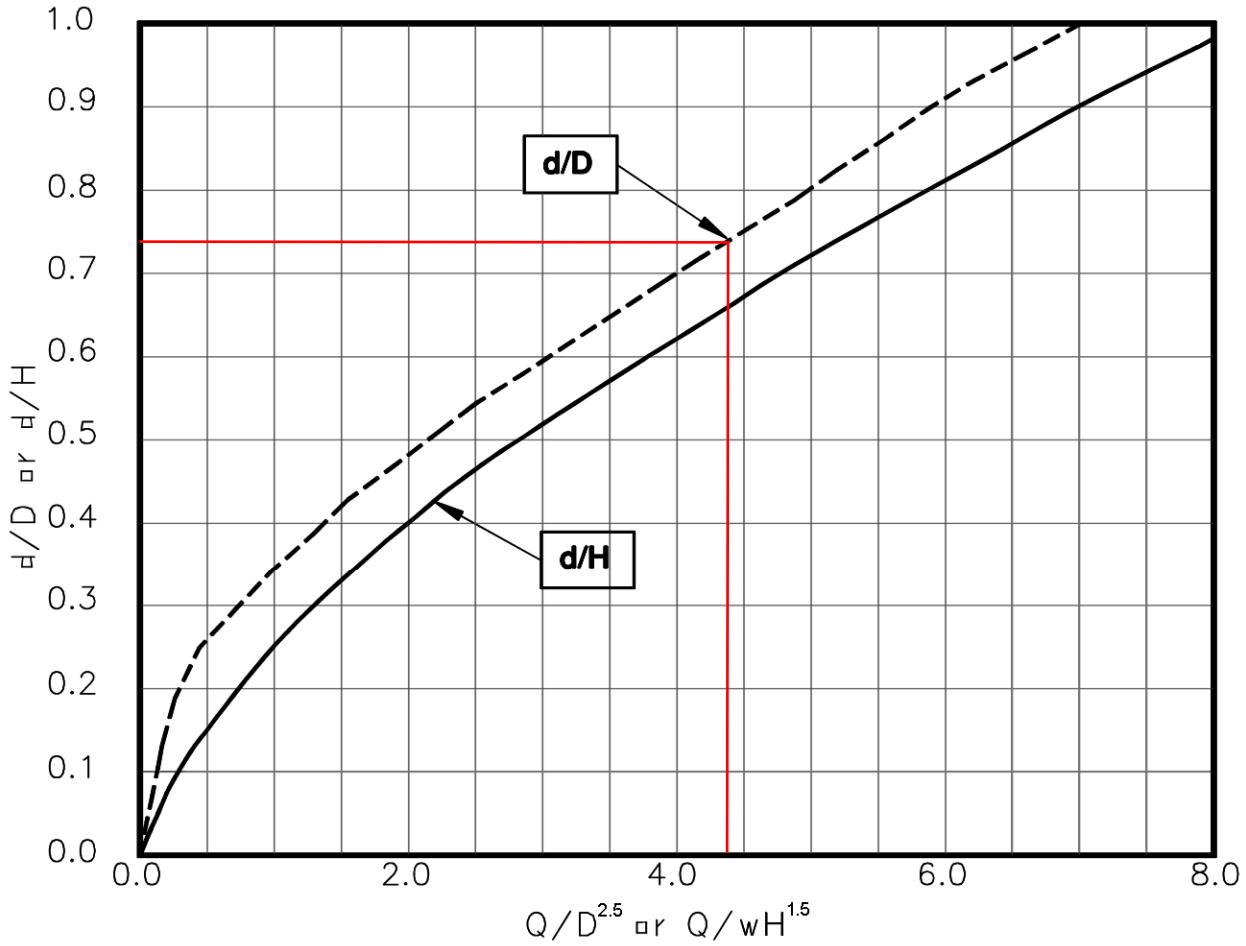


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

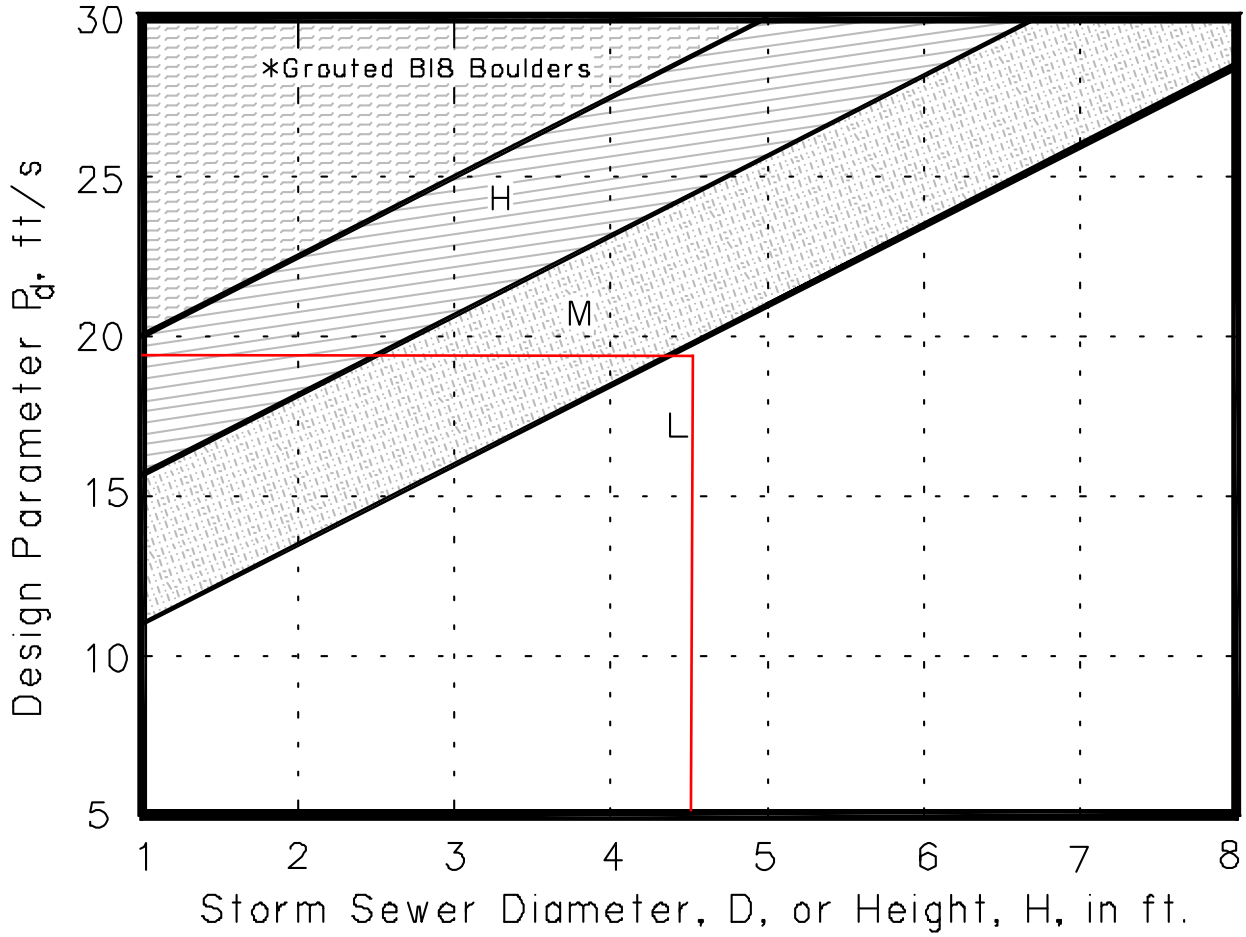


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

RIP RAP PLUNGE POOL

Urban Drainage & Flood Control District Pipe Outlet Design

Low Tailwater Design ($y_t \leq D/3$)

OUTLET # OS-2

Outlet Size (D) :	54	in.	Discharge (q):	189	CFS
Capacity (Q): (full flow)	222	CFS	Flow depth (d): (calculated)	40.0	in.

Q_{full} =	222 CFS	q/Q_{full} =	0.85
A_{full} =	15.9 SF		
V_{full} =	14.0 FPS	$Q/D^{2.5}$ =	4.4

d/D	0.78	from HS-20a using q/Q_{full}
d/D	0.74	from HS-20b using $Q/D^{2.5}$

A' (A/A_{full})	0.74	from HS-20a using smaller d/D from above	Flow Area ($a=A' \times A_{full}$)	11.8	SF

Outlet Velocity (V = q/a) 16.1 FPS

$P_d = (V^2 + gd)^{1/2}$ = 19

RIP-RAP SIZE: M from HS-20c

d_{50}= 12 in $T=1.75xd_{50}$ 1.75 ft

Basin Length (L)	18.0	FT.	Cutoff Wall Depth (B=D/2+T)	4	FT
Basin Width (W)	18.0	FT.			

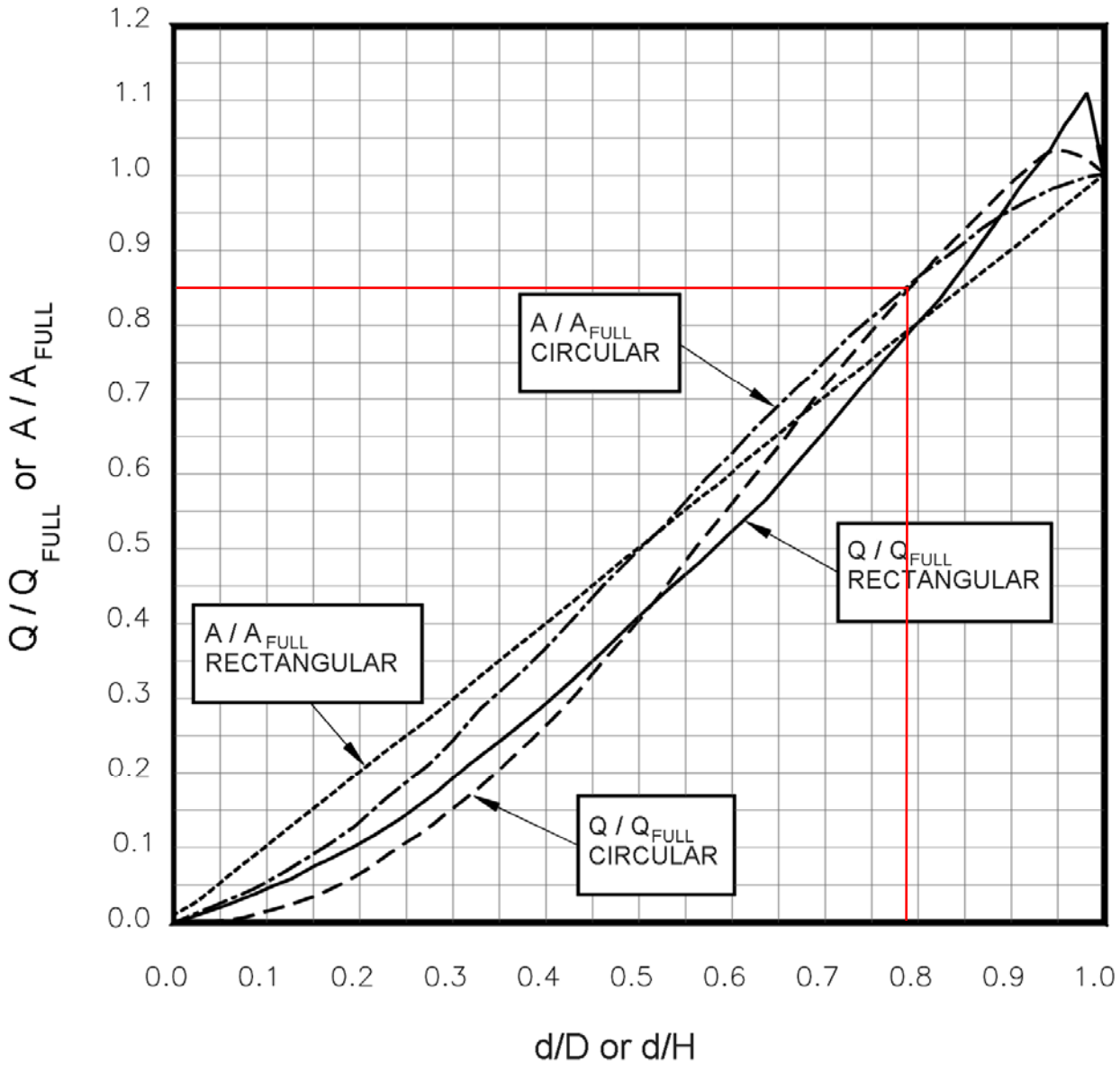


Figure HS-20a—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Discharge and Flow Area Relationships for Circular and Rectangular Pipes
(Ratios for Flow Based on Manning's n Varying With Depth)
(Stevens and Urbonas 1996)

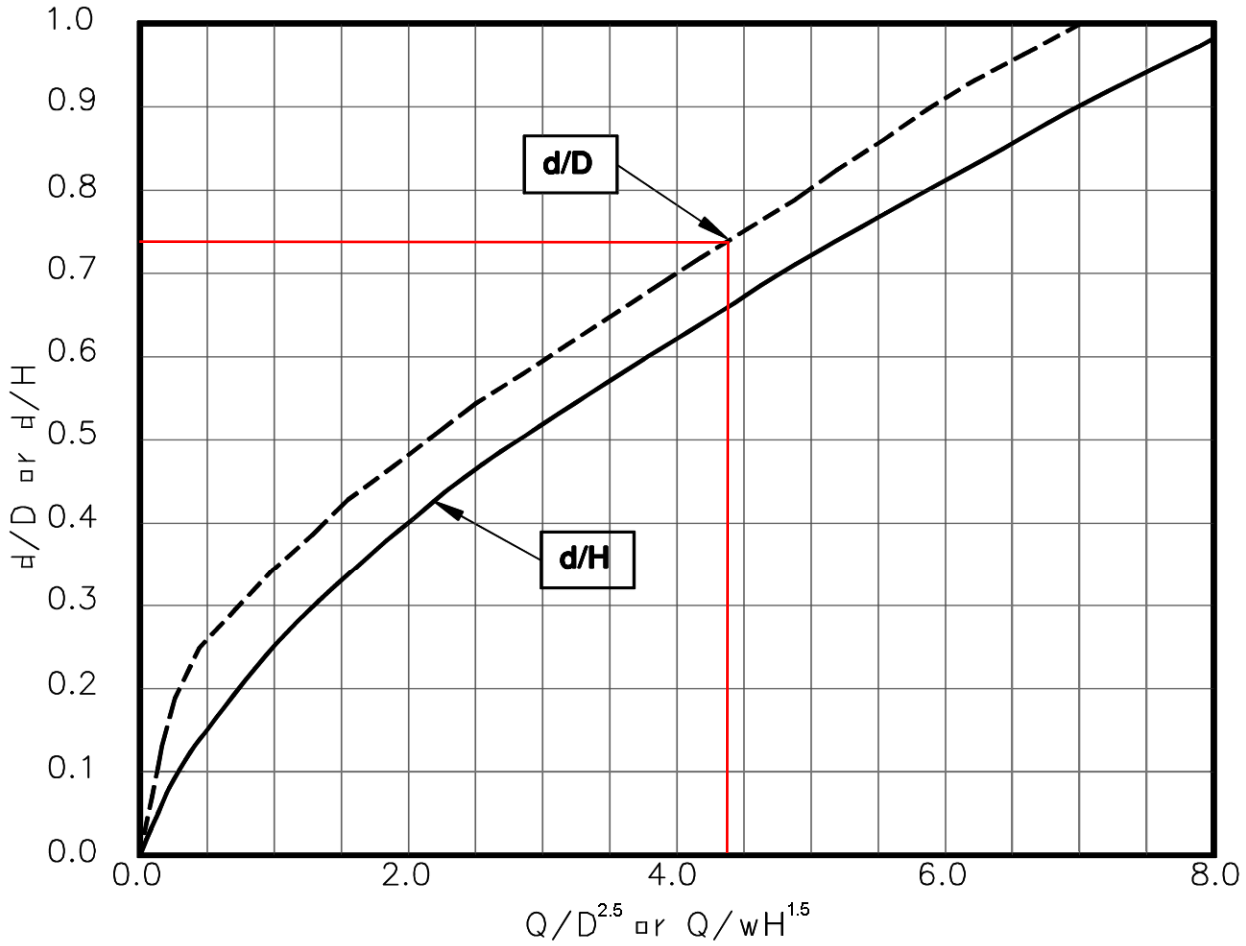


Figure HS-20b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

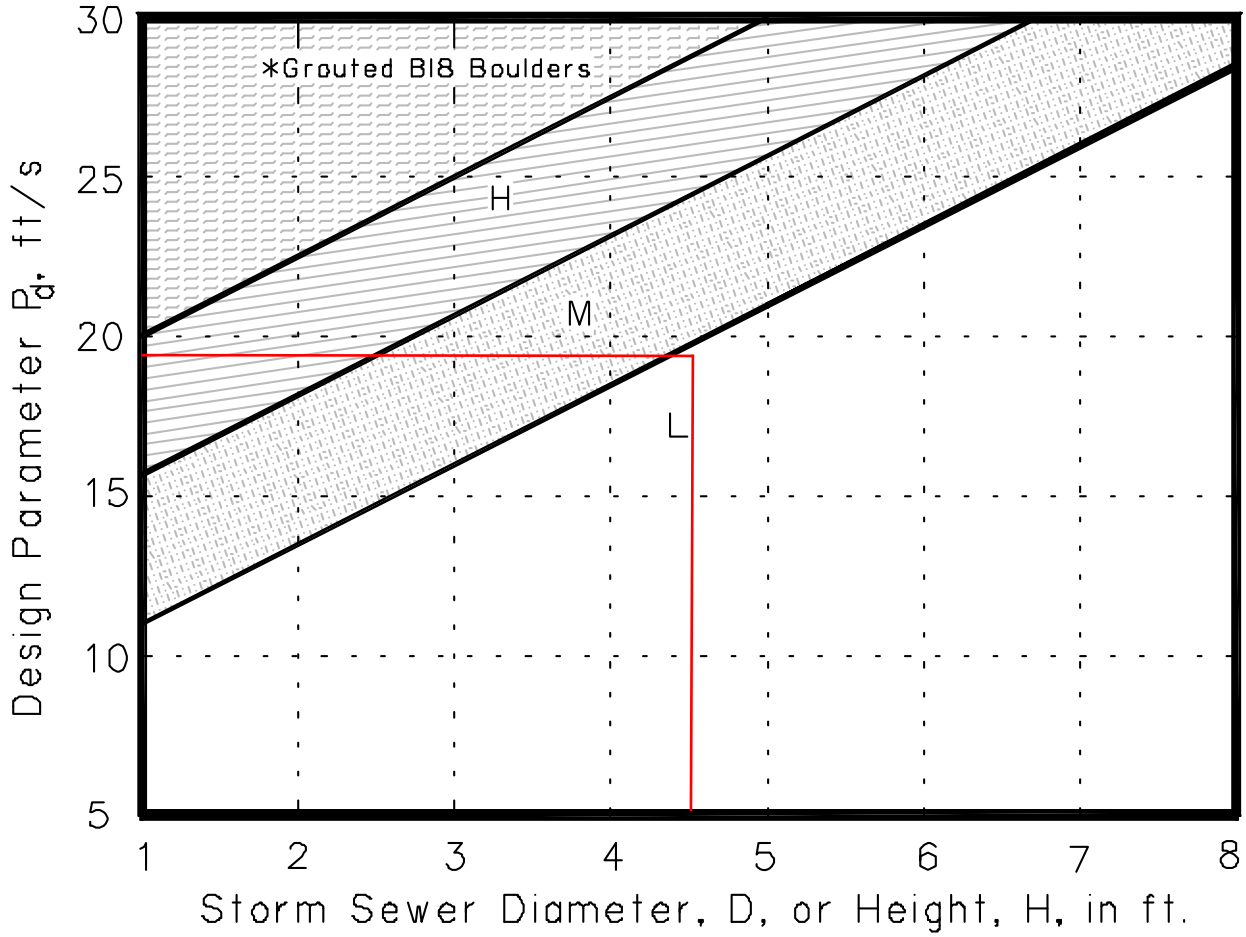


Figure HS-20c—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet

(Stevens and Urbonas 1996)

