AMENDMENT TO THE

PRELIMINARY DRAINAGE REPORT

for

WINDERMERE

Colorado Springs, CO

November 6, 2020

Engineering Review

12/09/2020 2:52:30 PM
dsdrice
JeffRice@elpasoco.com
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EPC Planning & Community Development Department

Cursory comments. See comment letter also.

Prepared for:

Windsor Ridge Homes
4164 Austin Bluffs Pkwy #361
Colorado Springs, CO 80918
Contact: James Todd Stephens
(719) 200-9594

Prepared by:

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PRELIMINARY DRAINAGE REPORT

for

WINDERMERE

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: Windsor Ridge Homes

By:

James Todd Stephens Date

Title: President

Address: 4164 Austin Bluffs Pkwy #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
CONDITION

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Windermere Preliminary Plan Amendment. 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 Chateau at Antelope Ridge subdivision, on the east by Marksheffel Rd., and on the south by N. Carefree Cir.

Site Conditions

The site is approximately 52.07 acres in size and is proposed as a single family home subdivision. The proposed site development includes approximately 203 single-family residences and will be developed in two filings. The site is currently undeveloped and is covered with native grass and vegetation. The site is located within the Sand Creek Drainage Basin. Historically, this site drains in all directions with a large hill in the southern half of the site and an existing temporary detention facility located at the northern end. There is a large roadside ditch adjacent to Marksheffel Road (M.D.D.P. DP-1x) that routes off-site (non-tributary to site facilities) runoff to the existing 24" CMP storm culvert under Marksheffel Road. This site has been previously studied as part of the previously approved "Master Development Drainage Plan for Hilltop Subdivision El Paso County, Colorado" by URS Greiner, Inc. last revised February 1998.

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 "areas determined to be outside 500-year floodplain". A firmette map is included in the appendix.

4.0 EXISTING HYDROLOGY

This report is an amendment to the Preliminary Drainage Report for Windermere. Existing conditions have not changed. The existing detention facility at the north end of the project has already been temporarily capturing flows from the Chateau at Antelope Ridge subdivision to the north. This facility will be replaced with an expanded pond of larger capacity meeting current drainage criteria to include concrete forebays at all inflows, a concrete trickle channel at the bottom, an outlet structure and pipe that will reduce the release of flows, and a reinforced spillway on the east side of the facility. Please refer to "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014 for the write up for existing conditions and existing drainage map. (in Appendix _)

5.0 PROPOSED HYDROLOGY (RATIONAL METHOD) & HYDRAULIC SUMMARY

For the purposes of site specific analysis, the project site has been divided into several grouped drainage basins as shown on the proposed drainage plan. Twenty three (23) Design Points have been analyzed for sizing of the drainage facilities.

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals. Urban Drainage UD-Detention, UD-Inlet and Flowmaster were also used to identify pond and storm system sizing (see appendix for calculations). See below for a summary runoff table.

Rational Method Runoff Summary

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	2.16	4.9	11.4
A2	4.70	9.0	20.9
A3	1.63	4.6	9.9
A4	1.01	1.7	4.0
A5	1.98	4.3	10.1
A6	3.75	7.0	16.4
A7	1.33	2.5	5.9
A8	2.96	6.1	14.2
A9	1.86	4.0	9.2
A10	4.00	7.5	17.5

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	2.16	4.9	11.4
8	14.19	26.8	55.7
B	4.70	9.0	20.9
C	20.52	34.4	73.7
D	21.53	35.6	76.5
E	1.98	4.3	10.1
F	27.26	43.2	94.2
G	1.33	2.5	5.9
H	2.96	6.1	14.2
I	1.86	4.0	9.2

A11	2.66	5.3	12.4
A12	9.75	9.4	41.0
B1	3.62	7.9	18.4
B2	2.94	6.2	14.6
B3	2.91	5.7	13.3
B4	0.53	0.4	2.4
B5	0.75	1.1	3.6
C1	4.27	4.8	18.6
C2	2.28	3.6	10.1
C3	0.13	0.1	0.6

J	6.15	12.2	28.5
K	33.41	51.0	112.4
L	37.41	56.0	124.2
M	40.07	59.4	132.2
24	42.07	111.3	199.7
N	49.82	175.6	355.6
O	3.62	7.9	18.4
P	2.94	6.2	14.6
Q	2.91	5.7	13.3
R	10.00	18.8	45.2
4		7.2	14.6
EXR	0.53	1.7	3.4
S	1.28	10.3	26.9
T	434.39	191.2	638.3
U	2.28	3.6	10.1
V	0.13	0.1	0.6
19	3.89	8.8	20.5
J1	5.17	21.6	53.8
20	5.60	23.1	56.7

Was this an SCS method calculation?

A-group basins represent on-site flows that are captured by the pond on the north end of the site. The pond is a proposed Full Spectrum EDB with an outfall via a 30" pipe.

DP-A are the flows from Basin A1, which flow off-site into Antelope Ridge Dr. where they are picked up by the existing 10' inlet at Design Point 8. The flows from Basin A1 are Q_5=4.9 cfs and Q_{100}=11.4 cfs.

DP-8 is an existing design point in Antelope Ridge Dr. at a 10' sump inlet. This design point captures all of the flows from Basin A1 as well as the offsite flows from Basins D-13, D-14 and D-15 and conveys them towards DP-C. More information can be found on these offsite flows in the "Preliminary Drainage Report for Windermere and Final Drainage Report for Windermere Filing No. 1," October 2014. The combined flows at DP-8 are Q_5=26.8 cfs and Q_{100}=55.7 cfs.

DP-B is located at the two proposed at-grade Double Type R inlets in Basin A2. The flows leave this inlet via a 24" storm pipe towards DP-C. This design point captures all of the flows from Basin A2. The flows from Basin A2 are Q_5=9.0 cfs and Q_{100}=20.9 cfs.

DP-C is located at the proposed at-grade Double Type R inlet in Basin A3. The flows leave this inlet via a 36" storm pipe towards DP-D. This design point captures all of the flows from Basins A1 through A3 and offsite Basins D-13 through D-15. The combined flows at DP-C are Q_5=34.4 cfs and Q_{100}=73.7 cfs.

DP-D is located at the proposed at-grade Single Type R inlet in Basin A4. The flows leave this inlet via a 36" storm pipe and are conveyed towards DP-F. This design point captures all of the flows from Basins A1 through A4 and offsite Basins D-13 through D-15. The combined flows at DP-D are Q_5=35.6 cfs and Q_{100}=76.5 cfs.

DP-E is located at the proposed at-grade Double Type R inlet in Basin A5. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-F. This design point captures all of the flows from Basin A5. The flows from Basin A5 are Q_5=4.3 cfs and Q_{100}=10.1 cfs.

DP-F is located at the proposed at-grade Triple Type R inlet in Basin A6. The flows leave this inlet via a 36" storm pipe and are conveyed towards DP-K. This design point captures all of the flows from Basins A1 through A6 and offsite Basins D-13 through D-15. The combined flows at DP-F are Q_5=43.2 cfs and Q_{100}=94.2 cfs.

DP-G is located at the proposed at-grade Single Type R inlet in Basin A7. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-H. This design point captures all of the flows from Basin A7. The flows from Basin A7 are Q_5=2.5 cfs and Q_{100}=5.9 cfs.

DP-H is located at the proposed at-grade Triple Type R inlet in Basin A8. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-J. This design point captures all of the flows from Basins A7 and A8. The combined flows at DP-H are Q_5=6.1 cfs and Q_{100}=14.2 cfs.

DP-I is located at the proposed at-grade Double Type R inlet in Basin A9. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-J. This design point captures all of the flows from Basin A9. The flows from Basin A9 are Q_5=4.0 cfs and Q_{100}=9.2 cfs.

DP-J is located at the proposed 18"x30" wye in Basin A10. The flows leave this wye via a 30" storm pipe which conveyed the flows towards DP-K. This design point captures all of the flows from Basins A7 through A9. The combined flows at DP-J are Q_5=12.2 cfs and Q_{100}=28.5 cfs.

DP-K is located at the proposed manhole in Basin A10. The flows leave this manhole via a 48" storm pipe and are conveyed towards DP-L. This design point captures all of the flows from Basins A1 through A9 and offsite Basins D-13 through D-15. The combined flows at DP-K are Q_5=51.0 cfs and Q_{100}=112.4 cfs.

DP-L is located at the two proposed sump 10' Type R inlets in Basin A10. The flows leave this inlet via a 48" storm pipe and are conveyed towards DP-M. This design point captures all of the flows from Basins A1 through A10 and offsite Basins D-13 through D-15. The combined flows at DP-L are Q_5=56.0 cfs and Q_{100}=124.2 cfs.

DP-M is located at the proposed sump 15' Type R inlet in Basin A11. The flows leave this inlet via a 48" storm pipe and are conveyed into the north Full Spectrum EDB pond. This design point captures all of the flows from Basins A1 through A11 and offsite Basins D-13 through D-15. The combined flows at DP-M are Q_5=59.4 cfs and Q_{100}=132.2 cfs.

DP-N is located at the bottom of the north proposed Full Spectrum EDB pond in Basin A12. The flows leave the pond via an outlet structure and a 30" storm pipe which conveys the flows to the roadside ditch along Marksheffel Rd. towards DP-T. This design point reflects all of the flows from all "A" basins, offsite basins D-13 through D-15, and offsite flows entering the pond from offsite Basins CT and WS. More information can be found on offsite flows from Basins CT and WS in the "Preliminary Drainage Report for Windermere and Final Drainage Report for Windermere Filing No. 1," October 2014. The combined flows at DP-N are Q_5=175.6 cfs and Q_{100}=355.6 cfs. The release rates for Pond 1 are Q_5=1.4 cfs and Q_{100}=19.7 cfs

B-group basins represent on-site flows that are captured by the pond on the south end of the site. The pond is a proposed Full Spectrum EDB with an outfall via an 18" pipe.

DP-O is located at the proposed at-grade Triple Type R inlet in Basin B1. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-P. This design point captures all of the flows from Basin B1. The flows from Basin B1 are Q_5=7.9 cfs and Q_{100}=18.4 cfs.

DP-P is located at the proposed sump 15' Type R inlet in Basin B2. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-Q. This design point captures all of the flows from Basins B1 and B2. The combined flows at DP-P are Q_5=6.2 cfs and Q_{100}=14.6 cfs.

DP-Q is located at the proposed sump 10' Type R inlet in Basin B3. The flows leave this inlet via a 24" storm pipe and are conveyed into the south Full Spectrum EDB pond. This design point captures all of the flows from Basins B1 through B3. The combined flows at DP-Q are Q_5=5.7 cfs and Q_{100}=13.3 cfs.

DP-R is located at the bottom of the south proposed Full Spectrum EDB pond in Basin B4. The flows leave the pond via an outlet structure and an 18" storm pipe where the flows are conveyed to DP-S. This design point captures all of the flows from Basins B1 through B4. The combined flows at DP-R are Q_5=18.8 cfs and Q_{100}=45.2 cfs.

DP-S is located at the existing area inlet in Basin B5. The flows leave this inlet via an existing 24" storm pipe that connects to the existing storm system in N. Carefree Cir., which carries the flows to the south. This design point reflects all of the flows from Basins B1 through B5, offsite Basin EXR, and offsite Basin D-16. More information can be found on offsite flows from Basins EXR and D-16 in the "Preliminary Drainage Report for Windermere and Final Drainage Report for Windermere Filing No. 1," October 2014. The combined flows at DP-S are Q_5=10.3 cfs and Q_{100}=26.9 cfs.

C-group basins represent flows that leave the project site and are captured by existing storm system.

DP-T is located at the existing 24" CMP Marksheffel Rd. culvert crossing. This design point reflects all of the flows from Basin C1, the flows released from the pond at DP-N, and the flows from MDDP DP-1X. More information can be found on the MDDP flows in the "Preliminary Drainage Report for Windermere and Final Drainage Report for Windermere Filing No. 1," October 2014 and the "Final Drainage Report and Erosion Control

Amendment for Chateau at Antelope Ridge," September 2002. According to the "MDDP for Hilltop Subdivision," November 1996, the flows for MDDP DP-1X were calculated using the SCS method. The combined flows at DP-T are Q_5=191.2 cfs and Q_{100}=638.3 cfs. When Marksheffel Rd. is improved in the future, this culvert is planned to be upgraded to a larger box culvert, which will be designed at that time to accomodate these flows.

DP-U are the flows from Basin C2, which flow off-site into N. Carefree Cir. where they are picked up by the existing 15' at-grade inlet at Design Point 19 in offsite Basin NC2. The flows leave this inlet via an existing 18" storm pipe where the flows converge with the flows from DP-S at an existing manhole. The flows leave this existing manhole via an existing 24" storm pipe and are carried to the existing 10' sump inlet at DP-20 in offsite Basin NC1. The flows leave this existing inlet via an existing 30" storm pipe and are then carried to the south. More information for these design points and offsite basins can be found in the "Preliminary Drainage Report for Windermere and Final Drainage Report for Windermere Filing No. 1," October 2014. The flows from Basin C2 are Q_5=3.6 cfs and Q_{100}=10.1 cfs.

DP-V is located at the north end of the site on Antelope Ridge Dr. This design point reflects all of the flows from Basin C3 that exit the site and flow to the north along the curb and gutter in Antelope Ridge Dr. before being captured by existing storm system. The flows from Basin C3 are Q_5=0.1 cfs and Q_{100}=0.6 cfs.

6.0 PROPOSED DETENTION/WATER QUALITY FACILITIES

North Pond

The north pond captures all of the flows from the "A" basins, offsite basins D-13 through D-15, and offsite flows entering the pond from offsite Basins CT and WS. A total of 132.67 acres is tributary to this facility, with a composite imperviousness of 45.4%. The Detention Basin Design Workbook by UDFCD was used to size this pond. The required pond volume for 100-yr detention is 11.03 acre-feet. The required WQCV is 2.144 ac-ft and the required EURV is 4.614 ac-ft. The EURV is provided under the top of the outlet box opening. The actual pond volume is 17.29 acre-feet. Concrete forebays with dissipaters will be placed where the flows enter the pond on the south and the north sides of the pond. The combined volume of the two forebays will be 3% of the WQCV volume for the pond and will be divided proportionally. The flows will exit the forebays through a notch and into the concrete trickle channel at the bottom of the pond that conveys the flows to the micropool. It will capture then release the flows at a reduced flow rate with the use of a plate with orifice holes into a proposed 30" pipe, which will release into a ditch that conveys the flows to a 24" CMP culvert under Marksheffel Rd. after which the flows continue in historic patterns to the east. 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. The pond release rates will be Q_5=1.4 cfs and Q_{100}=19.7 cfs. A spillway has been placed on the east side of the pond. In the event that water overtops the spillway, it will flow to the ditch along Marksheffel Rd. The spillway will be reinforced with riprap. The north pond will be fully built to final design as part of the early grading. Once completed, the embankment for the existing pond upstream will be removed and the new pond will be fully operational.

South Pond

The south pond captures all of the flows from the "B" basins. A total of 9.62 acres is tributary to this facility, with a composite imperviousness of 73.3%. The Detention Basin Design Workbook by UDFCD was used to size this pond. The required pond volume for 100-yr detention is 1.27 acre-feet. The required WQCV is 0.226 ac-ft and the required EURV is 0.876 ac-ft. The EURV is provided under the top of the outlet box opening. The actual pond volume is 1.31 acre-feet. A concrete forebay with dissipater will be plced where the flows enter the pond on the west side of the pond. The volume of the forebay will be 3% of the WQCV for the pond. The flows will exit the forebay through a notch and into the concrete trickle channel at the bottom of the pond that conveys the flows to the micropool. It will capture then release the flows at a reduced flow rate with the use of a plate with orifice holes into a proposed 18" pipe, which connects to the existing area inlet and is then carried to the south. No other existing storm sewer is being modified. 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. The pond release rates will be Q_5=0.2 cfs and Q_{100}=5.3 cfs. A spillway has been placed on the south side of the pond. In the event that water overtops the spillway, it will flow to the curb and gutter in N. Carefree Cir., then picked up by the existing storm system. The spillway will be reinforced with riprap.

Calculations are provided in the appendix for the on-site ponds, forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillways.

Each pond will have a 15' wide maintenance access that will provide access to the pond bottoms, forebays and outlet structures per ECM 3.3.3.K. Private maintenance agreements and O&M manuals will be established for these ponds as required by the County.

The existing channel along Marksheffel Rd. in the northeast portion of the project site will be aesthetically maintained by Windermere Metropolitan District and will be structurally maintained by the City of Colorado Springs/El Paso County. The slopes of the channel are such that it can be accessed for maintenance along Marksheffel Rd.

7.0 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 two permanent Extended Detention Basin facilities designed per current

City of Colorado Springs/El Paso County drainage criteria.

3. ***Stabilize Drainage Ways:*** Flows from the north pond are released into the ditch alongside Marksheffel Rd. This ditch has previously been stabilized with rip-rap to handle the MDDP flows of 600 cfs. Our release rate is 19.7 cfs and therefore no additional stabilization will be necessary. Flows from the south pond 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 I.7.2.A the need for industrial and commercial BMPs are not applicable for this project.

"Consider Need for Industrial and Commercial BMPs"

8.0 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:

10.1 Soil and Rock Design Parameters

TB-6 (Job No. 142206, dated May 28, 2015) and TB-107 (Job No. 162062, last dated February 5, 2019) were located in the general vicinity of the proposed Full Spectrum Detention Basin, Tract A. TB-160 (Job No. 162062, last dated February 5, 2019) was located in the general vicinity of the proposed Private Full Spectrum Extended Detention Basin, Tract B. RMG has performed laboratory tests of soil from across the proposed development. Based upon Field and laboratory testing, the following soil and rock parameters are typical for the soils likely to be encountered, and are recommended for use in detention pond embankment design.

Soil Description	Unit Weight (lb/ft^{3})	Friction Angle (degree)	Active Earth Pressure, Ka	Passive Earth Pressure, Kp	At Rest Earth Pressure, Ko
Silty to Clayey Sand (SC/SM)	105	30	0.33	3.0	0.50
Silty Sandstone	110	30	0.33	3.0	0.50
Sandy Claystone/ Siltstone	100	20	0.49	2.0	0.66

10.2 Embankment Recommendations

Based on a review of the *Preliminary Erosion Control Plan* for Windermere, referenced in Appendix A, the proposed detention pond in Tract B is to be excavated approximately 40 plus feet below the surrounding ground surface on the western portion and approximately 10 feet below the surrounding ground surface on the eastern portion. As such, above-ground embankment construction is not anticipated nor is it anticipated that impounded stormwater runoff will be stored above the natural ground surface. Detention pond side slopes are to be constructed with a maximum 3:1 slope. Side slopes should be constructed in accordance with applicable sections of the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, and the El Paso County Land Development Code.

Is this correct? Grading plans show otherwise.

9.0 DRAINAGE/BRIDGE/LAND DEDICATION FEES

The project lies within the Sand Creek Drainage Basin.

The percent imperviousness for the project is calculated as follows:

Site imperviousness = 50.3%

52.07 Acres at 50.3% Impervious = 26.2 Impervious Acres

The following calculations are based on the 2019 drainage/bridge fees for the Sand Creek Drainage Basin and are for information purposes only. The fees will be calculated at time of each final plat submittal.

Drainage Fee
$18,940 x 26.2 Impervious Ac = $496,228.00

Bridge Fee
$5,559 x 26.2 Impervious Ac. = $145,645.80

This doesn't need to be in a PDR and the fees will change.

Description	Quantity	Unit Cost	Cost
5' Type R Inlet	2 EA	$5,500/EA	$11,000
10' Type R Inlet	8 EA	$7,600/EA	$60,800
15' Type R Inlet	5 EA	$10,000/EA	$50,000
18" storm	137 LF	$50/LF	$6,850
24" storm	658 LF	$70/LF	$46,060
30" storm	28 LF	$85/LF	$2,380
36" storm	1,039 LF	$110/LF	$114,290
48" storm	329 LF	$195/LF	$64,155
Water Quality/Detention Ponds	2 EA	$90,000/LS	$180,000
		Subtotal	$535,535
		Engineering & Contingency (10%)	$53,554
		TOTAL	$589,089

Land Dedication Fee

Fees in lieu of land dedication for regional park purposes	=	$92,568
Fees in lieu of land dedication for urban park purposes	=	$58,464
TOTAL LAND DEDICATION FEES	=	$151,032

10.0 CONCLUSIONS

The Windermere project has been designed in accordance with El Paso County criteria. The EDB/water quality ponds have been designed to limit the release of storm runoff. This development will not negatively impact the downstream facilities.

11.0 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.

6. "Final Drainage Report for Pronghorn Meadows, Filing 2," prepared by URS, July 2004.

7. "Final Drainage Report and Erosion Control Amendment for Chateau at Antelope Ridge," prepared by URS, September 9, 2002.

8. "Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1," prepared by Classic Consulting Engineers & Surveyors, October 2014.

9. "MDDP for Hilltop Subdivision," prepared by URS Greiner, Inc., November 1, 1996.

10. "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.

APPENDIX

NEW DOC

Innovative Design. Classic Results.

PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

October 2014

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PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

DRAINAGE REPORT STATEMENT

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 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 omissions on my part in preparing this report.

COLORADO LICENSE KYLE R. CAMPBELL 29794 PROFESSIONAL ENGINEER

_______________________ 6-18-15

Kyle R Campbell, Colorado P.E. #29794 Date

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: Windsor Ridge Homes

By: _______________________

Title: Manager

Address: 4164 Austin Bluffs Parkway #361

Colorado Springs, CO 80918

EL PASO COUNTY ONLY:

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

_______________________ 6-22-15

Andre P. Brackin, P.E. Date

County Engineer / ECM Administrator

Conditions:

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PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

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PRELIMINARY DRAINAGE REPORT FOR WINDERMERE & FINAL DRAINAGE REPORT FOR WINDERMERE FILING NO. 1

PURPOSE

This document is the Preliminary Drainage Report for the entire Windermere (Filings 1-3) development and the Final Drainage Report for Windermere Filing No. 1. 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 detention and water quality facilities while releasing storm water at or below historic rates and in accordance with all applicable master drainage plans. This report will discuss the proposed storm system to be built with Filing 1 and the future system to be built with Filings 2 & 3. A Final Drainage Report will be needed for Filings 2 & 3 that will discuss the final construction details, and more specifically, the final design details of the proposed sub-regional public detention/water quality facility located at the north end of the site. Preliminary design of the sub-regional public facility is included in this report, along with the final design information for the Filing No. 1 detention/water quality facility located at the south-east corner of the site.

GENERAL DESCRIPTION

Windermere is a 52.07 acre single family home subdivision within the east half of Section 29, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located on the east side of Antelope Ridge Drive just north of North Carefree Circle. The existing Chateau at Antelope Ridge subdivision sits directly north of the site, with Marksheffel Road bordering the east side of the site. The proposed development includes a total of 201 single-family residences and will be developed in three filings. Filing 1 includes 59 residential lots on approximately 15 acres. Filing 2 will include 70 lots on approximately 22 acres, and Filing 3 is 72 lots on approximately 15 acres.

The average soil condition of the entire site and tributary area to the proposed ponds reflects Hydrologic Group "B" (Truckton sandy loam) as determined by the "Soil Survey of El Paso County Area," prepared by the National Cooperative Soil Survey (see map in Appendix).

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EXISTING DRAINAGE CONDITIONS

The site is located within the Sand Creek Drainage Basin. Historically, this site drains in all directions with a large hill in the southern half of the site and an existing temporary detention facility located at the northern end. There is a large roadside ditch adjacent to Marksheffel Road (M.D.D.P. DP-1X) that routes off-site (non-tributary to site facilities) runoff to the existing 24" CMP storm culvert under Marksheffel Road (Design Point 26). This site has been previously studied as part of the previously approved "Master Development Drainage Plan for Hilltop Subdivision El Paso County, Colorado" by URS Greiner, Inc. last revised February 1998. See below for detailed descriptions of the existing drainage conditions and see appendix for the Existing Conditions Drainage Map.

Design Point 4 - Existing (Q_5 = 7.2 cfs, Q_{100}= 14.6 cfs) consists of runoff from off-site Basin D-16, 2.73 acres of existing Pronghorn Meadows Subdivision, Antelope Ridge Drive, and North Carefree Circle. An existing 8' curb sump inlet intercepts the runoff with an existing 24" RCP conveying it directly onto the proposed site where a roadside ditch along N. Carefree Circle drains to the area drain at DP-6 (North West corner of Marksheffel Rd. and N. Carefree Cir.). The Basin D-16 characteristics and size was derived from the previously approved "Final Drainage Report for Pronghorn Meadows Filing 2," by URS, dated July 2004; "Preliminary Drainage Report for Pronghorn Meadows and Final Drainage Report for Pronghorn Meadows Filing No. 1," by URS, dated September 4, 2002; and also using observed field conditions and satellite imagery.

Design Point 6 - Existing (Q_5 = 18.4 cfs, Q_{100}= 42.6 cfs) consists of runoff from DP-4-EX, Basin EX-R, and Basin EX-A. Basin EX-R is 0.53 acres of existing Marksheffel Rd. and roadside ditch that drain to the existing grated area drain at DP-6. Basin EX-A is 13.20 acres of undeveloped Windermere property with historic runoff of Q_5 = 11.3 cfs and Q_{100}= 28.2 cfs. This historic runoff rate from Basin EX-A is used as the allowable release rate for the proposed Filing 1 detention/water quality facility located at this corner of the site. This cumulative historic and existing storm water runoff (Q_5 = 18.4 cfs, Q_{100}= 42.6 cfs) at this grated sump area drain inlet does not appear to have been quantified correctly in the design of the downstream Marksheffel Road storm sewer system as the outfall pipe from the existing grated inlet (24" RCP) only has a capacity of 16 cfs at 0.50% grade. The "Final Drainage Report Marksheffel Road from Constitution Ave. to Dublin Rd.," by CH2M Hill dated May 2008 was approved by El Paso County for the storm sewer improvement design associated with the expansion of Marksheffel Road. Construction plans

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for the Marksheffel Rd. improvements were completed by Wilson & Company Engineers & Architects in accordance with the Final Drainage Report. On these construction plans (PPRTA Project #75174, Sheets 12 & 13) a 24" RCP (Pipe 6b, Q_5 = 18.4 cfs and Q_{100}= 42.6 cfs) was constructed to this existing area drain with a capacity listed as 16 cfs. It appears that the historic runoff from the proposed Windermere site (Basin EX-A) was not included in the downstream pipe sizing and construction. The Marksheffel Road Final Drainage Report by CH2M Hill states on page 13 that "Storm pipes are designed to convey the 10-year flow, except at sump locations where they are designed to convey the 100-year flow." A sump condition exists at this Design Point and at the adjacent N. Carefree Circle median inlet at DP-20. Therefore, it is our belief and understanding that the storm system should convey the entire 100 year historic and existing runoff at this location.

Design Point 7 - Existing (Q_5 = 20.0 cfs, Q_{100}= 41.6 cfs) consists of runoff from off-site Basins D-13 & D-14, 6.79 acres & 3.88 acres respectively of existing Pronghorn Meadows Subdivision and existing Antelope Ridge Drive. The previous approved reports for Pronghorn Meadows and existing field conditions were used to determine the tributary basin sizes and the results are in conformance to the previously approved reports. An existing 25' (field verified) Type R curb inlet intercepts all of this runoff and an existing storm pipe routes flows to the existing inlet at DP-8 prior to day lighting onto the proposed site. This developed runoff does not appear to be detained or treated for storm water quality before being released onto the Windermere site.

Design Point 8 - Existing (Q_5 = 5.6 cfs, Q_{100}= 11.2 cfs) consists of runoff from off-site Basin D-15, 1.36 acres of existing Antelope Ridge Drive, and from Basin EX-E, 1.10 acres of on-site undeveloped land that drains onto Antelope Ridge Drive. An existing 10' (field verified) Type R curb inlet intercepts all of this runoff and an existing 36" storm (Pipe 8) routes the combined runoff (Q_5 = 24.7 cfs and Q_{100}= 50.9 cfs) directly onto the proposed Windermere site. This runoff drains across the site to Design Point 26. This developed runoff also does not appear to have been detained or treated for water quality prior to releasing onto the proposed site.

Design Point 19 - Existing (Q_5 = 6.7 cfs, Q_{100}= 12.5 cfs) consists of runoff from off-site Basin NC-2, 1.49 acres of existing Antelope Ridge Drive and N. Carefree Circle. An existing 15' Type R at-grade curb inlet just west of Marksheffel Road intercepts a portion of this runoff (Q_5 = 4.8 cfs and Q_{100}= 8.1 cfs) and an

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existing 18" storm (Pipe 6a) connects with Pipe 6B at an existing storm manhole. Pipe 6C is the 24" outfall pipe from this connection manhole and contains a combined runoff of Q_5 = 21.6 cfs and Q_{100}= 47.9 cfs. From the Marksheffel Rd. Construction Drawings, the capacity of the system at Pipe 6C is 16 cfs. Pipe 6C connects into the face of the median sump inlet at DP-20.

Design Point 20 - Existing (Q_5 = 3.7 cfs, Q_{100}= 8.0 cfs) consists of runoff from off-site Basin NC-1, 0.42 acres of existing N. Carefree Circle and Marksheffel Rd, and the flow-by from the at-grade inlet at Design Point 19. An existing 10' Type R sump median curb inlet intercepts all of this runoff and combines it with that from the incoming Pipe 6C. Pipe 7 represents the existing 30" outfall pipe from this inlet and contains a historic and existing runoff rate of Q_5 = 24.2 cfs and Q_{100}= 53.3 cfs. From the Marksheffel Rd. Construction Drawings, the capacity of the 30" Pipe 7 is 29 cfs. This runoff continues within the existing Marksheffel Rd. storm system to the south to downstream facilities.

Design Point 24 - Existing (Q_5 = 111.3 cfs, Q_{100}= 199.7 cfs) consists of off-site tributary area to the existing temporary detention facility located along the northern site boundary. The temporary detention facility was constructed in conjunction with the Chateau at Antelope Ridge subdivision located directly north of the proposed site. The tributary runoff at DP-24 is a combination of developed runoff from the Chateau at Antelope Ridge subdivision and detained release from the Whispering Springs Development, located west of Antelope Ridge Drive and the Chateau at Antelope Ridge subdivision. The "Preliminary Drainage Report for Whispering Springs Development and Final Drainage Report for Whispering Springs Filing No. 1," by Rockwell Consulting, Inc., dated August 2013 details the overall detained and water quality treated runoff that drains directly into the storm sewer system of the Chateau at Antelope Ridge. This runoff is described in this report as Basin WS, 41.47 acres with a release rate of Q_5 = 47.3 cfs and Q_{100}= 66.4 cfs (Design Point 10 from Whispering Springs Drainage Report).

DP-24 also contains the developed runoff from Basin CT, 42.07 acres of the existing Chateau at Antelope Ridge subdivision. The Basin CT characteristics and size was derived from the previously approved "Final Drainage Report and Erosion Control for Chateau at Antelope Ridge," by URS, approved January 21, 1999 as well as observed field conditions and satellite imagery. Basin CT produces a developed runoff rate of Q_5 = 90.8 cfs and Q_{100}= 184.7 cfs that drains to DP-24 and into the existing and proposed detention/water quality facility.

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Design Point 25 - Existing (Q_5 = 117.5 cfs, Q_{100}= 215.1 cfs) consists of the total existing runoff into the existing temporary detention facility located along the northern site boundary. This runoff consists of DP-24, Basins EX-D (6.19 acres of on-site undeveloped land) and EX-F (3.15 acres of temporary detention pond area). Per the Hilltop Subdivision M.D.D.P., detention of developed runoff is required in order to maintain historic release rates under Marksheffel Road and to the east to the main Sand Creek channel. An existing 48" CMP serves as the temporary facility's outfall along with a riprap lined emergency overall spillway. The discharge pipe and portions of the embankment are located outside of the Tract A Temporary Detention Facility.

Design Point 26 - Existing (Q_5 = 138.3 cfs, Q_{100}= 266.9 cfs) consists of the total existing runoff to the existing 24" CMP Marksheffel Road culvert crossing from the north-west. This runoff is comprised of the DP-25 storm water and that from Basins EX-B and EX-C, 7.30 acres and 24.28 acres respectively of on-site undeveloped land that drains directly east to the Marksheffel Road ditch. This runoff quantity does not include that from the upstream Marksheffel Road ditch, described in the Hilltop MDDP as Design Point 1X. Per the Hilltop MDDP the existing runoff within the Marksheffel Rd. ditch is Q_5 = 144 cfs and Q_{100}= 481 cfs. However, with the "Final Drainage Report and Erosion Control Plans for Chateau at Antelope Ridge El Paso County, Colorado," by URS, dated December 18, 1998 discusses the Marksheffel Road ditch design and assumptions used; varying the flow within the ditch from 420 to 714.5 cfs. As stated in this previous report "these flows were added as each design point without considering routing to give a worst case scenario." This large range of flow rates was used as a very conservative channel design and does not reflect the actual (routed) flow within the Marksheffel ditch. The same December 1998 report included a HEC model to more accurately define the ditch runoff and determine the allowable release rate for the temporary pond. The flow of 521 cfs was used as the routed flow in the Marksheffel ditch.

However, the "Final Drainage Report and Erosion Control Amendment for Chateau at Antelope Ridge El Paso County, Colorado," by URS, dated September 9, 2002 was approved by El Paso County and discusses an increase in tributary runoff to this Marksheffel Rd. ditch (north of Barnes Road). This increase of 79 cfs directly transposed to the M.D.D.P. DP-1X results in a 100-yr historic runoff within the Marksheffel Ditch of 600 cfs (estimated 5 year increased flow to 185 cfs).

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Design Point 26 directly correlates with M.D.D.P. DP-1C, which states a maximum flow rate in existing and developed conditions of Q_5 = 250 cfs and Q_{100}= 852 cfs that crosses under Marksheffel Road. Using a conservative approach by directly adding the M.D.D.P. DP-1X runoff (increased as previously stated) with the quantified DP-26 runoff from the proposed site analysis, a total runoff value can be compared with the M.D.D.P. allowable runoff rate at this culvert crossing of Marksheffel Road. In the current undeveloped conditions, the total runoff is Q_5 = 323.3 cfs and Q_{100}= 866.9 cfs. The 5 year & 100 year storm event runoffs are slightly higher than that quantified in the Chateau at Antelope Ridge Drainage Report due to conservatively assuming runoff drains directly into and out of the temporary facility at DP-25 since an outlet structure restricting runoff does not exist. The proposed developed conditions will ensure the runoff at DP-26 is less than the allowable rates per the M.D.D.P. (Q_5 = 250 cfs, Q_{100}= 852 cfs).

PROPOSED DRAINAGE CONDITIONS

Developed runoff from Windermere Development will be conveyed into the proposed storm sewer systems as shown on the Developed Conditions Drainage Map, and will outfall into two separate Public Full Spectrum Extended Detention Basin (EDB) Water Quality Facilities. All curb inlets are CDOT Type R, storm pipes are reinforced concrete pipe (RCP), and curbs are El Paso County Type A (6" vertical curb) and El Paso County Type C (ramp curb).

Per current El Paso County Drainage Criteria for stormwater capacity within street sections, the following applies:

Street Type	*Allowable – Initial Storm (5 yr)*	*Allowable–Major Storm (100 yr)*
Residential w/Ramp Curb	Flow spread to crown. Maximum of 20 cfs per side.	12" maximum depth at flowline with no adjacent flooding.
Residential w/Vertical Curb	6" allowable depth at flowline. Maximum of 34 cfs per side.	12" maximum depth at flowline with no adjacent flooding.
Collector Street	6" allowable depth at flowline, maximum of 34 cfs per side, no overtopping of crown.	12" maximum depth at flowline with no adjacent flooding.

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For more exact allowable curb capacities for each curb and roadway type at varying street slopes the Curb Capacity Equations were used as shown on the charts located in the front of the Drainage Criteria Manual. At no times is curb capacity an issue due to the placement of at-grade inlets when needed.

Drainage from individual lots is assumed to travel in side-lot swales to the street. A detailed description of the developed runoff for Windermere, including the final design of Filing No. 1 is as follows:

Design Point 1 (Q_5 = 13.1 cfs, Q_{100}= 26.2 cfs) consists of runoff from Basin C, 4.20 acres of Filing No. 1 single family home lots, and the two Pronghorn Meadows Circle roadways. A proposed 15' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to Design Point 2. Pipe 1 (24" RCP, Q_5 = 8.9 cfs and Q_{100}= 15.6 cfs) conveys the intercepted runoff south toward the detention/water quality facility at Design Point 5. As is typical throughout the proposed Windermere subdivision, all developed flows are within allowable street capacities for both 5 yr and 100 year events. For the minor event storm, the curb capacity of ramp curb at 1.5% is 13.8 cfs.

Design Point 2 (Q_5 = 12.4 cfs, Q_{100}= 27.3 cfs) consists of runoff from Basin B, 2.72 acres of Filing No. 1 single family home lots and adjacent residential roadways, and the flow-by from the at-grade inlet at DP-1. A proposed 15' sump inlet will intercept this runoff and combine with that from Pipe 1. Pipe 2 (30" RCP, Q_5 = 20.9 cfs and Q_{100}= 41.9 cfs) conveys the combined runoff south toward the detention/water quality facility at Design Point 5.

Design Point 3 (Q_5 = 9.1 cfs, Q_{100}= 18.2 cfs) consists of runoff from Basin A, 3.35 acres of Filing No. 1 single family home lots and adjacent residential roadways. A proposed 10' sump inlet will intercept this runoff and a 24" RCP (Pipe 3a) will connect to the storm main from DP-2. Pipe 3b (36" RCP, Q_5 = 27.6 cfs and Q_{100}= 55.5 cfs) conveys the combined runoff from the Filing No. 1 development into the proposed Full Spectrum Extended Detention Basin at Design Point 5.

Design Point 4 (Q_5 = 7.2 cfs, Q_{100}= 14.6 cfs) is exactly as described within the Existing Conditions portion of this report. The existing 24" RCP will be extended with a proposed 24" RCP (Pipe 4) and connected directly into the downstream Marksheffel Road storm sewer system.

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Design Point 5 (Q_5 = 28.1 cfs, Q_{100}= 56.8 cfs) is the Filing No. 1 developed runoff into the proposed Private Full Spectrum Extended Detention Basin. This storm water consists of that from Pipe 3b and Basin P, 0.60 acres of the detention facility itself. The facility was designed using the sizing spreadsheet (See Appendix) and criteria from the Urban Drainage and Flood Control District (UDFCD). A total of 10.87 acres of Windermere Filing No. 1 is tributary to this facility, with a composite impervious value of 73.3%. A required Excess Urban Runoff Volume (EURV) of 0.893 acre-feet is required. This volume is provided under the top of outlet box opening (elevation 6570.00, within the orifice plate of the outlet box).

A concrete box forebay will be placed at the Pipe 3b entry point into the facility. Per the UDFCD sizing spreadsheet a 6" notch in the vertical wall of the forebay box is required. All pond structure details are included in the Filing No. 1 construction drawings. A 6' wide concrete trickle channel at 1.0% grade will be installed down the center of the basin to convey the low flows to the outlet box and limit erosion within the bottom of the facility. A 3.0% minimum basin bottom slope into the trickle channel is provided as per the UDFCD requirements.

