

Drainage Letter
Report



PRELIMINARY DRAINAGE REPORT
for
WINDERMERE FILING NO. 2

Colorado Springs, CO

April 6, 2022

Prepared for:

Colo Windermere #2, LLC
4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918
Contact: James Todd Stephens

Prepared by:

Drexel, Barrell & Co.
3 South Seventh Street
Colorado Springs, CO 80905
Contact: Tim McConnell, P.E.
(719) 260-0887

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DRAINAGE MAP

PRELIMINARY DRAINAGE REPORT

for

WINDERMERE FILING NO. 2

Colorado Springs, Colorado

1.0 CERTIFICATION STATEMENTS

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 El Paso 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 omission on my part in preparing this report.

Tim D. McConnell, P.E. Date
Colorado P.E. License No. 33797
For and on Behalf of Drexel, Barrell & Co.

DEVELOPER'S STATEMENT

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

Business Name: Colo Windermere #2, LLC

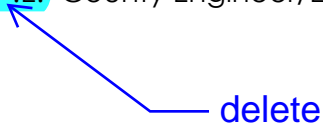
By: Date
James Todd Stephens
Title: Owner
Address: 4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918

EL PASO COUNTY

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

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

CONDITIONS



PRELIMINARY DRAINAGE REPORT

for

WINDERMERE FILING NO. 2

Colorado Springs, Colorado

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Windermere Filing No. 2 subdivision. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location

The site is located at the northwest corner of N. Carefree Cir. and Marksheffel Rd. - the E 1/2 of Section 29, Township 13 S, Range 65 W of the 6th P.M., El Paso County, Colorado.

The site is bound on the west by Antelope Ridge Dr., on the north by the Windermere Filing No. 1 subdivision (Mardale Lane), on the east by Marksheffel Rd., and on the south by N. Carefree Cir.

Site Conditions

The site is approximately 9.26 acres in size and is proposed as a multi-family home subdivision. The proposed site development includes approximately 200 multi-family units. The site has recently been overlot graded, seeded and mulched as part of the Windermere Filing No. 1 development to the north. The site is located within the Sand Creek Drainage Basin. Historically, this site drains to the southeast towards the intersection of N. Carefree Circle and Marksheffel Road.

This site was studied as part of the approved Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1, by Classic Consulting (October 2014) and the more recently approved Final Drainage Report for Windermere Filing No. 1, by Drexel, Barrell & Co. (April 2022).

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is underlain by Truckton sandy loam, a type 'A' hydrologic soil. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the

majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C0543 G (December 7, 2018) the project site is within a designated Zone X area described as "area of minimal hazard". A firmette map is included in the appendix.

4.0 HISTORIC HYDROLOGY

Refer to an excerpt in the appendix for historic condition drainage map.

Existing Design Point 6 (DP-6-EX) covers runoff from DP-4-EX, Basin EX-R, and Basin EX-A.

- Design Point DP-4-EX consists of runoff from off-site Basin D-16, that discharges onto the Windermere property in the southwest corner and travels via roadside ditch towards DP-6-EX with runoff rates of $Q_5=4.9$ cfs and $Q_{100}=10.7$ cfs.
- EX-R is 0.53 acres of existing Marksheffel Road and roadside ditch that drains to the existing grated area drain at DP-6. ($Q_5=2.4$ cfs and $Q_{100}=4.4$ cfs)
- Basin EX-A is 13.20 acres of Windermere property with historic runoff of $Q_5=14.5$ cfs and $Q_{100}=34.2$ cfs.

Runoff rates of $Q_5=18.5$ cfs and $Q_{100}=41.8$ cfs reach the existing area drain at DP-6-EX in the historic condition. As discussed in the Classic Consulting report referenced above, the existing 24" storm sewer that exits this area drain appears to have been undersized, as [the capacity of the existing 24" RCP pipe at 0.5% grade is only 17.2 cfs.](#)

Existing Design Point 19 (DP-19-EX) consists of runoff from off-site basin NC-2 ($Q_5=6.5$ cfs and $Q_{100}=11.8$ cfs). An existing 15' Type R at-grade curb inlet just west of the intersection of N. Carefree Circle and Marksheffel Road intercepts a portion of this runoff ($Q_5=4.8$ cfs and $Q_{100}=8.1$ cfs) and discharges to the east via public 18" RCP storm sewer. Bypass flows continue to the east towards DP-20-EX.

Existing Design Point 20 (DP-20-EX) consists of basin runoff from basin NC-1, flowby from the at-grade inlet at DP-19-EX and pipe flow from DP-6-EX. An existing 10' Type R sump inlet intercepts all the surface runoff and combines it with the upstream flows from DP-6-EX and DP-19-EX inlet capture. Total historic runoff at this location is $Q_5=24.5$ cfs and $Q_{100}=52.6$ cfs. This runoff is captured in its entirety and continues within the existing Marksheffel Road storm system to the south.

5.0 EXISTING HYDROLOGY

As described above, the Windermere Filing No. 2 site was overlot graded as part of the Windermere Filing No. 1 development. A full-spectrum detention facility was designed as part of the Filing No.1 Final Drainage Report, and in order to minimize future grading within the detention facility area, the volume was based on assumed final build-out

watershed imperviousness of 68%. Comparison between the original design and this proposed condition is further described below.

6.0 PROPOSED HYDROLOGY & HYDRAULIC SUMMARY

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals. Mile High Flood District design software (MHFD-Detention v.4.03) and Flowmaster were used to identify pond and storm system sizing, and inlet capacity charts from the current drainage criteria manual used for inlet sizing (see appendix for calculations). See below for a summary runoff table and description of each design point.

Rational Method Runoff Summary

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	2.90	7.3	15.3
A2	3.29	6.4	13.4
B1	3.33	7.2	16.0
B2	0.49	1.0	2.3
B4	0.16	0.4	0.8
P1	1.00	0.5	2.7
D16	2.73	4.9	10.7
A3	1.61	1.4	6.1
NC2	1.61	6.3	12.1
EXR	0.53	2.4	4.4
C3	0.63	0.5	2.5
Pond Release	0.00	0.3	10.6
NC1	0.43	1.9	3.4

Design Point 1 represents the flows generated by basin A1 ($Q_5=7.3$ cfs and $Q_{100}=15.3$ cfs). These flows are captured by a proposed public 10' Type R sump inlet located at the low point of the proposed roadway.

Design Point 2 represents the surface flows generated by basin A2 ($Q_5=6.4$ cfs and $Q_{100}=13.4$ cfs), and the piped flows from DP1. The surface flows will be captured in their entirety by a proposed 10' Type R sump inlet located at the low point in the proposed roadway. These flows then combine with the piped flows from DP1, for a total flow of $Q_5=12.1$ cfs and $Q_{100}=25.4$ cfs, that will be discharged to the north via public 24" RCP storm sewer.

Design Point 3 covers flow from offsite basins B1 and B2, combined with onsite DP2. Flows of $Q_5=18.2$ cfs and $Q_{100}=38.8$ cfs travel via the existing private 24" RCP storm sewer to the east and discharge into the north end of the detention facility.

Does this drain onto the property? If so, would it go to DP S, not into the pond?

Design Point 4 represents all flows reaching the existing detention facility (Basins B4, P1 and DP3) for a total flow of $Q_5= 18.4\text{cfs}$ and $Q_{100}=41.1\text{cfs}$. The existing detention facility and modifications for this developed condition are described further below,

Design Point 5 is identical to DP-4-EX in the historic condition, and represents flows ($Q_5= 4.9\text{cfs}$ and $Q_{100}=10.7\text{cfs}$) from offsite basin D16 that discharges on to the Windermere property. In the developed condition, it is proposed that the 24" RCP be extended to allow for the flow to be piped to the east and the roadside ditch removed.

Design Point 19 is equivalent to DP-19-EX, and consists of runoff from off-site basin NC-2 and basin A3, for a total flow of $Q_5= 6.7\text{cfs}$ and $Q_{100}=16.3\text{cfs}$. An existing 15' Type R at-grade curb inlet just west of the intersection of N. Carefree Circle and Marksheffel Road intercepts a portion of this runoff ($Q_5=4.8\text{ cfs}$ and $Q_{100}=8.1\text{ cfs}$) and discharges to the east via public 18" RCP storm sewer.

Design Point S is located at the same existing area inlet as DP-6-EX. In the developed condition flows reaching this point, from basins EXR and C3, Design Point 6 and the pond release rate equate to $Q_5= 7.1\text{ cfs}$ and $Q_{100}=26.1\text{ cfs}$. Far less than the $Q_5=18.5\text{ cfs}$ and $Q_{100}=41.8\text{ cfs}$ in the historic condition. As identified in the historic analysis of this design point, the existing 24" storm sewer exiting the area inlet is currently undersized. In this developed condition, the reduction in flows will allow for this existing pipe to function within capacity.

Design Point J1 is located at the existing manhole on the north side of N. Carefree Circle and represents the combining of flows from DP-19 and DP-S. Flows of $Q_5= 12.9\text{ cfs}$ and $Q_{100}=40.3\text{ cfs}$ continue to the south via 30" RCP towards DP-20.

