

**AMENDMENT TO THE
PRELIMINARY DRAINAGE REPORT
for
WINDERMERE**

Colorado Springs, CO

March 8, 2021

Prepared for:

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PRELIMINARY DRAINAGE REPORT

for

WINDERMERE

Colorado Springs, Colorado

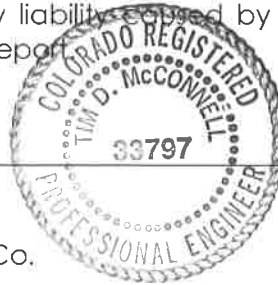
1.0 CERTIFICATION STATEMENTS

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



3/23/21
Date

DEVELOPER'S STATEMENT

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

Business Name: Eagle Development Company

By:



3/23/21

Jeff Mark
President

Date

Title:

Address:

212 N. Wahsatch Ave. #301
Colorado Springs, CO 80903

EL PASO COUNTY

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

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

Date

CONDITIONS

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 55.2 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 was 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," by Classic Consulting Engineers & Surveyors, October 2014. The existing conditions have not changed. An existing detention facility located at the north end of the project has already been capturing flows from the Chateau at Antelope Ridge subdivision to the north. This temporary facility will be replaced with an expanded pond of larger capacity as part of this development. The expanded facility will meet current drainage criteria, including concrete forebays at all piped 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 excerpts from the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014 in the appendix for existing conditions description and drainage maps.

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 in the appendix. A-, B-, and C-group basins represent the flows generated onsite. A number of offsite basins were also considered as part of this analysis and are described below.

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

Rational Method Runoff Summary

Onsite A-group basins and offsite Basins D-13, D-14, D-15, CT and WS represent flows that are captured by the full spectrum detention facility at the north end of the site.

Existing Design Point 7 (DP7) ($Q_5=20.0$ cfs and $Q_{100}=41.6$ cfs) represents flows generated by offsite basins D-13 and D-14 of Pronghorn Meadows Subdivision and Antelope Ridge Drive, on the west side of this project development. These flows were established by the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014. An existing 25' Type R curb inlet intercepts these flows and discharges to the east across Antelope Ridge Dr. This inlet and piping is to remain.

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	1.56	3.5	8.2
A2	4.61	8.8	20.5
A3	2.18	6.2	13.3
A4	1.01	1.7	4.0
A5	1.98	4.3	10.1
A6	3.73	7.0	16.3
A7	1.56	3.0	7.0
A8	2.96	6.1	14.2
A9	1.86	4.0	9.2
A10	4.00	7.5	17.5
A11	2.67	5.3	12.5
A12	9.46	9.2	39.9
B1	3.62	7.9	18.4
B2	2.94	6.2	14.6
B3	4.00	7.9	18.3
B4	0.43	0.3	1.9
C1	4.24	4.3	18.1
C2	0.83	1.1	3.9
C3	1.40	1.8	5.8
C4	0.11	0.1	0.5

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	1.56	3.5	8.2
Ex. 8	13.59	26.0	53.7
B	4.61	8.8	20.5
C	20.38	34.2	73.3
D	21.39	35.4	76.0
E	1.98	4.3	10.1
F	27.10	43.0	93.7
G	1.56	3.0	7.0
H	2.96	6.1	14.2
I	1.86	4.0	9.2
J	6.38	12.7	29.6
K	33.48	51.1	112.7
L	37.48	56.1	124.4
M	40.15	59.5	132.5
Ex. 24	42.07	111.3	199.7
N	49.61	175.6	355.1
O	3.62	7.9	18.4
P	2.94	6.2	14.6
Q	4.00	7.9	18.3
R	10.99	20.9	49.8
Ex. 4		7.2	14.6
Ex. EXR	0.53	1.7	3.4
S	1.36	10.3	27.2
T	434.39	191.1	684.1
U	1.40	1.8	5.8
V	0.11	0.1	0.5
Ex. 19	3.01	6.9	16.1
Ex. J1	4.37	19.7	49.8
Ex. 20	4.80	21.2	52.6

DP-A represents the flows generated by onsite Basin A1. Runoff from this basin flows to the west, off-site onto Antelope Ridge Dr. towards existing Design Point 8. The flows from Basin A1 are $Q_5=3.5$ cfs and $Q_{100}=8.2$ cfs.

Existing Design Point 8 (DP-8) was established by the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014, and is located

at a low point on Antelope Ridge Dr. at an existing 10' sump inlet. This design point represents combined flows from Basins D-15, offsite DP-7 and onsite DP-A. The existing inlet is proposed to be replaced in kind (10' Type R sump inlet) as a turn lane will be installed on Antelope Ridge Dr. for access into the Windermere Subdivision, resulting in the need to adjust the existing inlet. The existing flows currently discharge onto the project site. In the developed condition, the combined flows at DP-8 are $Q_5=26.0$ cfs and $Q_{100}=53.7$ cfs, will be captured in their entirety by the new inlet, and redirected to the north via 36" RCP storm sewer. To accommodate the angle of the 36" pipe, the new inlet is proposed to be a modified design with greater depth. This will be detailed at the construction document stage. An emergency overflow swale will allow for flows to be directed to the north and east in the event of inlet blockage.

DP-B is located at a proposed 10' double Type R at-grade inlet in Basin A2. The flows leave this inlet via a 24" storm pipe to the south towards DP-C. This design point captures all the flows from Basin A2. The flows from Basin A2 are $Q_5=8.8$ cfs and $Q_{100}=20.5$ cfs.

DP-C is located at a proposed 10' double Type R at-grade inlet in Basin A3. The flows leave this inlet via a 36" storm pipe towards DP-D to the northeast. This design point captures all the flows from Basins A1 through A3 and offsite Basins D-13 through D-15. The combined flows at DP-C are $Q_5=34.2$ cfs and $Q_{100}=73.3$ cfs.

DP-D is located at a proposed 5' single Type R at grade inlet in Basin A4. The flows leave this inlet via a 36" storm pipe and are conveyed towards DP-F to the northeast. This design point captures all the flows from Basins A1 through A4 and offsite Basins D-13 through D-15. The combined flows at DP-D are $Q_5=35.4$ cfs and $Q_{100}=76.0$ cfs.

DP-E is located at a proposed at-grade 10' double Type R inlet in Basin A5. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-F to the south. This design point captures all 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 a proposed at-grade 15' triple Type R inlet in Basin A6. The flows leave this inlet via a 36" storm pipe and are conveyed towards DP-K to the northeast. This design point captures all the flows from Basins A1 through A6 and offsite Basins D-13 through D-15. The combined flows at DP-F are $Q_5=43.0$ cfs and $Q_{100}=93.7$ cfs.

DP-G is located at a proposed at-grade 5' single Type R inlet in Basin A7. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-H to the west. This design point captures all the flows from Basin A7. The flows from Basin A7 are $Q_5=3.0$ cfs and $Q_{100}=7.0$ cfs.

DP-H is located at a proposed at-grade 15' triple Type R inlet in Basin A8. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-J to the northwest. This design point captures all 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 a proposed at-grade 10' double Type R inlet in Basin A9. The flows leave this inlet via an 18" storm pipe and are conveyed towards DP-J to the northeast. This design point captures all 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 a proposed 18"x24"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 the flows from Basins A7 through A9. The combined flows at DP-J are $Q_5=12.7$ cfs and $Q_{100}=29.6$ cfs.

DP-K is located at a proposed manhole in Basin A10. The flows leave this manhole via a 48" storm pipe and are conveyed towards DP-L to the northwest. This design point captures all the flows from Basins A1 through A9 and offsite Basins D-13 through D-15. The combined flows at DP-K are $Q_5=51.1$ cfs and $Q_{100}=112.7$ cfs.

DP-L is located at a proposed sump 10' double Type R inlet in Basin A10. The flows leave this inlet via a 48" storm pipe and are conveyed towards DP-M to the northeast. This design point captures all the flows from Basins A1 through A10 and offsite Basins D-13 through D-15. The combined flows at DP-L are $Q_5=56.1$ cfs and $Q_{100}=124.4$ cfs.

DP-M is located at the proposed sump 15' triple 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 the flows from Basins A1 through A11 and offsite Basins D-13 through D-15. The combined flows at DP-M are $Q_5=59.5$ cfs and $Q_{100}=132.5$ cfs.

Existing Design Point 24 (DP24) was established by the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014, and consists of offsite area tributary to the existing detention facility along the northern project boundary. According to the aforementioned report, the runoff for basin WS was calculated at 2% (historic flow analysis) as all developed runoff is treated and released at historic rates within the Whispering Springs onsite facilities to the north. The tributary runoff for basin CT was calculated at 70%. The combined flows at DP-N are $Q_5=111.3$ cfs and $Q_{100}=199.7$ 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 36" storm pipe which conveys the flows to the roadside ditch along Marksheffel Rd. towards DP-T. This design point reflects all 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 (DP24). The combined flows at DP-N are $Q_5=175.6$ cfs and $Q_{100}=355.1$ cfs. The release rates for Pond 1 are $Q_5=1.8$ cfs and $Q_{100}=66.0$ cfs.

Onsite B-group basins represent flows that are captured by the full spectrum detention facility on the south end of the site.

DP-O is located at the proposed at-grade 15' triple Type R inlet in Basin B1. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-P to the south. This design point captures all 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 a proposed sump 15' triple Type R inlet in Basin B2. The flows leave this inlet via a 24" storm pipe and are conveyed towards DP-Q to the south. This design point captures all 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 a proposed sump 10' double 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 the flows from Basins B1 through B3. The combined flows at DP-Q are $Q_5=7.9$ cfs and $Q_{100}=18.3$ 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 the flows from Basins B1 through B4. The combined flows at DP-R are $Q_5=20.9$ cfs and $Q_{100}=49.8$ cfs.

Existing Design Point 4 covers runoff from Basin D-16 of the Pronghorn Meadows Subdivision to the west of this project development. An existing 8' sump curb inlet intercepts the runoff ($Q_5=7.2$ cfs and $Q_{100}=14.6$ cfs) and directs it via existing 24" RCP across Antelope Ridge Drive, where it currently discharges into a roadside swale along North Carefree Circle. This 24" RCP is proposed to be extended to the east and connected to the existing storm sewer system at DP-S.

Onsite C-group basins represent flows that leave the project site and are captured by the existing storm system. The discharge of these flows from the site without treatment is permissible under MS4 criteria, since the combined acreage of developed area, outside of County owned right-of-way is less than an acre for each established drainageway.

DP-T is located at the existing 24" CMP culvert crossing at Marksheffel Road, and represents flows generated by Basin C1, flows released by the northern detention facility (DP-N) and the offsite flows from MDDP DP-1X. The combined flows at DP-T are $Q_5=191.1$ cfs and $Q_{100}=684.1$ cfs, a portion of which were calculated using the SCS Method. More information of the MDDP flows can be found in the "Preliminary Drainage Report for Windermere," by Classic Consulting Engineers & Surveyors, October 2014, in the appendix.