The bottom of the detention basin is at an elevation of 6562.50 with the EURV provided at the elevation 6570.00. A 6' wide outlet box (4' deep opening) is proposed with a top of box at this 6570.00 elevation. For a Full Spectrum facility, the outlet box orifice holes within the front plate are to drain the EURV in 72 hours, resulting in the necessary orifice hole sizing of 1 column of 3/4" diameter circular holes. A 2.5' deep concrete bottom micropool is to be installed within the outlet structure, with a surface area of 107 square feet. A removable trash screen of 12" in width will be placed in front of the orifice plate to help prevent the orifice holes from clogging. A 24" RCP outlet, Pipe 5, will convey the facility's restricted release (Q_5 = 0.63 cfs, Q_{100}= 9.77 cfs) (historic from site is Q_5 = 11.3 cfs, Q_{100}= 28.2 cfs) to the existing 24" storm sewer pipe of the Marksheffel Road storm sewer system. See Design Point 6 for continued discussion of downstream system.

A 20' length emergency spillway located at elevation 6571.00 will pass the entire incoming 100-year storm event (56.8 cfs) at a flood depth less than 1.0' (0.84' using equation Q = CLH^0.5 from the DCM). Per the El Paso County Drainage Criteria Manual (DCM), the top of the pond berm shall be 2.0' higher than the flood depth water surface elevation, in this case at 6574.00. This emergency spillway will only be utilized in the case of a complete outlet box failure and will be constructed of riprap rock buried under top soil and re-

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vegetated. Also, a 15' wide maintenance access road at 15% grade will be installed to the bottom of the facility from the interior roadway, Grizedale Terrace. By utilizing the Full Spectrum Outlet box design, the minor storm event release rates are significantly below historic levels, and the 100-year event is less than a third of the historic (allowable) runoff rate of the proposed site (Basin EX-A Q_5 = 11.3 cfs, Q_{100}= 28.2 cfs).

Maintenance of the Private detention/water quality structures and aesthetic maintenance of the facility will be by either the home owner's association or Windermere Metropolitan District 1 as is to be determined.

Initially, as a part of the early grading permit, a temporary sediment pond will be constructed in the same location as the ultimate detention and stormwater quality facility. The temporary sediment basin outlet pipe will ultimately be replaced with a formal outlet structure at the time of Filing No. 1 public street and storm construction. The storm outfalls into the ultimate pond will also be constructed along with the proposed perimeter retaining walls.

Design Point 6 (Q_5 = 3.4 cfs, Q_{100}= 7.1 cfs) consists of runoff from Basin R, 1.18 acres of existing Marksheffel Road, adjacent roadside swale, and proposed home lots that drain in the same pattern as existing Basin EX-R. The existing type D grated area drain must remain due to existing electric vaults being installed lower than the roadway intersection. However, this inlet must be relocated to the east in order to construct the N. Carefree sidewalk. The new Type D inlet intercepts all of this runoff and an 18" RCP conveys it to the storm outfall from the proposed detention/water quality facility at DP-5. Pipe 6b (24" RCP, Q_5 = 10.3 cfs, Q_{100}= 29.4 cfs) is the combined runoff rate from the Pond Outfall (Pipe 5), DP-6, and off-site DP-14 (Pipe 4). This 24" RCP connects to the existing 24" RCP of the Marksheffel Rd. storm system. Per the Existing Conditions analysis of this report, the allowable historic runoff rate to the existing 24" RCP is Q_5 = 18.4 cfs and Q_{100}= 42.6 cfs. As stated in the Existing Conditions section, the existing storm sewer system constructed with the Marksheffel Road improvements does not have the capacity (listed as 16 cfs) to convey even the reduced detained runoff. See Design Point 19 for continued discussion of the existing Marksheffel Road storm system.

Design Point 7 (Q_5 = 20.0 cfs, Q_{100}= 41.6 cfs) is the same as described in the Existing Conditions section of this report.

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Design Point 8 (Q_5 = 7.7 cfs, Q_{100}= 15.1 cfs) consists of runoff from off-site Basin D-15, 1.36 acres of existing Antelope Ridge Drive, and from Basin E, 1.47 acres of the back yards of proposed single family home lots that drains onto Antelope Ridge Drive. The runoff at this location in the developed conditions is slightly higher than in the existing conditions; however the existing inlet and storm pipe have adequate capacity. The existing 10' Type R curb inlet intercepts all of this runoff and an existing 36" storm (Pipe 8) the previously daylighted onto the proposed site will be extended east within Borrowdale Lane and eventually to the detention/water quality facility at DP-25. This 36" Pipe 8 conveys runoff of Q_5 = 26.4 cfs and Q_{100}= 54.1 cfs.

Design Point 9 (Q_5 = 12.9 cfs, Q_{100}= 26.0 cfs) consists of runoff from Basin I, 4.44 acres of Filing No. 3 single family home lots and Ryedale Way. A proposed 20' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to Design Point 10. Pipe 9 (24" RCP, Q_5 = 9.0 cfs and Q_{100}= 16.0 cfs) conveys the intercepted runoff to the 36" main from DP-8 (Pipe 10 36" RCP, Q_5 = 32.4 cfs and Q_{100}= 64.7 cfs). At no times within the proposed site is curb capacity an issue due to the placement of these at-grade storm inlets. For the minor event storm, the curb capacity of ramp curb at 4.0% is above the maximum of 20.0 cfs.

Design Point 10 (Q_5 = 5.6 cfs, Q_{100}= 13.5 cfs) consists of runoff from Basin N, 0.58 acres of Filing No. 3 single family home lots and Borrowdale Lane, and the flow-by from DP-9. A proposed 15' at-grade inlet will intercept the majority of this runoff while the remaining continues within the curb and gutter to Design Point 11. Pipe 11 (18" RCP, Q_5 = 4.3 cfs and Q_{100}= 8.5 cfs) conveys the intercepted runoff to the at-grade inlet at DP-11.

Design Point 11 (Q_5 = 11.2 cfs, Q_{100}= 24.8 cfs) consists of runoff from Basin J, 3.30 acres of single family home lots and Patterdale Place, and the flow-by from DP-10. A proposed 10' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 15. Pipe 12 (24" RCP, Q_5 = 9.8 cfs and Q_{100}= 16.4 cfs) conveys the intercepted runoff from this at-grade inlet and that from the at-grade at DP-10 (Pipe 11) to the storm main. The outfall main (Pipe 13, 42" RCP, Q_5 = 38.9 cfs and Q_{100}= 75.5 cfs) continues east within Borrowdale Lane and ultimately to the proposed detention/water quality facility at DP-25.

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Design Point 12 (Q_5 = 11.0 cfs, Q_{100}= 22.4 cfs) consists of runoff from Basin K, 3.74 acres of single family home lots and Pronghorn Meadows Circle. A proposed 20' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 15. Pipe 16 (24" RCP, Q_5 = 8.7 cfs and Q_{100}= 15.4 cfs) conveys the intercepted runoff and connects to the 60" RCP storm main that drains into the detention/water quality facility at Design Point 25. For the minor event storm, the curb capacity of ramp curb at 1.5% is 13.8 cfs.

Design Point 14 (Q_5 = 12.3 cfs, Q_{100}= 24.5 cfs) consists of runoff from Basins F & Q, 2.85 acres and 1.70 acres respectively of single family home lots and adjacent residential roadways. A proposed 20' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 15. Pipe 14 (24" RCP, Q_5 = 8.8 cfs and Q_{100}= 15.1 cfs) conveys the intercepted runoff from this at-grade inlet and connects to the 42" storm main (Pipe 15, Q_5 = 45.9 cfs and Q_{100}= 87.4 cfs).

Design Point 15 (Q_5 = 20.5 cfs, Q_{100}= 50.7 cfs) consists of runoff from Basin G, 3.97 acres of single family home lots and adjacent residential roadways, and the flow-by runoff from the at-grade inlets at Design Points 11, 12, & 14. A proposed 20' sump inlet will intercept all of this runoff with a 42" RCP lateral connecting with the 42" main within Borrowdale Lane at a proposed storm manhole.

Design Point 16 (Q_5 = 10.4 cfs, Q_{100}= 20.8 cfs) consists of runoff from Basin L, 3.86 acres of single family home lots, the Ryedale Way cul-de-sac, and Pronghorn Meadows Circle. A proposed 10' at-grade inlet will intercept a portion of this runoff while the remaining continues within the curb and gutter to the sump inlet at Design Point 17. Pipe 17 (18" RCP, Q_5 = 6.5 cfs and Q_{100}= 9.3 cfs) conveys the intercepted runoff and connects to the 60" RCP storm main (Pipe 22, Q_5 = 78.1 cfs and Q_{100}= 158.1 cfs) that drains into the detention/water quality facility at Design Point 23/25. For the minor event storm, the curb capacity of ramp curb at 1.5% is 13.8 cfs.

Design Point 17 (Q_5 = 7.8 cfs, Q_{100}= 19.1 cfs) consists of runoff from Basin H, 1.42 acres of single family home lots and adjacent residential roadways, and the flow-by runoff from the at-grade inlet at Design Point 16. A proposed 10' sump inlet will intercept all of this runoff with a 24" RCP (Pipe 20) connecting with the 42" lateral to DP-15. The 42" lateral combines with the 42" Borrowdale Lane main at a storm manhole at

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the roadway intersection. Pipe 18 (60" RCP, Q_5 = 67.7 cfs and Q_{100}= 141.5 cfs) conveys the combined runoff to the north to DP-23.

Design Point 19 (Q_5 = 10.4 cfs, Q_{100}= 20.7 cfs) consists of runoff from off-site Basin NC-2, 1.49 acres of existing Antelope Ridge Drive and N. Carefree Circle, and from Basin D, 1.75 acres of landscaped areas and single family home lots. For arterial streets in the minor storm event, the maximum street capacity is 6" depth at flowline with 34 cfs per side while maintaining at least (1) 10' lane width free of water. For the major storm event the maximum street flow is 8" depth at flowline dependant on street grade. An existing 15' Type R at-grade curb inlet (at approx. 4% street grade) intercepts a portion of this runoff (Q_5 = 9.0 cfs and Q_{100}= 12.8 cfs) and an existing 18" storm (Pipe 6a) connects with Pipe 6B at an existing storm manhole. Pipe 6C is the 24" outfall pipe from this connection manhole and contains a combined runoff of Q_5 = 17.5 cfs and Q_{100}= 39.7 cfs. The storm water in the existing Marksheffel Road storm sewer system is less in the developed conditions than in the existing conditions due to the over-detention of the proposed development runoff at DP-5. Per the Marksheffel Rd. Construction Drawings, the capacity of the system at Pipe 6C is 16 cfs. Pipe 6C connects into the face of the median sump inlet at DP-20.

Design Point 20 (Q_5 = 4.5 cfs, Q_{100}= 11.3 cfs) consists of runoff from off-site Basin NC-1, 0.42 acres of existing N. Carefree Circle and Marksheffel Rd, and the flow-by from the at-grade inlet at Design Point 19. An existing 10' Type R sump curb inlet intercepts all of this runoff and combines it with that from the incoming Pipe 6C. Pipe 7 represents the existing 30" outfall pipe from this inlet and contains a developed runoff rate of Q_5 = 21.2 cfs and Q_{100}= 48.9 cfs (less than in the existing conditions). From the Marksheffel Rd. Construction Drawings, the capacity of the 30" Pipe 7 is 29 cfs. This runoff continues within the existing Marksheffel Rd. storm system to the south to downstream facilities.

Design Point 20-DS (Q_5 = 33.8 cfs, Q_{100}= 84.5 cfs) This design point quantifies the worst case surface storm runoff downstream of Design Point 20 if the existing Marksheffel Road storm system is at full capacity and the proposed facility overtops the emergency spillway. The quantity is a combination of the surface runoff at Design Point 20 and the theoretical difference in the listed capacity of Pipe 6C (16 cfs) and the total un-detained proposed developed runoff; which is a difference of Q_5 = 29.3 cfs and Q_{100}= 73.2 cfs. As previously mentioned, the allowable street runoff for arterial streets in the minor storm event is a max. 6" depth at flowline with 34 cfs per side while maintaining at least (1) 10' lane width free of water. For the

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major storm event the maximum street flow is 8" depth at flowline dependant on street grade. Flowmaster gutter calculations are included in the Appendix of this report. The capacity of the arterial roadway (Marksheffel Rd.) downstream of the existing Marksheffel and N. Carefree intersection maintains acceptable flow depths, spreads, and overall flow rates as defined in the current Drainage Criteria Manual in the event of an entire 100-yr storm overtopping the spillway.

Design Point 23 (Q_5 = 83.8 cfs, Q_{100}= 173.0 cfs) consists of the total runoff from the Windermere development that drains into the northern proposed Public Full Spectrum Extended Detention Basin and Water Quality Facility to be constructed with Filing 2. A Final Drainage Report will be completed with Windermere Filings 2 & 3 that further detail the detention/water quality facility and address any changes made to this Preliminary Drainage Report for Filings 2 & 3. DP-23 represents the runoff from 49.32 acres (including Pond Basin M) of proposed Windermere on-site developed land at a calculated impervious value of 60.88%. A forebay will be constructed at this 60" RCP entry point into the facility with a concrete low flow trickle channel draining to the outlet box micropool.

As the existing temporary detention facility is located on property not owned or controlled by the Windermere developer, please find in the appendix a letter from the Tract A owner (Yes! Communities) acknowledging their willingness to work with the Windermere developer in converting this existing temporary private facility into a public facility.

Design Point 24 (Q_5 = 111.3 cfs, Q_{100}= 199.7 cfs) is described in the Existing Conditions section of this report. A forebay will be constructed at this channel entry point in the facility with a concrete low flow trickle channel within the middle of the pond bottom. For the design purposes of the proposed EDB facility at DP-25, this tributary runoff was calculated at the following impervious values: Basin WS 41.47 acres @ 2% (historic flow analysis since all developed runoff is treated and released at historic rates with Whispering Springs on-site facilities) and Basin CT 42.07 acres @ 70% (interpolated from previous reports and satellite imagery).

Design Point 25 (Q_5 = 185.7 cfs, Q_{100}= 353.3 cfs) consists of the combination of the existing tributary runoff (DP-24) with the developed runoff from the proposed Windermere site (DP-23) that collect in this proposed Public Full Spectrum Extended Detention Basin (EDB) Water Quality Facility. Per the Hilltop

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Subdivision M.D.D.P., detention of developed runoff is required in order to maintain historic release rates under Marksheffel Road and to the east to the main Sand Creek channel. As mentioned in the Existing Conditions Section, there is currently a temporary detention pond located in this area constructed with the Chateau at Antelope Ridge development to the north. This facility was to be removed when the large regional Sand Creek detention facility was constructed to the south. This facility is no longer a feasible option due to multiple ownerships and lack of planned development to the east of Marksheffel Road. Therefore this permanent facility will ensure acceptable downstream runoff rates and the statement of this facility being temporary in the Chateau reports no longer applies. This Public EDB facility will be required with the development of Windermere Filing No. 2 and a Final Drainage Report will be completed at that time that will provide the final design of this facility. The following pond design/analysis has been completed with this Preliminary Drainage Report for Windermere:

The Extended Detention Basin (EDB) facility was designed using the sizing spreadsheet (See Appendix) and criteria from the Urban Drainage and Flood Control District (UDFCD). A total of 132.86 acres of land is tributary to this facility at a composite imperviousness of 45.4%. An Excess Urban Runoff Volume (EURV) of 6.548 acre-feet is required. This volume is provided under the top of outlet box opening (elevation 6576.50, within the orifice plate of the outlet box).

Forebays will be constructed at both Design Points 23 & 24 and will likely consist of riprap berms with small outlet pipes draining a concrete bottom forebay. Final details will be provided with the Windermere Filing No. 2 Final Drainage Report. An 8' wide concrete trickle channel at 0.50% grade will be installed down the center of the basin to convey the low flows to the outlet box and limit erosion within the bottom of the facility. A 3.0% minimum basin bottom slope into the trickle channel is provided as per the UDFCD requirements.

The bottom of the detention basin is at an elevation of 6571.00 with the EURV provided at the elevation 6576.50. A 20' wide outlet box (4' deep opening) is proposed with a top of box at this 6576.50 elevation. For a Full Spectrum facility, the outlet box orifice holes within the front plate are to drain the EURV in 72 hours, resulting in the necessary orifice hole sizing of 1 column of 1-7/8" diameter circular holes. A 2.5' deep concrete bottom micropool is to be installed within the outlet structure. A removable trash screen of 35" in width will be placed in front of the orifice plate to help prevent the orifice holes from clogging. A

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54" RCP outlet, Pipe 23, will convey the facility's restricted release (Q_5 = 3.22 cfs, Q_{100}= 80.70 cfs) to the adjacent Marksheffel Road ditch, which drains to the existing 24" CMP culvert under Marksheffel Road (DP-26).

A 115' length emergency spillway located at elevation 6579.00 will pass the entire incoming 100-year storm event (353.3 cfs) at a flood depth less than 1.0'. Per the El Paso County Drainage Criteria Manual (DCM), the top of the pond berm shall be 2.0' higher than the flood depth water surface elevation, in this case at 6582.00. This emergency spillway will only be utilized in the case of a complete outlet box failure and will be constructed of riprap rock buried under top soil and re-vegetated. Also, a 15' wide maintenance access road at 12% grade will be installed to the bottom of the facility as per the DCM. By utilizing the Full Spectrum Outlet box design, the release rates are significantly below historic levels. A maximum allowable release rate from this facility can be conservatively calculated as the direct difference between the release rates at M.D.D.P. Design Points 1C & 1X; Q_5 = 65 cfs and Q_{100}= 252 cfs).

Maintenance of the Public detention/water quality structures is by El Paso County. Aesthetic maintenance of the facility will be by either the home owner's association or Windermere Metropolitan District 1 as is to be determined.

Design Point 26 (Q_5 = 7.6 cfs, Q_{100}= 90.9 cfs) consists of the total developed runoff to the existing 24" CMP Marksheffel Road culvert crossing from the north-west (proposed facility release and Basin S, 4.52 acres of single family homes and Marksheffel Road ditch). This runoff quantity does not include that from the upstream Marksheffel Road ditch.

Design Point 26 directly correlates with M.D.D.P. DP-1C, which states a maximum flow rate in existing and developed conditions of Q_5 = 250 cfs and Q_{100}= 852 cfs that crosses under Marksheffel Road. Using a conservative approach by directly adding the M.D.D.P. DP-1X runoff (increased as previously stated) with the quantified DP-26 runoff from the proposed site analysis, a total runoff value can be compared with the M.D.D.P. allowable runoff rate at this culvert crossing of Marksheffel Road. In the proposed developed conditions, the total runoff is Q_5 = 192.6 cfs and Q_{100}= 690.9 cfs. The proposed development and construction of a large public regional detention/water quality facility releases runoff to downstream

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facilities below historic and allowable rates and therefore will not be detrimental to any downstream facilities.

EROSION CONTROL PLAN

Erosion control measures will be installed per the approved grading/erosion control plans and in accordance with the El Paso County Drainage Criteria Manual.

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. Stormwater quality analysis and Extended Detention Basin (EDB) design are per the Urban Drainage and Flood Control District Manual and UD-BMP Version 3.01 spreadsheet. The Rational Method was used to estimate stormwater runoff to the proposed inlets, storm sewer pipes, and detention/water quality facilities.

FLOODPLAIN STATEMENT

No portion of this site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C 0543F effective date, March 17, 1997 (See Appendix).

DRAINAGE AND BRIDGE FEES FILING NO. 1

The Windermere development is located in the Sand Creek Basin and consists of a total acreage of 52.068 acres with a total of 201 single family home lots (3.86 DU/Acre). Filing No. 1 will be platted at this time and contains a total of 14.957 acres. The 2014 El Paso County Drainage Fees are $15,000 per impervious acrea and the Bridge Fees are $4,544 per impervious acre. An impervious value of 4 DU/Acre was applied (38%).

Drainage Fees Filing 1:	
$15,000/acre x 5.684 acres	$ 85,260.00
Bridge Fees Filing 1:	
$4,544/acre x 5.684 acres	$ 25,828.10
TOTALS:	**$ 111,088.10**

Fees or use of existing credits are due prior to plat recordation. Prior to issuance of building permits a plat will need to be recorded and appropriate drainage facility and erosion control assurances will need to be posted.

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CONSTRUCTION COST OPINION – WINDERMERE FILING NO. 1

Private Drainage Facilities Non-Reimbursable

ITEM	DESCRIPTION	QUANTITY		UNIT COST	COST
1.	Retaining Walls in Private Pond (Face foot)	1,789.00	FF	$ 35	$ 62,615.00
2.	Geotextile Fabric (Erosion Control) (Under riprap)	192.00	SY	$ 5	$ 960.00
3.	Rip Rap, d50 Size from 6" to 24"	192.00	CY	$ 98	$ 18,816.00
4.	Detention Facility Construction	1,760.00	CY	$ 11	$ 19,360.00
5.	Detention Outlet Structure	1.00	EA	$18,000	$ 18,000.00
6.	Detention Emergency Spillway	1.00	EA	$ 2,000	$ 2,000.00
	SUB TOTAL				**$ 121,751.00**
	10% ENGINEERING				**$ 12,175.10**
	5% CONTINGENCIES				**$ 6,087.55**
	TOTAL				**$ 140,013.65**

Public Drainage Facilities Non-Reimbursable

1.	10' Type R Inlet	1 EACH	$6,680/EA	$ 6,680.00
2.	15' Type R Inlet	2 EACH	$7,422/EA	$ 14,844.00
3.	Grated Inlet	1 EACH	$3,440/EA	$ 3,440.00
4.	18" RCP Storm Drain	54 LF	$53/LF	$ 2,862.00
5.	24" RCP Storm Drain	1,144 LF	$58/LF	$ 66,352.00
6.	30" RCP Storm Drain	44 LF	$77/LF	$ 3,388.00
7.	36" RCP Storm Drain	66 LF	$95/LF	$ 6,270.00
8.	36" FES	1 EA	$1,200/EA	$ 1,200.00
9.	Type I Storm MH (slab)	2 EACH	$4,575/EA	$ 9,150.00
10.	Type I Storm MH (box)	1 EACH	$7,160/EA	$ 7,160.00
SUB-TOTAL				$ 121,346.00
10% ENGINEERING				$ 12,134.60
5% CONTINGENCIES				$ 6,067.30
TOTAL				**$ 139,547.90**

Classic Consulting Engineers & Surveyors cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

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SUMMARY

Runoff for the proposed Windermere development is collected in on-site storm sewer systems and routed to two Public Full Spectrum Extended Detention Basin Water Quality facilities. This report describes the final design of the Filing No. 1 storm sewer system and detention/water quality pond. Preliminary design for the storm system and large regional facility at the north end of the site is included in the report. A final drainage report is required with the future Filing 2 & 3 of Windermere that will discuss final design of such facilities. The use of Full Spectrum outlet structures provides a release rate from the proposed facilities much less than historic and therefore the proposed Windermere development does not cause any downstream facility constraints. This report/development is in compliance with the Master Development Drainage Plan for Hilltop Subdivision, the Sand Creek Drainage Basin Planning Study, and the El Paso County Drainage Criteria Manual.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Matthew Larson
Project Engineer

mal/244100/REPORTS/PDR-FDR-FIL1.doc

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REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual dated October 1991.

2. "Sand Creek Drainage Basin Planning Study," Kiowa Engineering Corp, dated March 1996.

3. "Master Development Drainage Plan for Hilltop Subdivision El Paso County, Colorado," by URS Greiner, Inc. prepared November 1, 1996 (last revised February 1998)

4. "Preliminary Drainage Report for Whispering Springs Development and Final Drainage Report for Whispering Springs Filing No. 1," by Rockwell Consulting, Inc. dated August 2013.

5. "Final Drainage Report and Erosion Control for Chateau at Antelope Ridge," by URS, dated December 1998.

6. "Preliminary Drainage Report for Pronghorn Meadows and Final Drainage Report for Pronghorn Meadows Filing No. 1," by URS, dated September 4, 2002.

7. "Final Drainage Report for Pronghorn Meadows Filing 2," by URS, dated July 2004.

8. "Final Drainage Report for Pronghorn Meadows Filing 3," by URS, dated May 2005.

9. 'North Carefree Circle Developed Drainage Basins Map,' by URS, dated February 2003.

10. "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.

11. Drainage Criteria Manual (Volume 3) latest revision April 2008, Urban Drainage and Flood Criteria District.

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APPENDIX

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VICINITY MAP

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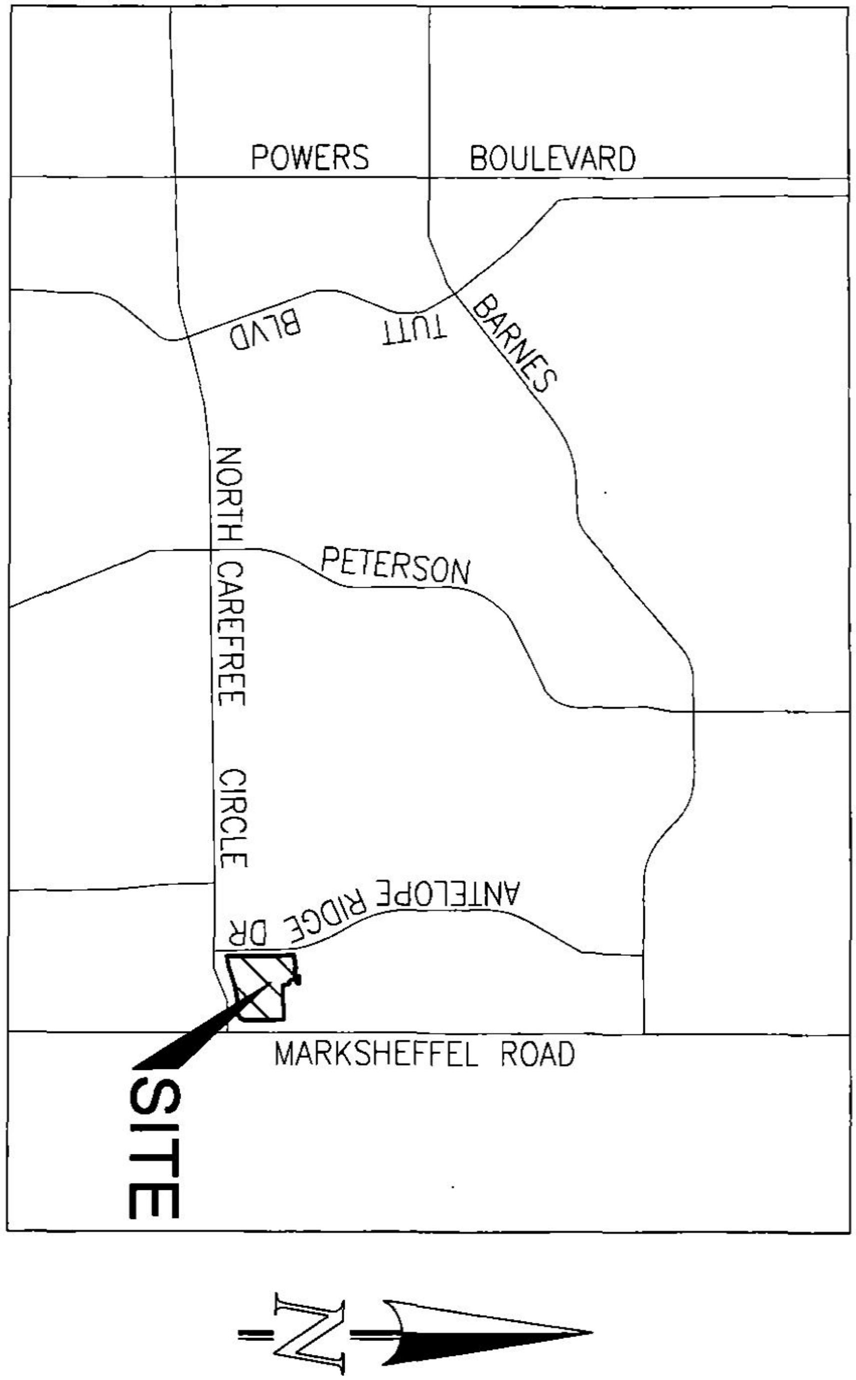

VICINITY MAP
N.T.S.

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SOILS MAP (S.C.S SURVEY)

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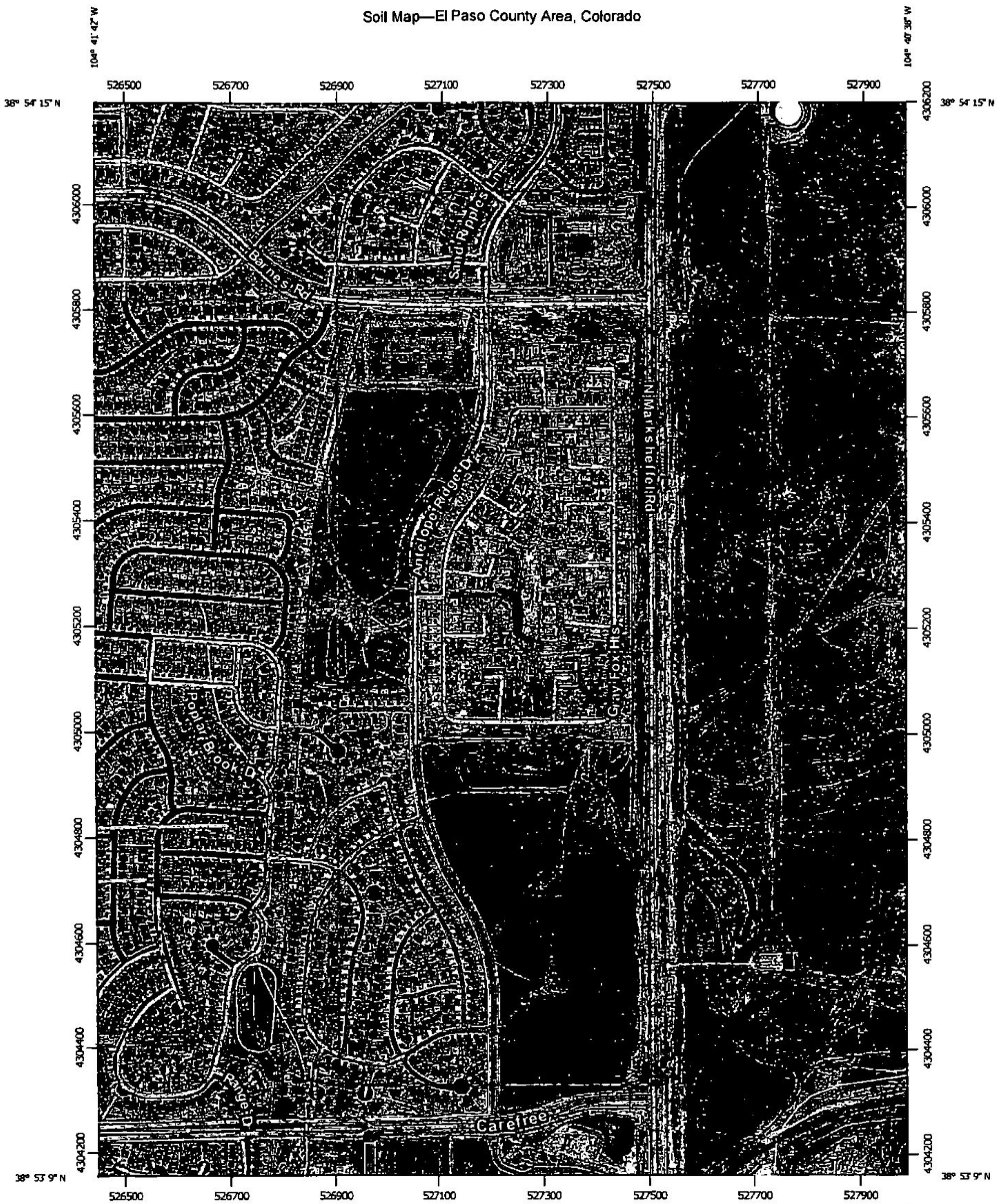

Map Scale: 1:9,950 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 450, 900, 1800, 2700

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

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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: http://websoilsurvey.nrcs.usda.gov
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 10, Dec 23, 2013

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—Sep 22, 2011

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.

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Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
97	Truckton sandy loam, 3 to 9 percent slopes	261.8	100.0%
Totals for Area of Interest		**261.8**	**100.0%**

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F.E.M.A. MAP

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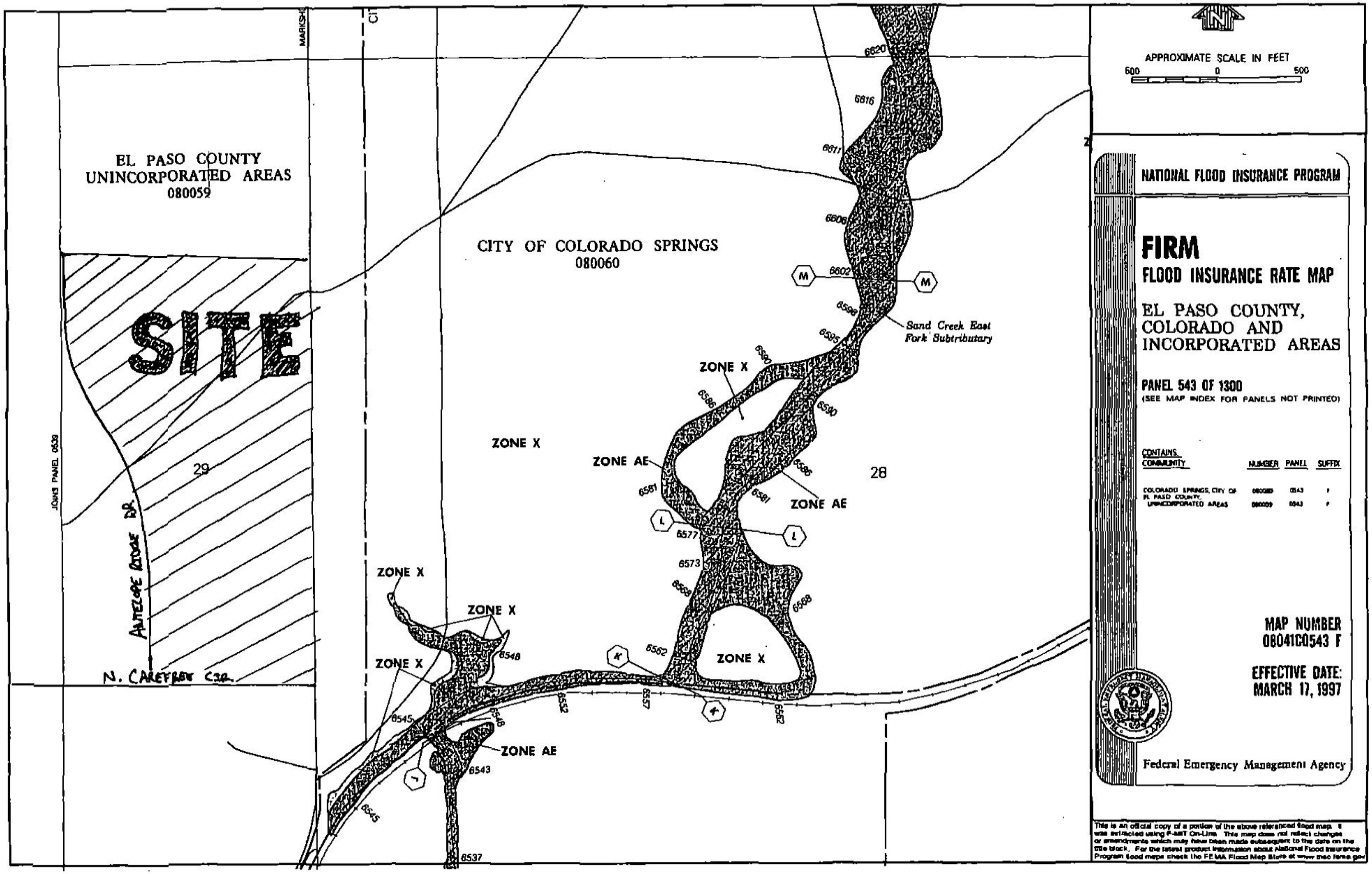

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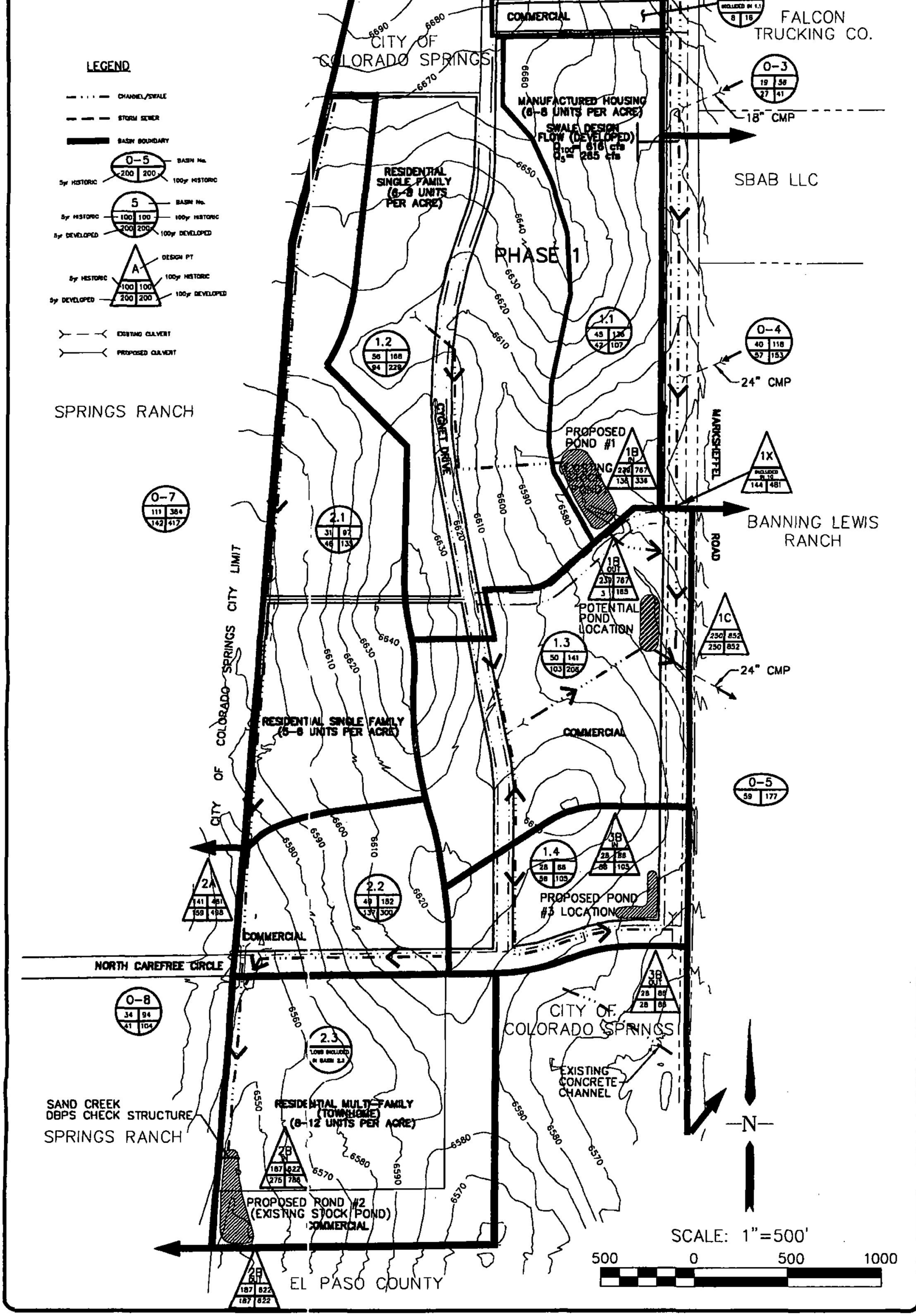