Design Point 20 (equivalent to DP-EX-20) as in the existing condition consists of surface runoff from basin NC-1, flowby from the at-grade inlet at DP-19 and pipe flow from DP-J1. An existing 10' Type R sump inlet intercepts all the surface runoff and combines it with the upstream flows from DP-J1 and DP-19 existing at-grade inlet capture. Total developed runoff at this location is $Q_5=14.3\text{ cfs}$ and $Q_{100}=42.7\text{ cfs}$, significantly less than the historic $Q_5=24.5\text{ cfs}$ and $Q_{100}=52.6\text{ cfs}$. This runoff continues within the existing Marksheffel Road storm system to the south.

7.0 EXISTING DETENTION/WATER QUALITY FACILITY

As part of the overlot design for Windermere Filing No. 1, the detention pond located in the southeast corner of the property was designed as a full-spectrum detention facility to capture flows from the Windermere Filing No. 2 basins.

In order to minimize future grading within the detention facility area, the volume was based on an assumed final build-out watershed imperviousness of 68.0%, which considered Windermere Filing No. 2 (Windermere Filing No. 1 – Tract B) as potentially higher density than single-family residential. As part of the Windermere Filing 1 overlot grading, the pond was excavated to full volume and the outlet structure and associated piping installed. An interim orifice plate (assuming full developed condition within the

street right-of-way, but no further development) was installed to allow for appropriate WQCV drain time. The orifice plate will need to be switched out to allow for discharge of the developed flows, and the restrictor plate raised to 7.80" above the invert of the 18" outfall pipe. No other portion of the detention facility will need to be modified.

Based on the analysis in this report, the developed condition encompasses a total of 12.79 acres that is tributary to this existing facility, with a composite imperviousness of 54.9% for the final fully developed condition. Required volumes are listed below.

		<i>Required Volume</i>		
	Imperviousness	WQCV	EURV	100-YR
FINAL	54.9%	0.24	0.83	1.29

The actual pond volume at the proposed spillway stage is 1.15 acre-feet. A concrete forebay with an energy dissipater has been installed where the flows enter the pond. The volume of the forebay was designed for 3% of the WQCV volume for the pond, as is still within that limit for this final design condition. The flows exit the forebay through a notch, discharging into the concrete trickle channel at the bottom of the pond. The trickle channel conveys the flows to the micropool. The outlet structure then releases the flows at a reduced flow rate with the use of a plate with orifice holes, into a proposed 18" pipe with restrictor plate, discharging into an existing storm inlet at the corner of N. Carefree Circle and Marksheffel Rd, after which the flows continue to the south via the existing storm sewer system.

In accordance with El Paso County criteria, the modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period. Switching out of the orifice plate will ensure that the WQCV release rate remains within criteria for the final developed condition. The outlet structure will remain in place for the final condition and will result in release rates of $Q_5=0.3$ cfs and $Q_{100}=10.6$ cfs. For comparison, the existing basin EX-A released flow rates of $Q_5=11.3$ cfs and $Q_{100}=28.2$ cfs.

A 27-ft wide riprap emergency spillway is located on the south side of the pond. In the event that water overtops the spillway, flow will discharge into existing area inlet at the intersection of N. Carefree Cir and Marksheffel Rd, where it is then picked up by the existing storm system.

All detention facility calculations, including excerpts for forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillway design are provided in the appendix.

The pond has a 15' wide maintenance access that provides access to the pond bottom, forebay and outlet structure per ECM 3.3.3.K. A private maintenance agreement and O&M manual has been established for this pond as required by the County.

8.0 FOUR-STEP PROCESS

This project conforms to the City of Colorado Springs/El Paso County Four Step Process. The process focuses on reducing runoff volumes, treating the water quality capture

volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

1. **Employ Runoff Reduction Practices:** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.
2. **Implement BMP's that provide a Water Quality Capture Volume with slow release:** Runoff from this project will be treated through capture and slow release of the WQCV in a permanent Extended Detention Basin designed per current City of El Paso County drainage criteria.
3. **Stabilize Drainage Ways:** Flows from the detention facility are released directly into the existing storm sewer system and no stabilization will be necessary.
4. **Implement Site Specific and Other Source Control BMP's:** The site is proposed as a residential development, and as such standard household source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: garages for storage of household chemicals, trash receptacles for individual households and in common areas for pet waste. The need for Industrial and Commercial BMP's was considered, however per ECM 1.7.2.A the need for industrial and commercial BMPs are not applicable for this project.

9.0 GEOTECHNICAL HAZARDS

In accordance with geotechnical recommendations, the project design is intended to direct runoff away from structures, and into the receiving storm sewer system and water quality/detention basins. This will be accomplished by a variety of means, i.e. curb and gutter and storm sewer. Per "Soils and Geology Study, Windermere Subdivision" by RMG, October 26, 2020 (Revised January 18, 2021), and updated with an addendum for Tract B (March 30, 2022)

10.0 FACILITY MAINTENANCE

Ownership and maintenance of all public facilities, generally located within the public right-of-way will be by El Paso County. Ownership and maintenance of all tracts and private facilities will be by the Sands Metropolitan District #4.

11.0 CONSTRUCTION COST ESTIMATE

Construction cost estimate will be provided with the Final Drainage Report.

12.0 DRAINAGE/BRIDGE FEES

Drainage/Bridge fees will be provided with the Final Drainage Report.

Provide calculation -
see comment letter

13.0 CONCLUSIONS

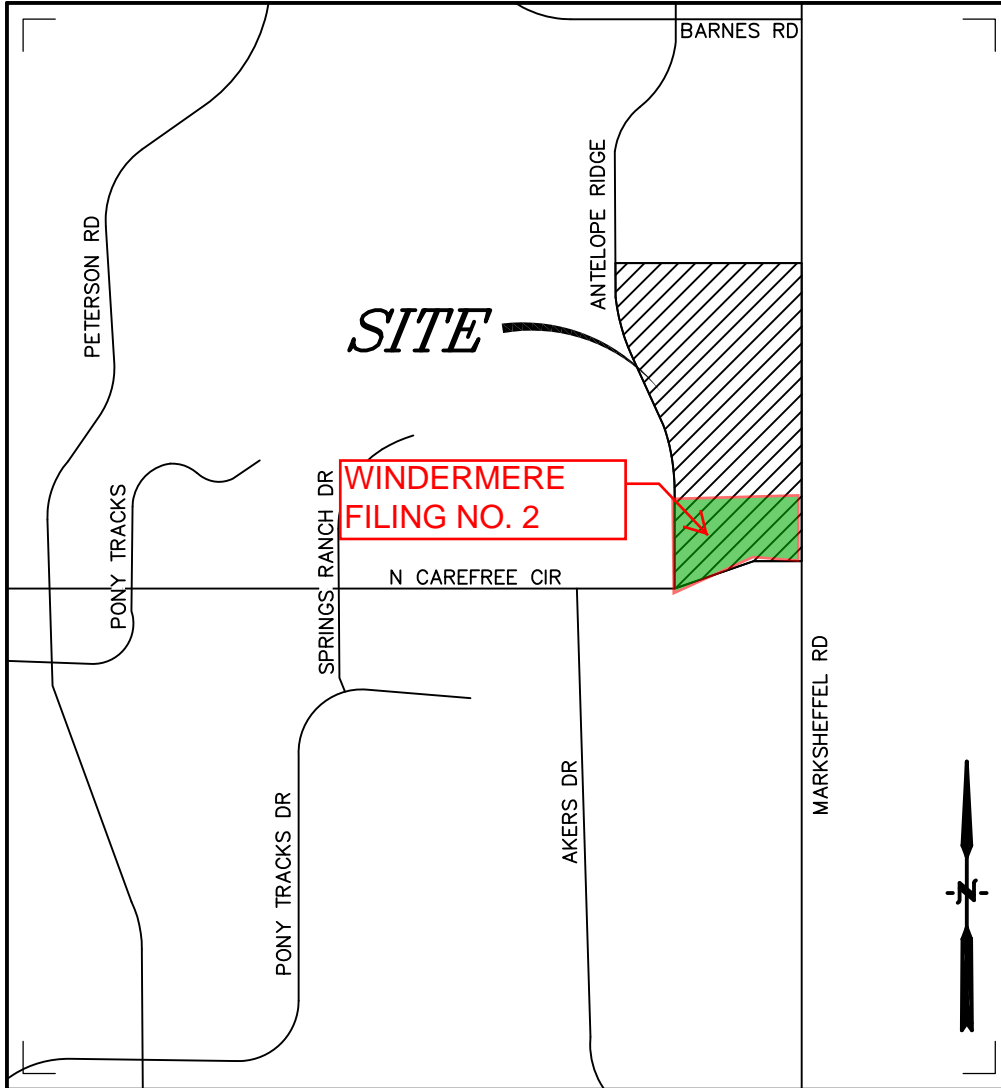
The Windermere Filing No. 2 project has been designed in accordance with El Paso County criteria. The detention facility has been designed to limit the release of storm runoff. This development will not negatively impact or increase flows in the downstream facilities.