Appendix E – Street Flow

Worksheet for Ramp Full Street Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+13	-0.25
0+14	-0.75
0+15	-0.59
0+30	-0.29
0+45	-0.59
0+46	-0.75
0+48	-0.25
0+60	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+13, -0.25)	0.030
(0+13, -0.25)	(0+15, -0.59)	0.013
(0+15, -0.59)	(0+45, -0.59)	0.015
(0+45, -0.59)	(0+48, -0.25)	0.013
(0+48, -0.25)	(0+60, 0.00)	0.030
<None>	(0+60, 0.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Ramp Full Street Section

Results

Discharge		42.54	ft^3/s
Elevation Range	-0.75 to 0.00 ft		
Flow Area		19.32	ft^2
Wetted Perimeter		60.21	ft
Hydraulic Radius		0.32	ft
Top Width		60.00	ft
Normal Depth		0.75	ft
Critical Depth		0.66	ft
Critical Slope		0.01121	ft/ft
Velocity		2.20	ft/s
Velocity Head		0.08	ft
Specific Energy		0.83	ft
Froude Number		0.68	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01121	ft/ft

Cross Section for Ramp Full Street Section

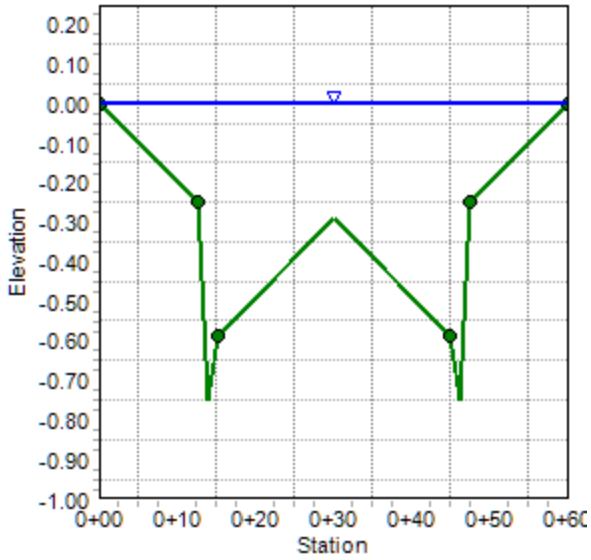
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft
Discharge	42.54	ft³/s

Cross Section Image



RESIDENTIAL STREET SECTION
RAMP CURB

5-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Top of Curb)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	19	2.5	7.45	35.2	35.0	9.4	2.5	3.7	17.5
0.0063	21	2.8	7.45	35.2	35.0	11	2.8	3.7	17.5
0.0075	23	3.1	7.45	35.2	35.0	12	3.1	3.7	17.5
0.0088	25	3.4	7.45	35.2	35.0	12	3.3	3.7	17.5
0.0100	27	3.6	7.45	35.2	35.0	13	3.6	3.7	17.5
0.0113	28	3.8	7.45	35.2	35.0	14	3.8	3.7	17.5
0.0125	30	4.0	7.45	35.2	35.0	15	4.0	3.7	17.5
0.0138	31	4.2	7.45	35.2	35.0	16	4.2	3.7	17.5
0.0150	33	4.4	7.45	35.2	35.0	16	4.4	3.7	17.5
0.0163	34	4.6	7.45	35.2	35.0	17	4.5	3.7	17.5
0.0175	35	4.7	7.45	35.2	35.0	18	4.7	3.7	17.5
0.0188	37	4.9	7.45	35.2	35.0	18	4.9	3.7	17.5
0.0200	38	5.1	7.45	35.2	35.0	19	5.0	3.7	17.5
0.0213	39	5.2	7.45	35.2	35.0	19	5.2	3.7	17.5
0.0225	40	5.4	7.45	35.2	35.0	20	5.4	3.7	17.5
0.0238	41	5.5	7.45	35.2	35.0	20	5.5	3.7	17.5
0.0250	42	5.7	7.45	35.2	35.0	21	5.6	3.7	17.5
0.0263	43	5.8	7.45	35.2	35.0	22	5.8	3.7	17.5
0.0275	44	5.9	7.45	35.2	35.0	22	5.9	3.7	17.5
0.0288	45	6.1	7.45	35.2	35.0	23	6.0	3.7	17.5
0.0300	46	6.2	7.45	35.2	35.0	23	6.2	3.7	17.5
0.0313	47	6.3	7.45	35.2	35.0	23	6.3	3.7	17.5
0.0325	48	6.5	7.45	35.2	35.0	24	6.4	3.7	17.5
0.0338	49	6.6	7.45	35.2	35.0	24	6.6	3.7	17.5
0.0350	50	6.7	7.45	35.2	35.0	25	6.7	3.7	17.5
0.0363	51	6.8	7.45	35.2	35.0	25	6.8	3.7	17.5
0.0375	52	6.9	7.45	35.2	35.0	26	6.9	3.7	17.5
0.0388	53	7.1	7.45	35.2	35.0	26	7.0	3.7	17.5
0.0400	53	7.2	7.45	35.2	35.0	27	7.1	3.7	17.5

100-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Right-of-Way)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	43	2.2	19.32	60.2	60.0	21	2.2	9.7	30
0.0063	48	2.5	19.32	60.2	60.0	24	2.4	9.7	30
0.0075	52	2.7	19.32	60.2	60.0	26	2.7	9.7	30
0.0088	56	2.9	19.32	60.2	60.0	28	2.9	9.7	30
0.0100	60	3.1	19.32	60.2	60.0	30	3.1	9.7	30
0.0113	64	3.3	19.32	60.2	60.0	32	3.3	9.7	30
0.0125	67	3.5	19.32	60.2	60.0	33	3.5	9.7	30
0.0138	71	3.7	19.32	60.2	60.0	35	3.6	9.7	30
0.0150	74	3.8	19.32	60.2	60.0	36	3.8	9.7	30
0.0163	77	4.0	19.32	60.2	60.0	38	3.9	9.7	30
0.0175	80	4.1	19.32	60.2	60.0	39	4.1	9.7	30
0.0188	82	4.3	19.32	60.2	60.0	41	4.2	9.7	30
0.0200	85	4.4	19.32	60.2	60.0	42	4.4	9.7	30
0.0213	88	4.5	19.32	60.2	60.0	43	4.5	9.7	30
0.0225	90	4.7	19.32	60.2	60.0	45	4.6	9.7	30
0.0238	93	4.8	19.32	60.2	60.0	46	4.8	9.7	30
0.0250	95	4.9	19.32	60.2	60.0	47	4.9	9.7	30
0.0263	97	5.0	19.32	60.2	60.0	48	5.0	9.7	30
0.0275	100	5.2	19.32	60.2	60.0	49	5.1	9.7	30
0.0288	102	5.3	19.32	60.2	60.0	50	5.2	9.7	30
0.0300	104	5.4	19.32	60.2	60.0	52	5.3	9.7	30
0.0313	106	5.5	19.32	60.2	60.0	53	5.5	9.7	30
0.0325	108	5.6	19.32	60.2	60.0	54	5.6	9.7	30
0.0338	111	5.7	19.32	60.2	60.0	55	5.7	9.7	30
0.0350	113	5.8	19.32	60.2	60.0	56	5.8	9.7	30
0.0363	115	5.9	19.32	60.2	60.0	57	5.9	9.7	30
0.0375	117	6.0	19.32	60.2	60.0	58	6.0	9.7	30
0.0388	118	6.1	19.32	60.2	60.0	59	6.1	9.7	30
0.0400	120	6.2	19.32	60.2	60.0	60	6.2	9.7	30

Street Flows Ramp Curb (Maximum Flow to Crown of Roadway)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	13	2.2	6.05	35.0	34.8	6.7	2.2	3.0	17.4
0.0063	15	2.5	6.05	35.0	34.8	7.5	2.5	3.0	17.4
0.0075	16	2.7	6.05	35.0	34.8	8.2	2.7	3.0	17.4
0.0088	18	2.9	6.05	35.0	34.8	8.9	2.9	3.0	17.4
0.0100	19	3.1	6.05	35.0	34.8	9.5	3.1	3.0	17.4
0.0113	20	3.3	6.05	35.0	34.8	10	3.3	3.0	17.4
0.0125	21	3.5	6.05	35.0	34.8	11	3.5	3.0	17.4
0.0138	22	3.7	6.05	35.0	34.8	11	3.7	3.0	17.4
0.0150	23	3.8	6.05	35.0	34.8	12	3.8	3.0	17.4
0.0163	24	4.0	6.05	35.0	34.8	12	4.0	3.0	17.4
0.0175	25	4.1	6.05	35.0	34.8	13	4.1	3.0	17.4
0.0188	26	4.3	6.05	35.0	34.8	13	4.3	3.0	17.4
0.0200	27	4.4	6.05	35.0	34.8	13	4.4	3.0	17.4
0.0213	28	4.6	6.05	35.0	34.8	14	4.6	3.0	17.4
0.0225	28	4.7	6.05	35.0	34.8	14	4.7	3.0	17.4
0.0238	29	4.8	6.05	35.0	34.8	15	4.8	3.0	17.4
0.0250	30	5.0	6.05	35.0	34.8	15	5.0	3.0	17.4
0.0263	31	5.1	6.05	35.0	34.8	15	5.1	3.0	17.4
0.0275	31	5.2	6.05	35.0	34.8	16	5.2	3.0	17.4
0.0288	32	5.3	6.05	35.0	34.8	16	5.3	3.0	17.4
0.0300	33	5.4	6.05	35.0	34.8	16	5.4	3.0	17.4
0.0313	34	5.5	6.05	35.0	34.8	17	5.5	3.0	17.4
0.0325	34	5.7	6.05	35.0	34.8	17	5.6	3.0	17.4
0.0338	35	5.8	6.05	35.0	34.8	17	5.8	3.0	17.4
0.0350	35	5.9	6.05	35.0	34.8	18	5.9	3.0	17.4
0.0363	36	6.0	6.05	35.0	34.8	18	6.0	3.0	17.4
0.0375	37	6.1	6.05	35.0	34.8	18	6.1	3.0	17.4
0.0388	37	6.2	6.05	35.0	34.8	19	6.2	3.0	17.4
0.0400	38	6.3	6.05	35.0	34.8	19	6.3	3.0	17.4

Worksheet for Vertical Full Street Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+13	-0.25
0+13	-0.25
0+13	-0.75
0+15	-0.58
0+30	-0.28
0+45	-0.58
0+47	-0.75
0+47	-0.25
0+48	-0.25
0+60	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+13, -0.25)	0.030
(0+13, -0.25)	(0+15, -0.58)	0.013
(0+15, -0.58)	(0+45, -0.58)	0.015
(0+45, -0.58)	(0+48, -0.25)	0.013
(0+48, -0.25)	(0+60, 0.00)	0.030
<None>	(0+60, 0.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method

Worksheet for Vertical Full Street Section

Options

Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge		41.33	ft^3/s
Elevation Range	-0.75 to 0.00 ft		
Flow Area		19.04	ft^2
Wetted Perimeter		61.02	ft
Hydraulic Radius		0.31	ft
Top Width		60.00	ft
Normal Depth		0.75	ft
Critical Depth		0.66	ft
Critical Slope		0.01143	ft/ft
Velocity		2.17	ft/s
Velocity Head		0.07	ft
Specific Energy		0.82	ft
Froude Number		0.68	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01143	ft/ft

Cross Section for Vertical Full Street Section

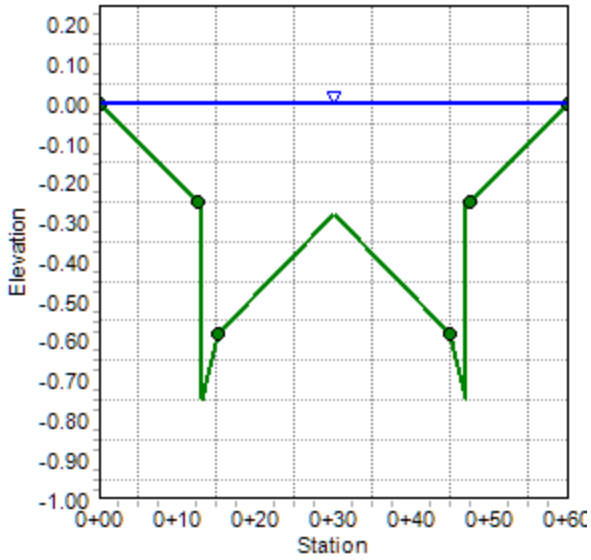
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft
Discharge	41.33	ft³/s

Cross Section Image



RESIDENTIAL STREET SECTION
VERTICAL CURB

5-Year Storm Event Maximum Allowable Street Flows
(Maximum Flow to Top of Curb)

Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	18	2.5	7.17	35.0	34.0	8.9	2.5	3.6	17
0.0063	20	2.8	7.17	35.0	34.0	9.9	2.8	3.6	17
0.0075	22	3.0	7.17	35.0	34.0	11	3.0	3.6	17
0.0088	23	3.3	7.17	35.0	34.0	12	3.3	3.6	17
0.0100	25	3.5	7.17	35.0	34.0	13	3.5	3.6	17
0.0113	27	3.7	7.17	35.0	34.0	13	3.7	3.6	17
0.0125	28	3.9	7.17	35.0	34.0	14	3.9	3.6	17
0.0138	29	4.1	7.17	35.0	34.0	15	4.1	3.6	17
0.0150	31	4.3	7.17	35.0	34.0	15	4.3	3.6	17
0.0163	32	4.5	7.17	35.0	34.0	16	4.5	3.6	17
0.0175	33	4.6	7.17	35.0	34.0	17	4.6	3.6	17
0.0188	34	4.8	7.17	35.0	34.0	17	4.8	3.6	17
0.0200	36	5.0	7.17	35.0	34.0	18	5.0	3.6	17
0.0213	37	5.1	7.17	35.0	34.0	18	5.1	3.6	17
0.0225	38	5.3	7.17	35.0	34.0	19	5.3	3.6	17
0.0238	39	5.4	7.17	35.0	34.0	19	5.4	3.6	17
0.0250	40	5.5	7.17	35.0	34.0	20	5.5	3.6	17
0.0263	41	5.7	7.17	35.0	34.0	20	5.7	3.6	17
0.0275	42	5.8	7.17	35.0	34.0	21	5.8	3.6	17
0.0288	43	5.9	7.17	35.0	34.0	21	5.9	3.6	17
0.0300	43	6.1	7.17	35.0	34.0	22	6.1	3.6	17
0.0313	44	6.2	7.17	35.0	34.0	22	6.2	3.6	17
0.0325	45	6.3	7.17	35.0	34.0	23	6.3	3.6	17
0.0338	46	6.4	7.17	35.0	34.0	23	6.4	3.6	17
0.0350	47	6.6	7.17	35.0	34.0	23	6.6	3.6	17
0.0363	48	6.7	7.17	35.0	34.0	24	6.7	3.6	17
0.0375	49	6.8	7.17	35.0	34.0	24	6.8	3.6	17
0.0388	49	6.9	7.17	35.0	34.0	25	6.9	3.6	17
0.0400	50	7.0	7.17	35.0	34.0	25	7.0	3.6	17

100-Year Storm Event Maximum Allowable Street Flows
(Maximum Flow to Right-of-Way)

Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	41	2.2	19.04	61.0	60.0	21	2.2	9.5	30
0.0063	46	2.4	19.04	61.0	60.0	23	2.4	9.5	30
0.0075	51	2.7	19.04	61.0	60.0	25	2.7	9.5	30
0.0088	55	2.9	19.04	61.0	60.0	27	2.9	9.5	30
0.0100	58	3.1	19.04	61.0	60.0	29	3.1	9.5	30
0.0113	62	3.3	19.04	61.0	60.0	31	3.2	9.5	30
0.0125	65	3.4	19.04	61.0	60.0	33	3.4	9.5	30
0.0138	69	3.6	19.04	61.0	60.0	34	3.6	9.5	30
0.0150	72	3.8	19.04	61.0	60.0	36	3.8	9.5	30
0.0163	75	3.9	19.04	61.0	60.0	37	3.9	9.5	30
0.0175	77	4.1	19.04	61.0	60.0	39	4.1	9.5	30
0.0188	80	4.2	19.04	61.0	60.0	40	4.2	9.5	30
0.0200	83	4.3	19.04	61.0	60.0	41	4.3	9.5	30
0.0213	85	4.5	19.04	61.0	60.0	42	4.5	9.5	30
0.0225	88	4.6	19.04	61.0	60.0	44	4.6	9.5	30
0.0238	90	4.7	19.04	61.0	60.0	45	4.7	9.5	30
0.0250	92	4.9	19.04	61.0	60.0	46	4.8	9.5	30
0.0263	95	5.0	19.04	61.0	60.0	47	5.0	9.5	30
0.0275	97	5.1	19.04	61.0	60.0	48	5.1	9.5	30
0.0288	99	5.2	19.04	61.0	60.0	49	5.2	9.5	30
0.0300	101	5.3	19.04	61.0	60.0	50	5.3	9.5	30
0.0313	103	5.4	19.04	61.0	60.0	51	5.4	9.5	30
0.0325	105	5.5	19.04	61.0	60.0	52	5.5	9.5	30
0.0338	107	5.6	19.04	61.0	60.0	53	5.6	9.5	30
0.0350	109	5.7	19.04	61.0	60.0	54	5.7	9.5	30
0.0363	111	5.8	19.04	61.0	60.0	55	5.8	9.5	30
0.0375	113	5.9	19.04	61.0	60.0	56	5.9	9.5	30
0.0388	115	6.0	19.04	61.0	60.0	57	6.0	9.5	30
0.0400	117	6.1	19.04	61.0	60.0	58	6.1	9.5	30