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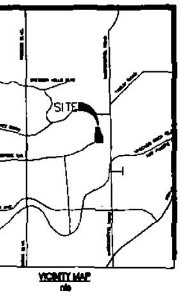
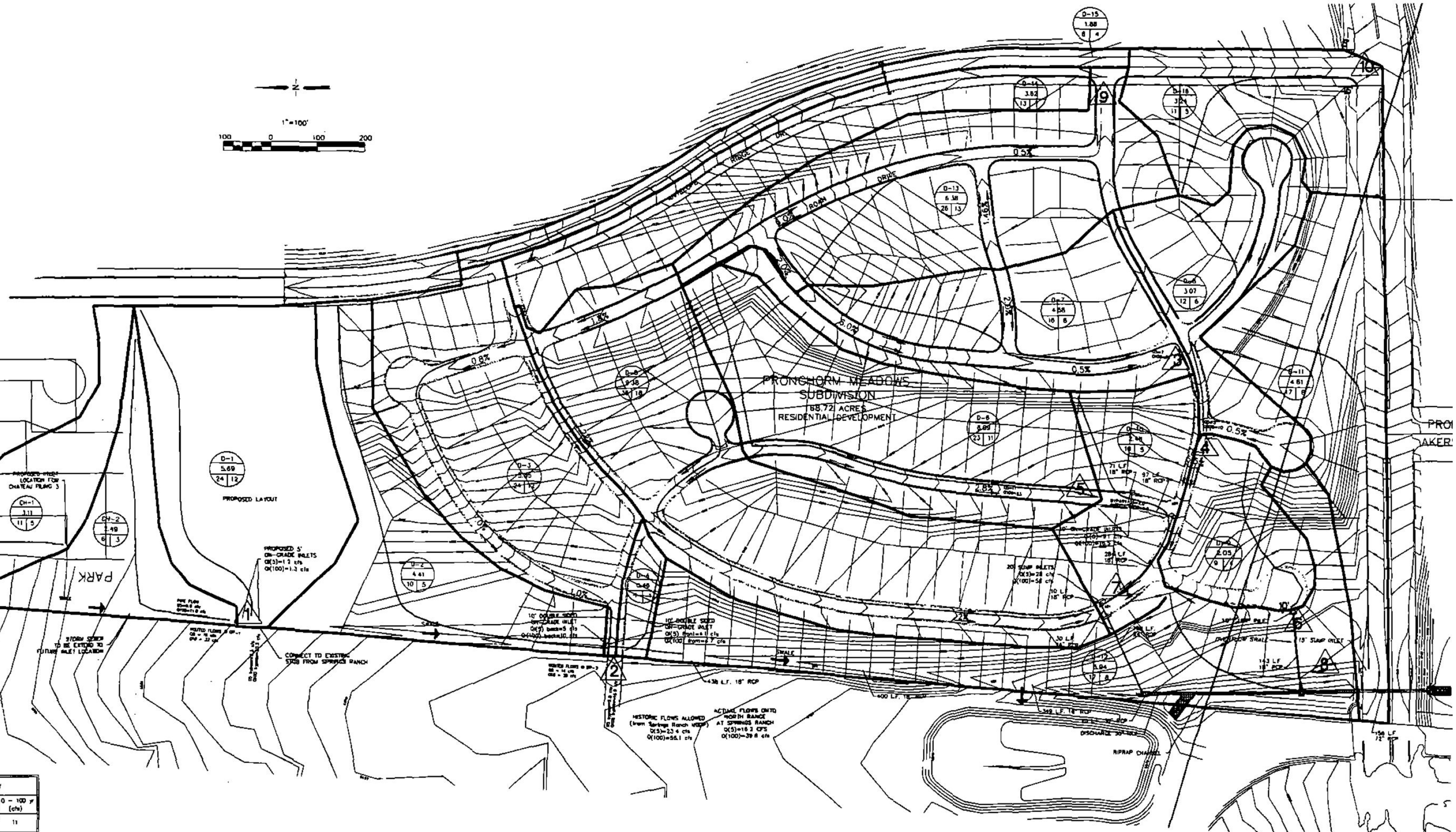
FIGURE

PRONGHORN MEADOWS
DEVELOPED BASINS





	SURFACE FLOW			PIPE FLOW		
DESIGN POINT	CONTRIBUTING BASINS	Q - 5 yr. (cfs)	Q - 100 yr. (cfs)	CONTRIBUTING BASINS	Q - 5 - (cfs)	Q - 100 yr (cfs)
1	D-1	12	24	CH-1	5	11
2	D-2	5	10	D-1	7.5	10.5
3	D-7	8	16	D-3	8.1	14.7
4	D-8	6	12	-	-	-
5	D-4	11	23	ON-GRADE DP-5	11	23
6	D-9 FLOWBY DP-4	9	18	SUMP INLETS DP-7	28	58
7	D-5,D-10 FLOWBY DP-3	28	58			
9	D-13	13	26			
10	D-16 FLOWBY DP-6	16	32			

LEGEND

PROPOSED COUNTOURS
DEVELOPED BASINS
TOC LINE
DIRECTION OF FLOW
DRAINAGE BASIN — D-5 BASIN DESIGNATION; AREA 9.38; Q 100YR 36; Q 5YR 18

REVISIONS		
NO	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: DC DATE: 5/9/02
DRAWN BY: BG DATE: 7/11/02
CHECKED BY: DC DATE: 10/20/03

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CITY OF COLORADO SPRINGS DEPT. OF UTILITIES GAS, ELECTRIC, WATER AND WASTEWATER

URS
9960 FEDERAL DRIVE, SUITE 300
COLORADO SPRINGS, COLORADO
PHONE (71
FAX: (719)

PROJECT PRONGHORN MEADOWS
SHEET TITLE DEVELOPED BASINS
CLIENT WATT/COX, LLC
JOB NO. 42539
SHEET

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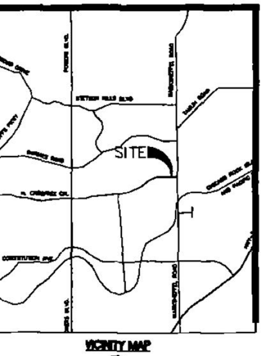
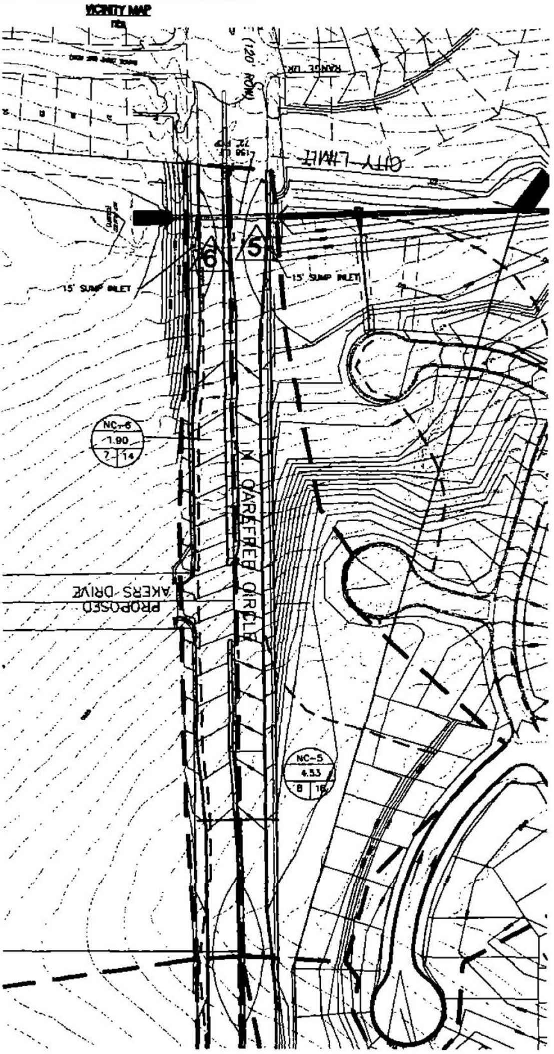
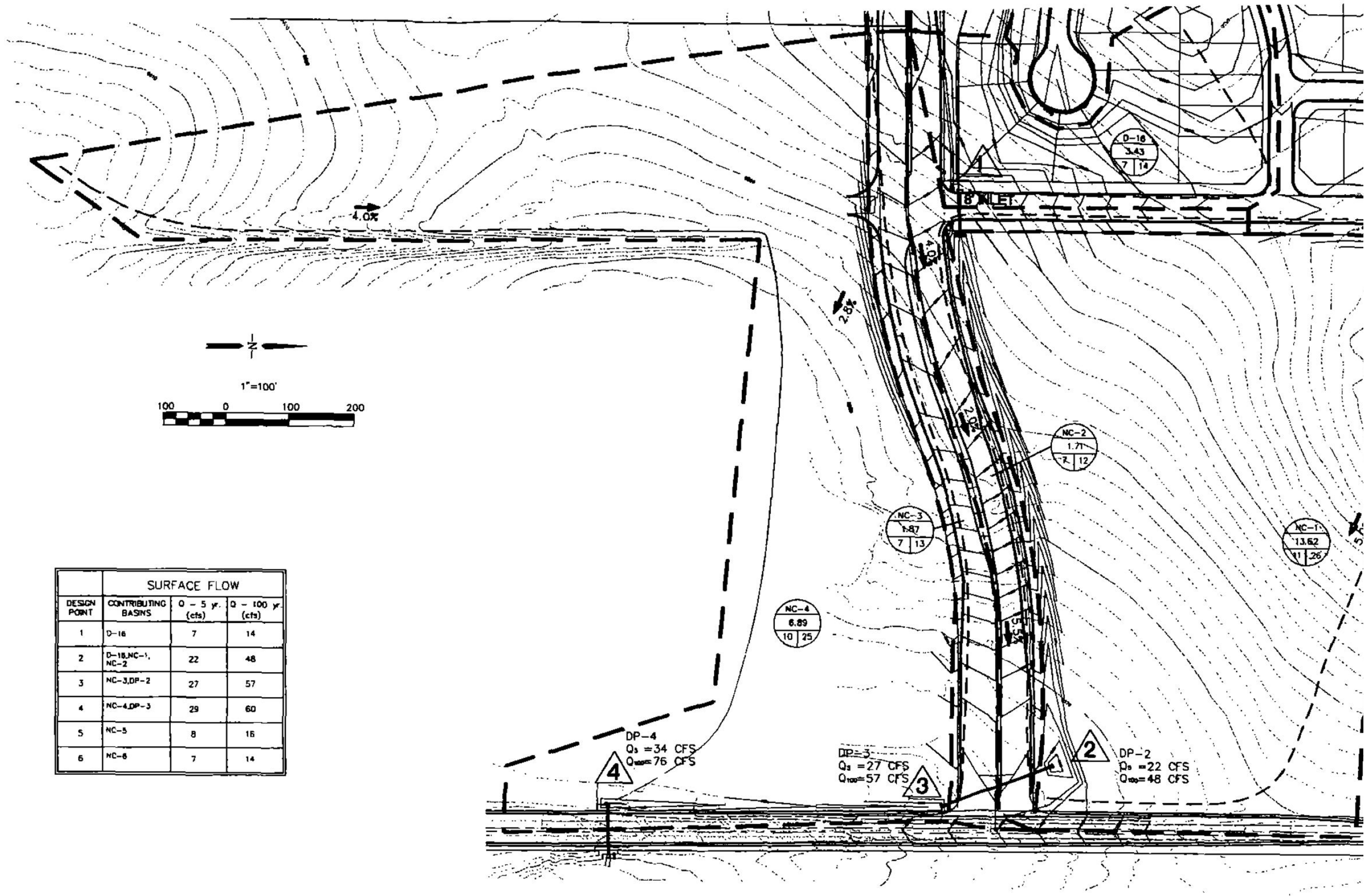
NORTH CAREFREE CIRCLE
DEVELOPED DRAINAGE BASINS







SURFACE FLOW			
DESIGN POINT	CONTRIBUTING BASINS	Q – 5 yr. (cfs)	Q – 100 yr. (cfs)
1	D-16	7	14
2	D-16,NC-1, NC-2	22	48
3	NC-3,DP-2	27	57
4	NC-4,DP-3	29	60
5	NC-5	8	16
6	NC-6	7	14

LEGEND

PROPOSED COUNTOURS

DEVELOPED BASINS

TOC LINE

DIRECTION OF FLOW

DRAINAGE BASIN — BASIN DESIGNATION NC-1; AREA 13.62; Q 5-YR 11; Q 100-YR 26

REVISIONS:		
NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: DC DATE: 2/12/03
DRAWN BY: DC DATE: 2/13/03
CHECKED BY: CKC DATE: 2/14/03

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
(SEE COVER FOR LIST OF UTILITY CONTACTS)

URS
9960 FEDERAL DRIVE #300
COLORADO SPRINGS, COLORADO 80921

PROJECT NORTH CAREFREE CIR
SHEET TITLE DEVELOPED DRAINAGE PLA
FROM ______ TO ______
JOB NO. 21708978

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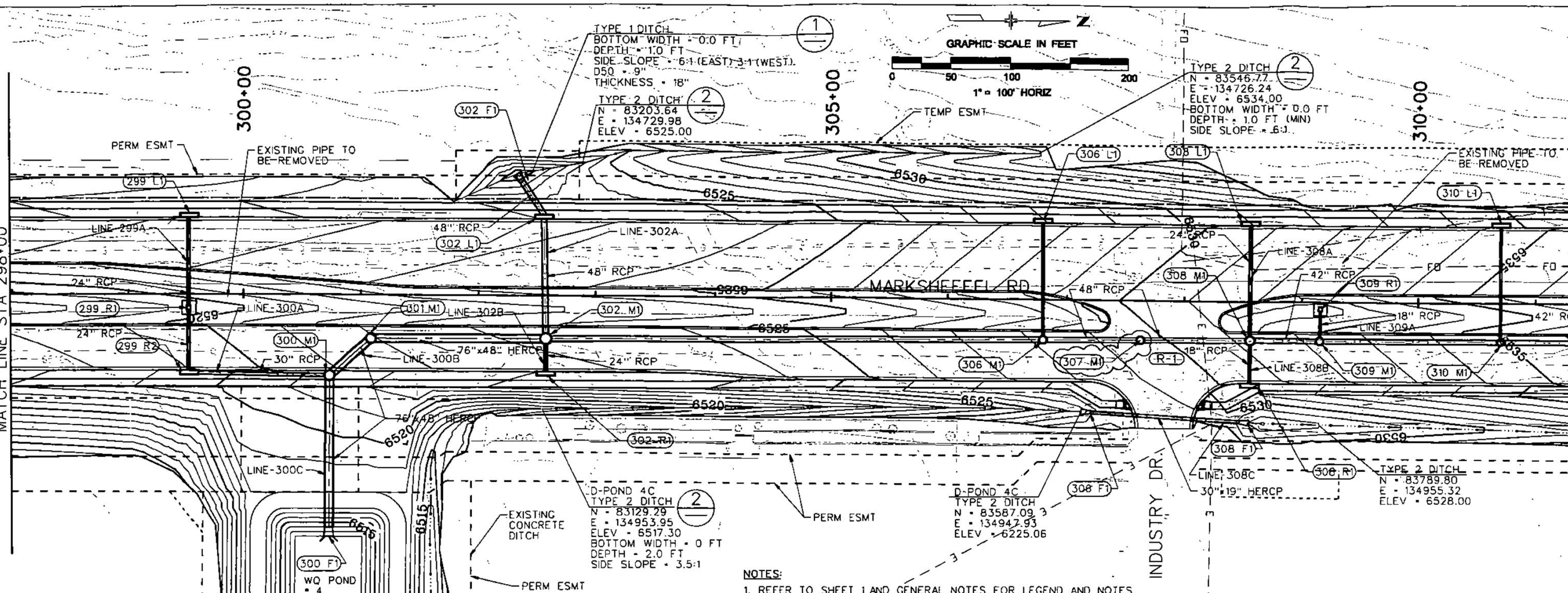
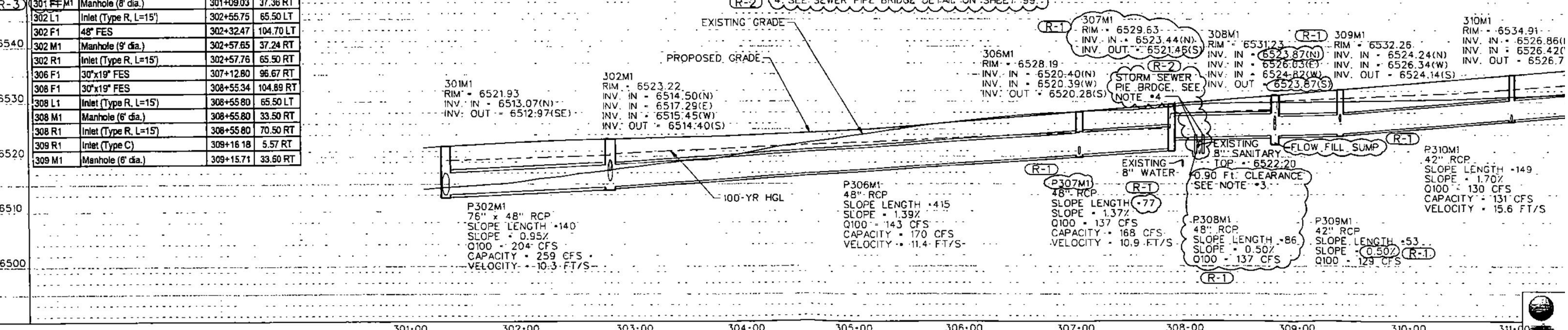


ID	DESCRIPTION	STATION	OFFSET
299 L1	Inlet (Type R, L=15')	299+52.24	65.50 LT
299 R1	Inlet (Type C)	299+52.46	11.83 RT
299 R2	Inlet (Type R, L=15')	299+52.56	65.50 RT
300 M1	Manhole (8' dia.)	300+73.19	69.86 RT
300 F1	76"x48" FES	300+72.89	208.00 RT
301 M1	Manhole (8' dia.)	301+09.03	37.36 RT
302 L1	Inlet (Type R, L=15')	302+55.75	65.50 LT
302 F1	48" FES	302+32.47	104.70 LT
302 M1	Manhole (9' dia.)	302+57.65	37.24 RT
302 R1	Inlet (Type R, L=15')	302+57.76	65.50 RT
306 F1	30"x19" FES	307+12.80	96.67 RT
308 F1	30"x19" FES	308+55.34	104.89 RT
308 L1	Inlet (Type R, L=15')	308+55.80	65.50 LT
308 M1	Manhole (6' dia.)	308+55.80	33.50 RT
308 R1	Inlet (Type R, L=15')	308+55.80	70.50 RT
309 R1	Inlet (Type C)	309+16.18	5.57 RT
309 M1	Manhole (6' dia.)	309+15.71	33.60 RT

ID	DESCRIPTION	STATION	OFFSET
306L1	INLET (TYPE R, L=15')	306+79.36	65.50' LT
306M1	MANHOLE (6' dia.)	306+79.98	34.60' RT
310M1	MANHOLE (5' dia.)	310+69.88	33.50' RT
310L1	INLET (TYPE R, L=15')	310+69.88	65.50' LT
307M1	MANHOLE (6' dia.)	307+63.14	34.08' RT

NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.
3. (R-1) INSTALL PIPE BRIDGE PER DETAIL A 8-8 (COLORADO SPRINGS UTILITIES). INSTALL FULL LENGTH OF 48" RCP CENTERED OVER EXISTING SANITARY SEWER. NOTIFY CHEROKEE METROPOLITAN DISTRICT NO MORE THAN TWO BUSINESS DAYS PRIOR TO INSTALLATION OF PIPE BRIDGE. NO RCP JOINTS ALLOWED BETWEEN CONCRETE SUPPORTS FOR THE PIPE BRIDGE.
4. (R-2) SEE SEWER PIPE BRIDGE DETAIL ON SHEET 99.



Computer File Information

Creation Date: 10/23/2007	Initials: LMS
Print Date: 08/25/2009	Initials: ADH
File Name: drpp04.dgn	

Sheet Revisions

	Date:	Comments	Init.
(R-1)	3/15/2011	Add 307M1 & Pipe Raise	GCS
(R-2)	4/8/2011	Add Storm Sewer Pipe Bridge	GMH
(R-3)	1/7/2011	Revised ID Table	GMH
( )			

EL PASO COUNTY
COLORADO

PPRTA

WILSON & COMPANY
Engineers & Architects
5755 Mark Dabling Blvd.
Ste. 220
Colorado Springs, CO 80919
Phone: 719-520-5800
Fax: 719-520-0108

As Constructed
No Revisions:
Revised: GMH 12-12-11
Void:

Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 7 of 14

Proj
Sheet

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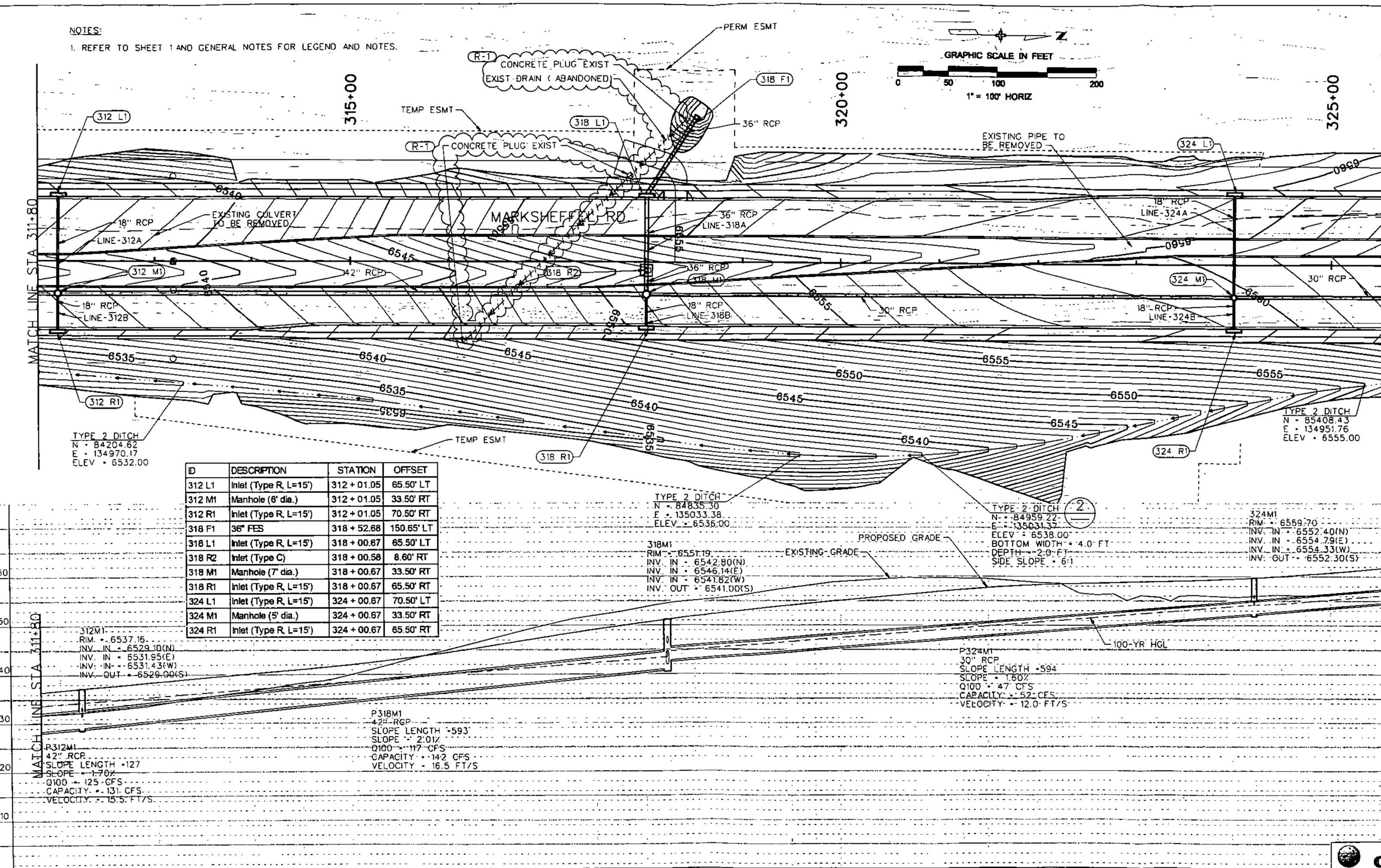
NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.



ID	DESCRIPTION	STATION	OFFSET
312 L1	Inlet (Type R, L=15')	312 + 01.05	65.50' LT
312 M1	Manhole (6' dia.)	312 + 01.05	33.50' RT
312 R1	Inlet (Type R, L=15')	312 + 01.05	70.50' RT
318 F1	36" FES	318 + 52.68	150.65' LT
318 L1	Inlet (Type R, L=15')	318 + 00.67	65.50' LT
318 R2	Inlet (Type C)	318 + 00.58	8.60' RT
318 M1	Manhole (7' dia.)	318 + 00.67	33.50' RT
318 R1	Inlet (Type R, L=15')	318 + 00.67	65.50' RT
324 L1	Inlet (Type R, L=15')	324 + 00.67	70.50' LT
324 M1	Manhole (5' dia.)	324 + 00.67	33.50' RT
324 R1	Inlet (Type R, L=15')	324 + 00.67	65.50' RT

Computer File Information
ion Date: 10/23/2007 Initials: LMS
Date: 08/25/2009 Initials: ADH
ame: drpp05.dgn

Sheet Revisions

	Date:	Comments	Init.
R-1	7-6-11	PLUG & ABANDONED EXIST DRAIN	GMH

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Engineers & Architects
5755 Mark Dabling Blvd.
Ste. 220
Colorado Springs, CO 80919
Phone: 719-520-5800
Fax: 719-520-0108

As Constructed
No Revisions:
Revised: GMH 12-6-11
Void:

Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 10 of 14

Projec
PF
7
Sheet Nu

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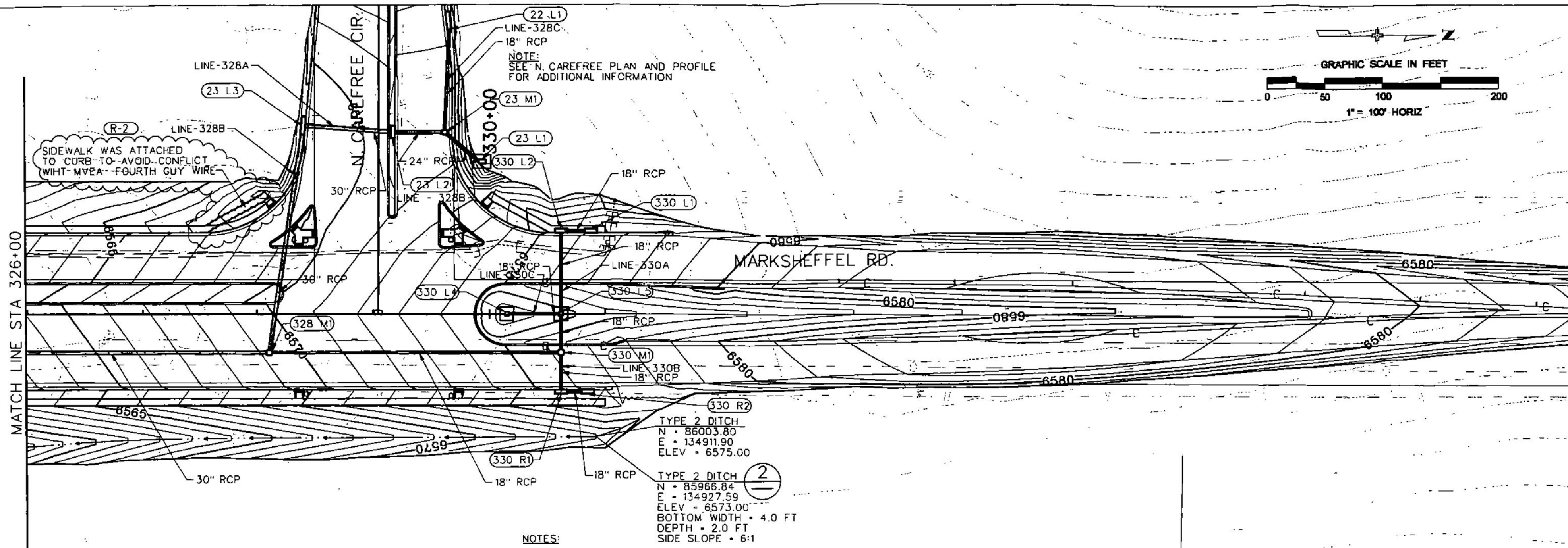
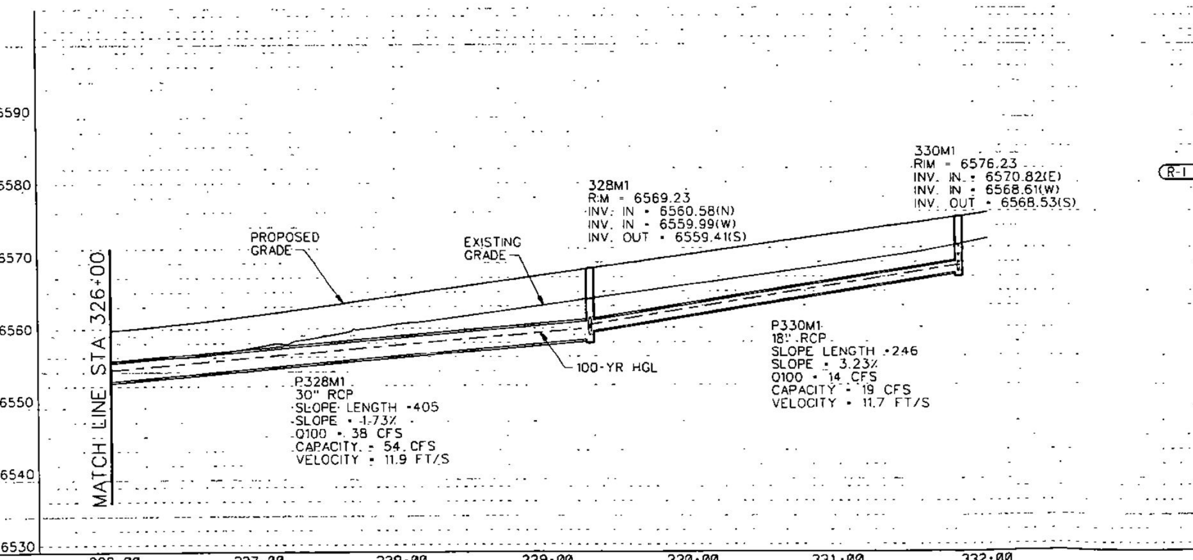


NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.



ID	DESCRIPTION	STATION	OFFSET
22 L1	Inlet (Type R, L=15')	22+25.23	57.79' LT
23 M1	Manhole (4' dia.)	23+21.64	57.00' LT
23 L1	Inlet (Type D)	23+47.10	89.22' LT
23 L2	Inlet (Type R, L=10')	23+21.64	15.00' LT
23 L3	Inlet (Type R, L=15')	23+16.06	62.23' RT
328 M1	Manhole (6' dia.)	325+10.74	33.50' RT
330 L1	Inlet (Type R, L=10')	330 + 87.57	70.50' LT
330 L2	Inlet (Type R, L=10')	330 + 62.07	70.50' LT
330 L4	Inlet (Type C)	330 + 14.95	0.36' LT
330 L5	Inlet (Type C)	330 + 62.12	0.25' LT
330 M1	Manhole (6' dia.)	330 + 62.07	33.50' RT
330 R1	Inlet (Type R, L=10')	330 + 62.07	65.50' RT
330 R2	Inlet (Type R, L=10')	330 + 85.07	65.50' RT

R-1

Computer File Information
Creation Date: 10/23/2007 Initials: SAK
Print Date: 08/25/2009 Initials: ADH
File Name: drpp06.dgn

Sheet Revisions

	Date:	Comments	Init.
R-1	3/25/10	Addendum 4	GCS
R-2	10/3/11	MOVED SIDEWALK	GMH

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Ste. 220
Colorado Springs, CO 80919
Phone: 719-520-5800
Fax: 719-520-0108

As Constructed
No Revisions:
Revised: GMH 12-6-11
Void:

Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 12 of 14

Proj
Sheet

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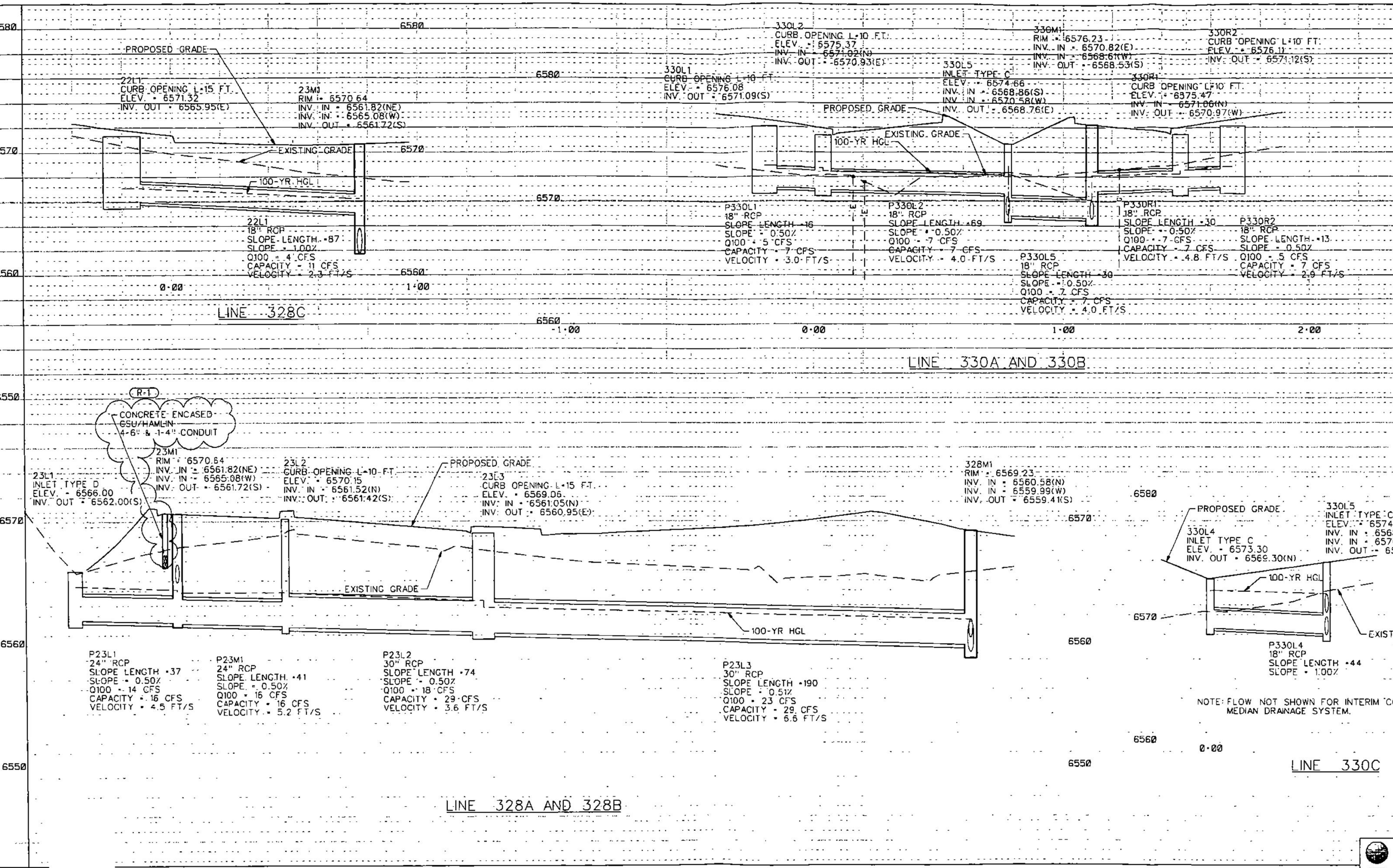

Computer File Information	
Creation Date: 10/23/2007	Initials: LMS
Print Date: 08/25/2009	Initials: ADH
File Name: DRPR06.dgn	

	Sheet Revisions		
	Date:	Comments	Init.
R-1	12-6-11	ADDED CONCRETE ENCASEMENT	GMH

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5755 Mark Dabling Blvd.
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Phone: 719-520-5800
Fax: 719-520-0108

As Constructed
No Revisions:
Revised: GMH 12-6-11
Void:

Marksheffel Road
Storm Drain Lateral Profile

Designer: GCS	Structure Numbers
Detailer: ADH	
Sheet Subset: Drainage	Subset Sheets: 13 of 14

Proj

Sheet

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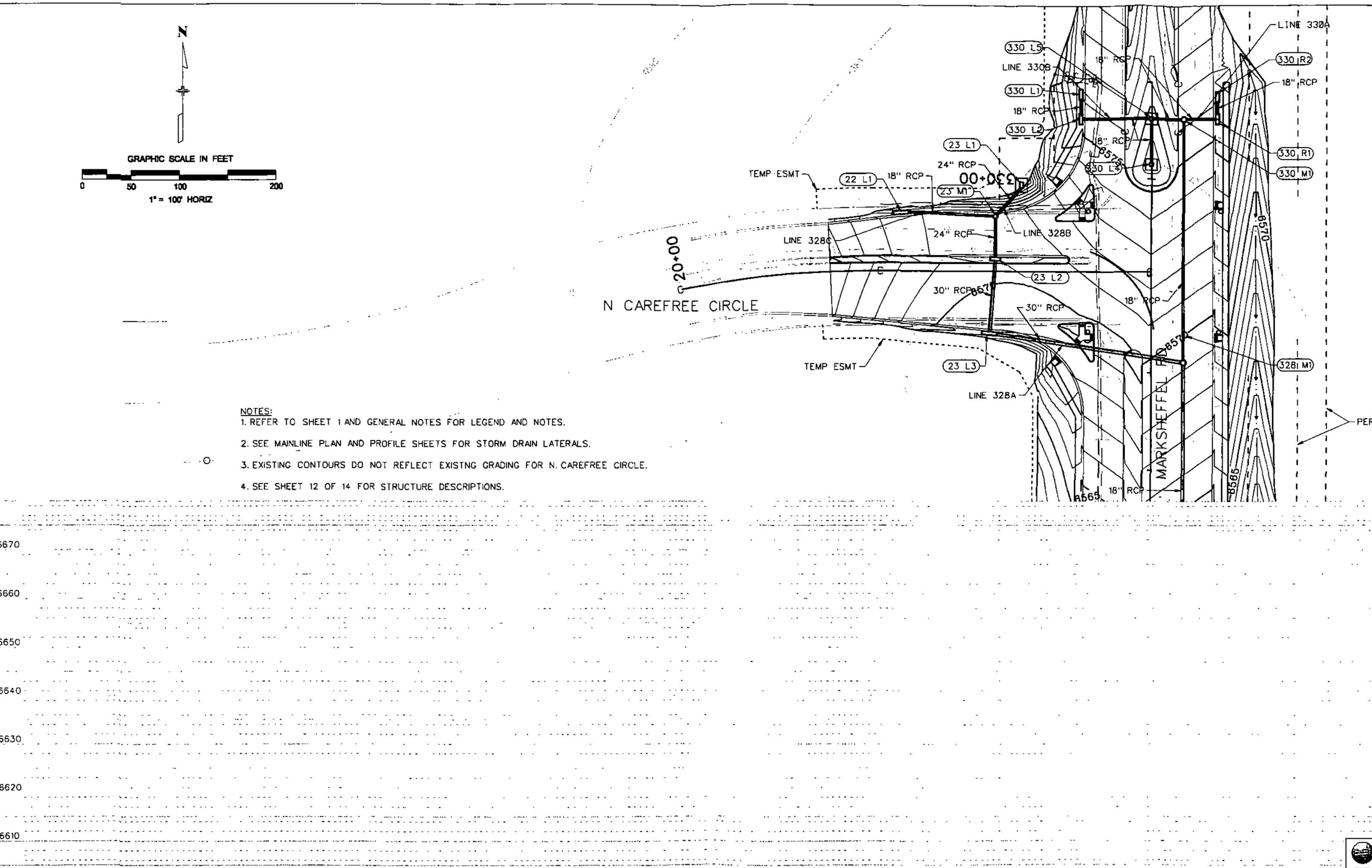

NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE MAINLINE PLAN AND PROFILE SHEETS FOR STORM DRAIN LATERALS.
3. EXISTING CONTOURS DO NOT REFLECT EXISTNG GRADING FOR N. CAREFREE CIRCLE.
4. SEE SHEET 12 OF 14 FOR STRUCTURE DESCRIPTIONS.