14.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs "Drainage Criteria Manual", 2016.
2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised October 2019.
3. Soil Survey for Colorado Springs and El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.
4. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 2018.
5. "Soils and Geology Study, Windermere Subdivision", prepared by RMG, October 26, 2020, Revised January 18, 2021.
6. "Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1," prepared by Classic Consulting Engineers & Surveyors, October 2014.
7. "Final Drainage Report Marksheffel Road from Constitution Ave. to Dublin Rd.," by CH2M Hill, dated May 2008 and Marksheffel Road Construction Drawings by Wilson & Company.
8. "Final Drainage Report for Windermere Filing No. 1" prepared by Drexel, Barrell & Co., March 8, 2022.

APPENDIX



Vicinity Map
Not to scale



**WINDERMERE
COLORADO SPRINGS, CO
VICINITY MAP**

Drexel, Barrell & Co.
Engineers • Surveyors

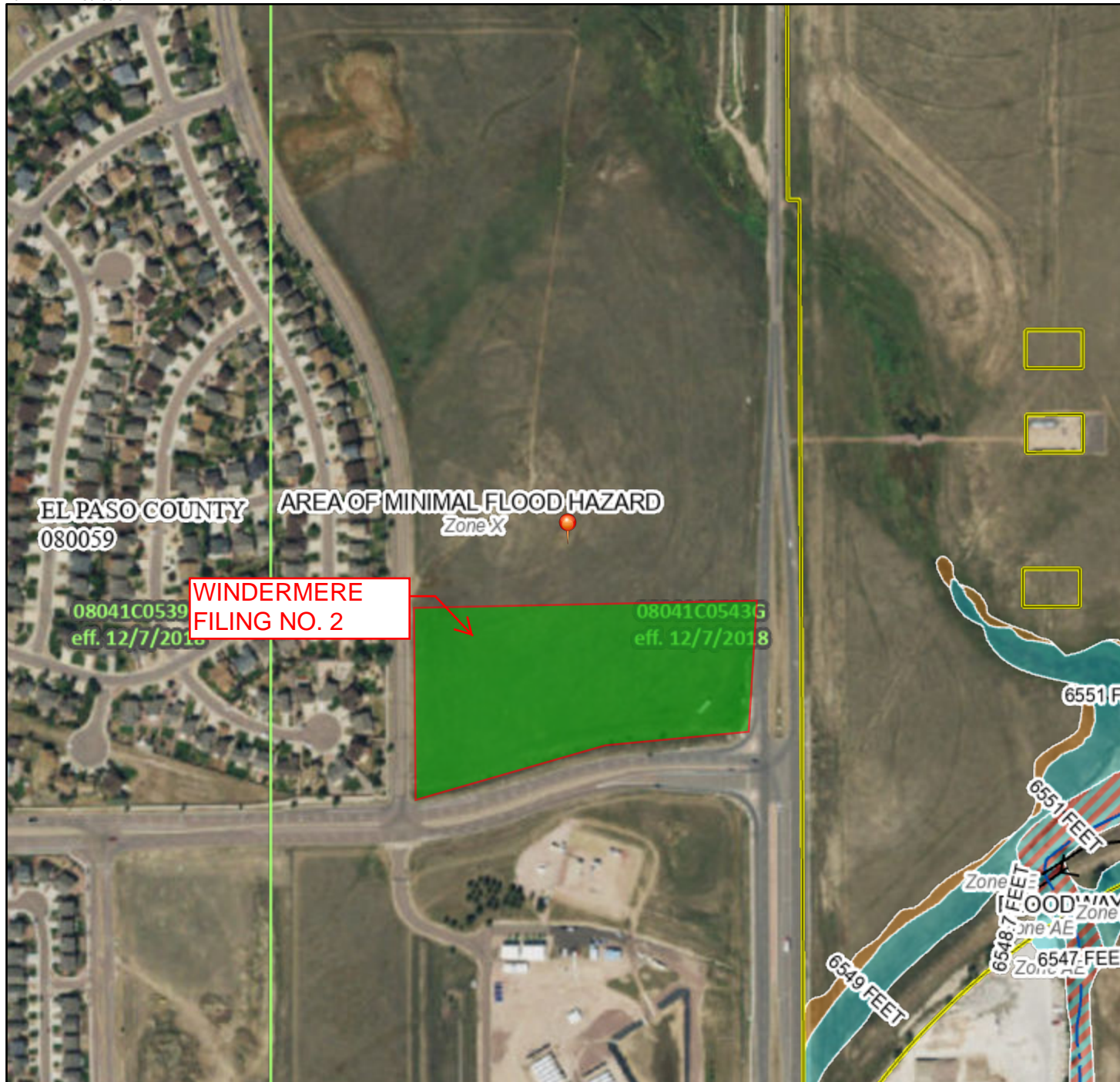
DATE: _____
JOB NO:
21187-00CSCV

DWG. NO.
VMAP
PAGE 123
SHEET 1 OF 1

National Flood Hazard Layer FIRMMette



104°41'24"W 38°53'34"N



Legend

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

- | | | |
|------------------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
<i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | 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 <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard <i>Zone D</i> |
| | | Channel, Culvert, or Storm Sewer |
| OTHER FEATURES | | Levee, Dike, or Floodwall |
| | | 20.2 Cross Sections with 1% Annual Chance |
| | | 17.5 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 |



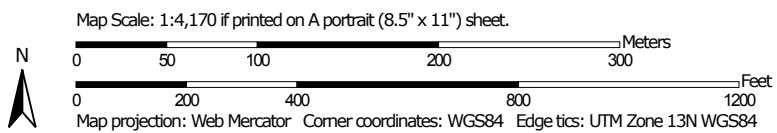
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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 9/8/2021 at 3:46 PM 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.

Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points






-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available


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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: Apr 15, 2011—Jun 17, 2014

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
97	Truckton sandy loam, 3 to 9 percent slopes	A	56.4	100.0%
Totals for Area of Interest			56.4	100.0%

Description

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 soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified



PROJECT INFORMATION								
PROJECT:	Windermere 2							
PROJECT NO:	21187-03							
DESIGN BY:	KGV							Drexel, Barrell & Co.
REV. BY:	TDM							
AGENCY:	El Paso County							
REPORT TYPE:	Preliminary							
DATE:	4/7/2022							
Soil Type: A								
				C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn					0.25		0.35	0
Residential (<1/8 acre)					0.45		0.59	65
Asphalt/Sidewalk					0.90		0.96	100
EXISTING								
SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV	
		ACRE	C2	C5	C10	C100		
EX-A	Landscape/Lawn	13.20		0.25		0.35	0	
	Residential (<1/8 acre)	0.00		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.25		0.35	0%	
TOTAL A1		13.20						
OFFSITE								
D16	Landscape/Lawn	0.00		0.25		0.35	0	
	Residential (<1/8 acre)	2.73		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL D16		2.73						
EXR	Landscape/Lawn	0.00		0.25		0.35	0	
	Residential (<1/8 acre)	0.00		0.45		0.59	65	
	Asphalt/Sidewalk	0.53		0.90		0.96	100	
	WEIGHTED AVERAGE			0.90		0.96	100%	
TOTAL EXR		0.53						
NC2	Landscape/Lawn	0.27		0.25		0.35	0	
	Residential (<1/8 acre)	0.00		0.45		0.59	65	
	Asphalt/Sidewalk	1.34		0.90		0.96	100	
	WEIGHTED AVERAGE			0.79		0.86	83%	
TOTAL NC2		1.61						
NC1	Landscape/Lawn	0.03		0.25		0.35	0	
	Residential (<1/8 acre)	0.00		0.45		0.59	65	
	Asphalt/Sidewalk	0.40		0.90		0.96	100	
	WEIGHTED AVERAGE			0.85		0.92	93%	
TOTAL NC1		0.43						

PROJECT INFORMATION

PROJECT: Windermere 2
 PROJECT NO: 21187-03
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Preliminary
 DATE: 4/7/2022



**RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF
 EXISTING**

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t _i)				TRAVEL TIME (t _t)					PIPE TRAVEL TIME (t _p)				TIME OF CONC. t _c		FINAL t _c
BASIN	DESIGN PT.	C ₅	C ₁₀₀	AREA	LENGTH	HT	SLOPE	t _i	LENGTH	HT	SLOPE	VEL.	t _t	LENGTH	SLOPE	VEL.	t _p	COMP.	MINIMUM	Min
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t _c	t _c	Min
EX-A		0.25	0.35	13.20	50	2	4.0	7.1	690	21	3.0	10.1	1.1					8.2	5	8.2
D16	DP-4-EX	0.45	0.59	2.73	200	10	5.0	10.1	350	12	3.5	6.5	0.9					11.0	5	11.0
EXR		0.90	0.96	0.53	20	2	10.0	0.8	320	6	2.0	4.9	1.1					1.9	5	5.0
DP4+EXA+EXR	DP-6-EX	0.30	0.41	16.46										850	3.0	7.0	2.0	13.0	5	13.0
NC2	DP-19-EX	0.79	0.86	1.61	50	2	4.0	2.6	1340	35	2.6	9.4	2.4					4.9	5	5.0
NC1		0.85	0.92	0.43	45	1	2.2	2.4	185	4	2.2	8.7	0.4					2.7	5	5.0
DP19+NC1+DP6	DP-20-EX	0.36	0.46	18.50										50	1.0	8.4	0.1	13.1	5	13.1