DP-S is located at the existing area inlet in Basin NC2. The flows leave this inlet via an existing 24" storm pipe that connects to the existing storm system in N. Carefree Cir., which then carries the flows to the south. This design point reflects all the flows from Basins B1 through B5, offsite Basin EXR, and offsite Basin D-16. The combined flows at DP-S are $Q_5=10.3$ cfs and $Q_{100}=27.2$ cfs.

DP-U represents the flows generated Basin C3 ($Q_5=1.8$ cfs and $Q_{100}=5.8$ cfs), which flow off-site into N. Carefree Cir. The flows are picked up by the existing 15' triple at-grade inlet at Existing Design Point 19 in offsite Basin NC2. The flows then leave this inlet via an existing 18" storm pipe to the east, ultimately converging with the flows from DP-S at an existing manhole, at existing design point J1.

Flows leave DP-J1 via an existing 24" storm pipe and are carried to the existing 10' sump inlet at Existing 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, ultimately traveling to the south via the Marksheffel Road storm system.

DP-V is located at the north end of the site on Antelope Ridge Dr. and exclusively covers right-of-way. This design point reflects all the flows from Basin C4 that exit the site and flow to the north along the curb and gutter in Antelope Ridge Dr. before being captured by the existing storm system. The flows from Basin C3 are $Q_5=0.1$ cfs and $Q_{100}=0.5$ cfs.

6.0 PROPOSED DETENTION/WATER QUALITY FACILITIES

North Detention Facility

The north detention facility has been designed to capture flows from the "A" basins, offsite basins D-13, D-14, D-15, CT and WS. An existing temporary facility located in the same area, that serves the property to the north, will be incorporated into the permanent facility described below.

During the overlot grading of the project, the pond is to excavated to full volume in its entirety and the outlet structure and associated piping installed. An orifice plate for the interim condition (full developed condition within the street right-of-way, but no development of lots) has been designed to be installed at the overlot grading stage, to allow for appropriate WQCV drain time. Once full build out of the project is underway, the orifice plate will be replaced per the final design. See below for description of detention volume and pond characteristics.

A total of 133.15 acres is tributary to this north facility, with a composite imperviousness of 27.8% for the interim condition and 40.7% for the final fully developed condition. Required volumes are listed below.

		<i>Required Volume</i>		
	Imperviousness	WQCV	EURV	100-YR
INTERIM	27.8%	1.60	3.62	6.95
FINAL	40.7%	2.02	5.90	9.94

The actual design pond volume at the proposed spillway stage is 12.6 acre-feet. Concrete forebays with energy 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 36" 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. Switching out of the orifice plate will ensure that the WQCV release rate remains within criteria for the interim and developed conditions. The outlet structure will remain in place for the final condition and will result in release rates of $Q_5=1.8$ cfs and $Q_{100}=66.0$ cfs.

A 70-ft wide riprap emergency spillway will be located on the east side of the pond. In the event that water overtops the spillway, flow will discharge into the ditch along Marksheffel Rd.

Interim pond calculations are provided in the appendix. Final forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillway design will be provided at the Final Plat stage.

The 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.

South Detention Facility

The south detention facility has been designed to capture flows from the "B" basins.

During the overlot grading of the project, the pond is to excavated to full volume in its entirety and the outlet structure and associated piping installed. An orifice plate for the interim condition (full developed condition within the street right-of-way, but no development of lots) has been designed to be installed at the overlot grading stage, to allow for appropriate WQCV drain time. Once full build out of the project is underway, the orifice plate will be replaced per the final design. See below for description of detention volume and pond characteristics.

A total of 11.0 acres is tributary to this south facility, with a composite imperviousness of 23% for the interim condition and 62.0% for the final fully developed condition. Required volumes are listed below.

		<i>Required Volume</i>		
	Imperviousness	WQCV	EURV	100-YR
INTERIM	23.0%	0.12	0.24	0.49
FINAL	62.5%	0.23	0.84	1.27

The actual design pond volume at the proposed spillway stage is 1.28 acre-feet. A concrete forebay with an energy dissipater will be installed where the flows enter the pond on the west side of the pond. The volume of the forebay will be 3% of the WQCV volume for the pond. The flow 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 24" pipe, which will be connected to an existing

storm inlet at the corner of N. Carefree Circle and Marksheffel Rd, after which the flows continue to the south via the existing storm sewer system.

In accordance with El Paso County criteria, the modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period. Switching out of the orifice plate will ensure that the WQCV release rate remains within criteria for the interim and developed conditions. The outlet structure will remain in place for the final condition and will result in release rates of $Q_5=0.2$ cfs and $Q_{100}=9.6$ cfs.

A 15-ft wide riprap emergency spillway will be located on the south side of the pond. In the event that water overtops the spillway, flow will discharge into existing Type C area inlet at the intersection of N. Carefree Cir and Marksheffel Rd, where it is then picked up by the existing storm system.

Interim pond calculations are provided in the appendix. Final forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillway design will be provided at the Final Plat stage.

The 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.

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. 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 1.7.2.A the need for industrial and commercial BMPs are not applicable for this project.

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 (Revised January 18, 2021):

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

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 11 feet above the surrounding ground surface on the eastern portion. Above grade embankments are to be constructed with 4:1 slopes. Embankments should be constructed in accordance with applicable sections of the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, the El Paso County Land Development Code, and the geotechnical report recommendations.

9.0 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.

10.0 REFERENCES

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

1. City of Colorado Springs "Drainage Criteria Manual", 2016.
2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised October 2019.
3. Soil Survey for Colorado Springs and El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.
4. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 2018.
5. "Soils and Geology Study, Windermere Subdivision", prepared by RMG, October 26, 2020, Revised January 18, 2021.
6. "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



Innovative Design. Classic Results.

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

October 2014

Prepared for:
**JAMES TODD STEPHENS
c/o WINDSOR RIDGE HOMES
4164 AUSTIN BLUFFS PKWY #361
COLORADO SPRINGS CO 80918**

Prepared by:
**CLASSIC CONSULTING ENGINEERS &
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(719) 785-0790**

Job no. 2441.00

RECEIVED
JUN 18 2015
BY: *[Signature]*



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.



Kyle R Campbell, Colorado P.E. #29794

6-18-15
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: 

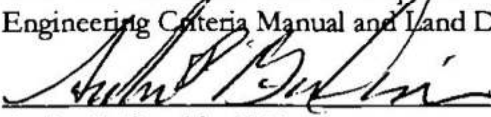
Title: Manager

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.



Andre P. Brackin, P.E.
County Engineer / ECM Administrator

6-22-15
Date

Conditions:



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).



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



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



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.



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).



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:

<i>Street Type</i>	<i>Allowable – Initial Storm (5 yr)</i>	<i>Allowable–Major Storm (100 yr)</i>
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.



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.



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-



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.



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.



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



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



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



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



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



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 acre 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
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Bridge Fees Filing 1:

\$4,544/acre x 5.684 acres	\$ 25,828.10
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TOTALS:	<u>\$ 111,088.10</u>
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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.



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.



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

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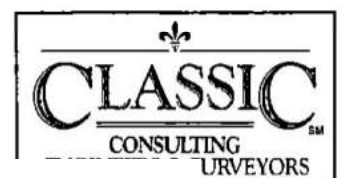