Computer File Information		Sheet Revisions		
eation Date: 02/06/2008	Initials: ADH	Date:	Comments	Init.
nt Date: 08/25/2009	Initials: ADH			
Name: drpp17.dgn				

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Colorado Springs, CO 80919
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Fax: 719-520-0108

As Constructed
No Revisions: GMH 12-12-11
Revised:
Void:

Marksheffel Road
Drainage Plan and Profile - N. Carefree

Designer: GCS	Structure Numbers	
Detailer: ADH		
Sheet Subset: Drainage	Subset Sheets: 14 of 14	

Pro

Sheet

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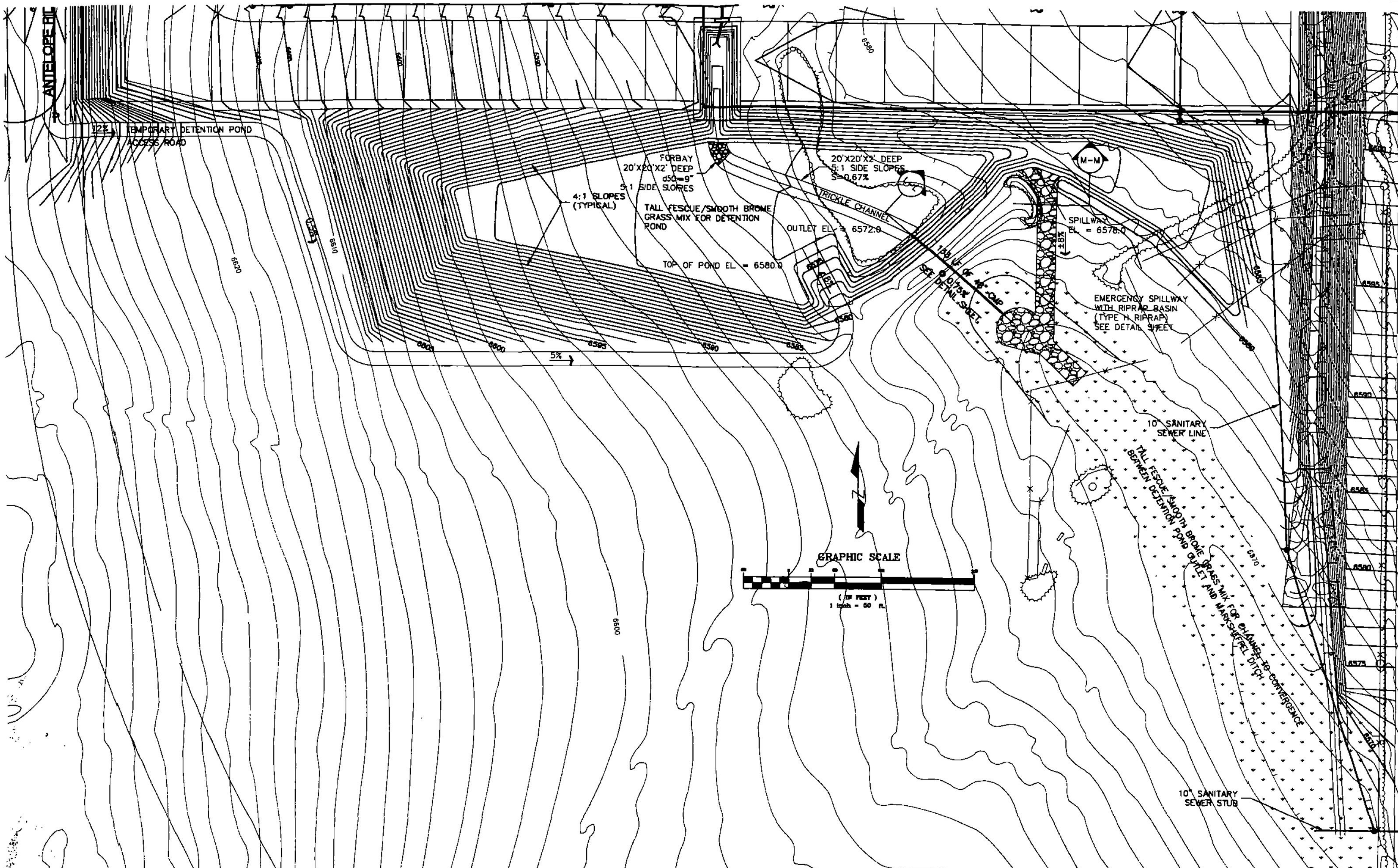

TEMPORARY DETENTION POND
CHATEAU AT ANTELOPE RIDGE

URS Greiner Woodward

DRAWN BY: EDE
DATE: 03/03/
PROJ. NO.: 874221

SHEET 11 OF 17

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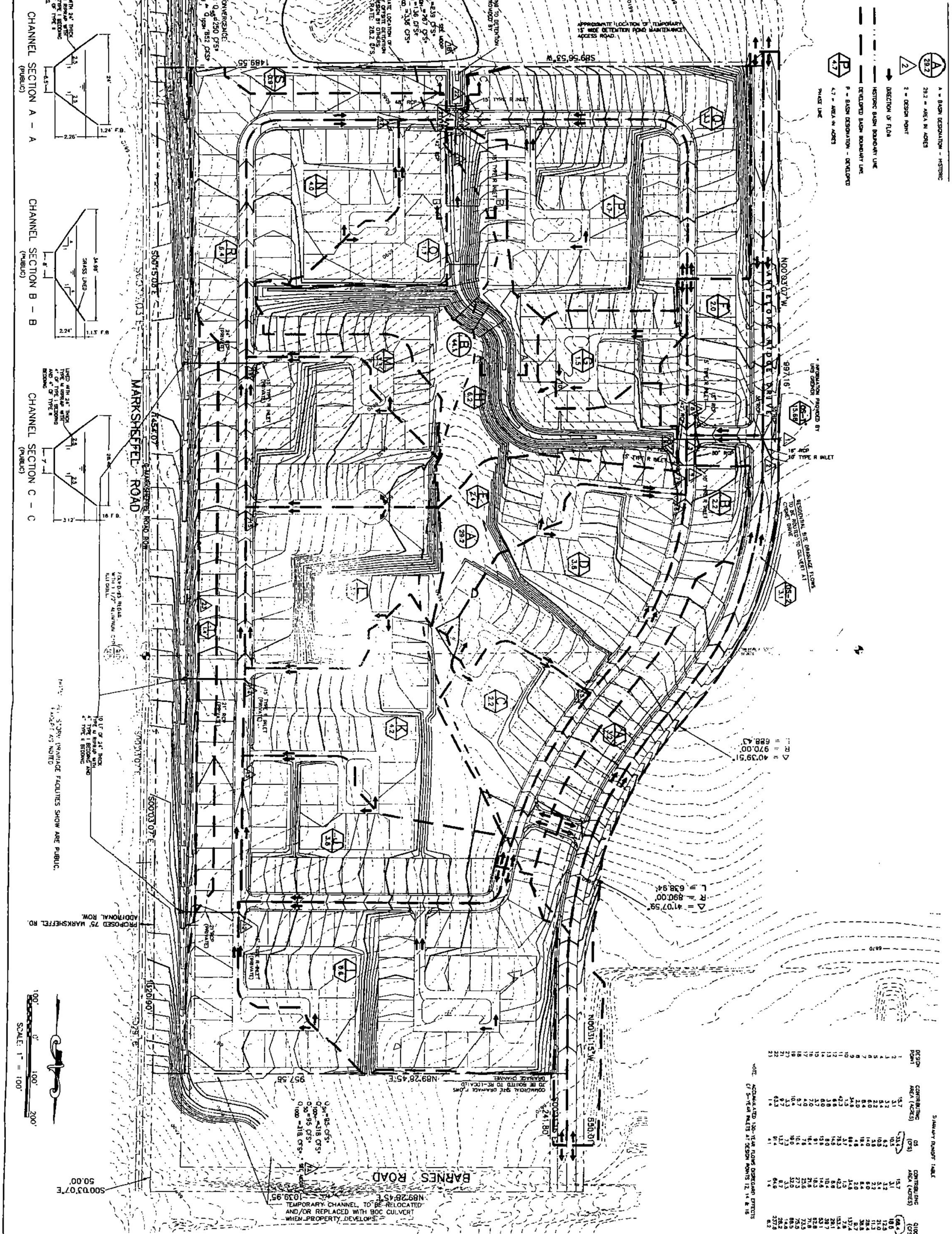

Project No.:	CHA100
Date of Issue	11/11/98
Designed by:	GTW
Drawn by:	ATV
Checked by:	GTW
CAD File No.:	CHA100\GRADING\DRAIN-1.DWG
CAD File Date	11/11/98 ATV

sheet no. 69 of 74

QCI DEVELOPMENT SERVICES GROUP, INC.
11184 Huron Street, Suite 13
Denver, Colorado 80234-3344
(303) 280-9200 Fax: (303) 450-0917

Antelope Ridge
El Paso County, Colorado.
Final Construction Plans
Final Drainage Plan

NO.	REVISIONS	DATE

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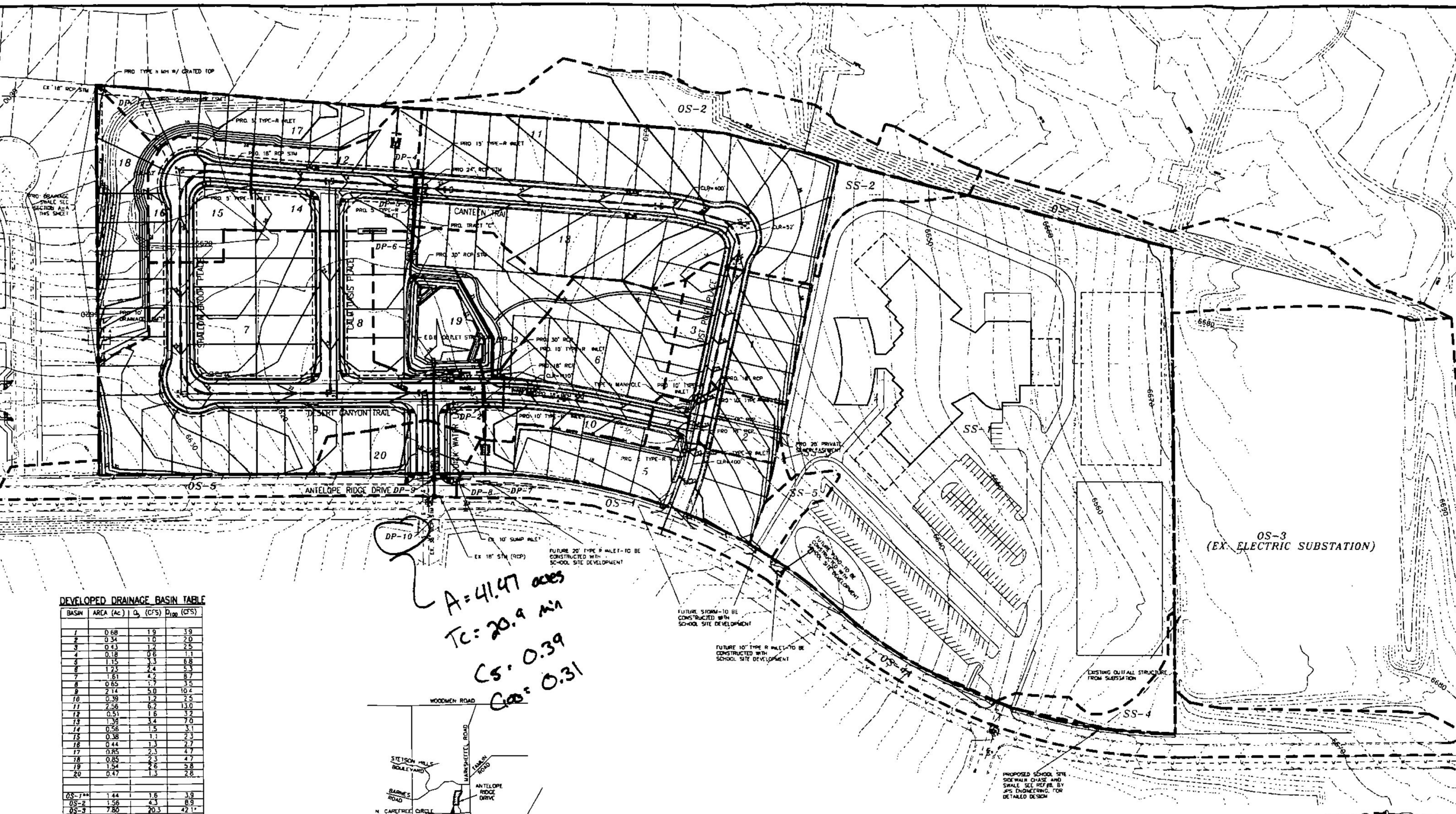


A=41.47 acres
Tc: 20.9 min
Cs: 0.39
C100: 0.31

DEVELOPED DRAINAGE BASIN TABLE

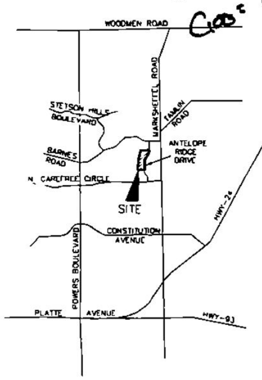
BASIN	AREA (Ac)	Q_5 (CFS)	Q_{100} (CFS)
1	0.68	1.9	3.9
2	0.34	1.0	2.0
3	0.43	1.2	2.5
4	0.18	0.6	1.1
5	1.15	3.3	6.8
6	1.23	2.4	5.3
7	1.61	4.2	8.7
8	0.65	1.7	3.5
9	2.14	5.0	10.4
10	0.39	1.2	2.5
11	2.56	6.2	13.0
12	0.51	1.6	3.2
13	1.39	3.4	7.0
14	0.56	1.5	3.1
15	0.38	1.1	2.3
16	0.44	1.3	2.7
17	0.85	2.3	4.7
18	0.85	2.3	4.7
19	1.54	2.6	5.8
20	0.47	1.3	2.8
OS-1**	1.44	1.6	3.9
OS-2	1.56	4.3	8.9
OS-3	7.80	20.3	42.1*
OS-4	0.54	2.4	4.6
OS-4A**	1.58	4.3	8.6
OS-5	0.80	2.1	4.1
SS-1**	11.80	31.7	65.0
SS-2**	0.23	0.3	0.7
SS-3**	0.04	0.1	0.1
SS-4**	0.36	0.5	1.1
SS-5**	0.23	0.6	1.3

* Q100 FLOW TAKEN FROM STETSON HILLS SUBSTATION DRAINAGE REPORT. RELEASE RATE IS 28.1 CFS

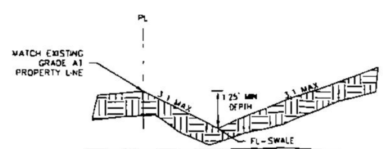
** BASIN INFORMATION PROVIDED BY, "DRAINAGE LETTER REPORT FOR ROCKY MOUNTAIN CLASSICAL ACADEMY LOT 46, WHISPERING SPRINGS FILING NO. 1", PREPARED BY JPS ENGINEERING. DATED JULY 27, 2013

DESIGN POINT TABLE

DP#	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
DP-1	3.49	8.0	16.8
DP-2	2.53	5.9	12.2
DP-3	7.65	17.3	36.1
DP-4	4.86	9.1	19.1
DP-5	1.95	4.7	9.8
DP-6	7.63	14.4	30.1
DP-7	5.46	10.6	26.1
DP-8	2.49	2.9	12.8
DP-9	38.98	45.2	55.4
DP-10	41.47	47.3	66.4
DP-11	1.70	4.5	9.4



VICINITY MAP
NOT TO SCALE



SOUTH PL SWALE SECTION A-A
N.T.S.

LEGEND

6418	EXISTING 2' CONTOUR
	EXISTING 10' CONTOUR
	PROPOSED 2' CONTOUR
6410	PROPOSED 10' CONTOUR
→	DIRECTION OF FLOW
— — —	DRAINAGE BASIN
H-3	DRAINAGE BASIN DESIGNATION

1" = 80'

0 40 80 160
Scale in Feet

ROCKWELL CONSULTING, Inc.

TITLE :	WHISPERING SPRINGS FILING NO. 1 DEVELOPED DRAINAGE MAP
SCALE : 1"=80'	DRAWN BY : KPK
DATE : 7/30/13	CHECKED BY : KDR

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EXISTING DRAINAGE CONDITIONS CALCULATIONS

CLASSIC
CONSULTING
SURVEYORS

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JOB NUMBER: 2441.00
DATE: 10/03/14
CALCULATED BY: MAL

EXISTING DRAINAGE CONDITIONS ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
EX-A	13.20	0.00	0.90	0.95	13.20	0.25	0.35	0.25	0.35	**3.30**	**4.62**
EX-B	7.30	0.00	0.90	0.95	7.30	0.25	0.35	0.25	0.35	**1.83**	**2.56**
EX-C	24.28	0.00	0.90	0.95	24.28	0.25	0.35	0.25	0.35	**6.07**	**8.50**
EX-D	6.19	0.00	0.90	0.95	6.19	0.25	0.35	0.25	0.35	**1.55**	**2.17**
EX-E	1.10	0.00	0.90	0.95	1.10	0.25	0.35	0.25	0.35	**0.28**	**0.39**
EX-F	3.15	0.00	0.90	0.95	3.15	0.25	0.35	0.25	0.35	**0.79**	**1.10**
EX-R	0.53	0.32	0.90	0.95	0.21	0.25	0.35	0.64	0.71	**0.34**	**0.38**
D-13	6.79	1.37	0.90	0.95	5.42	0.53	0.64	0.60	0.70	**4.11**	**4.77**
D-14	3.88	1.66	0.90	0.95	2.22	0.37	0.52	0.60	0.70	**2.32**	**2.73**
D-15	1.36	1.36	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**1.22**	**1.29**
D-16	2.73	0.77	0.90	0.95	1.96	0.53	0.64	0.63	0.73	**1.73**	**1.99**
NC-1	0.42	0.42	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**0.38**	**0.40**
NC-2	1.49	1.49	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**1.34**	**1.42**
WS	41.47		0.90	0.95		0.55	0.65	0.39	0.31	**16.05**	**12.67**
CT	42.07	8.67	0.90	0.95	33.40	0.55	0.65	0.62	0.71	**26.17**	**29.95**

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JOB NAME: ***WINDERMERE***
JOB NUMBER: ***2441.00***
DATE: ***10/03/14***
CALC'D BY: ***MAL***

EXISTING DRAINAGE CONDITIONS ~ BASIN RUNOFF SUMMARY

	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
BASIN	CA(5)	CA(100)	C(5)	Length *(ft)*	Height *(ft)*	Tc *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	Tc *(min)*	TOTAL *(min)*	I(5) (in/hr)	I(100) (in/hr)	Q(5) *(cfs)*	Q(100) *(cfs)*
EX-A	3.30	4.62	0.25	250	16	13.6	700	3.9%	6.9	1.7	15.3	3.43	6.10	**11.3**	**28.2**
EX-B	1.83	2.56	0.25	450	40	16.4	600	1.7%	4.5	2.2	18.6	3.13	5.56	**5.7**	**14.2**
EX-C	6.07	8.50	0.25	450	24	19.4	750	3.7%	6.7	1.9	21.3	2.92	5.19	**17.7**	**44.1**
EX-D	1.55	2.17	0.25	260	24	12.3	150	20.0%	15.7	0.2	12.5	3.75	6.68	**5.8**	**14.5**
EX-E	0.28	0.39	0.25	200	12	12.4	50	12.0%	12.1	0.1	12.5	3.75	6.67	**1.0**	**2.6**
EX-F	0.79	1.10	0.25	30	8	2.9	400	1.0%	3.5	1.9	5.0	5.10	9.07	**4.0**	**10.0**
EX-R	0.34	0.38	0.25	20	2	3.3	320	2.0%	4.9	1.1	5.0	5.10	9.07	**1.7**	**3.4**
D-13	4.11	4.77	0.25	270	21	13.3	1380	6.0%	8.6	2.7	16.0	3.36	5.98	**13.8**	**28.5**
D-14	2.32	2.73	0.25	125	2.5	14.1	1250	1.7%	4.6	4.6	18.7	3.12	5.54	**7.2**	**15.1**
D-15	1.22	1.29	0.25	25	1	5.0	2050	1.7%	4.6	7.5	12.5	3.75	6.66	**4.6**	**8.6**
D-16	1.73	1.99	0.53	200	10	8.9	350	3.5%	6.5	0.9	9.8	4.14	7.36	**7.2**	**14.6**
NC-1	0.38	0.40	0.25	10	2	1.9	25	3.5%	6.5	0.1	5.0	5.10	9.07	**1.9**	**3.6**
NC-2	1.34	1.42	0.25	15	2	2.6	1125	3.5%	6.5	2.9	5.5	4.98	8.86	**6.7**	**12.5**
WS	16.05	12.67	0.25			#DIV/0!		2.0%	4.9	0.0	20.9	2.95	5.24	**47.3**	**66.4**
CT	26.17	29.95	0.25	100	4	10.1	1450	2.0%	4.9	4.9	14.9	3.47	6.17	**90.8**	**184.7**

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/04/14*
CALCULATED BY: *MAL*

EXISTING DRAINAGE CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
4	BASIN D-16	1.73	1.99	9.8	4.14	7.36	7.2	14.6	8' Existing Sump Inlet
6	BASIN EX-R + BASIN EX-A + DP-4-EXIST	5.37	6.98	15.3	3.43	6.10	18.4	42.6	Existing Type D Grated Inlet
7	BASIN D-13 & BASIN D-14	6.42	7.50	18.7	3.12	5.54	20.0	41.6	Existing 25' Type R Inlet
8	BASIN D-15 & BASIN EX-E	1.50	1.68	12.5	3.75	6.66	5.6	11.2	Existing 10' Type R Inlet
19	BASIN NC-2	1.34	1.42	5.5	4.98	8.86	6.7	12.5	15' Existing At-Grade Inlet
20	BASIN NC-1 + Flow-by DP-19	0.75	0.90	5.5	4.98	8.86	3.7	8.0	10' Exising sump median inlet
24	BASIN WS + BASIN CT	42.22	42.62	25.8	2.64	4.69	111.3	199.7	OFF-SITE TO POND
25	DP-24 + BASIN EX-D + BASIN EX-F	44.56	45.88	25.8	2.64	4.69	117.5	215.1	EXIST. TO POND
26	DP-25 + BASIN EX-B + BASIN EX-C	52.45	56.94	25.8	2.64	4.69	138.3	266.9	EXIST. TO MARKSHEFFEL (Not including Marksheffel Ditch)

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALCULATED BY: *MAL*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

EXISTING DRAINAGE CONDITIONS ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Pipe Size*
6a	DP-19-EXIST (Intercept)	0.97	0.91	5.5	4.98	8.86	4.8	8.1	EX. 18" RCP
6b	DP-6	5.37	6.98	15.3	3.43	6.10	18.4	42.6	EX. 24" RCP
6c	PIPE 6a + PIPE 6b	6.34	7.90	15.5	3.41	6.06	21.6	47.9	EX. 24" RCP
7	PIPE 6C + DP-20-EXIST	7.09	8.80	15.5	3.41	6.06	24.2	53.3	EX. 30" RCP
8	DP-7-EXIST & DP-8-EXIST	7.92	9.18	18.7	3.12	5.54	24.7	50.9	EX. 36" RCP

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JOB NAME:	***WINDERMERE***
JOB NUMBER:	***2441.00***
DATE:	***10/03/14***
CALCULATED BY:	***MAL***

DESIGN POINT EX-8

Total Flow: Q_5 = 6 cfs

Q_{100} = 11 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

EXISTING 10 FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	*WINDERMERE*
JOB NUMBER:	*2441.00*
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CALCULATED BY:	*MAL*

DESIGN POINT **EX-19** **100 YEAR FLOW**

Q(100)	12.5	**I(100)**	8.9		
DEPTH	0.35	**Fr**	2.46	**Inlet size ? L(i) =**	15
SPREAD	11.0	**L(1)**	20.8	**If Li < L(2) then Qi =**	9
CROSS SLOPE	2.0%	**L(2)**	12.5	**If Li > L(2) then Qi =**	8
STREET SLOPE	4.0%	**L(3)**	44.7	**FB =**	4.4
				CA(eqv.)=	0.50

5 YEAR FLOW

Q(5)	6.7	**I(5)**	5.0		
DEPTH	0.30	**Fr**	2.35	**Inlet size ? L(i) =**	15
SPREAD	8.8	**L(1)**	15.8	**If Li < L(2) then Qi =**	6
CROSS SLOPE	2.0%	**L(2)**	9.5	**If Li > L(2) then Qi =**	5
STREET SLOPE	4.0%	**L(3)**	33.9	**FB =**	1.9
				CA(eqv.)=	0.37

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JOB NAME:	***WINDERMERE***
JOB NUMBER:	***2441.00***
DATE:	***10/03/14***
CALCULATED BY:	***MAL***

DESIGN POINT EX-20

Total Flow: Q_5 = 4 cfs

Q_{100} = 8 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.50 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 *foot inlet required*

100-Year Event: 4 foot inlet required

EXISTING 10 FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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DEVELOPED DRAINAGE CONDITIONS CALCULATIONS

CLASSIC
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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALCULATED BY: *MAL*

DEVELOPED CONDITIONS ~ BASIN RUNOFF COEFFICIENT SUMMARY

		IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
BASIN	TOTAL AREA (AC)	AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
A	3.35	0.88	0.90	0.95	2.47	0.60	0.7	0.68	0.77	**2.27**	**2.57**
B	2.72	0.56	0.90	0.95	2.16	0.60	0.7	0.66	0.75	**1.80**	**2.04**
C	4.20	1.10	0.90	0.95	3.10	0.60	0.7	0.68	0.77	**2.85**	**3.22**
D	1.75	1.08	0.60	0.70	0.67	0.25	0.35	0.47	0.57	**0.82**	**0.99**
E	1.47	0.21	0.90	0.95	1.26	0.51	0.61	0.57	0.66	**0.83**	**0.97**
F	2.85	0.76	0.90	0.95	2.09	0.60	0.7	0.68	0.77	**1.94**	**2.19**
G	3.97	0.67	0.90	0.95	3.30	0.60	0.7	0.65	0.74	**2.58**	**2.95**
H	1.42	0.43	0.90	0.95	0.99	0.60	0.7	0.69	0.78	**0.98**	**1.10**
I	4.44	1.12	0.90	0.95	3.32	0.56	0.66	0.65	0.73	**2.87**	**3.26**
J	3.30	0.74	0.90	0.95	2.56	0.60	0.7	0.67	0.76	**2.20**	**2.50**
K	3.74	0.61	0.90	0.95	3.13	0.60	0.7	0.65	0.74	**2.43**	**2.77**

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JOB NAME: ***WINDERMERE***
JOB NUMBER: ***2441.00***
DATE: ***10/03/14***
CALCULATED BY: ***MAL***

DEVELOPED CONDITIONS ~ BASIN RUNOFF COEFFICIENT SUMMARY

		IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
BASIN	TOTAL AREA (AC)	AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
L	3.86	1.15	0.90	0.95	2.71	0.60	0.7	0.69	0.77	**2.66**	**2.99**
M	9.96	0.00	0.90	0.95	9.96	0.25	0.35	0.25	0.35	**2.49**	**3.49**
N	0.58	0.12	0.90	0.95	0.46	0.60	0.7	0.66	0.75	**0.38**	**0.44**
P	0.60	0.00	0.90	0.95	0.60	0.25	0.35	0.25	0.35	**0.15**	**0.21**
Q	1.70	0.62	0.90	0.95	1.08	0.60	0.7	0.71	0.79	**1.21**	**1.35**
R	1.18	0.25	0.90	0.95	0.93	0.50	0.6	0.58	0.67	**0.69**	**0.80**
S	4.52	1.55	0.60	0.70	2.97	0.25	0.35	0.37	0.47	**1.67**	**2.12**
D-13	6.79	1.37	0.90	0.95	5.42	0.53	0.64	0.60	0.70	**4.11**	**4.77**
D-14	3.88	1.66	0.90	0.95	2.22	0.37	0.52	0.60	0.70	**2.32**	**2.73**
D-15	1.36	1.36	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**1.22**	**1.29**
D-16	2.73	0.77	0.90	0.95	1.96	0.53	0.64	0.63	0.73	**1.73**	**1.99**
NC-1	0.42	0.42	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**0.38**	**0.40**
NC-2	1.49	1.49	0.90	0.95	0.00	0.25	0.35	0.90	0.95	**1.34**	**1.42**
WS	41.47		0.90	0.95		0.55	0.65	0.39	0.31	**16.05**	**12.67**
CT	42.07	8.67	0.90	0.95	33.40	0.55	0.65	0.62	0.71	**26.17**	**29.95**

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JOB NAME: ***WINDERMERE***
JOB NUMBER: ***2441.00***
DATE: ***10/03/14***
CALC'D BY: ***MAL***

DEVELOPED CONDITIONS ~ BASIN RUNOFF SUMMARY

	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
BASIN	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
A	2.27	2.57	0.6	170	5	8.5	680	2.2%	5.2	2.2	10.7	3.99	7.10	**9.1**	**18.2**
B	1.80	2.04	0.6	10	1	1.4	715	2.5%	5.5	2.2	5.0	5.10	9.07	**9.2**	**18.5**
C	2.85	3.22	0.6	50	1	5.3	790	3.5%	6.5	2.0	7.3	4.59	8.15	**13.1**	**26.2**
D	0.82	0.99	0.6	100	7	4.9	490	3.9%	6.9	1.2	6.1	4.84	8.60	**3.9**	**8.5**
E	0.83	0.97	0.6	60	4	3.9	400	1.5%	4.3	1.6	5.4	5.00	8.88	**4.2**	**8.6**
F	1.94	2.19	0.25	70	20	4.4	550	2.9%	6.0	1.5	5.9	4.87	8.67	**9.4**	**18.9**
G	2.58	2.95	0.6	190	12	7.0	480	1.5%	4.3	1.9	8.9	4.29	7.62	**11.1**	**22.4**
H	0.98	1.10	0.6	50	1	5.3	480	1.5%	4.3	1.9	7.1	4.62	8.21	**4.5**	**9.0**
I	2.87	3.26	0.6	120	8	5.5	800	2.8%	5.8	2.3	7.8	4.49	7.98	**12.9**	**26.0**
J	2.20	2.50	0.6	115	8	5.3	470	2.1%	5.1	1.5	6.8	4.68	8.31	**10.3**	**20.7**
K	2.43	2.77	0.6	50	1	5.3	945	4.0%	7.0	2.3	7.5	4.54	8.07	**11.0**	**22.4**

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALC'D BY: *MAL*

DEVELOPED CONDITIONS ~ BASIN RUNOFF SUMMARY

	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
BASIN	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
L	2.66	2.99	0.6	130	3	8.1	1265	3.5%	6.5	3.2	11.3	3.91	6.95	**10.4**	**20.8**
M	2.49	3.49	0.25	170	54	6.6	760	0.5%	2.5	5.1	11.7	3.85	6.85	**9.6**	**23.9**
N	0.38	0.44	0.5	100	4	7.1	160	4.0%	7.0	0.4	7.5	4.54	8.08	**1.7**	**3.5**
P	0.15	0.21	0.25	90	22	5.3	0	1.0%	3.5	0.0	5.3	5.04	8.96	**0.8**	**1.9**
Q	1.21	1.35	0.25	145	10	10.1	530	4.5%	7.4	1.2	11.3	3.91	6.95	**4.7**	**9.3**
R	0.69	0.80	0.5	70	6	4.6	380	4.5%	7.4	0.9	5.5	4.99	8.86	**3.4**	**7.1**
S	1.67	2.12	0.25	100	14	6.7	720	1.8%	4.7	2.6	9.2	4.23	7.52	**7.1**	**16.0**
D-13	4.11	4.77	0.25	270	21	13.3	1380	6.0%	8.6	2.7	16.0	3.36	5.98	**13.8**	**28.5**
D-14	2.32	2.73	0.25	125	2.5	14.1	1250	1.7%	4.6	4.6	18.7	3.12	5.54	**7.2**	**15.1**
D-15	1.22	1.29	0.25	25	1	5.0	2050	1.7%	4.6	7.5	12.5	3.75	6.66	**4.6**	**8.6**
D-16	1.73	1.99	0.53	200	10	8.9	350	3.5%	6.5	0.9	9.8	4.14	7.36	**7.2**	**14.6**
NC-1	0.38	0.40	0.25	10	2	1.9	25	3.5%	6.5	0.1	5.0	5.10	9.07	**1.9**	**3.6**
NC-2	1.34	1.42	0.25	15	2	2.6	1125	3.5%	6.5	2.9	5.5	4.98	8.86	**6.7**	**12.5**
WS	16.05	12.67	0.25			#DIV/0!		2.0%	4.9	0.0	20.9	2.95	5.24	**47.3**	**66.4**
CT	26.17	29.95	0.25	100	4	10.1	1450	2.0%	4.9	4.9	14.9	3.47	6.17	**90.8**	**184.7**

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JOB NAME: ***WINDERMERE***
JOB NUMBER: ***2441.00***
DATE: ***10/03/14***
CALCULATED BY: ***MAL***

DEVELOPED CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
1	BASIN C	2.85	3.22	7.3	4.59	8.15	13.1	26.2	15' At-Grade Type R Inlet
2	BASIN B + Flow-by DP-1	2.70	3.35	7.3	4.59	8.15	12.4	27.3	15' Sump Type R Curb Inlet
3	BASIN A	2.27	2.57	10.7	3.99	7.10	9.1	18.2	10' Sump Type R Curb Inlet
4	BASIN D-16	1.73	1.99	9.8	4.14	7.36	7.2	14.6	*8' Existing Sump Inlet*
5	BASIN P + PIPE 3b	7.07	8.03	10.8	3.98	7.07	28.1	56.8	SWQ/DETENTION POND
6	BASIN R	0.69	0.80	5.5	4.99	8.86	3.4	7.1	Relocated Type D Grated Inlet
7	BASIN D-13 & BASIN D-14	6.42	7.50	18.7	3.12	5.54	20.0	41.6	Existing 25' Type R Inlet
8	BASIN D-15 & BASIN E	2.06	2.26	12.5	3.75	6.66	7.7	15.1	Existing 10' Type R Inlet
9	BASIN I	2.87	3.26	7.8	4.49	7.98	12.9	26.0	20' At-Grade Type R Inlet
10	BASIN N + Flow-by DP-9	1.24	1.69	7.8	4.49	7.98	5.6	13.5	15' At-Grade Type R Inlet

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JOB NAME: *WINDERMERE*
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DEVELOPED CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
11	BASIN J + Flow-by DP-10	2.49	3.12	7.8	4.49	7.98	11.2	24.8	10' At-Grade Type R Inlet
12	BASIN K	2.43	2.77	7.5	4.54	8.07	11.0	22.4	20' At-Grade Type R Inlet
14	BASIN F + BASIN Q	3.14	3.53	11.3	3.91	6.95	12.3	24.5	20' At-Grade Type R Inlet
15	BASIN G + Flow-by DP-11 + Flow-by DP 12 + Flow-by DP-14	5.24	7.29	11.3	3.91	6.95	20.5	50.7	20' Sump Type R Inlet
16	BASIN L	2.66	2.99	11.3	3.91	6.95	10.4	20.8	10' At-Grade Type R Inlet
17	BASIN H + Flow-by DP-16	1.98	2.75	11.3	3.91	6.95	7.8	19.1	10' Sump Type R Curb Inlet
19	BASIN NC-2 + BASIN D	2.16	2.41	6.1	4.84	8.60	10.4	20.7	15' Existing At-Grade Inlet
20	BASIN NC-1 + Flow-by DP-19	0.93	1.31	6.1	4.84	8.60	4.5	11.3	10' Exising sump median inlet
23	PIPE 22 + BASIN M	28.22	32.77	20.6	2.97	5.28	83.8	173.0	WINDERMERE TO POND
24	BASIN WS + BASIN CT	42.22	42.62	25.8	2.64	4.69	111.3	199.7	OFF-SITE TO POND
25	DP-23 + DP-24	70.44	75.39	25.8	2.64	4.69	185.7	353.3	FILING 2 POND TOTAL IN
26	PIPE 23 + BASIN S	2.89	19.33	25.8	2.64	4.69	7.6	90.6	Developed to Marksheffel (Not Including Marksheffel Ditch)

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JOB NAME: *WINDERMERE*
JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALCULATED BY: *MAL*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

DEVELOPED CONDITIONS ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP-1 (Intercept.)	1.95	1.91	7.3	4.59	8.15	8.9	15.6	24" RCP
2	PIPE 1 + DP-2	4.65	5.26	7.8	4.49	7.98	20.9	41.9	30" RCP
3a	DP-3	2.27	2.57	10.7	3.99	7.10	9.1	18.2	24" RCP
3b	PIPE 2b + PIPE 3a	6.92	7.82	10.7	3.99	7.10	27.6	55.5	36" RCP
4	DP-4	1.73	1.99	9.8	4.14	7.36	7.2	14.6	EX. 24" RCP
5	POND RELEASE	0.16	1.38	10.8	3.98	7.07	0.6	9.8	24" RCP
6a	DP-19 (Intercept)	1.85	1.49	6.1	4.84	8.60	9.0	12.8	EX. 18" RCP
6b	PIPE 4 + PIPE 5 + DP-6	2.58	4.16	10.8	3.98	7.07	10.3	29.4	EX. 24" RCP
6c	PIPE 6a + PIPE 6b	4.43	5.65	11.0	3.95	7.02	17.5	39.7	EX. 24" RCP
7	PIPE 6C + DP-20	5.36	6.97	11.0	3.95	7.02	21.2	48.9	EX. 30" RCP
8	DP-7 & DP-8	8.48	9.76	18.7	3.12	5.54	26.4	54.1	36" RCP
9	DP-9 (Intercepted)	2.01	2.00	7.8	4.49	7.98	9.0	16.0	24" RCP
10	PIPE 8 + PIPE 9	10.49	11.76	19.0	3.09	5.50	32.4	64.7	36" RCP

