Falcon Highlands

Final Drainage Report

Owner/Developer
Challenger Homes
8605 Explorer Drive Ste. 250
Colorado Springs, CO 80920
(719) 598-5192
Contact: Jim Byers

Engineer
Atwell, LLC
143 Union Blvd., Suite 700
Lakewood, CO 80228
303-462-1100
Contact: Kevin Blumhardt, PE

Atwell Project Number
24004308

PCD File Number
SF1418

Submitted by: Atwell, LLC

December 20, 2024

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 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.

Kevin Blumhardt, PE 54413 Date Seal:

Developer's Statement:

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

Business Name: Challenger Homes

By:

Title:

Address:

El Paso County Approval:

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

Date

County Engineer,
Conditions:

Contents

INTRODUCTION

This Final Drainage Report (FDR) has been completed for Challenger Homes in order to present an effective storm water management plan for the Falcon Highlands South Filing 1 development, hereinafter referred to as the Site. This report is intended to guide the development of the Site and recommend general drainage concepts that can be implemented as development progresses. Included within this report is a proposed drainage plan for the Site along with reference information for drainage basins and storm water conveyance facilities.

The Site was most recently studied in the Preliminary Drainage Report (PDR) level in the *Falcon Highlands South PUDSP Preliminary Drainage Report* by Atwell, LLC, approved May 17, 2024.

The Site for Falcon Highlands South Filing 1 is approximately 19.66 acres and will include a total of approximately 24 single-family residential units.

Proposed herein is a network of storm infrastructure, permanent water quality and detention facilities, and swales that will meet relevant drainage criteria.

GENERAL LOCATION AND DESCRIPTION

The Site is located within Section 12, Township 13 South, Range 65 West of the Sixth Principal Meridian, County of El Paso, State of Colorado. The Site is bounded by Antelope Meadows to the south, Bridal Vail Way to the west. Falcon Highlands Filing No. 2 is located to the north of the Site.

The overall area consists of approximately 19.66 acres that is proposed to be developed into 24 single-family residential units, roadways, and open space. In addition to the Site development, two off-site water quality and detention will be constructed to detain runoff from the Site and other areas of the overall Falcon Highlands development.

The Site is within the Sand Creek Drainage Basin.

A vicinity map showing the location of the Site is included in appendix A.

The Site is within the Falcon Highlands MDDP by Atwell, LLC, dated March 2022.

SOILS AND EXISTING CONDITIONS

Much of the Site is currently undeveloped. Of the development within the Site, there are existing dirt roadways and sanitary sewer infrastructure installed per the Construction Drawings for Falcon Highlands Filing No. 2 prepared by Terra Nova Engineering, most recent revised date of September 7, 2010. The ALTA survey conducted by Atwell, LLC., shows the existing conditions of Falcon Highlands and adjacent development of Filing No. 2. The Site is comprised of existing

natural grass vegetation typical of the eastern plains with sparse vegetative cover at its outer limits to the south and southeast. There is an existing detention pond south of the Site, from Falcon Highlands Filing No.2 and the future development of Falcon Highlands Filing No. 3. The on-Site slopes range from 0 percent to 10 percent and generally sheet flows from west to east. An Existing Conditions Drainage Map is included in Appendix G showing the delineated drainage basins.

The Site is compromised of Blakeland-Fluvaquentic Haplaquolls soil, a loamy sand, and hydraulic soils group A. The Natural Resources Conservation Service of the United State Department of Agriculture Web Soil Survey has been included in Appendix B for reference.

Based on a Geotechnical Report done by Rocky Mountain Group, dated October 8, 2021, three bore holes were drilled within the Site, TB-1, TB-2, TB-3. From these bore holes it was noted that ground water was hit at 16.0', 14.6', and 11.4' respectively. A copy of this report can be found in Appendix F.

DRAINAGE DESIGN CRITERIA

The El Paso County Drainage Manual (EPC DCM) and El Paso County Engineering Criteria Manual (EPC ECM) were used in conjunction with the Colorado Springs Drainage Criteria Manual (DCM) Mile High Flood District (MHFD) Criteria Manual. The rational method was used for a drainage basin less than 100-acres. The 5-year design frequency was used for the minor storm and a 100-year design frequency was used for the major storm in calculation on-Site storm hydraulics. The City of Colorado Springs IDF Curve has used for calculating the rainfall intensity of 1.50 inches for the 5-year and 2.52 inches for the 100-year.

EXISTING ONSITE AND OFFSITE DRAINAGE BASINS

Off-Site drainage basin runoff data and calculations have been updated per current codes and standards. The developments of Falcon Highlands Filings No. 1 and 2 remain consistent with the Master Drainage Development Plan, MDDP (EDARP project number SF05033) and therefore off Site basin descriptions are delineations provided are based on previous County approved reports.

The Site has been broken down into several major existing drainage basins. An Existing Conditions Drainage Map is in appendix F.

Off-Site Basins (Existing):

Filing No. 2:

OS-1 (6.38 ac, Q_5 = 5.58 cfs, Q_{100} = 16.11 cfs) is an off-Site basin located on the northwestern part of Falcon Highlands Filing No. 2 and consists of the rear yard areas of PUD residential zoned lots.

The historic drainage pattern sheet flows southwesterly where it is captured by basin OS-5 at **Design Point 7** and ultimately outfalls into existing Pond 1 through the public 60" RCP storm pipe that runs through Falcon Highlands South.

OS-2 (3.12 ac, Q_5 = 2.29 cfs, Q_{100} = 6.06 cfs) is an off-Site sub-basin within the developed area of Filing No. 1 for quarter-acre lots and is an off-Site basin that was included in the MDDP for Filing No. 2. The basin's runoff sheet flows due south in Filing No. 2 and is captured by the roadways and storm system in Filing No. 2 that runs through Falcon Highlands South, and ultimately outfalls into the existing Pond 1. The basin flows to OS-5.

OS-3 (1.14 ac, Q_5 = 4.06 cfs, Q_{100} = 7.04 cfs) is an off-Site basin within Filing No. 1 that includes the developed right-of-way of Rolling Thunder Way. This sub-basin was included in the previous MDDP as an off-Site basin and represents a portion of the landscaped right-of-way on the south side of Rolling Thunder Way that sheet flows due south into the developed areas of Filing No. 2 and ultimately into the public storm system shared with Falcon Highlands South, outfalling to existing Detention Pond 2.

OS-4 (13.09 ac, Q_5 = 4.44 cfs, Q_{100} = 15.98 cfs) is an off-Site basin located on the southwestern part of Falcon Highlands Filing No. 2 and consists of mostly Tract A and portions of PUD residential zoned lots rear yard areas. The historic drainage pattern sheet flows south where it is captured by basin A, and per existing drainage patterns is not tributary to on-Site detention ponds and drains directly offSite via overland sheet flow.

OS-5 (59.62 ac, Q_5 = 51.26 cfs, Q_{100} = 135.39 cfs) is an off-Site basin that stretches from the eastern border of basin OS-4 to the eastern edge of Bridal Vail Way within Filing No. 2. The basin is zoned as PUD residential lots of about quarter-acre size. Runoff is carried in the public rights-of-way where the flow travels south through a series of public curb and gutters, sump inlets and storm infrastructure within Filing No. 2. The flow outfalls into the existing Pond 1 through the public 60" RCP storm pipe that runs through Falcon Highlands South. No surface flow from this basin enters the Site.

OS-6 (35.75 ac, Q_5 = 14.22 cfs, Q_{100} = 49.60 cfs) is off-Site basin located between Bridal Vail Way and Antelope Meadows Circle within Filing 2. This basin includes PUD residential zoned lots of half-acre size and contains drainage tracts. The basin is captured by a series of public curb and gutter systems in the rights-of-way where public storm infrastructure conveys storm water to the end of the cul-de-sac of Wagon Track Drive where the public storm system of Filing No. 2 connects and daylights to Falcon Highlands South within future Antelope Meadows Circle right-of-way. Flows continue through Falcon Highlands South via an existing diversion ditch to Pond 2.

OS-7 (6.47 ac, Q_5 = 2.29 cfs, Q_{100} = 7.97 cfs) is the off-Site basin located within Filing 2, just north of Basin D of Filing 3. The basin includes PUD residential zoned lots of half-acre size with right of way. The basin runoff is captured in the public right-of-way curb and gutter where it travels south and is released at the road end, where it continues south through Antelope Meadows Circle and then due east through Falcon Highlands South's Basin D in the existing access path where it outfalls to Pond WU.

Future Falcon Highlands Phases:

OS-8 (3.74 ac, Q_5 = 0.15 cfs, Q_{100} = 2.03 cfs) is the basin located southwest of Antelope Meadow Circle, just below basin OS-4, and west of basin OS-11. The storm water runoff from this basin sheet flows south and off-Site at with the combined flow of OS-4, and per existing drainage patterns is not tributary to on-Site detention ponds.

OS-9 (3.14 ac, Q_5 = .20 cfs, Q_{100} = 2.62 cfs) is the undeveloped, natural landscaped area between Tamlin Road and the existing Pond 1. Runoff from Basin E is directed by a ditch section to a low point between the future Dublin Road and Highway 24. This drainage concept and its associated storm infrastructure is presented in the previous master plan and is to remain as the intended plan. The 2005 PDR suggested that an inline grate inlet be installed but there is no evidence that this was installed. The existing drainage pattern consists of pooling within the local low point of the ditch that surcharges and is directed south through the grassland swale.

OS-10 (3.67 ac, Q_5 = 0.18 cfs, Q_{100} = 2.42 cfs) is the undeveloped area between Tamlin Road and the existing Detention Pond 2. The runoff from Basin F is directed to the low point in the downstream grasslined swale between the Site and Tamlin Road. This drainage concept and its associated storm infrastructure is presented in the previous master plan and is to remain as the intended plan. The 2005 PDR suggested that a 4'x4' area inlet be constructed but there is no evidence that this was installed. The existing drainage pattern consists of pooling within the local low point of the ditch that surcharges and is directed south through the grassland swale.

OS-11 (35.55 ac, Q_5 = 1.32 cfs, Q_{100} = 17.58 cfs) is located south of Antelope Meadow Circle, adjacent to basin A. The Site is covered in native grasses with limited grading work from a previous development. Runoff from the Site sheet flows southwesterly overland to existing Pond 1). The private 42" RCP outlet pipe from the outlet structure of the pond daylights at the grassland swale south of the abandoned future Tamlin Road right-of-way.

OS-12 (39.29 ac, Q_5 = 1.57 cfs, Q_{100} = 20.90 cfs) is located adjacent to Basin B and covered in native grasses and weeds. The Site has limited grading due to work from a previous development that did not finish. Runoff from the Site sheet flows southwesterly overland to an existing diversion ditch that spans from an existing public 24" RCP storm sewer main that daylights within Falcon Highlands South south of Wagon Track Way. The diversion ditch flows directly to existing Pond 2. The private 42" RCP outlet pipe from the outlet structure of the pond daylights at the grassland swale south of the project Site.

OS-13 (10.54 ac, Q_5 =0.44 cfs, Q_{100} = 5.86 cfs) is located to the northeast of the Filing and consists of undeveloped area with native grasses. The basin's runoff drains directly to existing Pond WU.

OS-14 (8.84 ac, Q_5 = 0.39 cfs, Q_{100} = 5.14 cfs) is the area east of Basin C that is not to be disturbed and remain as open, natural landscape. The runoff from Basin G is collected in a local

topographic low point and when overtopping the low point, the runoff continues southeast to the low point in the grasslined swale along Highway 24.

On-Site Basins (Existing):

This Site has been broken down into three major existing drainage basins. An existing drainage map can be found in Appendix F.

EX-1 (3.38 ac, Q_5= 0.12 cfs, Q_{100}= 1.60 cfs) is located in the west portion of the Site, and consists of undeveloped land. Stormwater flows south and west into the existing Bridal Vail Way then continues south via curb and gutter to a cross pan at the intersection of Bridal Vail Way and Antelope Meadows Circle and flows west to an existing inlet (Design point C1), flow from this inlet is then conveyed west and then south through existing storm infrastructure where it is then released into the existing detention pond 1 built with Falcon Highlands Filing No. 2 & No. 3 File No. SF05033 .

EX-2 (9.38 ac, Q_5= 0.36 cfs, Q_{100}= 4.85 cfs) is located in the northern part of the Site, and consists of undeveloped land. Stormwater flows southwest to a natural swale and continues off-Site and into an existing detention pond 2, built with Falcon Highlands Filing No. 2 & No. 3 File No. SF05033.

EX-3 (9.14 ac, Q_5= 0.42 cfs, Q_{100}= 5.53 cfs) is located in the south portion of the Site and consists of undeveloped land. Stormwater flows south to a low point in the basin then continues south to existing detention pond 2, built with Falcon Highlands Filing No. 2 & No. 3 File No. SF05033.

PROPOSED DRAINAGE BASINS

Preliminary grading design on the Site has been completed to include right-of-way design and assignment of lot type A, B, and Transition (T). The assigned lots drain per a typical lot template, into roadways where on-grade sump inlets are located to capture and convey stormwater through public storm system and outfall to a permanent water quality and detention facility.

The overreaching premise of the drainage design is to route overland flow from residential lots to adjacent right-of-ways where public storm infrastructure will be installed and ultimately convey the stormwater to the downstream permanent water quality and detention facility to provide water quality treatment as well as flow attenuation and detention. Previous drainage reports designed ponds 1 and 2 in order to provide detention for existing Filings 2 and 3. The analysis in this report provides a detailed and defined design of these ponds to account for drainage requirement changes as well as a design to account for full spectrum detention. This report will redesign these existing ponds to meet current standards and provide full-spectrum detention.

There is a proposed grass-lined swale to capture flows in the open space behind the northern lots, The design of this swale is included in the report in Appendix E, to accurately access the width and depth of the drainage way for the minor and major storm events.

HLG calculations for both the 5-year and 100-year storms are provided in Appendix E.

On-Site Basins (Proposed):

A-1 (4.49 ac, Q_5= 0.12 cfs, Q_{100}= 1.64 cfs) is located in the north portion of the Site along the back of the existing lots and the proposed lots, and consists of open space. Stormwater flows to a proposed swale in the open space and flows to and existing outlet (Design point A1). The existing Design point discharges to a natural swale that flows southwest to proposed pond 2.

A-2 (4.83 ac, Q_5= 2.89 cfs, Q_{100}= 8.24 cfs) is located in the north portion of the Site south of Basin A-1 and consists of large lots (greater than 19,000 sf) public right-of-way, curb and gutter, and attached sidewalk. Stormwater sheet flows from the lots toward the public right-of-way, and is conveyed south via curb and gutter to a local low point in the roadway where it is then captured by a proposed 10' Type R sump inlet (Design point B1) and enters the proposed public storm infrastructure and is released into a proposed temporary water quality pond (Design point P.1). Emergency overflow from the inlet will overtop the crown in the roadway and continue to flow south and will be picked up by future inlets in Antelope Meadows Circle (Design Point B4) and will be released into proposed pond 2.

A-3 (2.46 ac, Q_5= 1.48 cfs, Q_{100}= 4.22 cfs) is located on the west side on the Site south of Basin B-1 and consists of large lots (greater than 19,000 sf) public right-of-way, curb and gutter, and attached sidewalk. Stormwater sheet flows from the lots toward the public right-of-way, and is conveyed south via curb and gutter to a local low point in the roadway where it is then captured by a proposed 10' Type R sump inlet (Design point A2) and enters the proposed public storm infrastructure and is released into a proposed temporary water quality pond (Design point P.1). Emergency overflow from the inlet will overtop the crown in the roadway and continue to flow south and will be picked up by future inlets in Antelope Meadows Circle (Design Point C2) and will be released into proposed pond 2.

A-4 (1.98 ac, Q_5= 1.54 cfs, Q_{100}= 4.38 cfs) is located on the southwest side on the Site south of Basin B-2 and consists of large lots (greater than 19,000 sf) public right-of-way, curb and gutter, and attached sidewalk. Stormwater sheet flows from the lots toward the public right-of-way, and is conveyed east via curb and gutter to a local low point in the roadway where it is then captured by a proposed 5' Type R sump inlet (Design point B3) and enters the proposed public storm infrastructure and is released into a proposed temporary water quality pond (Design point P.1) and will be released into proposed pond 2.

A-5 (3.52 ac, Q_5= 2.35 cfs, Q_{100}= 6.7 cfs) is located on the southeast side on the Site south of Basin B-1 and consists of large lots (greater than 19,000 sf) public right-of-way, curb and gutter, and attached sidewalk. Stormwater sheet flows from the lots toward the public right-of-way, and is conveyed west via curb and gutter to a local low point in the roadway where it is then captured by a proposed 10' Type R sump inlet (Design point B4) and enters the proposed public storm

infrastructure and is released into a proposed temporary water quality pond (Design point P.1) and will be released into proposed pond 2.

A-6 (1.63 ac, Q_5= 1.61 cfs, Q_{100}= 4.59 cfs) is located on the western boundary of the Site and consists of large lots (greater than 19,000 sf) public right-of-way, curb and gutter, and attached sidewalk. Stormwater sheet flows west toward the public right-of-way, and is conveyed south via curb and gutter to a local low point in the roadway where it is captured by an existing 20' inlet (Design point C1), where it will enter existing storm infrastructure and be release into the proposed pond 1.

Major Basin B (40.12 ac, Q_5= 18.65 cfs, Q_{100}= 53.18 cfs) is located south-west of the proposed Site. It is modeled as a future Falcon Highlands development and will consist of lots, public right-of-way, curb and gutter, and attached sidewalk. Stormwater will be conveyed via storm infrastructure into proposed pond 1.

Major Basin C (41.08 ac, Q_5= 25.69 cfs, Q_{100}= 73.24 cfs) is located south of the proposed Site. It is modeled as a future Falcon Highlands development and will consist of lots, public right-of-way, curb and gutter, and attached sidewalk. Stormwater will be conveyed via storm infrastructure into proposed pond 2.

Major Basin D (8.26 ac, Q_5= 12.79 cfs, Q_{100}= 26.67 cfs) is located east of the proposed Site. It is modeled as a future Falcon Highlands development and will consist of lots, public right-of-way, curb and gutter, and attached sidewalk. Stormwater will be conveyed via storm infrastructure into proposed pond 2.

Major Basin E (1.41 ac, Q_5= 0.08 cfs, Q_{100}= 1.03 cfs) is located south of pond 1. It is undisturbed area and is planned to remain undisturbed. Stormwater sheets flows off the basin south into Sand Creek.

Major Basin F (5.91 ac, Q_5= 0.26 cfs, Q_{100}= 1.41 cfs) is located east of pond 1 and west of pond 2. It is undisturbed area and is planned to remain undisturbed. Stormwater sheets flows off the basin south into Sand Creek.

Major Basin G (8.38 ac, Q_5= 0.37 cfs, Q_{100}= 4.93 cfs) is located north east of pond 2. It is undisturbed area and is planned to remain undisturbed. Stormwater sheets flows off the basin south into Sand Creek.

STORMWATER CONVEYANCE AND STORAGE FACILITIES

The proposed on-Site conveyance facilities will consist of a combination of storm pipe, swales/channels, curb and gutter, and inlets, and has been designed using runoff data from the calculations shown in Appendix D. Proposed drainage patterns will generally follow historic drainage patterns outlined in the previous section of this report. At sump conditions, inlets will be sized to collect 100-year flows. Runoff entering the inlets will be conveyed within the public storm sewer system to proposed pond 2.

The Site will send storm water runoff to both proposed ponds 1 and 2. These proposed ponds have been redesigned to meet current standards and provide full spectrum detention.

Proposed Flows to Proposed Ponds for Entire Development				
	WQCV	**EURV-WQCV**	**100-year - EURV-WQCV**	**Total Volume Required**
Proposed Pond 1	2.411 ac-ft	6.711 ac-ft	4.500 ac-ft	13.683 ac-ft
Proposed Pond 2	2.033 ac-ft	5.710 ac-ft	3.795 ac-ft	11.539 ac-ft

Both ponds were designed using Mile High Flood District Detention Spread Sheets for volume and outlet structures.

Both ponds are designed to release into Sand Creek at or below the peak existing flows.

MHFD-Inlet_v5.03 software was used to analyze and design the street and inlet capacities throughout the Site. The results of the software is included in the appendices for reference. Chapter 7 of the City of Colorado Springs Drainage Criteria Manual, Volume 1 was used for street flow design criteria.

A proposed grass lined swale is designed to convey stormwater to an outfall point for tributary areas within the northern open space portion of the Site. This swale is to be designed to El Paso County and Colorado Springs Drainage standards with one foot of freeboard. Design calculations and cross sections are included within the appendix.