REFERENCES

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

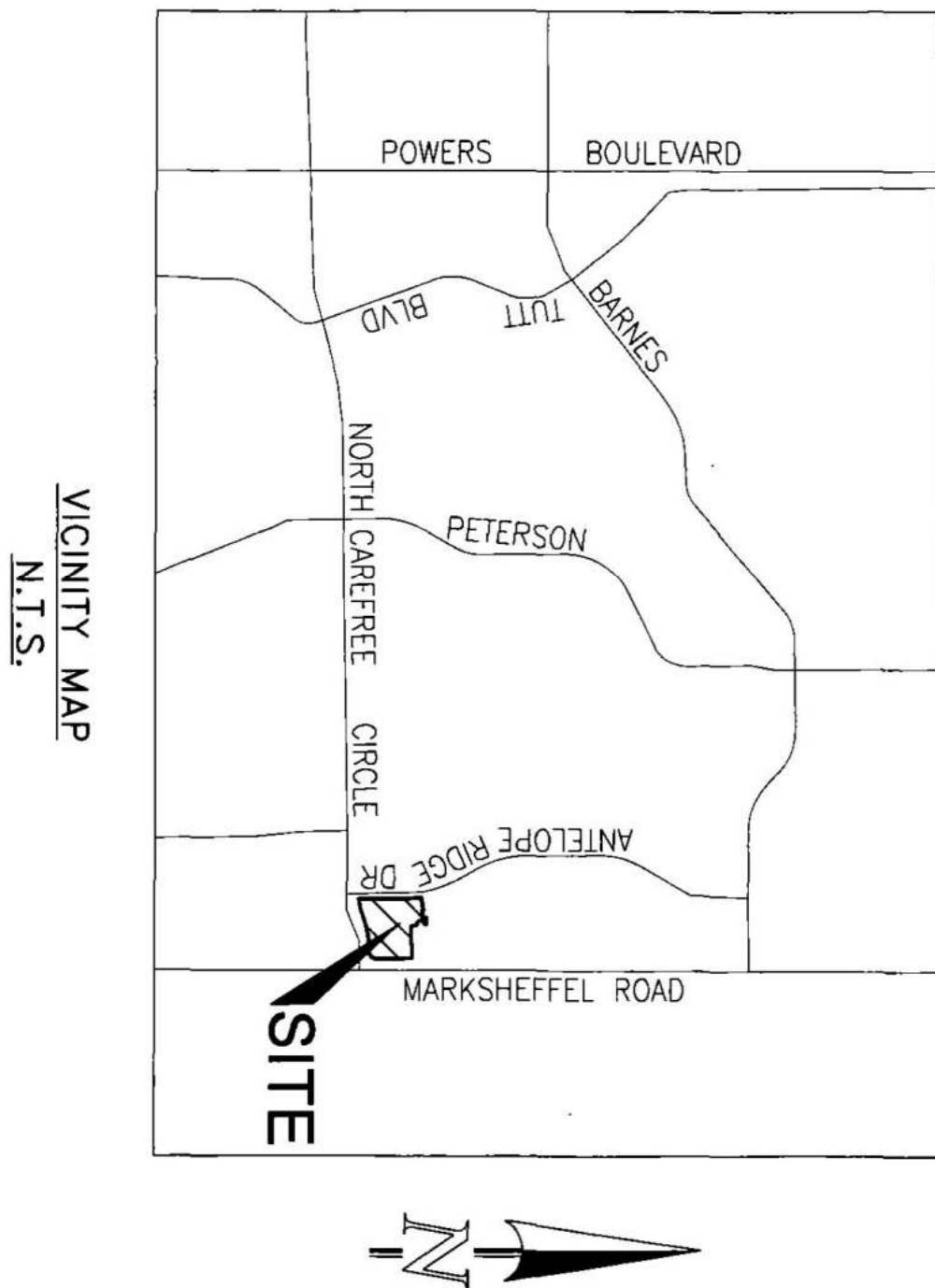


APPENDIX

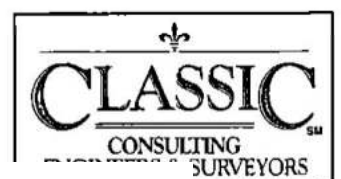


VICINITY MAP

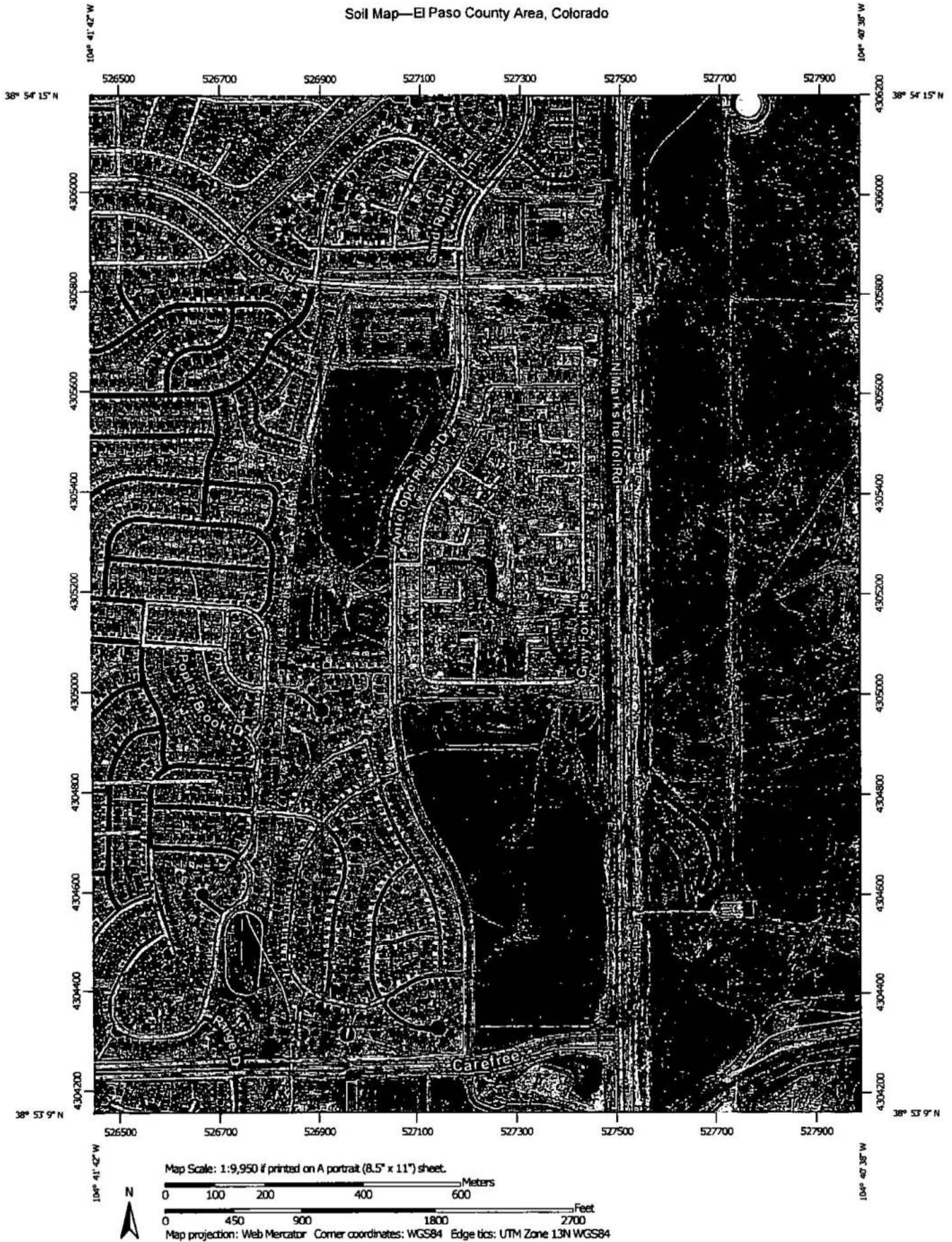




SOILS MAP (S.C.S SURVEY)



Soil Map—El Paso County Area, Colorado












































**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

6/30/2014
Page 1 of 3

MAP LEGEND

	Area of Interest (AOI)		Spill Area
	Area of Interest (AOI)		Stony Spot
	Soil Map Unit Polygons		Very Stony Spot
	Soil Map Unit Lines		Wet Spot
	Soil Map Unit Points		Other
	Special Point Features		Special Line Features
	Blowout		Water Features
	Borrow Pit		Streams and Canals
	Clay Spot		Transportation
	Closed Depression		Rails
	Gravel Pit		Interstate Highways
	Gravelly Spot		US Routes
	Landfill		Major Roads
	Lava Flow		Local Roads
	Marsh or swamp		Background
	Mine or Quarry		Aerial Photography
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

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

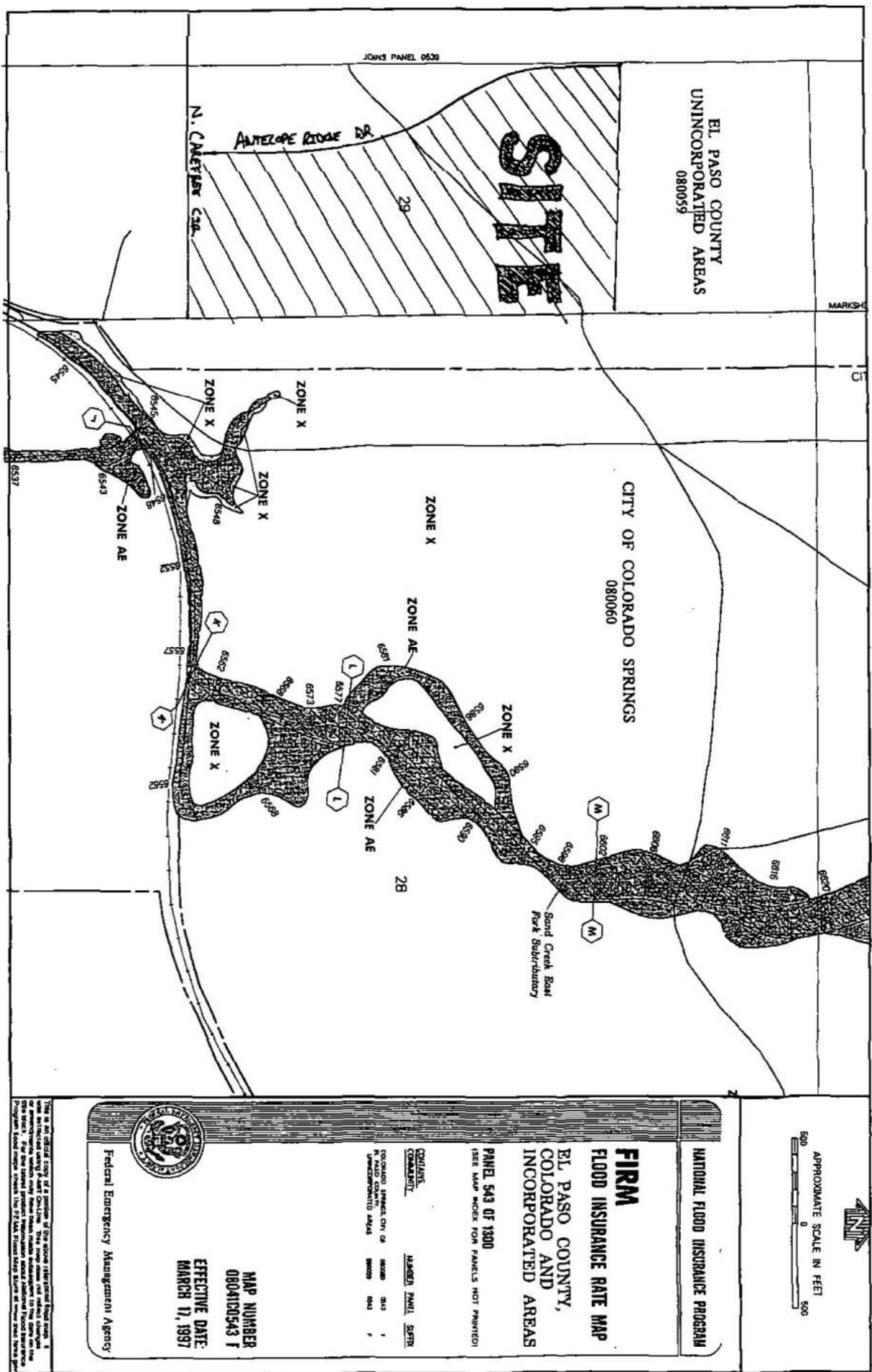
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

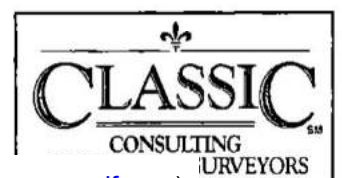
El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres In AOI	Percent of AOI
97	Truckton sandy loam, 3 to 9 percent slopes	261.8	100.0%
Totals for Area of Interest		261.8	100.0%