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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

DEVELOPED CONDITIONS ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
11	DP-10 (Intercepted)	0.95	1.07	7.8	4.49	7.98	4.3	8.5	18" RCP
12	PIPE 11 + DP-11 (Intercept.)	2.18	2.06	7.8	4.49	7.98	9.8	16.4	24" RCP
13	PIPE 10 + PIPE 12	12.67	13.82	19.2	3.07	5.46	38.9	75.5	42" RCP
14	DP-14 (Intercepted)	2.26	2.17	11.3	3.91	6.95	8.8	15.1	24" RCP
15	PIPE 13 + PIPE 14	14.92	16.00	19.2	3.07	5.46	45.9	87.4	42" RCP
16	DP-12 (Intercepted)	1.92	1.91	7.5	4.54	8.07	8.7	15.4	24" RCP
17	DP-16 (Intercepted)	1.66	1.34	11.3	3.91	6.95	6.5	9.3	18" RCP
18	PIPE 15 + PIPE 21	22.14	26.03	19.4	3.06	5.44	67.7	141.5	60" RCP
19	DP-15	5.24	7.29	11.3	3.91	6.95	20.5	50.7	36" RCP
20	DP-17	1.98	2.75	11.3	3.91	6.95	7.8	19.1	24" RCP
21	PIPE 19 + PIPE 20	7.22	10.04	11.3	3.91	6.95	28.2	69.8	42" RCP
22	PIPE 16 + PIPE 17 + PIPE 18	25.73	29.29	19.7	3.04	5.40	78.1	158.1	60" RCP
23	DP-25 POND RELEASE	1.22	17.21	25.8	2.64	4.69	3.2	80.6	54" RCP

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DEVELOPED CONDITIONS ~ PIPE TRAVEL TIMES

PIPE RUN	STREET / CHANNEL FLOW				
	Pipe Diameter *(ft)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	Tc *(min)*
1	2.0	220	1.0%	7.2	0.5
3b	3.0	60	1.0%	9.5	0.1
4	2.0	750	4.0%	14.4	0.9
8	3.0	300	3.0%	16.4	0.3
10	3.0	270	4.0%	18.9	0.2
15	3.5	250	4.0%	21.0	0.2
18	5.0	155	0.5%	9.4	0.3
22	5.0	490	0.5%	9.4	0.9

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DESIGN POINT 1 **100 YEAR FLOW**

Q(100)	26.2	I(100)	8.2		
DEPTH	0.52	Fr	1.68	Inlet size ? L(i) =	15
SPREAD	19.5	L(1)	25.3	If Li < L(2) then Qi =	16
CROSS SLOPE	2.0%	L(2)	15.2	If Li > L(2) then Qi =	16
STREET SLOPE	1.5%	L(3)	54.2	FB =	11
				CA(eqv.)=	1.31

5 YEAR FLOW

Q(5)	13.1	I(5)	4.6		
DEPTH	0.42	Fr	1.60	Inlet size ? L(i) =	15
SPREAD	14.8	L(1)	18.1	If Li < L(2) then Qi =	11
CROSS SLOPE	2.0%	L(2)	10.9	If Li > L(2) then Qi =	9
STREET SLOPE	1.5%	L(3)	38.9	FB =	4
				CA(eqv.)=	0.90

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DESIGN POINT 2

Total Flow: Q_5 = 12 cfs

Q_{100} = 27 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 8 foot inlet required

100-Year Event: 14 foot inlet required

INSTALL A PUBLIC 15 FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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DESIGN POINT 3

Total Flow: Q_5 = 9 cfs

Q_{100} = 18 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 8 foot inlet required

INSTALL A PUBLIC 10 FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NUMBER: *2441.00*
DATE: *10/03/14*
CALCULATED BY: *MAL*

DESIGN POINT 4

Total Flow: Q_5 = 7 cfs
Q_{100} = 15 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50
D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

EXISTING 8 FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	***WINDERMERE***
JOB NUMBER:	***2441.00***
DATE:	***10/03/14***
CALCULATED BY:	***MAL***

DESIGN POINT 7

Total Flow: Q_5 = 20 cfs

Q_{100} = 42 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 14 foot inlet required

100-Year Event: 24 foot inlet required

EXISTING 25 FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	***WINDERMERE***
JOB NUMBER:	***2441.00***
DATE:	***10/03/14***
CALCULATED BY:	***MAL***

DESIGN POINT 8

Total Flow: Q_5 = 8 cfs

Q_{100} = 15 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 6 foot inlet required

EXISTING 10 FT TYPE R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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JOB NAME:	*WINDERMERE*
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DATE:	*10/03/14*
CALCULATED BY:	*MAL*

DESIGN POINT 9 **100 YEAR FLOW**

Q(100)	26.0	**I(100)**	8.0		
DEPTH	0.44	**Fr**	2.63	**Inlet size ? L(i) =**	20
SPREAD	15.5	**L(1)**	31.4	**If Li < L(2) then Qi =**	17
CROSS SLOPE	2.0%	**L(2)**	18.9	**If Li > L(2) then Qi =**	16
STREET SLOPE	4.0%	**L(3)**	67.3	**FB =**	10
				CA(eqv.)=	1.25

5 YEAR FLOW

Q(5)	12.9	**I(5)**	4.5		
DEPTH	0.36	**Fr**	2.49	**Inlet size ? L(i) =**	20
SPREAD	11.8	**L(1)**	22.6	**If Li < L(2) then Qi =**	11
CROSS SLOPE	2.0%	**L(2)**	13.6	**If Li > L(2) then Qi =**	9
STREET SLOPE	4.0%	**L(3)**	48.4	**FB =**	4
				CA(eqv.)=	0.85

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JOB NAME:	*WINDERMERE*
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DESIGN POINT **10** **100 YEAR FLOW**

Q(100)	13.5	**I(100)**	8.0		
DEPTH	0.36	**Fr**	2.48	**Inlet size ? L(i) =**	15
SPREAD	11.5	**L(1)**	22.0	**If Li < L(2) then Qi =**	9
CROSS SLOPE	2.0%	**L(2)**	13.2	**If Li > L(2) then Qi =**	9
STREET SLOPE	4.0%	**L(3)**	47.1	**FB =**	5
				CA(eqv.)=	0.62

5 YEAR FLOW

Q(5)	5.6	**I(5)**	4.5		
DEPTH	0.28	**Fr**	2.28	**Inlet size ? L(i) =**	15
SPREAD	7.8	**L(1)**	13.6	**If Li < L(2) then Qi =**	6
CROSS SLOPE	2.0%	**L(2)**	8.2	**If Li > L(2) then Qi =**	4
STREET SLOPE	4.0%	**L(3)**	29.2	**FB =**	1
				CA(eqv.)=	0.29

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CALCULATED BY:	*MAL*

DESIGN POINT 11 — 100 YEAR FLOW

Q(100)	24.8	I(100)	8.0		
DEPTH	0.44	Fr	2.63	Inlet size ? L(i) =	10
SPREAD	15.5	L(1)	31.4	If Li < L(2) then Qi =	8
CROSS SLOPE	2.0%	L(2)	18.9	If Li > L(2) then Qi =	12
STREET SLOPE	4.0%	L(3)	67.3	FB =	17
				CA(eqv.)=	2.12

5 YEAR FLOW

Q(5)	11.2	I(5)	4.5		
DEPTH	0.34	Fr	2.45	Inlet size ? L(i) =	10
SPREAD	10.8	L(1)	20.3	If Li < L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	12.2	If Li > L(2) then Qi =	6
STREET SLOPE	4.0%	L(3)	43.4	FB =	6
				CA(eqv.)=	1.26

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JOB NAME:	*WINDERMERE*
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DESIGN POINT 12 — 100 YEAR FLOW

Q(100)	22.4	**I(100)**	8.1		
DEPTH	0.50	**Fr**	1.67	**Inlet size ? L(i) =**	20
SPREAD	18.5	**L(1)**	23.7	**If Li < L(2) then Qi =**	19
CROSS SLOPE	2.0%	**L(2)**	14.3	**If Li > L(2) then Qi =**	15
STREET SLOPE	1.5%	**L(3)**	50.9	**FB =**	7
				CA(eqv.)=	0.86

5 YEAR FLOW

Q(5)	11.0	**I(5)**	4.5		
DEPTH	0.40	**Fr**	1.58	**Inlet size ? L(i) =**	20
SPREAD	13.8	**L(1)**	16.7	**If Li < L(2) then Qi =**	13
CROSS SLOPE	2.0%	**L(2)**	10.0	**If Li > L(2) then Qi =**	9
STREET SLOPE	1.5%	**L(3)**	35.7	**FB =**	2
				CA(eqv.)=	0.50

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DESIGN POINT 14 **100 YEAR FLOW**

Q(100)	24.5	**I(100)**	6.9		
DEPTH	0.44	**Fr**	2.63	**Inlet size ? L(i) =**	20
SPREAD	15.5	**L(1)**	31.4	**If Li < L(2) then Qi =**	16
CROSS SLOPE	2.0%	**L(2)**	18.9	**If Li > L(2) then Qi =**	15
STREET SLOPE	4.0%	**L(3)**	67.3	**FB =**	9
				CA(eqv.)=	1.36

5 YEAR FLOW

Q(5)	12.3	**I(5)**	3.9		
DEPTH	0.35	**Fr**	2.47	**Inlet size ? L(i) =**	20
SPREAD	11.3	**L(1)**	21.4	**If Li < L(2) then Qi =**	11
CROSS SLOPE	2.0%	**L(2)**	12.9	**If Li > L(2) then Qi =**	9
STREET SLOPE	4.0%	**L(3)**	45.9	**FB =**	3
				CA(eqv.)=	0.89

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DESIGN POINT 15

Total Flow: Q_5 = 20 cfs

Q_{100} = 51 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.87 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 16 foot inlet required

100-Year Event: 20 foot inlet required

INSTALL A PUBLIC 20 FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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DESIGN POINT 16 — 100 YEAR FLOW

Q(100)	20.8	I(100)	6.9		
DEPTH	0.48	Fr	1.65	Inlet size ? L(i) =	10
SPREAD	17.5	L(1)	22.2	If Li < L(2) then Qi =	9
CROSS SLOPE	2.0%	L(2)	13.4	If Li > L(2) then Qi =	11
STREET SLOPE	1.5%	L(3)	47.6	FB =	11
				CA(eqv.)=	1.64

5 YEAR FLOW

Q(5)	10.4	I(5)	3.9		
DEPTH	0.38	Fr	1.55	Inlet size ? L(i) =	10
SPREAD	12.8	L(1)	15.2	If Li < L(2) then Qi =	7
CROSS SLOPE	2.0%	L(2)	9.2	If Li > L(2) then Qi =	6
STREET SLOPE	1.5%	L(3)	32.7	FB =	4
				CA(eqv.)=	1.00

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DESIGN POINT 17

Total Flow: Q_5 = 8 cfs

Q_{100} = 19 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.67 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 8 foot inlet required

INSTALL A PUBLIC 10 FT D-10-R INLET TO ACCEPT BOTH 5YR & 100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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DESIGN POINT 19 — 100 YEAR FLOW

Q(100)	20.7	**I(100)**	8.6		
DEPTH	0.37	**Fr**	2.50	**Inlet size ? L(i) =**	15
SPREAD	12.0	**L(1)**	23.1	**If Li < L(2) then Qi =**	13
CROSS SLOPE	2.0%	**L(2)**	13.9	**If Li > L(2) then Qi =**	13
STREET SLOPE	4.0%	**L(3)**	49.6	**FB =**	7.9
				CA(eqv.)=	0.91

5 YEAR FLOW

Q(5)	10.4	**I(5)**	4.8		
DEPTH	0.29	**Fr**	2.32	**Inlet size ? L(i) =**	15
SPREAD	8.3	**L(1)**	14.7	**If Li < L(2) then Qi =**	11
CROSS SLOPE	2.0%	**L(2)**	8.8	**If Li > L(2) then Qi =**	8
STREET SLOPE	4.0%	**L(3)**	31.5	**FB =**	2.7
				CA(eqv.)=	0.55

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DESIGN POINT 20

Total Flow: Q_5 = 5 cfs

Q_{100} = 11 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.50

D_{100} = 0.50 (dmax)

Qi = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event:	4	foot inlet required
100-Year Event:	6	foot inlet required
EXISTING	10	FT TYPE R INLET TO ACCEPT BOTH 5YR &

100 YR DEVELOPED FLOWS AT THIS DESIGN POINT.

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Design Point 20-DS

Worksheet for Gutter - 5yr

Project Description

Solve For	Spread

Input Data

Channel Slope	0.02800	ft/ft
Discharge	33.80	ft^3/s
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.013	

Results

Spread	20.07	ft
Flow Area	4.15	ft^2
Depth	0.53	ft
Gutter Depression	0.13	ft
Velocity	8.14	ft/s

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Design Point 20-DS

Worksheet for Gutter - 100yr

Project Description

Solve For	Spread

Input Data

Channel Slope	0.02800	ft/ft
Discharge	84.50	ft^3/s
Gutter Width	2.00	ft
Gutter Cross Slope	0.08	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.013	

Results

Spread	28.67	ft
Flow Area	8.34	ft^2
Depth	0.70	ft
Gutter Depression	0.13	ft
Velocity	10.13	ft/s

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FILING NO. 1 –

FULL SPECTRUM EDB FINAL DESIGN

CLASSIC CONSULTING SURVEYORS

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**M.Larson**
Company:	**Classic Consulting**
Date:	**October 4, 2014**
Project:	**Windermere**
Location:	**FILING NO. 1 POND**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 73.3 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.733
C) Contributing Watershed Area	Area = 10.870 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$	V_{DESIGN}= 0.316 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= 0.309 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ○ A ◉ B ○ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = (0.1878i - 0.0104)*Area$ For HSG B: $EURV_B = (0.1178i - 0.0042)*Area$ For HSG C/D: $EURV_{C/D} = (0.1043i - 0.0031)*Area$	EURV = 0.893 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 3.00 ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
4 Inlet	Concrete box forebay
A) Describe means of providing energy dissipation at concentrated inflow locations:	

|4, 3:08 PM

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 1 POND

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.008 ac-ft

B) Actual Forebay Volume — V_F = 0.009 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 57.00 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.14 cfs

E) Forebay Discharge Design — Choose One: ○ Berm With Pipe; ◉ Wall with Rect. Notch; ○ Wall with V-Notch Weir (flow too small for berm w/ pipe)

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = ____ in

G) Rectangular Notch Width — Calculated W_N = 5.8 in

6. Trickle Channel

A) Type of Trickle Channel — Choose One: ◉ Concrete; ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0100 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 107 sq ft

C) Outlet Type — Choose One: ◉ Orifice Plate; ○ Other (Describe):

D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E. — H = 7.00 feet

E) Volume to Drain Over Prescribed Time — EURV = 0.893 ac-ft

F) Drain Time (Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours) — T_D = 72 hours

G) Recommended Maximum Outlet Area per Row, (A_o) — A_o = 0.47 square inches

H) Orifice Dimensions:
i) Circular Orifice Diameter or — $D_{orifice}$ = 3 / 4 inches
ii) Width of 2" High Rectangular Orifice — $W_{orifice}$ = ____ inches

I) Number of Columns — n_c = 1 number

J) Actual Design Outlet Area per Row (A_o) — A_o = 0.44 square inches

K) Number of Rows (nr) — n_r = 21 number

L) Total Outlet Area (A_{ot}) — A_{ot} = 9.3 square inches

M) Depth of WQCV (H_{WQCV}) (Estimate using actual stage-area-volume relationship and V_{WQCV}) — H_{WQCV} = ____ feet

N) Ensure Minimum 40 Hour Drain Time for WQCV — $T_{D\,WQCV}$ = ____ hours

4, 3:08 PM

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**M.Larson**
Company:	**Classic Consulting**
Date:	**October 4, 2014**
Project:	**Windermere**
Location:	**FILING NO. 1 POND**

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4.0 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 34.4 cu ft

C) Initial Surcharge Provided Above Micropool — V_s = 35.7 cu ft

9. Trash Rack

A) Type of Water Quality Orifice Used — Choose One: (●) Circular (up to 2" diameter) / ( ) Rectangular (2" high)

B) Water Quality Screen Open Area: $A_t = 38.5*(e^{-0.095D})*A_{ot}$ — A_t = 333 square inches

C) For 2", or Smaller, **Circular Opening** (See Fact Sheet T-12):

i) Width of Water Quality Screen and Concrete Opening ($W_{opening}$) — $W_{opening}$ = 12.0 inches

ii) Height of Water Quality Screen (H_{TR}) — H_{TR} = 112.0 inches

iii) Type of Screen, Describe if "Other" — Choose One: (●) S.S. Well Screen with 60% Open Area* / ( ) Other (Describe):

D) For 2" High **Rectangular Opening**

i) Width of Rectangular Opening ($W_{orifice}$) — W = ______ inches

ii) Width of Water Quality Screen Opening ($W_{opening}$) — $W_{opening}$ = ______ ft

iii) Height of Water Quality Screen (H_{TR}) — H_{TR} = ______ ft

iv) Type of Screen, Describe if "Other" — Choose One: ( ) Aluminum Amico-Klemp SR Series (or equal) / ( ) Other (Describe):

v) Cross-bar Spacing — ______ inches

vi) Minimum Bearing Bar Size — ______

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	M.Larson
Company:	Classic Consulting
Date:	October 4, 2014
Project:	Windermere
Location:	FILING NO. 1 POND

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z_E = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING NO. 1 POND - EURV (TOP OF BOX)

POND SIZING WITH PONDPACK EQUATION:
NSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)	AREA (BTM to TOP):		
6562.50		-	acres
6562.50	-	-	acres
6562.50	435	0.01	acres
6562.83	488	0.01	acres
6564.00	4,247	0.10	acres
6566.00	5,558	0.13	acres
6568.00	6,866	0.16	acres
6570.00	8,219	0.19	acres
		-	acres
		-	acres
		-	acres
		-	acres

PRELIMINARY SIZE:

VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

						CUMMULATIVE VOLUME:
-	AC-FT	from	6,563	to	6,563	
-	AC-FT	from	6,563	to	6,563	-
0.00	AC-FT	from	6,563	to	6,563	0.00
0.05	AC-FT	from	6,563	to	6,564	0.06
0.22	AC-FT	from	6,564	to	6,566	0.28
0.28	AC-FT	from	6,566	to	6,568	0.56
0.34	AC-FT	from	6,568	to	6,570	0.90
-	AC-FT	from	6,570	to	-	0.90
-	AC-FT	from	-	to	-	0.90
-	AC-FT	from	-	to	-	0.90
-	AC-FT	from	-	to	-	0.90

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 0.90 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	0.90	=	39,404	9,851
6	0.90	=	39,404	6,567
8	0.90	=	39,404	4,925
10	0.90	=	39,404	3,940

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JOB NAME:	WINDERMERE
JOB NUMBER:	2441.00
DATE:	10/04/14
CALCULATED BY:	MAL

FILING NO. 1 POND - VOLUME TO SPILLWAY

POND SIZING WITH PONDPACK EQUATION:

NSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)	AREA (BTM to TOP):		
6562.50		-	acres
6562.50	-	-	acres
6562.50	435	0.010	acres
6562.83	488	0.011	acres
6564.00	4,247	0.098	acres
6566.00	5,558	0.128	acres
6568.00	6,866	0.158	acres
6570.00	8,219	0.189	acres
6571.00	10,977	0.252	acres
		-	acres
		-	acres
		-	acres

PRELIMINARY SIZE:

VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

						CUMMULATIVE VOLUME:
-	AC-FT	from	6,563	to	6,563	
-	AC-FT	from	6,563	to	6,563	-
0.00	AC-FT	from	6,563	to	6,563	0.00
0.05	AC-FT	from	6,563	to	6,564	0.06
0.22	AC-FT	from	6,564	to	6,566	0.28
0.28	AC-FT	from	6,566	to	6,568	0.56
0.34	AC-FT	from	6,568	to	6,570	0.90
0.22	AC-FT	from	6,570	to	6,571	1.12
-	AC-FT	from	6,571	to	-	1.12
-	AC-FT	from	-	to	-	1.12
-	AC-FT	from	-	to	-	1.12

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 1.12 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	1.12	=	48,873	12,218
6	1.12	=	48,873	8,146
8	1.12	=	48,873	6,109
10	1.12	=	48,873	4,887

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FILING NO. 1 - 5 YEAR

Project Summary	
Title	WINDERMERE - FILING NO. 1
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 1 5 YEAR POND ROUTING W/ STORMWATER QUALITY

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FILING NO. 1 - 5 YEAR

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
FIL-1	Base	5	0.617	0.180	20.50

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Base	5	0.607	0.550	0.63

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	5	0.619	0.200	20.50	(N/A)	(N/A)
PO-1 (OUT)	Base	5	0.607	0.550	0.63	6,568.19	0.599

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FILING NO. 1 - 5 YEAR

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,562.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	20.50 ft³/s	Time to Peak (Flow, In)	0.200 hours
Flow (Peak Outlet)	0.63 ft³/s	Time to Peak (Flow, Outlet)	0.550 hours

Elevation (Water Surface, Peak)	6,568.19 ft
Volume (Peak)	0.599 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.619 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.607 ac-ft
Volume (Retained)	0.010 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.3 %

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FILING NO. 1 - 5 YEAR

Subsection: Modified Rational Hydrograph
Label: FIL-1

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Modified Rational Method

Q = CiA * Unit Conversion; Where Conversion = 43560 / (12 * 3600)

Frequency (years)	C Coefficient	C Adjustment Factor	C Coefficient (Final)	Intensity (in/h)	Area (acres)	Flow (Peak) (ft^3/s)
5	1.000	1.000	0.650	2.878	10.870	20.50

Peak Discharge	20.50 ft^3/s
Time to Peak	0.300 hours
Hydrograph Volume	1.214 ac-ft

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
0.050	3.42	9.11	14.81	20.50	20.50
0.300	20.50	20.50	18.99	13.29	7.59
0.550	1.90	0.00	(N/A)	(N/A)	(N/A)

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FILING NO. 1 - 5 YEAR

Index

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100-YR - FILING NO. 1

Project Summary	
Title	WINDERMERE - FILING NO. 1
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 1 100 YEAR POND ROUTING W/ STORMWATER QUALITY

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100-YR - FILING NO. 1

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
FIL-1	Base	100	1.126	0.180	46.07

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
O-1	Base	100	1.063	0.450	9.77

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	100	1.130	0.200	46.07	(N/A)	(N/A)
PO-1 (OUT)	Base	100	1.063	0.450	9.77	6,570.61	1.043

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100-YR - FILING NO. 1

Subsection: Level Pool Pond Routing Summary | Return Event: 100 years
Label: PO-1 (IN) | Storm Event: CO SPRINGS - 100 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,562.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	46.07 ft³/s	Time to Peak (Flow, In)	0.200 hours
Flow (Peak Outlet)	9.77 ft³/s	Time to Peak (Flow, Outlet)	0.450 hours

Elevation (Water Surface, Peak)	6,570.61 ft
Volume (Peak)	1.043 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.130 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.063 ac-ft
Volume (Retained)	0.065 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.1 %

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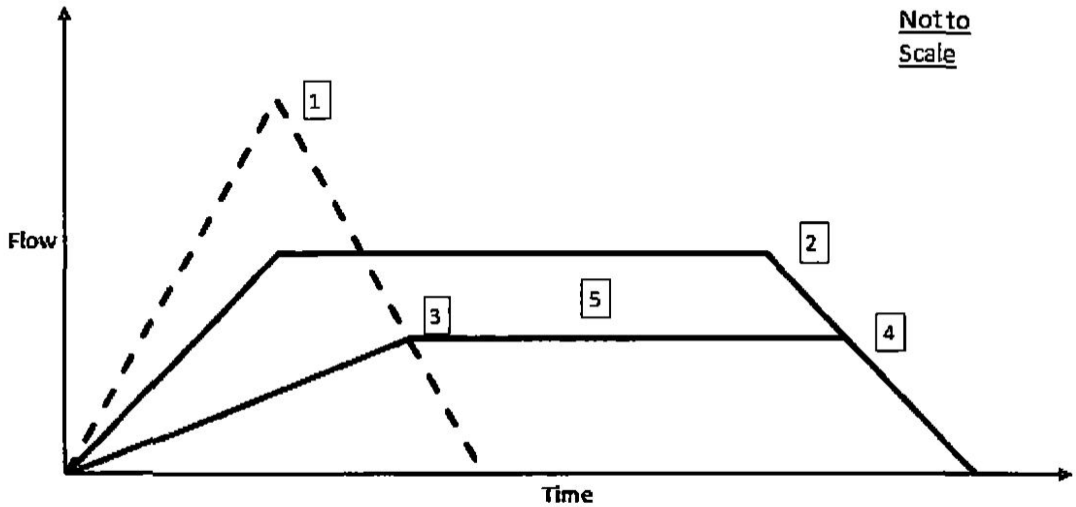
100-YR - FILING NO. 1

Subsection: Modified Rational Graph
Label: FIL-1

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.300 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.180	hours	Time of Duration (Modified Rational, Critical)	0.300	hours
Intensity (Modified Rational, Peak)	7.109	in/h	Intensity (Modified Rational, Critical)	5.680	in/h
Flow (Modified Rational, Peak)	57.66	ft³/s	Flow (Modified Rational, Critical)	46.07	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.379 hours
Flow (Modified Rational, Allowable)	25.80 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.279	hours	Storage (Modified Rational, Estimated)	0.524	ac-ft
Flow (Modified Rational, Allowable)	25.80	ft³/s			

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100-YR - FILING NO. 1

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FILING NO. 2 –
FULL SPECTRUM EDB PRELIMINARY DESIGN

CLASSIC
CONSULTING
URVEYORS

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	M.Larson
Company:	Classic Consulting
Date:	October 4, 2014
Project:	Windermere
Location:	FILING NO. 2 REGIONAL FACILITY

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a	I_a = 45.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.454
C) Contributing Watershed Area	Area = 132.860 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$	V_{DESIGN} = 2.577 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$ = 2.518 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$ = ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ○ A ◉ B ○ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: EURVA = (0.1878i - 0.0104)*Area For HSG B: $EURV_B$ = (0.1178i - 0.0042)*Area For HSG C/D: $EURV_{C/D}$ = (0.1043i - 0.0031)*Area	EURV = 6.548 ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	Forebay with depressed bottom and riprap berm.

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Design Procedure Form: Extended Detention Basin (EDB)

Designer:	M.Larson
Company:	Classic Consulting
Date:	October 4, 2014
Project:	Windermere
Location:	FILING NO. 2 REGIONAL FACILITY

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} =	0.063	ac-ft
B) Actual Forebay Volume	V_F =	0.070	ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F =	18.0	in
D) Forebay Discharge			
i) Undetained 100-year Peak Discharge	Q_{100} =	199.70	cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F =	3.99	cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ◉ Wall with Rect. Notch; ○ Wall with V-Notch Weir		
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P =		in
G) Rectangular Notch Width	Calculated W_N =	11.4	in

6. Trickle Channel

A) Type of Trickle Channel	Choose One: ◉ Concrete; ○ Soft Bottom		
F) Slope of Trickle Channel	S =	0.0050	ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)	D_M =	2.5	ft
B) Surface Area of Micropool (10 ft² minimum)	A_M =	1000	sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate; ○ Other (Describe):		
D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.	H =	5.50	feet
E) Volume to Drain Over Prescribed Time	EURV =	6.548	ac-ft
F) Drain Time (Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours)	T_D =	72	hours
G) Recommended Maximum Outlet Area per Row, (A_o)	A_o =	3.73	square inches
H) Orifice Dimensions:			
i) Circular Orifice Diameter or	$D_{orifice}$ =	1 - 1 / 2	inches
ii) Width of 2" High Rectangular Orifice	$W_{orifice}$ =		inches
I) Number of Columns	n_c =	2	number
J) Actual Design Outlet Area per Row (A_o)	A_o =	3.53	square inches
K) Number of Rows (nr)	n_r =	16	number
L) Total Outlet Area (A_{ot})	A_{ot} =	56.3	square inches
M) Depth of WQCV (H_{WQCV}) (Estimate using actual stage-area-volume relationship and V_{WQCV})	H_{WQCV} =		feet
N) Ensure Minimum 40 Hour Drain Time for WQCV	$T_{D\ WQCV}$ =		hours

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 2 REGIONAL FACILITY

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4.0 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 280.7 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 333.3 cu ft
9. Trash Rack	Choose One: ◉ Circular (up to 2" diameter) ○ Rectangular (2" high)
A) Type of Water Quality Orifice Used	
B) Water Quality Screen Open Area: $A_t = 38.5*(e^{-0.095D})*A_{ot}$	A_t = 1,947 square inches
C) For 2", or Smaller, **Circular Opening** (See Fact Sheet T-12):	
i) Width of Water Quality Screen and Concrete Opening ($W_{opening}$)	$W_{opening}$ = 35.0 inches
ii) Height of Water Quality Screen (H_{TR})	H_{TR} = 94.0 inches
iii) Type of Screen, Describe if "Other"	Choose One: ◉ S.S. Well Screen with 60% Open Area* ○ Other (Describe):
D) For 2" High Rectangular Opening	
i) Width of Rectangular Opening ($W_{orifice}$)	W = ____ inches
ii) Width of Water Quality Screen Opening ($W_{opening}$)	$W_{opening}$ = ____ ft
iii) Height of Water Quality Screen (H_{TR})	H_{TR} = ____ ft
iv) Type of Screen, Describe if "Other"	Choose One: ○ Aluminum Amico-Klemp SR Series (or equal) ○ Other (Describe):
v) Cross-bar Spacing	____ inches
vi) Minimum Bearing Bar Size	____

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Design Procedure Form: Extended Detention Basin (EDB)

Designer: M.Larson
Company: Classic Consulting
Date: October 4, 2014
Project: Windermere
Location: FILING NO. 2 REGIONAL FACILITY

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z_E = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

Notes:

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING 2 - EURV (TOP OF BOX)

POND SIZING WITH PONDPACK EQUATION:
ISERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)	AREA (BTM to TOP):		
6571.00		-	acres
6571.00	4,724	0.11	acres
6572.00	7,502	0.17	acres
6574.00	49,737	1.14	acres
6576.00	135,006	3.10	acres
6576.50	153,596	3.53	acres
		-	acres
		-	acres
		-	acres
		-	acres
		-	acres
		-	acres

PRELIMINARY SIZE:
VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

						CUMMULATIVE VOLUME:
-	AC-FT	from	6,571	to	6,571	
0.14	AC-FT	from	6,571	to	6,572	0.14
1.16	AC-FT	from	6,572	to	6,574	1.30
4.04	AC-FT	from	6,574	to	6,576	5.34
1.64	AC-FT	from	6,576	to	6,577	6.98
-	AC-FT	from	6,577	to	-	6.98
-	AC-FT	from	-	to	-	6.98
-	AC-FT	from	-	to	-	6.98
-	AC-FT	from	-	to	-	6.98
-	AC-FT	from	-	to	-	6.98
-	AC-FT	from	-	to	-	6.98

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 6.98 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		CF	SURFACE AREA (SF)
4	6.98	=	######	75,980
6	6.98	=	######	50,653
8	6.98	=	######	37,990
10	6.98	=	######	30,392

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JOB NAME: WINDERMERE
JOB NUMBER: 2441.00
DATE: 10/04/14
CALCULATED BY: MAL

FILING 2 VOLUME TO SPILLWAY

POND SIZING WITH PONDPACK EQUATION:
ISERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION : (from lowest to highest)	AREA (BTM to TOP):		
6571.00		-	acres
6571.00	4,724	0.108	acres
6572.00	7,502	0.172	acres
6574.00	49,737	1.142	acres
6576.00	135,006	3.099	acres
6578.00	198,782	4.563	acres
6579.00	216,813	4.977	acres
		-	acres
		-	acres
		-	acres
		-	acres
		-	acres

PRELIMINARY SIZE:
VOLUME = 1/3{(EL2-EL1)*(A1+A2+((A1*A2)^.5))}

						CUMMULATIVE VOLUME:
-	AC-FT	from	6,571	to	6,571	
0.14	AC-FT	from	6,571	to	6,572	0.14
1.16	AC-FT	from	6,572	to	6,574	1.30
4.04	AC-FT	from	6,574	to	6,576	5.34
7.54	AC-FT	from	6,576	to	6,578	12.88
4.72	AC-FT	from	6,578	to	6,579	17.60
-	AC-FT	from	6,579	to	-	17.60
-	AC-FT	from	-	to	-	17.60
-	AC-FT	from	-	to	-	17.60
-	AC-FT	from	-	to	-	17.60
-	AC-FT	from	-	to	-	17.60

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME = 17.60 AC-FT

APPROXIMATE SURFACE AREA REQUIREMENT

POND DEPTH (FT)	POND VOLUME AC-FT		POND VOLUME CF	SURFACE AREA (SF)
4	17.60	=	######	191,654
6	17.60	=	######	127,769
8	17.60	=	######	95,827
10	17.60	=	######	76,661

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FILING NO. 2 - 5 YEAR

Project Summary	
Title	WINDERMERE - FILING NO. 2
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 2 5 YEAR POND ROUTING W/ STORMWATER QUALITY

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Table of Contents

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FILING NO. 2 - 5 YEAR

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
DP-23	Base	5	2.827	0.343	68.85
DP-24	Base	5	4.237	0.430	102.88

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Base	5	5.168	0.950	3.21

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	5	7.080	0.450	171.74	(N/A)	(N/A)
PO-1 (OUT)	Base	5	5.168	0.950	3.21	6,576.46	6.898

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FILING NO. 2 - 5 YEAR

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,571.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	171.74 ft³/s	Time to Peak (Flow, In)	0.450 hours
Flow (Peak Outlet)	3.21 ft³/s	Time to Peak (Flow, Outlet)	0.950 hours

Elevation (Water Surface, Peak)	6,576.46 ft
Volume (Peak)	6.898 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.080 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.168 ac-ft
Volume (Retained)	1.893 ac-ft
Volume (Unrouted)	-0.018 ac-ft
Error (Mass Balance)	0.3 %

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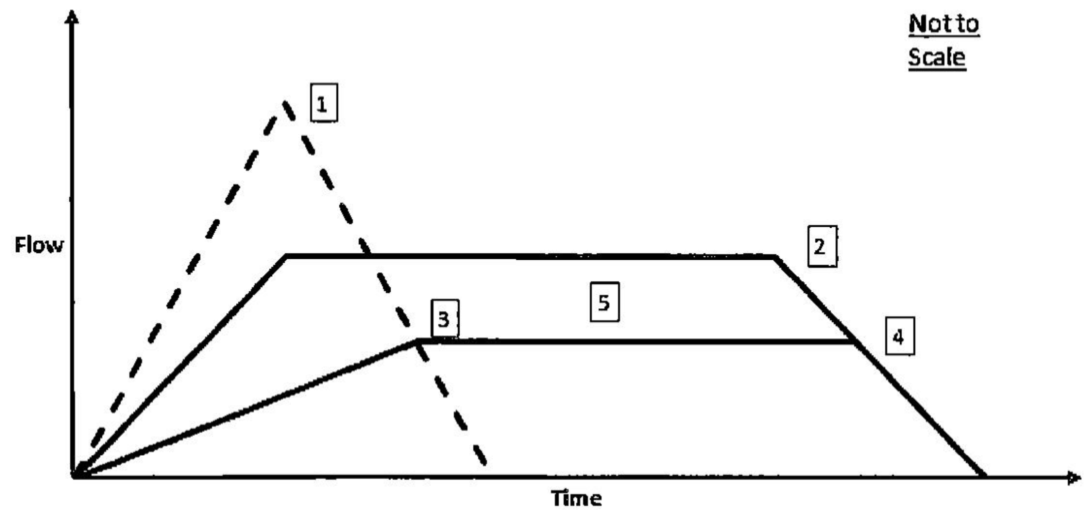
FILING NO. 2 - 5 YEAR

Subsection: Modified Rational Graph
Label: DP-24

Return Event: 5 years
Storm Event: CO SPRINGS - 5 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.500 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.430	hours	Time of Duration (Modified Rational, Critical)	0.500	hours
Intensity (Modified Rational, Peak)	2.638	in/h	Intensity (Modified Rational, Critical)	2.420	in/h
Flow (Modified Rational, Peak)	112.17	ft³/s	Flow (Modified Rational, Critical)	102.88	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.700 hours
Flow (Modified Rational, Allowable)	55.00 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.649	hours	Storage (Modified Rational, Estimated)	2.022	ac-ft
Flow (Modified Rational, Allowable)	55.00	ft³/s			

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FILING NO. 2 - 5 YEAR

Index

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FILING 2 - 100 YEAR

Project Summary	
Title	WINDERMERE - FILING NO. 2
Engineer	MLARSON
Company	CCES
Date	10/3/2014

Notes	WINDERMERE - FILING NO. 2 100 YEAR POND ROUTING W/ STORMWATER QUALITY

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Table of Contents

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FILING 2 - 100 YEAR

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
DP-23	Base	100	5.847	0.343	142.39
DP-24	Base	100	7.620	0.430	185.05

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Base	100	11.046	0.800	80.66

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	Base	100	13.499	0.450	327.44	(N/A)	(N/A)
PO-1 (OUT)	Base	100	11.046	0.800	80.66	6,577.68	11.595

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FILING 2 - 100 YEAR

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	6,571.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	327.44 ft³/s	Time to Peak (Flow, In)	0.450 hours
Flow (Peak Outlet)	80.66 ft³/s	Time to Peak (Flow, Outlet)	0.800 hours

Elevation (Water Surface, Peak)	6,577.68 ft
Volume (Peak)	11.595 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	13.499 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	11.046 ac-ft
Volume (Retained)	2.415 ac-ft
Volume (Unrouted)	-0.038 ac-ft
Error (Mass Balance)	0.3 %

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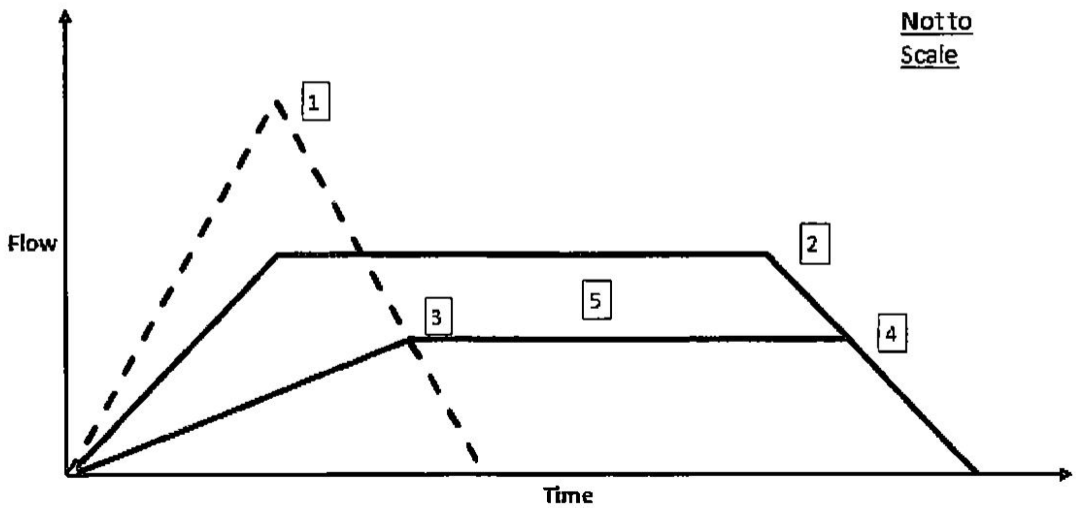
FILING 2 - 100 YEAR

Subsection: Modified Rational Graph
Label: DP-24

Return Event: 100 years
Storm Event: CO SPRINGS - 100 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.500 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.430	hours	Time of Duration (Modified Rational, Critical)	0.500	hours
Intensity (Modified Rational, Peak)	4.696	in/h	Intensity (Modified Rational, Critical)	4.310	in/h
Flow (Modified Rational, Peak)	201.64	ft³/s	Flow (Modified Rational, Critical)	185.05	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.612 hours
Flow (Modified Rational, Allowable)	137.00 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.568	hours	Storage (Modified Rational, Estimated)	2.134	ac-ft
Flow (Modified Rational, Allowable)	137.00	ft³/s			

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FILING 2 - 100 YEAR

Index

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COORESPONDANCE FROM YES! COMMUNITIES

CLASSIC
CONSULTING
SURVEYORS

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September 18, 2014

El Paso County
Development Services
2880 International Circle
Suite 110
Colorado Springs, CO 80910

ATTN: Ms. Kari Parsons – Project Manager/Planner II

RE: Proposed Windermere Development Public Detention and Stormwater Quality Facility

Dear Ms. Parsons:

Based upon a meeting with Mr. Campbell of Classic Consulting Engineers and Surveyors, LLC, a proposal was presented to create a regional public detention and SWQ facility in an area where our existing private facility currently resides. Based upon the multiple private and public drainage facilities (both existing and proposed) that drain to this area, we support the creation of one public facility.