FOUR STEP PROCESS

The Four Step Process focuses on reducing runoff volumes, treating the WQCV, stabilizing drainageways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring events, as opposed to larger storms for which drainage and flood control infrastructure are sized. The Four Step Process is summarized below, and elements of the designed development are presented as a means to address and follow this process.

1. Step 1: Employ Runoff Reduction Practices

The Site is developed to capture runoff from impervious areas at sump locations and local low points within the public storm system. Impervious area is avoided where functional hardscape is not needed and open space is provided within the subdivision and remains undisturbed where developed lots are not laid out. Pervious landscaped areas are proposed where feasible in order to reduce runoff. Typical lot layouts will include pervious landscape areas surrounding the residences including front yards, rear yards, and side yard swales for drainage. The exact future ratio of pervious to impervious area per lot may vary depending on future homebuilding activity. In order

to calculate estimated runoff reduction for each lot for this project, lots were assumed to have 35% imperviousness as specified by the DCM Volume 1, Table 6-6 for residential lots sized as 0-3 dwelling per acre.

Runoff calculations were completed for three two separate areas, the basins tributary to the permanent water quality and detention facilities 1 and 2, and the basins that flow off Site. The 2 permanent water quality and detention facilities are responsible for all water quality treatment for the Site.

Runoff reduction calculations and results are included in Appendix D. Runoff reduction areas are shown and can be found in the Green Infrastructure Maps, included in Appendix G.

2. Step 2: Implement Control Measures That Provide a Water Quality Capture Volume with Slow Release.

Runoff from this development is treated through the capture and timed release of the WQCV via the 2 proposed detention ponds on Site. Proposed ponds 1 and 2 provide the required and necessary WQCV for their respective tributary basins. A drainage map can be found in appendix F.

Basin ID	Total Area (ac)	Total Proposed Disturbed Area (ac)	Area Tributary to Pond 1 (ac)	Area Tributary to Pond 2 (ac)	Disturbed Area Treated (ac)	Un-Disturbed Area un-Treated (ac)
A-1	4.49	4.49	0	4.49	4.49	
A-2	4.83	4.83	4.83		4.83	
A-3	2.46	2.46	2.46		2.46	
A-4	2.55	2.55	2.55		2.55	
A-5	3.52	3.52	3.52		3.52	
A-6	2.75	2.75	2.75		2.75	
B	40.12	0		40.12		
C	41.08	0	41.08			
D	8.26	0	8.26			
E	1.41	0				1.41
F	5.91	0				5.91
G	8.38	0				8.38
TOTAL	125.76	20.6	65.45	44.61	20.6	15.7

3. Step 3: Stabilized Drainageways

The Site utilizes concrete curb and gutter to channel stormwater from impervious runoff, mostly paved roadways, and residential lots. Landscaped areas are to be permanently stabilized with

native seeding and mulching as well as trees and shrubbery according to the landscaping plans. Sloped landscaped areas will not exceed 3H:1V grades. The proposed grass lined swale follows El Paso Country and City of Colorado Springs drainage criteria. The Site will outfall into the Existing Detention Pond 2.

4. Step 4: Implement Site Specific and Other Control Measures

Site construction is to follow a Stormwater Management Report and Grading and Erosion Control Plan that includes non-structural control measures during the initial, interim, and final phases of construction. As the development is multifamily residential land use, there are no anticipated Site-specific permanent source control measures required for the Site.

WATER QUALITY ENHANCEMENT CONTROL MEASURES

The proposed ponds 1 and 2 discussed in previous sections shall have infrastructure in place that meets El Paso County and MHFD Urban Storm Drainage Criteria Manuals. The proposed permanent water quality and detention facility is designed to treat the WQCV and detain the EURV and the 100-year detention volumes as well as meet release rate criteria. Runoff from the upstream tributary areas will be conveyed to the permanent water quality and detention facility via storm sewer. A developed drainage plan showing developed areas and their drainage patterns to the permanent water quality and detention facility is included in Appendix G.

Non-structural Best Management Practices that will be incorporated into the project are anticipated to include grass swales. Water quality is provided via side yard grass swales between lots in developed areas throughout the subdivision. It is provided for basins that drain directly offSite and are not tributary to the ponds by way of grass-lined swales, and by having minimal grading with no developed imperviousness in these areas as either open space or permanently seeded and landscaped rear yard areas.

Structural Best Management Practices that are incorporated in the Site design include storm infrastructure within the extended detention basins such as outlet structures and spillways.

MAINTENENANCE

The proposed permanent water quality and detention facility will be maintained by El Paso County. The proposed storm sewer system in the internal streets will be owned and maintained by El Paso County.

FLOODPLAIN MODIFICATION

There are no floodplain modifications required or proposed for the Site, see Appendix C for the FEMA Flood Zone Map.

DRAINAGE/BRIDGE FEES AND COST ESTIMATES

The Site lies within the Sand Creek Drainage Basin. The El Paso County Drainage Basin Fees were last updated in 2024 and were used.

The project Site has a total area of 19.66 acres. The following calculations for the imperviousness of the development is shown below.

Average Housing Footprint: =3,400 sf

Total Housing Footprint Area: 3,400 x 24 =21,600 sf

Total ROW Area: =155,700 sf

ROW and Housing Footprint areas are 100% impervious.

Total Impervious Area: (21,600 + 155,700) / 43,560 = 4.07 ac

Drainage Fees:

$25,632 x 4.07 Imp. Acres = $104,322.24

Bridge Fees:

$10,484 x 4.07 Imp. Acres = $42,669.88

The table below summarizes these costs.

Drainage Basin	Area Impervious (acres)	2024 Drainage Fee (per impervious acre $)	2024 Bridge Fee (per impervious acre)	Drainage fees ($)	Bridge Fees ($)	Total ($)
Sand Creek	4.07	$ 25,632.00	$ 10,484.00	$ 104,322.24	$ 42,669.88	$ 146,992.50

Below is a cost estimate for the proposed storm infrastructure proposed within the filing.

Item	Quantity	Unit	Unit Cost	Cost
Storm Infrastructure				
5' CDOT Type R Inlet	1	EA	$ 9,200.00	$ 9,200.00
10' CDOT Type R Inlet	3	EA	$ 12,800.00	$ 38,400.00
24" RCP	72	LF	$ 130.00	$ 9,360.00
30" RCP	240	LF	$ 155.00	$ 37,200.00
36" RCP	504	LF	$ 212.00	$ 106,848.00
48" RCP	421	LF	$ 275.00	$ 115,775.00
54" RCP	170	LF	$ 325.00	$ 55,250.00
5' Manhole	4	EA	$ 8,200.00	$ 32,800.00
6' Manhole	3	EA	$ 10,000.00	$ 30,000.00
7' Manhole	1	EA	$ 12,000.00	$ 12,000.00
PBMPs				
Forebay	5	EA	$ 15,000.00	$ 75,000.00
Trickle Channel	1400	LF	$ 15.00	$ 21,000.00
Outlet Structure	2	EA	$ 15,000.00	$ 30,000.00
Outlet Pipe (36")	115	LF	$ 212.00	$ 24,380.00
Outlet Pipe (54")	130	LF	$ 325.00	$ 42,250.00
			Subtotal	$ 597,213.00
		Contingency (15%)		$ 89,581.95
			Total	$ 686,794.95

CONCLUSION

This Final Drainage Plan report describes the proposed storm water management plan for the Falcon Highlands South development Filing 1. This Plan will improve the existing ponds 1 and 2 on Site to current El Paso County standards and will provide water quality treatment and detention of storm water. This document will provide guidance so that the drainage infrastructure constructed throughout the Falcon Highlands South Filing 1 development will function efficiently and effectively. This report follows all standard criteria set forth by the El Paso County Drainage Criteria Manual, El Paso County Engineering Criteria Manual, the City of Colorado Springs Drainage Criteria Manuals Volumes 1, 2, and 3, and the Mile High Flood District Urban Storm Drainage Criteria Manual, with no requested variances. Downstream drainage facilities will not be negatively affected, as existing drainage patterns and allowable release rates shall be maintained. It has been concluded that the proposed Falcon Highlands South Filing 1 development will have no negative impact to infrastructure and development.

REFERENCES

1) Urban Storm Drainage Criteria Manuals; Mile High Flood District; latest edition

2) El Paso County Engineering Criteria Manual (ECM), latest revision October 14, 2020

3) El Paso County Drainage Criteria Manual (DCM), October 1991; latest revision October 31, 2018

4) City of Colorado Springs Drainage Criteria Manuals, Volumes 1, 2, and 3, latest revision May 2014 (Not Adopted by El Paso County)

5) Flood Insurance Rate Map of El Paso County Colorado, Federal Emergency Management Agency, Flood Insurance Rate Map No. 08041C0561G and 08041C0545G dated December 7, 2018.

6) Hydrologic Soil Group – El Paso County, Colorado, Web Soil Survey, National Cooperative Soils Survey, May 21, 2021

7) *Falcon Highlands Filing No. 2 & 3 Final Drainage Report* by Terra Nova Engineering, Inc., latest revision August 2010.

8) *Falcon Highlands Phase 2, Filing No. 2 & 3 Master Development Drainage Plan and Preliminary Drainage Report* by Terra Nova Engineering, Inc. latest revision September 2005

9) *Bent Grass Residential Subdivision Filing No. 2* (SF-19-014) Final Drainage Report, latest revision March 2020.

10) URS Section for Regional Detention Pond WU, developed by Galloway & Company

11) Sand Creek DBPS, developed by Stantec, HDR, and Dewberry dated January 2021 (Not Adopted by El Paso County)

12) Falcon DBS, developed by Matrix Design Group dated September 2015

Appendix B

Soils 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

June 7, 2024

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

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

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: 1:2,860 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 40 80 160 240

Feet
0 100 200 400 600

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 21, Aug 24, 2023

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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
9	Blakeland-Fluvaquentic Haplaquolls	19.0	100.0%
Totals for Area of Interest		**19.0**	**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

9—Blakeland-Fluvaquentic Haplaquolls

Map Unit Setting

National map unit symbol: 36b6
Elevation: 3,500 to 5,800 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 110 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 60 percent
Fluvaquentic haplaquolls and similar soils: 38 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose and/or eolian deposits derived from arkose

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: 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
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Fluvaquentic Haplaquolls

Setting

Landform: Swales
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 12 inches: variable
H2 - 12 to 60 inches: stratified very gravelly sand to loam

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

Minor Components

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

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or

soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

Hydrologic Soil Group and Surface Runoff–El Paso County Area, Colorado			
Map symbol and soil name	**Pct. of map unit**	**Surface Runoff**	**Hydrologic Soil Group**
9—Blakeland-Fluvaquentic Haplaquolls			
Blakeland	60	Low	A
Fluvaquentic haplaquolls	38	Very high	D

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix C

FEMA Map

National Flood Hazard Layer FIRMette

FEMA

104°37'40"W 38°56'3"N

104°37'3"W 38°55'35"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/21/2021 at 11:21 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Appendix D

Hydrologic Calculations

Calculation of Peak Runoff using Rational Method

Designer: LMS
Company: Atwell, LLC
Date: 12/5/2024
Project: Falcon Highlands
Location:

Version 2.00 released May 2017

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

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

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

Computed $t_c = t_i + t_t$

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

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

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

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

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.16	1.44	1.68	1.92	2.16	2.42	
Rainfall Intensity Equation Coefficients =	a	b	c	$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$			
	28.50	10.00	0.786				

$Q(cfs) = CIA$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
EX-1	3.38	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.050	19.88	1250.00			0.020	5	0.71	29.46	49.34	40.34	40.34	1.52	1.89	2.20	2.51	2.83	3.17		0.09	0.12	0.16	0.26	0.65	1.60	
EX-2	9.38	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.090	16.37	975.00			0.030	5	0.87	18.76	35.14	34.82	34.82	1.66	2.07	2.41	2.75	3.10	3.47		0.27	0.36	0.49	0.79	1.97	4.85	
EX-3	9.14	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.090	16.37	440.00			0.020	5	0.71	10.37	26.74	30.50	26.74	1.95	2.42	2.82	3.22	3.62	4.06		0.30	0.42	0.56	0.90	2.24	5.53	
OS-1	6.38	A	34.3	0.21	0.22	0.23	0.27	0.32	0.38	0.48	25.00			0.020	6.32	650.00			0.030	20	3.46	3.13	9.45	24.70	9.45	3.21	3.98	4.65	5.31	5.97	6.69		4.27	5.58	6.92	9.00	12.12	16.11	
OS-2	3.12	A	40.0	0.25	0.27	0.28	0.32	0.37	0.42	0.51	50.00			0.020	8.46	2180.00			0.020	20	2.83	12.85	21.30	36.80	21.30	2.21	2.74	3.20	3.65	4.11	4.60		1.75	2.29	2.82	3.60	4.70	6.06	
OS-3	1.14	A	100.0	0.84	0.86	0.87	0.88	0.88	0.89	0.90	20.00			0.020	1.54	1190.00			0.020	20	2.83	7.01	8.55	15.10	8.55	3.33	4.13	4.82	5.51	6.20	6.95		3.19	4.06	4.80	5.55	6.21	7.04	
OS-4	13.09	A	23.8	0.13	0.14	0.15	0.18	0.23	0.30	0.41	80.00			0.020	12.36	2300.00			0.020	20	2.83	13.55	25.91	43.93	25.91	1.98	2.46	2.87	3.28	3.69	4.13		3.36	4.44	5.59	7.56	11.02	15.98	
OS-5	59.62	A	40.0	0.25	0.27	0.28	0.32	0.37	0.42	0.51	100.00			0.020	11.96	608.00			0.020	20	2.83	3.58	15.54	24.11	15.54	2.59	3.21	3.75	4.29	4.82	5.40		39.33	51.26	63.13	80.65	105.39	135.79	
OS-6	35.75	A	25.0	0.14	0.15	0.16	0.19	0.24	0.30	0.42	300.00			0.020	23.71	0.00			0.006	20	1.55	0.00	23.71	21.75	21.75	2.18	2.71	3.16	3.61	4.06	4.55		10.78	14.22	17.88	24.03	34.65	49.60	
OS-7	6.47	A	25.0	0.14	0.15	0.16	0.19	0.24	0.30	0.42	300.00			0.020	23.71	300.00			0.006	20	1.55	3.23	26.94	26.91	26.91	1.94	2.41	2.81	3.21	3.61	4.04		1.73	2.29	2.87	3.86	5.57	7.97	
OS-8	3.74	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	202.00			0.020	22.07	910.00			0.010	15	1.50	10.11	32.18	40.79	32.18	1.75	2.17	2.53	2.89	3.25	3.64		0.11	0.15	0.21	0.33	0.82	2.03	
OS-9	3.14	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	75.00			0.020	13.45	150.00			0.030	15	2.60	0.96	14.41	26.64	14.41	2.68	3.33	3.89	4.44	5.00	5.60		0.14	0.20	0.27	0.43	1.06	2.62	
OS-10	3.67	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	125.00			0.020	17.36	630.00			0.016	15	1.90	5.53	22.90	33.71	22.90	2.12	2.63	3.07	3.51	3.95	4.43		0.13	0.18	0.25	0.39	0.98	2.42	
OS-11	35.55	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.020	26.90	950.00			0.010	15	1.50	10.56	37.45	41.47	37.45	1.59	1.98	2.30	2.63	2.96	3.32		0.96	1.32	1.78	2.85	7.13	17.58	
OS-12	39.29	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.020	26.90	570.00			0.010	15	1.50	6.33	33.23	34.94	33.23	1.71	2.13	2.48	2.83	3.19	3.57		1.14	1.57	2.12	3.39	8.48	20.90	
OS-13	10.54	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.020	26.90	360.00			0.010	15	1.50	4.00	30.90	31.34	30.90	1.79	2.22	2.59	2.96	3.33	3.73		0.32	0.44	0.59	0.95	2.38	5.86	
OS-14	8.84	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	200.00			0.020	21.96	630.00			0.011	15	1.57	6.67	28.64	35.47	28.64	1.87	2.32	2.71	3.10	3.48	3.90		0.28	0.39	0.52	0.83	2.08	5.14	

Calculation of Peak Runoff using Rational Method

Designer: LMS
Company: Atwell, LLC
Date: 1/2/2025
Project: Falcon Highlands
Location:

Version 2.00 released May 2017

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

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

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

Computed $t_c = t_i + t_t$

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

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

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

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

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.16	1.44	1.68	1.92	2.16	2.42	
Rainfall Intensity Equation Coefficients =	a	b	c	$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$			
	28.50	10.00	0.786				

$Q(cfs) = CIA$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A-1	4.49	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	200.00			0.020	21.96	1600.00			0.005	10	0.71	37.71	59.67	64.03	59.67	1.18	1.46	1.70	1.95	2.19	2.45		0.09	0.12	0.17	0.27	0.67	1.64	
A-2	4.83	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	200.00			0.020	17.76	650.00			0.013	20	2.24	4.84	22.61	27.02	22.61	2.14	2.65	3.10	3.54	3.98	4.46		2.21	2.89	3.58	4.64	6.23	8.24	
A-3	2.46	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	200.00			0.020	17.76	625.00			0.013	20	2.24	4.66	22.42	26.75	22.42	2.15	2.66	3.11	3.55	4.00	4.48		1.13	1.48	1.83	2.37	3.19	4.22	
A-6	2.75	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	200.00			0.020	17.76	975.00			0.020	20	2.83	5.75	23.51	28.32	23.51	2.09	2.60	3.03	3.46	3.90	4.36		1.23	1.61	2.00	2.59	3.47	4.59	
A-4	2.55	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	200.00			0.020	17.76	550.00			0.010	20	2.00	4.58	22.35	26.64	22.35	2.15	2.67	3.11	3.56	4.00	4.49		1.17	1.54	1.90	2.47	3.31	4.38	
A-5	3.52	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	100.00			0.020	12.56	700.00			0.010	20	2.00	5.83	18.39	28.44	18.39	2.38	2.96	3.45	3.94	4.44	4.97		1.80	2.35	2.91	3.77	5.06	6.70	
B	40.12	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	100.00			0.020	12.56	1900.00			0.005	20	1.41	22.39	34.95	52.27	34.95	1.66	2.06	2.40	2.75	3.09	3.46		14.26	18.65	23.11	29.95	40.18	53.18	
C	41.08	A	35.0	0.21	0.23	0.24	0.27	0.32	0.38	0.48	120.00			0.020	13.76	600.00			0.005	20	1.41	7.07	20.83	30.22	20.83	2.23	2.77	3.23	3.70	4.16	4.66		19.65	25.69	31.82	41.25	55.34	73.24	
D	8.26	A	65.0	0.48	0.50	0.51	0.54	0.58	0.62	0.67	120.00			0.020	9.49	600.00			0.020	10	1.41	7.07	16.56	18.86	16.56	2.51	3.12	3.64	4.16	4.68	5.24		9.94	12.79	15.42	18.70	22.40	26.67	
E	1.41	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	150.00			0.020	19.02	0.00			0.020	10	1.41	0.00	19.02	25.15	19.02	2.34	2.91	3.39	3.88	4.36	4.89		0.06	0.08	0.10	0.17	0.42	1.03	
F	5.91	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.020	26.90	240.00			0.020	20	2.83	1.41	28.31	28.07	28.07	1.89	2.35	2.74	3.13	3.52	3.95		0.19	0.26	0.35	0.56	1.41	3.48	
G	8.38	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	300.00			0.020	26.90	240.00			0.020	20	2.83	1.41	28.31	28.07	28.07	1.89	2.35	2.74	3.13	3.52	3.95		0.27	0.37	0.50	0.80	2.00	4.93	
OS-1	6.38	A	34.3	0.21	0.22	0.23	0.27	0.32	0.38	0.48	25.00			0.020	6.32	650.00			0.020	20	2.83	3.83	10.15	25.72	10.15	3.12	3.87	4.52	5.16	5.81	6.51		4.15	5.43	6.73	8.75	11.78	15.66	
OS-2	3.12	A	40.0	0.25	0.27	0.28	0.32	0.37	0.42	0.51	50.00			0.020	8.46	2180.00			0.020	20	2.83	12.85	21.30	36.80	21.30	2.21	2.74	3.20	3.65	4.11	4.60		1.75	2.29	2.82	3.60	4.70	6.06	
OS-3	1.14	A	100.0	0.84	0.86	0.87	0.88	0.88	0.89	0.90	20.00			0.020	1.54	1190.00			0.020	20	2.83	7.01	8.55	15.10	8.55	3.33	4.13	4.82	5.51	6.20	6.95		3.19	4.06	4.80	5.55	6.21	7.04	
OS-4	13.09	A	23.8	0.13	0.14	0.15	0.18	0.23	0.30	0.41	80.00			0.020	12.36	2300.00			0.020	20	2.83	13.55	25.91	43.93	25.91	1.98	2.46	2.87	3.28	3.69	4.13		3.36	4.44	5.59	7.56	11.02	15.98	
OS-5	59.62	A	40.0	0.25	0.27	0.28	0.32	0.37	0.42	0.51	100.00			0.020	11.96	608.00			0.006	20	1.55	6.54	18.50	28.16	18.50	2.38	2.95	3.44	3.93	4.42	4.96		36.09	47.03	57.92	74.00	96.69	124.58	
0S-6	35.75	A	25.0	0.14	0.15	0.16	0.19	0.24	0.30	0.42	300.00			0.020	23.71	0.00			0.006	20	1.55	0.00	23.71	21.75	21.75	2.18	2.71	3.16	3.61	4.06	4.55		10.78	14.22	17.88	24.03	34.65	49.60	
OS-7	6.47	A	25.0	0.14	0.15	0.16	0.19	0.24	0.30	0.42	300.00			0.020	23.71	300.00			0.020	20	2.83	1.77	25.48	24.58	24.58	2.04	2.53	2.96	3.38	3.80	4.26		1.82	2.41	3.03	4.07	5.86	8.39	