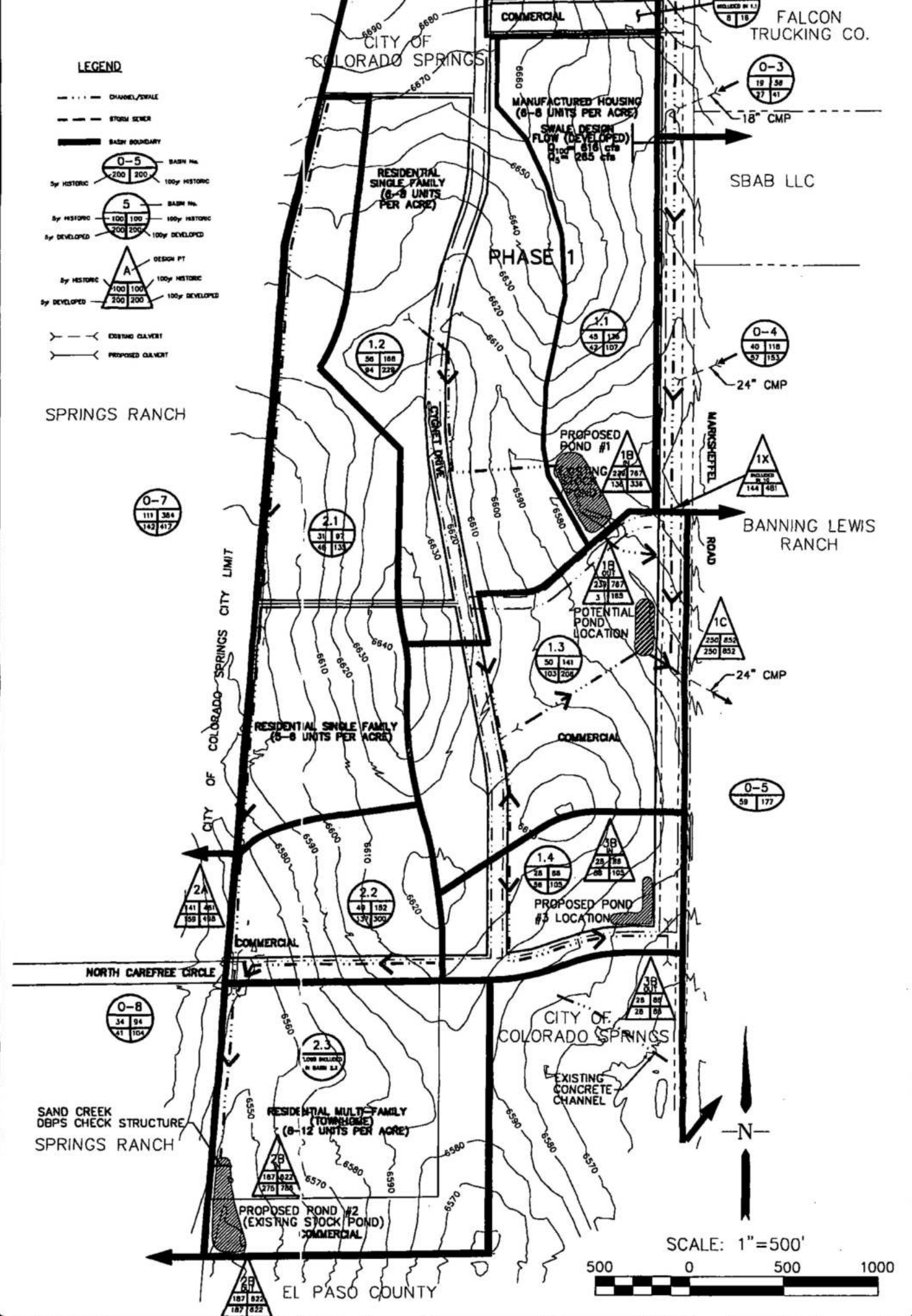
F.E.M.A. MAP



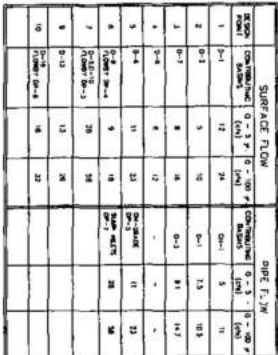


REFERENCE MATERIAL FROM ADJACENT STUDIES





A map showing the study area. The North Atlantic Ocean is to the west, and the Atlantic Ocean is to the east. A study site (SIS) is marked on the coast. The map includes latitude and longitude coordinates.



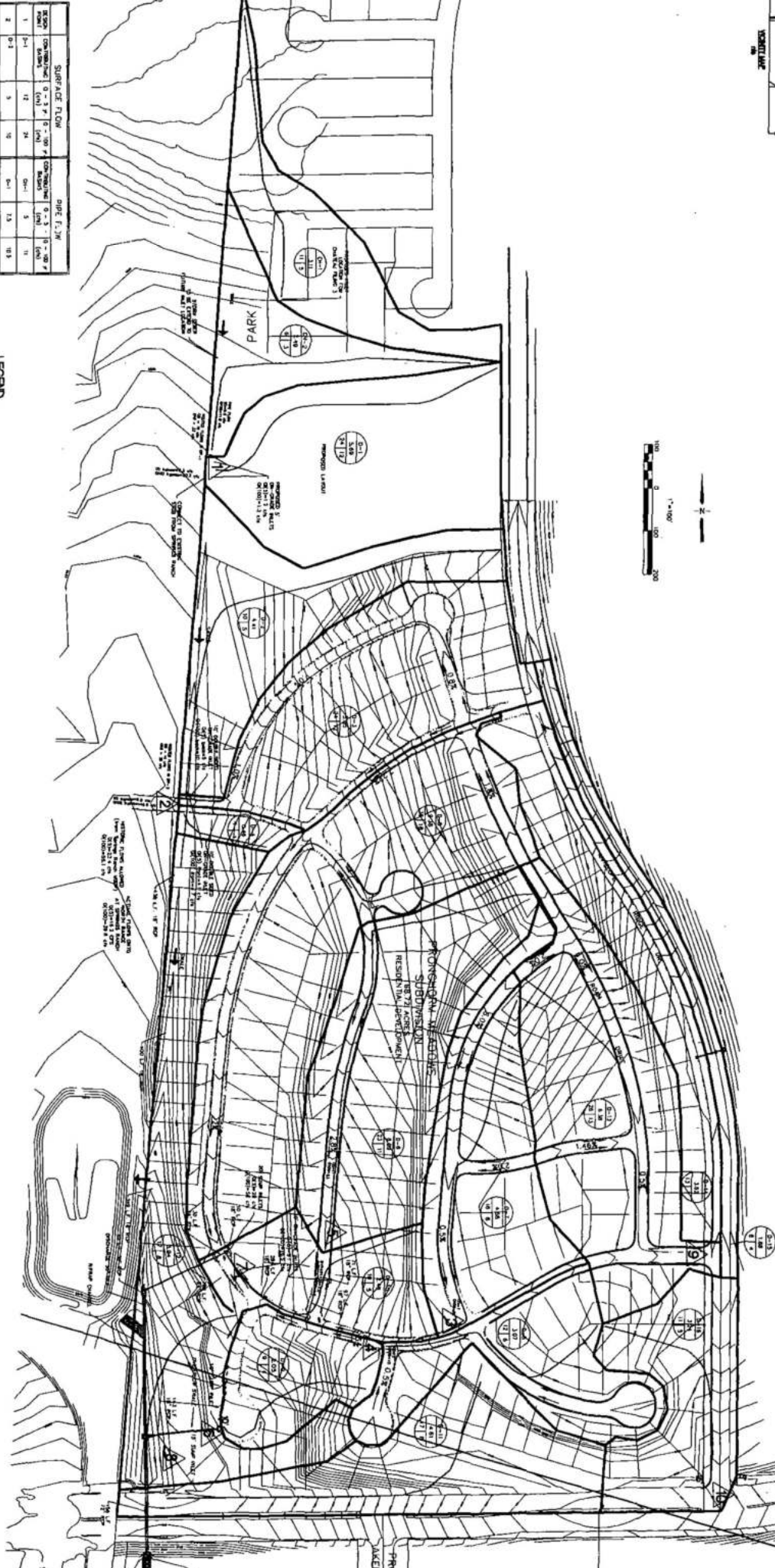
PROPOSED COLUMN TITLES

DEVELOPED BASINS

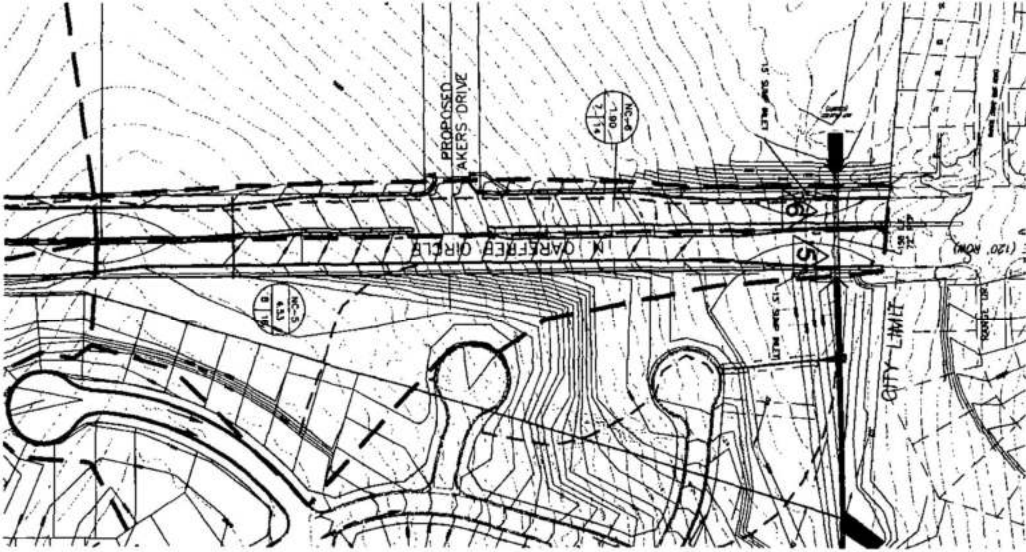
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DIRECTION OF FLOW