While not required for the Windermere's initial Phase 1 area, we will continue to work with the adjacent southerly owner and their representatives as Phase 2 and 3 develop to support this effect.

If you have any questions or comments, please do not hesitate to call.

Sincerely,

Wally Moreland
Managing Director
YES! Communities

Ag/244100/public detention swq facility.docx

CC: Kyle R Campbell

YES! Communities, 2401 15th Street, Suite 200, Denver, CO 80202

Fax: (303) 468-0525

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DRAINAGE MAP

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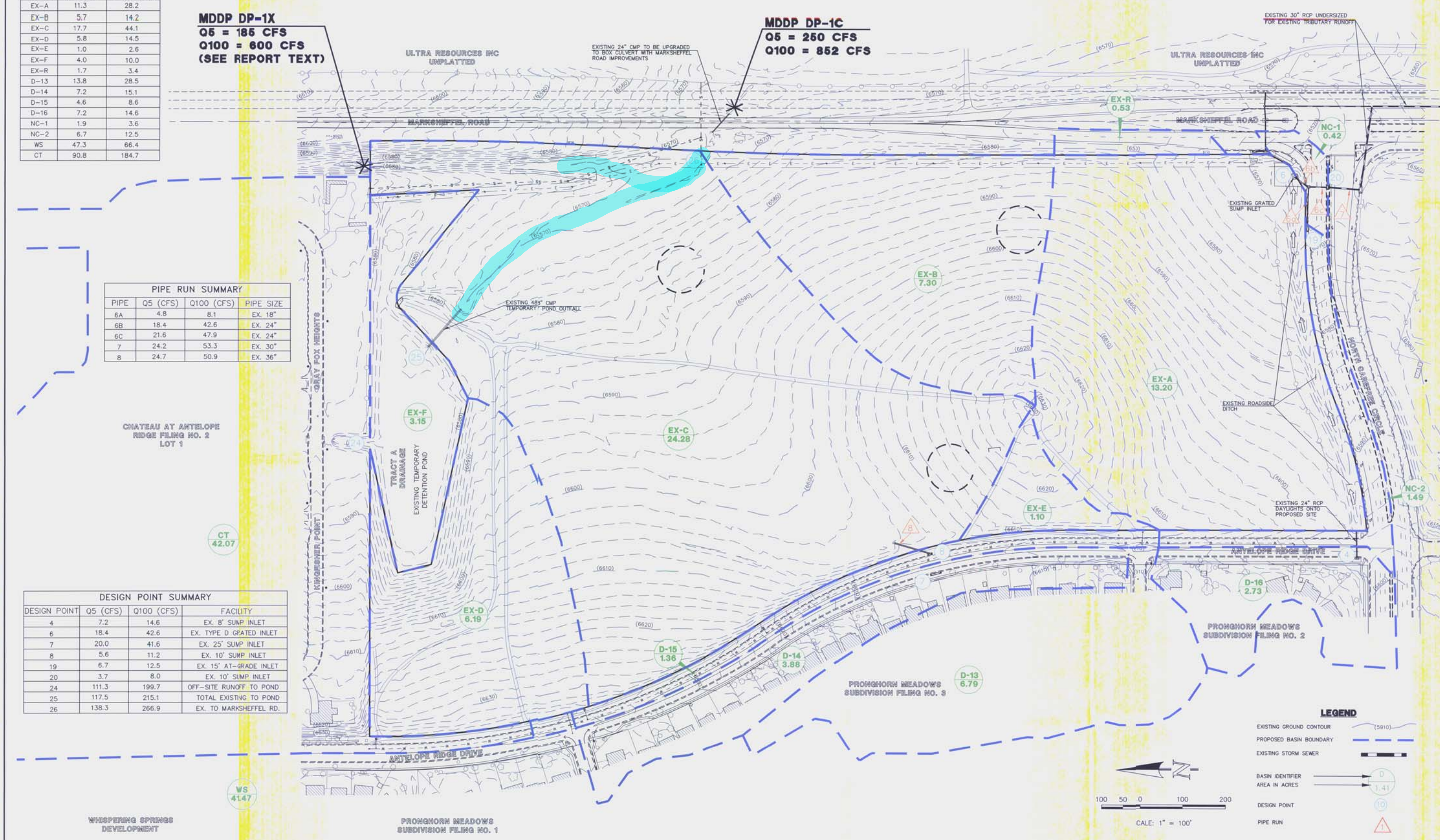
BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
EX-A	11.3	28.2
EX-B	5.7	14.2
EX-C	17.7	44.1
EX-D	5.8	14.5
EX-E	1.0	2.6
EX-F	4.0	10.0
EX-R	1.7	3.4
D-13	13.8	28.5
D-14	7.2	15.1
D-15	4.6	8.6
D-16	7.2	14.6
NC-1	1.9	3.6
NC-2	6.7	12.5
WS	47.3	66.4
CT	90.8	184.7

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.



48 HOURS BEFFORE YOU DIG,
CALL UTILITY LOCATORS
8'11
UTILITY NOTIFICATION OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY 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.

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

CLASSIC CONSULTING ENGINEERS & SURVEYORS
6385 Corpote Drive, Suite 101 (719)785-0790
Colorado Sings, Colorado 80919 (719)785-0799(Fax)

WINDERMERE
EXISTING CONDITIONS DRAINAGE MAP
PRELIMINARY DRAINAGE REPORT WINDERMERE
FINAL DRAINAGE REPORT WINDERMERE FIL. NO. 1

DESIGNED BY	MAL	SCALE	DATE 09/01/14
DRAWN BY	MAL	(H) 1"= 100'	SHEET 1 OF 1
CHECKED BY		(V) 1"= N/A	JOB NO. 2241.000

K:\224100\DRAWINGS\DEVELOPMENT\224100-PDR-EX-MAP.dwg, 6/16/2015 4:35:33 PM, Canon iPF8300S.pc3

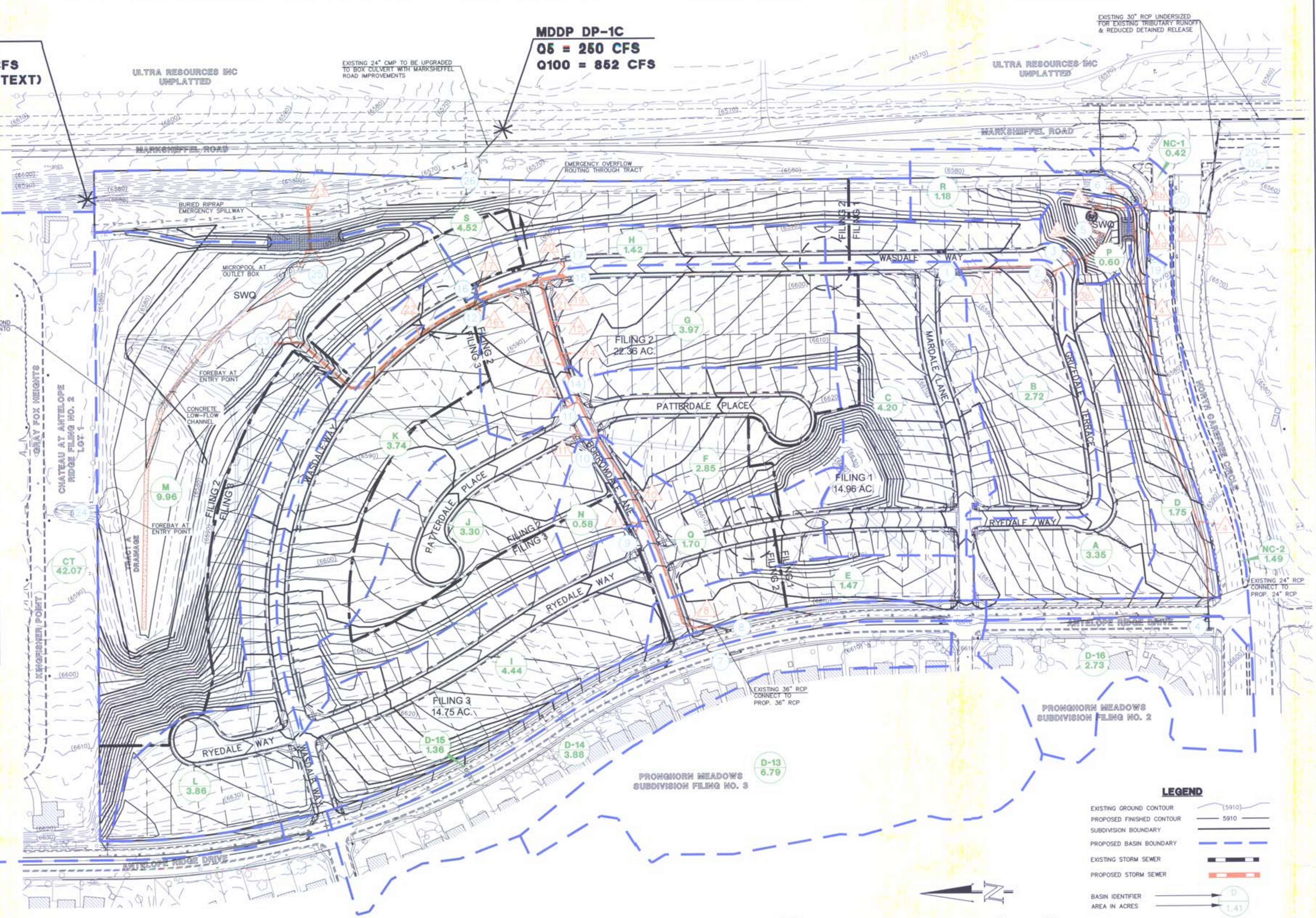
BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
A	9.1	18.2
B	9.2	18.5
C	13.1	26.2
D	3.9	8.5
E	4.2	8.6
F	9.4	18.9
G	11.1	22.4
H	4.5	9.0
I	12.9	26.0
J	10.3	20.7
K	11.0	22.4
L	10.4	20.8
M	9.6	23.9
N	1.7	3.5
P	0.8	1.9
Q	4.7	9.3
R	3.4	7.1
S	7.1	16.0
D-13	13.8	28.5
D-14	7.2	15.1
D-15	4.6	8.6
D-16	7.2	14.6
NC-1	1.9	3.6
NC-2	6.7	12.5
WS	47.3	66.4
CT	90.8	184.7

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	FACILITY
1	13.1	26.2	PROP. 15' AT-GRADE INLET
2	12.4	27.3	PROP. 15' SUMP INLET
3	9.1	18.2	PROP. 10' SUMP INLET
4	7.2	14.6	EX. 8' SUMP INLET
5	28.1	56.8	SWQ/DETENTION POND
6	3.4	7.1	RELOCATE TYPE D INLET
7	20.0	41.6	EX. 25' SUMP INLET
8	7.7	15.1	EX. 10' SUMP INLET
9	12.9	26.0	PROP. 20' AT-GRADE INLET
10	5.6	13.5	PROP. 15' AT-GRADE INLET
11	11.2	24.8	PROP. 10' AT-GRADE INLET
12	11.0	22.4	PROP. 20' AT-GRADE INLET
14	12.3	24.5	PROP. 20' AT-GRADE INLET
15	20.5	50.7	PROP. 20' SUMP INLET
16	10.4	20.8	PROP. 10' AT-GRADE INLET
17	7.8	19.1	PROP. 10' SUMP INLET
19	10.4	20.7	EX. 15' AT-GRADE INLET
20	4.5	11.3	EX. 10' SUMP INLET
23	83.8	173.0	PROP. SITE TO POND
24	111.3	199.7	OFF-SITE RUNOFF TO POND
25	185.7	353.3	TOTAL DEVELOPED TO POND
26	7.6	90.9	DEV. TO MARKSHEFFEL RD.

PIPE RUN SUMMARY			
PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
1	8.9	15.6	PROP. 24"
2	20.9	41.9	PROP. 30"
3A	9.1	18.2	PROP. 24"
3B	27.6	55.5	PROP. 36"
4	7.2	14.6	EX. 24"
5	0.6	9.8	PROP. 24"
6A	9.0	12.8	EX. 18"
6B	10.3	29.4	EX. 24"
6C	17.5	39.7	EX. 24"
7	21.2	48.9	EX. 30"
8	26.4	54.1	EX./PROP. 36"
9	9.0	16.0	PROP. 24"
10	32.4	64.7	PROP. 36"
11	4.3	8.5	PROP. 18"
12	9.8	16.4	PROP. 24"
13	38.9	75.5	PROP. 42"
14	8.8	15.1	PROP. 24"
15	45.9	87.4	PROP. 42"
16	8.7	15.4	PROP. 24"
17	6.5	9.3	PROP. 18"
18	67.7	141.5	PROP. 60"
19	20.5	50.7	PROP. 36"
20	7.8	19.1	PROP. 24"
21	28.2	69.8	PROP. 42"
22	78.1	158.1	PROP. 60"
23	3.2	80.6	PROP. 54"

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

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



PROPOSED FULL SPECTRUM DETENTION FACILITY INFORMATION					
FACILITY/D.P.	EURV/TOP OF BOX (AC.-FT.)	EMERGENCY SPILLWAY ELEV./VOL.	100-YR W.S.E.	Q5 (CFS) OUT	Q100 (CFS) OUT
FILING 1/DP-5	0.893	6571.00 / 1.09 AC.-FT.	6570.61	0.63	9.77
FILING 2/DP-25	6.548	6579.00 / 17.60 AC.-FT.	6577.68	3.22	80.70

LEGEND
EXISTING GROUND CONTOUR (5910)
PROPOSED FINISHED CONTOUR 5910
SUBDIVISION BOUNDARY
PROPOSED BASIN BOUNDARY
EXISTING STORM SEWER
PROPOSED STORM SEWER
BASIN IDENTIFIER / AREA IN ACRES
DESIGN POINT
PIPE RUN

100 50 0 100 200
SCALE 1" = 100'

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
811
UTILITY NOTIFICATION OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY 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.

NO.	REVISION	DATE

REVIEW:
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

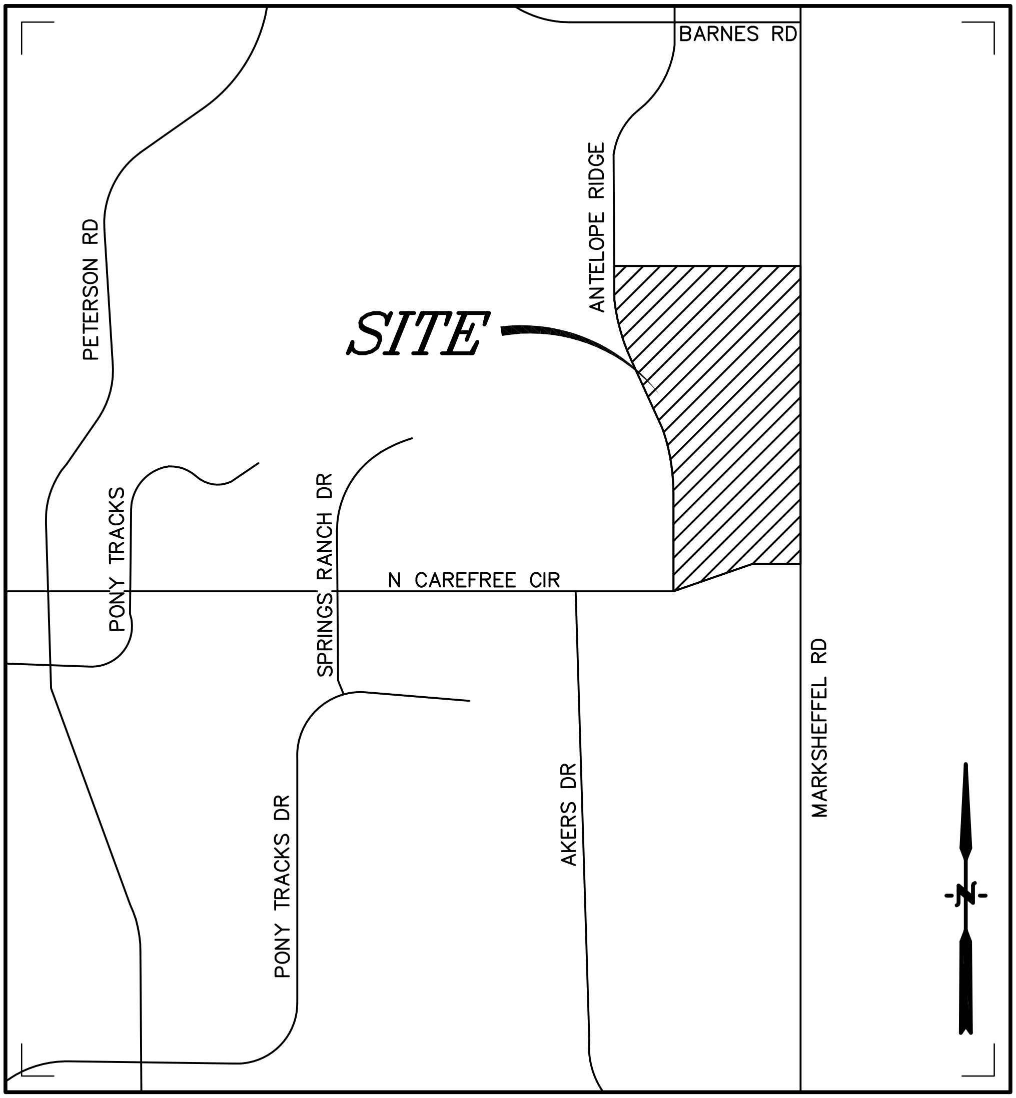
KYLE R. CAMPBELL, COLORADO P.E. #29794   DATE

CLASSIC CONSULTING ENGINEERS & SURVEYORS
6385 Corporate Drive, Suite 101 Colorado Sprgs, Colorado 80919
(719)785-0790 (719)785-0799(Fax)

WINDERMERE
DEVELOPED CONDITIONS DRAINAGE MAP
PRELIMINARY DRAINAGE REPORT WINDERMERE
FINAL DRAINAGE REPORT WINDERMERE FIL. NO. 1

DESIGNED BY	MAL	SCALE		DATE	09/01/14
DRAWN BY	MAL	(H) 1"= 100'		SHEET 1	OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	2241.00

K:\2441.00\DRAWINGS\DEVELOPMENT\244100-PDR-DEV.dwg, 6/16/2015 4:34:01 PM, Canon iPF8300S.pc3



Vicinity Map
Not to scale

WINDERMERE
COLORADO SPRINGS, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:	DWG. NO.
JOB NO: 21187-00CSCV	VMAP SHEET 1 OF 1

Map Scale: 1:4,170 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

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 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.

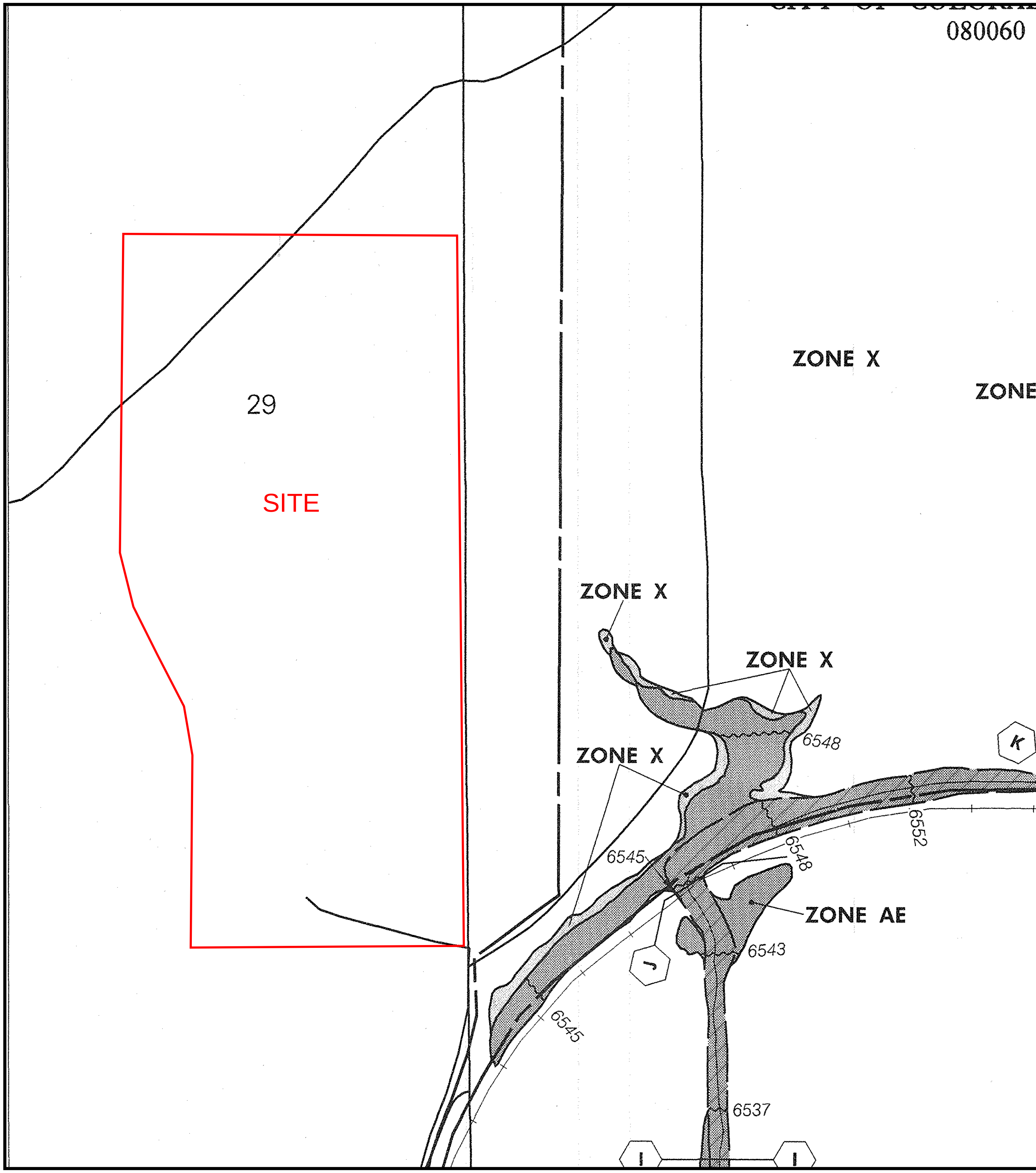
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over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

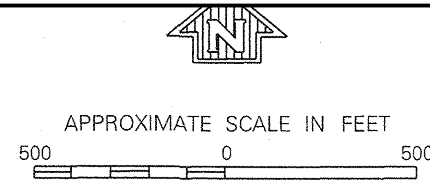
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified





NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 543 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0543	F

MAP NUMBER
08041C0543 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

September 18, 2020

Mr. Tim McConnell, PE
Principal / Regional Manager
Drexel, Barrell & Co.
3 S. 7th Street
Colorado Springs, CO 80905

Re: Proposed Windermere Development Pubic Detention and Stormwater Quality Facility

Dear Mr. McConnell,

Following to our recent correspondence, this is to confirm that YES Communities (YES) has no objection to proceeding forward with design and construction of a public detention pond and stormwater quality facility in conjunction with the proposed Windermere residential development currently under design. The specific property in question is owned by YES and is situated in the southwest quadrant of the intersection of Barnes Road on the north, and Marksheffel Road on the east. It is platted as Chateau at Antelope Ridge, Filing No. 2 in El Paso County, Colorado. The proposed pond location will be within Tract A, as situated on the south side of the property and which is currently used for storm water conveyance and detention. The Windermere property is located adjacent to the east, south, and west sides of Tract A.

It is understood that no adverse impacts to the existing homes and other infrastructure improvements within the YES property will be incurred with the proposed pond construction. The pond will serve local area drainage requirements from both the YES and Windermere properties. All pond improvements will be constructed and paid for by the Windermere developer. No financial burdens or liabilities will be incurred by YES with the work as proposed.

Please let us know if any additional information should be required. Thank you,

Sincerely,
YES Communities

Craig P. Schellbach, PE
Development Manager

This pond needs to be included in a DBPS amendment if it is to be publicly maintained. Staff does not know that there is County support for this.

c: Mike Askins

5605 N. MacArthur Blvd.; Suite 280; Irving, TX 75038
972-379-9610: | Email: cschellbach@yescommunities.com

(Calculations not checked)

PROJECT INFORMATION							
PROJECT:	Windermere						
PROJECT NO:	21187-01						
DESIGN BY:	SBN						Drexel, Barrell & Co.
REV. BY:	TDM						
AGENCY:	City of Colorado Springs						
REPORT TYPE:	Final						
DATE:	11/9/2020						
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

*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"

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)	2.16		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A1		2.16					
A2	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	4.70		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A2		4.70					
A3	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.63		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A3		1.63					
A4	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.01		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A4		1.01					
A5	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.98		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A5		1.98					
A6	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	3.75		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A6		3.75					
A7	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.33		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A7		1.33					
A8	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.96		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A8		2.96					

A9	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	1.86		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A9		1.86					
A10	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	4.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A10		4.00					
A11	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.66		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A11		2.66					
A12	Landscape/Lawn	7.79		0.15		0.50	0
	Residential (<1/8 acre)	1.96		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.21		0.52	13%
TOTAL A12		9.75					
B1	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	3.62		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B1		3.62					
B2	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.94		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B2		2.94					
B3	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.91		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B3		2.91					
B4	Landscape/Lawn	0.53		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 B4		0.53					
B5	Landscape/Lawn	0.39		0.15		0.50	0
	Residential (<1/8 acre)	0.36		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.29		0.54	31%
TOTAL B5		0.75					
C1	Landscape/Lawn	2.96		0.15		0.50	0
	Residential (<1/8 acre)	1.31		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.24		0.53	20%
TOTAL C1		4.27					
C2	Landscape/Lawn	0.70		0.15		0.50	0
	Residential (<1/8 acre)	1.58		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.36		0.56	45%
TOTAL C2		2.28					
C3	Landscape/Lawn	0.13		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		0.13					
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					
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					
TOTAL SITE			**55.22**		**0.38**		**0.57**	**50.3%**

PROJECT INFORMATION

PROJECT: Windermere
PROJECT NO: 21187-01
DESIGN BY: SBN
REV. BY: TDM
AGENCY: City of Colorado Springs
REPORT TYPE: Final
DATE: 11/9/2020

Drexel, Barrell & Co.

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	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	LENGTH	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t_c	t_c	**Min**
A1	A	0.45	0.59	2.16	100	12	12.0	5.3	20	5	25.0	15.5	0.0					5.3	5	**5.3**
	8	0.61	0.71	14.19																**18.7**
A2	B	0.45	0.59	4.70	100	5	5.1	7.1	1051	21	2.0	8.3	2.1					9.2	5	**9.2**
A3		0.56	0.67	1.63	35	1	3.5	4.0	600	16	2.6	9.4	1.1					5.0	5	**5.0**
	C	0.56	0.67	20.52										450	0.5	5.4	1.4	20.1	5	**20.1**
A4		0.45	0.59	1.01	100	1	1.0	12.2	205	10	4.8	12.8	0.3					12.4	5	**12.4**
	D	0.55	0.67	21.53										220	4.0	15.3	0.2	20.3	5	**20.3**
A5	E	0.45	0.59	1.98	100	12	11.9	5.3	385	9	2.4	9.1	0.7					6.0	5	**6.0**
A6		0.45	0.59	3.75	100	3	3.0	8.4	790	32	4.0	11.7	1.1					9.6	5	**9.6**
	F	0.53	0.65	27.26										90	3.5	14.3	0.1	20.4	5	**20.4**
A7	G	0.45	0.59	1.33	75	2	2.7	7.6	610	9	1.4	6.9	1.5					9.1	5	**9.1**
A8	H	0.45	0.59	2.96	100	10	10.4	5.6	740	11	1.5	7.2	1.7					7.3	5	**7.3**
A9	I	0.45	0.59	1.86	100	10	10.5	5.6	460	8	1.6	7.4	1.0					6.6	5	**6.6**
	J	0.45	0.59	6.15										300	1.0	5.9	0.9	8.1	5	**8.1**
	K	0.52	0.64	33.41										275	3.5	12.7	0.4	20.8	5	**20.8**
A10		0.45	0.59	4.00	100	3	3.0	8.4	770	25	3.2	10.5	1.2					9.7	5	**9.7**
	L	0.51	0.63	37.41										115	1.0	9.3	0.2	21.0	5	**21.0**
A11		0.45	0.59	2.66	40	1	1.5	6.7	945	40	4.2	12.0	1.3					8.0	5	**8.0**
	M	0.51	0.63	40.07										35	1.0	9.3	0.1	21.1	5	**21.1**
A12		0.21	0.52	9.75	100	30	29.6	5.4	1005	18	1.8	8.3	2.0					7.4	5	**7.4**
	N	0.45	0.61	49.82					260	4	1.4	8.3	0.5	180	3.5	14.3	0.2	21.8	5	**21.8**
B1	O	0.45	0.59	3.62	35	1	3.5	4.7	885	30	3.4	10.8	1.4					6.1	5	**6.1**
B2	P	0.45	0.59	2.94	50	2	4.0	5.4	725	20	2.8	9.8	1.2					6.6	5	**6.6**
B3	Q	0.45	0.59	2.91	100	5	5.3	7.0	825	21	2.5	9.3	1.5					8.4	5	**8.4**
B4		0.15	0.50	0.53	85	24	28.5	5.4	75	4	5.3	14.3	0.1					5.5	5	**5.5**
	R	0.43	0.59	10.00					75	4	5.3	14.3	0.1	70	25.0	29.3	0.0	8.6	5	**8.6**
B5		0.29	0.54	0.75	60	12	20.0	4.3	455	15	3.3	5.6	1.3					5.6	5	**5.6**

	S	0.49	0.68	1.28										105	2.0	8.3	0.2	8.8	5	**8.8**
C1	T	0.24	0.53	4.27	100	13	13.0	6.8	90	7	7.8	8.7	0.2					7.0	5	**7.0**
C2	U	0.36	0.56	2.28	100	5	5.5	7.9	75	2	2.1	4.5	0.3					8.2	5	**8.2**
C3	V	0.15	0.50	0.13	35	6	15.9	4.2										4.2	5	**5.0**

PROJECT INFORMATION

PROJECT:	Windermere
PROJECT NO:	21187-01
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	City of Colorado Springs
REPORT TYPE:	Final
DATE:	11/9/2020

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED | RUNOFF 5 YR STORM | P1= 1.50

		DIRECT RUNOFF						PIPE SIZING			
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	n	Slope (ft/ft)	Calculated Pipe Dia	Used Pipe
A1	A	2.16	0.45	5.3	0.97	5.02	**4.9**				
	8	14.19	0.61	18.7	8.60	3.12	**26.8**				
A2	B	4.70	0.45	9.2	2.12	4.23	**9.0**				
A3		1.63	0.56	5.0	0.91	5.10	**4.6**				
	C	20.52	0.56	20.1	11.45	3.01	**34.4**				
A4		1.01	0.45	12.4	0.45	3.76	**1.7**				
	D	21.53	0.55	20.3	11.90	2.99	**35.6**				
A5	E	1.98	0.45	6.0	0.89	4.85	**4.3**				
A6		3.75	0.45	9.6	1.69	4.17	**7.0**				
	F	27.26	0.53	20.4	14.48	2.98	**43.2**				
A7	G	1.33	0.45	9.1	0.60	4.26	**2.5**				
A8	H	2.96	0.45	7.3	1.33	4.58	**6.1**				
A9	I	1.86	0.45	6.6	0.84	4.73	**4.0**				
	J	6.15	0.45	8.1	2.77	4.42	**12.2**				
	K	33.41	0.52	20.8	17.25	2.96	**51.0**				
A10		4.00	0.45	9.7	1.80	4.16	**7.5**				
	L	37.41	0.51	21.0	19.05	2.94	**56.0**				
A11		2.66	0.45	8.0	1.20	4.45	**5.3**				
	M	40.07	0.51	21.1	20.24	2.94	**59.4**				
A12		9.75	0.21	7.4	2.05	4.56	**9.4**				
	N	49.82	0.45	21.8	22.29	2.88	**175.6**				
North Pond Release							**1.4**				
B1	O	3.62	0.45	6.1	1.63	4.84	**7.9**				
B2	P	2.94	0.45	6.6	1.32	4.72	**6.2**				
B3	Q	2.91	0.45	8.4	1.31	4.36	**5.7**				
B4		0.53	0.15	5.5	0.08	4.99	**0.4**				
	R	10.00	0.43	8.6	4.34	4.34	**18.8**				
South Pond Release							**0.3**				
B5		0.75	0.29	5.6	0.22	4.94	**1.1**				
	S						**10.3**				
C1		4.27	0.24	7.0	1.03	4.64	**4.8**				
	T						**191.2**				
C2	U	2.28	0.36	8.2	0.82	4.42	**3.6**				
C3	V	0.13	0.15	5.0	0.02	5.10	**0.1**				
NC2	19	3.89	0.53	9.0	2.06	4.26	**8.8**				

	J1	5.17	0.52	9.3	2.69	4.22	**21.6**				
NC1		0.43	0.85	5.0	0.36	5.10	**1.9**				
	20	5.60	0.55	9.3	3.06	4.21	**23.1**				

PROJECT INFORMATION

Drexel, Barrell & Co.