Street Flows Veritcal Curb (Maximum Flow to Crown of Roadway)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	14	2.2	6.15	35.0	34.0	6.7	2.2	3.0	17
0.0063	15	2.5	6.15	35.0	34.0	7.5	2.5	3.0	17
0.0075	17	2.7	6.15	35.0	34.0	8.2	2.7	3.0	17
0.0088	18	3.0	6.15	35.0	34.0	8.8	2.9	3.0	17
0.0100	19	3.2	6.15	35.0	34.0	9.4	3.1	3.0	17
0.0113	21	3.4	6.15	35.0	34.0	10	3.3	3.0	17
0.0125	22	3.5	6.15	35.0	34.0	11	3.5	3.0	17
0.0138	23	3.7	6.15	35.0	34.0	11	3.7	3.0	17
0.0150	24	3.9	6.15	35.0	34.0	12	3.8	3.0	17
0.0163	25	4.0	6.15	35.0	34.0	12	4.0	3.0	17
0.0175	26	4.2	6.15	35.0	34.0	12	4.1	3.0	17
0.0188	27	4.3	6.15	35.0	34.0	13	4.3	3.0	17
0.0200	28	4.5	6.15	35.0	34.0	13	4.4	3.0	17
0.0213	28	4.6	6.15	35.0	34.0	14	4.6	3.0	17
0.0225	29	4.8	6.15	35.0	34.0	14	4.7	3.0	17
0.0238	30	4.9	6.15	35.0	34.0	15	4.8	3.0	17
0.0250	31	5.0	6.15	35.0	34.0	15	4.9	3.0	17
0.0263	32	5.1	6.15	35.0	34.0	15	5.1	3.0	17
0.0275	32	5.3	6.15	35.0	34.0	16	5.2	3.0	17
0.0288	33	5.4	6.15	35.0	34.0	16	5.3	3.0	17
0.0300	34	5.5	6.15	35.0	34.0	16	5.4	3.0	17
0.0313	34	5.6	6.15	35.0	34.0	17	5.5	3.0	17
0.0325	35	5.7	6.15	35.0	34.0	17	5.6	3.0	17
0.0338	36	5.8	6.15	35.0	34.0	17	5.7	3.0	17
0.0350	36	5.9	6.15	35.0	34.0	18	5.9	3.0	17
0.0363	37	6.0	6.15	35.0	34.0	18	6.0	3.0	17
0.0375	38	6.1	6.15	35.0	34.0	18	6.1	3.0	17
0.0388	38	6.2	6.15	35.0	34.0	19	6.2	3.0	17
0.0400	39	6.3	6.15	35.0	34.0	19	6.3	3.0	17

Appendix F – Regional Stormwater Quality Analysis

Several Regional Detention Facilities are located within the Meridian Ranch, all the detention facilities have Water Quality Capture Volume incorporated into the design and construction. The facilities are owned and maintained by the Meridian Service Metropolitan District under the jurisdiction and authority of El Paso County. The design and construction of the facilities meet the minimum standards of the County as outlined in the Drainage Criteria Manual and Engineering Criteria Manual. The WQCV found in each of the detention facilities was designed to provide water quality for 100 percent of the tributary area for the facility. Regional Facilities are designed and are intended as flood control and water quality as the primary use.

Below is the governing section from the ECM regarding the use of regional detention facilities with a WQCV component for reference:

Appendix I Stormwater Quality Policy and Procedures-revisions
I.7.1.C.5.

Applicable Development Site Draining to a Regional WQCV Facility The regional WQCV facility is designed to accept drainage from the Applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the applicable development site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. The control measure must be designed in accordance with a design manual identified by the permittee. In addition,
The stream channel between the discharge point of the applicable development site and the regional WQCV facility must be stabilized. The regional WQCV facility must meet the following requirements:

a. The regional WQCV facility must be implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.
b. The regional WQCV facility must be designed and maintained for 100% WQCV for its entire drainage area.
c. The regional WQCV facility must have capacity to accommodate the drainage from the applicable development site.
d. The regional WQCV facility must be designed and built to comply with all assumptions for the development activities planned by the County within its drainage area, including the imperviousness of its drainage area and the applicable development site.
e. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the facility. Consideration of drain time shall include maintaining vegetation necessary for operation of the facility (e.g., wetland vegetation).
f. The County shall require site plans and perform a site plan review consistent with the requirements of this ECM to ensure the regional WQCV facility and control measures for the applicable development site plans include:
    i. Design details for all structural control measures implemented to meet the requirements of Part I.E.4.
    ii. A narrative reference for all non-structural control measures for the site, if applicable. "Non-structural control measures" are control measures that are not

structural control measures and include, but are not limited to, control measures that preventor reduce pollutants being introduced to water or that prevent or reduce the generation of runoff or illicit discharges.

iii. Documentation of operation and maintenance procedures to ensure the long-term observation, maintenance, and operation of the control measures. The documentation shall include frequencies for routine inspections and maintenance activities.

iv. Documentation regarding easements or other legal means for access of the control measure sites for operation, maintenance, and inspection of control measures.

v. Confirmation that control measures meet the requirements of section I.7.C.

vi. Confirmation that site plans meet the requirements of County's Site plan review and approval requirements.

g. The regional WQCV facility must be subject to the County's authority consistent with requirements and actions for a Control Measure in accordance with a base design standard.

h. Regional Facilities must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered Regional Facilities. Water bodies listed by name in surface water quality classifications and standards regulations (5CCR1002-32 through 5CCR1002-38) may not be considered regional facilities.

See the exhibits on the following pages for impacted areas, calculations and more information.

The following exhibits show the typical lot types, general drainage areas and calculations for each area. Two locations will have individual water quality facilities when the sites/lots are developed. Three locations drain the rear yards and open spaces where there would be little to no impervious areas. The final two areas include the lots where the runoff will enter directly into a storm drain facility prior to reaching Pond G and receive water quality treatment.

The lots are all 0.5 acres or larger and will qualify for the exemption.

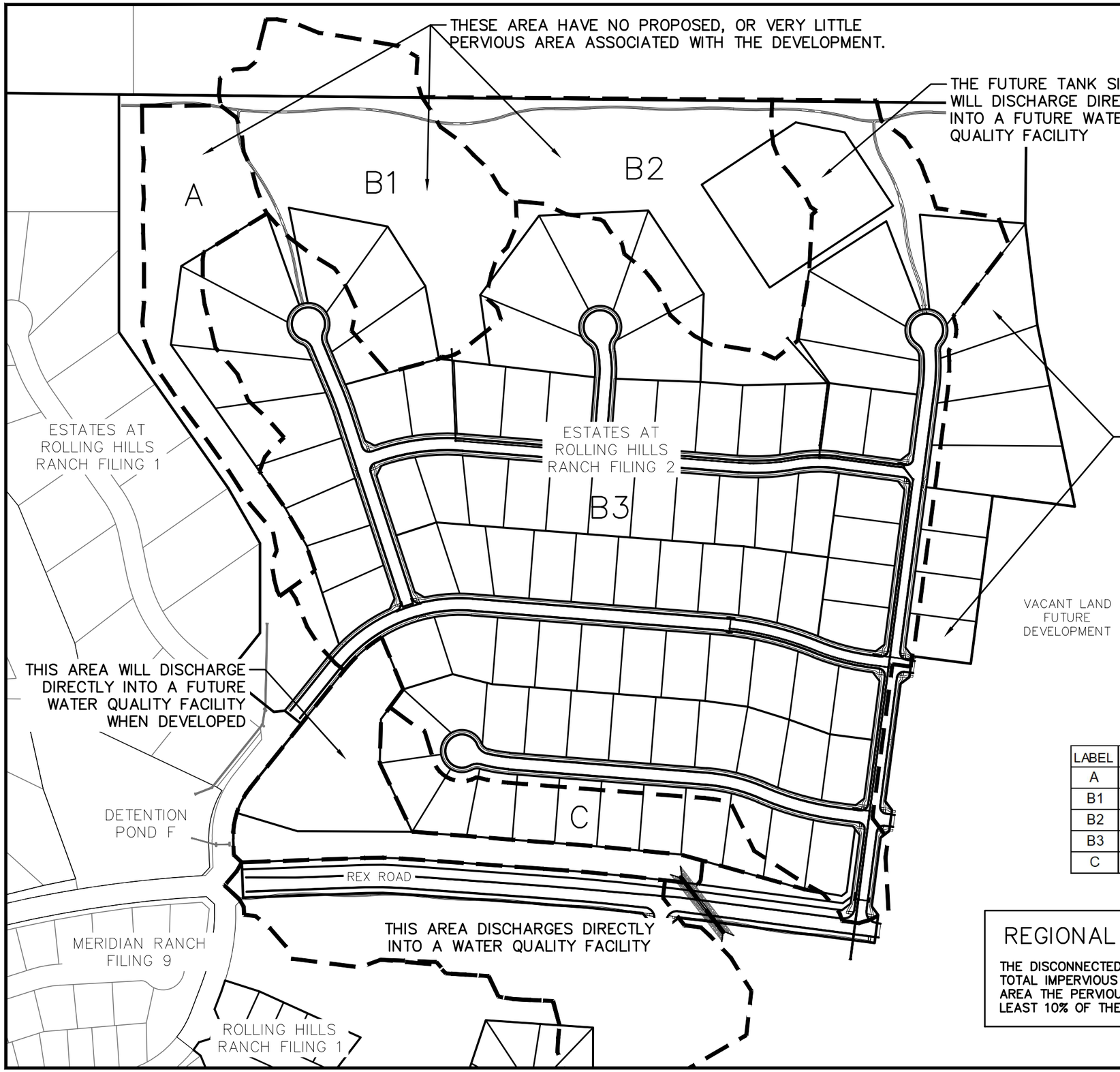
Areas A, B1, & B2 consist of open space and rear yard drainage tributary to storm drain systems. Any pervious areas would be relatively small compared to the large areas and would qualify for the exemption. Anticipated pervious areas could include a shed, RV garage, or sports court.

Two locations include areas where Meridian Service Metropolitan District build improvements. These improvements would likely require specialized water quality features, such as oil/water separators. These facilities would be necessary at the time of development of these areas.

The area draining overland easterly away from the development adjacent to Estate Ridge Drive will drain overland to a temporary sedimentation pond then into the arroyo. This area has tributary areas with little to no imperviousness. It is anticipated this area will qualify for the exemption upon development of the lands to the east.

Area B3 includes the main portion of the developed lots with surface drainage collected by the installed storm drain system. This area consists of 64.6 acres in total with an impervious factor of 24.1% based on the Rational Drainage Calculations. The total impervious area is estimated at 15.6 acres. Assuming the homes in the area will have footprint of 2,500 sf on average the total roof top area will be 4.1 acres or 26.3% of the total imperviousness of the area. The roof tops will discharge onto the surface from downspouts and surface drain overland to the streets and into the storm drain system. The estimated receiving pervious surface area is estimated to be approximately 6.3 acres of land or 153% of the total roof top area. The receiving pervious area consists of side yard and rear yard areas as the surface drainage is directed to the front yards onto the streets.

Area C includes the rear yards of lots along the south side of Crescent Creek Drive. These lots will surface discharge to the adjacent rip-rap lined channel then be conveyed to Pond G. The lots will have no direct impervious area and any indirect pervious area will discharge across the rear yards of the lots into the channel.



LABEL	AREA	#/HOMES	SPA	RPA	UIA	DCIA
A	6.1	0	6.1	0	0	0
B1	11.3	0	11.3	0	0	0
B2	11.4	0	11.4	0	0	0
B3	64.6	89	42.8	6.3	4.1	11.5
C	4.4	5	3.7	0.4	0.3	0

REGIONAL WATER QUALITY CALCULATION

THE DISCONNECTED IMPERVIOUS AREA IS GREATER THAN 20% OF THE TOTAL IMPERVIOUS AREA. THE FOOTPRINT OF THE RECEIVING PERVIOUS AREA THE PERVIOUS AREA IS PASSING THROUGH IS COMPRISED OF AT LEAST 10% OF THE TOTAL DISCONNECTED IMPERVIOUS AREA.

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

REGIONAL WATER QUALITY

OVERALL MAP

ROLLING HILLS RANCH FILING 1

Drawn by TAK | Checked by - | Date APR 2020

Scale N.T.S. | Sheet Number 1

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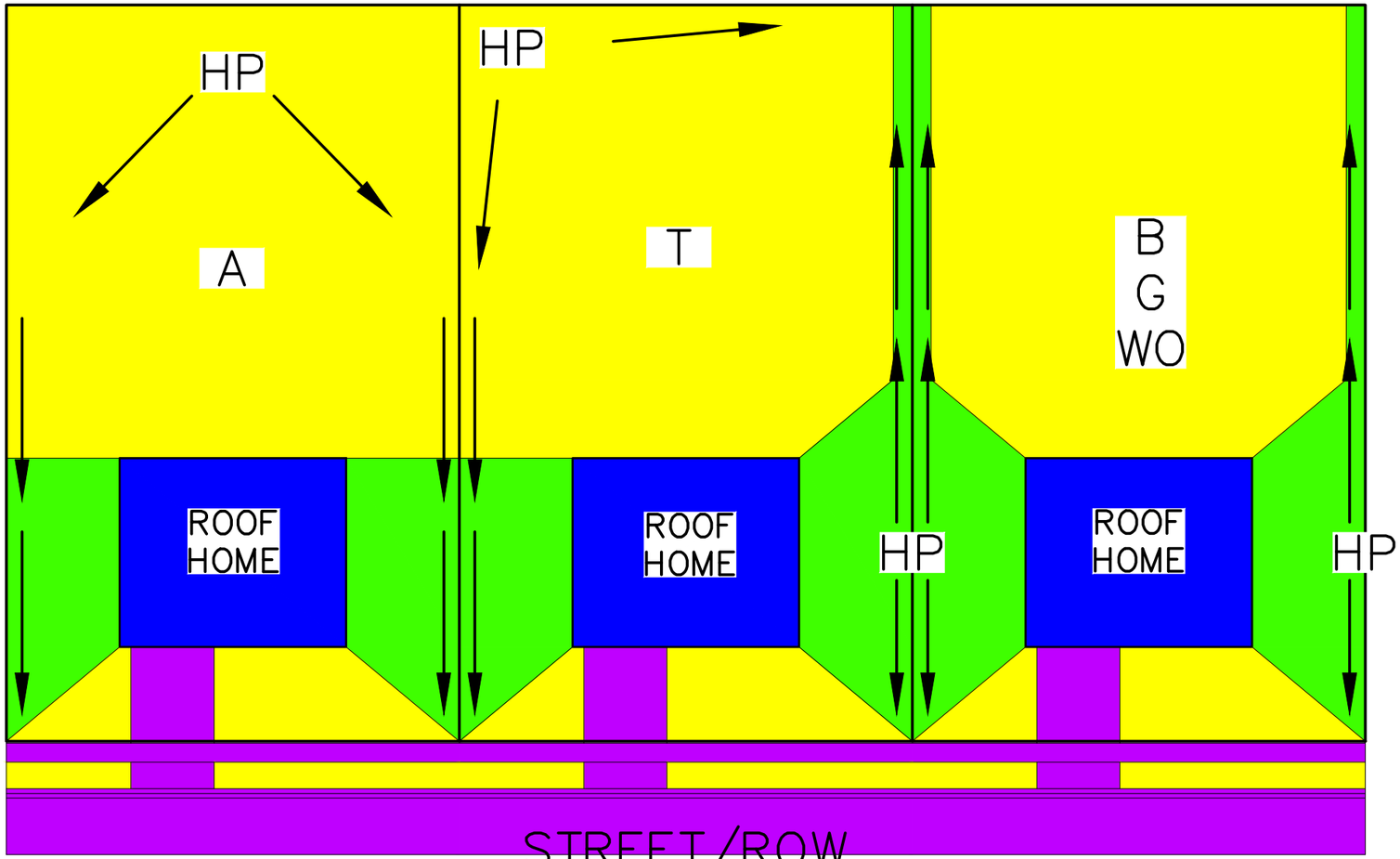

TYPICAL DRAINAGE PATTERN

NTS

REGIONAL WATER QUALITY CALCULATION
FOR TYPICAL LOT TYPES

AREA DESIGNATION	TYPE A LOTS		TYPE T LOTS		TYPE B, T, & WO	
SPA SEPARATE PERV AREAS	16786 SF		15926 SF		15065 SF	
RPA RECEIVING PERV AREAS (FRONT & SIDE YARDS)	3668 SF	146.7%	4279 SF	171.2%	5140 SF	205.6%
UIA UNCONNECTED IMPV AREAS (ROOFTOPS)	2500 SF	38.5%	2500 SF	38.5%	2500 SF	38.5%
DCIA DIRECT IMPV AREAS	3986 SF		3986 SF		3986 SF	

THE DISCONNECTED IMPERVIOUS AREA IS GREATER THAN 20% OF THE TOTAL IMPERVIOUS AREA. THE FOOTPRINT OF THE RECEIVING PERVIOUS AREA THE PERVIOUS AREA IS PASSING THROUGH IS COMPRISED OF AT LEAST 10% OF THE TOTAL DISCONNECTED IMPERVIOUS AREA. THE ABOVE FIGURES ARE BASED ON TYPICAL 0.5 ACRE LOTS WITH A 2,500 SF HOME FOOT PRINT.