PROJECT INFORMATION

PROJECT: Windermere 2
 PROJECT NO: 21187-03
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Preliminary
 DATE: 4/7/2022



RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING		RUNOFF			5 YR STORM		P1=	1.50
BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF		C * A	I (IN/HR)	Q (CFS)	
			RUNOFF COEFF	t _c (MIN)				
EX-A		13.20	0.25	8.2	3.30	4.40	14.5	
D16	DP-4-EX	2.73	0.45	11.0	1.23	3.96	4.9	
EXR		0.53	0.90	5.0	0.48	5.10	2.4	
DP4+EXA+EXR	DP-6-EX	16.46	0.30	13.0	5.01	3.69	18.5	
NC2	DP-19-EX	1.61	0.79	5.0	1.27	5.10	6.5	
NC1		0.43	0.85	5.0	0.37	5.10	1.9	
DP19+NC1+DP6	DP-20-EX	18.50	0.36	13.1	6.65	3.68	24.5	

PROJECT INFORMATION

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RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING	RUNOFF		100 YR STORM			P1=	2.52	
	BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t _c (MIN)	C * A	I (IN/HR)	Q (CFS)
	EX-A		13.20	0.35	8.2	4.62	7.40	34.2
	D16	DP-4-EX	2.73	0.59	11.0	1.61	6.65	10.7
	EXR		0.53	0.96	5.0	0.51	8.58	4.4
	DP4+EXA+EXR	DP-6-EX	16.46	0.41	13.0	6.74	6.20	41.8
	NC2	DP-19-EX	1.61	0.86	5.0	1.38	8.58	11.8
	NC1		0.43	0.92	5.0	0.39	8.58	3.4
	DP19+NC1+DP6	DP-20-EX	18.50	0.46	13.1	8.51	6.18	52.6

PROJECT INFORMATION								
PROJECT:	Windermere 2							
PROJECT NO:	21187-03							
DESIGN BY:	KGV							
REV. BY:	TDM							
AGENCY:	El Paso County							
REPORT TYPE:	Preliminary							
DATE:	4/7/2022							
Soil Type: A								
				C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn					0.15		0.50	0
Residential (<1/8 acre)					0.45		0.59	65
Asphalt/Sidewalk					0.90		0.96	100
PROPOSED								
SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV	
		ACRE	C2	C5	C10	C100		
A1	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	2.45		0.45		0.59	65	
	Asphalt/Sidewalk	0.44		0.90		0.96	100	
	WEIGHTED AVERAGE			0.52		0.65	70%	
TOTAL A1		2.90						
A2	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	2.85		0.45		0.59	65	
	Asphalt/Sidewalk	0.44		0.90		0.96	100	
	WEIGHTED AVERAGE			0.51		0.64	70%	
TOTAL A2		3.29						
A3	Landscape/Lawn	1.51		0.15		0.50	0	
	Residential (<1/8 acre)	0.00		0.45		0.59	65	
	Asphalt/Sidewalk	0.10		0.90		0.96	100	
	WEIGHTED AVERAGE			0.20		0.53	6%	
TOTAL A3		1.61						
POND								
P1	Landscape/Lawn	1.00		0.15		0.50	0	
	Residential (<1/8 acre)	0.00		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.15		0.50	0%	
TOTAL P1		1.00						
OFFSITE								
B1	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	3.33		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL B1		3.33						
B2	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	0.49		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL B2		0.49						

B4	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.16		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B4		0.16					
Tributary to Pond		12.79					54.9%
D16	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.73		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL D16		2.73					
NC2	Landscape/Lawn	0.27		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	1.34		0.90		0.96	100
	WEIGHTED AVERAGE			0.77		0.88	83%
TOTAL NC2		1.61					
EXR	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.53		0.90		0.96	100
	WEIGHTED AVERAGE			0.90		0.96	100%
TOTAL EXR		0.53					
C3	Landscape/Lawn	0.63		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C3		0.63					
NC1	Landscape/Lawn	0.03		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.40		0.90		0.96	100
	WEIGHTED AVERAGE			0.85		0.93	93%
TOTAL NC1		0.43					

PROJECT INFORMATION

PROJECT: Windermere 2
 PROJECT NO: 21187-03
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Preliminary
 DATE: 4/7/2022

Note: detailed review will be provided with the final plat/SDP.



RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA				INITIAL/OVERLAND TIME (t _i)				TRAVEL TIME (t _t)				PIPE TRAVEL TIME (t _p)				TIME OF CONC. t _c		FINAL t _c		
BASIN	DESIGN PT.	C ₅	C ₁₀₀	AREA Ac	LENGTH Ft	HT FT	SLOPE %	t _i Min	LENGTH Ft	HT FT	SLOPE %	VEL. FPS	t _t Min	LENGTH Ft	SLOPE %	VEL. FPS	t _p Min	COMP. t _c	MINIMUM t _c	Min
A1	1	0.52	0.65	2.90	50	2	4.0	4.8	690	21	3.0	10.1	1.1					6.0	5	6.0
A2		0.51	0.64	3.29	100	1	1.0	11.0	720	22	3.0	10.1	1.2					12.2	5	12.2
A1+A2	2	0.51	0.64	6.19														12.2	5	12.2
B1		0.45	0.59	3.33	35	1	3.5	4.7	885	30	3.4	10.8	1.4					6.1	5	6.1
B2		0.45	0.59	0.49	50	2	4.0	5.4	725	20	2.8	9.8	1.2					6.6	5	6.6
DP2+B1+B2	3	0.49	0.62	10.01										212	0.5	5.1	0.7	12.9	5	12.9
B4		0.45	0.59	0.16	50	17	33.3	2.7	185	3	1.5	4.0	0.8					3.4	5	5.0
P1		0.15	0.50	1.00	100	1	1.0	17.8	205	10	4.8	12.8	0.3					18.0	5	18.0
DP3+B4+P1	4	0.46	0.61	11.18					250	2.5	1.0	4.0	1.0					13.9	5	13.9
D16	5	0.45	0.59	2.73	200	10	5.0	10.1	350	12	3.5	6.5	0.9					11.0	5	11.0
A3		0.20	0.53	1.61	100	10	10.0	7.8	670	25	3.7	11.3	1.0					8.8	5	8.8
NC2		0.77	0.88	1.61	50	2	4.0	2.7	1340	35	2.6	9.4	2.4					5.1	5	5.1
A3+NC2	19	0.49	0.71	3.22					100	10	10.0	7.8	0.2					9.0	5	9.0
EXR		0.90	0.96	0.53	20	2	10.0	0.8	320	6	2.0	4.9	1.1					1.9	5	5.0
C3		0.15	0.50	0.63	60	12	20.0	5.1	455	15	3.3	5.6	1.4					6.4	5	6.4
EXR+C3+DP5	S	0.46	0.63	3.89										850	3.0	11.8	1.2	12.2	5	12.2
DP19+DPS	J1	0.47	0.66	7.11										100	1.0	5.9	0.3	12.4	5	12.4
NC1		0.85	0.93	0.43	45	1	2.2	2.4	185	4	2.2	8.7	0.4					2.8	5	5.0
DPJ1+NC1	20	0.49	0.68	7.54										50	1.0	8.4	0.1	12.5	5	12.5

PROJECT INFORMATION

PROJECT: Windermere 2
 PROJECT NO: 21187-03
 DESIGN BY: KGV
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Preliminary
 DATE: 4/7/2022



RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED	RUNOFF		5 YR STORM		P1=		1.50
BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF		C * A	I (IN/HR)	Q (CFS)
			RUNOFF COEFF	t _c (MIN)			
A1	1	2.90	0.52	6.0	1.50	4.87	7.3
A2		3.29	0.51	12.2	1.68	3.79	6.4
A1+A2	2	6.19	0.51	12.2	3.19	3.79	12.1
B1		3.33	0.45	6.1	1.50	4.84	7.2
B2		0.49	0.45	6.6	0.22	4.72	1.0
DP2+B1+B2	3	10.01	0.49	12.9	4.91	3.70	18.2
B4		0.16	0.45	5.0	0.07	5.10	0.4
P1		1.00	0.15	18.0	0.15	3.17	0.5
DP3+B4+P1	4	11.18	0.46	13.9	5.13	3.58	18.4
D16	5	2.73	0.45	11.0	1.23	3.96	4.9
A3		1.61	0.20	8.8	0.32	4.30	1.4
NC2		1.61	0.77	5.1	1.25	5.08	6.3
A3+NC2	19	3.22	0.49	9.0	1.56	4.26	6.7
EXR		0.53	0.90	5.0	0.48	5.10	2.4
C3		0.63	0.15	6.4	0.09	4.76	0.5
Pond Release							0.3
EXR+C3+DP5+POND RELEASE	S	3.89	0.46	12.2	1.80	3.80	7.1
DP19+DPS	J1	7.11	0.47	12.4	3.36	3.76	12.9
NC1		0.43	0.85	5.0	0.36	5.10	1.9
DPJ1+NC1	20	7.54	0.49	12.5	3.73	3.75	14.3