Appendix E

Hydraulic Calculations

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	A-2	A-3	A-4	A-5
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.9	1.5	1.5	2.4
Major Q_{Known} (cfs)	8.2	4.2	4.4	6.7

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	A-3	A-2
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.2	2.1

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				

Watershed Profile

Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.9**	**1.5**	**1.5**	**2.4**
Major Total Design Peak Flow, Q (cfs)	**8.2**	**4.2**	**4.6**	**8.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	2.1	0.2	N/A	N/A

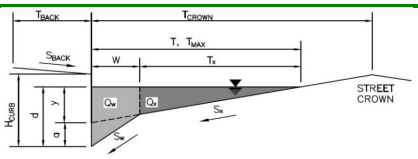
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project:

Inlet ID: **A-2**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.7	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.2	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

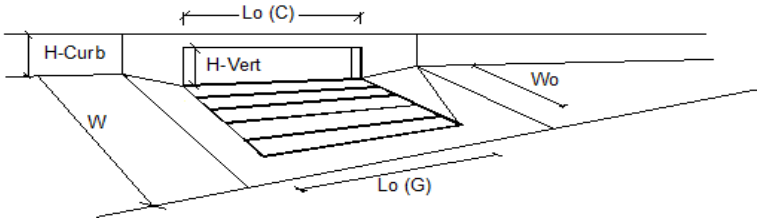
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**18.9**	**18.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.20 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

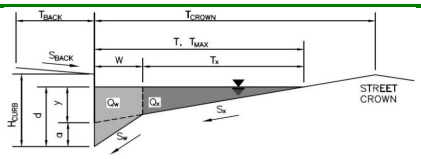
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.9**	**6.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**74**	**%**

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

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

Project:

Inlet ID: **A-3**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.7	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.2	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

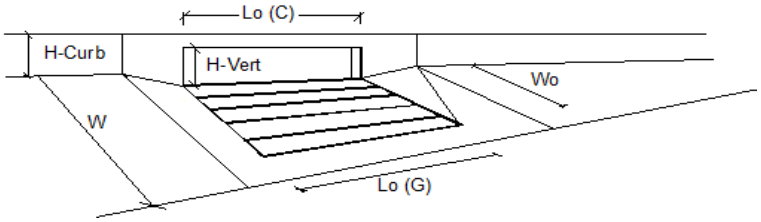
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**18.9**	**18.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.50 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.20 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**4.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**95**	**%**

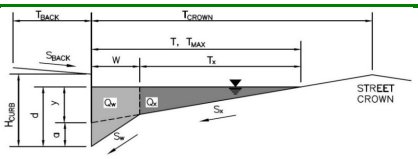
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project:

Inlet ID: **A-4**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.7	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.2	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

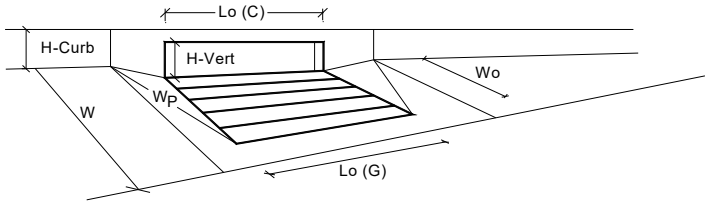
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



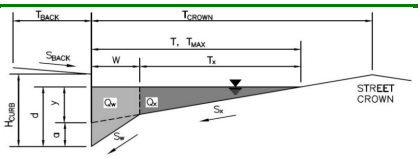
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	7.2	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**4.6**	**8.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.5	4.6	cfs

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

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

Project:

Inlet ID: **A-5**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.7	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.2	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

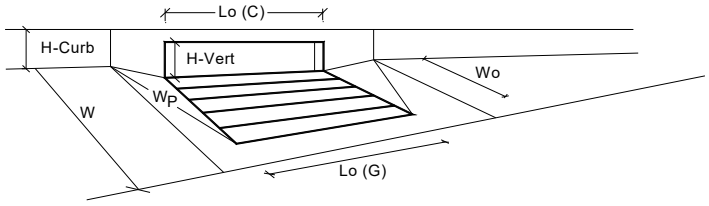
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



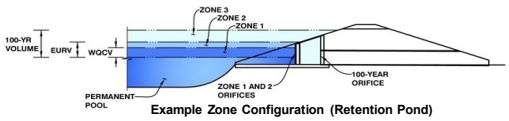
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	7.2	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.43	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.9**	**13.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.4	8.8	cfs

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Highlands

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	113.84	acres
Watershed Length =	3,300	ft
Watershed Length to Centroid =	1,200	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	2.411	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	9.182	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	6.802	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	8.919	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.620	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	12.843	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	15.025	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	17.675	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.68 in.) =	28.732	acre-feet	3.68 inches
Approximate 2-yr Detention Volume =	5.974	acre-feet	
Approximate 5-yr Detention Volume =	7.810	acre-feet	
Approximate 10-yr Detention Volume =	9.414	acre-feet	
Approximate 25-yr Detention Volume =	11.328	acre-feet	
Approximate 50-yr Detention Volume =	12.481	acre-feet	
Approximate 100-yr Detention Volume =	13.683	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	2.411	acre-feet
Zone 2 Volume (EURV - Zone 1) =	6.771	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.500	acre-feet
Total Detention Basin Volume =	13.683	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

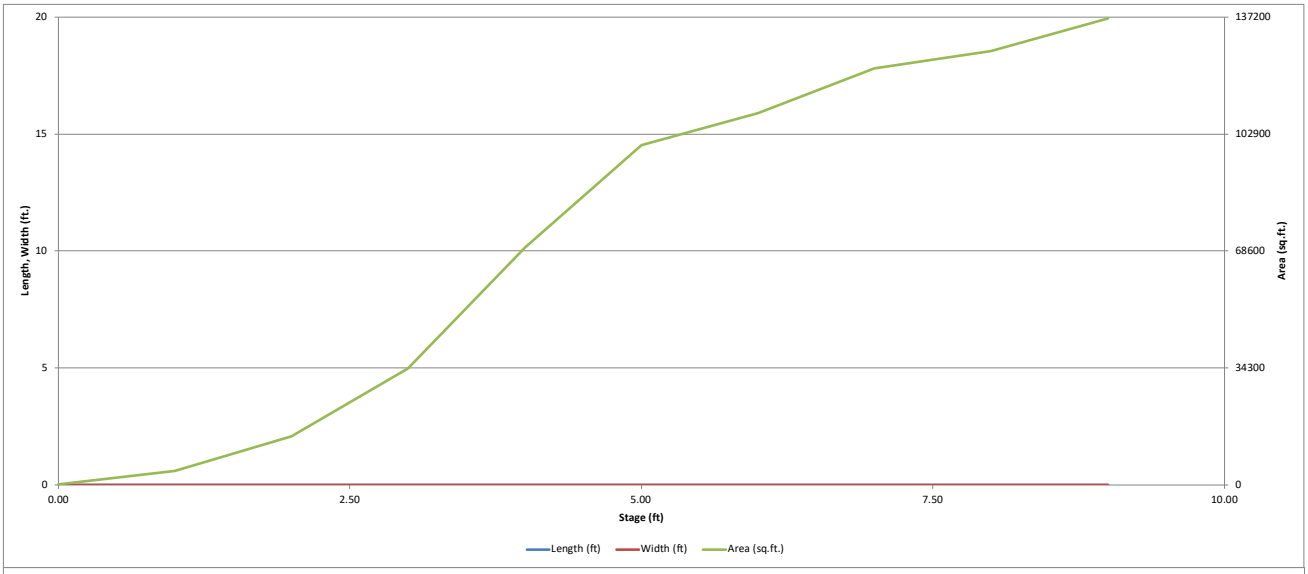
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

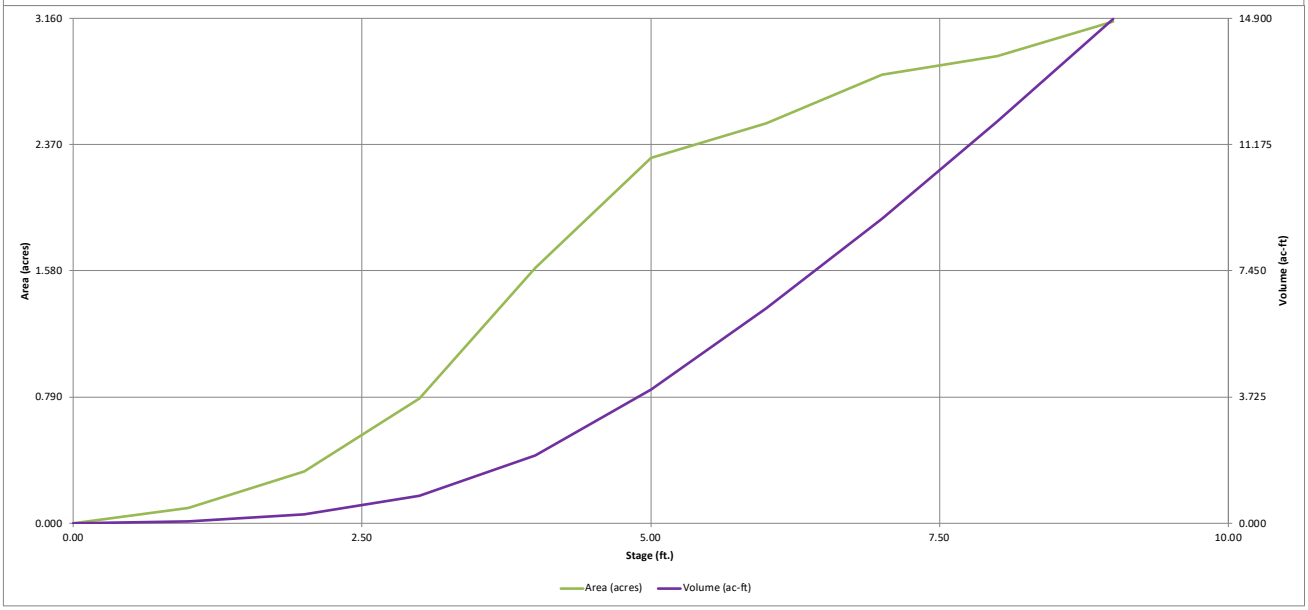
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6810	--	1.00	--	--	--	4,090	0.094	2,095	0.048
6811	--	2.00	--	--	--	14,094	0.324	11,187	0.257
6812	--	3.00	--	--	--	34,050	0.782	35,259	0.809
6813	--	4.00	--	--	--	69,584	1.597	87,076	1.999
6814	--	5.00	--	--	--	99,580	2.286	171,658	3.941
6815	--	6.00	--	--	--	109,085	2.504	275,990	6.336
6816	--	7.00	--	--	--	122,200	2.805	391,633	8.991
6817	--	8.00	--	--	--	127,270	2.922	516,368	11.854
6818	--	9.00	--	--	--	136,830	3.141	648,418	14.886

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



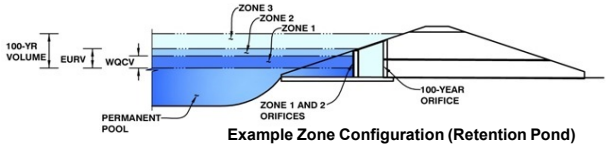


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Highlands

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.25	2.411	Orifice Plate
Zone 2 (EURV)	7.07	6.771	Orifice Plate
Zone 3 (100-year)	8.62	4.500	Weir&Pipe (Restrict)
Total (all zones)		13.683	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	7.10	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.40	4.80	6.00				
Orifice Area (sq. inches)	9.15	9.15	34.00	34.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orif

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	7.10	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	8.26	N/A
Overflow Weir Front Edge Length =	23.00	N/A	feet	Overflow Weir Slope Length =	5.94	N/A
Overflow Weir Grate Slope =	5.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	23.89	N/A
Horiz. Length of Weir Sides =	5.82	N/A	feet	Overflow Grate Open Area w/o Debris =	107.98	N/A
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	53.99	N/A
Debris Clogging % =	50%	N/A	%			

Calculated Parameters for Overflow W

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.52	N/A
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.16	N/A
Restrictor Plate Height Above Pipe Invert =	26.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.39	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.98	feet
Spillway Crest Length =	110.00	feet	Stage at Top of Freeboard =	10.98	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	3.14	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	14.89	acre-ft

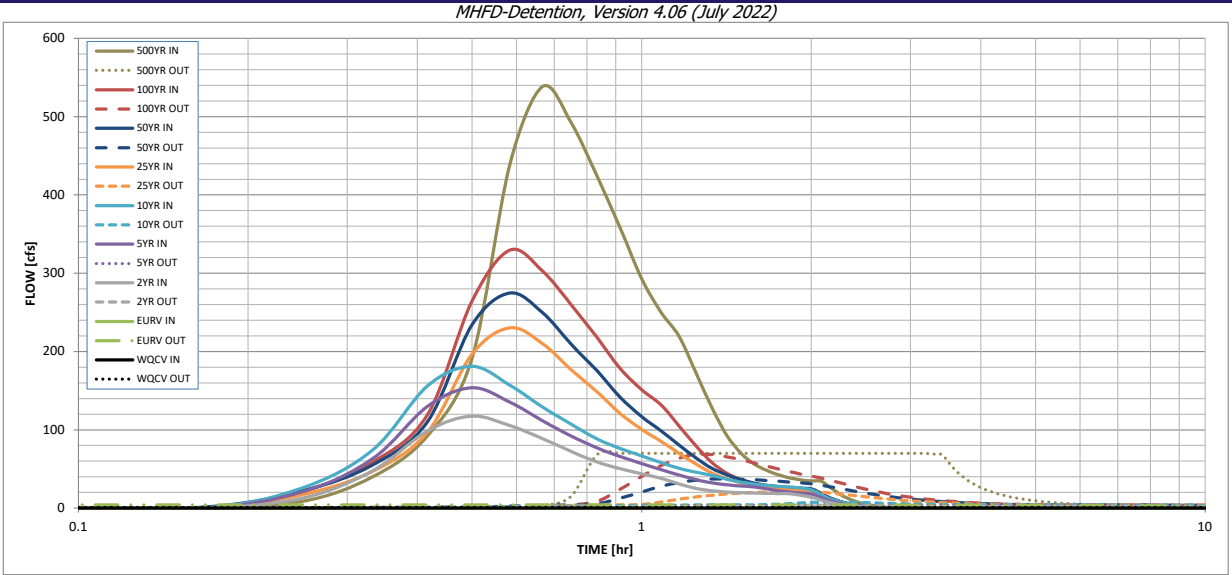
Calculated Parameters for Spillway

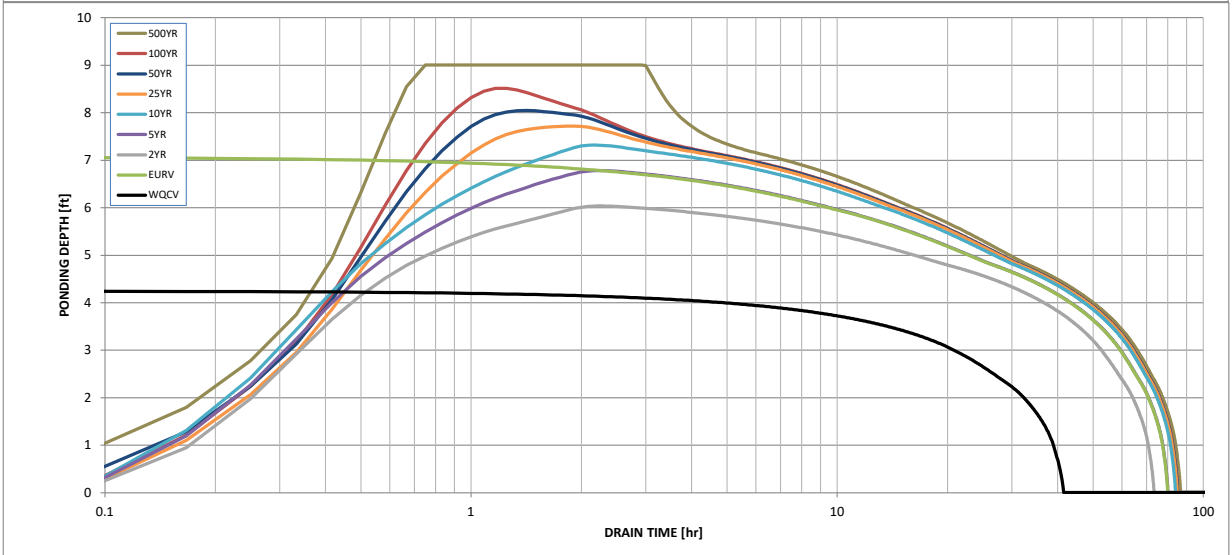
Routed Hydrograph Results — *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AI*

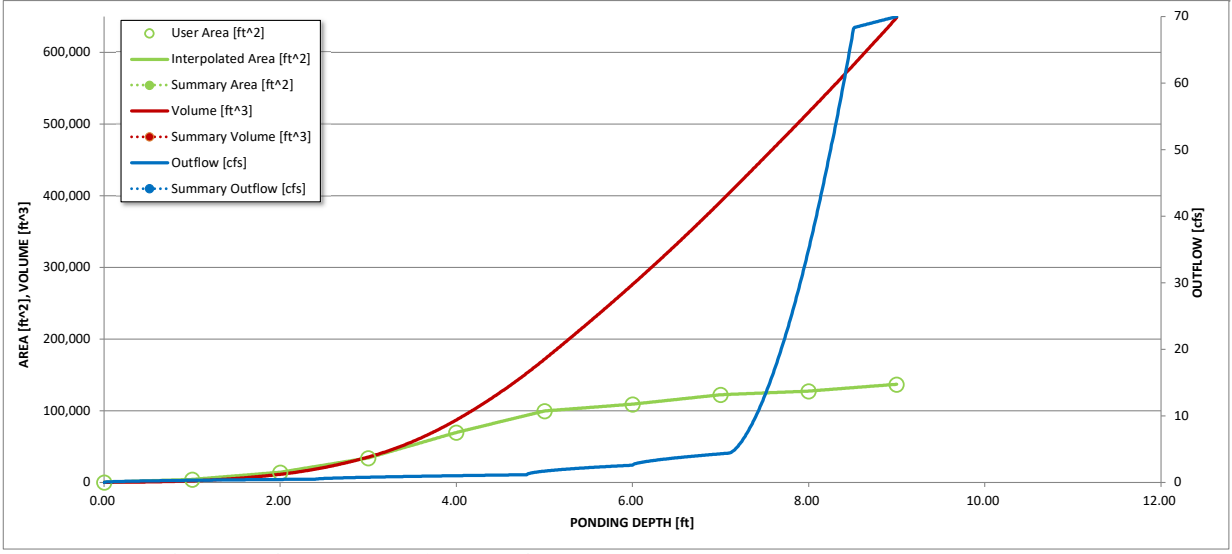
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	2.411	9.182	6.802	8.919	10.620	12.843	15.025	17.675
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	6.802	8.919	10.620	12.843	15.025	17.675
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.9	1.7	2.4	21.9	43.6	72.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.19	0.38	0.64
Peak Inflow Q (cfs) =	N/A	N/A	117.6	153.8	181.1	230.3	274.6	329.5
Peak Outflow Q (cfs) =	1.0	4.4	2.8	4.0	7.8	21.1	37.4	68.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.3	3.2	1.0	0.9	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.3	0.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	70	66	71	73	72	71	69
Time to Drain 99% of Inflow Volume (hours) =	**40**	76	70	76	79	80	79	78
Maximum Ponding Depth (ft) =	4.25	7.07	6.03	6.78	7.32	7.72	8.04	8.51
Area at Maximum Ponding Depth (acres) =	1.77	2.81	2.51	2.74	2.84	2.89	2.93	3.03
Maximum Volume Stored (acre-ft) =	2.420	9.187	6.411	8.353	9.866	11.012	11.971	13.373