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

REGIONAL WATER QUALITY
CATCHMENT AREA B2
ROLLING HILLS RANCH FILING 1

Drawn by	Checked by	Date
TAK	-	APR 2020

Scale	Sheet Number
N.T.S.	3

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Appendix G – Rex Road Box Culvert

Culvert Calculator Report
Rex Road Box Culvert

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,104.00	ft	Headwater Depth/Height	0.88	
Computed Headwater Elevation	7,101.60	ft	Discharge	185.00	cfs
Inlet Control HW Elev.	7,101.54	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	7,101.60	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	7,098.08	ft	Downstream Invert	7,096.03	ft
Length	204.00	ft	Constructed Slope	0.010049	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.52	ft
Slope Type	Steep		Normal Depth	1.48	ft
Flow Regime	Supercritical		Critical Depth	2.20	ft
Velocity Downstream	12.21	ft/s	Critical Slope	0.003079	ft/ft

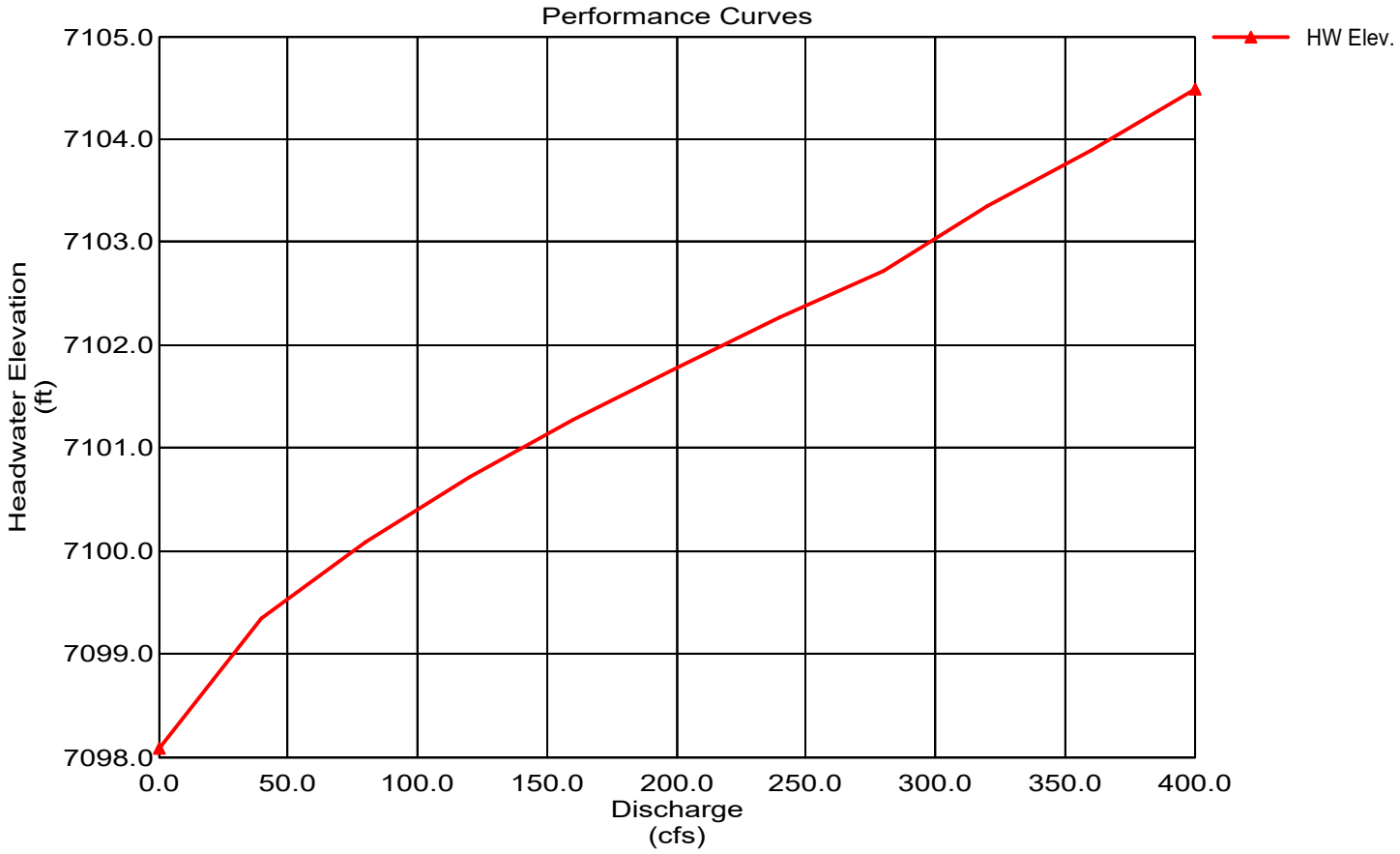
Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 4 ft		Rise	4.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	7,101.60	ft	Upstream Velocity Head	1.10	ft
Ke	0.20		Entrance Loss	0.22	ft

Inlet Control Properties					
Inlet Control HW Elev.	7,101.54	ft	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	40.0	ft²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Performance Curves Report
Rex Road Box Culvert

Range Data:				
	Minimum	Maximum	Increment	
Discharge	0.00	400.00	40.00	cfs



Appendix H – Soil Resource Report

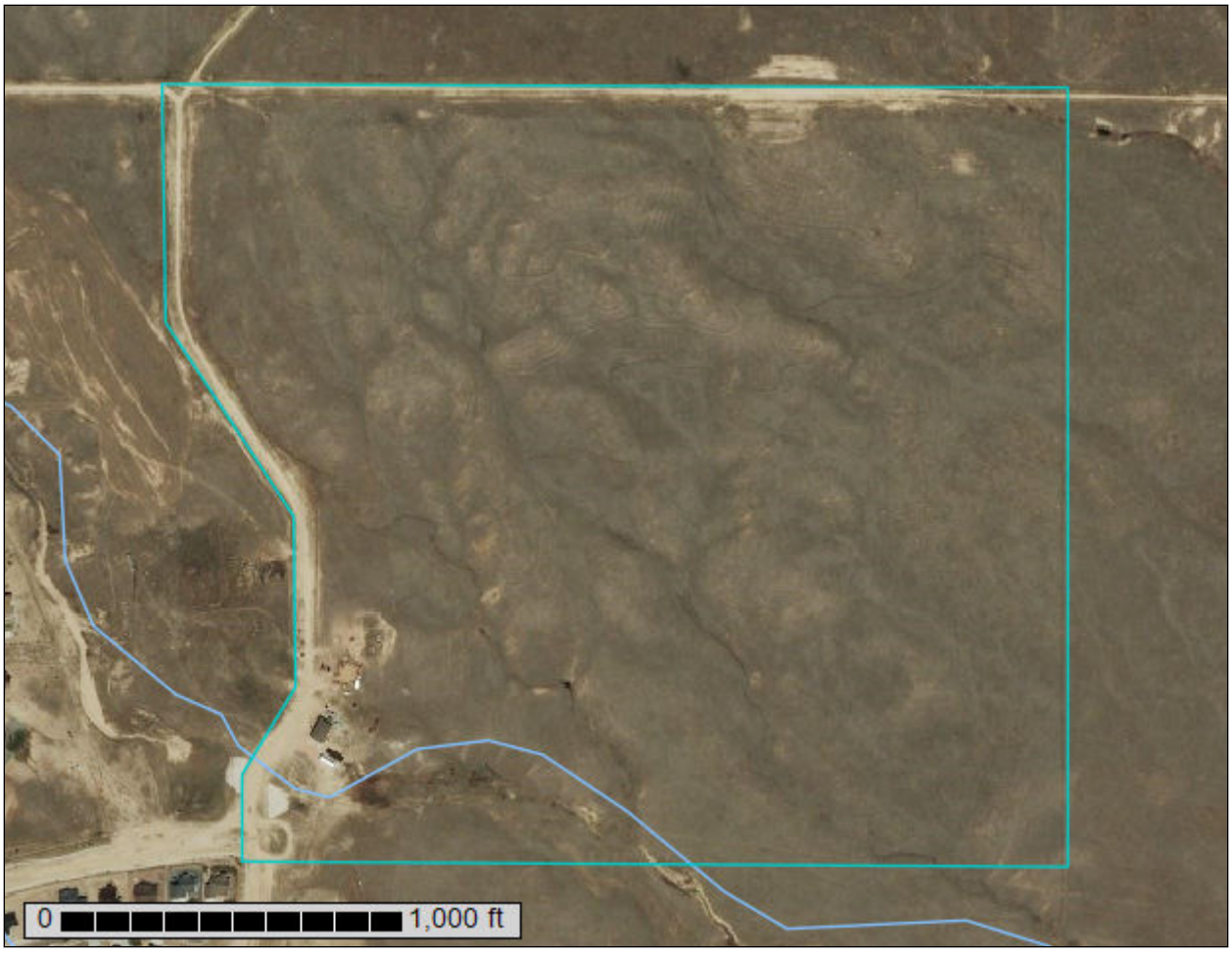
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



April 6, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Soil Map.....9
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19—Columbine gravelly sandy loam, 0 to 3 percent slopes.....13
83—Stapleton sandy loam, 3 to 8 percent slopes.....14
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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

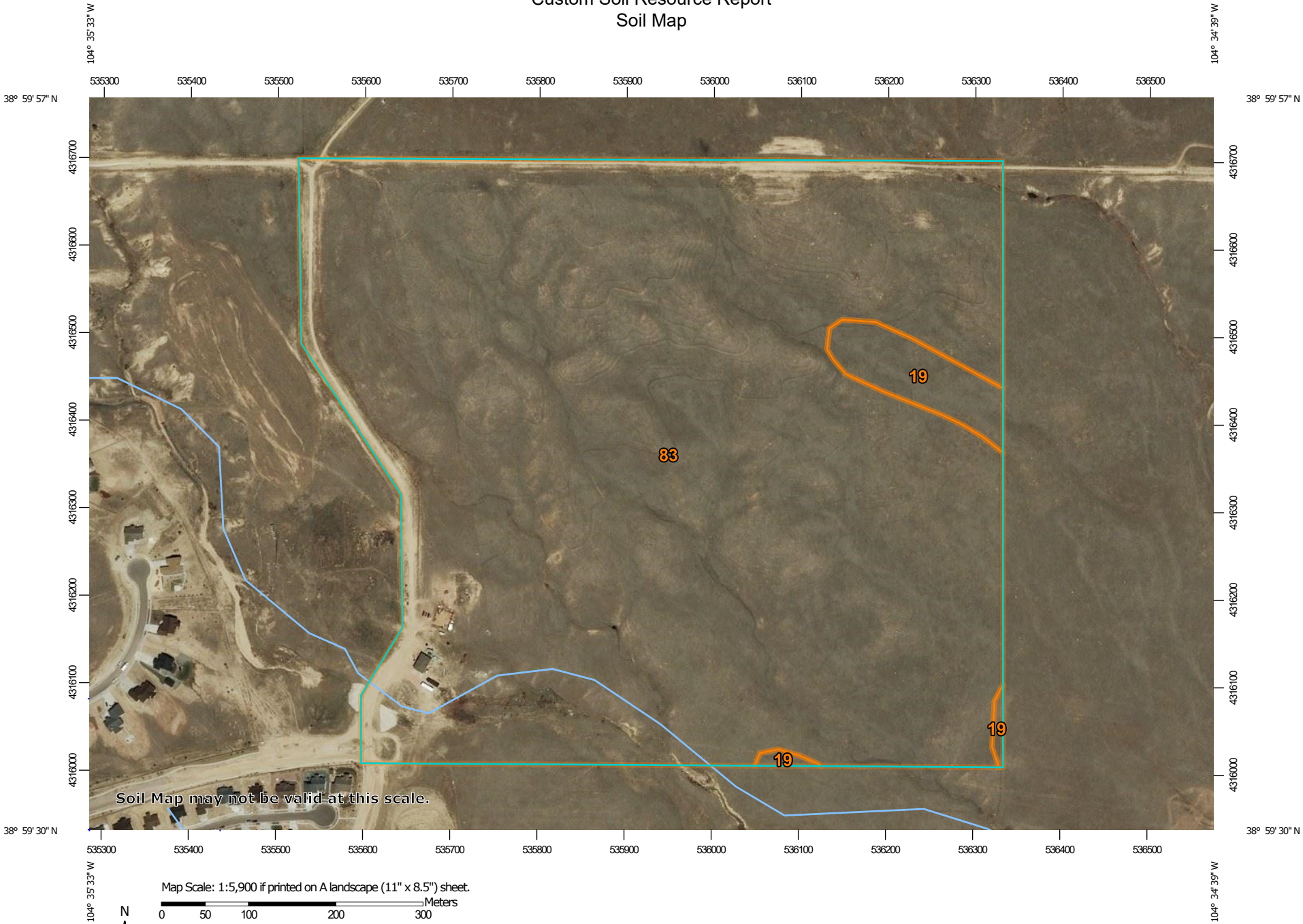
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	3.8	3.0%
83	Stapleton sandy loam, 3 to 8 percent slopes	124.6	97.0%
Totals for Area of Interest		**128.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

References

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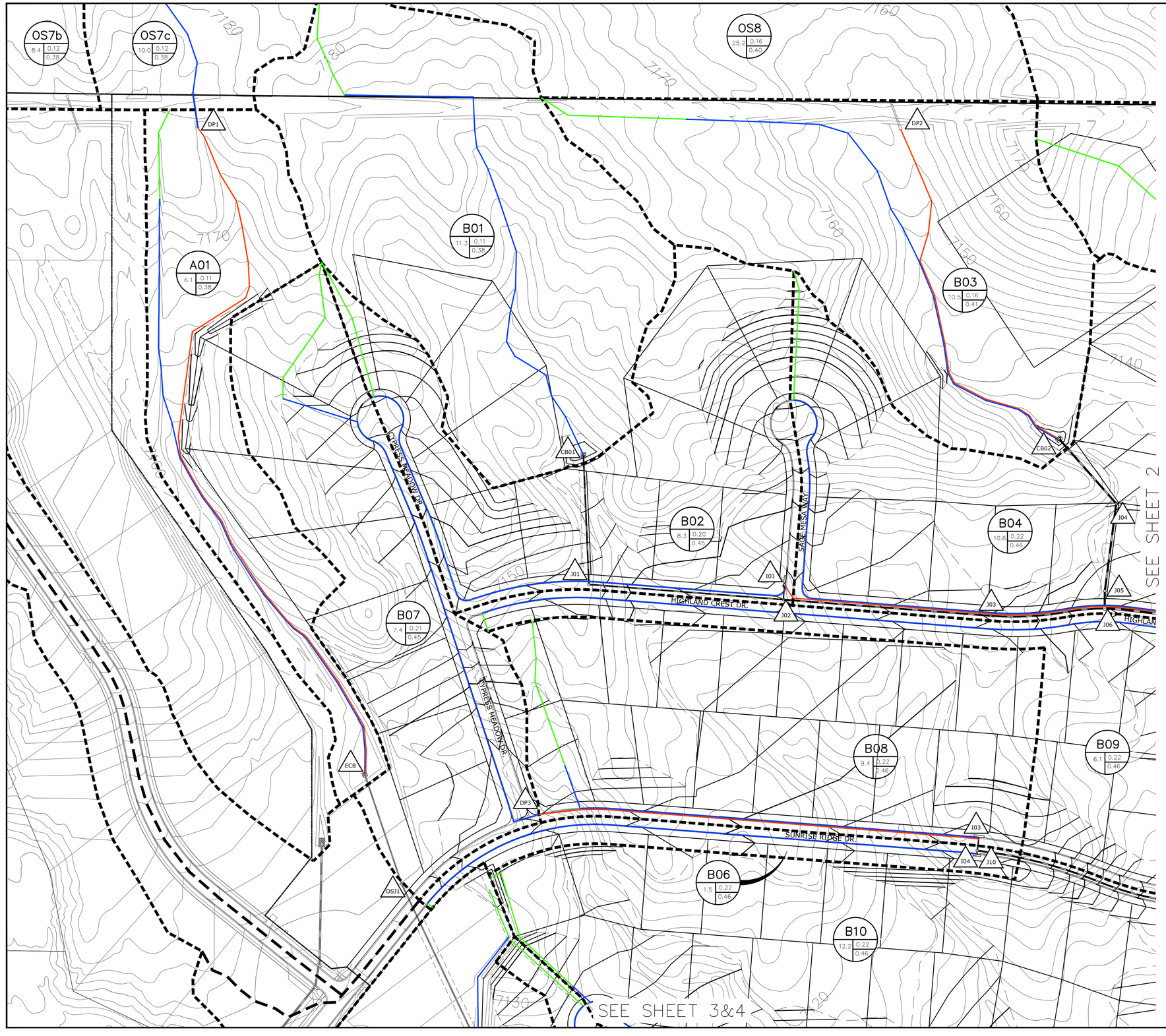
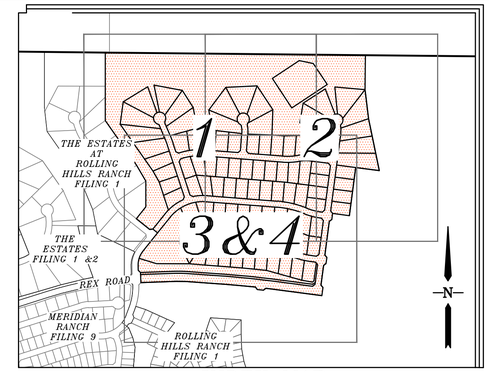
Appendix I – Drainage Maps





INDEX MAP

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- G01 / 2.7 / 0.40 / 0.55 — BASIN DESIGNATION; SUB-WATERSHED DESIGNATION; MINOR/MAJOR STORM COEFFICIENT; BASIN AREA IN ACRES
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- SUB-BASIN BOUNDARY
- 6130 — EXISTING CONTOUR
- 6130 — PROPOSED COUNTOUR
- PROPOSED STORM SEWER
- INITIAL OVERLAND TIME (TI)
- TRAVEL TIME (Tt)
- OVERLAND TIME (To)

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
DP1	OS7c	10.0	4.1	22	EX 30 " CULVERT	4.1	22	24 " RCP
ECB	A01	6.1	5.0	27	EX TYPE C INLET	5.0	27	24 " RCP
OSJ01						5.0	27	24 " RCP
OSJ02						5.0	27	24 " RCP
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J01						4.2	24	24 " RCP
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J02						9.5	40	30 " RCP
J03						9.5	40	30 " RCP
DP2	OS8	24.2	10	43	EX 30 " CULVERT	10	43	36 " RCP
CB02	B03	10.5	13	56	PR TYPE D INLET	13	56	36 " RCP
J04						13	56	36 " RCP
J05						13	56	36 " RCP
I02	B04	10.6	7.4	26	PR 20 ' FORCED SUMP	7	17	24 " RCP
J06						20	85	42 " RCP
J07						26	97	42 " RCP
J08						26	97	42 " RCP
I05	B09	6.1	4.1	22	PR 20 ' SUMP	4.1	17	18 " RCP
I06	B05	5.6	4.0	13	PR 20 ' FLOW-BY	3.6	10	18 " RCP
J09						31	117	42 " RCP
DP3	B07	7.4	5.1	18				
I03	B08	9.4	10	35	PR 20 ' SUMP	10.0	17	18 " RCP
I04	B06	1.5	1.1	21	PR 15 ' SUMP	1.1	21	18 " RCP
J10						11	38	30 " RCP
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J12						47	163	48 " RCP
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J13						49	179	54 " RCP
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I09	FB12	6.2	7.5	29	PR 20 ' SUMP	7.5	17	18 " RCP
J13						54	187	54 " RCP

BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

NOTE:

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11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
THE ESTATES AT
ROLLING HILLS RANCH FILING 2

Drawn by TJK | Checked by - | Date SEPT 2020

Scale 1" = 100' | 1 of 4

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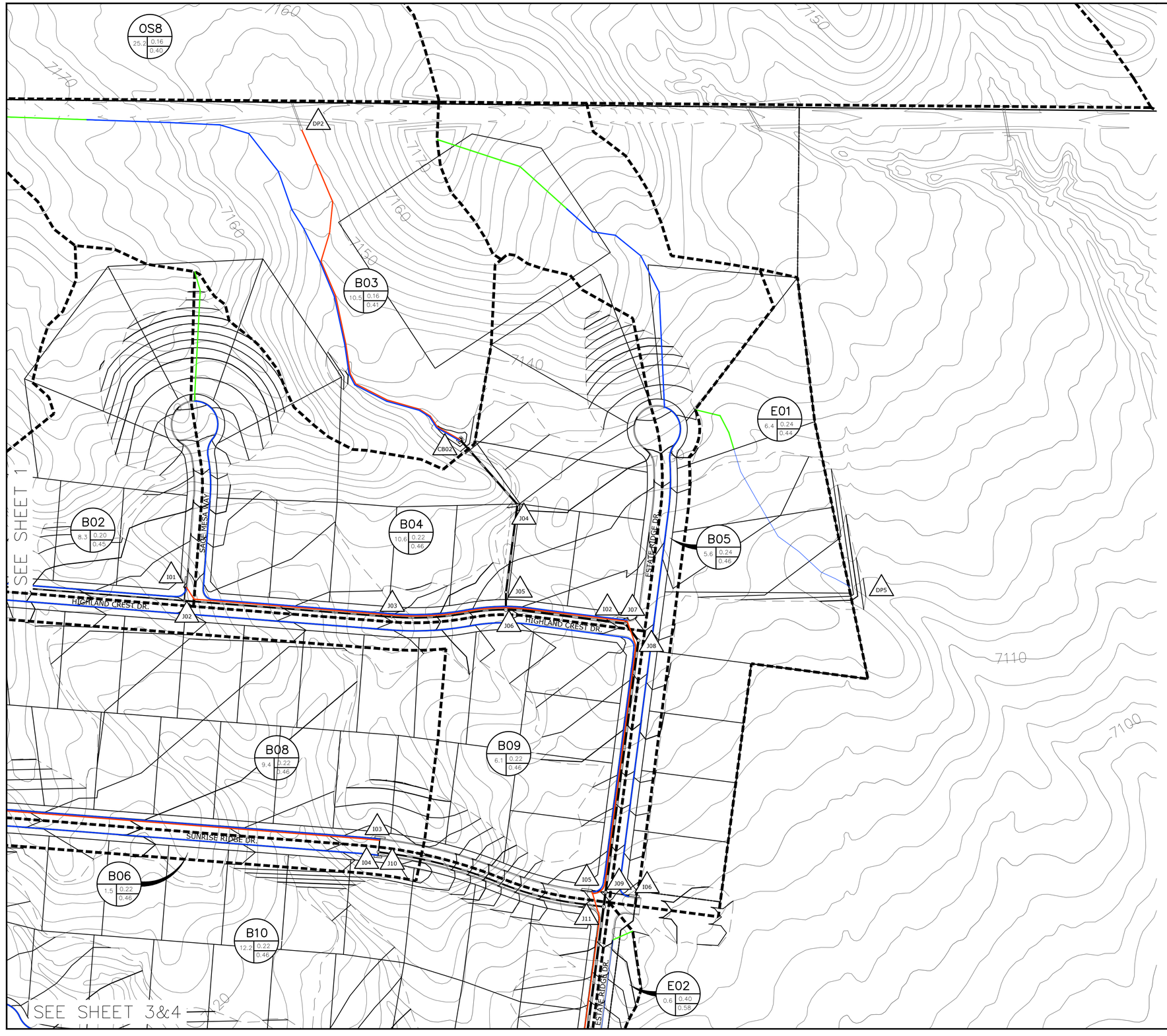

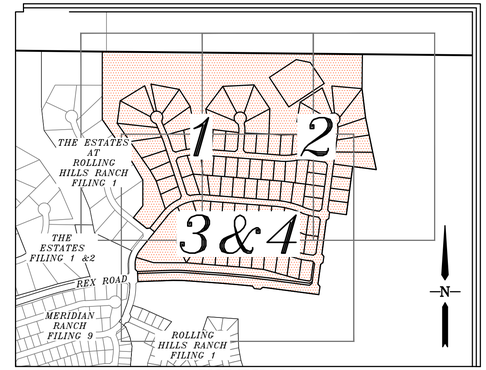

INDEX MAP

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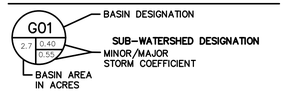

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

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DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
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OSJ01						5.0	27	24 " RCP
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BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT
SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

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11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
THE ESTATES AT
ROLLING HILLS RANCH FILING 2

Drawn by TAK | Checked by - | Date SEPT 2020

Scale 1" = 100' | 2 of 4

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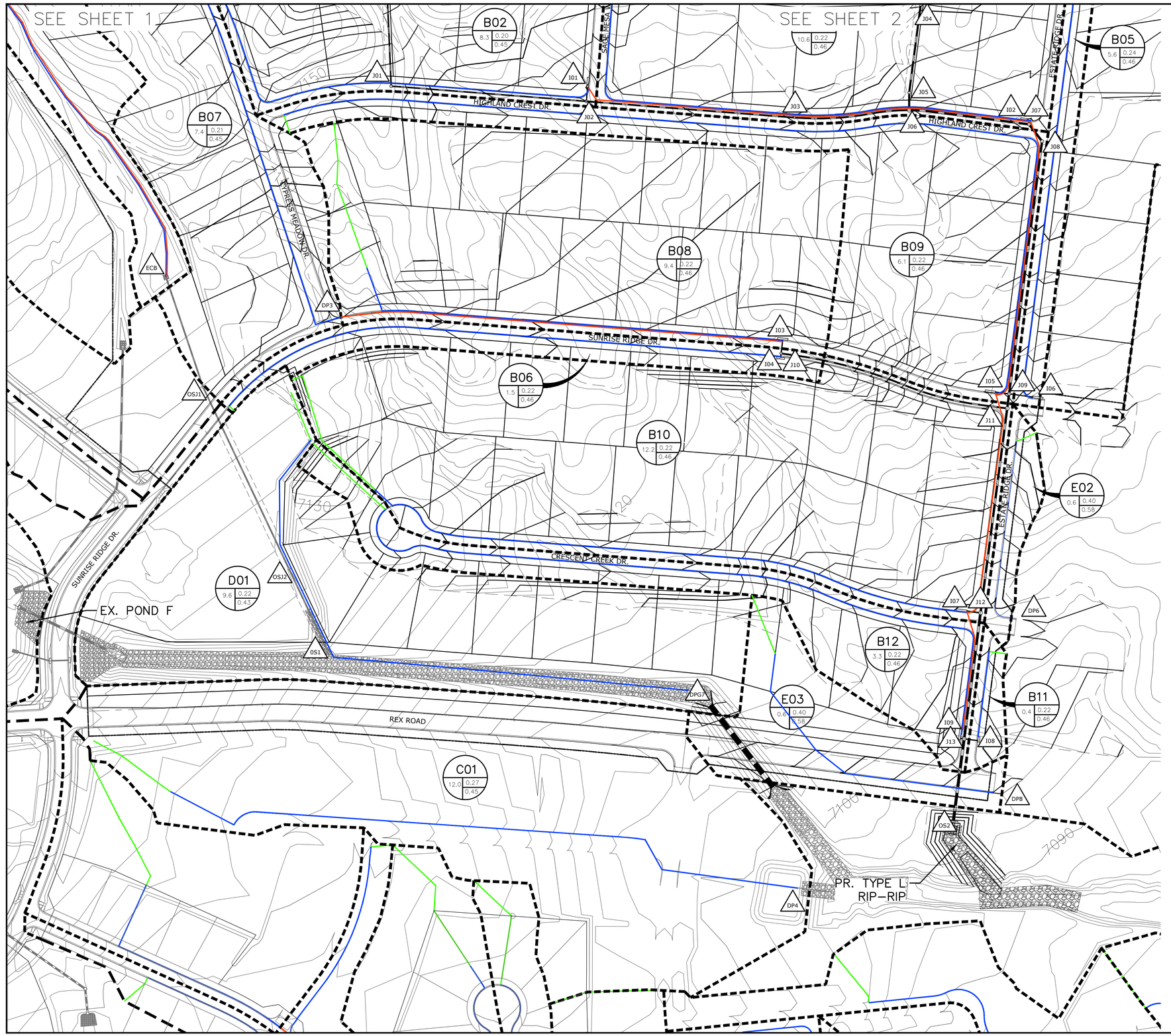

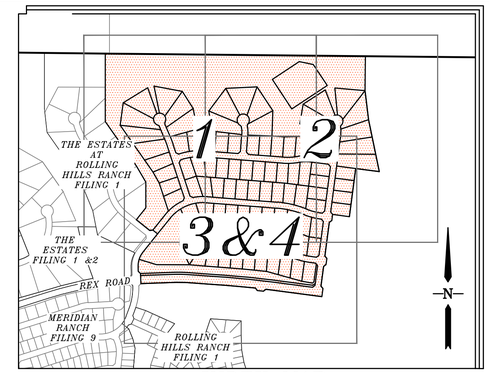

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ELEVATION = 6874.00

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FALCON, CO 80831
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MERIDIAN RANCH

INTERIM RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
THE ESTATES AT
ROLLING HILLS RANCH FILING 2

Drawn by TAK | Checked by - | Date SEPT 2020

Scale 1" = 100' | 3 of 4

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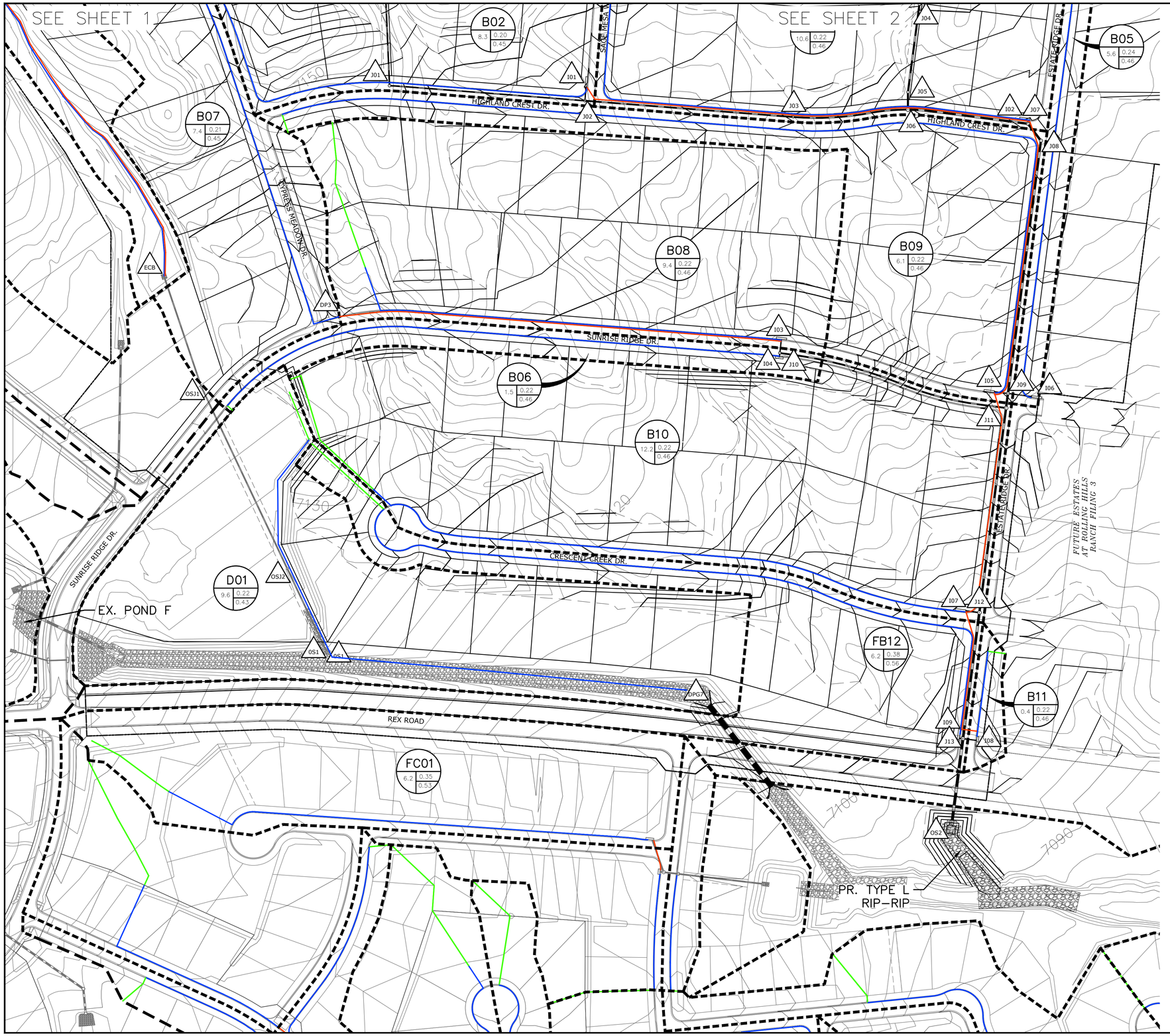

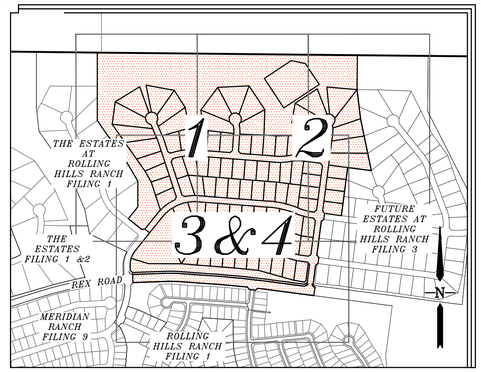

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11886 STAPLETON DRIVE
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TELEPHONE: 719.495.7444
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MERIDIAN RANCH

FUTURE RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
THE ESTATES AT ROLLING HILLS RANCH FILING 2

Drawn by	Checked by	Date
TAK	-	SEPT 2020

Scale	
1" = 100'	4 of 4

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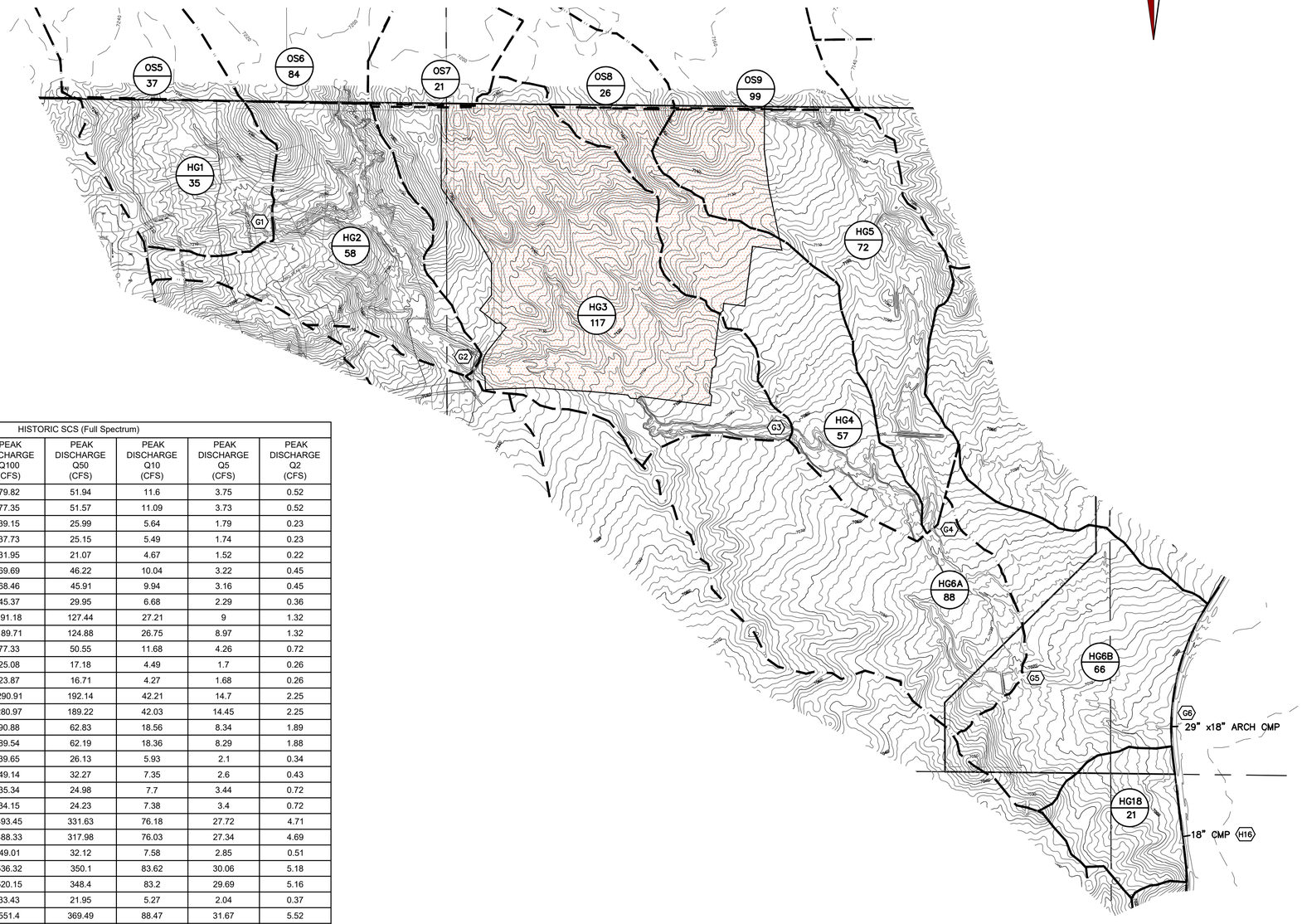
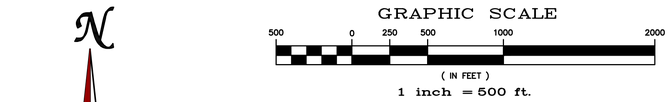
ESTATES AT ROLLING HILLS RANCH
FILING 2 AT MERIDIAN RANCH





GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

1 inch = 500 ft.