PROJECT INFORMATION

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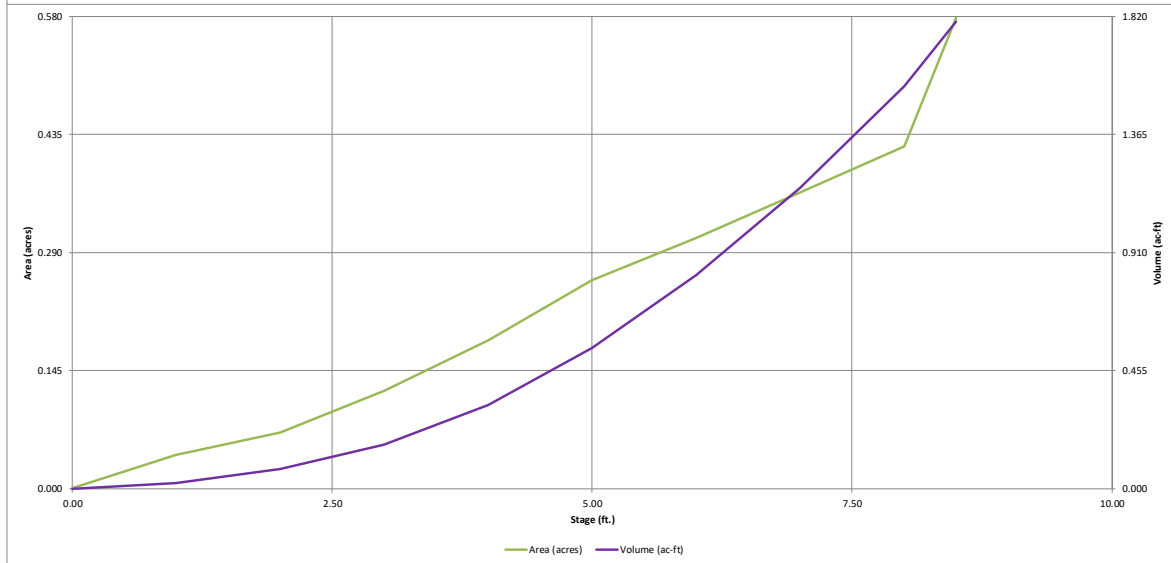
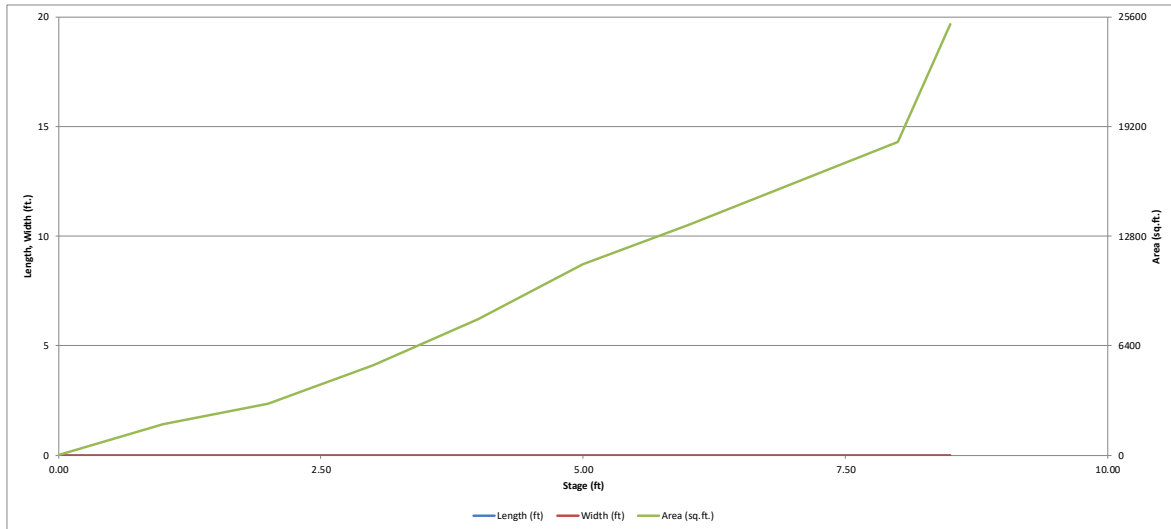
Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED	RUNOFF	100 YR STORM		P1=	2.52		
BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF		C * A	I (IN/HR)	Q (CFS)
			RUNOFF COEFF	t _c (MIN)			
A1	1	2.90	0.65	6.0	1.88	8.17	15.3
A2		3.29	0.64	12.2	2.11	6.36	13.4
A1+A2	2	6.19	0.64	12.2	3.98	6.36	25.4
B1		3.33	0.59	6.1	1.96	8.12	16.0
B2		0.49	0.59	6.6	0.29	7.92	2.3
DP2+B1+B2	3	10.01	0.62	12.9	6.24	6.22	38.8
B4		0.16	0.59	5.0	0.09	8.58	0.8
P1		1.00	0.50	18.0	0.50	5.33	2.7
DP3+B4+P1	4	11.18	0.61	13.9	6.83	6.01	41.1
D16	5	2.73	0.59	11.0	1.61	6.65	10.7
A3		1.61	0.53	8.8	0.85	7.22	6.1
NC2		1.61	0.88	5.1	1.42	8.54	12.1
A3+NC2	19	3.22	0.71	9.0	2.27	7.15	16.3
EXR		0.53	0.96	5.0	0.51	8.58	4.4
C3		0.63	0.50	6.4	0.32	8.00	2.5
Pond Release							10.6
EXR+C3+DP5+POND RELEASE	S	3.89	0.63	12.2	2.43	6.38	26.1
DP19+DPS	J1	7.11	0.66	12.4	4.71	6.32	40.3
NC1		0.43	0.93	5.0	0.40	8.58	3.4
DPJ1+NC1	20	7.54	0.68	12.5	5.10	6.29	42.7

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

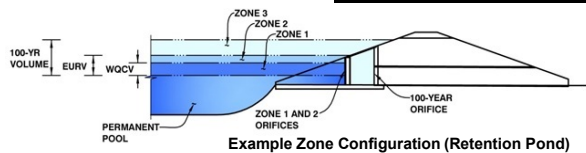


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.03 (May 2020)*

Project: Windermere Filing No. 2

Basin ID: Pond - Final



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.48	0.235	Orifice Plate
Zone 2 (EURV)	6.03	0.596	Orifice Plate
Zone 3 (100-year)	7.35	0.458	Weir&Pipe (Restrict)
Total (all zones)		1.289	

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

Underdrain Orifice Invert Depth =	<input type="text" value=""/>	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	<input type="text" value=""/>	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	<input type="text" value=""/>	ft ²
Underdrain Orifice Centroid =	<input type="text" value=""/>	feet

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

Invert of Lowest Orifice =	<input type="text" value="0.00"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	<input type="text" value="6.03"/>	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	<input type="text" value="24.10"/>	inches
Orifice Plate: Orifice Area per Row =	<input type="text" value="N/A"/>	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	<input type="text" value="N/A"/>	ft ²
Elliptical Half-Width =	<input type="text" value="N/A"/>	feet
Elliptical Slot Centroid =	<input type="text" value="N/A"/>	feet
Elliptical Slot Area =	<input type="text" value="N/A"/>	ft ²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	<input type="text" value="0.00"/>	<input type="text" value="2.01"/>	<input type="text" value="4.02"/>					
Orifice Area (sq. inches)	<input type="text" value="1.10"/>	<input type="text" value="1.70"/>	<input type="text" value="2.00"/>					

	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)

	<input type="checkbox"/> Not Selected	<input type="checkbox"/> Not Selected	
Invert of Vertical Orifice =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Vertical Orifice

	<input type="checkbox"/> Not Selected	<input type="checkbox"/> Not Selected	
Vertical Orifice Area =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	ft ²
Vertical Orifice Centroid =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	feet

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	
Overflow Weir Front Edge Height, H _o =	<input type="text" value="6.40"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="3.92"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Grate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="3.92"/>	<input type="text" value="N/A"/>	feet
Overflow Grate Open Area % =	<input type="text" value="70%"/>	<input type="text" value="N/A"/>	%, grate open area/total area
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _t =	<input type="text" value="6.40"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="3.92"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="14.68"/>	<input type="text" value="N/A"/>	
Overflow Grate Open Area w/o Debris =	<input type="text" value="10.78"/>	<input type="text" value="N/A"/>	ft ²
Overflow Grate Open Area w/ Debris =	<input type="text" value="5.39"/>	<input type="text" value="N/A"/>	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.50"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="18.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="7.80"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="0.73"/>	<input type="text" value="N/A"/>	ft ²
Outlet Orifice Centroid =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="1.44"/>	<input type="text" value="N/A"/>	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	<input type="text" value="6.94"/>	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	<input type="text" value="27.00"/>	feet
Spillway End Slopes =	<input type="text" value="4.00"/>	H:V
Freeboard above Max Water Surface =	<input type="text" value="1.00"/>	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	<input type="text" value="0.55"/>	feet
Stage at Top of Freeboard =	<input type="text" value="8.49"/>	feet
Basin Area at Top of Freeboard =	<input type="text" value="0.58"/>	acres
Basin Volume at Top of Freeboard =	<input type="text" value="1.80"/>	acre-ft