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.15	8.66
	0:15:00	0.00	0.00	12.85	20.88	25.90	17.42	21.99	21.29	40.05
	0:20:00	0.00	0.00	47.77	63.25	74.60	47.26	55.15	58.92	92.26
	0:25:00	0.00	0.00	98.59	129.86	156.05	96.97	110.60	119.25	191.29
	0:30:00	0.00	0.00	117.56	153.76	181.06	196.57	234.13	264.36	438.42
	0:35:00	0.00	0.00	105.39	135.30	157.08	230.35	274.64	329.46	538.20
	0:40:00	0.00	0.00	88.89	111.59	129.16	209.99	249.61	302.87	492.00
	0:45:00	0.00	0.00	72.20	91.97	107.09	176.45	209.19	259.57	423.87
	0:50:00	0.00	0.00	58.77	76.86	88.34	148.58	175.28	217.74	357.49
	0:55:00	0.00	0.00	50.32	65.89	76.18	120.79	141.44	178.08	292.91
	1:00:00	0.00	0.00	43.91	57.00	66.77	100.43	116.92	151.28	249.75
	1:05:00	0.00	0.00	38.00	48.99	58.01	85.17	98.70	131.83	218.72
	1:10:00	0.00	0.00	30.86	42.25	50.61	69.68	80.30	104.48	171.80
	1:15:00	0.00	0.00	25.18	36.27	45.73	55.98	63.96	79.10	127.98
	1:20:00	0.00	0.00	22.25	32.22	41.77	44.64	50.61	58.05	92.86
	1:25:00	0.00	0.00	20.70	29.81	37.03	37.72	42.62	44.50	70.23
	1:30:00	0.00	0.00	19.77	28.26	33.28	32.32	36.41	36.47	56.52
	1:35:00	0.00	0.00	19.28	27.23	30.77	28.46	32.03	31.57	48.12
	1:40:00	0.00	0.00	18.89	24.68	29.02	25.91	29.15	28.23	42.37
	1:45:00	0.00	0.00	18.61	22.26	27.83	24.31	27.34	26.04	38.58
	1:50:00	0.00	0.00	18.43	20.61	27.01	23.17	26.06	24.54	36.01
	1:55:00	0.00	0.00	16.21	19.43	25.74	22.46	25.26	23.74	34.69
	2:00:00	0.00	0.00	13.96	18.09	23.38	22.02	24.77	23.44	34.24
	2:05:00	0.00	0.00	10.31	13.55	17.26	16.68	18.75	17.81	25.97
	2:10:00	0.00	0.00	6.98	9.14	11.68	11.25	12.63	12.06	17.55
	2:15:00	0.00	0.00	4.70	6.15	7.94	7.66	8.59	8.23	11.96
	2:20:00	0.00	0.00	3.12	4.02	5.27	5.11	5.73	5.48	7.94
	2:25:00	0.00	0.00	1.96	2.56	3.39	3.30	3.69	3.53	5.11
	2:30:00	0.00	0.00	1.19	1.66	2.15	2.15	2.40	2.29	3.30
	2:35:00	0.00	0.00	0.62	0.95	1.19	1.24	1.38	1.32	1.88
	2:40:00	0.00	0.00	0.26	0.44	0.53	0.58	0.64	0.61	0.86
	2:45:00	0.00	0.00	0.08	0.13	0.14	0.17	0.18	0.17	0.23
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

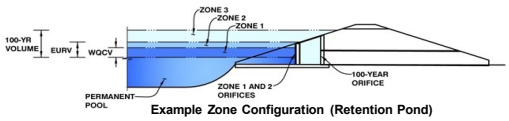
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Highlands

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	96.00	acres
Watershed Length =	2,400	ft
Watershed Length to Centroid =	1,200	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	2.033	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	7.743	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	5.700	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	7.474	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.895	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	10.744	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.566	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	14.781	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	19.627	acre-feet	inches
Approximate 2-yr Detention Volume =	5.037	acre-feet	
Approximate 5-yr Detention Volume =	6.586	acre-feet	
Approximate 10-yr Detention Volume =	7.939	acre-feet	
Approximate 25-yr Detention Volume =	9.553	acre-feet	
Approximate 50-yr Detention Volume =	10.525	acre-feet	
Approximate 100-yr Detention Volume =	11.539	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	2.033	acre-feet
Zone 2 Volume (EURV - Zone 1) =	5.710	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.795	acre-feet
Total Detention Basin Volume =	11.539	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

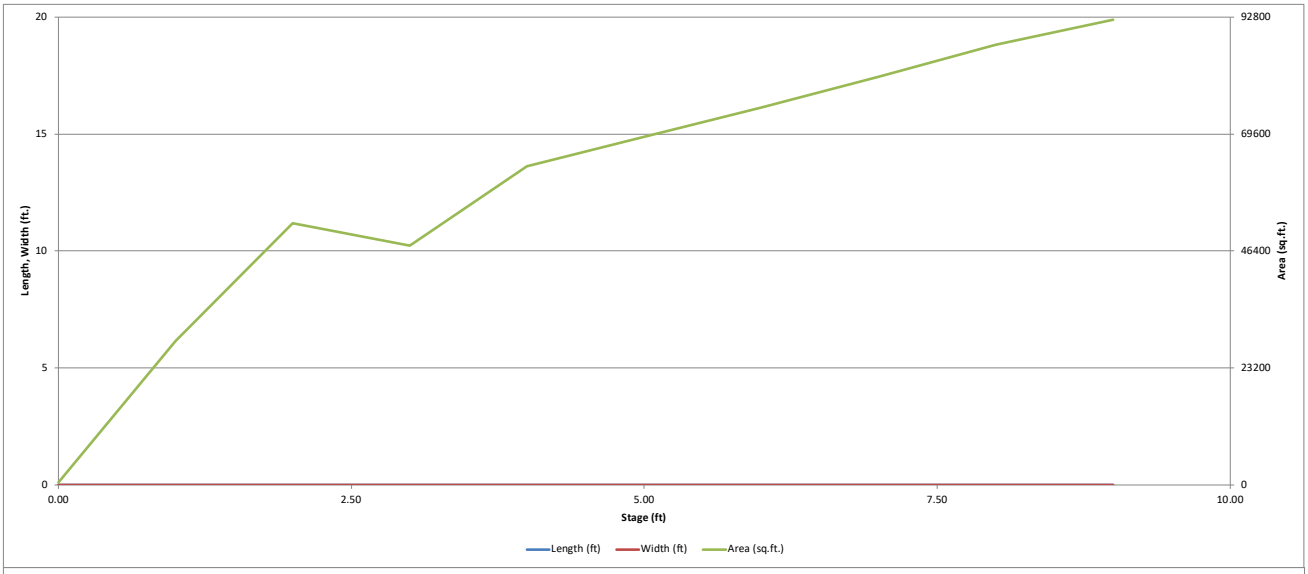
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

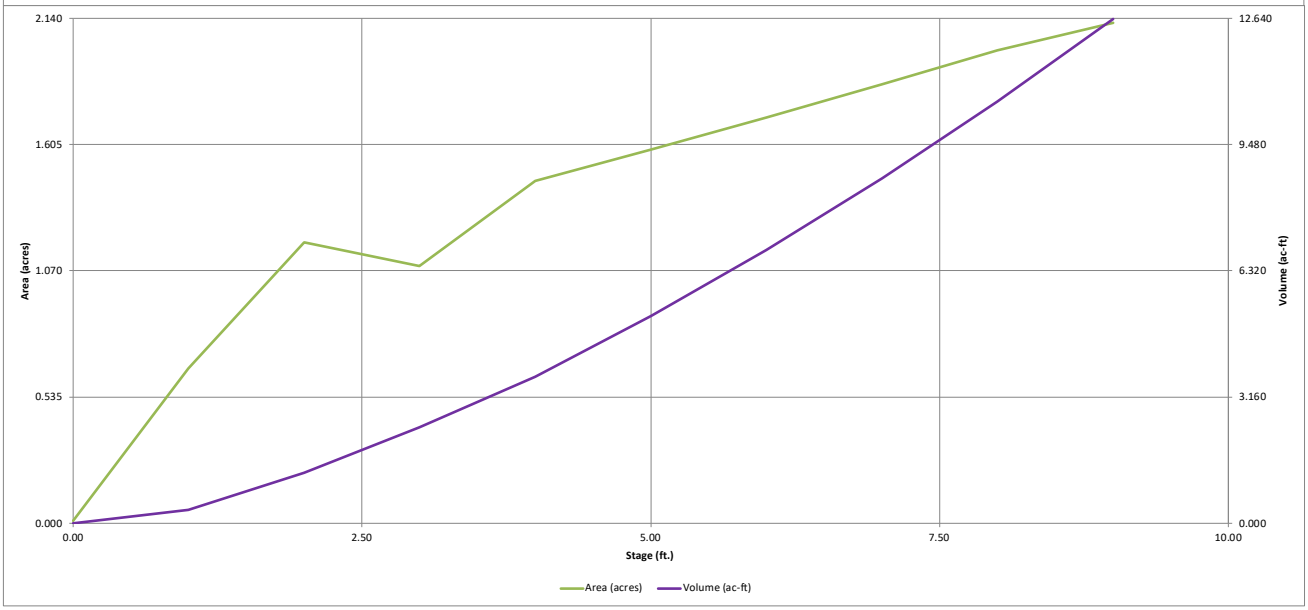
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	500	0.011		
6812	--	1.00	--	--	--	28,550	0.655	14,525	0.333
6813	--	2.00	--	--	--	51,908	1.192	54,753	1.257
6814	--	3.00	--	--	--	47,479	1.090	104,447	2.398
6815	--	4.00	--	--	--	63,235	1.452	159,804	3.669
6816	--	5.00	--	--	--	69,011	1.584	225,927	5.187
6817	--	6.00	--	--	--	74,945	1.721	297,905	6.839
6818	--	7.00	--	--	--	81,037	1.860	375,896	8.629
6819	--	8.00	--	--	--	87,287	2.004	460,058	10.561
6820	--	9.00	--	--	--	92,401	2.121	549,902	12.624

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



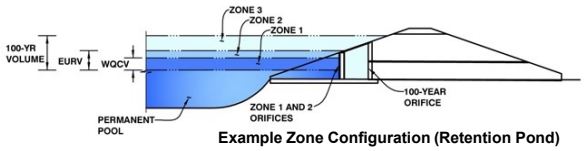


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Falcon Highlands

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.68	2.033	Orifice Plate
Zone 2 (EURV)	6.52	5.710	Orifice Plate
Zone 3 (100-year)	8.49	3.795	Weir&Pipe (Restrict)
Total (all zones)		11.539	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	6.60	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.20	4.40					
Orifice Area (sq. inches)	14.00	18.00	18.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.33	N/A	feet
Overflow Weir Front Edge Length =	5.67	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.56	N/A	
Horiz. Length of Weir Sides =	2.91	N/A	feet	Overflow Grate Open Area w/o Debris =	13.45	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	6.73	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.57	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.58	N/A	feet
Restrictor Plate Height Above Pipe Invert =	12.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.90	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.97	feet
Spillway Crest Length =	95.00	feet	Stage at Top of Freeboard =	10.87	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.12	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	12.62	acre-ft

Calculated Parameters for Spillway

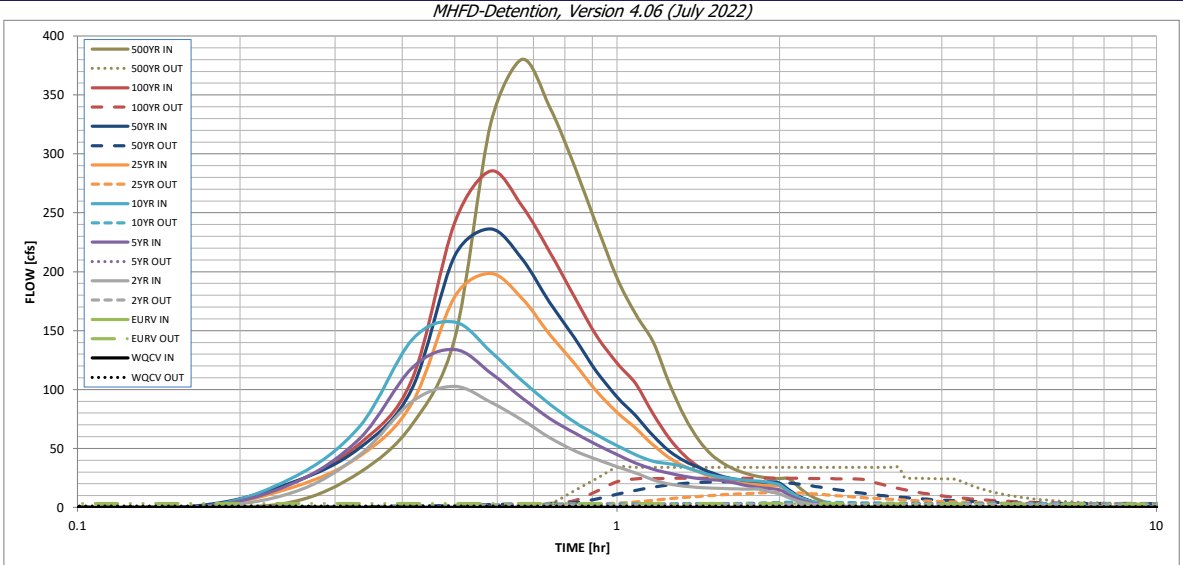
Routed Hydrograph Results

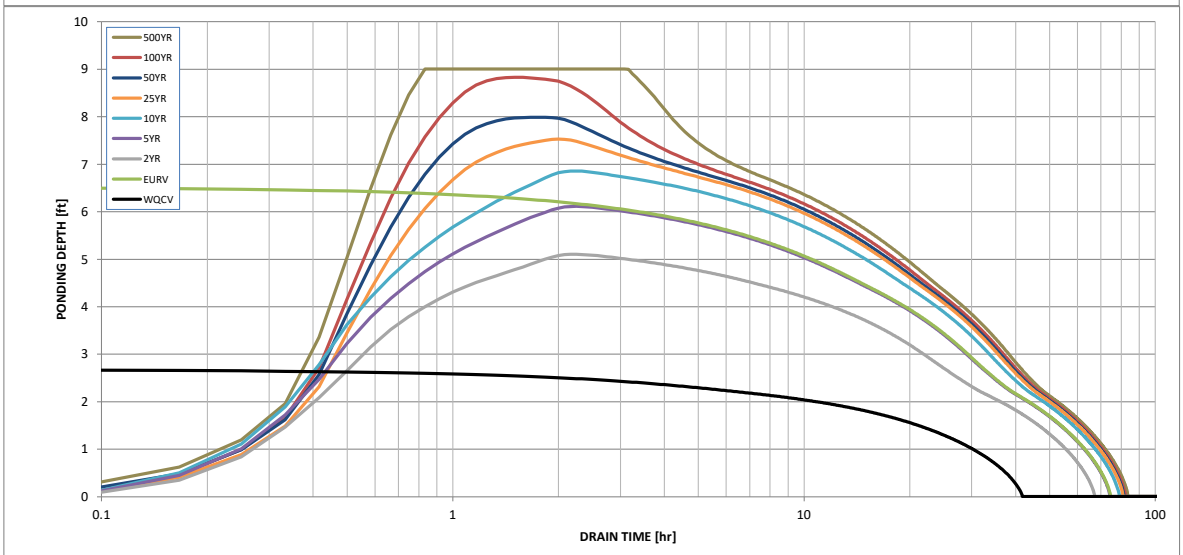
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

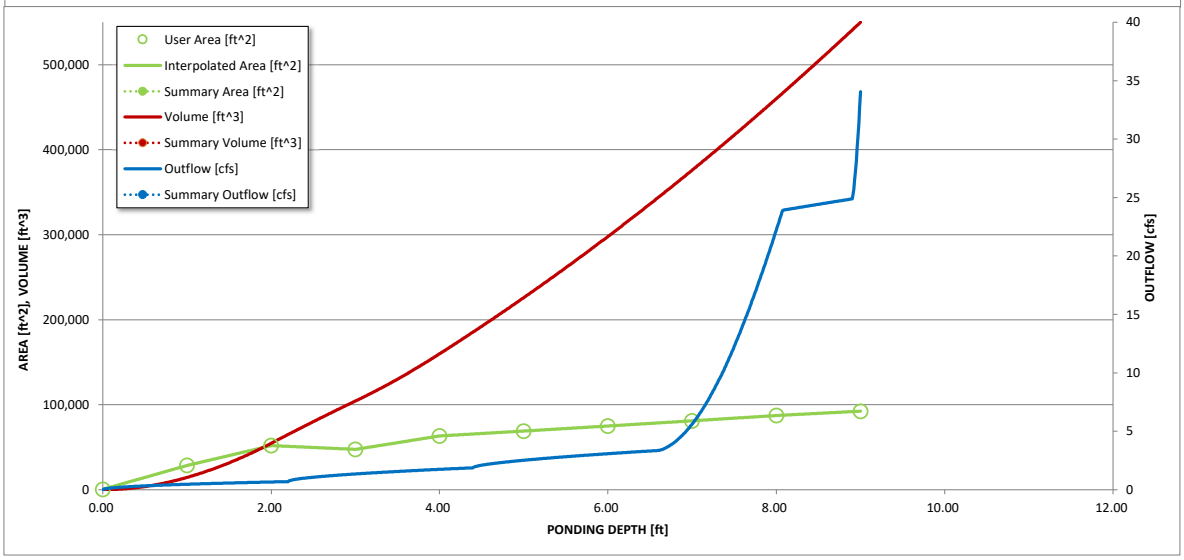
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	2.033	7.743	5.700	7.474	8.895	10.744	12.566	14.781	19.627
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	5.700	7.474	8.895	10.744	12.566	14.781	19.627
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.8	1.6	2.2	20.0	39.8	64.9	116.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.21	0.41	0.68	1.21
Peak Inflow Q (cfs) =	N/A	N/A	102.6	134.0	157.3	198.5	236.4	285.5	380.1
Peak Outflow Q (cfs) =	1.2	3.3	2.6	3.1	4.5	12.8	21.9	24.8	34.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.0	2.0	0.6	0.5	0.4	0.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.7	1.3	1.5	1.5
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	66	60	66	69	70	69	68	66
Time to Drain 99% of Inflow Volume (hours) =	**40**	71	64	71	75	76	76	76	76
Maximum Ponding Depth (ft) =	2.68	6.52	5.10	6.11	6.86	7.53	7.98	8.83	9.00
Area at Maximum Ponding Depth (acres) =	1.12	1.79	1.60	1.73	1.84	1.93	2.00	2.10	2.12
Maximum Volume Stored (acre-ft) =	2.044	7.753	5.346	7.012	8.352	9.616	10.521	12.244	12.624