LEGEND

MAJOR BASIN BOUNDARY

MINOR BASIN BOUNARY

SCS MODEL ID / SIZE ACRES — EB15 / 65 — BASIN IDENTIFICATION

H8 B10 DESIGN POINTS

MAJOR CONTOUR INTERVAL

MINOR CONTOUR INTERVAL

100 YEAR FLOOD PLAIN

HISTORIC SCS (Full Spectrum)

HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	79.82	51.94	11.6	3.75	0.52
OS06-G02	0.1313	77.35	51.57	11.09	3.73	0.52
OS05	0.0578	39.15	25.99	5.64	1.79	0.23
OS05-G01	0.0578	37.73	25.15	5.49	1.74	0.23
HG01	0.0547	31.95	21.07	4.67	1.52	0.22
G01	0.1125	69.69	46.22	10.04	3.22	0.45
G01-G02	0.1125	68.46	45.91	9.94	3.16	0.45
HG02	0.0906	45.37	29.95	6.68	2.29	0.36
G02	0.3344	191.18	127.44	27.21	9	1.32
G02-G03	0.3344	189.71	124.88	26.75	8.97	1.32
HG03	0.1828	77.33	50.55	11.68	4.26	0.72
OS07	0.0328	25.08	17.18	4.49	1.7	0.26
OS07-G03	0.0328	23.87	16.71	4.27	1.68	0.26
G03	0.55	290.91	192.14	42.21	14.7	2.25
G03-G04	0.55	280.97	189.22	42.03	14.45	2.25
OS09	0.1547	90.88	62.83	18.56	8.34	1.89
OS09-G04	0.1547	89.54	62.19	18.36	8.29	1.88
HG04	0.0891	39.65	26.13	5.93	2.1	0.34
HG05	0.1125	49.14	32.27	7.35	2.6	0.43
OS08	0.0406	35.34	24.98	7.7	3.44	0.72
OS08-G04	0.0406	34.15	24.23	7.38	3.4	0.72
G04	0.9469	493.45	331.63	76.18	27.72	4.71
G04-G05	0.9469	488.33	317.98	76.03	27.34	4.69
HG06A	0.1375	49.01	32.12	7.58	2.85	0.51
G05	1.0844	536.32	350.1	83.62	30.06	5.18
G05-G06	1.0844	520.15	348.4	83.2	29.69	5.16
HG06B	0.1031	33.43	21.95	5.27	2.04	0.37
G06	1.1875	551.4	369.49	88.47	31.67	5.52

HISTORIC CONDITIONS - SCS MAP

FIGURE 5

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

RANCH FILING 2

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

HISTORIC CONDITIONS - SCS MAP
ESTATES AT
ROLLING HILLS

Drawn by TAK | Checked by RG | Date SEPT 2020

Scale AS SHOWN

- of -

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ESTATES AT ROLLING HILLS RANCH
FILING 2 AT MERIDIAN RANCH

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

1 inch = 500 ft.

LEGEND

- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- SCS MODEL ID / SIZE ACRES — BASIN IDENTIFICATION (e.g. FG31 / 2)
- DESIGN POINT
- MAJOR CONTOUR INTERVAL
- MINOR CONTOUR INTERVAL

INTERIM SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9.2	2.5	0.9	0.1
OS07a-POND F	0.0170	13	9.0	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	7	3.9	1.7
FG21a	0.0095	7	5	1.3	0.5	0.1
FG21a-G7	0.0095	7	4.9	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1264	84	60	20.6	10.5	3.3
OS08	0.0394	34	24	7	3	0.7
OS08-G8	0.0394	33	23	7	3	0.7
FG23a	0.0231	16	11	3	1.0	0.2
OS07c	0.0156	15	10	3	1.0	0.1
OS07c-G8	0.0156	13	9	2	0.9	0.1
G8	0.6910	292	193	36.5	16.6	4.4
G7-G10	0.6910	292	192	36.3	16.4	4.2
OS09	0.1527	90	62	18	8	1.9
OS09-G10	0.1527	88	61	18	8	1.9
FG24	0.1405	74	49	12	4.1	0.7
G9	0.2932	154	105	28	12	2.5
G8-G10	0.2932	154	103	28	12	2.5
FG23b	0.0334	22	14	3.1	1.0	0.1
G10	1.0176	449	290	65.3	28.9	6.8
G10-G11	1.0176	447	288	64.9	28.6	6.7
FG23c	0.0070	5	3	1	0	0.0
G11	1.0246	449	289	65	29	6.8
FG25	0.1086	48	32	7	3	0.4
FG28	0.0688	33	21	5	2	0.3
POND G IN	1.2020	522	333	76	33	7.4
POND G	1.2020	358	206	28	10	3.6
G12	1.2020	358	206	28	10	3.6
G12-G06	1.2020	357	205	28	10	3.6
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	27	18	4	1	0.2
FG32-G06	0.0402	27	18	4	1	0.2
G06	1.3419	377	217	29	11	4.0

*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

INTERIM CONDITIONS - SCS MAP

FIGURE 6

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

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

INTERIM CONDITIONS - SCS MAP
ESTATES AT ROLLING HILLS RANCH FILING 2

Drawn by TJK
Checked by RG
Date SEPT 2020

Scale AS SHOWN

- of -

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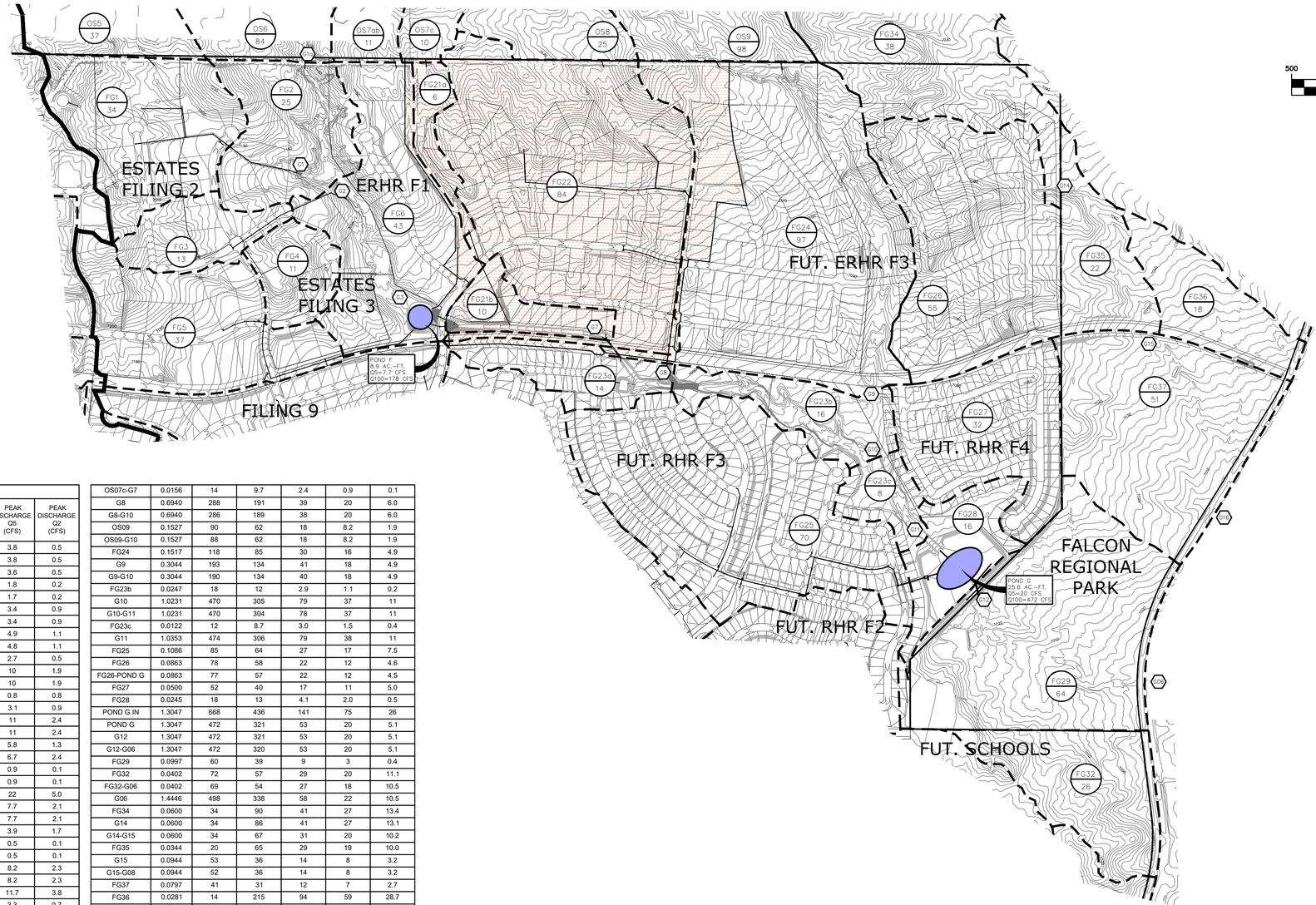
ESTATES AT ROLLING HILLS RANCH
FILING 2 AT MERIDIAN RANCH



GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

1 inch = 500 ft.

LEGEND

- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- SCS MODEL ID / SIZE ACRES — FG31 / 2 — BASIN IDENTIFICATION
- DESIGN POINT
- MAJOR CONTOUR INTERVAL
- MINOR CONTOUR INTERVAL

FUTURE SCS (Full Spectrum)

	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9	2.5	0.9	0.1
OS07ab-POND F	0.0170	13	9	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	7	3.9	1.7
FG21a	0.0095	7	5	1.3	0.5	0.1
FG21a-G7	0.0095	7	5	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1309	89	64	22	11.7	3.8
OS08	0.0394	34	24	7.5	3.3	0.7
OS08-G8	0.0394	33	23	7.3	3.3	0.7
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07c	0.0156	15	10.0	2.6	1.0	0.1
OS07c-G7	0.0156	14	9.7	2.4	0.9	0.1
G8	0.6940	288	191	39	20	6.0
G8-G10	0.6940	286	189	38	20	6.0
OS09	0.1527	90	62	18	8.2	1.9
OS09-G10	0.1527	88	62	18	8.2	1.9
FG24	0.1517	118	85	30	16	4.9
G9	0.3044	193	134	41	18	4.9
G9-G10	0.3044	190	134	40	18	4.9
FG23b	0.0247	18	12	2.9	1.1	0.2
G10	1.0231	470	305	79	37	11
G10-G11	1.0231	470	304	78	37	11
FG23c	0.0122	12	8.7	3.0	1.5	0.4
G11	1.0353	474	306	79	38	11
FG25	0.1086	85	64	27	17	7.5
FG26	0.0863	78	58	22	12	4.6
FG26-POND G	0.0863	77	57	22	12	4.5
FG27	0.0500	52	40	17	11	5.0
FG28	0.0245	18	13	4.1	2.0	0.5
POND G IN	1.3047	668	436	141	75	26
POND G	1.3047	472	321	53	20	5.1
G12	1.3047	472	321	53	20	5.1
G12-G06	1.3047	472	320	53	20	5.1
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	72	57	29	20	11.1
FG32-G06	0.0402	69	54	27	18	10.5
G06	1.4446	498	338	58	22	10.5
FG34	0.0600	34	90	41	27	13.4
G14	0.0600	34	86	41	27	13.1
G14-G15	0.0600	34	67	31	20	10.2
FG35	0.0344	20	65	29	19	10.0
G15	0.0944	53	36	14	8	3.2
G15-G08	0.0944	52	36	14	8	3.2
FG37	0.0797	41	31	12	7	2.7
FG36	0.0281	14	215	94	59	28.7
FG36-G08	0.0281	14	61	25	15	6.5
G16	0.2022	106	59	28	19	9.8

*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

FUTURE CONDITIONS - SCS MAP

FIGURE 7

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

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

FUTURE CONDITIONS - SCS MAP
ESTATES AT ROLLINGS HILLS RANCH FILING 2

Drawn by TAK | Checked by RG | Date SEPT 2020

Scale AS SHOWN | - of -

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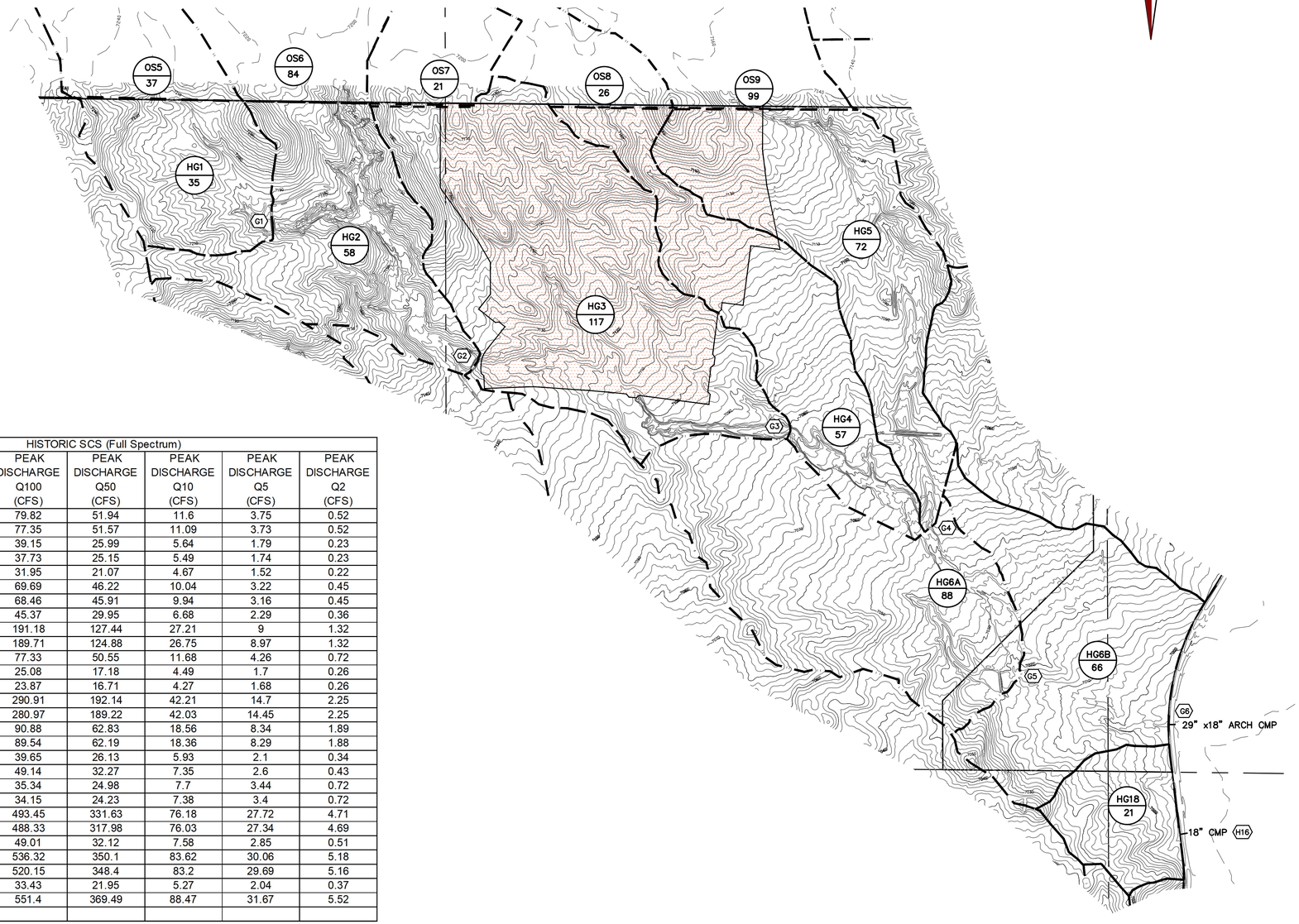
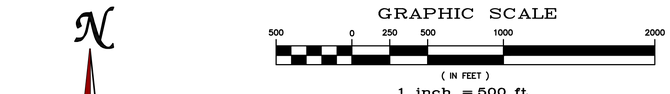
Appendix J – Drainage Maps

ESTATES AT ROLLING HILLS RANCH
FILING 2 AT MERIDIAN RANCH





GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

1 inch = 500 ft.