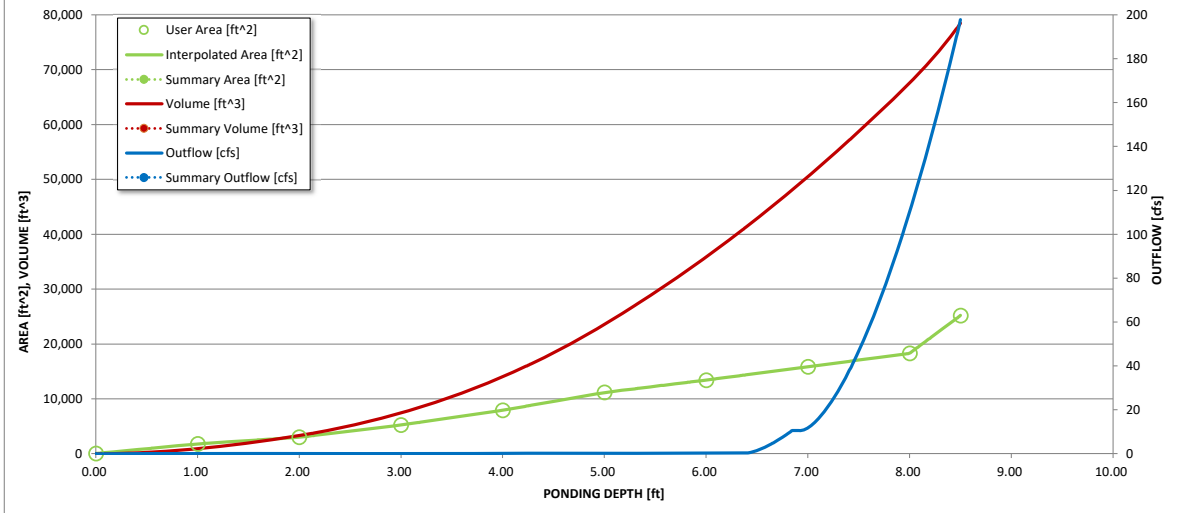
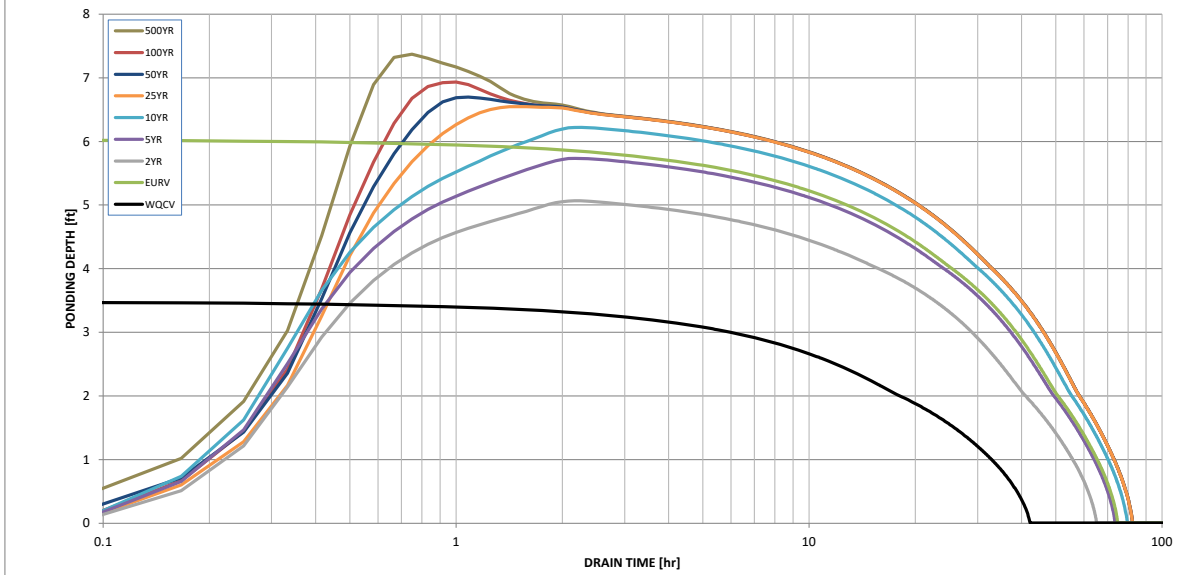
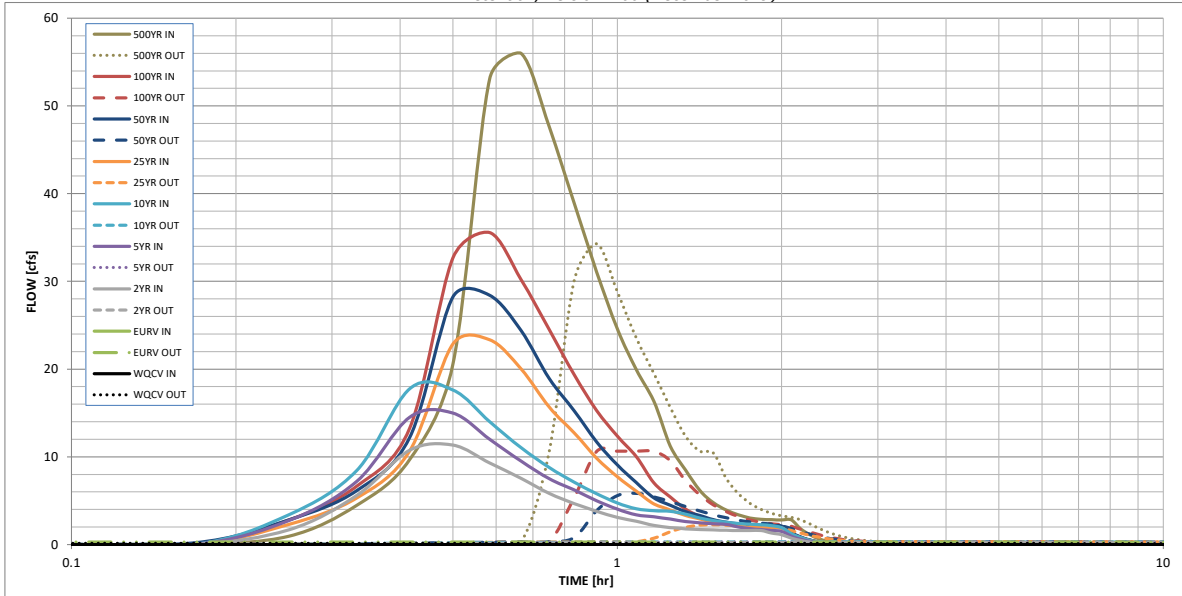
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.235	0.831	0.593	0.785	0.938	1.163	1.384	1.660	2.617
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.593	0.785	0.938	1.163	1.384	1.660	2.617
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.3	0.4	3.3	6.4	10.4	23.5
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	0.03	0.26	0.50	0.81	1.83
Peak Inflow Q (cfs) =	N/A	N/A	11.3	15.0	17.8	23.3	28.4	35.6	56.0
Peak Outflow Q (cfs) =	0.1	0.3	0.3	0.3	0.3	2.3	5.8	10.6	34.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	0.8	0.7	0.9	1.0	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.5	1.0	1.0
Max Velocity through Gate 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) =	38	64	57	64	68	69	67	65	58
Time to Drain 99% of Inflow Volume (hours) =	40	70	62	69	75	77	76	75	72
Maximum Ponding Depth (ft) =	3.48	6.03	5.06	5.73	6.22	6.54	6.69	6.93	7.37
Area at Maximum Ponding Depth (acres) =	0.15	0.31	0.26	0.29	0.32	0.34	0.35	0.36	0.38
Maximum Volume Stored (acre-ft) =	0.236	0.832	0.556	0.742	0.889	0.998	1.049	1.134	1.294