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.14	4.55
	0:15:00	0.00	0.00	12.40	20.15	24.99	16.94	21.16	20.68	29.74
	0:20:00	0.00	0.00	44.53	58.49	68.80	43.38	50.43	54.13	70.18
	0:25:00	0.00	0.00	89.68	118.19	142.15	88.17	100.43	108.25	143.30
	0:30:00	0.00	0.00	102.59	134.03	157.30	178.74	213.47	241.76	325.40
	0:35:00	0.00	0.00	89.22	114.19	132.27	198.45	236.37	285.45	380.07
	0:40:00	0.00	0.00	74.27	93.02	107.54	177.46	210.89	255.75	340.06
	0:45:00	0.00	0.00	59.25	75.52	87.82	146.89	174.04	217.08	289.77
	0:50:00	0.00	0.00	48.13	63.16	72.40	122.21	143.87	178.76	239.41
	0:55:00	0.00	0.00	40.73	53.32	61.59	98.55	115.24	145.59	194.64
	1:00:00	0.00	0.00	34.52	44.75	52.44	80.64	93.73	122.43	163.72
	1:05:00	0.00	0.00	29.19	37.62	44.67	67.07	77.58	104.76	140.50
	1:10:00	0.00	0.00	23.33	32.41	39.08	52.96	60.79	79.39	105.49
	1:15:00	0.00	0.00	19.80	28.99	37.08	42.11	47.84	58.68	77.08
	1:20:00	0.00	0.00	18.04	26.33	34.36	34.73	39.30	43.95	57.30
	1:25:00	0.00	0.00	16.96	24.50	30.32	30.05	33.88	34.42	44.39
	1:30:00	0.00	0.00	16.37	23.32	27.27	25.95	29.21	28.67	36.59
	1:35:00	0.00	0.00	15.97	22.54	25.26	22.93	25.79	24.99	31.62
	1:40:00	0.00	0.00	15.67	20.25	23.87	21.10	23.74	22.56	28.34
	1:45:00	0.00	0.00	15.47	18.22	22.95	19.84	22.31	20.93	26.14
	1:50:00	0.00	0.00	15.38	16.89	22.29	19.02	21.39	19.99	24.89
	1:55:00	0.00	0.00	13.31	15.97	21.22	18.56	20.87	19.66	24.49
	2:00:00	0.00	0.00	11.40	14.89	19.17	18.26	20.54	19.51	24.30
	2:05:00	0.00	0.00	8.09	10.67	13.63	13.19	14.82	14.15	17.60
	2:10:00	0.00	0.00	5.29	6.96	8.98	8.71	9.78	9.37	11.64
	2:15:00	0.00	0.00	3.46	4.53	5.91	5.79	6.50	6.23	7.73
	2:20:00	0.00	0.00	2.17	2.84	3.75	3.70	4.14	3.96	4.91
	2:25:00	0.00	0.00	1.28	1.77	2.31	2.32	2.60	2.48	3.07
	2:30:00	0.00	0.00	0.69	1.04	1.31	1.38	1.54	1.47	1.81
	2:35:00	0.00	0.00	0.29	0.50	0.60	0.68	0.75	0.72	0.88
	2:40:00	0.00	0.00	0.10	0.16	0.18	0.22	0.24	0.23	0.28
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

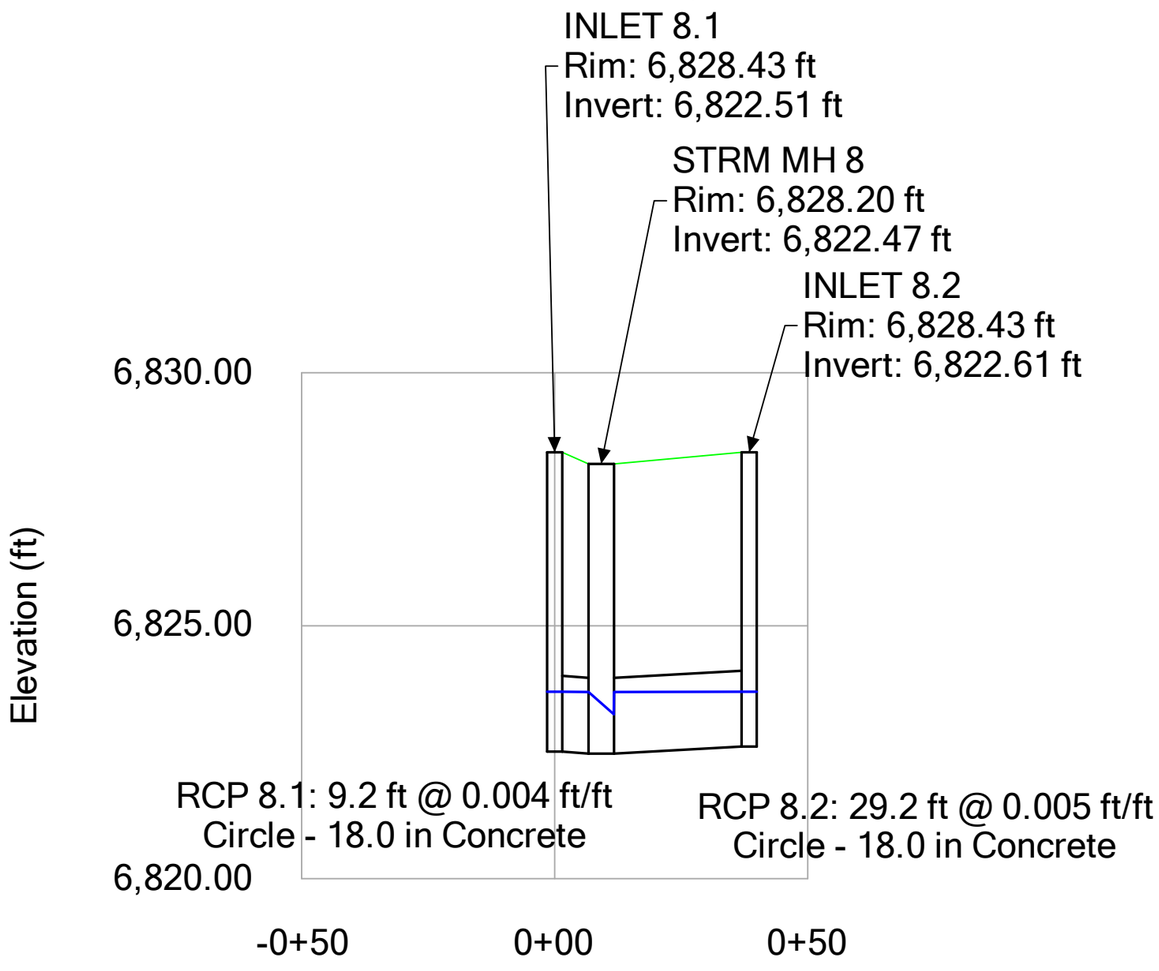
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

FlexTable: Conduit Table

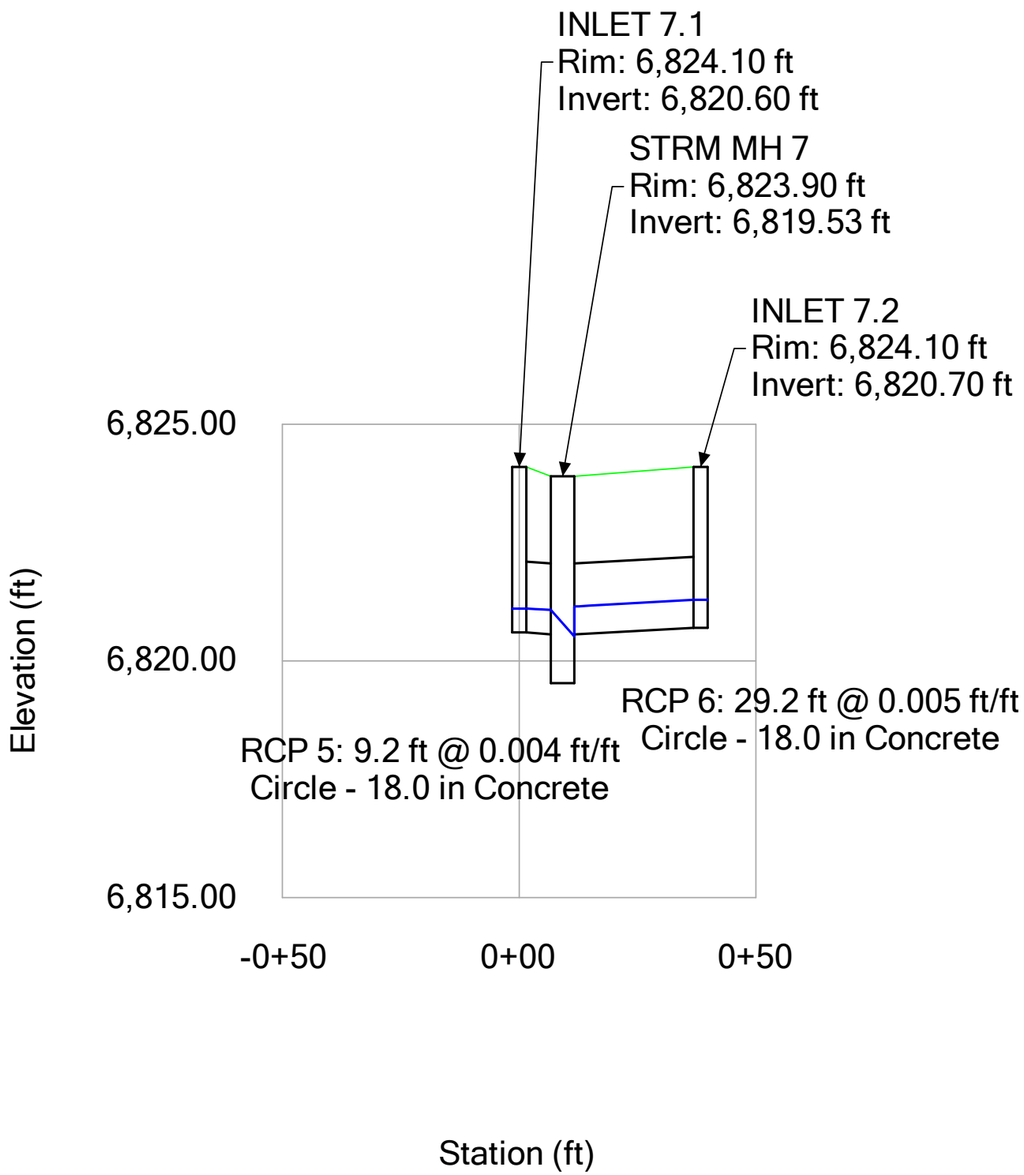
Active Scenario: 5-year

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Flow (cfs)	Length (3D) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Capacity (Design) (cfs)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Area (Flow) (ft²)
RCP 4	STRM MH 8	STRM MH 7	6,822.47	6,820.06	4.91	239.1	0.010	24.0	0.013	5.75	22.62	21.7	6,823.25	6,821.08	22.62	6,823.54	6,821.22	0.9
RCP 6	INLET 7.2	STRM MH 7	6,820.70	6,820.56	2.39	23.8	0.005	18.0	0.013	3.69	7.28	32.8	6,821.29	6,821.14	7.28	6,821.50	6,821.36	0.6
RCP 5	INLET 7.1	STRM MH 7	6,820.60	6,820.56	1.68	11.8	0.004	18.0	0.013	3.24	6.94	24.3	6,821.11	6,821.08	6.94	6,821.27	6,821.23	0.5
RCP 10	STRM MH 7	STRM MH 8	6,815.15	6,814.68	8.50	94.9	0.005	48.0	0.013	4.90	101.51	8.4	6,816.00	6,815.46	101.51	6,816.30	6,815.84	1.7
RCP 11	STRM MH 8	STRM MH 9	6,814.48	6,813.21	8.45	254.8	0.005	48.0	0.013	4.89	101.29	8.3	6,815.33	6,814.08	101.29	6,815.62	6,814.35	1.7
RCP 12	STRM MH 9	STRM MH 10	6,813.21	6,812.85	8.30	71.7	0.005	48.0	0.013	4.89	101.99	8.1	6,814.05	6,813.62	101.99	6,814.34	6,813.99	1.7
RCP 13	STRM MH 10	P2 OUTFALL 1	6,812.35	6,811.52	8.26	192.4	0.005	54.0	0.013	4.84	140.75	5.9	6,813.16	6,812.26	140.75	6,813.44	6,812.62	1.7
CO-9	MH-8	P1 OUTFALL 1	6,811.70	6,811.00	0.00	63.4	0.011	36.0	0.013	0.00	70.09	0.0	6,811.70	6,811.00	70.09	6,811.70	6,811.00	0.0
CO-10	MH-10	P1 OUTFALL 3	6,814.96	6,814.00	0.00	191.7	0.005	36.0	0.013	0.00	47.20	0.0	6,814.96	6,814.00	47.20	6,814.96	6,814.00	0.0
CO-11	CB-7	MH-8	6,813.50	6,811.70	0.00	155.3	0.012	36.0	0.013	0.00	71.81	0.0	6,813.50	6,811.70	71.81	6,813.50	6,811.70	0.0
CO-12	CB-8	MH-10	6,816.20	6,814.96	0.00	173.9	0.007	36.0	0.013	0.00	56.32	0.0	6,816.20	6,814.96	56.32	6,816.20	6,814.96	0.0
CO-13	MH-12	P2 OUTFALL 2	6,814.00	6,812.70	0.00	93.8	0.014	36.0	0.013	0.00	78.54	0.0	6,814.00	6,812.70	78.54	6,814.00	6,812.70	0.0
RCP 7	STRM MH 7	STRM MH 5	6,819.53	6,818.33	8.81	206.7	0.006	30.0	0.013	5.51	31.53	27.9	6,820.52	6,819.23	31.53	6,820.89	6,819.71	1.6
RCP 8.1	INLET 8.1	STRM MH 8	6,822.51	6,822.47	3.25	7.9	0.004	18.0	0.013	3.86	6.93	47.0	6,823.70	6,823.69	6.93	6,823.77	6,823.76	0.8
RCP 8.2	INLET 8.2	STRM MH 8	6,822.61	6,822.47	1.66	30.3	0.005	18.0	0.013	3.34	7.27	22.9	6,823.70	6,823.69	7.27	6,823.72	6,823.71	0.5
CO-16	STRM MH 5	STRM MH 7	6,817.84	6,816.15	8.69	297.0	0.006	36.0	0.013	5.33	50.32	17.3	6,818.77	6,816.99	50.32	6,819.11	6,817.44	1.6

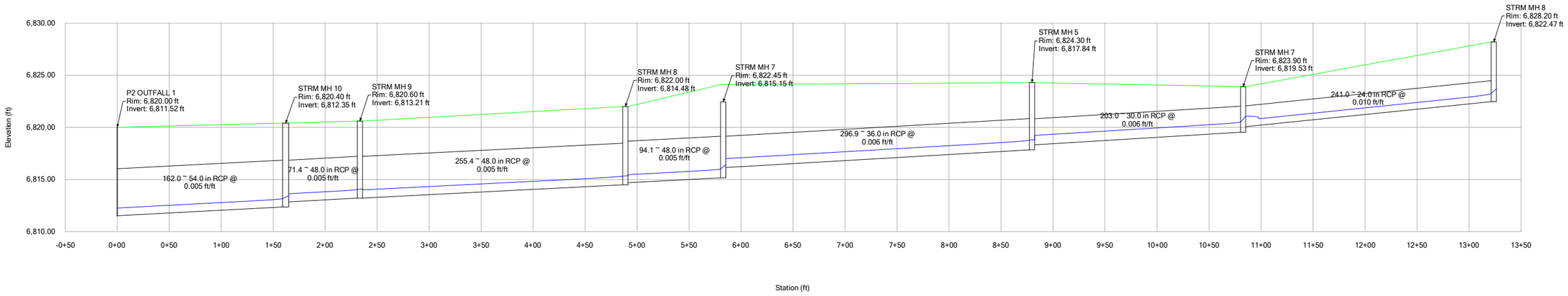
Profile Report
Engineering Profile - STORM RUN 1.1 (24004308-StormCAD-2024-12-11.stsw)
Active Scenario: 5-year



Profile Report
Engineering Profile - STORM RUN 1.2 (24004308-StormCAD-2024-12-11.stsw)
Active Scenario: 5-year



Profile Report
Engineering Profile - STORM RUN 1 (24004308-StormCAD-2024-12-11.stsw)
Active Scenario: 5-year