LEGEND

MAJOR BASIN BOUNDARY

MINOR BASIN BOUNARY

SCS MODEL ID / SIZE ACRES — EB15 / 65 — BASIN IDENTIFICATION

H8 B10 DESIGN POINTS

MAJOR CONTOUR INTERVAL

MINOR CONTOUR INTERVAL

100 YEAR FLOOD PLAIN

HISTORIC SCS (Full Spectrum)						
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	79.82	51.94	11.6	3.75	0.52
OS06-G02	0.1313	77.35	51.57	11.09	3.73	0.52
OS05	0.0578	39.15	25.99	5.64	1.79	0.23
OS05-G01	0.0578	37.73	25.15	5.49	1.74	0.23
HG01	0.0547	31.95	21.07	4.67	1.52	0.22
G01	0.1125	69.69	46.22	10.04	3.22	0.45
G01-G02	0.1125	68.46	45.91	9.94	3.16	0.45
HG02	0.0906	45.37	29.95	6.68	2.29	0.36
G02	0.3344	191.18	127.44	27.21	9	1.32
G02-G03	0.3344	189.71	124.88	26.75	8.97	1.32
HG03	0.1828	77.33	50.55	11.68	4.26	0.72
OS07	0.0328	25.08	17.18	4.49	1.7	0.26
OS07-G03	0.0328	23.87	16.71	4.27	1.68	0.26
G03	0.55	290.91	192.14	42.21	14.7	2.25
G03-G04	0.55	280.97	189.22	42.03	14.45	2.25
OS09	0.1547	90.88	62.83	18.56	8.34	1.89
OS09-G04	0.1547	89.54	62.19	18.36	8.29	1.88
HG04	0.0891	39.65	26.13	5.93	2.1	0.34
HG05	0.1125	49.14	32.27	7.35	2.6	0.43
OS08	0.0406	35.34	24.98	7.7	3.44	0.72
OS08-G04	0.0406	34.15	24.23	7.38	3.4	0.72
G04	0.9469	493.45	331.63	76.18	27.72	4.71
G04-G05	0.9469	488.33	317.98	76.03	27.34	4.69
HG06A	0.1375	49.01	32.12	7.58	2.85	0.51
G05	1.0844	536.32	350.1	83.62	30.06	5.18
G05-G06	1.0844	520.15	348.4	83.2	29.69	5.16
HG06B	0.1031	33.43	21.95	5.27	2.04	0.37
G06	1.1875	551.4	369.49	88.47	31.67	5.52

HISTORIC CONDITIONS - SCS MAP

FIGURE 5

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

RANCH FILING 2

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

HISTORIC CONDITIONS - SCS MAP
ESTATES AT
ROLLING HILLS

Drawn by TK
Checked by RG
Date SEPT 2021

Scale AS SHOWN

- of -

ESTATES AT ROLLING HILLS RANCH
FILING 2 AT MERIDIAN RANCH

INTERIM SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9.2	2.5	0.9	0.1
OS07a-POND F	0.0170	13	9.0	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	7	3.9	1.7
FG21a	0.0095	7	5	1.3	0.5	0.1
FG21a-G7	0.0095	7	4.9	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1264	84	60	20.6	10.5	3.3
OS08	0.0394	34	24	7	3	0.7
OS08-G8	0.0394	33	23	7	3	0.7
FG23a	0.0231	16	11	3	1.0	0.2
OS07c	0.0156	15	10	3	1.0	0.1
OS07c-G8	0.0156	13	9	2	0.9	0.1
G8	0.6910	292	193	36.5	16.6	4.4
G7-G10	0.6910	292	192	36.3	16.4	4.2
OS09	0.1527	90	62	18	8	1.9
OS09-G10	0.1527	88	61	18	8	1.9
FG24	0.1405	74	49	12	4.1	0.7
G9	0.2932	154	105	28	12	2.5
G8-G10	0.2932	154	103	28	12	2.5
FG23b	0.0334	22	14	3.1	1.0	0.1
G10	1.0176	449	290	65.3	28.9	6.8
G10-G11	1.0176	447	288	64.9	28.6	6.7
FG23c	0.0070	5	3	1	0	0.0
G11	1.0246	449	289	65	29	6.8
FG25	0.1086	48	32	7	3	0.4
FG28	0.0688	33	21	5	2	0.3
POND G IN	1.2020	522	333	76	33	7.4
POND G	1.2020	358	206	28	10	3.6
G12	1.2020	358	206	28	10	3.6
G12-G06	1.2020	357	205	28	10	3.6
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	27	18	4	1	0.2
FG32-G06	0.0402	27	18	4	1	0.2
G06	1.3419	377	217	29	11	4.0

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

1 inch = 500 ft.

LEGEND

- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- SCS MODEL ID / SIZE ACRES — FG31 / 2 — BASIN IDENTIFICATION
- DESIGN POINT
- MAJOR CONTOUR INTERVAL
- MINOR CONTOUR INTERVAL

*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

INTERIM CONDITIONS - SCS MAP

⚠ REVISE SUB-BASIN BOUNDARY BETWEEN FG22 & FG24 WITH WITH THE ELIMINATION OF STREET

FIGURE 6

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

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

INTERIM CONDITIONS - SCS MAP
ESTATES AT ROLLING HILLS RANCH FILING 2

Drawn by TJK
Checked by RG
Date SEPT 2020

Scale AS SHOWN

- of -

ESTATES AT ROLLING HILLS RANCH
FILING 2 AT MERIDIAN RANCH

FUTURE SCS (Full Spectrum)						
	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE Q100 (CFS)	PEAK DISCHARGE Q50 (CFS)	PEAK DISCHARGE Q10 (CFS)	PEAK DISCHARGE Q5 (CFS)	PEAK DISCHARGE Q2 (CFS)
OS06	0.1313	80	52	12	3.8	0.5
G1a	0.1313	80	52	12	3.8	0.5
G1a-G2	0.1313	79	52	11	3.6	0.5
OS05	0.0578	39	26	5.6	1.8	0.2
OS05-G1	0.0578	39	25	5.5	1.7	0.2
FG01	0.0538	31	22	7.0	3.4	0.9
FG01-G1	0.0538	31	22	7.0	3.4	0.9
G1	0.1116	61	41	11	4.9	1.1
G1-G2	0.1116	61	41	11	4.8	1.1
FG02	0.0391	32	22	6.4	2.7	0.5
G2	0.2820	167	112	27	10	1.9
G2-G3	0.2820	163	109	27	10	1.9
FG03	0.0203	24	17	5.9	0.8	0.8
FG04	0.0172	22	16	5.8	3.1	0.9
G3	0.3195	185	123	31	11	2.4
G3-POND F	0.3195	183	121	31	11	2.4
FG06	0.0675	56	40	12	5.8	1.3
FG05	0.0580	45	33	12	6.7	2.4
OS07ab	0.0170	14	9	2.5	0.9	0.1
OS07ab-POND F	0.0170	13	9	2.4	0.9	0.1
POND F IN	0.4620	293	200	54	22	5.0
POND F	0.4620	178	121	16	7.7	2.1
POND F-G7	0.4620	177	121	16	7.7	2.1
FG21b	0.0150	21	16	7	3.9	1.7
FG21a	0.0095	7	5	1.3	0.5	0.1
FG21a-G7	0.0095	7	5	1.3	0.5	0.1
G7	0.4865	185	126	17	8.2	2.3
G7-G8	0.4865	184	125	17	8.2	2.3
FG22	0.1309	89	64	22	11.7	3.8
OS08	0.0394	34	24	7.5	3.3	0.7
OS08-G8	0.0394	33	23	7.3	3.3	0.7
FG23a	0.0216	21	15	5.2	2.7	0.8
OS07c	0.0156	15	10.0	2.6	1.0	0.1
OS07c-G7	0.0156	14	9.7	2.4	0.9	0.1
G8	0.6940	288	191	39	20	6.0
G8-G10	0.6940	286	189	38	20	6.0
OS09	0.1527	90	62	18	8.2	1.9
OS09-G10	0.1527	88	62	18	8.2	1.9
FG24	0.1517	118	85	30	16	4.9
G9	0.3044	193	134	41	18	4.9
G9-G10	0.3044	190	134	40	18	4.9
FG23b	0.0247	18	12	2.9	1.1	0.2
G10	1.0231	470	305	79	37	11
G10-G11	1.0231	470	304	78	37	11
FG23c	0.0122	12	8.7	3.0	1.5	0.4
G11	1.0353	474	306	79	38	11
FG25	0.1086	85	64	27	17	7.5
FG26	0.0863	78	58	22	12	4.6
FG26-POND G	0.0863	77	57	22	12	4.5
FG27	0.0500	52	40	17	11	5.0
FG28	0.0245	18	13	4.1	2.0	0.5
POND G IN	1.3047	668	436	141	75	26
POND G	1.3047	472	321	53	20	5.1
G12	1.3047	472	321	53	20	5.1
G12-G06	1.3047	472	320	53	20	5.1
FG29	0.0997	60	39	9	3	0.4
FG32	0.0402	72	57	29	20	11.1
FG32-G06	0.0402	69	54	27	18	10.5
G06	1.4446	498	338	58	22	10.5
FG34	0.0600	34	90	41	27	13.4
G14	0.0600	34	86	41	27	13.1
G14-G15	0.0600	34	67	31	20	10.2
FG35	0.0344	20	65	29	19	10.0
G15	0.0944	53	36	14	8	3.2
G15-G08	0.0944	52	36	14	8	3.2
FG37	0.0797	41	31	12	7	2.7
FG36	0.0281	14	215	94	59	28.7
FG36-G08	0.0281	14	61	25	15	6.5
G16	0.2022	106	59	28	19	9.8

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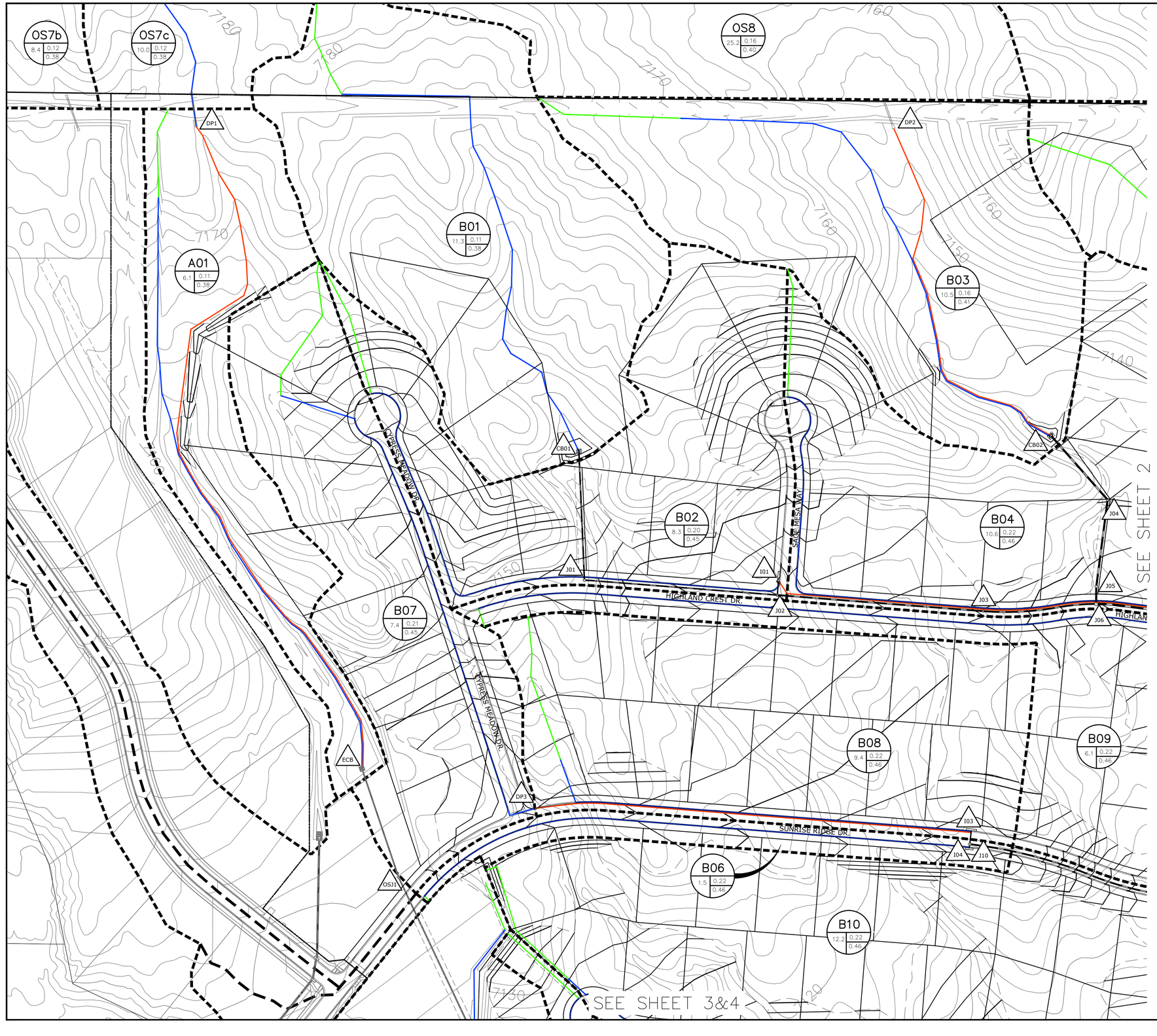

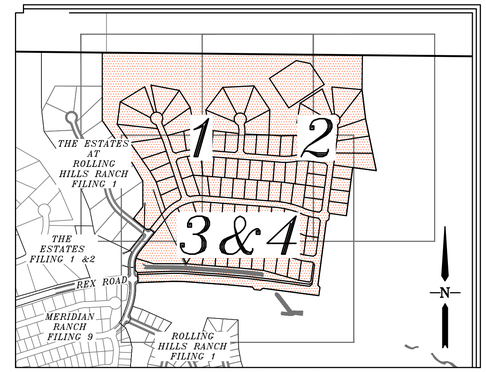

INDEX MAP

N.T.S.

G01 | 2.7 | 0.40 | 0.55 — BASIN DESIGNATION; SUB-WATERSHED DESIGNATION; MINOR/MAJOR STORM COEFFICIENT; BASIN AREA IN ACRES

61 — DESIGN POINT DESIGNATION

MAJOR BASIN BOUNDARY

SUB-BASIN BOUNDARY

6130 — EXISTING CONTOUR

6130 — PROPOSED COUNTOUR

PROPOSED STORM SEWER

INITIAL OVERLAND TIME (TI)

TRAVEL TIME (Tt)

OVERLAND TIME (To)

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
DP1	OS7c	10.0	4.1	22	EX 30 " CULVERT	4.1	22	24 " RCP
ECB	A01	6.1	5.0	27	EX TYPE C INLET	5.0	27	24 " RCP
OSJ01						5.0	27	24 " RCP
OSJ02						5.0	27	24 " RCP
CB01	B01	11.3	4.2	24	PR TYPE C INLET	4.2	24	24 " RCP
J01						4.2	24	24 " RCP
I01	B02	8.3	5.5	20	PR 20 ' FORCED SUMP	5.5	17	18 " RCP
J02						9.5	40	30 " RCP
J03						9.5	40	30 " RCP
DP2	OS8	25.2	10	45	EX 30 " CULVERT	10	45	36 " RCP
CB02	B03	10.5	14	57	PR TYPE D INLET	14	57	36 " RCP
J04						13	57	36 " RCP
J05						13	57	36 " RCP
I02	B04	10.6	7.4	26	PR 20 ' FORCED SUMP	7	17	24 " RCP
J06						20	86	42 " RCP
J07						26	98	42 " RCP
J08						26	98	42 " RCP
I05	B09	6.1	4.1	22	PR 20 ' SUMP	4.1	17	18 " RCP
I06	B05	5.6	4.0	13	PR 20 ' FLOW-BY	3.6	10	18 " RCP
J09						31	118	42 " RCP
DP3	B07	7.4	5.1	18				
I03	B08	9.4	10	35	PR 20 ' SUMP	10.0	17	18 " RCP
I04	B06	1.5	1.1	21	PR 15 ' SUMP	1.1	21	18 " RCP
J10						11	38	30 " RCP
J11						41	151	42 " RCP
I07	B10	12.2	8.6	31	PR 20 ' FORCED SUMP	8.6	17	24 " RCP
J12						47	164	48 " RCP
I08	B11	1.0	1.7	5	PR 10 ' SUMP	1.7	5.1	18 " RCP
I09	B12	3.3	2.3	20	PR 20 ' SUMP	2.3	17	18 " RCP
J13						51	182	54 " RCP
I08	FB11	0.7	1.6	14	PR 10 ' SUMP	1.6	14	18 " RCP
I09	FB12	6.2	7.5	29	PR 20 ' SUMP	7.5	17	18 " RCP
J13						55	189	54 " RCP

BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

NOTE:

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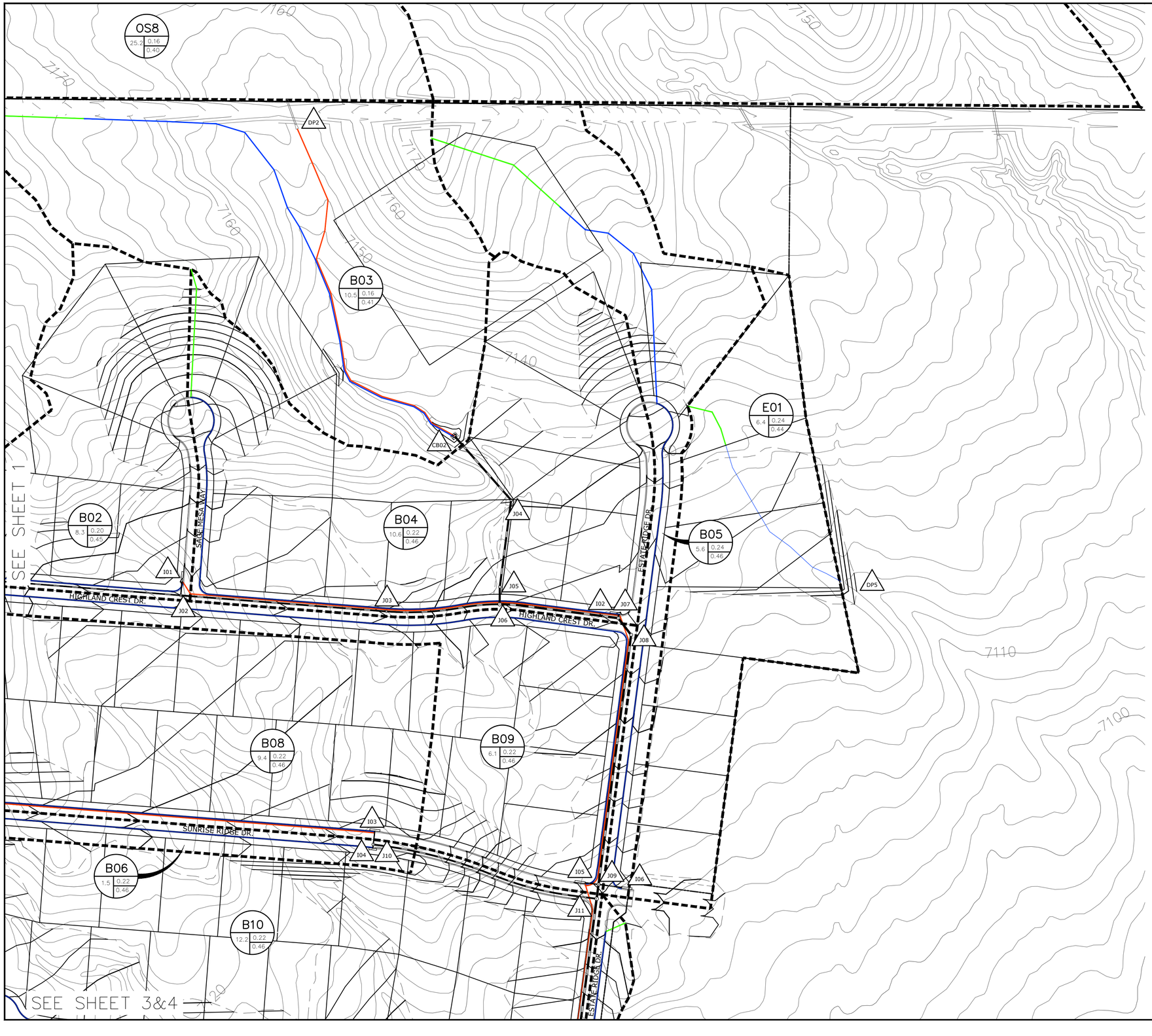
TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

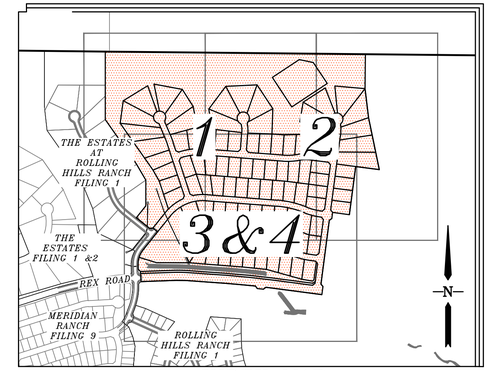
MERIDIAN RANCH

RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
THE ESTATES AT
ROLLING HILLS RANCH FILING 2

Drawn by TJK | Checked by - | Date SEPT 2021

Scale 1" = 100' | 1 of 4





INDEX MAP

N.T.S.