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.19	0.02	0.95
	0:15:00	0.00	0.00	1.68	2.73	3.39	2.28	2.81	2.79	4.49
	0:20:00	0.00	0.00	5.61	7.23	8.47	5.32	6.15	6.66	9.68
	0:25:00	0.00	0.00	10.75	14.52	17.75	10.67	12.20	13.26	20.56
	0:30:00	0.00	0.00	11.32	14.97	17.61	22.87	28.23	32.69	53.10
	0:35:00	0.00	0.00	9.30	12.01	14.00	23.34	28.40	35.57	55.97
	0:40:00	0.00	0.00	7.55	9.51	11.03	20.01	24.38	30.21	47.63
	0:45:00	0.00	0.00	5.82	7.52	8.79	15.67	18.93	24.52	38.91
	0:50:00	0.00	0.00	4.67	6.22	7.11	12.74	15.26	19.35	31.09
	0:55:00	0.00	0.00	3.80	5.00	5.79	9.84	11.69	15.27	24.59
	1:00:00	0.00	0.00	3.09	4.02	4.72	7.73	9.07	12.35	19.94
	1:05:00	0.00	0.00	2.65	3.40	4.07	6.08	7.06	10.03	16.32
	1:10:00	0.00	0.00	2.19	3.15	3.85	4.64	5.31	7.03	11.24
	1:15:00	0.00	0.00	1.94	2.90	3.78	3.95	4.48	5.42	8.50
	1:20:00	0.00	0.00	1.80	2.64	3.47	3.31	3.74	4.04	6.17
	1:25:00	0.00	0.00	1.71	2.47	3.02	2.93	3.30	3.20	4.77
	1:30:00	0.00	0.00	1.66	2.36	2.72	2.51	2.83	2.71	3.93
	1:35:00	0.00	0.00	1.63	2.30	2.53	2.25	2.54	2.38	3.37
	1:40:00	0.00	0.00	1.60	2.01	2.40	2.09	2.35	2.17	3.03
	1:45:00	0.00	0.00	1.59	1.81	2.32	1.99	2.23	2.07	2.87
	1:50:00	0.00	0.00	1.59	1.69	2.26	1.93	2.17	2.04	2.82
	1:55:00	0.00	0.00	1.31	1.61	2.15	1.90	2.13	2.02	2.80
	2:00:00	0.00	0.00	1.13	1.50	1.92	1.88	2.11	2.02	2.80
	2:05:00	0.00	0.00	0.72	0.96	1.24	1.21	1.36	1.30	1.79
	2:10:00	0.00	0.00	0.45	0.60	0.78	0.77	0.86	0.82	1.13
	2:15:00	0.00	0.00	0.27	0.37	0.48	0.47	0.53	0.50	0.69
	2:20:00	0.00	0.00	0.15	0.22	0.28	0.28	0.31	0.30	0.41
	2:25:00	0.00	0.00	0.08	0.12	0.15	0.16	0.18	0.17	0.23
	2:30:00	0.00	0.00	0.03	0.06	0.06	0.07	0.08	0.07	0.10
	2:35:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.02
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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	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
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	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
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	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

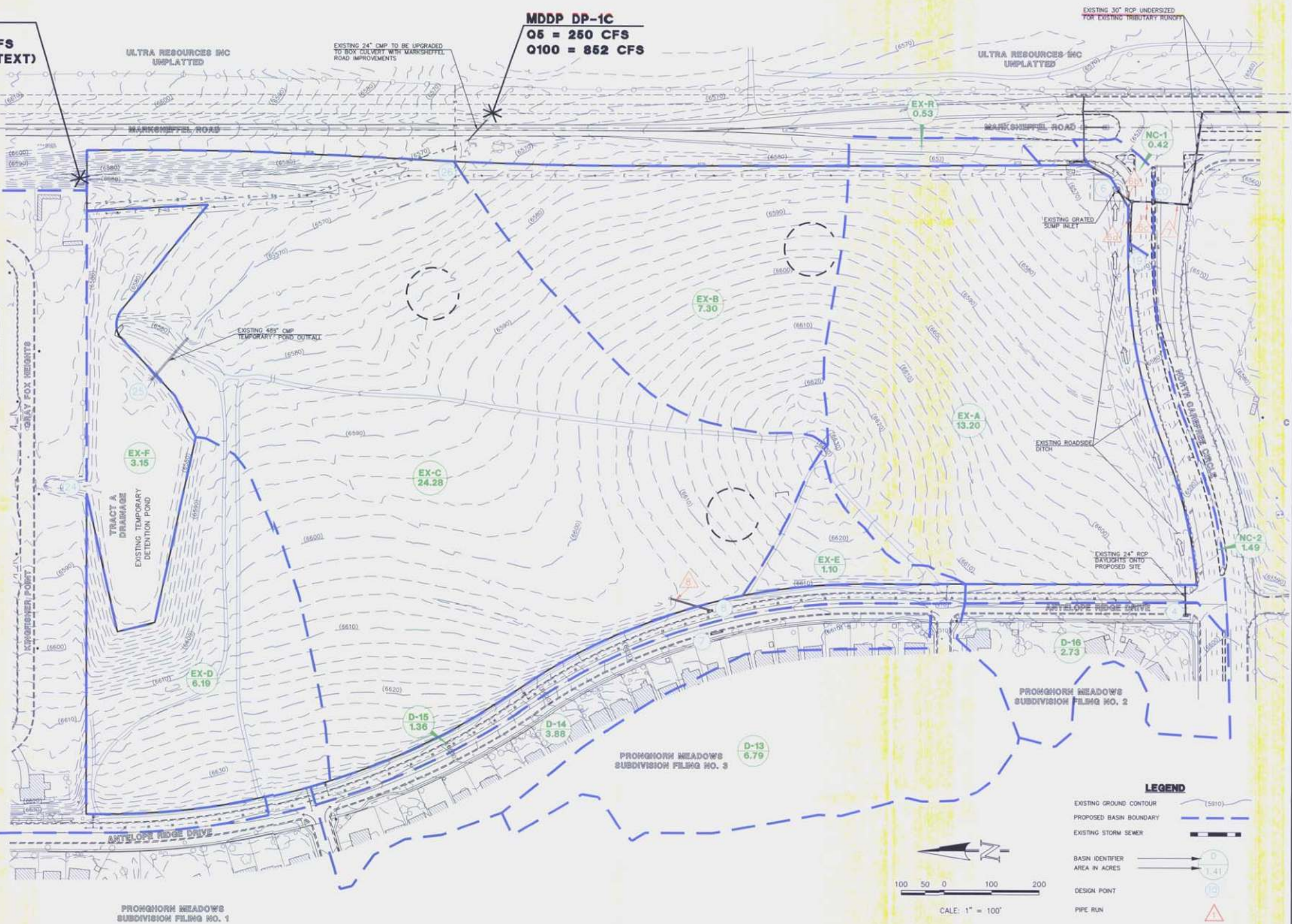
BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
EX-A	11.3	28.2
EX-B	5.7	14.2
EX-C	17.7	44.1
EX-D	5.8	14.5
EX-E	1.0	2.6
EX-F	4.0	10.0
EX-R	1.7	3.4
D-13	13.8	28.5
D-14	7.2	15.1
D-15	4.6	8.6
D-16	7.2	14.6
NC-1	1.9	3.6
NC-2	6.7	12.5
WS	47.3	86.4
CT	90.8	184.7

MDDP DP-1X
Q5 = 185 CFS
Q100 = 600 CFS
(SEE REPORT TEXT)

MDDP DP-1C
Q5 = 250 CFS
Q100 = 852 CFS

PIPE RUN SUMMARY			
PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
6A	4.8	8.1	EX. 18"
6B	18.4	42.6	EX. 24"
6C	21.6	47.9	EX. 24"
7	24.2	53.3	EX. 30"
8	24.7	50.9	EX. 36"

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	FACILITY
4	7.2	14.6	EX. 8" SUMP INLET
6	18.4	42.6	EX. TYPE D GRATED INLET
7	20.0	41.6	EX. 25' SUMP INLET
8	5.6	11.2	EX. 10' SUMP INLET
19	6.7	12.5	EX. 15" AT-GRADE INLET
20	3.7	8.0	EX. 10' SUMP INLET
24	111.3	199.7	OFF-SITE RUNOFF TO POND
25	117.5	215.1	TOTAL EXISTING TO POND
26	138.3	266.9	EX. TO MARKSHEFFEL RD.