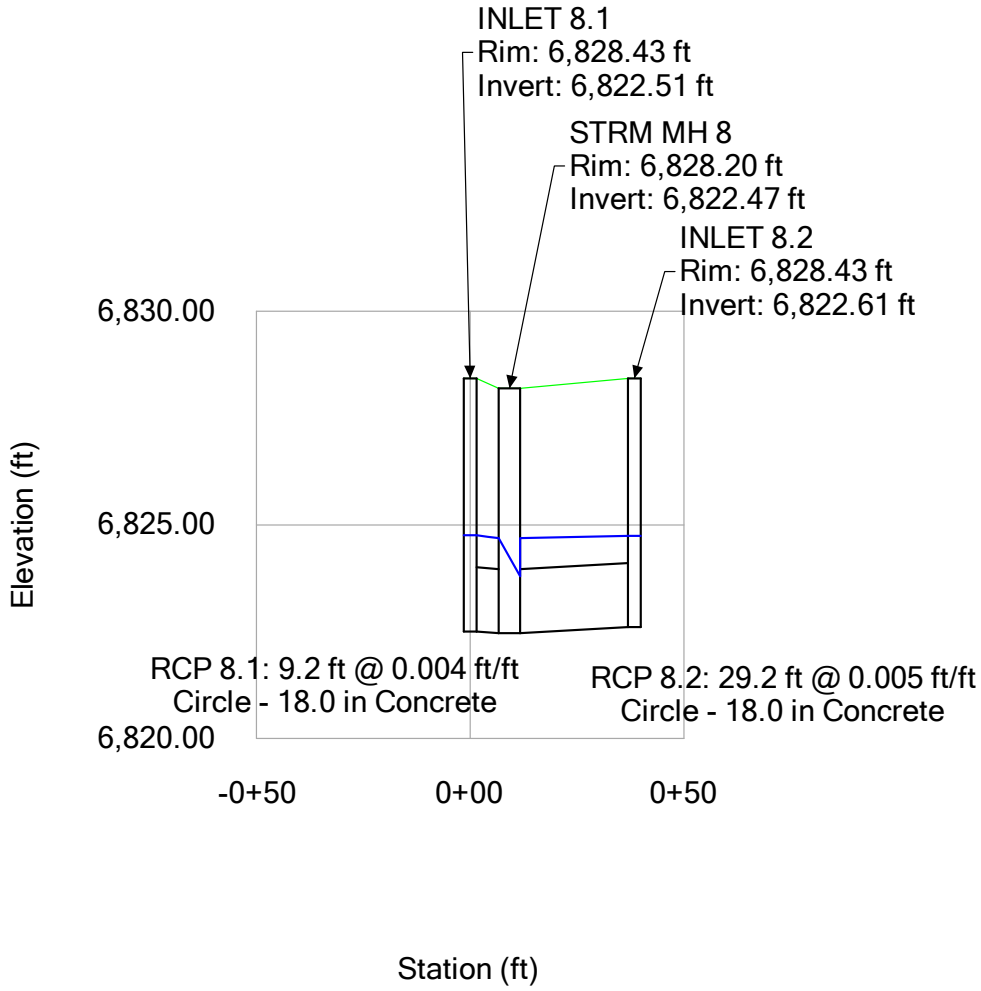


FlexTable: Conduit Table

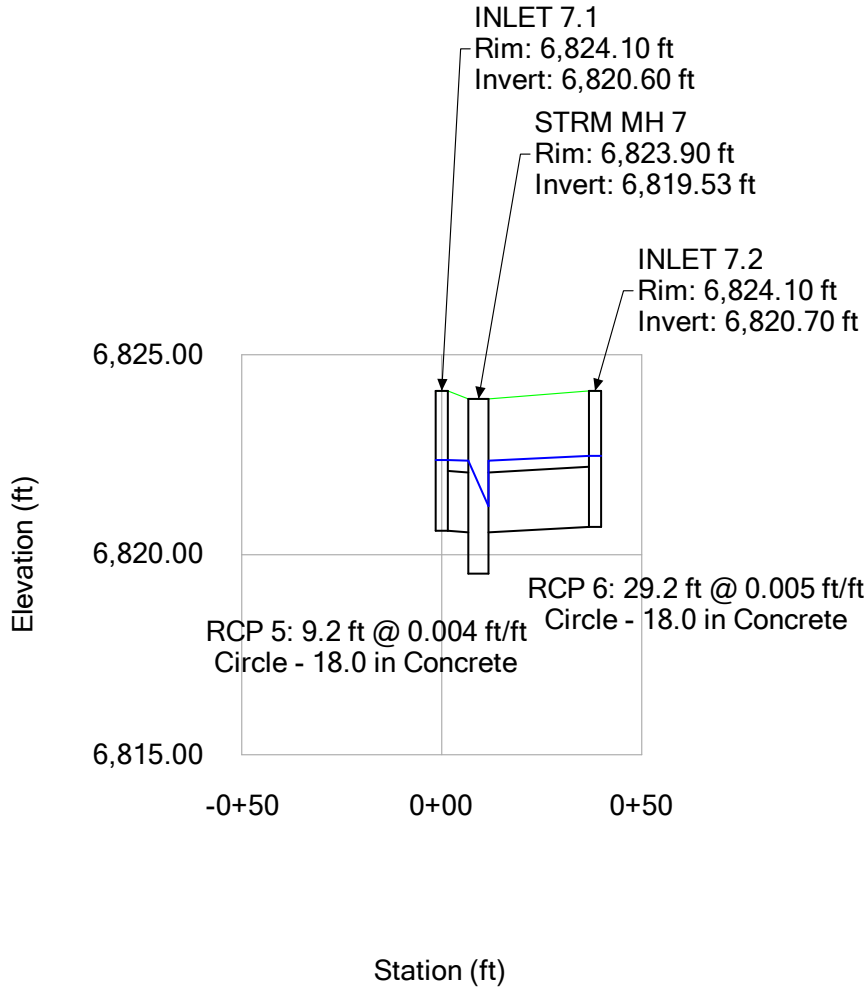
Active Scenario: 100-year

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Flow (cfs)	Length (3D) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Capacity (Design) (cfs)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Area (Flow) (ft²)
RCP 4	STRM MH 8	STRM MH 7	6,822.47	6,820.06	13.62	239.1	0.010	24.0	0.013	7.53	22.62	60.2	6,823.80	6,822.35	22.62	6,824.39	6,822.65	1.8
RCP 6	INLET 7.2	STRM MH 7	6,820.70	6,820.56	6.62	23.8	0.005	18.0	0.013	3.75	7.28	91.0	6,822.47	6,822.35	7.28	6,822.69	6,822.57	1.4
RCP 5	INLET 7.1	STRM MH 7	6,820.60	6,820.56	4.67	11.8	0.004	18.0	0.013	2.64	6.94	67.3	6,822.37	6,822.35	6.94	6,822.48	6,822.46	1.1
RCP 10	STRM MH 7	STRM MH 8	6,815.15	6,814.68	51.42	94.9	0.005	48.0	0.013	4.09	101.51	50.7	6,819.88	6,819.76	101.51	6,820.14	6,820.02	6.3
RCP 11	STRM MH 8	STRM MH 9	6,814.48	6,813.21	51.22	254.8	0.005	48.0	0.013	4.08	101.29	50.6	6,819.74	6,819.41	101.29	6,819.99	6,819.67	6.3
RCP 12	STRM MH 9	STRM MH 10	6,813.21	6,812.85	50.72	71.7	0.005	48.0	0.013	4.04	101.99	49.7	6,819.39	6,819.30	101.99	6,819.64	6,819.55	6.3
RCP 13	STRM MH 10	P2 OUTFALL 1	6,812.35	6,811.52	66.85	192.4	0.005	54.0	0.013	4.20	140.75	47.5	6,819.02	6,818.83	140.75	6,819.29	6,819.10	7.7
CO-9	MH-8	P1 OUTFALL 1	6,811.70	6,811.00	47.45	63.4	0.011	36.0	0.013	6.71	70.09	67.7	6,816.71	6,816.39	70.09	6,817.41	6,817.09	4.5
CO-10	MH-10	P1 OUTFALL 3	6,814.96	6,814.00	64.88	191.7	0.005	36.0	0.013	9.18	47.20	137.5	6,818.60	6,816.58	47.20	6,819.91	6,818.14	7.1
CO-11	CB-7	MH-8	6,813.50	6,811.70	47.45	155.3	0.012	36.0	0.013	6.71	71.81	66.1	6,817.50	6,816.71	71.81	6,818.20	6,817.41	4.4
CO-12	CB-8	MH-10	6,816.20	6,814.96	64.88	173.9	0.007	36.0	0.013	9.18	56.32	115.2	6,820.25	6,818.60	56.32	6,821.56	6,819.91	7.1
CO-13	MH-12	P2 OUTFALL 2	6,814.00	6,812.70	50.49	93.8	0.014	36.0	0.013	7.14	78.54	64.3	6,819.37	6,818.83	78.54	6,820.16	6,819.62	4.3
RCP 7	STRM MH 7	STRM MH 5	6,819.53	6,818.33	24.45	206.7	0.006	30.0	0.013	7.10	31.53	77.5	6,821.21	6,820.67	31.53	6,821.96	6,821.08	3.4
RCP 8.1	INLET 8.1	STRM MH 8	6,822.51	6,822.47	9.03	7.9	0.004	18.0	0.013	5.11	6.93	130.4	6,824.76	6,824.69	6.93	6,825.16	6,825.10	1.8
RCP 8.2	INLET 8.2	STRM MH 8	6,822.61	6,822.47	4.62	30.3	0.005	18.0	0.013	2.61	7.27	63.5	6,824.75	6,824.69	7.27	6,824.85	6,824.80	1.1
CO-16	STRM MH 5	STRM MH 7	6,817.84	6,816.15	24.18	297.0	0.006	36.0	0.013	7.05	50.32	48.1	6,820.66	6,820.28	50.32	6,820.85	6,820.46	3.4

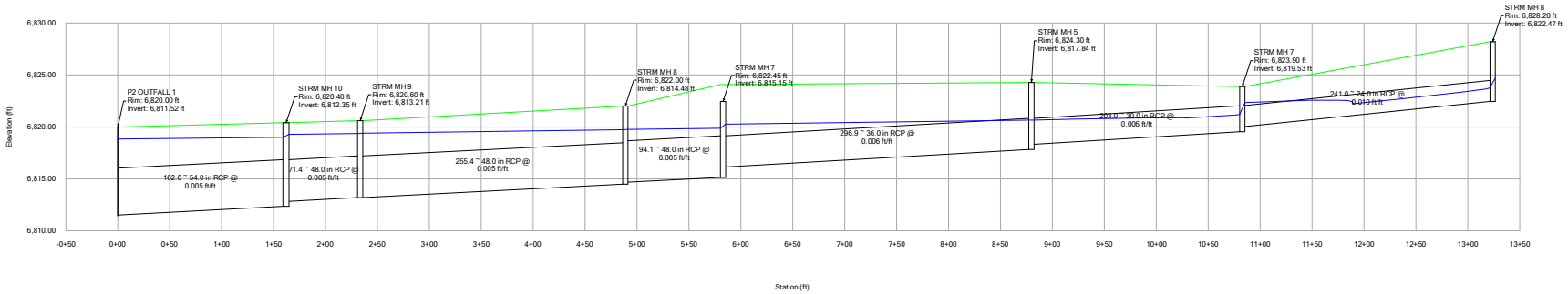
Profile Report
Engineering Profile - STORM RUN 1.1 (24004308-StormCAD-2024-12-11.stsw)
Active Scenario: 100-year



Profile Report
Engineering Profile - STORM RUN 1.2 (24004308-StormCAD-2024-12-11.stsw)
Active Scenario: 100-year



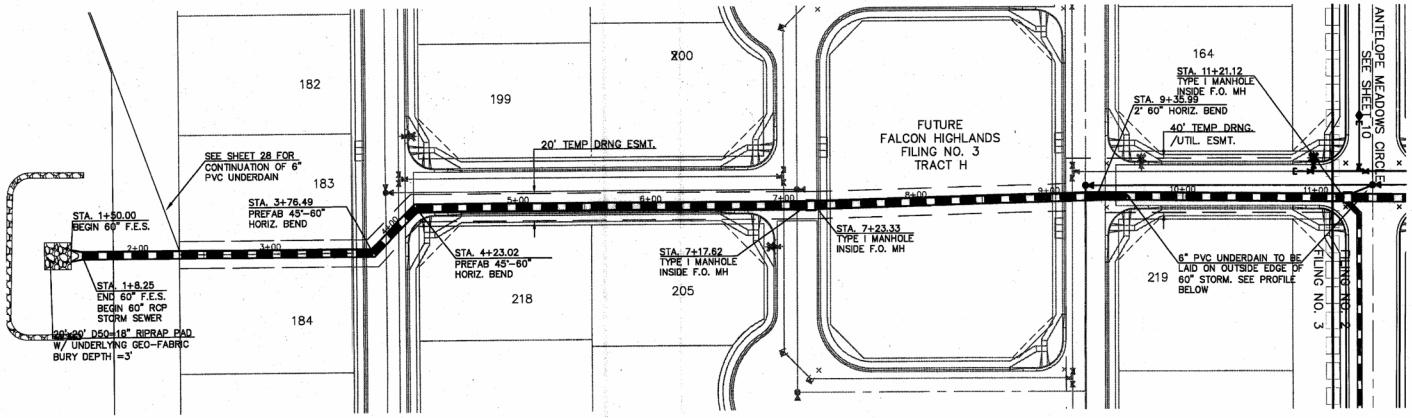
Profile Report
Engineering Profile - STORM RUN 1 (24004308-StormCAD-2024-12-11.stsw)
Active Scenario: 100-year



Appendix F

Reference Material

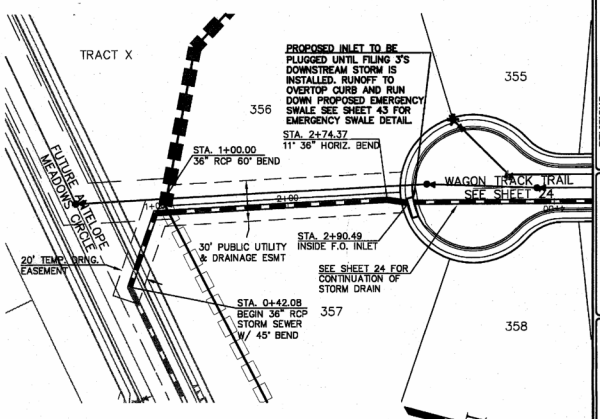
Pages from Falcon Highlands Filing
NO. 2 & 3 Final Drainage Report
Revised November 2005
SF-05-033



60" RCP STORM SEWER

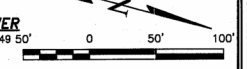
STA. 1+50.00 ~ STA. 11+21.12

SCALE: 1"=50'



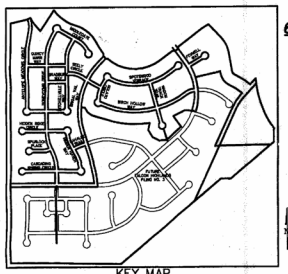
36" RCP STORM SEWER

STA. 1+00.00 ~ STA. 2+90.49



SCALE: 1"=50'

NOTE: THESE PLANS FOR STORM SEWER PLAN AND PROFILE ONLY.



KEY MAP

NOTE:
SEE CONSTRUCTION DRAWINGS FOR FALCON HIGHLANDS FILING NO. 3 BY TERRA NOVA ENGINEERING FOR EXISTING SANITARY AND STORM SEWER INFORMATION

NOTE:
SEE SHEET 35-39 FOR SANITARY, WATER, STORM AND CURB RETURN LINE TABLES

EL PASO COUNTY RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN. THE COUNTY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY.

RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

ASPHALT DATA FOR: _____

ASPHALT THICKNESS: ALT. 1: ALT. 2:

AC SURFACE: _____

AC BASE: _____

AGGREGATE BASE THICKNESS: ALT. 1: ALT. 2:

CLASS 6: _____

CLASS 5: _____

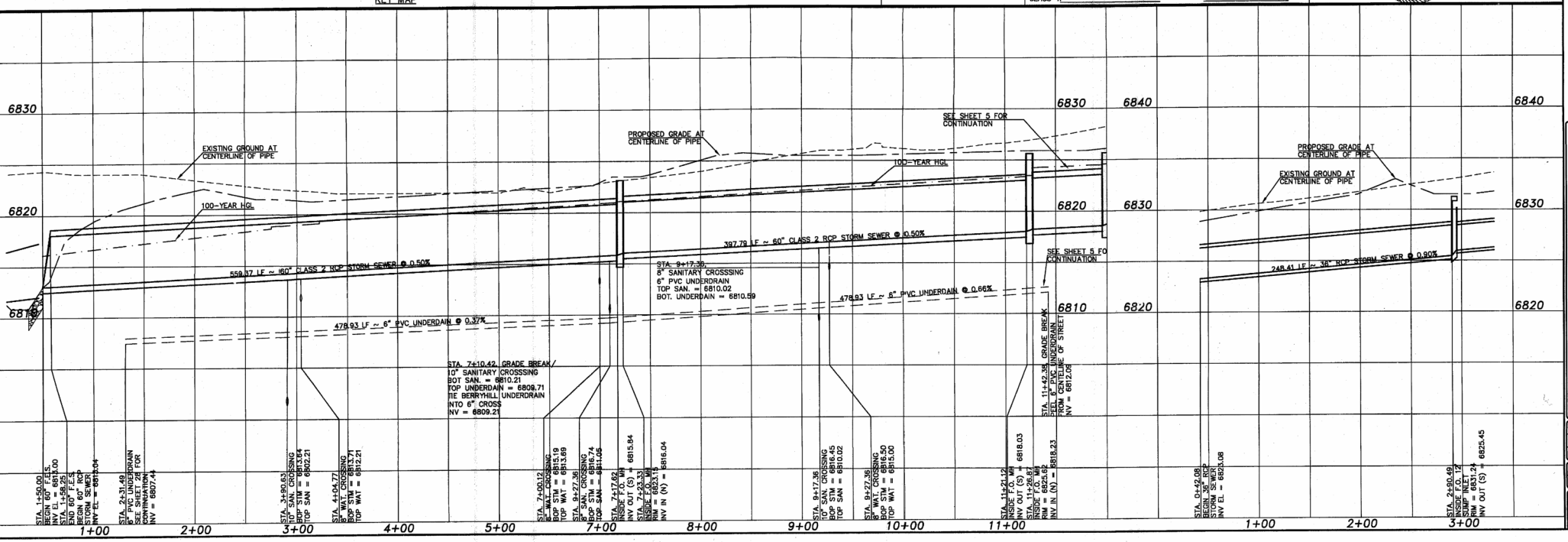
CLASS 4: _____

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

STATE OF COLORADO REGISTERED QUENTIN N. ARMIJO 37470 PROFESSIONAL ENGINEER

QUENTIN N. ARMIJO PROFESSIONAL ENGINEER
COLORADO P.E. NO. 37470

11/16/05



REVISIONS			
NO.	DESCRIPTION	DATE
1	PER COUNTY/IN-HOUSE COMMENTS	10/17/05
2	PER WOODMEN DIST. COMMENTS	10/21/05

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AUTHORITY, TERRA NOVA ENGINEERING

PREPARED FOR:
TAMLIN VENTURES, LLC
MR. MIKE SCOTT
25 N. TEJON AVENUE

125 N. WAHSATCH AVE., SUITE 101
COLORADO SPRINGS, CO. 80903

FALCON HIGHLANDS FILING NO. 2

DESIGNED BY	
DRAWN BY	
CHECKED BY	
H-SCALE	
V-SCALE	
JOB NO.	04
DATE ISSUED	
SHEET NO.	

60" Storm Main

HYDRAULIC GRADE LINE CALCULATIONS

From Station	To Station	Loss Type	Start Inv. [ft]	Dia. [ft]			Flow [cfs]			Slope	Horiz	Manning	Friction Slope [%]			H.G.L	Head	Velocity
				D_1	D_2	D_3	Q_1	Q_2	Q_3	S_1 [%]	Bend [°]	n Coeff.	S_{f-1}	S_{f-3}	S_{f-3}	Elev. [ft]	Loss [ft]	fps
1+50.00	3+76.49	1	6813.04	5			196			0.50%		0.013	0.57%	--	--	***6816.10***	0.00	9.98
3+76.49	3+76.49	2	6814.17	5			196			0.50%	45	0.013	0.57%	--	--	***6818.62***	0.22	9.98
3+76.49	4+23.02	1	6814.17	5			196			0.50%		0.013	0.57%	--	--	***6818.84***	0.26	9.98
4+23.02	4+23.02	2	6814.40	5			196			0.50%	45	0.013	0.57%	--	--	***6819.10***	0.22	9.98
4+23.02	7+17.62	1	6814.40	5			196			0.50%		0.013	0.57%	--	--	***6819.32***	1.67	9.98
7+17.62	7+17.62	3	6815.84	5			196			0.50%		0.013	0.57%	--	--	***6820.99***	0.08	9.98
7+17.62	7+23.33	1	6815.84	5			196			0.50%		0.013	0.57%	--	--	***6821.07***	0.03	9.98
7+23.33	9+35.99	1	6816.04	5			196			0.50%		0.013	0.57%	--	--	***6821.10***	1.20	9.98
9+35.99	9+35.99	2	6817.10	5			196			0.50%	2	0.013	0.57%	--	--	***6822.30***	0.05	9.98
9+35.99	11+21.12	1	6817.10	5			196			0.50%		0.013	0.57%	--	--	***6822.35***	1.05	9.98
11+21.12	11+21.12	3	6818.03	5			196			0.50%		0.013	0.57%	--	--	***6823.39***	0.08	9.98
11+21.12	11+26.87	1	6818.03	5			196			0.50%		0.013	0.57%	--	--	***6823.47***	0.03	9.98
11+26.87	11+26.87	6	6818.23	5	5	3	166	196	30	0.50%	45	0.013	0.41%	0.57%	0.20%	***6823.50***	0.73	8.45
11+26.87	11+95.80	1	6818.23	5			166			0.50%		0.013	0.41%	--	--	***6824.24***	0.28	8.45
11+95.80	11+95.80	3	6818.57	5			166			0.50%		0.013	0.41%	--	--	***6824.52***	0.06	8.45
11+95.80	12+01.55	1	6818.57	5			166			0.50%		0.013	0.41%	--	--	***6824.57***	0.02	8.45
12+01.55	12+01.55	6	6820.07	3.5	5	3	84	166	41	0.50%	45	0.013	0.70%	0.41%	0.38%	***6824.60***	1.07	8.73
12+01.55	16+79.95	1	6820.07	3.5			84			1.00%		0.013	0.70%	--	--	***6825.66***	3.33	8.73
16+79.95	16+79.95	3	6824.87	3.5			84			1.00%		0.013	0.70%	--	--	***6828.99***	0.06	8.73
16+79.95	16+84.86	1	6824.87	3.5			84			1.00%		0.013	0.70%	--	--	***6829.05***	0.03	8.73
16+84.86	19+24.03	1	6825.07	3.5			84			0.90%		0.013	0.70%	--	--	***6829.09***	1.67	8.73
19+24.03	19+24.03	6	6827.23	3.5	3.5	1.5	63	84	11	0.90%	45	0.013	0.39%	0.70%	1.10%	***6830.75***	0.88	6.55
19+24.03	19+28.53	1	6827.23	3.5			63			0.90%		0.013	0.39%	--	--	***6831.63***	0.02	6.55
19+28.53	22+22.51	1	6827.73	3.5			63			1.93%		0.013	0.39%	--	--	***6831.65***	1.15	6.55
22+22.51	22+22.51	6	6833.40	2.5	3.5	2.5	33	63	30	1.93%	45	0.013	0.65%	0.39%	0.53%	***6835.05***	0.26	6.72
22+22.51	22+42.51	1	6833.40	2.5			33			1.93%		0.013	0.65%	--	--	***6835.31***	0.13	6.72
22+42.51	22+42.51	2	6833.79	2.5			33			1.93%	45	0.013	0.65%	--	--	***6835.44***	0.10	6.72
22+42.51	22+53.36	1	6833.79	2.5			33			1.93%		0.013	0.65%	--	--	***6835.53***	0.07	6.72
22+53.36			6781.90									0.013	--	--	--	***6835.60***	--	

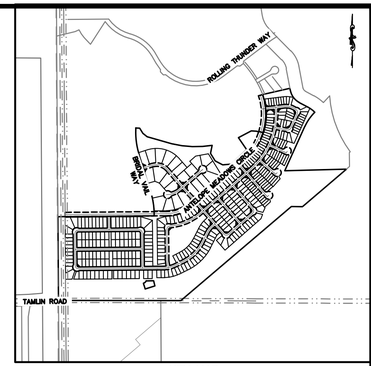
Pages from Falcon Highlands
South Preliminary Drainage Report
Dated March 2024
PUDSP-22-005

NOTE:
SEE SHEETS DR-3 THRU DR-5 FOR SUB-BASINS B, C, & D

SECTION 1
19.0'
2.3' 4:1 4:1 1.0'

SECTION 2
30.0'
2.3' 4:1 4:1 12.0'

GRASS LINED SWALE SECTIONS
N.T.S.