PROJECT:	Windermere
PROJECT NO:	21187-01
DESIGN BY:	SBN
REV. BY:	TDM
AGENCY:	City of Colorado Springs
REPORT TYPE:	Final
DATE:	11/9/2020

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED — RUNOFF — 100 YR STORM — P1= 2.67

			DIRECT RUNOFF					PIPE SIZING			
BASIN (S)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	n	Slope (ft/ft)	Calculated Pipe Dia (ft)	Used Pipe (in)
A1	A	2.16	0.59	5.3	1.27	8.94	**11.4**				
	8	14.19	0.71	18.7	10.04	5.55	**55.7**	0.016	0.005	3.4	36
A2	B	4.70	0.59	9.2	2.77	7.54	**20.9**	0.016	0.01	2.1	24
A3		1.63	0.67	5.0	1.09	9.08	**9.9**				
	C	20.52	0.67	20.1	13.77	5.35	**73.7**	0.016	0.04	2.6	36
A4		1.01	0.59	12.4	0.60	6.69	**4.0**				
	D	21.53	0.67	20.3	14.37	5.32	**76.5**	0.016	0.035	2.7	36
A5	E	1.98	0.59	6.0	1.17	8.64	**10.1**	0.016	0.01	1.6	18
A6		3.75	0.59	9.6	2.21	7.43	**16.4**				
	F	27.26	0.65	20.4	17.75	5.31	**94.2**	0.016	0.035	2.9	36
A7	G	1.33	0.59	9.1	0.78	7.57	**5.9**	0.016	0.01	1.1	18
A8	H	2.96	0.59	7.3	1.75	8.16	**14.2**	0.016	0.008	1.9	24
A9	I	1.86	0.59	6.6	1.10	8.42	**9.2**	0.016	0.01	1.6	18
	J	6.15	0.59	8.1	3.63	7.87	**28.5**	0.016	0.009	2.3	30
	K	33.41	0.64	20.8	21.38	5.26	**112.4**	0.016	0.01	3.9	48
A10		4.00	0.59	9.7	2.36	7.40	**17.5**				
	L	37.41	0.63	21.0	23.74	5.23	**124.2**	0.016	0.01	4.1	48
A11		2.66	0.59	8.0	1.57	7.91	**12.4**				
	M	40.07	0.63	21.1	25.30	5.23	**132.2**	0.016	0.035	3.3	48
A12		9.75	0.52	7.4	5.05	8.12	**41.0**				
	N	49.82	0.61	21.8	30.36	5.13	**355.6**				
North Pond Release							**19.7**	0.016	0.02	2.0	30
B1	O	3.62	0.59	6.1	2.14	8.61	**18.4**	0.016	0.02	1.8	24
B2	P	2.94	0.59	6.6	1.73	8.40	**14.6**	0.016	0.006	2.0	24
B3	Q	2.91	0.59	8.4	1.72	7.77	**13.3**	0.016	0.25	0.9	24
B4		0.53	0.50	5.5	0.27	8.88	**2.4**				
	R	10.00	0.59	8.6	5.85	7.73	**45.2**				
South Pond Release							**5.3**	0.016	0.02	1.1	18
B5		0.75	0.54	5.6	0.41	8.80	**3.6**				
	S						**26.9**	0.016	0.005	2.7	24
C1		4.27	0.53	7.0	2.25	8.26	**18.6**				
	T						**638.3**				
C2	U	2.28	0.56	8.2	1.28	7.86	**10.1**				
C3	V	0.13	0.50	5.0	0.07	9.09	**0.6**				
NC2	19	3.89	0.70	9.0	2.70	7.58	**20.5**				

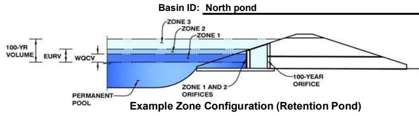
	J1	5.17	0.69	9.3	3.58	7.51	**53.8**				
NC1		0.43	0.93	5.0	0.40	9.09	**3.6**				
	20	5.60	0.71	9.3	3.98	7.49	**56.7**				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Windermere

Basin ID: North pond



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	133.36	acres		
Watershed Length =	4,000	ft		
Watershed Slope =	0.020	ft/ft		
Watershed Imperviousness =	45.40%	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		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			
Water Quality Capture Volume (WQCV) =	2.156	acre-feet	Optional User Override	
Excess Urban Runoff Volume (EURV) =	6.795	acre-feet	1-hr Precipitation	
2-yr Runoff Volume (P1 = 1.19 in.) =	4.622	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.091	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.533	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.485	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.043	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	15.109	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	24.694	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	4.351	acre-feet		
Approximate 5-yr Detention Volume =	5.742	acre-feet		
Approximate 10-yr Detention Volume =	7.039	acre-feet		
Approximate 25-yr Detention Volume =	8.664	acre-feet		
Approximate 50-yr Detention Volume =	9.723	acre-feet		
Approximate 100-yr Detention Volume =	11.091	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	2.156	acre-feet
Zone 2 Volume (EURV - Zone 1) =	4.639	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.296	acre-feet
Total Detention Basin Volume =	11.091	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 = 1 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	--	--	--	250	0.006		
6571	--	0.50	--	--	--	250	0.006	123	0.003
6572	--	1.50	--	--	--	7,586	0.174	3,967	0.091
6573	--	2.50	--	--	--	17,267	0.396	16,469	0.378
6574	--	3.50	--	--	--	49,754	1.142	49,980	1.147
6575	--	4.50	--	--	--	82,355	1.891	116,034	2.664
6576	--	5.50	--	--	--	135,090	3.101	224,757	5.160
6577	--	6.50	--	--	--	163,617	3.756	374,110	8.588
6578	--	7.50	--	--	--	192,865	4.428	552,351	12.680
6579-Spillway	--	8.50	--	--	--	208,824	4.794	753,195	17.291
6580	--	9.50	--	--	--	221,127	5.076	968,171	22.226
6581	--	10.50	--	--	--	237,413	5.450	1,197,441	27.489
6582-Embnkmnt	--	11.50	--	--	--	251,492	5.773	1,441,893	33.101
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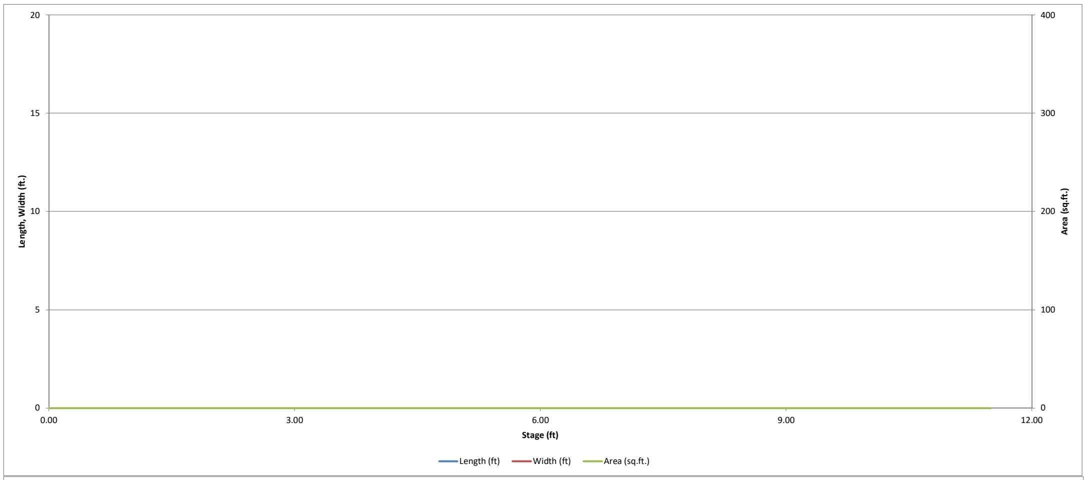
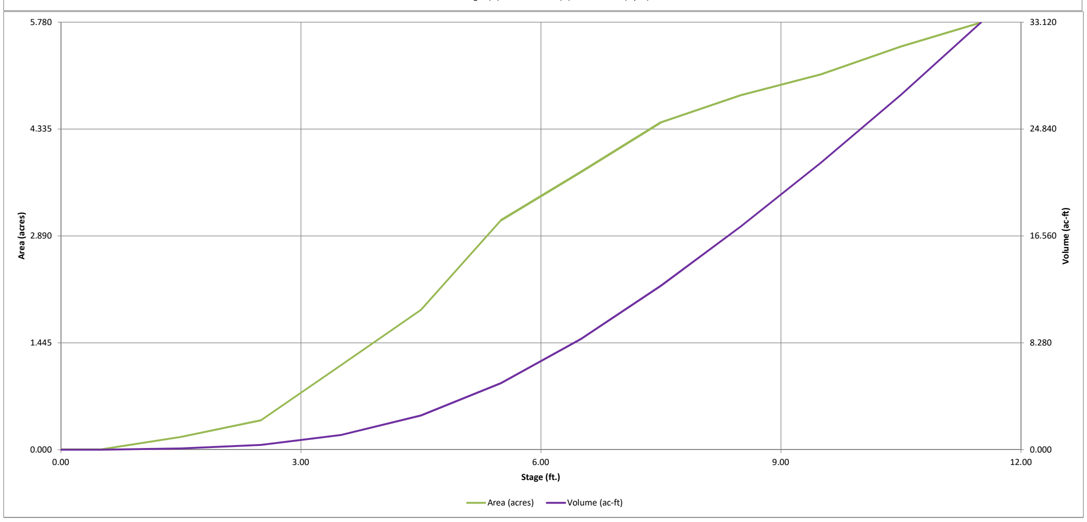
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

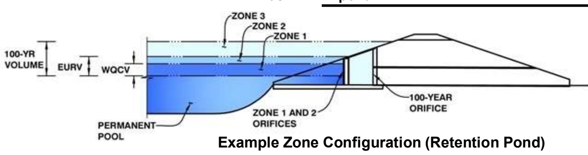




Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Windermere
Basin ID: N pond



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.22	2.156	Orifice Plate
Zone 2 (EURV)	6.01	4.639	Orifice Plate
Zone 3 (100-year)	7.14	4.296	Weir&Pipe (Circular)
		11.091	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	7.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	24.00	inches
Orifice Plate: Orifice Area per Row =	7.42	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.153E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.00	4.00					
Orifice Area (sq. inches)	7.42	7.42	7.42					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	7.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.91	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	7.00	N/A	feet
Over Flow Weir Slope Length =	3.91	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.18	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	10.70	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.35	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	30.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	4.91	N/A	ft^2
Outlet Orifice Centroid =	1.25	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	71.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

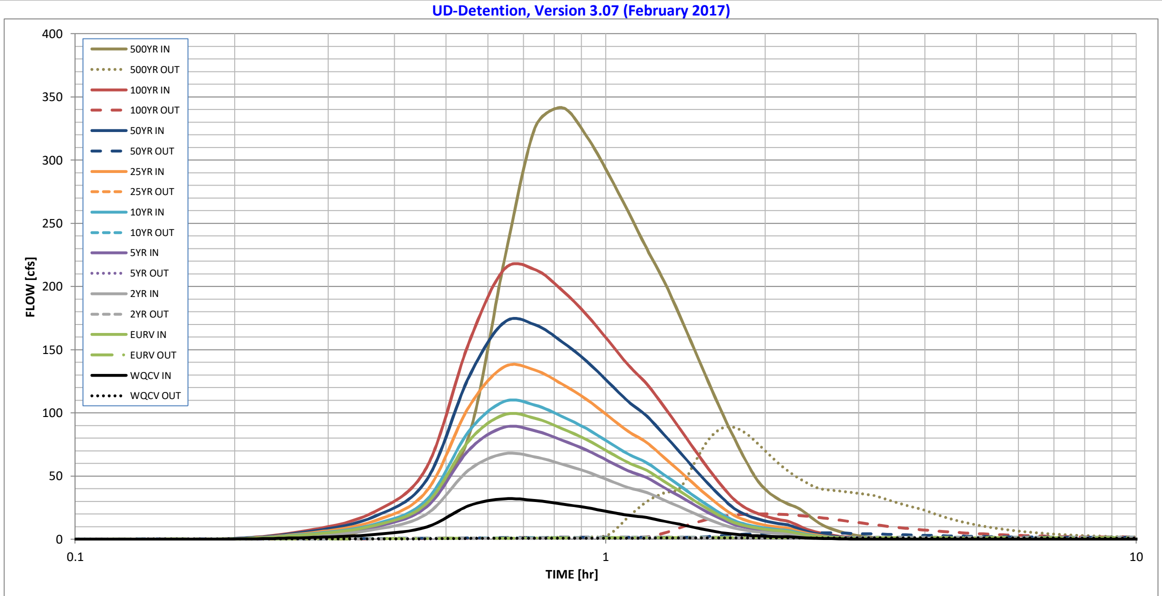
Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	10.46	feet
Basin Area at Top of Freeboard =	5.44	acres

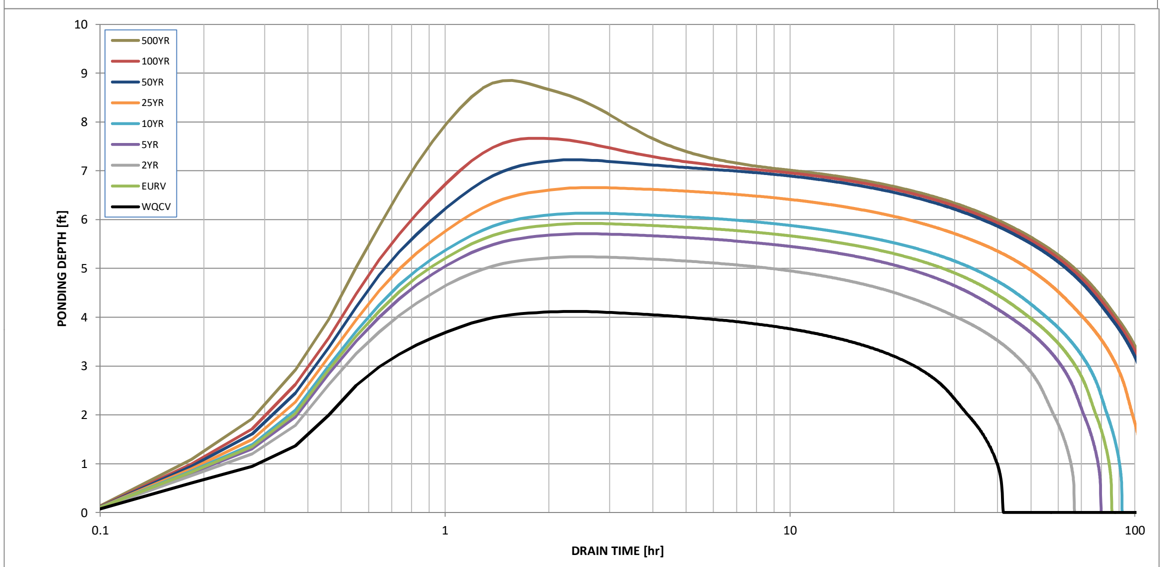
Routed Hydrograph Results

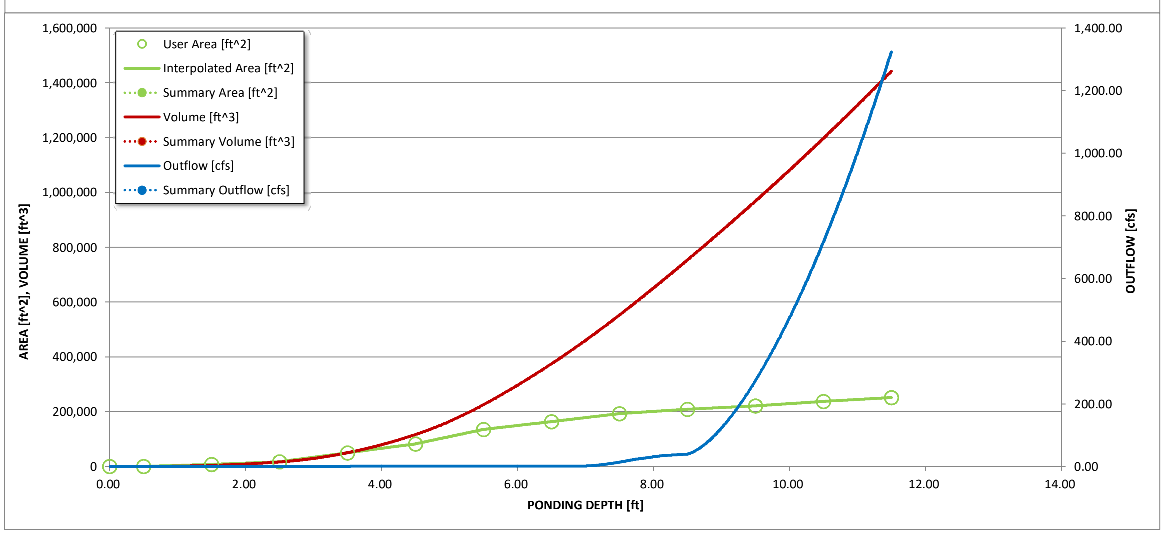
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.49
Calculated Runoff Volume (acre-ft) =	2.156	6.795	4.622	6.091	7.533	9.485	12.043	15.109	24.694
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	2.155	6.791	4.621	6.082	7.530	9.482	12.034	15.102	24.688
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.17	0.42	1.06
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.6	1.4	3.1	22.8	55.5	141.0
Peak Inflow Q (cfs) =	31.9	98.6	67.7	88.5	109.0	136.3	171.6	213.4	341.5
Peak Outflow Q (cfs) =	1.0	1.4	1.3	1.4	1.5	1.6	5.3	20.1	88.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.4	1.1	0.5	0.2	0.4	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.3	1.7	3.9
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) =	38	77	61	72	83	96	109	109	105
Time to Drain 99% of Inflow Volume (hours) =	40	82	64	77	88	103	116	117	115
Maximum Ponding Depth (ft) =	4.12	5.92	5.24	5.71	6.13	6.66	7.23	7.67	8.85
Area at Maximum Ponding Depth (acres) =	1.60	3.38	2.77	3.24	3.51	3.86	4.24	4.49	4.89
Maximum Volume Stored (acre-ft) =	1.983	6.520	4.366	5.825	7.243	9.159	11.467	13.393	18.937

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

Time Interval	Hydrograph Constant
5.52 min	0.906

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:11:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:16:34	1.37	3.87	2.78	3.53	4.21	5.06	6.06	7.14	9.36
0:22:05	3.75	11.04	7.77	9.99	12.11	14.84	18.23	22.07	31.07
0:27:36	9.62	28.35	19.94	25.66	31.10	38.12	46.85	56.77	80.94
0:33:07	26.41	77.61	54.65	70.27	85.10	104.20	127.90	154.75	219.58
0:38:38	31.95	98.55	67.67	88.50	108.97	136.30	171.63	213.44	325.27
0:44:10	30.60	95.76	65.22	85.77	106.18	133.75	169.88	213.32	341.50
0:49:41	27.85	87.58	59.45	78.36	97.21	122.76	156.39	197.00	319.42
0:55:12	25.02	78.98	53.56	70.64	87.67	110.77	141.19	177.93	289.38
1:00:43	21.76	69.34	46.89	61.97	77.03	97.50	124.51	157.20	259.11
1:06:14	18.92	60.65	40.96	54.19	67.41	85.38	109.08	137.78	229.96
1:11:46	17.15	54.54	36.94	48.77	60.56	76.53	97.54	122.90	204.53
1:17:17	14.31	45.99	31.00	41.06	51.15	64.90	83.07	105.12	177.01
1:22:48	11.80	38.21	25.70	34.09	42.51	53.99	69.17	87.61	149.85
1:28:19	9.27	30.51	20.40	27.17	34.00	43.33	55.73	70.86	124.16
1:33:50	7.07	23.72	15.78	21.10	26.47	33.82	43.60	55.58	100.54
1:39:22	5.21	17.87	11.81	15.86	19.97	25.60	33.11	42.41	80.08
1:44:53	3.95	13.29	8.84	11.82	14.83	18.94	24.41	31.39	61.88
1:50:24	3.21	10.60	7.10	9.45	11.81	15.03	19.29	24.64	46.70
1:55:55	2.71	8.90	5.97	7.94	9.91	12.59	16.14	20.53	37.53
2:01:26	2.37	7.72	5.19	6.89	8.59	10.89	13.94	17.68	31.77
2:06:58	2.12	6.89	4.64	6.15	7.66	9.70	12.40	15.70	27.80
2:12:29	1.95	6.30	4.25	5.62	7.00	8.86	11.30	14.29	24.98
2:18:00	1.44	4.76	3.17	4.24	5.31	6.79	8.76	11.21	20.24
2:23:31	1.05	3.44	2.30	3.06	3.83	4.89	6.31	8.08	14.88
2:29:02	0.77	2.55	1.70	2.27	2.84	3.63	4.69	5.99	10.82
2:34:34	0.57	1.89	1.26	1.69	2.11	2.70	3.48	4.44	8.08
2:40:05	0.41	1.39	0.93	1.24	1.56	1.99	2.57	3.29	6.07
2:45:36	0.30	1.01	0.67	0.89	1.12	1.44	1.87	2.39	4.52
2:51:07	0.21	0.73	0.48	0.65	0.81	1.04	1.35	1.73	3.32
2:56:38	0.15	0.51	0.34	0.46	0.58	0.74	0.96	1.24	2.47
3:02:10	0.09	0.34	0.22	0.30	0.38	0.49	0.64	0.84	1.77
3:07:41	0.05	0.20	0.13	0.17	0.22	0.29	0.39	0.51	1.19
3:13:12	0.02	0.09	0.06	0.08	0.11	0.14	0.19	0.26	0.73
3:18:43	0.00	0.03	0.02	0.02	0.03	0.05	0.06	0.09	0.37
3:24:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.13
3:29:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
3:35:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:46:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:51:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:57:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:02:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:08:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:13:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:19:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:24:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:36:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:41:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:47:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:52:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:58:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:03:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:09:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:14:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:31:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:36:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:42:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:47:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:53:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:04:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:09:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:15:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:20:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:26:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:31:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:37:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Windermere - Forebay volumes for North pond

3% of WQCV = 0.03 x 2.156 = 0.0647 ac-ft

Qin north = 199.7 cfs
Qin south = 130.0 cfs
Qtotal = 329.7 cfs

North forebay volume:

$$\frac{199.7 \text{ cfs}}{329.7 \text{ cfs}} = \frac{x \text{ ac-ft}}{0.0647 \text{ ac-ft}}$$

x = 0.0392 ac-ft

$$\boxed{= 1706.5 \text{ ft}^3}$$

South forebay volume:

$$\frac{130.0 \text{ cfs}}{329.7 \text{ cfs}} = \frac{x \text{ ac-ft}}{0.0647 \text{ ac-ft}}$$

x = 0.0255 ac-ft

$$\boxed{= 1110.9 \text{ ft}^3}$$

FOREBAY RELEASE NOTCH WIDTH - NORTH

$Q=CLH^{2/3}$

Q_{100}=	199.7	cfs
2% of Q=	3.99	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	18	in

FOREBAY RELEASE NOTCH WIDTH - SOUTH

$Q=CLH^{2/3}$

Q_{100}=	132.2	cfs
2% of Q=	2.64	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	12	in

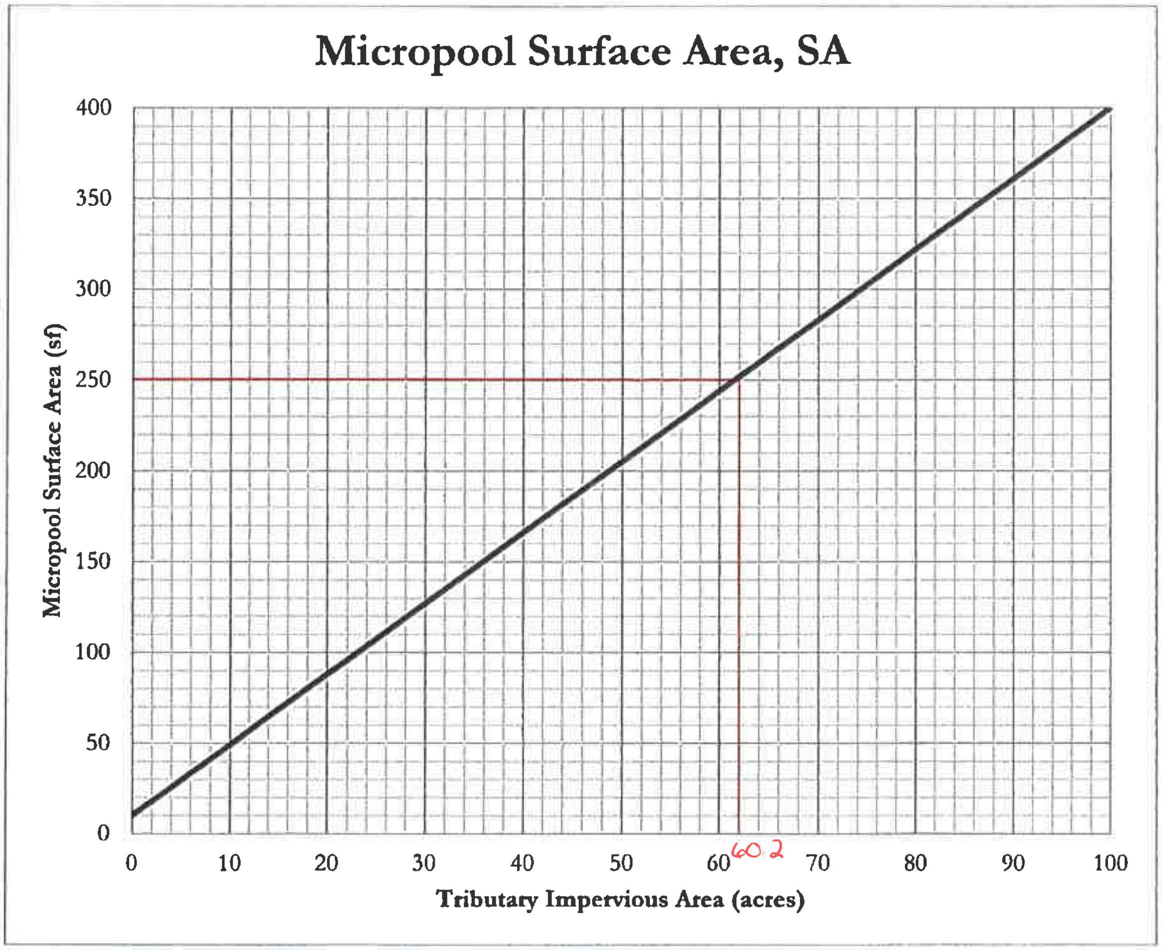


Figure 1 – Micropool surface area (SA) determination chart

The tributary impervious area is the effective number of impervious acres that will be treated by the extended detention basin (EDB). It is calculated by multiplying the tributary area to be treated by the impervious fraction of that area.

$$TIA = I \times A$$

$\frac{45.4}{100} \times 132.63 = 60.2$ ac

TIA = Tributary impervious area (acres)
I = Imperviousness (fraction)
A = Tributary catchment area upstream (acres)

For EDBs with tributary impervious areas greater than 100 acres, the micropool surface area is 400 sf. The initial surcharge depth (ISD) is defined as the depth of the initial surcharge volume (ISV). The surface area determined using Figure 1 assumes an ISD of 4 inches. The initial surcharge volume is thus calculated by multiplying the micropool surface area by 4 inches.

$$ISV = SA \times 4\ inches$$

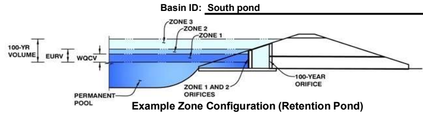
ISV = Initial surcharge volume (cf)
SA = Surface area (from Figure 1, sf)

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Windermere

Basin ID: South pond



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	10.00	acres		
Watershed Length =	770	ft		
Watershed Slope =	0.060	ft/ft		
Watershed Imperviousness =	61.60%	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		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			
Water Quality Capture Volume (WQCV) =	0.201	acre-feet	Optional User Override	
Excess Urban Runoff Volume (EURV) =	0.753	acre-feet	1-hr Precipitation	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.517	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.676	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.825	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.005	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.209	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.447	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	2.213	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	0.489	acre-feet		
Approximate 5-yr Detention Volume =	0.640	acre-feet		
Approximate 10-yr Detention Volume =	0.773	acre-feet		
Approximate 25-yr Detention Volume =	0.934	acre-feet		
Approximate 50-yr Detention Volume =	1.031	acre-feet		
Approximate 100-yr Detention Volume =	1.136	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.201	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.552	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.383	acre-feet
Total Detention Basin Volume =	1.136	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 = 1 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	--	--	--	40	0.001		
6563	--	0.50	--	--	--	40	0.001	20	0.000
6564	--	1.50	--	--	--	4,047	0.093	2,023	0.046
6565	--	2.50	--	--	--	4,744	0.109	6,459	0.148
6566	--	3.50	--	--	--	5,413	0.124	11,537	0.265
6567	--	4.50	--	--	--	6,058	0.139	17,273	0.397
6568	--	5.50	--	--	--	6,715	0.154	23,659	0.543
6569	--	6.50	--	--	--	7,370	0.169	30,702	0.705
6570	--	7.50	--	--	--	8,037	0.185	38,405	0.882
6571	--	8.50	--	--	--	9,445	0.217	47,146	1.082
6572-Spillway	--	9.50	--	--	--	10,731	0.246	57,234	1.314
6573	--	10.50	--	--	--	12,088	0.278	68,644	1.576
6574-Embnkmnt	--	11.50	--	--	--	13,493	0.310	81,434	1.869
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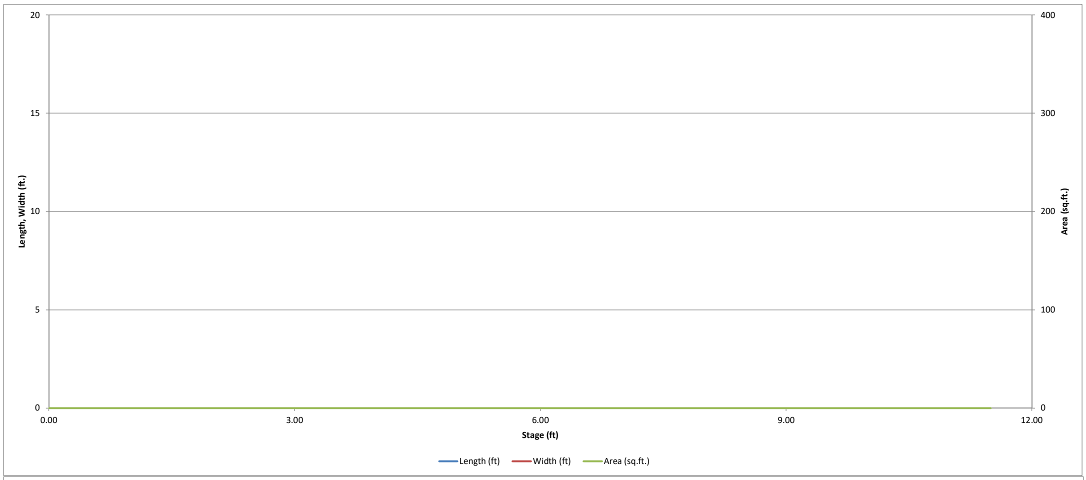
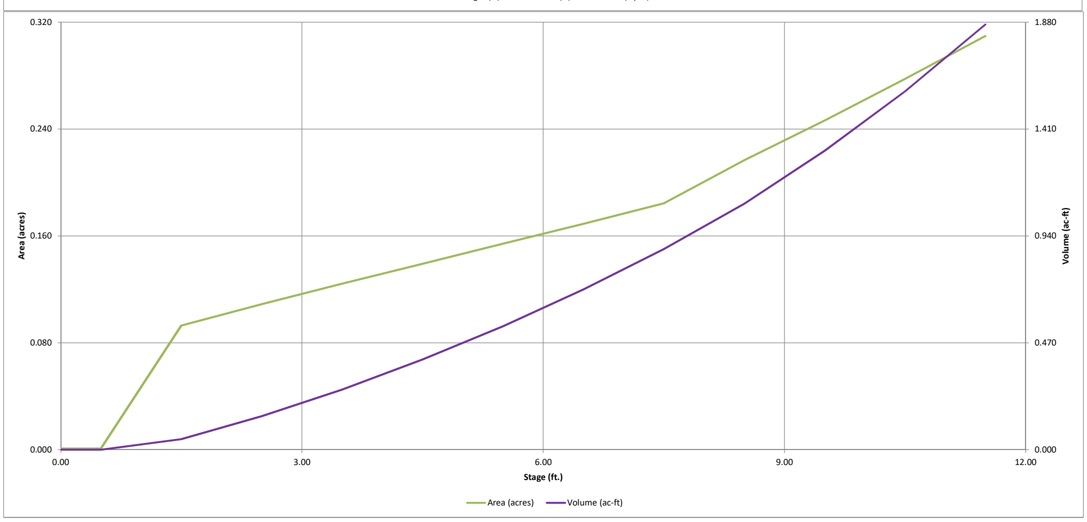
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



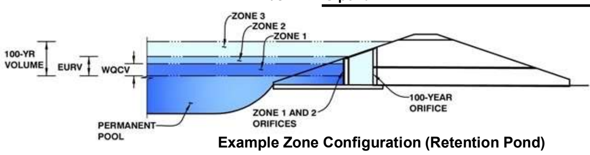


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Windermere

Basin ID: S pond



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.98	0.201	Orifice Plate
Zone 2 (EURV)	6.79	0.552	Orifice Plate
Zone 3 (100-year)	8.75	0.383	Weir&Pipe (Restrict)
		1.136	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	8.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	24.00	inches
Orifice Plate: Orifice Area per Row =	1.16	sq. inches (diameter = 1-3/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.056E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.00	4.00					
Orifice Area (sq. inches)	1.16	1.16	1.16					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	8.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.91	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	8.50	N/A	feet
Over Flow Weir Slope Length =	3.91	N/A	feet
Grate Open Area / 100-yr Orifice Area =	33.03	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	10.70	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.35	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.30		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.32	N/A	ft^2
Outlet Orifice Centroid =	0.21	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.02	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	11.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

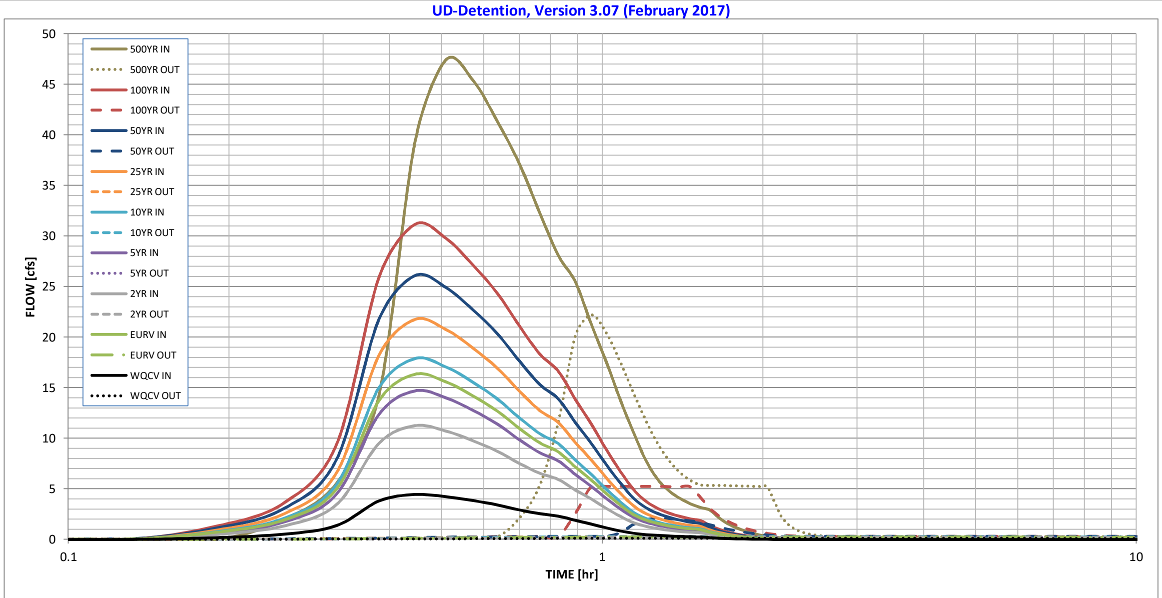
Spillway Design Flow Depth=	0.85	feet
Stage at Top of Freeboard =	11.35	feet
Basin Area at Top of Freeboard =	0.30	acres

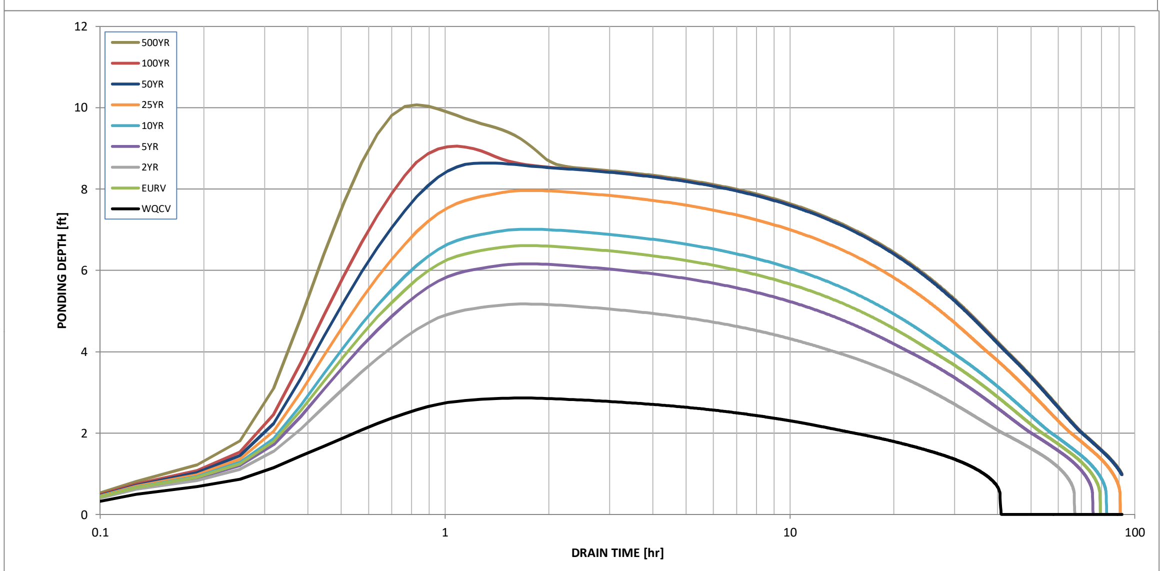
Routed Hydrograph Results

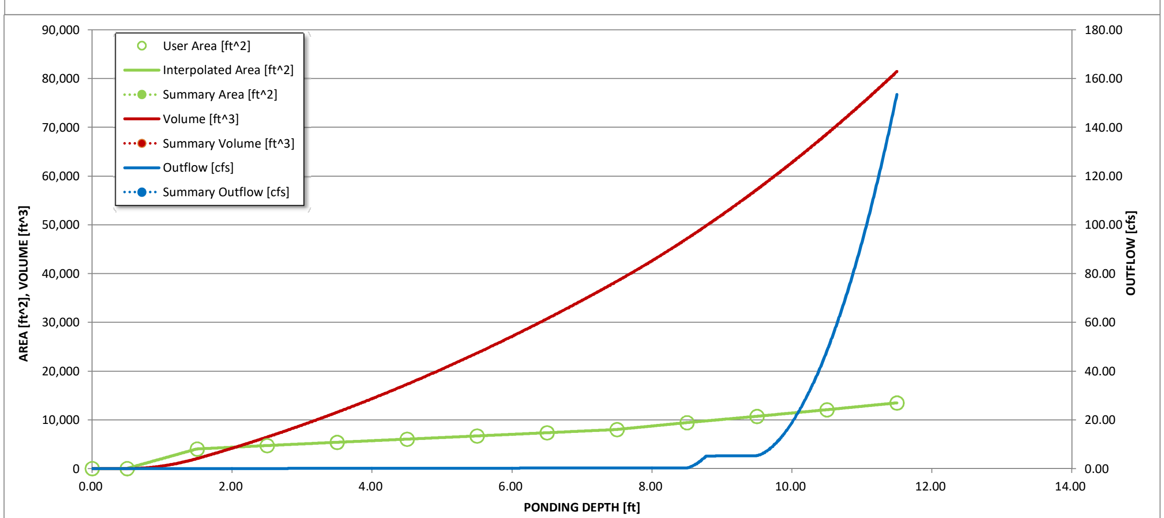
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.49
Calculated Runoff Volume (acre-ft) =	0.201	0.753	0.517	0.676	0.825	1.005	1.209	1.447	2.213
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.201	0.752	0.516	0.675	0.824	1.005	1.209	1.446	2.213
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.01	0.02	0.04	0.27	0.65	1.59
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.2	0.4	2.7	6.5	15.9
Peak Inflow Q (cfs) =	4.4	16.3	11.2	14.7	17.9	21.7	26.1	31.1	47.4
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.3	0.3	2.1	5.3	22.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.3	1.6	0.8	0.8	0.8	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.2	0.5	0.5
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	72	62	69	75	81	85	83	77
Time to Drain 99% of Inflow Volume (hours) =	40	77	65	73	80	87	92	91	89
Maximum Ponding Depth (ft) =	2.86	6.61	5.17	6.16	7.01	7.97	8.64	9.05	10.07
Area at Maximum Ponding Depth (acres) =	0.11	0.17	0.15	0.16	0.18	0.20	0.22	0.23	0.26
Maximum Volume Stored (acre-ft) =	0.188	0.722	0.493	0.648	0.793	0.970	1.113	1.206	1.459

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

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

Time Interval
3.82 min

Hydrograph Constant
1.309

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:03:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:07:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:11:28	0.20	0.72	0.50	0.65	0.79	0.95	1.14	1.35	2.03
0:15:17	0.53	1.94	1.35	1.75	2.12	2.58	3.09	3.68	5.55
0:19:06	1.37	4.99	3.46	4.49	5.46	6.62	7.93	9.44	14.26
0:22:55	3.78	13.72	9.51	12.35	15.00	18.19	21.78	25.92	39.15
0:26:44	4.42	16.32	11.25	14.67	17.86	21.73	26.09	31.14	47.39
0:30:34	4.21	15.58	10.73	14.00	17.06	20.76	24.94	29.79	45.40
0:34:23	3.83	14.18	9.77	12.75	15.53	18.90	22.70	27.12	41.32
0:38:12	3.39	12.68	8.71	11.39	13.89	16.92	20.34	24.31	37.12
0:42:01	2.91	10.96	7.51	9.83	12.01	14.65	17.63	21.09	32.30
0:45:50	2.54	9.54	6.55	8.57	10.46	12.75	15.33	18.33	28.09
0:49:40	2.30	8.65	5.93	7.76	9.48	11.56	13.90	16.63	25.45
0:53:29	1.87	7.15	4.88	6.41	7.84	9.58	11.54	13.83	21.23
0:57:18	1.51	5.84	3.98	5.24	6.42	7.85	9.48	11.37	17.52
1:01:07	1.14	4.51	3.06	4.04	4.96	6.09	7.37	8.87	13.76
1:04:56	0.83	3.37	2.27	3.01	3.71	4.57	5.56	6.72	10.51
1:08:46	0.61	2.44	1.65	2.18	2.68	3.31	4.04	4.90	7.75
1:12:35	0.48	1.88	1.28	1.69	2.07	2.55	3.10	3.75	5.87
1:16:24	0.40	1.55	1.05	1.39	1.70	2.09	2.54	3.06	4.77
1:20:13	0.34	1.31	0.89	1.18	1.44	1.77	2.15	2.59	4.02
1:24:02	0.30	1.15	0.78	1.03	1.27	1.55	1.88	2.27	3.51
1:27:52	0.27	1.04	0.71	0.93	1.14	1.40	1.69	2.03	3.15
1:31:41	0.25	0.96	0.65	0.86	1.05	1.29	1.56	1.87	2.89
1:35:30	0.18	0.70	0.48	0.63	0.77	0.94	1.14	1.38	2.14
1:39:19	0.13	0.52	0.35	0.46	0.57	0.69	0.84	1.01	1.55
1:43:08	0.10	0.38	0.26	0.34	0.41	0.51	0.61	0.74	1.15
1:46:58	0.07	0.28	0.19	0.25	0.31	0.38	0.45	0.55	0.85
1:50:47	0.05	0.20	0.13	0.18	0.22	0.27	0.33	0.39	0.62
1:54:36	0.04	0.14	0.10	0.13	0.16	0.19	0.23	0.28	0.44
1:58:25	0.02	0.10	0.07	0.09	0.11	0.14	0.17	0.20	0.32
2:02:14	0.02	0.07	0.04	0.06	0.07	0.09	0.11	0.14	0.22
2:06:04	0.01	0.04	0.03	0.04	0.04	0.06	0.07	0.08	0.14
2:09:53	0.00	0.02	0.01	0.02	0.02	0.03	0.04	0.04	0.08
2:13:42	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.03
2:17:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
2:21:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:25:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:28:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:32:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:36:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:40:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:44:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:48:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:51:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:55:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:59:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:03:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:07:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:11:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:14:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:18:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:22:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:26:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:33:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:37:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:41:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:49:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:53:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:56:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:04:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:08:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:12:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:19:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:23:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:27:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:31:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SOUTH POND