G01 — 27 — 0.40 / 0.55

- BASIN DESIGNATION
- SUB-WATERSHED DESIGNATION
- MINOR/MAJOR STORM COEFFICIENT
- BASIN AREA IN ACRES
- 61 — DESIGN POINT DESIGNATION
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- 6130 — EXISTING CONTOUR
- 6130 — PROPOSED COUNTOUR
- PROPOSED STORM SEWER
- INITIAL OVERLAND TIME (TI)
- TRAVEL TIME (TT)
- OVERLAND TIME (To)

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
DP1	OS7c	10.0	4.1	22	EX 30 " CULVERT	4.1	22	24 " RCP
ECB	A01	6.1	5.0	27	EX TYPE C INLET	5.0	27	24 " RCP
OSJ01						5.0	27	24 " RCP
OSJ02						5.0	27	24 " RCP
CB01	B01	11.3	4.2	24	PR TYPE C INLET	4.2	24	24 " RCP
J01						4.2	24	24 " RCP
I01	B02	8.3	5.5	20	PR 20 ' FORCED SUMP	5.5	17	18 " RCP
J02						9.5	40	30 " RCP
J03						9.5	40	30 " RCP
DP2	OS8	25.2	10	45	EX 30 " CULVERT	10	45	36 " RCP
CB02	B03	10.5	14	57	PR TYPE D INLET	14	57	36 " RCP
J04						13	57	36 " RCP
J05						13	57	36 " RCP
I02	B04	10.6	7.4	26	PR 20 ' FORCED SUMP	7	17	24 " RCP
J06						20	86	42 " RCP
J07						26	98	42 " RCP
J08						26	98	42 " RCP
I05	B09	6.1	4.1	22	PR 20 ' SUMP	4.1	17	18 " RCP
I06	B05	5.6	4.0	13	PR 20 ' FLOW-BY	3.6	10	18 " RCP
J09						31	118	42 " RCP
DP3	B07	7.4	5.1	18				
I03	B08	9.4	10	35	PR 20 ' SUMP	10.0	17	18 " RCP
I04	B06	1.5	1.1	21	PR 15 ' SUMP	1.1	21	18 " RCP
J10						11	38	30 " RCP
J11						41	151	42 " RCP
I07	B10	12.2	8.6	31	PR 20 ' FORCED SUMP	8.6	17	24 " RCP
J12						47	164	48 " RCP
I08	B11	1.0	1.7	5	PR 10 ' SUMP	1.7	5.1	18 " RCP
I09	B12	3.3	2.3	20	PR 20 ' SUMP	2.3	17	18 " RCP
J13						51	182	54 " RCP
I08	FB11	0.7	1.6	14	PR 10 ' SUMP	1.6	14	18 " RCP
I09	FB12	6.2	7.5	29	PR 20 ' SUMP	7.5	17	18 " RCP
J13						55	189	54 " RCP

BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT
SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

NOTE:

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TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
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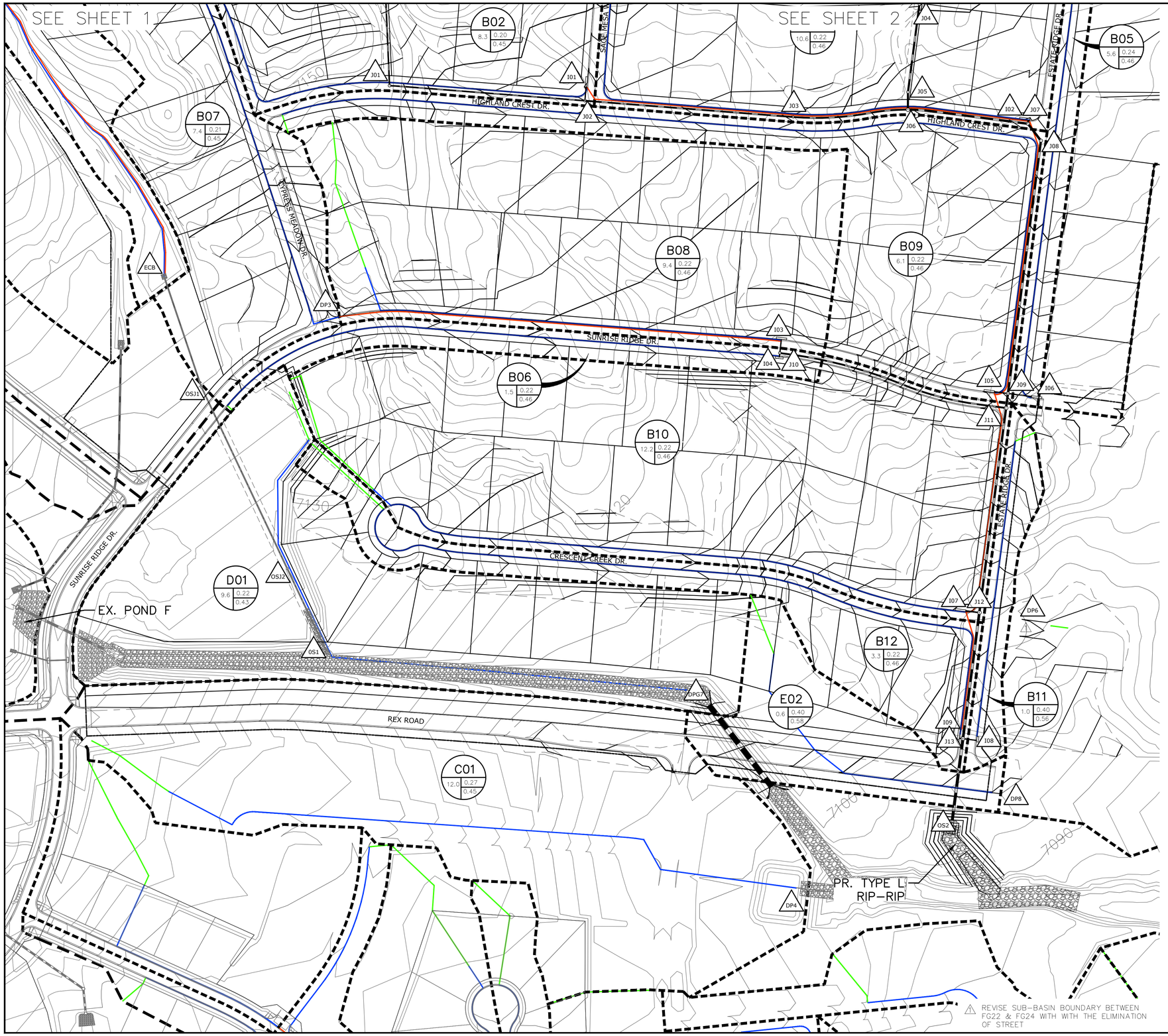
MERIDIAN RANCH

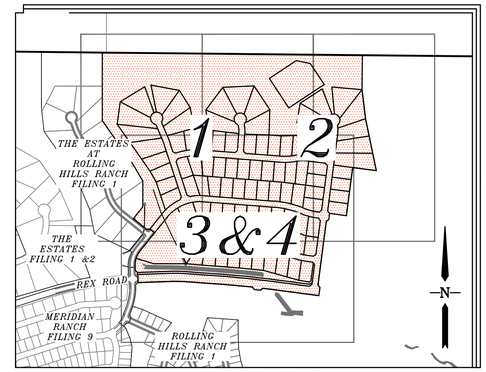
RATIONAL DRAINAGE MAP
FINAL DRAINAGE REPORT
THE ESTATES AT
ROLLING HILLS RANCH FILING 2

Drawn by TAK | Checked by - | Date SEPT 2021

Scale 1" = 100' | 2 of 4



⚠ REVISE SUB-BASIN BOUNDARY BETWEEN FG22 & FG24 WITH WITH THE ELIMINATION OF STREET



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GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
DP1	OS7c	10.0	4.1	22	EX 30 " CULVERT	4.1	22	24 " RCP
ECB	A01	6.1	5.0	27	EX TYPE C INLET	5.0	27	24 " RCP
OSJ01						5.0	27	24 " RCP
OSJ02						5.0	27	24 " RCP
CB01	B01	11.3	4.2	24	PR TYPE C INLET	4.2	24	24 " RCP
J01						4.2	24	24 " RCP
I01	B02	8.3	5.5	20	PR 20 ' FORCED SUMP	5.5	17	18 " RCP
J02						9.5	40	30 " RCP
J03						9.5	40	30 " RCP
DP2	OS8	25.2	10	45	EX 30 " CULVERT	10	45	36 " RCP
CB02	B03	10.5	14	57	PR TYPE D INLET	14	57	36 " RCP
J04						13	57	36 " RCP
J05						13	57	36 " RCP
I02	B04	10.6	7.4	26	PR 20 ' FORCED SUMP	7	17	24 " RCP
J06						20	86	42 " RCP
J07						26	98	42 " RCP
J08						26	98	42 " RCP
I05	B09	6.1	4.1	22	PR 20 ' SUMP	4.1	17	18 " RCP
I06	B05	5.6	4.0	13	PR 20 ' FLOW-BY	3.6	10	18 " RCP
J09						31	118	42 " RCP
DP3	B07	7.4	5.1	18				
I03	B08	9.4	10	35	PR 20 ' SUMP	10.0	17	18 " RCP
I04	B06	1.5	1.1	21	PR 15 ' SUMP	1.1	21	18 " RCP
J10						11	38	30 " RCP
J11						41	151	42 " RCP
I07	B10	12.2	8.6	31	PR 20 ' FORCED SUMP	8.6	17	24 " RCP
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MERIDIAN RANCH

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THE ESTATES AT
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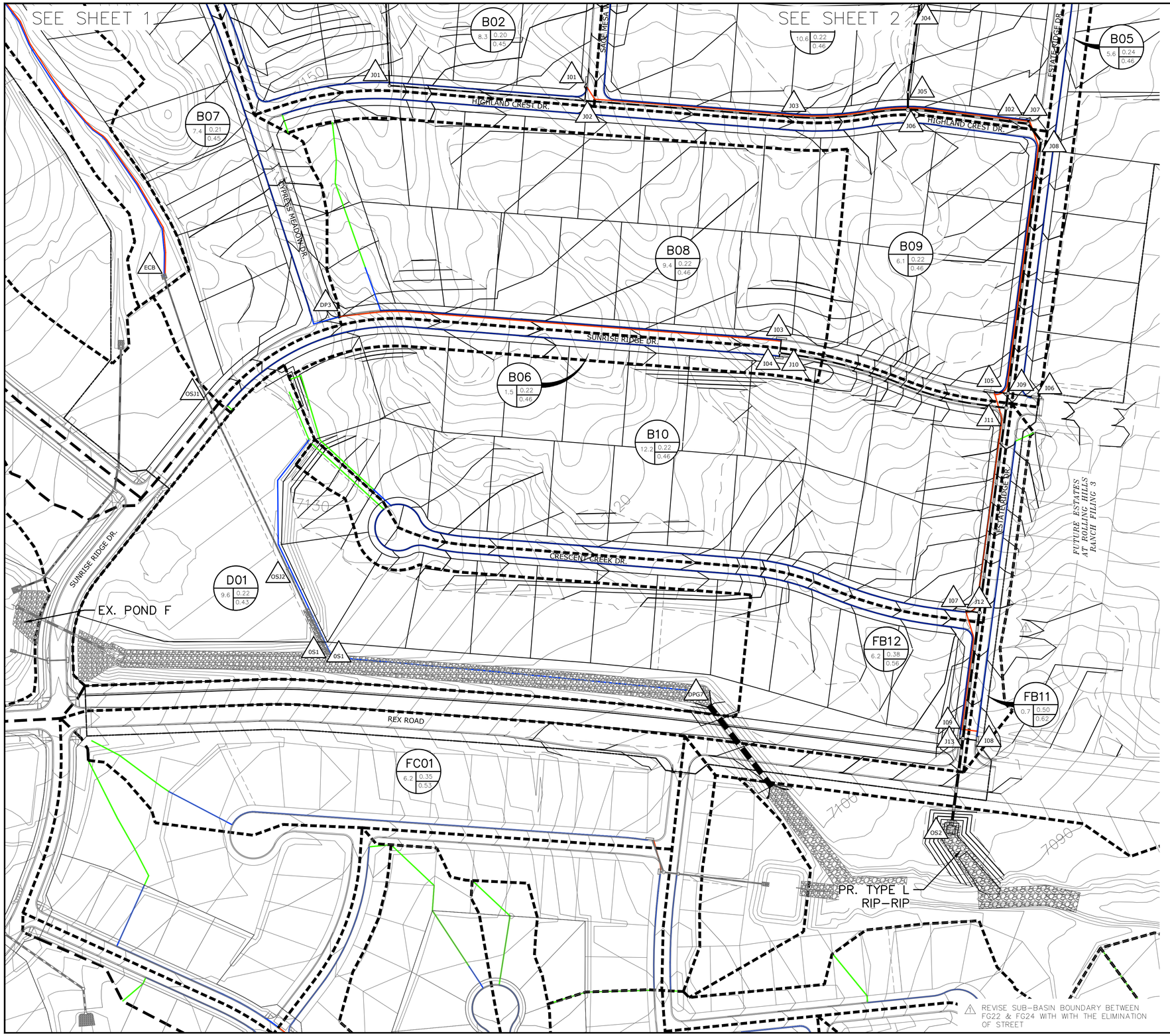
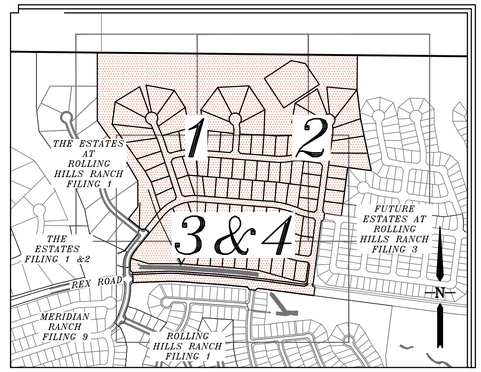
Drawn by TAK | Checked by - | Date SEPT 2021

Scale 1" = 100' | 3 of 4





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- 6130 — PROPOSED COUNTOUR
- PROPOSED STORM SEWER
- INITIAL OVERLAND TIME (TI)
- TRAVEL TIME (Tt)
- OVERLAND TIME (To)

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

DP	BASIN	AREA (AC)	Q(5) (CFS)	Q(100) (CFS)	INLET	Q(5) (CFS)	Q(100) (CFS)	PIPE
DP1	OS7c	10.0	4.1	22	EX 30 " CULVERT	4.1	22	24 " RCP
ECB	A01	6.1	5.0	27	EX TYPE C INLET	5.0	27	24 " RCP
OSJ01						5.0	27	24 " RCP
OSJ02						5.0	27	24 " RCP
CB01	B01	11.3	4.2	24	PR TYPE C INLET	4.2	24	24 " RCP
J01						4.2	24	24 " RCP
I01	B02	8.3	5.5	20	PR 20 ' FORCED SUMP	5.5	17	18 " RCP
J02						9.5	40	30 " RCP
J03						9.5	40	30 " RCP
DP2	OS8	25.2	10	45	EX 30 " CULVERT	10	45	36 " RCP
CB02	B03	10.5	14	57	PR TYPE D INLET	14	57	36 " RCP
J04						13	57	36 " RCP
J05						13	57	36 " RCP
I02	B04	10.6	7.4	26	PR 20 ' FORCED SUMP	7	17	24 " RCP
J06						20	86	42 " RCP
J07						26	98	42 " RCP
J08						26	98	42 " RCP
I05	B09	6.1	4.1	22	PR 20 ' SUMP	4.1	17	18 " RCP
I06	B05	5.6	4.0	13	PR 20 ' FLOW-BY	3.6	10	18 " RCP
J09						31	118	42 " RCP
DP3	B07	7.4	5.1	18				
I03	B08	9.4	10	35	PR 20 ' SUMP	10.0	17	18 " RCP
I04	B06	1.5	1.1	21	PR 15 ' SUMP	1.1	21	18 " RCP
J10						11	38	30 " RCP
J11						41	151	42 " RCP
I07	B10	12.2	8.6	31	PR 20 ' FORCED SUMP	8.6	17	24 " RCP
J12						47	164	48 " RCP
I08	B11	1.0	1.7	5	PR 10 ' SUMP	1.7	5.1	18 " RCP
I09	B12	3.3	2.3	20	PR 20 ' SUMP	2.3	17	18 " RCP
J13						51	182	54 " RCP
I08	FB11	0.7	1.6	14	PR 10 ' SUMP	1.6	14	18 " RCP
I09	FB12	6.2	7.5	29	PR 20 ' SUMP	7.5	17	18 " RCP
J13						55	189	54 " RCP

BENCH MARK:

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

NOTE:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GNERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

⚠ REVISE SUB-BASIN BOUNDARY BETWEEN FG22 & FG24 WITH WITH THE ELIMINATION OF STREET

No.	Revisions	Date	Init.	Apprv.	Date
-					
-					
-					

TECH CONTRACTORS
11886 STAPLETON DRIVE
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MERIDIAN RANCH

FUTURE RATIONAL DRAINAGE MAP FINAL DRAINAGE REPORT THE ESTATES AT ROLLING HILLS RANCH FILING 2

Drawn by	Checked by	Date
TAK	-	SEPT 2020

Scale	
1" = 100'	4 of 4