KEY MAP
1" = 1000'

OS-1 6.4 10.7 21.7
OS-2 3.1 7.8 13.6
OS-3 1.1 3.4 6.0
OS-4 13.1 12.3 26.3
OS-5 62.2 86.4 173.7
OS-6 35.8 31.9 58.4
OS-7 6.5 5.2 18.3
OS-8 13.8 4.6 31.1
A 4.03 1.1 7.7
B 33.21 44.5 109.9
C 59.71 79.3 204.7
D 10.5 16.5 37.6
E 1.8 0.8 4.3
F 6.1 2.3 15.6
G 8.8 6.8 16.0

POINT OF OFFSITE FLOW
ROLLING THUNDER WAY
TALMENA TERRACE
INDIAN ECHO TERRACE
SYCAMORE WAY
FALCON BASIN - SAND CREEK BASIN
BRIDAL VAIL WAY
FEMA FLOODPLAIN BOUNDARY (TYP.)
ANTELOPE MEADOWS CIRCLE
FALCON HIGHLANDS FILING NO. 1
SAND CREEK/FALCON DRAINAGE BASIN BOUNDARY (TYP.)
MIDDLEGATE COURT
HONEYCOMB DRIVE
QUINCY MARR DRIVE
FILING NO. 1
FILING NO. 2
SEELY CIRCLE
MICHELLVILLE WAY
SPOTSWOOD TERRACE
FALCON HIGHLANDS FILING NO. 2
NULATO CIRCLE
MADISON WAY
EX. PUBLIC 36" RCP STORM SEWER
BIRCH HOLLOW WAY
TRACT X
FILING NO. 3
BONNEBELLE CIRCLE
PUB. D-10-R CURB INLET (TYP.)
EX. PUB. 36" RCP STORM SEWER
HIDDEN RIDGE CIRCLE
SPURLOCK PLACE
HIDDEN RIDGE CIRCLE
EX. PUB. 42" RCP STORM SEWER
CASCADING SPRING CIRCLE
ANTELOPE MEADOWS CIR.
TRACT C
DRNG. ESMT. REC. NO. 206066535
DRNG. & UTIL. ESMT. REC. NO. 206066537 TO BE VACATED
30' FORCE MAIN ESMT. REC. NO. 220130580
EX. PUBLIC 60" RCP STORM SEWER
DRNG. & UTIL. ESMT. REC. NO. 206066537
RYLAND WAY
ALMUR TRAIL
EX. PUBLIC 8" PVC SANITARY SEWER
DRNG. ESMT. REC. NO. 206066536
FALCON HIGHLANDS METRO DIST. REC. NO. 206055833
TRACT J
TRACT K
30' DRAINAGE ESMT. REC. NO. 206133777
FILING NO. 3 BOUNDARY
OWNER: H2O SUB BLH LLC TAX NO. 5313000103
60' ROAD R.O.W. BOOK A, PAGE 78
SAND CREEK BASIN
FALCON BASIN
EXISTING DETENTION POND 2 RETROFIT/PROPOSED CONDITIONS ARE THE FOLLOWING:
VOLUME PROVIDED: 10.49 AC.
WQCV WSEL = 6812.00
EURV WSEL = 6814.43
100 YR. WSEL = 6816.00
TOP OF POND = 6817.50
RELEASE FLOWS:
WQCV: 0.8 CFS @ 40 HRS
EURV: 4.5 CFS @ 52 HRS
100-YR: 5.2 CFS @ 63 HRS
EMERGENCY OVERFLOW: 69.5 CFS
EX. POND 2 OUTLET STRUCTURE
POND 2 EX. 42" RCP OUTLET PIPE
GRASSLINED SWALE SECTION 2
EX. OFFSITE DITCH
OWNER: BLH NO. 2, LLC. TAX NO. 5300000642
TAMLIN RD EXISTING 60' ROW
FEMA FLOODPLAIN BOUNDARY
FLOOD ZONE AE
BASE FLOOD ELEVATION (TYP.)
US HWY 24
PROPOSED GRASSLINED SWALE TO EX. POND 2 SECTION 2
OWNER: KLK 1031 INVESTMENTS LLC TAX NO. 5312100006
ROLLING THUNDER WAY
FOXMELL WAY
HP: 6450
FALCON BASIN
SAND CREEK BASIN
UTIL. ESMT. REC. NO. 206066535 TO BE VACATED
BIRCH HOLLOW WAY
50' TEMP. ACCESS ESMT. REC. NO. 206066534 TO BE VACATED
TAMLIN RD EXISTING 60' ROW
TRACT T
EXISTING REGIONAL POND WJ
PROPOSED GRASSLINED SWALE TO EX. POND WJ
OWNER: CYGNET LAND, LLC TAX. NO. 5312406001
EX. POND OUTLET STRUCTURE (BY GALLOWAY, 2020)
EX. PVT. 48" RCP OUTLET PIPE AND (3) 60" RCP OUTLET PIPES
PEAK OUTFLOW AT CULVERTS #1 THROUGH #4 + SPILLWAY AT ELEVATION 6830.20 = 1,402.6 CFS (SEE STAGE-STORAGE-DISCHARGE TABLE IN MDDP FOR MORE INFORMATION)
FILING NO. 3 BOUNDARY
GRASSLINED SWALE SECTION 1
TRACT Z
PROPOSED GRASSLINED SWALE TO EX. POND 2 SECTION 2
DRNG. ESMT. REC. NO. 206066535
DRNG. & UTIL. ESMT. REC. NO. 206066537 TO BE VACATED
FOX KESTREL COURT
SWALE TRAIL
APLOMADO TRAIL
BANDED FALCON COURT
GREY FALCON LANE
SPOTTED KESTREL WAY
DUNLIN LANE
LANNER LANE
SCOOTY LANE
TRACT A
OWNER: WALTON COLORADO LLC TAX NO. 5300000716
BASIN A 4.2 AC
ITEM #11 50' ELECTRIC TRANSMISSION EASEMENT BOOK 2649, PAGE 17
ITEM #9 60' ROAD RIGHT-OF-WAY BOOK A, PAGE 78
EXISTING DETENTION POND 1 RETROFIT CONDITIONS ARE THE FOLLOWING:
VOLUME PROVIDED: 15.77 AC.
WQCV WSEL = 6811.65
EURV WSEL = 6813.50
100 YR. WSEL = 6815.00
TOP OF POND = 6817.00
RELEASE FLOWS:
WQCV: 0.9 CFS @ 40 HRS
EURV: 3.5 CFS @ 72 HRS
100-YR: 5.6 CFS @ 86 HRS
EMERGENCY OVERFLOW: 72.2 CFS
EX. POND 1 OUTLET STRUCTURE
EX. POND 1 42" RCP OUTLET PIPE
TAMLIN ROAD (EXISTING R.O.W.)

200 0 200 400
(IN FEET)
1 inch = 200 ft.

LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- EXISTING SECTION LINE
- EXISTING EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- SAND CREEK / FALCON DRAINAGE BASINS DELINEATION
- FEMA FLOODPLAIN LINE
- BASIN ID (BASIN / AREA / C5 C100)
- DESIGN POINT ID (X)
- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNDARY
- FLOW ARROW

PROPOSED CONDITIONS COMMULATIVE DRAINAGE BASIN SUMMARY

Basin	Design Point	Area (acres)	WEIGHTED C_5	WEIGHTED C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A	1	4.03	0.08	0.33	1.1	7.7
B	2	33.21	0.36	0.54	45.4	112.3
C	3	62.88	0.34	0.53	87.0	222.9
D	4	7.36	0.42	0.57	11.5	26.7
E	5	1.77	0.09	0.36	0.6	4.3
F	6	6.06	0.10	0.41	2.3	15.6
G	6	8.84	0.09	0.36	6.8	16.0
OS-1	7	6.38	0.27	0.48	10.7	21.7
OS-2	8	3.12	0.30	0.50	7.8	13.6
OS-3	9	1.14	0.90	0.96	3.4	6.0
OS-4	10	13.09	0.34	0.44	12.3	26.3
OS-5	11	62.20	0.34	0.55	86.4	173.7
OS-6	12	35.75	0.22	0.46	31.9	58.4
OS-7	13	6.47	0.22	0.46	5.4	19.1
OS-8	4	13.79	0.09	0.36	4.8	32.5
TOTAL		266.09			317.6	756.8

Know what's below. Call before you dig.

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BLVD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CLIENT
CHALLENGER HOMES
8605 EXPLORER DRIVE STE. 250
COLORADO SPRINGS, CO 80920
(719) 598-5192
JIM BYERS

PROJECT
CHALLENGER HOMES
FALCON HIGHLANDS FILING NO. 3
EL PASO COUNTY, COLORADO
DRAINAGE MAP
MAJOR BASINS PROPOSED CONDITIONS

DATE: 08/26/2022

A	1st SUBMITTAL TO EPC 02/11/2022 - RDL
B	2nd SUBMITTAL TO EPC 08/26/2022 - RDL
C	3rd SUBMITTAL TO EPC 04/28/2023 - RDL
D	4TH SUBMITTAL TO EPC 07/21/2023 - DJM

REVISIONS

DR. SLP CH. DJM
P.M. DJM
JOB 21002568
SHEET NO. 1
DR-02

CAD FILE: 21002568-DRAINAGE MAPS-OVERALL SITE.DWG

On-site Basins (Falcon Highlands South, Undeveloped):

The site has been broken down into seven major on-site basins upstream within the limits of Falcon Highlands South. A drainage map is in the appendix.

Basin A (3.74 ac, Q_5 = 1.15 cfs, Q_{100} = 7.7 cfs) is the basin located southwest of Antelope Meadow Circle, just below basin OS-4, west of Basin B. The majority of the basin is comprised of Tract F and consists of some rear yard runoff from the PUD lots at the western edge of Basin B. The storm water runoff from this basin sheet flows south and off-site at **Design Point 1** with the combined flow of OS-4, and per existing drainage patterns is not tributary to on-site detention ponds.

Basin B (38.93 ac, Q_5 = 11.65 cfs, Q_{100} = 78.20 cfs) is located south of Antelope Meadow Circle, adjacent to basin A. The site is covered in native grasses with limited grading work from a previous development. Runoff from the site sheet flows southwesterly overland to existing Pond 1 **(Design Point 2**). The private 42" RCP outlet pipe from the outlet structure of the pond daylights at the grassland swale south of the abandoned future Tamlin Road right-of-way at **Design Point 5**.

Basin C (57.81 ac, Q_5 = 18.4 cfs, Q_{100} = 123.57 cfs) is located adjacent to Basin B and covered in native grasses and weeds. The site has limited grading due to work from a previous development that did not finish. Runoff from the site sheet flows southwesterly overland to an existing diversion ditch that spans from an existing public 24" RCP storm sewer main that daylights within Falcon Highlands South south of Wagon Track Way. The diversion ditch flows directly to existing Pond 2 (**Design Point 3**). The private 42" RCP outlet pipe from the outlet structure of the pond daylights at the grassland swale south of the project site at **Design Point 6**.

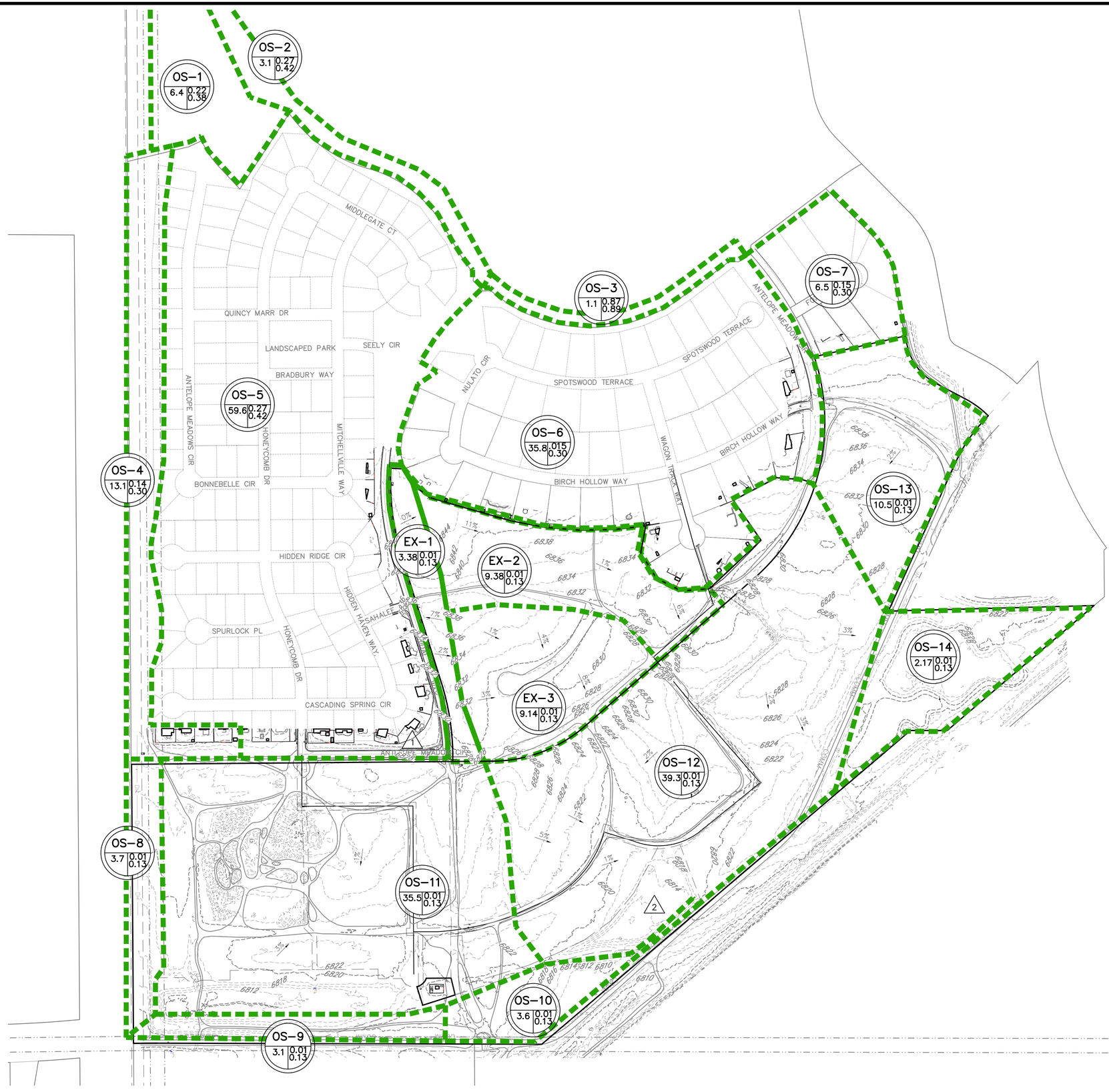
Only a po
described
Drainage
remain un
during this
planing.

Basin D (10.54 ac, Q_5 = 3.47 cfs, Q_{100} = 23.31 cfs) is located to the northeast of the Filing and consists of undeveloped area with native grasses. The basin's runoff drains directly to existing Pond WU (**Design Point 4**).

Basin E (3.14 ac, Q_5 = 1.12 cfs, Q_{100} = 7.5 cfs) is the undeveloped, natural landscaped area between Tamlin Road and the existing Pond 1. Runoff from Basin E is directed by a ditch section to a low point between the future Dublin Road and Highway 24 (**Design Point 5**). This drainage concept and its associated storm infrastructure is presented in the previous master plan and is to remain as the intended plan. The 2005 PDR suggested that an inline grate inlet be installed but there is no evidence that this was installed. The existing drainage pattern consists of pooling within the local low point of the ditch that surcharges and is directed south through the grassland swale.

Basin F (3.67 ac, Q_5 = 1.19 cfs, Q_{100} = 7.99 cfs) is the undeveloped area between Tamlin Road and the existing Detention Pond 2. The runoff from Basin F is directed to the low point in the downstream grasslined swale between the Site and Tamlin Road (**Design Point 6**). This drainage concept and its associated storm infrastructure is presented in the previous master plan and is to remain as the intended plan. The 2005 PDR suggested that a 4'x4' area inlet be constructed but

Appendix G
Drainage Maps

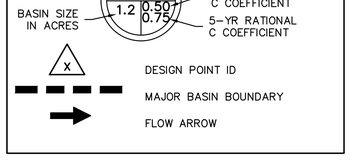


EXISTING CONSDITIONS DRAINAGE BASIN SUMMARY						
Basin	Design Point	Area (acres)	C_5	C_{100}	Q_5 (cfs)	Q_{100}(cfs)
EX-1	1	3.38	0.01	0.13	0.04	1.32
EX-2	2	9.38	0.01	0.13	0.11	4.05
EX-3	2	9.14	0.01	0.13	0.13	4.64
OS-1	2	2.17	0.01	0.13	0.03	0.93
OS-2	2	1.28	0.01	0.13	0.02	0.66
Total		**25.35**			**0.33**	**11.6**

Existing Conditions Design Point Summary			
Design Point	Contributing Basins	Q_5 (cfs)	Q_{100}(cfs)
1	EX-1	0.04	1.32
2	EX-2,EX-3,OS-1,OS-2	0.29	10.28

LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- EXISTING SECTION LINE
- EXISTING EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS



BENCHMARK:
ELEVATIONS ARE BASED UPON SW COR SEC. 12, T13S, R65W, 6TH PM, FND. 3.25" ALUM. CAP.
(ELEVATION: 6810.43=NAVD88).

BASIS OF BEARINGS:
BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, MONUMENTED AT THE SOUTH END BY A FOUND3-1/4" ALUMINUM CAP STAMPED "AZTEC CONSULTANTS PLS 38256" AND AT THE NORTH END BY A FOUND 3-1/4" ALUMINUM CAP STAMPED "PLS 4842".

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

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BOULEVARD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CHALLENGER HOMES
8605 EXPLORER DRIVE
SUITE 250, CO 80920
COLORADO SPRINGS,
719-598-5192
JIM BYERS

CLIENT

CHALLENGER HOMES
FALCON HIGHLANDS SOUTH – FILING 1
EL PASO COUNTY, COLORADO
DRAINAGE MAPS

EXISTING DRAINAGE MAP

DATE --

REVISIONS	
A	1st SUBMITTAL TO JURISDICTION 07/08/2024 – KMB

COUNTY FILE NO.:

DR.	TN	CH.	KB
P.M.	DM		
JOB	24004308		
SHEET NO.			

CAD FILE: 24004308-EX DRAINAGE MAP.DWG

Proposed Basin Summary

Basin	Area (acres)	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A	20.60	0.23	0.38	9.99	29.77
B	40.12	0.23	0.38	18.65	53.18
C	41.08	0.23	0.38	25.69	73.24
D	8.26	0.50	0.62	12.79	26.67
E	1.41	0.02	0.15	0.08	1.03
F	5.91	0.02	0.15	0.26	3.48
G	8.38	0.02	0.15	0.37	4.93
OS-1	6.38	0.22	0.38	5.43	15.66
OS-2	3.12	0.27	0.42	2.29	6.06
OS-3	1.14	0.86	0.89	4.06	7.04
OS-4	13.09	0.14	0.30	4.44	15.98
OS-5	59.62	0.27	0.42	47.03	124.58
OS-6	35.75	0.15	0.30	14.22	49.60
OS-7	6.47	0.15	0.30	2.41	8.39

LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT–OF–WAY
- PROPOSED RIGHT–OF–WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- EXISTING SECTION LINE
- EXISTING EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- BASIN ID
- 5–YR RATIONAL C COEFFICIENT
- BASIN SIZE IN ACRES
- 5–YR RATIONAL C COEFFICIENT
- DESIGN POINT ID
- MAJOR BASIN BOUNDARY
- FLOW ARROW

BENCHMARK:
ELEVATIONS ARE BASED UPON SW COR SEC. 12, T13S, R65W, 6TH PM, FND. 3.25" ALUM. CAP.
(ELEVATION: 6810.43=NAVD88).

BASIS OF BEARINGS:
BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, MONUMENTED AT THE SOUTH END BY A FOUND3–1/4" ALUMINUM CAP STAMPED "AZTEC CONSULTANTS PLS 38256" AND AT THE NORTH END BY A FOUND 3–1/4" ALUMINUM CAP STAMPED "PLS 4842".

Know what's below. Call before you dig.