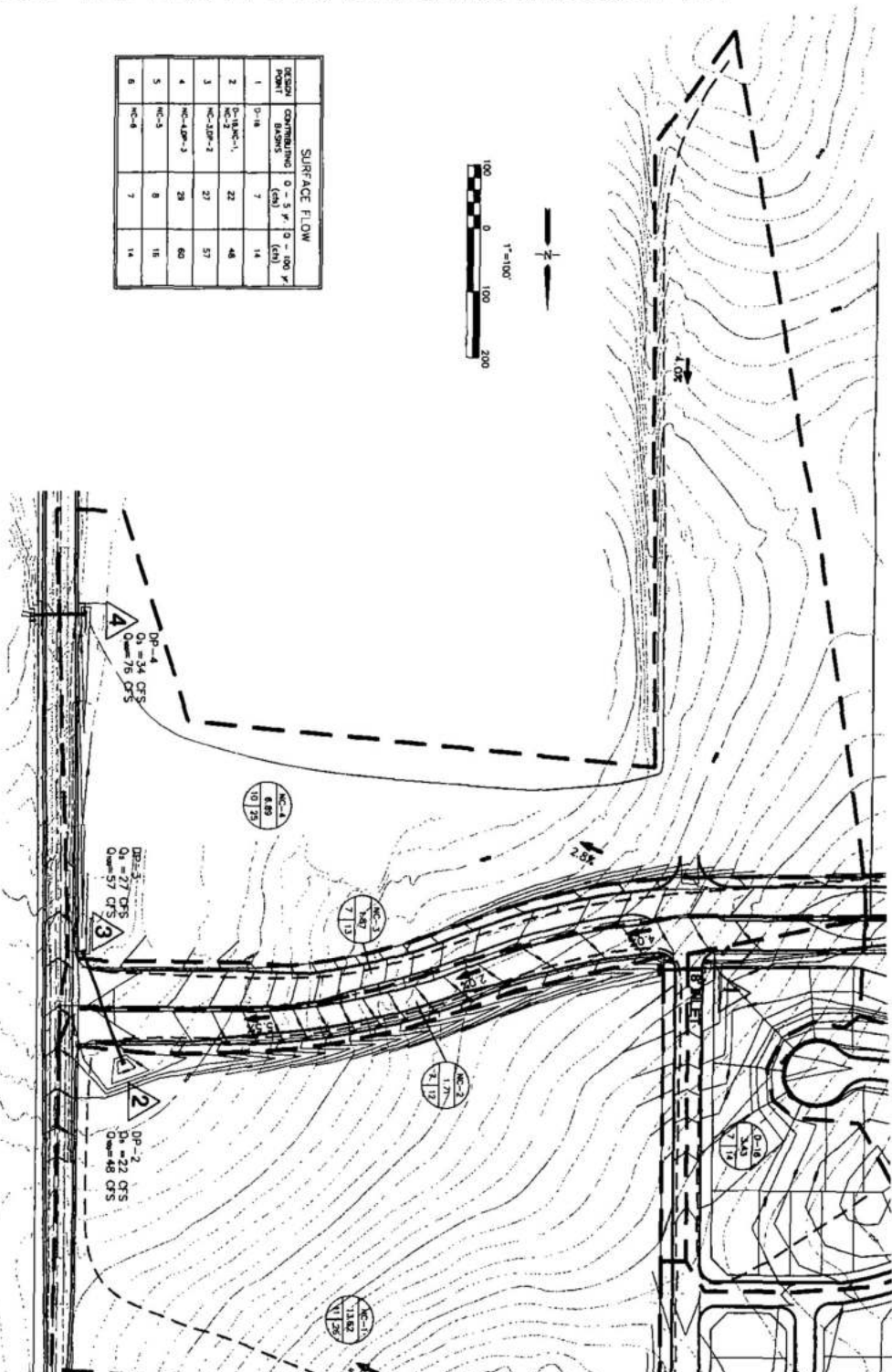
GRAVITY GAZE

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NORTH CAREFREE CIRCLE DEVELOPED DRAINAGE BASINS



SURFACE FLOW			
DESIGN POINT	CONTRIBUTING BASINS	0 - 5' (in)	5 - 100' (in)
1	DC-1H	7	14
2	DC-1H-1	22	46
3	DC-1H-2	27	57
4	DC-1H-3	29	60
5	DC-3	8	16
6	DC-4	7	14



LEGEND

- PROPOSED CONTOURS
- DEVELOPED BASINS
- TOC LINE
- DIRECTION OF FLOW
- DRAINAGE BASIN AREA
- BASIN DESIGNATION
- 0 - 5' - 10'
- 0 - 100' - 10'

REVISIONS		ENGINEER	
NO.	DESCRIPTION	DATE	DATE
1		DC	2/12/03
2		DC	2/13/03
3		DC	2/14/03
4		DC	2/15/03
5		DC	2/16/03
6		DC	2/17/03
7		DC	2/18/03
8		DC	2/19/03
9		DC	2/20/03
10		DC	2/21/03
11		DC	2/22/03
12		DC	2/23/03
13		DC	2/24/03
14		DC	2/25/03
15		DC	2/26/03
16		DC	2/27/03
17		DC	2/28/03
18		DC	2/29/03
19		DC	2/30/03
20		DC	3/1/03
21		DC	3/2/03
22		DC	3/3/03
23		DC	3/4/03
24		DC	3/5/03
25		DC	3/6/03
26		DC	3/7/03
27		DC	3/8/03
28		DC	3/9/03
29		DC	3/10/03
30		DC	3/11/03
31		DC	3/12/03
32		DC	3/13/03
33		DC	3/14/03
34		DC	3/15/03
35		DC	3/16/03
36		DC	3/17/03
37		DC	3/18/03
38		DC	3/19/03
39		DC	3/20/03
40		DC	3/21/03
41		DC	3/22/03
42		DC	3/23/03
43		DC	3/24/03
44		DC	3/25/03
45		DC	3/26/03
46		DC	3/27/03
47		DC	3/28/03
48		DC	3/29/03
49		DC	3/30/03
50		DC	3/31/03
51		DC	4/1/03
52		DC	4/2/03
53		DC	4/3/03
54		DC	4/4/03
55		DC	4/5/03
56		DC	4/6/03
57		DC	4/7/03
58		DC	4/8/03
59		DC	4/9/03
60		DC	4/10/03
61		DC	4/11/03
62		DC	4/12/03
63		DC	4/13/03
64		DC	4/14/03
65		DC	4/15/03
66		DC	4/16/03
67		DC	4/17/03
68		DC	4/18/03
69		DC	4/19/03
70		DC	4/20/03
71		DC	4/21/03
72		DC	4/22/03
73		DC	4/23/03
74		DC	4/24/03
75		DC	4/25/03
76		DC	4/26/03
77		DC	4/27/03
78		DC	4/28/03
79		DC	4/29/03
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82		DC	5/2/03
83		DC	5/3/03
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89		DC	5/9/03
90		DC	5/10/03
91		DC	5/11/03
92		DC	5/12/03
93		DC	5/13/03
94		DC	5/14/03
95		DC	5/15/03
96		DC	5/16/03
97		DC	5/17/03
98		DC	5/18/03
99		DC	5/19/03
100		DC	5/20/03

MATCH LINE STA 298+00

ID	DESCRIPTION	STATION	OFFSET
298 L1	Inter (Type R, L=15)	298+52.24	65.50 LT
299 R1	Inter (Type C)	299+52.46	11.83 RT
299 R2	Inter (Type R, L=15)	299+52.36	65.50 RT
300 L1	Inter (Type C)	300+73.19	69.86 RT
300 L2	Inter (Type R, L=15)	300+72.89	200.00 RT
301 R1	Inter (Type R, L=15)	301+69.03	37.26 RT
302 L1	Inter (Type R, L=15)	302+46.75	65.50 LT
302 F1	48" FES	302+42.27	104.70 LT
302 M1	Manhole (6 da)	302+57.55	37.26 RT
302 R1	Inter (Type R, L=15)	302+57.76	65.50 RT
306 F1	30" 18" FES	307+12.80	96.67 RT
306 L1	Inter (Type R, L=15)	306+55.34	104.86 RT
306 M1	Manhole (6 da)	306+55.80	65.50 LT
306 R1	Inter (Type R, L=15)	306+55.80	33.50 RT
308 R1	Inter (Type R, L=15)	308+55.80	70.50 RT
309 M1	Manhole (6 da)	309+15.71	33.50 RT

ID	DESCRIPTION	STATION	OFFSET
308 L1	Inter (Type R, L=15)	308+73.19	69.86 RT
309 M1	Manhole (6 da)	309+15.71	33.50 RT
309 R1	Inter (Type R, L=15)	309+15.71	33.50 RT
310 L1	Inter (Type R, L=15)	310+49.29	65.50 LT
310 M1	Manhole (6 da)	307+43.14	34.08 RT

NOTES:
1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SET POND PLANS AND DETAIL SHEETS FOR RRRAP REQUIREMENTS.

(R-1) INSTALL PIPE BRIDGE PER DETAIL A 8-8 CONCRETE SPRING JOINTS. INSTALL FULL LENGTH OF 48" RCP CENTERED OVER EXISTING SANITARY SEWER. NOTIFY CHESTER METROPOLITAN DISTRICT NO MORE THAN TWO BUSINESS DAYS BEFORE INSTALLATION FOR THE PIPE BRIDGE. NO JOINTS ALLOWED BETWEEN CONCRETE INSTALLATION FOR THE PIPE BRIDGE.

(R-2) SEE SEWER PIPE BRIDGE DETAIL ON SHEET 50.

EXISTING GRADE

307M1
RIM - 6521.93
INV. IN - 6517.25(E)
INV. OUT - 6512.97(E)
307M1
RIM - 6521.93
INV. IN - 6517.25(E)
INV. OUT - 6512.97(E)

307M1
RIM - 6523.22
INV. IN - 6514.50(N)
INV. IN - 6517.25(E)
INV. OUT - 6514.40(S)

308M1
RIM - 6528.19
INV. IN - 6520.40(N)
INV. IN - 6520.39(W)
INV. OUT - 6520.28(S)

308M1
RIM - 6528.19
INV. IN - 6520.40(N)
INV. IN - 6520.39(W)
INV. OUT - 6520.28(S)

309M1
RIM - 6529.63
INV. IN - 6521.44(N)
INV. IN - 6521.48(S)
INV. OUT - 6521.48(S)

309M1
RIM - 6529.63
INV. IN - 6521.44(N)
INV. IN - 6521.48(S)
INV. OUT - 6521.48(S)

309M1
RIM - 6532.25
INV. IN - 6526.24(N)
INV. IN - 6526.14(W)
INV. OUT - 6524.14(S)

310M1
RIM - 6534.91
INV. IN - 6526.86(N)
INV. IN - 6526.42(E)
INV. OUT - 6526.7

P302M1
76" x 48" RCP
SLOPE LENGTH - 1440
SLOPE - 1.43%
CAPACITY - 259 CFS
VELOCITY - 10.3 FT/S

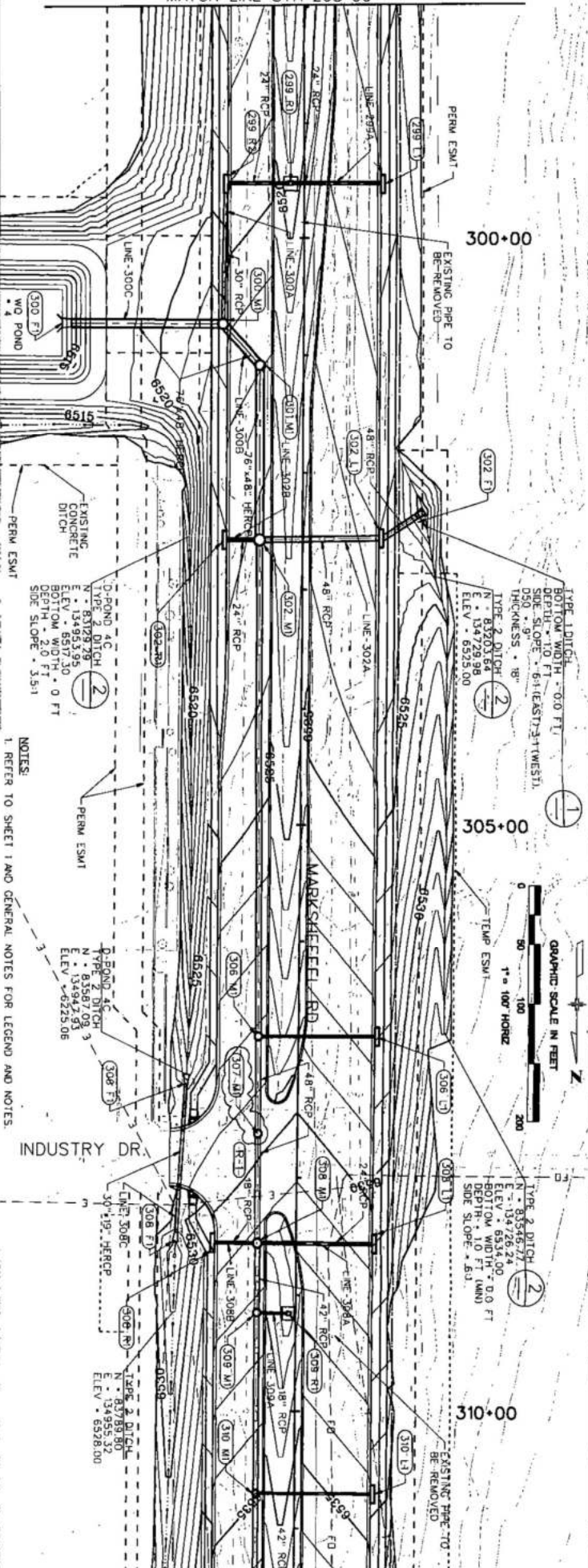
P306M1
48" RCP
SLOPE LENGTH - 415
SLOPE - 1.33%
CAPACITY - 170 CFS
VELOCITY - 11.4 FT/S