CHATEAU AT ANTELOPE
 RIDGE FILING NO. 2
 LOT 1

WHISPERING SPRINGS
 DEVELOPMENT

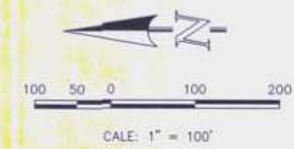
PROMHORN MEADOWS
 SUBDIVISION FILING NO. 1

PROMHORN MEADOWS
 SUBDIVISION FILING NO. 3

PROMHORN MEADOWS
 SUBDIVISION FILING NO. 2

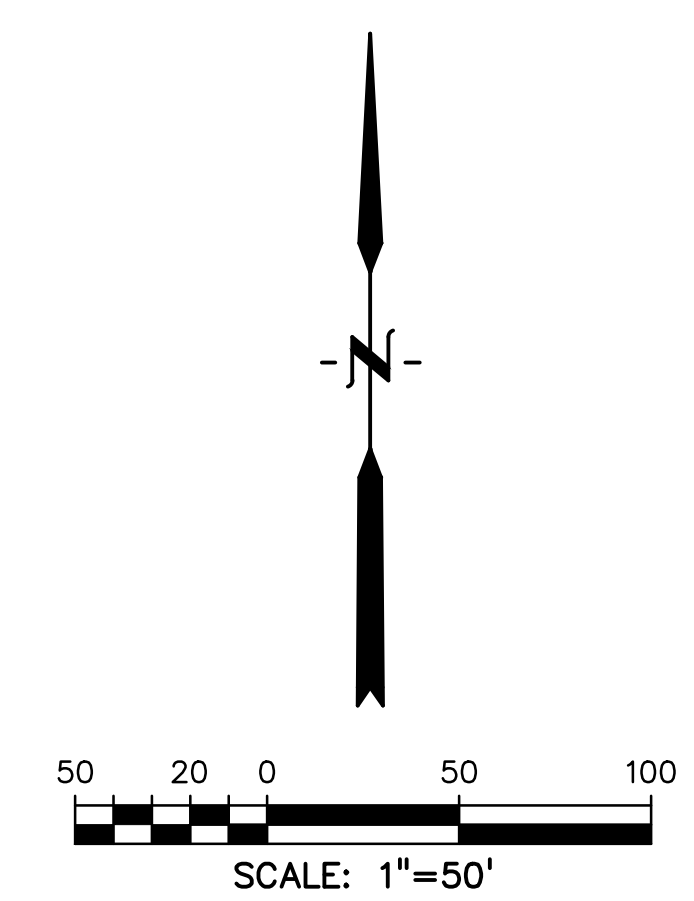
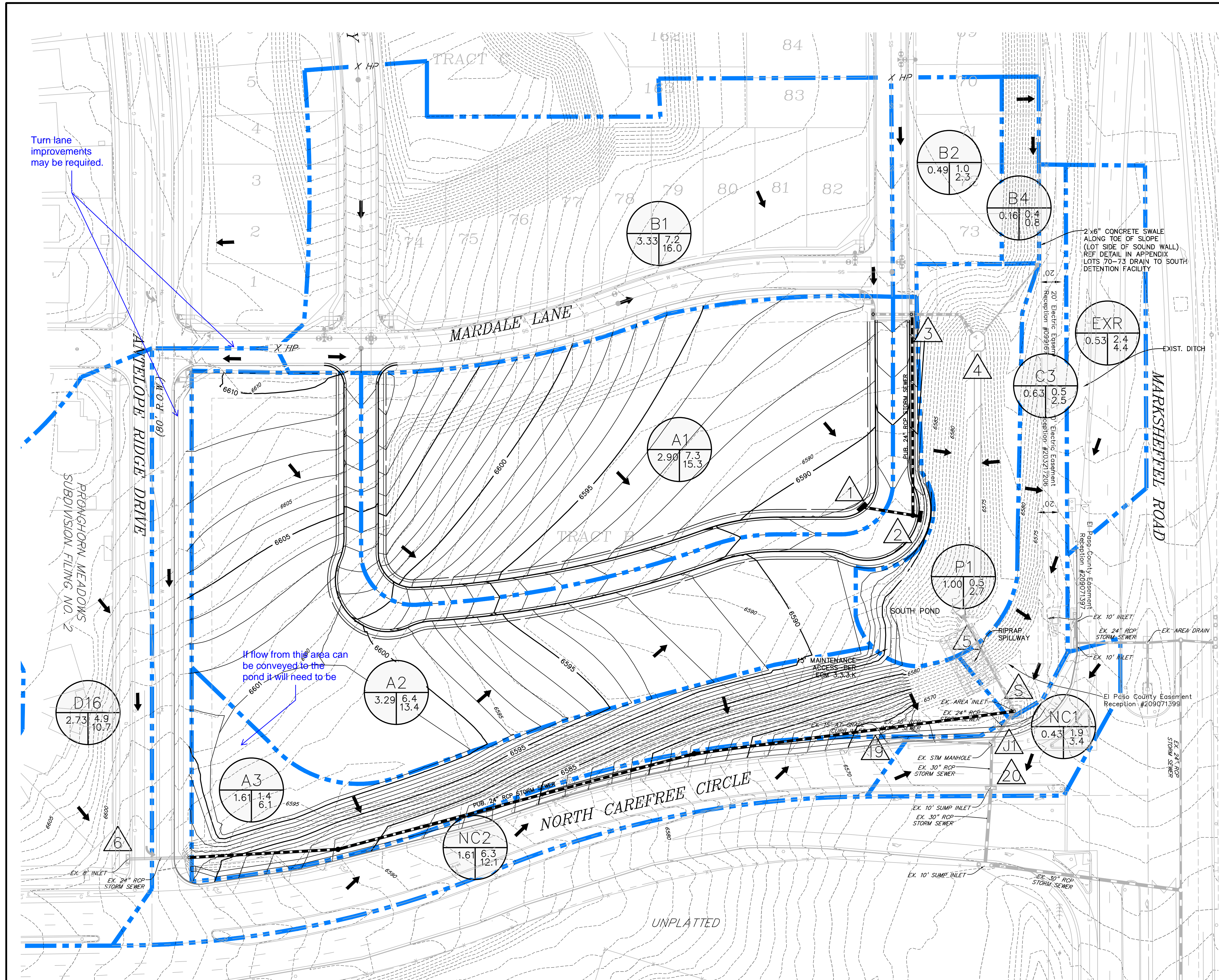
LEGEND

- EXISTING GROUND CONTOUR (5810)
- PROPOSED BASIN BOUNDARY
- EXISTING STORM SEWER
- BASIN IDENTIFIER
- AREA IN ACRES
- DESIGN POINT
- PIPE RUN



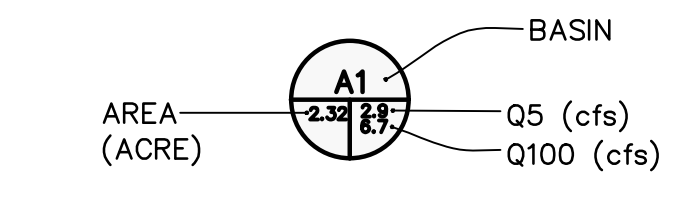
CLASSIC CONSULTING ENGINEERS & SURVEYORS, LLC
 6385 Corporate Drive, Suite 101, Colorado Springs, Colorado 80915
 (719) 785-0790
 PAGE 123

<p>48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS 811 UTILITY NOTIFICATION OF COLORADO IT'S THE LAW</p> <p>THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE MANNER ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.</p>	NO. REVISION _____ _____ _____	DATE _____ _____ _____	REVIEW: PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE _____	<p>6385 Corporate Drive, Suite 101 Colorado Springs, Colorado 80915 (719) 785-0790 (719) 785-0799(Fax)</p>	WINDERMERE EXISTING CONDITIONS DRAINAGE MAP PRELIMINARY DRAINAGE REPORT WINDERMERE FINAL DRAINAGE REPORT WINDERMERE FIL NO. 1
	DESIGNED BY: MAL DRAWN BY: MAL CHECKED BY: (V) 1" = N/A	SCALE: (H) 1" = 100' SHEET: 1 OF 1 JOB NO.: 2241.000	DATE: 09/01/14		



LEGEND

- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR
- EX. INTERMEDIATE CONTOUR
- EX. INDEX CONTOUR
- PROPOSED STORM SEWER
- PROPOSED INLET
- PROPOSED FLARED END SECTION
- EX. MANHOLE
- EX. STORM SEWER
- BASIN BOUNDARY
- FLOW DIRECTION
- DESIGN POINT



BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	2.90	7.3	15.3
A2	3.29	6.4	13.4
B1	3.33	7.2	16.0
B2	0.49	1.0	2.3
B4	0.16	0.4	0.8
P1	1.00	0.5	2.7
D16	2.73	4.9	10.7
A3	1.61	1.4	6.1
NC2	1.61	6.3	12.1
EXR	0.53	2.4	4.4
C3	0.63	0.5	2.5
Pond Release	0.00	0.3	10.6
NC1	0.43	1.9	3.4

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
1	2.90	7.3	15.3
2	6.19	12.1	25.4
3	10.01	18.2	38.8
4	11.18	18.4	41.1
5	2.73	4.9	10.7
19	3.22	6.7	16.3
S	3.89	7.1	26.1
J1	7.11	12.9	40.3
20	7.54	14.3	42.7

PREPARED BY:

DREXEL, BARRELL & CO.
 Engineers • Surveyors
 3 SOUTH 7TH STREET
 COLORADO SPGS, COLORADO 80905
 CONTACT: TIM D. MCCONNELL, P.E.
 (719) 260-0887
 BOULDER • COLORADO SPRINGS • GREELEY

CLIENT:
 COLO WINDERMERE #2, LLC
 4164 AUSTIN BLUFFS FWY, #361
 COLORADO SPRINGS, CO 80918
 (719) 200-9594
 CONTACT: JAMES TODD STEPHENS

DRAINAGE PLANS FOR
WINDERMERE FILING 2
 N. MARKSHEFFEL ROAD
 EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	4/1/22

DESIGNED BY: KGV
 DRAWN BY: KGV
 CHECKED BY: TDM

FILE NAME:
 PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
 HORIZONTAL: 1" = 50'
 VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187-03CSCV
 DRAWING NO.

DR

SHEET: 1 OF 1

COUNTY FILE NO.: _____