FOREBAY VOLUME

V=3% x WQCV

WQCV=	0.201	ac-ft
V=	0.0060	ac-ft

FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{2/3}$

Q_{100}=	13.3	cfs
2% of Q=	0.27	cfs
C=	2.6	
H (height of forebay wall)=	1	ft
L=	1	in

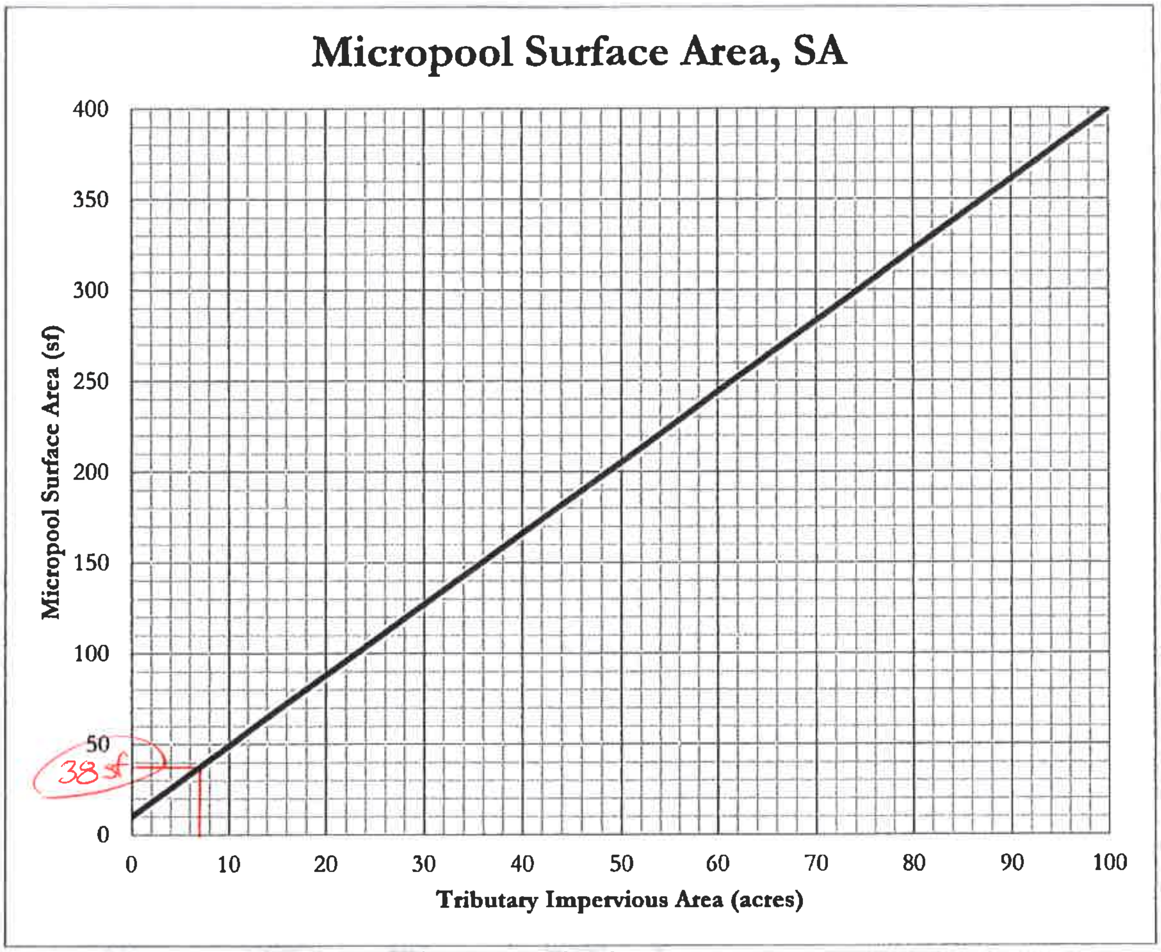


Figure 1 – Micropool surface area (SA) determination chart

The tributary impervious area is the effective number of impervious acres that will be treated by the extended detention basin (EDB). It is calculated by multiplying the tributary area to be treated by the impervious fraction of that area.

$$TIA = I \times A$$

$\frac{73.3}{100} \times 9.31 = 6.8$ ac

TIA = Tributary impervious area (acres)
I = Imperviousness (fraction)
A = Tributary catchment area upstream (acres)

For EDBs with tributary impervious areas greater than 100 acres, the micropool surface area is 400 sf. The initial surcharge depth (ISD) is defined as the depth of the initial surcharge volume (ISV). The surface area determined using Figure 1 assumes an ISD of 4 inches. The initial surcharge volume is thus calculated by multiplying the micropool surface area by 4 inches.

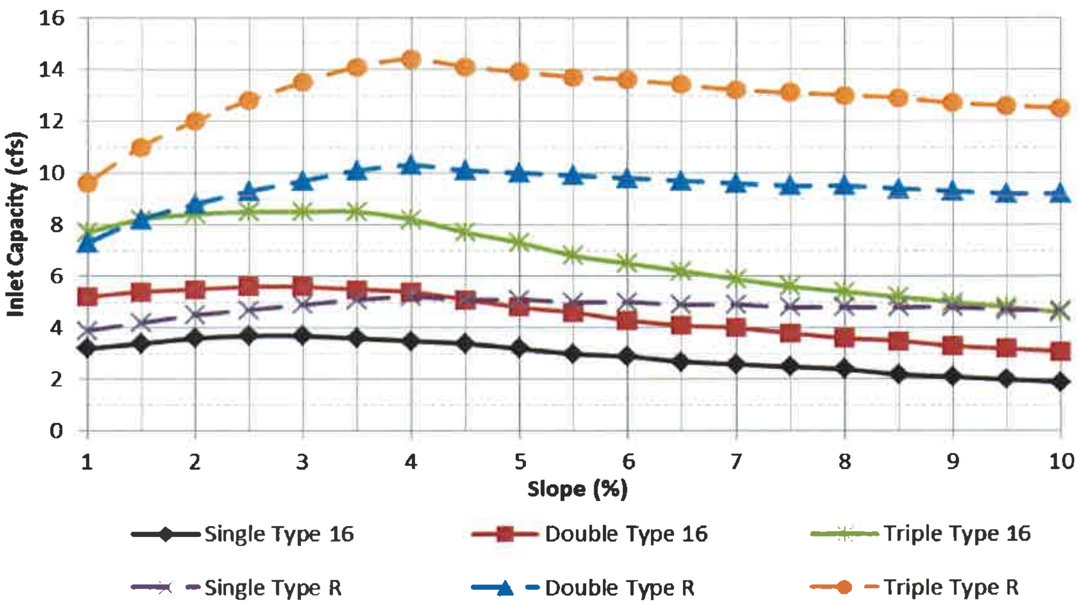
$$ISV = SA \times 4\ inches$$

ISV = Initial surcharge volume (cf)
SA = Surface area (from Figure 1, sf)

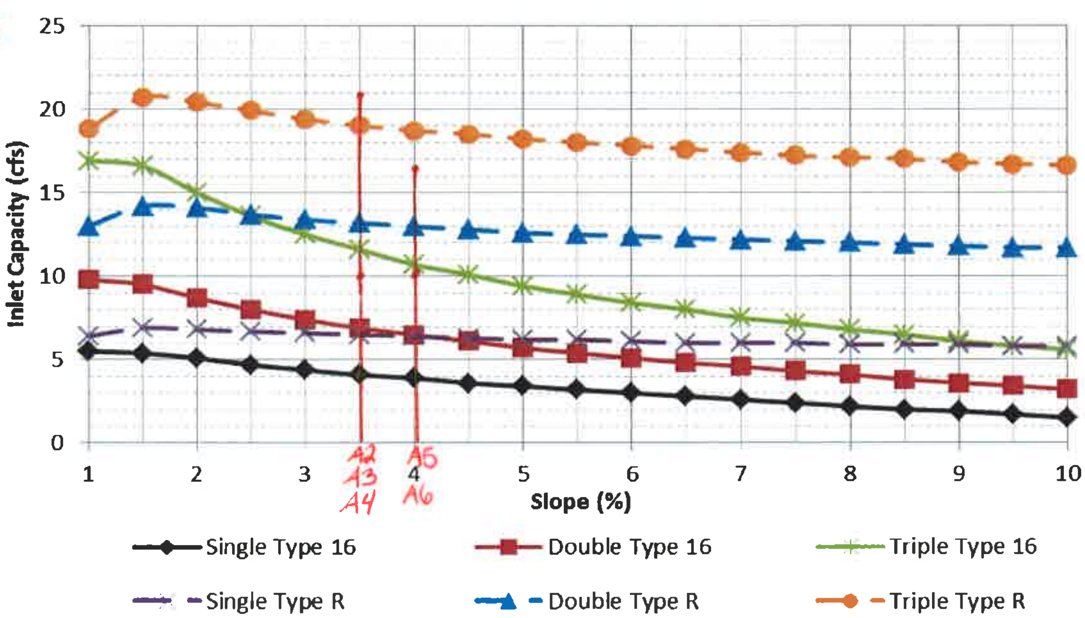
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical

Minor Storm



Major Storm

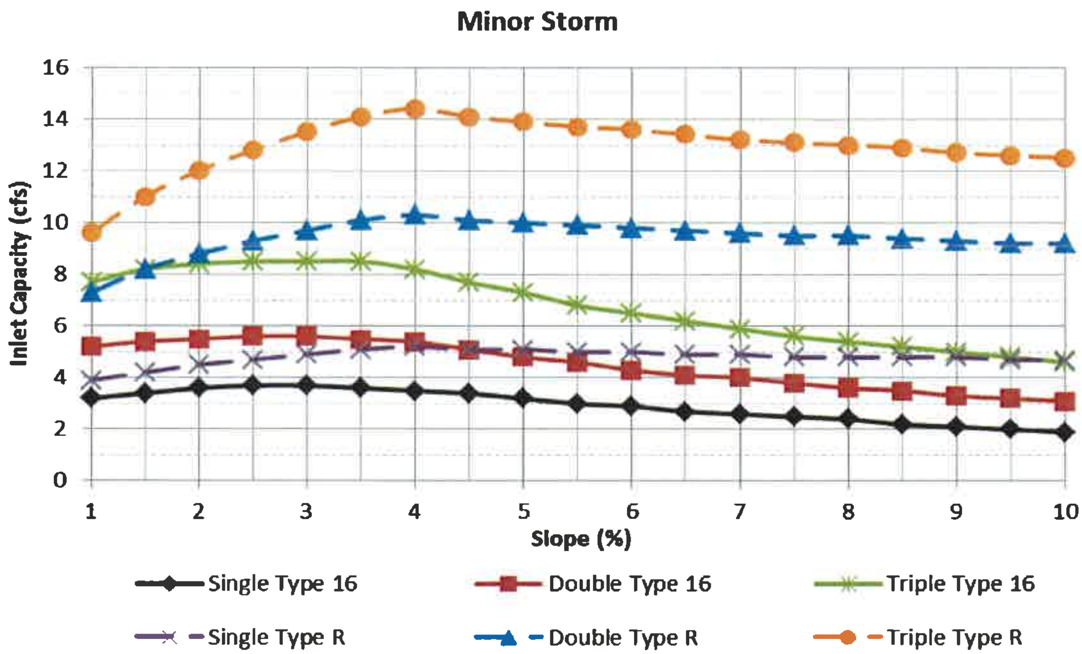


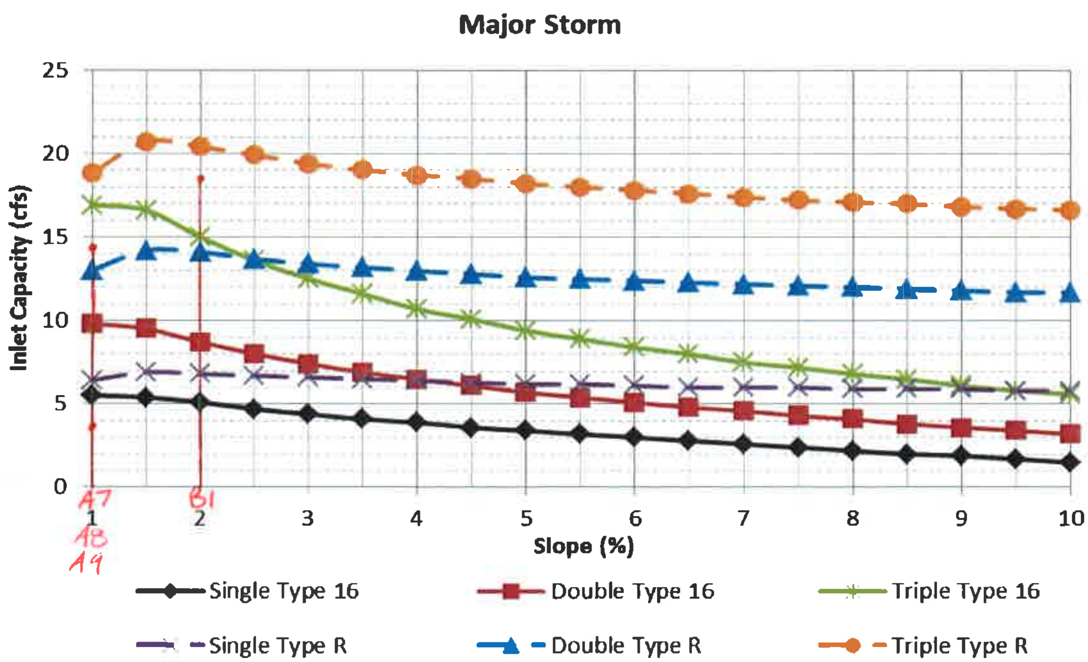
(A2: Q100 = 20.9 cfs → (2) Double Type R
(A3: Q100 = 9.9 cfs → Double Type R
A4: Q100 = 4.0 cfs → Single Type R
(A5: Q100 = 10.1 cfs → Double Type R
(A6: Q100 = 16.4 cfs → Triple Type R

The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical

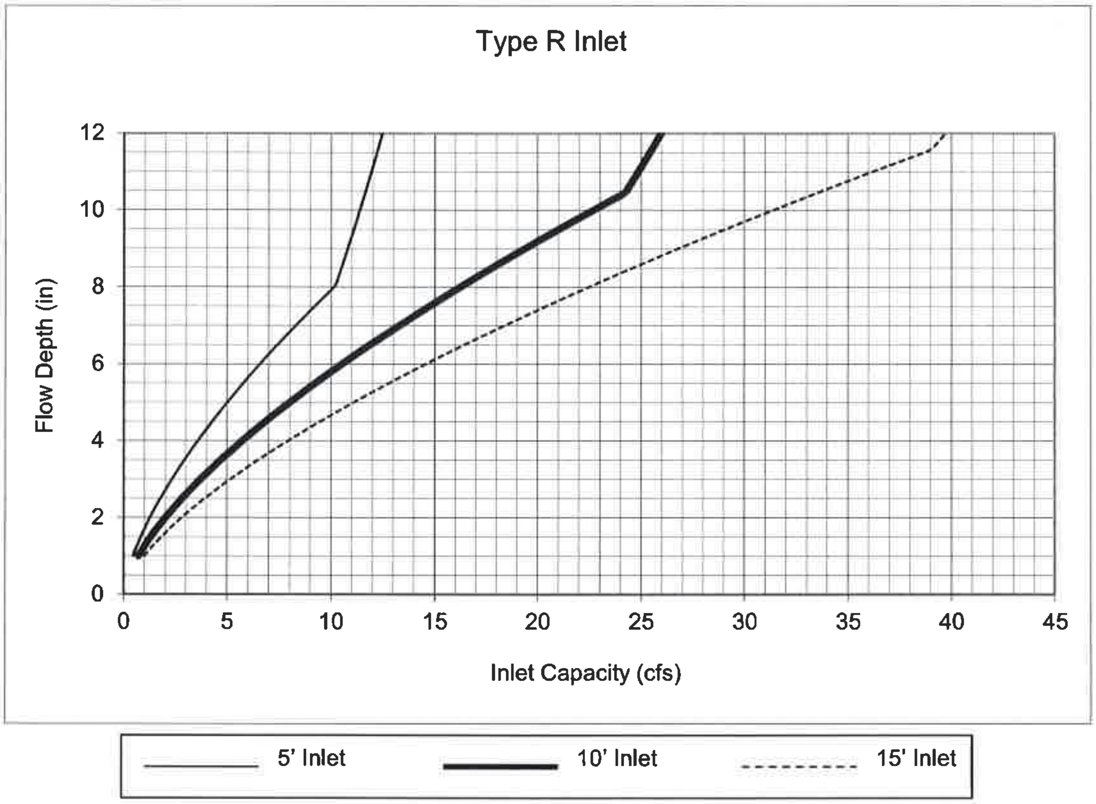




(A7: Q100 = 3.8 cfs → Single Type R
(A8: Q100 = 14.2 cfs → Triple Type R
A9: Q100 = 9.2 cfs → Double Type R
B1: Q100 = 18.4 cfs → Triple Type R

The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet

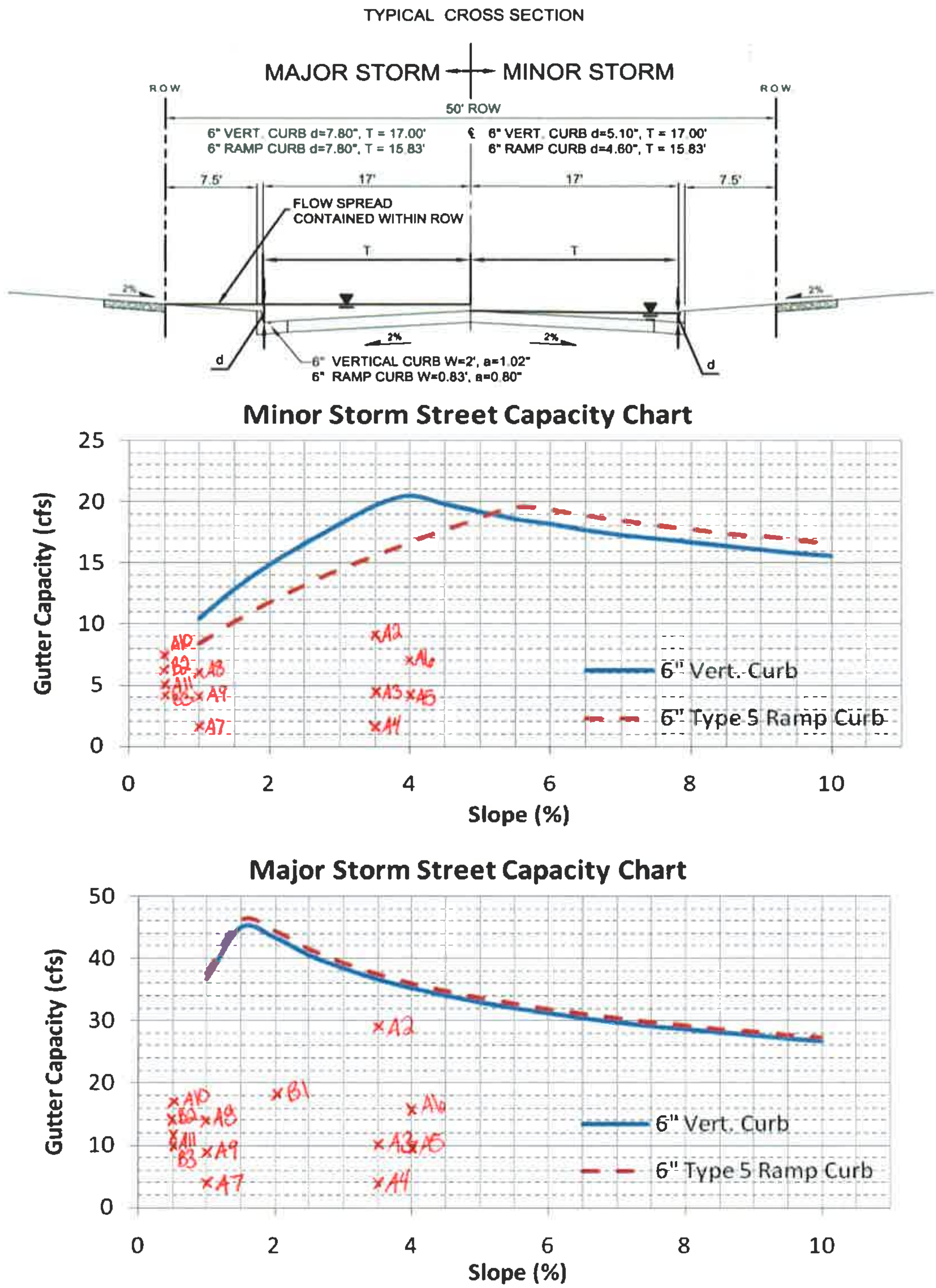


A10: Q_{100} = 17.5 cfs → (2) 10' inlets
A11: Q_{100} = 12.4 cfs → 15' inlet
B2: Q_{100} = 14.6 cfs → 15' inlet
B3: Q_{100} = 13.3 cfs → 15' inlet

Notes:

1. The standard inlet parameters must apply to use this chart.

Figure 7-7. Street Capacity Charts Residential (Detached Sidewalk)



These charts shall only be used for the standard street sections as shown. The capacity shown is based on ½ the street section as calculated by the UD-Inlet spreadsheets. Minor storm capacities are based on no crown overtopping, curb height or maximum allowable spread widths. Major storm capacities are based on flow being containing within the public right-of-way, including conveyance capacity behind the curb. The UDFCD Safety Reduction Factor was applied. An 'n_{STREET}' of 0.016 and 'n_{BACK}' of 0.020 was used. Calculations were done using UD-Inlet 3.00.xls, March, 2011.

LEGEND

PROPOSED INTERMEDIATE CONTOUR		*EX. MANHOLE*	
PROPOSED INDEX CONTOUR	5750	*EX. STORM SEWER*	
EX. INTERMEDIATE CONTOUR		BASIN BOUNDARY	
EX. INDEX CONTOUR	5750	EXISTING FLOWPATH	
PROPOSED STORM SEWER		FLOW DIRECTION	
PROPOSED INLET		DESIGN POINT	1
PROPOSED FLARED END SECTION			
PROPOSED SITE LIGHTING			

BASIN A1, AREA (ACRE) 2.32, Q5 (cfs) 2.8, Q100 (cfs) 6.7

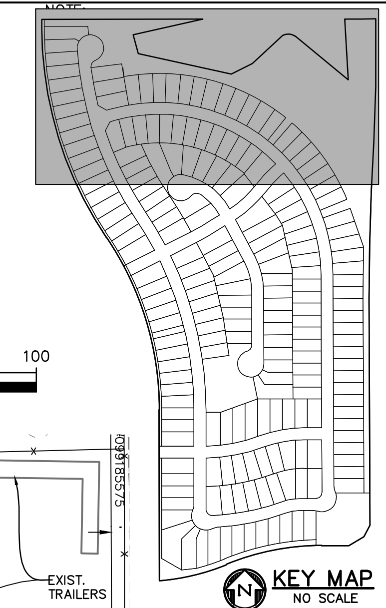
DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	2.16	4.9	11.4
8	14.19	26.8	55.7
B	4.70	9.0	20.9
C	20.52	34.4	73.7
D	21.53	35.6	76.5
E	1.98	4.3	10.1
F	27.26	43.2	94.2
G	0.77	1.6	3.8
H	2.96	6.1	14.2
I	1.86	4.0	9.2
J	5.59	11.1	25.9
K	32.85	50.2	110.7
L	36.85	55.3	122.5
M	39.38	58.5	130.1

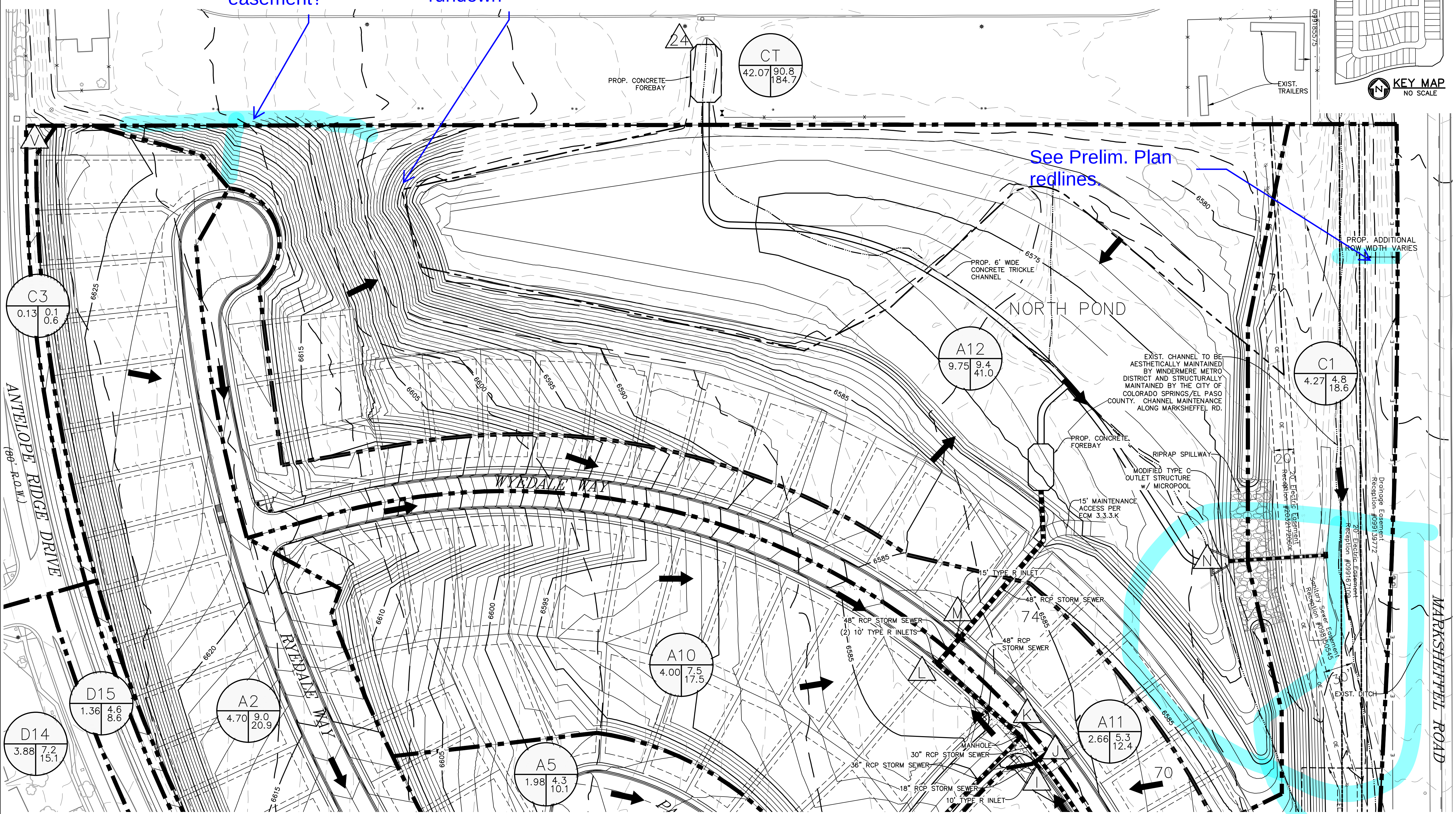
DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
24	42.07	111.3	199.7
N	49.13	174.7	353.5
O	3.62	7.9	18.4
P	2.94	6.2	14.6
Q	2.53	5.0	11.6
R	9.62	18.1	43.5
4		7.2	14.6
EXR	0.53	1.7	3.4
S	1.52	10.7	27.7
T	434.39	192.7	641.5
U	2.28	3.6	10.1
V	0.13	0.1	0.6
19	3.89	8.8	20.5
J1	5.41	22.5	55.6
20	5.84	24.0	58.5

N

50 20 0 50 100

SCALE: 1"=50'





PREPARED BY:

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CLIENT:

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COLORADO SPRINGS, CO 80918
(719) 200-9594
CONTACT: JAMES TODD STEVENS

WINDERMERE PRELIMINARY PLAN
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	2/6/18
LATEST ISSUE	11/2/20

DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	DRAINAGE MAP

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

DRAWING SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

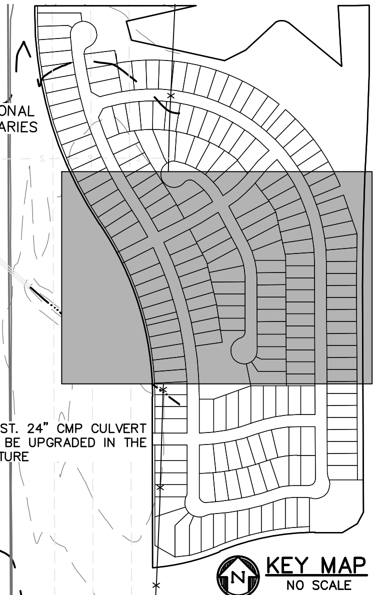
PROJECT NO. 21187-01CSCV

DRAWING NO.

DR

SHEET: 1 OF 3

no grading in County easement



N

50 20 0 50 100

SCALE: 1"=50'

LEGEND

PROPOSED INTERMEDIATE CONTOUR
PROPOSED INDEX CONTOUR — 5750 —
EX. INTERMEDIATE CONTOUR
EX. INDEX CONTOUR ---5750---
PROPOSED STORM SEWER
PROPOSED INLET
PROPOSED FLARED END SECTION
PROPOSED SITE LIGHTING
EX. MANHOLE
EX. STORM SEWER
BASIN BOUNDARY
FLOW DIRECTION
DESIGN POINT

AREA (ACRE) — A1 2.32 2.9 4.7 — BASIN, Q5 (cfs), Q100 (cfs)

NOTE:
SEE "PRELIMINARY DRAINAGE REPORT FOR WINDERMERE," BY CLASSIC CONSULTING ENGINEERS & SURVEYORS, OCTOBER 2014 FOR EXISTING DRAINAGE MAP AND CALCULATIONS INCLUDING BASINS D13, D14, D15 AND THEIR DESIGN POINTS

811 Know what's below. Call before you dig.
CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	2.16	4.9	11.4
8	14.19	26.8	55.7
B	4.70	9.0	20.9
C	20.52	34.4	73.7
D	21.53	35.6	76.5
E	1.98	4.3	10.1
F	27.26	43.2	94.2
G	0.77	1.6	3.8
H	2.96	6.1	14.2
I	1.86	4.0	9.2
J	5.59	11.1	25.9
K	32.85	50.2	110.7
L	36.85	55.3	122.5
M	39.38	58.5	130.1

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
24	42.07	111.3	199.7
N	49.13	174.7	353.5
O	3.62	7.9	18.4
P	2.94	6.2	14.6
Q	2.53	5.0	11.6
R	9.62	18.1	43.5
4		7.2	14.6
EXR	0.53	1.7	3.4
S	1.52	10.7	27.7
T	434.39	192.7	641.5
U	2.28	3.6	10.1
V	0.13	0.1	0.6
19	3.89	8.8	20.5
J1	5.41	22.5	55.6
20	5.84	24.0	58.5

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
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CLIENT:

4164 AUSTIN BLUFFS PKWY. #361
COLORADO SPRINGS, CO 80918
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CONTACT: JAMES TODD STEVENS

WINDERMERE PRELIMINARY PLAN

N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	2/6/18
LATEST ISSUE	11/2/20

DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	DRAINAGE MAP

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

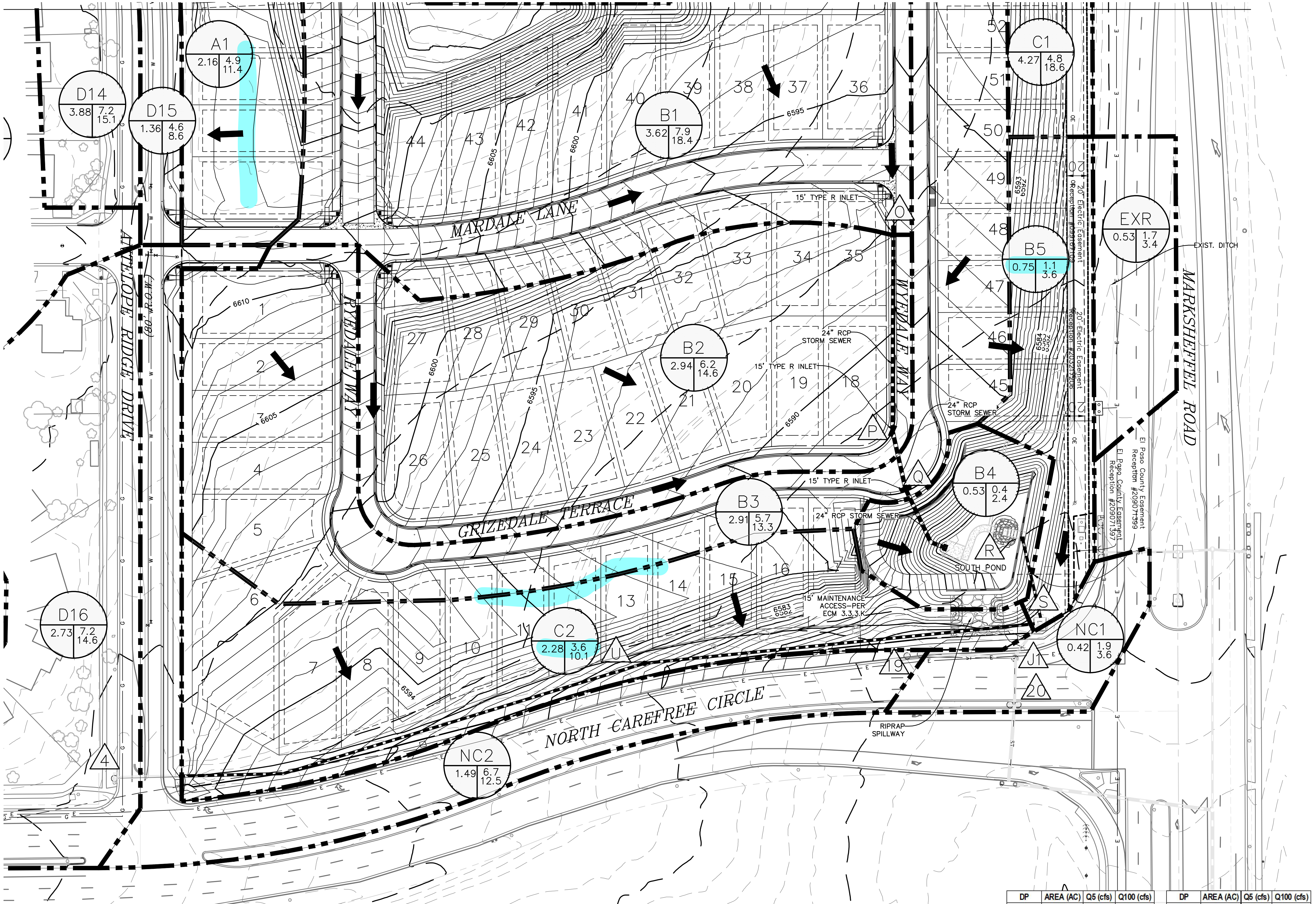
DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187-01CSCV

DRAWING NO.

DR



DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	2.16	4.9	11.4
8	14.19	26.8	55.7
B	4.70	9.0	20.9
C	20.52	34.4	73.7
D	21.53	35.6	76.5
E	1.98	4.3	10.1
F	27.26	43.2	94.2
G	0.77	1.6	3.8
H	2.96	6.1	14.2
I	1.86	4.0	9.2
J	5.59	11.1	25.9
K	32.85	50.2	110.7
L	36.85	55.3	122.5
M	39.38	58.5	130.1

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
24	42.07	111.3	199.7
N	49.13	174.7	353.5
O	3.62	7.9	18.4
P	2.94	6.2	14.6
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R	9.62	18.1	43.5
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J1	5.41	22.5	55.6
20	5.84	24.0	58.5

LEGEND

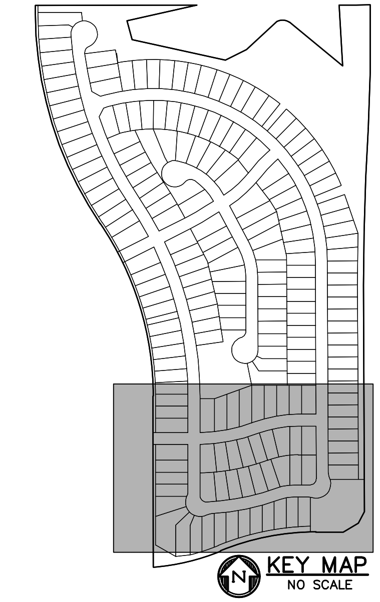
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR — 5750
- EX. INTERMEDIATE CONTOUR
- EX. INDEX CONTOUR — 5750
- PROPOSED STORM SEWER
- PROPOSED INLET
- PROPOSED FLARED END SECTION
- PROPOSED SITE LIGHTING
- EX. MANHOLE — MH
- EX. STORM SEWER
- BASIN BOUNDARY
- FLOW DIRECTION
- DESIGN POINT — 1

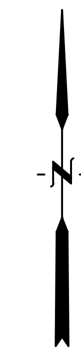
BASIN: A1; AREA (ACRE): 2.32; Q5 (cfs): 2.9; Q100 (cfs): 6.7

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

CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

NOTE:
SEE "PRELIMINARY DRAINAGE REPORT FOR WINDERMERE," BY CLASSIC CONSULTING ENGINEERS & SURVEYORS, OCTOBER 2014 FOR EXISTING DRAINAGE MAP AND CALCULATIONS INCLUDING BASINS D16, NC1, NC2 AND THEIR DESIGN POINTS





50 20 0 50 100
SCALE: 1"=50'

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SHEET: 3 OF 3