P306M1
48" RCP
SLOPE LENGTH - 415
SLOPE - 1.33%
CAPACITY - 170 CFS
VELOCITY - 11.4 FT/S

P307M1
48" RCP
SLOPE LENGTH - 77
SLOPE - 1.33%
CAPACITY - 170 CFS
VELOCITY - 10.9 FT/S

P308M1
48" RCP
SLOPE LENGTH - 86
SLOPE - 1.33%
CAPACITY - 170 CFS
VELOCITY - 10.9 FT/S

P310M1
42" RCP
SLOPE LENGTH - 149
SLOPE - 1.70%
CAPACITY - 137 CFS
VELOCITY - 15.6 FT/S



Computer File Information

Revision Date: 10/23/2007
Initials: LMS
Print Date: 08/25/2009
Includes: ADH
Name: drp04.dgn

Sheet Revisions

Date:	Comments	Init.
3/15/2011	Add Storm & Pipe Rise	CCS
4/8/2011	Add Storm Sewer Pipe Bridge	GMH
1/7/2011	Revised ID Table	GMH

EL PASO COUNTY
COURTROOM



WILSON & COMPANY
Engineers & Architects
3700 Main Building Blvd.
Colorado Springs, CO 80918
Phone: 719-520-8800
Fax: 719-520-8700

As Constructed

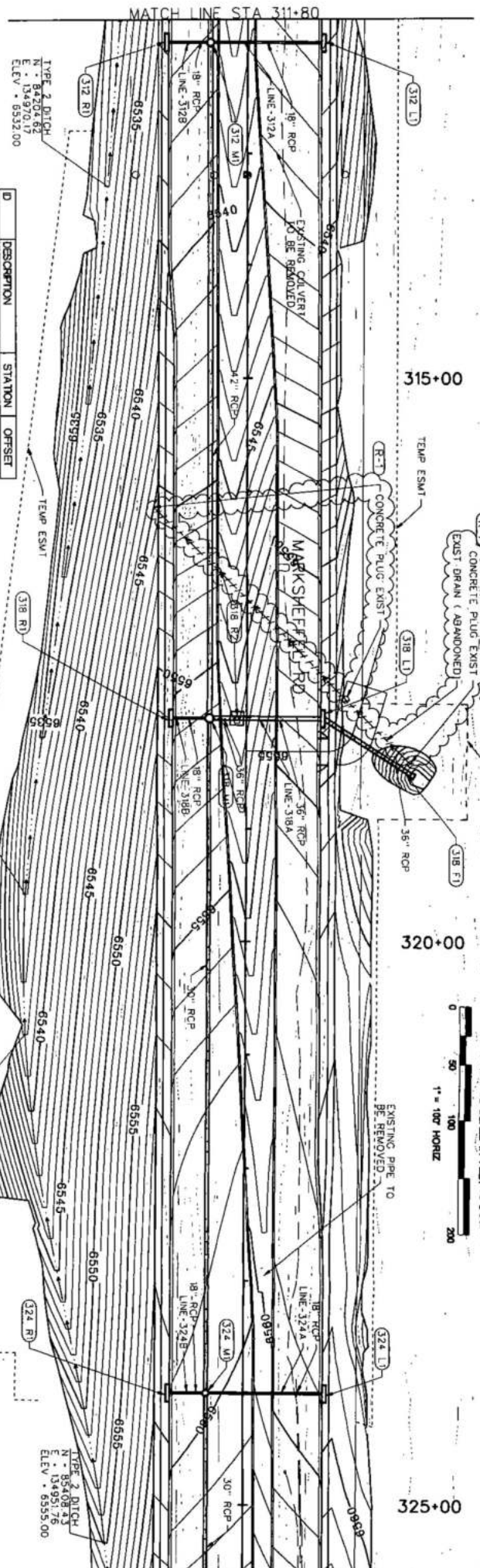
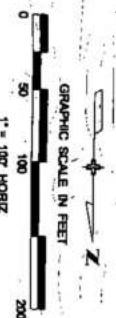
No Revisions:	
Revised:	GMH 12-2-11
Void:	

Marksheet Road Drainage Plan and Profile

Designer:	CCS	Structure Numbers	
Checker:	ADH		
Sheet Subset:	Drainage	Sheet Sheets:	7 of 14

Proj

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 + 52.88	150.65' LT
318 L1	Inlet (Type R, L=15)	318 + 00.67	65.50' LT
318 R2	Manhole (7' dia.)	318 + 00.56	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 (6' dia.)	324 + 00.67	33.50' RT
324 R1	Inlet (Type R, L=15)	324 + 00.67	65.50' RT

312M1
RW - 65.53.50
INV. IN - 65.53.10(N)
INV. IN - 65.53.19(E)
INV. IN - 65.53.43(W)
INV. OUT - 65.52.00(S)

318M1
RW - 65.52.79
INV. IN - 65.52.10(N)
INV. IN - 65.52.14(E)
INV. IN - 65.52.18(W)
INV. OUT - 65.41.00(S)

324M1
RW - 65.59.70
INV. IN - 65.52.10(N)
INV. IN - 65.52.14(E)
INV. IN - 65.54.31(W)
INV. OUT - 65.52.30(S)

312M1
RW - 65.53.50
INV. IN - 65.53.10(N)
INV. IN - 65.53.19(E)
INV. IN - 65.53.43(W)
INV. OUT - 65.52.00(S)

318M1
RW - 65.52.79
INV. IN - 65.52.10(N)
INV. IN - 65.52.14(E)
INV. IN - 65.52.18(W)
INV. OUT - 65.41.00(S)

324M1
RW - 65.59.70
INV. IN - 65.52.10(N)
INV. IN - 65.52.14(E)
INV. IN - 65.54.31(W)
INV. OUT - 65.52.30(S)

Computer File Information

Job Date: 10/23/2007
 Initials: LWS
 Date: 08/25/2009
 Initials: ADH
 Name: drp05.dgn

Sheet Revisions

Date:	Comments	Int.
7-6-11	PLUG & ABANDONED EXIST DRAIN	CMH

As Constructed

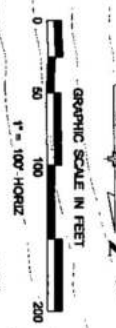
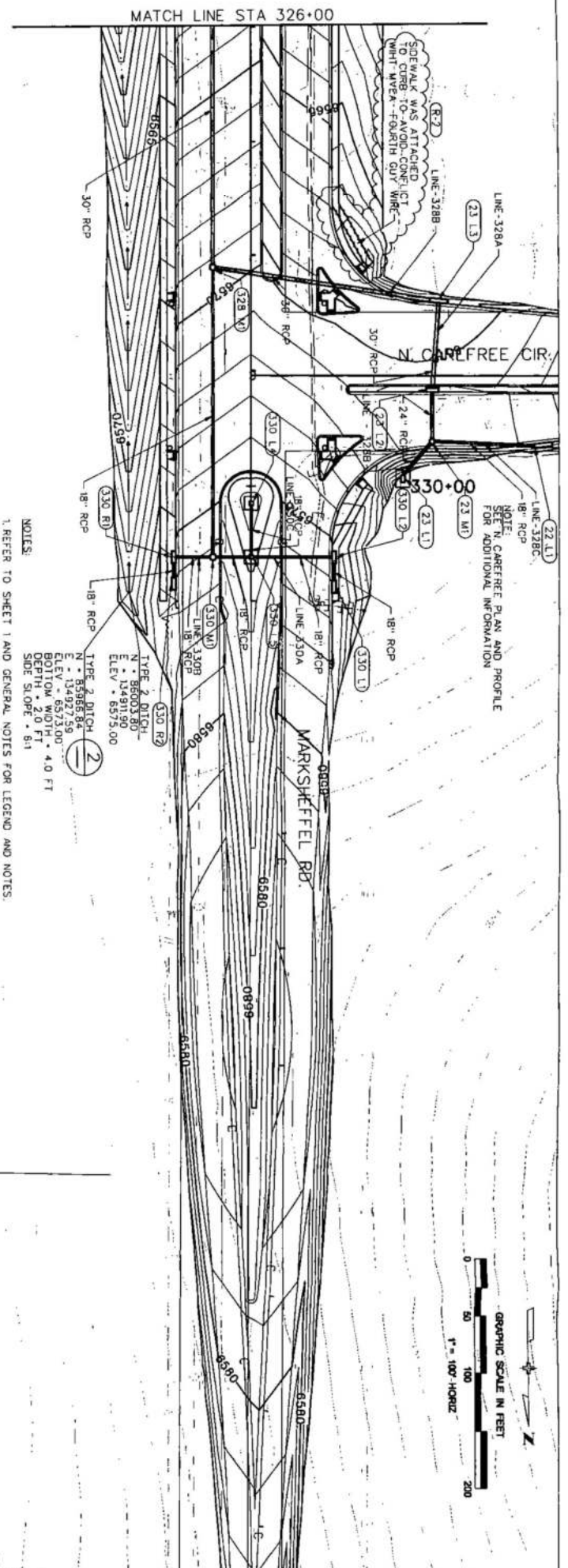
No Revisions:
Revised: CMH 12-6-11
Void:

Worksheet Road Drainage Plan and Profile

Designer: CCS	Structure Numbers
Detainer: ADH	Sheet Sheets: 10 of 14
Sheet Submitt: Drainage	Sheet Nu



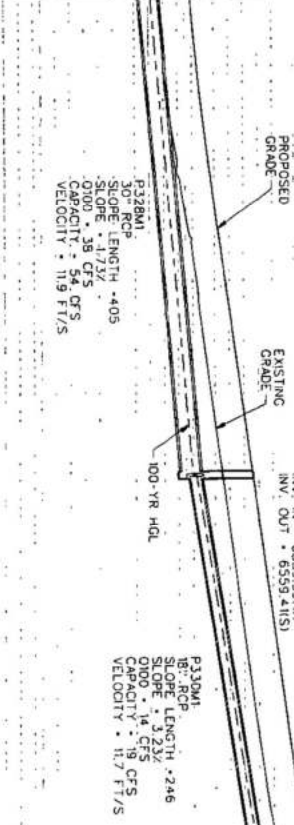
WILSON & COMPANY
 Engineers & Architects
 5700 Bank Building Blvd.
 Suite 220
 El Paso, TX 79905
 Phone: 915-762-0111
 Fax: 915-762-0111