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BOULEVARD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CHALLENGER HOMES
8605 EXPLORER DRIVE
SUITE 250 CO 80920
COLORADO SPRINGS, CO
719–598–5192
JIM BYERS

CLIENT: CHALLENGER HOMES
FALCON HIGHLANDS SOUTH – FILING 1
EL PASO COUNTY, COLORADO
DRAINAGE MAPS
OVERALL MAP

DATE --

A	1st SUBMITTAL TO JURISDICTION 07.08.2024 – KMB

REVISIONS

COUNTY FILE NO.:

DR.	TN	CH.	KB
P.M.	DM		
JOB	24004308		
SHEET NO.	02		

CAD FILE: 24004308-PROPOSED DRAINAGE MAP-OVERALL.DWG

Basin ID	Total Area (ac)	Design Point	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A-1	4.49	A1	0.23	0.38	9.99	29.77
A-2	4.83	A2	0.23	0.38	18.65	53.18
A-3	2.46	A2	0.23	0.38	25.69	73.24
A-4	2.55	A4	0.50	0.62	12.79	26.67
A-5	3.52	A5	0.02	0.15	0.08	1.03
A-6	2.75	A6	0.02	0.15	0.26	3.48
B	40.12	P1	0.02	0.15	0.37	4.93
C	41.08	P2	0.22	0.38	5.43	15.66
D	8.26	WU	0.27	0.42	2.29	6.06
E	1.41	10	0.86	0.89	4.06	7.04
F	5.91	11	0.14	0.30	4.44	15.98
G	8.38	11	0.27	0.42	47.03	124.58
TOTAL	125.76					

OS-6 35.8 | 015 | 0.30

A-1 4.49 | 0.02 | 0.15

A-2 4.83 | 0.23 | 0.38

A-3 2.46 | 0.23 | 0.38

A-4 2.55 | 0.23 | 0.38

A-5 3.52 | 0.23 | 0.38

A-6 .75 | 0.23 | 0.38

C 13.1 | 0.23 | 0.38

G 3.1 | 0.01 | 0.13

PROPOSED DRAINAGE SWALE

EXISTING DRAINAGE CHANNEL

PROPOSED 10' TYPE R ON-GRADE INLET

PROPOSED 10' TYPE R ON-GRADE INLET 18" RCP

PROPOSED 10' TYPE R SUMP INLET

24" RCP

30" RCP

24" RCP

5' STORM MANHOLE

36" RCP

5' STORM MANHOLE

36" RCP

6' STM MANHOLE

48" RCP

6' STORM MANHOLE

EX. 30.0' DRAINAGE & UTILITY ESMT REC. NO. 206066537

EX. 20.0' DRAINAGE ESMT REC NO. 206066535

EX. 30.0' FORCE MAIN ESMT REC NO. 220130580

ITEM #28 DRNG. & UTIL ESMT. REC. NO. 206066537

ITEM #28 DRNG. & UTIL ESMT. REC. NO. 206066537

SYO

A1 A2 A3 A4 A5 A6

200 0 200 400

(IN FEET)
1 inch = 200 ft.

LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- EXISTING SECTION LINE
- EXISTING EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- A-1 / 1.2 | 0.50 / 0.75 — BASIN ID; 5-YR RATIONAL C COEFFICIENT; BASIN SIZE IN ACRES; 5-YR RATIONAL C COEFFICIENT
- X — DESIGN POINT ID
- MAJOR BASIN BOUNDARY
- FLOW ARROW

BENCHMARK:
ELEVATIONS ARE BASED UPON SW COR SEC. 12, T13S, R65W, 6TH PM, FND. 3.25" ALUM. CAP.
(ELEVATION: 6810.43=NAVD88).

BASIS OF BEARINGS:
BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, MONUMENTED AT THE SOUTH END BY A FOUND 3-1/4" ALUMINUM CAP STAMPED "AZTEC CONSULTANTS PLS 38256" AND AT THE NORTH END BY A FOUND 3-1/4" ALUMINUM CAP STAMPED "PLS 4842".

Know what's below. Call before you dig.

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BLVD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CHALLENGER HOMES
8605 EXPLORER DRIVE
SUITE 250 CO 80920
COLORADO SPRINGS, CO 80920
719-598-5192
JIM BYERS

CLIENT
CHALLENGER HOMES
FALCON HIGHLANDS SOUTH – FILING 1
EL PASO COUNTY, COLORADO
DRAINAGE MAPS
PROPOSED MAP

DATE --

REVISIONS
A 1st SUBMITTAL TO JURISDICTION 07/08/2024 – KMB

COUNTY FILE NO.:

DR. TN | CH. KB
P.M. DM
JOB 24004308
SHEET NO. 03

CAD FILE: 24004308-PROPOSED DRAINAGE MAP-OVERALL.DWG

Basin ID	Total Area (ac)	Design Point	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A-1	4.49	A1	0.23	0.38	9.99	29.77
A-2	4.83	A2	0.23	0.38	18.65	53.18
A-3	2.46	A2	0.23	0.38	25.69	73.24
A-4	2.55	A4	0.50	0.62	12.79	26.67
A-5	3.52	A5	0.02	0.15	0.08	1.03
A-6	2.75	A6	0.02	0.15	0.26	3.48
B	40.12	P1	0.02	0.15	0.37	4.93
C	41.08	P2	0.22	0.38	5.43	15.66
D	8.26	WU	0.27	0.42	2.29	6.06
E	1.41	10	0.86	0.89	4.06	7.04
F	5.91	11	0.14	0.30	4.44	15.98
G	8.38	11	0.27	0.42	47.03	124.58
TOTAL	125.76					

200 0 200 400

(IN FEET)
1 inch = 200 ft.

PROPOSED 10' TYPE R ON-GRADE INLET 18" RCP
A3
30" RCP
24" RCP
PROPOSED 10' TYPE R SUMP INLET
24" RCP
PROPOSED 10' TYPE R SUMP INLET
A5
5' STORM MANHOLE
A4
A-4
2.55 0.23 0.38
36" RCP
5' STORM MANHOLE
36" RCP
48" RCP
6' MA
A6
EX. 20.0' DRAINAGE ESMT. REC. NO. 206066535
EX. 30.0' FORCE MAIN ESMT REC. NO. 220130580
ITEM #28 DRNG. & UTIL ESMT. REC. NO. 206066537
B
13.1 0.23 0.38
EX. 60" RCP STORM SEWER
EX. SANITARY MAIN
48" RCP
6' STORM MANHOLE
6' STORM MANHOLE
48" RCP
54" RCP
FOREBAY 2.1
P2
11
PROPOSED DETENTION POND 1
FOREBAY 1.1
FOREBAY 1.2
A
FOREBAY 1.3
F
3.1 0.01 0.13
B1
POND 1 OUTLET STRUCTURE
10

LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- EXISTING SECTION LINE
- EXISTING EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS

A-1 — BASIN ID
1.2 | 0.50 / 0.75 — BASIN SIZE IN ACRES; 5-YR RATIONAL C COEFFICIENT; 5-YR RATIONAL C COEFFICIENT
x — DESIGN POINT ID
MAJOR BASIN BOUNDARY
MINOR BASIN BOUNDARY
FLOW ARROW

BENCHMARK:
ELEVATIONS ARE BASED UPON SW COR SEC. 12, T13S, R65W, 6TH PM, FND. 3.25" ALUM. CAP.
(ELEVATION: 6810.43=NAVD88).

BASIS OF BEARINGS:
BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, MONUMENTED AT THE SOUTH END BY A FOUND3-1/4" ALUMINUM CAP STAMPED "AZTEC CONSULTANTS PLS 38256" AND AT THE NORTH END BY A FOUND 3-1/4" ALUMINUM CAP STAMPED "PLS 4842".

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

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BOULEVARD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CHALLENGER HOMES
8605 EXPLORER DRIVE
SUITE 250
COLORADO SPRINGS, CO 80920
719-598-5192
JIM BYERS

CHALLENGER HOMES
FALCON HIGHLANDS SOUTH – FILING 1
EL PASO COUNTY, COLORADO
DRAINAGE MAPS
PROPOSED MAP

CLIENT

DATE --

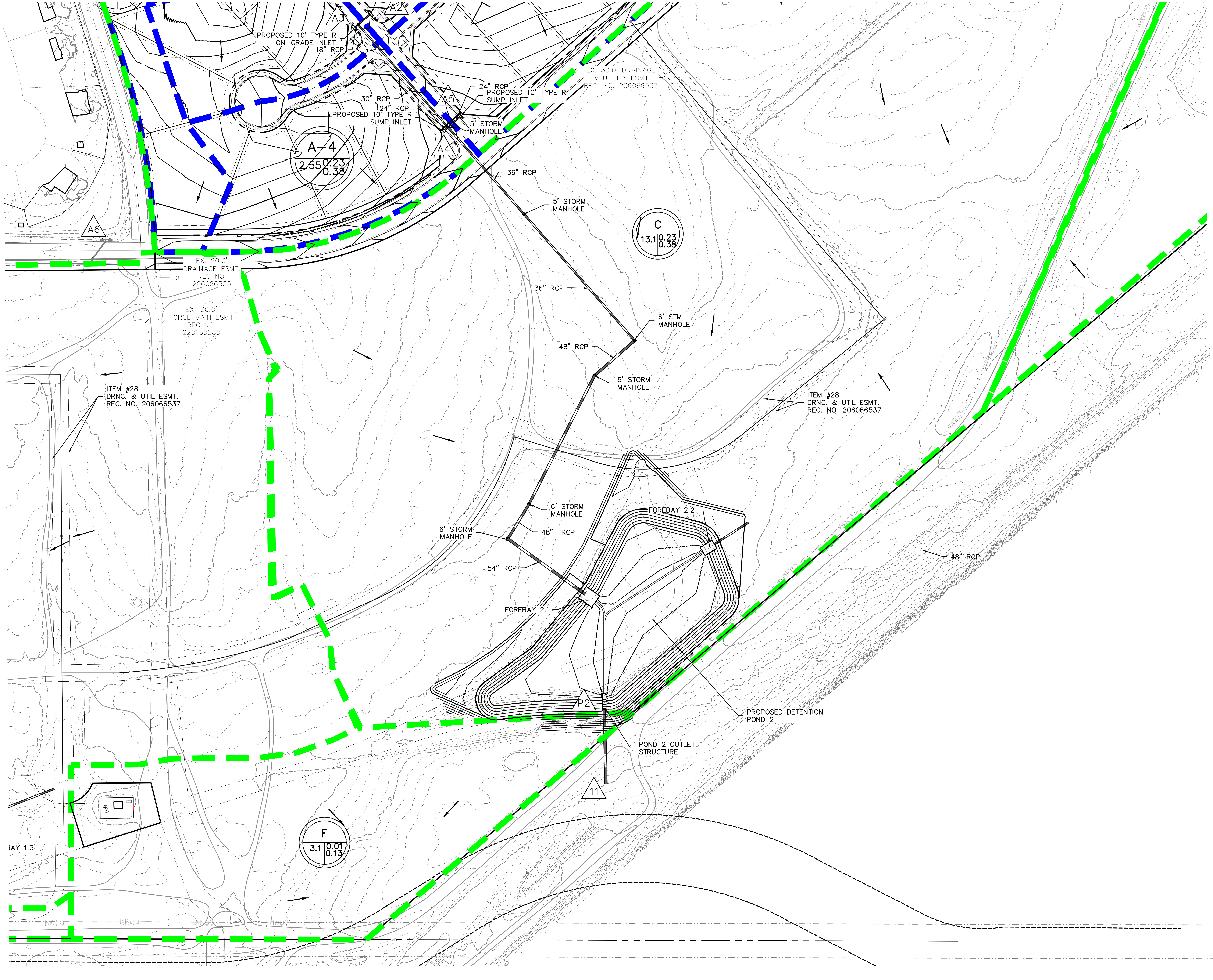
A 1ST SUBMITTAL TO JURISDICTION 07/08/2024 – KMB

REVISIONS

COUNTY FILE NO.:

DR. TN | CH. KB
P.M. DM
JOB 24004308
SHEET NO. 04

CAD FILE: 24004308-PROPOSED DRAINAGE MAP-OVERALL.DWG



Basin ID	Total Area (ac)	Design Point	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A-1	4.49	A1	0.23	0.38	9.99	29.77
A-2	4.83	A2	0.23	0.38	18.65	53.18
A-3	2.46	A2	0.23	0.38	25.69	73.24
A-4	2.55	A4	0.50	0.62	12.79	26.67
A-5	3.52	A5	0.02	0.15	0.08	1.03
A-6	2.75	A6	0.02	0.15	0.26	3.48
B	40.12	P1	0.02	0.15	0.37	4.93
C	41.08	P2	0.22	0.38	5.43	15.66
D	8.26	WU	0.27	0.42	2.29	6.06
E	1.41	10	0.86	0.89	4.06	7.04
F	5.91	11	0.14	0.30	4.44	15.98
G	8.38	11	0.27	0.42	47.03	124.58
TOTAL	125.76					

200 0 200 400

(IN FEET)
1 inch = 200 ft.

LEGEND

PROPERTY BOUNDARY
EXISTING RIGHT-OF-WAY
PROPOSED RIGHT-OF-WAY
EXISTING LOT LINE
PROPOSED LOT LINE
EXISTING SECTION LINE
EXISTING EASEMENT
EXISTING CONTOURS
PROPOSED CONTOURS

A-1 — BASIN ID
1.2 — BASIN SIZE IN ACRES
0.50 — 5-YR RATIONAL C COEFFICIENT
0.75 — 5-YR RATIONAL C COEFFICIENT

X — DESIGN POINT ID
MAJOR BASIN BOUNDARY
FLOW ARROW

BENCHMARK:

ELEVATIONS ARE BASED UPON SW COR SEC. 12, T13S, R65W, 6TH PM, FND. 3.25" ALUM. CAP. (ELEVATION: 6810.43=NAVD88).

BASIS OF BEARINGS:

BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, MONUMENTED AT THE SOUTH END BY A FOUND3-1/4" ALUMINUM CAP STAMPED "AZTEC CONSULTANTS PLS 38256" AND AT THE NORTH END BY A FOUND 3-1/4" ALUMINUM CAP STAMPED "PLS 4842".

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

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BOULEVARD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CLIENT
CHALLENGER HOMES
8605 EXPLORER DRIVE
SUITE 250
COLORADO SPRINGS, CO 80920
719-598-5192
JIM BYERS

CHALLENGER HOMES
FALCON HIGHLANDS SOUTH – FILING 1
EL PASO COUNTY, COLORADO
DRAINAGE MAPS

PROPOSED MAP

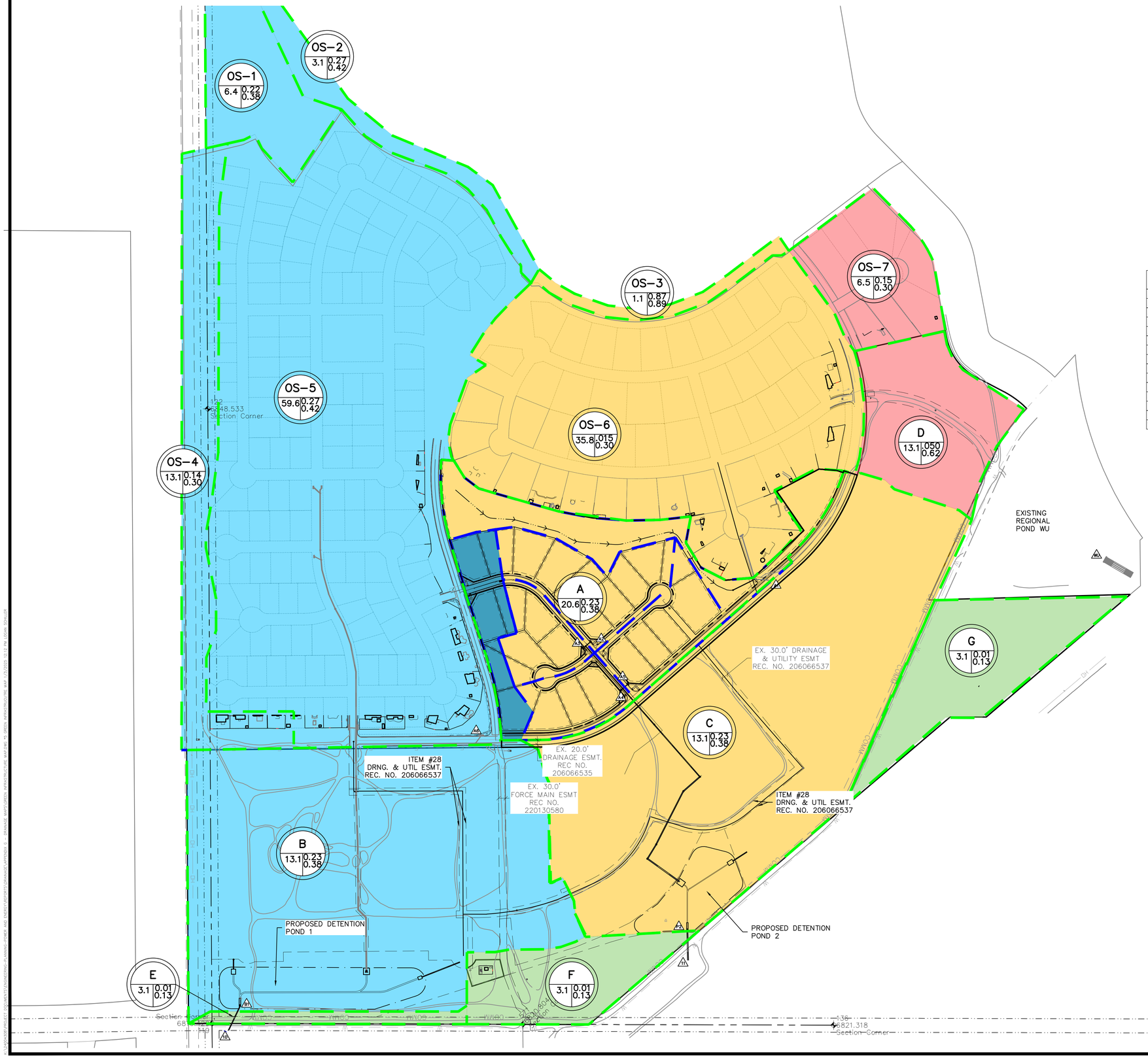
DATE
A 1st SUBMITTAL TO JURISDICTION 07/08/2024 – KMB

REVISIONS

COUNTY FILE NO.:

DR. TN CH. KB
P.M. DM
JOB 24004308
SHEET NO.
05

CAD FILE: 24004308-PROPOSED DRAINAGE MAP-OVERALL.DWG



Basin ID	Total Area (ac)	Total Proposed Disturbed Area (ac)	Area Tributary to Pond 1 (ac)	Area Tributary to Pond 2 (ac)	Disturbed Area Treated (ac)	Un-Disturbed Area un-Treated (ac)
A-1	4.49	4.49	0	4.49	4.49	
A-2	4.83	4.83	4.83		4.83	
A-3	2.46	2.46	2.46		2.46	
A-4	2.55	2.55	2.55		2.55	
A-5	3.52	3.52	3.52		3.52	
A-6	2.75	2.75	2.75		2.75	
B	40.12	0		40.12		
C	41.08	0	41.08			
D	8.26	0	8.26			
E	1.41	0				1.41
F	5.91	0				5.91
G	8.38	0				8.38
TOTAL	125.76	20.6	65.45	44.61	20.6	15.7

LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT–OF–WAY
- PROPOSED RIGHT–OF–WAY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- EXISTING SECTION LINE
- EXISTING EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS

A–1 1.2 0.50 0.75 — BASIN ID; 5–YR RATIONAL C COEFFICIENT; BASIN SIZE IN ACRES; 5–YR RATIONAL C COEFFICIENT

X — DESIGN POINT ID

MAJOR BASIN BOUNDARY

FLOW ARROW

AREA TRIBUTARY TO POND 1

AREA TRIBUTARY TO POND 2

FULLY UNDEVELOPED PERVIOUS AREA RUNNING OFFSITE

AREA TRIBUTARY TO REGIONAL POND WU

BENCHMARK:
ELEVATIONS ARE BASED UPON SW COR SEC. 12, T13S, R65W, 6TH PM, FND. 3.25" ALUM. CAP.
(ELEVATION: 6810.43=NAVD88).

BASIS OF BEARINGS:
BEARINGS ARE BASED UPON THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 13 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, MONUMENTED AT THE SOUTH END BY A FOUND3–1/4" ALUMINUM CAP STAMPED "AZTEC CONSULTANTS PLS 38256" AND AT THE NORTH END BY A FOUND 3–1/4" ALUMINUM CAP STAMPED "PLS 4842".

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

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
143 UNION BLVD, SUITE 700
LAKEWOOD, CO 80228
303.462.1100

CHALLENGER HOMES
8605 EXPLORER DRIVE
SUITE 250 CO 80920
COLORADO SPRINGS, CO
719–598–5192
JIM BYERS

CLIENT

CHALLENGER HOMES
FALCON HIGHLANDS SOUTH – FILING 1
EL PASO COUNTY, COLORADO
DRAINAGE MAPS

GREEN INFRASTRUCUTRE MAP

DATE --

A 1st SUBMITTAL TO JURISDICTION 07/08/2024 – KMB

REVISIONS

COUNTY FILE NO.:

DR. TN CH. KB
P.M. DM
JOB 24004308
SHEET NO. 5

CAD FILE: GREEN INFRASTRUCTURE MAP.DWG