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

ID	DESCRIPTION	STATION	OFFSET
22 L1	Right (Type R, L=15)	22+25.23	57.79' LT
23 M1	Manhole (4 dia.)	23+21.64	57.00' LT
23 L1	Right (Type D)	23+47.10	86.22' LT
23 L2	Right (Type R, L=10)	23+21.64	15.00' LT
23 L3	Right (Type R, L=15)	23+18.06	62.23' RT
328 M1	Manhole (6 dia.)	325+10.74	33.50' RT
330 L1	Right (Type R, L=10)	330 + 87.57	70.50' LT
330 L2	Right (Type R, L=10)	330 + 62.07	70.50' LT
330 L4	Right (Type C)	330 + 14.95	0.36' LT
330 L5	Right (Type C)	330 + 62.12	0.25' LT
330 M1	Manhole (6 dia.)	330 + 62.07	33.50' RT
330 R1	Right (Type R, L=10)	330 + 62.07	65.50' RT
330 R2	Right (Type R, L=10)	330 + 65.07	65.50' RT

MATCH LINE STA 326+00



Computer File Information

Revision Date: 10/23/2007
Initials: SKM

Revision Date: 08/25/2009
Initials: ADH

Name: d:\p005.dgn

Sheet Revisions

Date	Comments	Int.
3/25/10	Adendum 4	GCS
10/3/11	MOVED SIDEWALK	CHH

EL PASO COUNTY

WILSON & COMPANY

Engineers & Architects

7503 East Oakley Blvd.
Denver, CO 80231
Phone: 773-400-0000
Fax: 773-400-0000

As Constructed

No Revisions:

Revised: CHH 12-6-11

Void:

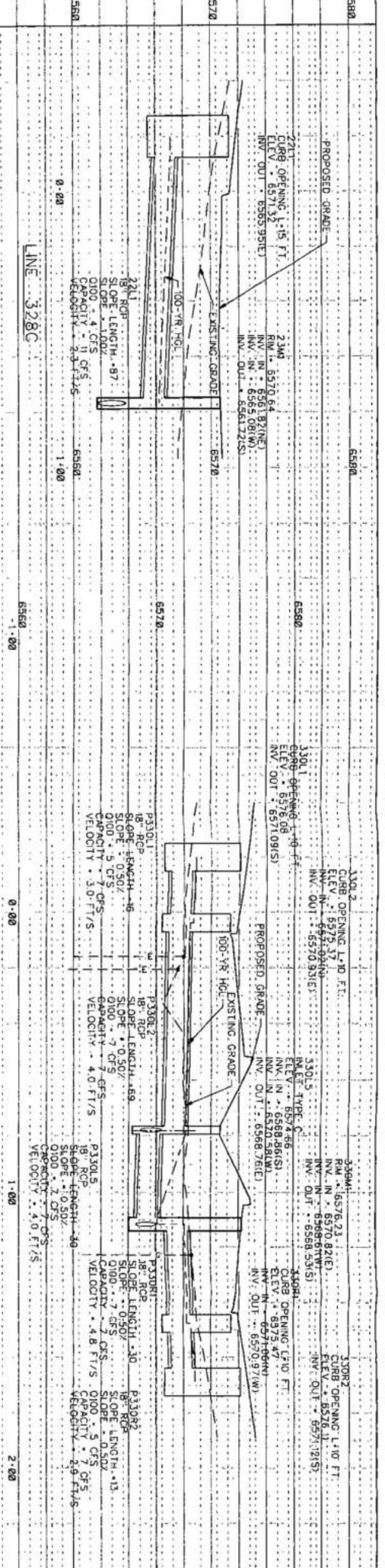
Drainage Plan and Profile

Design: GCS

Detail: ADH

Sheet Subst: Drainage

Sheet: 12 of 14



LINE 328A AND 328B

LINE 330A AND 330B

LINE 330C

NOTE: FLOW NOT SHOWN FOR INTERIOR TO MEDIAN DRAINAGE SYSTEM.

Computer File Information

Revision Date: 10/23/2007
 Initials: LMS
 Initials: ADH
 Name: DRP006.dgn

Sheet Revisions

Date:	Comments:	Int.
12-6-11	ADDED CONCRETE ENCASUREMENT	GMH

EL PASO COUNTY



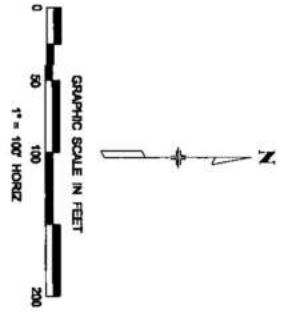
WILSON & COMPANY
 Engineers & Architects
 6700 Mesa Landing Blvd.
 Suite 200 Fort Worth, TX 76116
 Phone: 714-222-2111
 Fax: 714-222-2111

As Constructed

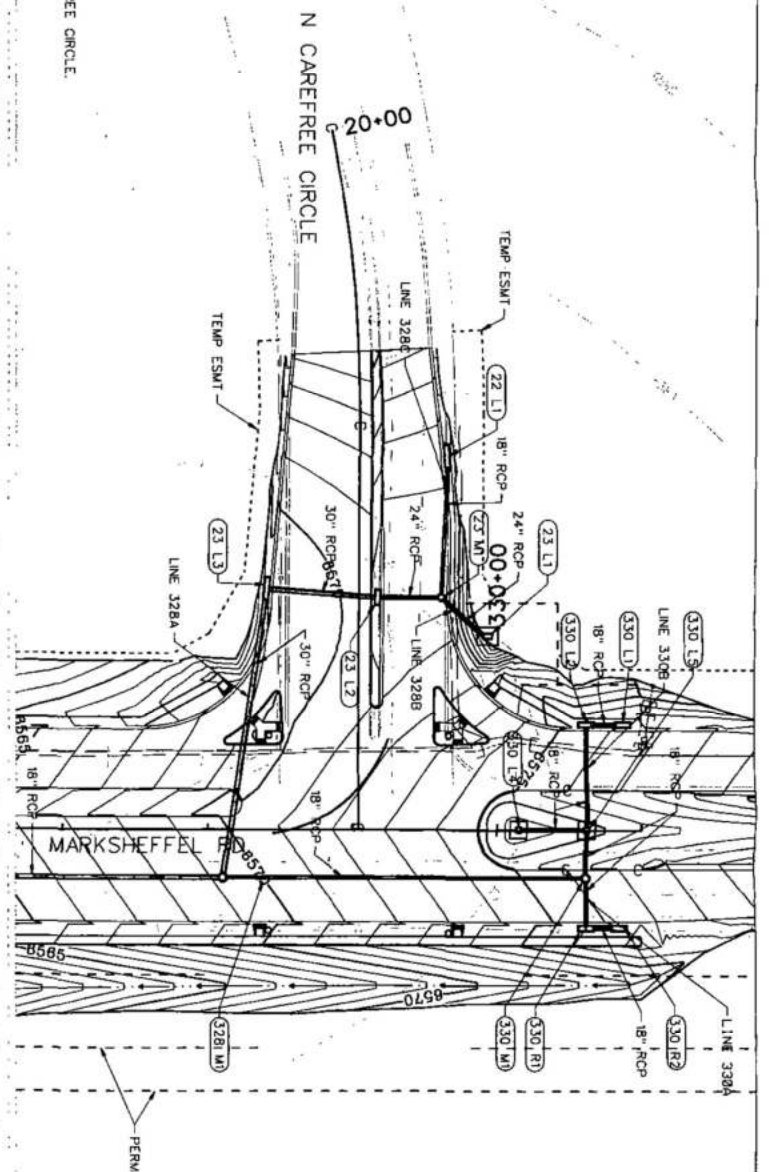
No Revisions:	Revised: GMH 12-6-11
Void:	

Storm Drain Lateral Profile

Designer: CCS	Structure Numbers
Detainer: ADH	
Sheet Subsets: Drainage	Sheet



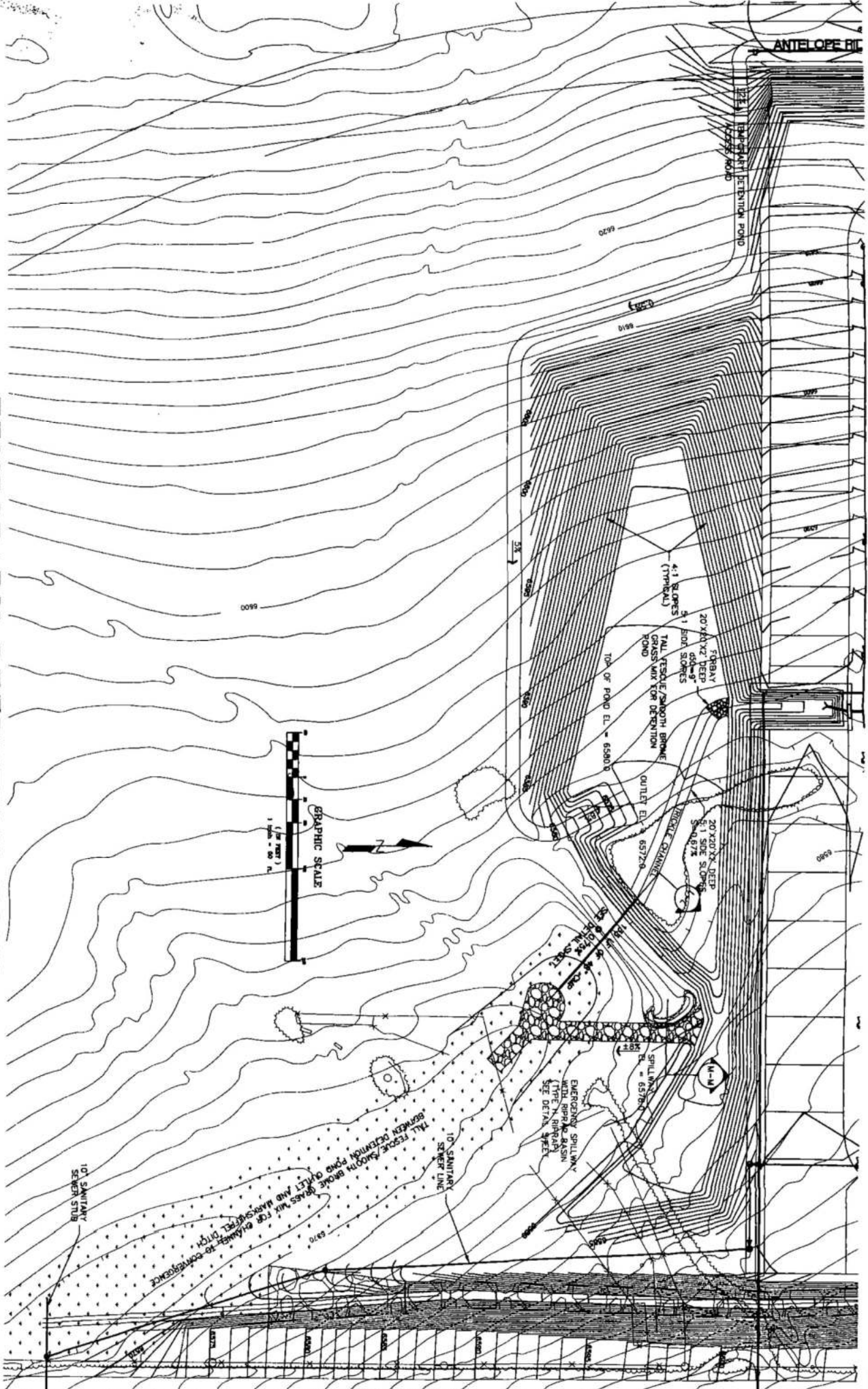
- NOTES:
1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
 2. SEE MAINLINE PLAN AND PROFILE SHEETS FOR STORM DRAIN LATERALS.
 3. EXISTING CONTOURS DO NOT REFLECT EXISTING GRADING FOR N. CAREFREE CIRCLE.
 4. SEE SHEET 12 OF 14 FOR STRUCTURE DESCRIPTIONS.



Computer File Information		Sheet Revisions		As Constructed		Pro	
Creation Date: 02/06/2008	Initials: ADH	Date:	Comments:	Init.		Marksheffel Road Drainage Plan and Profile N. Carefree	
Print Date: 08/25/2009	Initials: ADH					Designer: GCS	Structure
Name: drpp17.dgn						Detailer: ADH	Number
						Sheet Subset: Drainage	Sheet 14 of 14
							Sheet

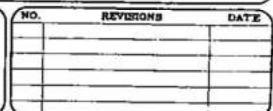


TEMPORARY DETENTION POND CHATEAU AT ANTELOPE RIDGE



URS
Ernst & Young
Woodward

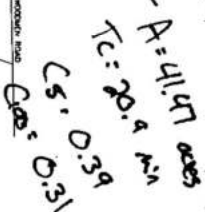
DATE: 09/03/00
PROJ. NO.: 97451
SHEET 11 OF 17



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DESIGN POINT TABLE

VICINITY MAP
NOT TO SCALE



DATE :	7/30/13	CHECKED BY :	ACR
--------	---------	--------------	-----

(EX. ~~ELECTRIC~~ SUBSTATION)

EXISTING DRAINAGE CONDITIONS CALCULATIONS



JOB _____ **DATE** _____
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

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

EXISTING DRAINAGE CONDITIONS ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				TOTAL		INTENSITY		TOTAL FLOWS	
	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	

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

EXISTING DRAINAGE CONDITIONS ~ SURFACE ROUTING SUMMARY

Design Points(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' Existing 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)

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		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
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

JOB NAME:	<u>WINDERMERE</u>	
JOB NUMBER:	<u>2441.00</u>	
DATE:	<u>10/03/14</u>	
CALCULATED BY:	<u>MAL</u>	

DESIGN POINT	EX-8
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Total Flow: $Q_5 = \underline{\quad 6 \text{ cfs} \quad}$
 $Q_{100} = \underline{\quad 11 \text{ cfs} \quad}$

Maximum allowable ponding depth at sump:

$D_5 = 0.50$
 $D_{100} = 0.67 \text{ (dmax)}$

$Q_i = 1.7(Li + 1.8(W))(dmax + w/12)^{1.85}$

Clogging Factor = 1.25
 $Li (1.25) = \text{Length of inlet opening}$

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.

JOB NAME:	WINDERMERE				
JOB NUMBER:	2441.00				
DATE:	10/03/14				
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

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)

$$Q_i = 1.7(L_i + 1.8(W))(d_{max} + w/12)^{1.85}$$

Clogging Factor = 1.25
 $L_i (1.25) =$ 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.

DEVELOPED DRAINAGE CONDITIONS CALCULATIONS



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

DEVELOPED 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)
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

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

DEVELOPED 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)
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

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

DEVELOPED CONDITIONS ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				TOTAL FLOWS				
	CA(5)	CA(100)	C(5) (ft)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	INTENSITY 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

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

DEVELOPED CONDITIONS ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND			STREET / CHANNEL FLOW			TOTAL			INTENSITY		TOTAL FLOWS	
	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

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

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)	
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' Existing 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	186.7	353.3	FILLING 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)

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		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
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

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		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
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

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

DEVELOPED CONDITIONS ~ PIPE TRAVEL TIMES

PIPE RUN	STREET / CHANNEL FLOW				
	Pipe Diameter	Length	Slope	Velocity	Tc
	(ft)	(ft)	(%)	(fps)	(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

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

JOB NAME:	<u>WINDERMERE</u>	
JOB NUMBER:	<u>2441.00</u>	
DATE:	<u>10/03/14</u>	
CALCULATED BY:	<u>MAL</u>	

DESIGN POINT	2
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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)

$Q_i = 1.7(Li + 1.8(W))(dmax + w/12)^{1.85}$

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.

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

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)

$$Q_i = 1.7(L_i + 1.8(W))(d_{\max} + w/12)^{1.85}$$

Clogging Factor = 1.25
 $L_i (1.25) =$ Length of inlet opening

5-Year Event: foot inlet required

100-Year Event: foot inlet required

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

JOB NAME: WINDERMERE
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)

$Q_i = 1.7(Li + 1.8(W))(dmax + w/12)^{1.85}$

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

5-Year Event: foot inlet required

100-Year Event: foot inlet required

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

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:

$$D_5 = 0.50$$

$$D_{100} = 0.67 \text{ (dmax)}$$

$$Q_i = 1.7(Li + 1.8(W))(dmax + w/12)^{1.85}$$

$$\text{Clogging Factor} = 1.25$$

$$Li (1.25) = \text{Length of inlet opening}$$

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.

JOB NAME:	<u>WINDERMERE</u>	
JOB NUMBER:	<u>2441.00</u>	
DATE:	<u>10/03/14</u>	
CALCULATED BY:	<u>MAL</u>	

DESIGN POINT	8
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Total Flow: $Q_5 = 8 \text{ cfs}$
 $Q_{100} = 15 \text{ cfs}$

Maximum allowable ponding depth at sump:

$D_5 = 0.50$
 $D_{100} = 0.67 \text{ (dmax)}$

$Q_i = 1.7(L_i + 1.8(W))(d_{max} + w/12)^{1.85}$

Clogging Factor = 1.25
 $L_i (1.25) = \text{Length of inlet opening}$

5-Year Event: foot inlet required

100-Year Event: foot inlet required

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

JOB NAME:	WINDERMERE				
JOB NUMBER:	2441.00				
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

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

JOB NAME:	WINDERMERE				
JOB NUMBER:	2441.00				
DATE:	10/03/14				
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

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

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	

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

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

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)

$Q_i = 1.7(L_i + 1.8(W))(d_{max} + w/12)^{1.85}$

Clogging Factor = 1.25
 $L_i (1.25) =$ Length of inlet opening

5-Year Event: foot inlet required

100-Year Event: foot inlet required

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

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

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

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)

$Q_i = 1.7(Li + 1.8(W))(dmax + w/12)^{1.85}$

Clogging Factor = 1.25

$Li (1.25) =$ Length of inlet opening

5-Year Event: foot inlet required

100-Year Event: foot inlet required

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

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

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

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)

$$Q_i = 1.7(L_i + 1.8(W))(d_{\max} + w/12)^{1.85}$$

Clogging Factor = 1.25
 $L_i (1.25) =$ Length of inlet opening

5-Year Event: foot inlet required

100-Year Event: foot inlet required

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

Design Print 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

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

**FILING NO. 1 –
FULL SPECTRUM EDB FINAL DESIGN**



Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

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_e
- B) Tributary Area's Imperviousness Ratio ($i = I_e / 100$)
- C) Contributing Watershed Area
- D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- E) Design Concept
(Select EURV when also designing for flood control)
- F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^2 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)$)
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_e * (V_{DESIGN} / 0.43))$)
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)
- I) Predominant Watershed NRCS Soil Group
- 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: $EURV_{C/D} = (0.1043i - 0.0031) * Area$

$I_e =$ 73.3 %

$i =$ 0.733

Area = 10.870 ac

$d_e =$ 0.42 in

Choose One

- ☐ Water Quality Capture Volume (WQCV)
☒ Excess Urban Runoff Volume (EURV)

$V_{DESIGN} =$ 0.318 ac-ft

$V_{DESIGN\ OTHER} =$ 0.309 ac-ft

$V_{DESIGN\ USER} =$ _____ ac-ft

Choose One

- ☐ A
☒ B
☐ C / D

EURV = 0.893 ac-ft

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

- A) Describe means of providing energy dissipation at concentrated inflow locations:

Concrete box forebay

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

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

5. Forebay

- A) Minimum Forebay Volume
($V_{MIN} = 3\%$ of the WQCV)
- B) Actual Forebay Volume
- C) Forebay Depth
($D_F = 18$ inch maximum)
- D) Forebay Discharge
- i) Undetained 100-year Peak Discharge
- ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
- E) Forebay Discharge Design

$$V_{MIN} = 0.008 \text{ ac-ft}$$

$$V_F = 0.009 \text{ ac-ft}$$

$$D_F = 18.0 \text{ in}$$

$$Q_{100} = 57.00 \text{ cfs}$$

$$Q_F = 1.14 \text{ cfs}$$

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 3-inches)

$$\text{Calculated } D_p = \text{in}$$

G) Rectangular Notch Width

$$\text{Calculated } W_N = 5.8 \text{ in}$$

6. Trickle Channel

- A) Type of Trickle Channel
- F) Slope of Trickle Channel

Choose One

- ☒ Concrete
☐ Soft Bottom

$$S = 0.0100 \text{ ft / ft}$$

7. Micropool and Outlet Structure

- A) Depth of Micropool (2.5-feet minimum)
- B) Surface Area of Micropool (10 ft² minimum)
- C) Outlet Type

$$D_M = 2.5 \text{ ft}$$

$$A_M = 107 \text{ sq ft}$$

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.

$$H = 7.00 \text{ feet}$$

E) Volume to Drain Over Prescribed Time

$$\text{EURV} = 0.893 \text{ ac-ft}$$

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

$$T_D = 72 \text{ hours}$$

G) Recommended Maximum Outlet Area per Row, (A_o)

$$A_o = 0.47 \text{ square inches}$$

H) Orifice Dimensions:

- i) Circular Orifice Diameter or
ii) Width of 2" High Rectangular Orifice

$$D_{\text{orifice}} = 3/4 \text{ inches}$$

$$W_{\text{orifice}} = \text{inches}$$

I) Number of Columns

$$n_c = 1 \text{ number}$$

J) Actual Design Outlet Area per Row (A_o)

$$A_o = 0.44 \text{ square inches}$$

K) Number of Rows (nr)

$$n_r = 21 \text{ number}$$

L) Total Outlet Area (A_o)

$$A_o = 9.3 \text{ square inches}$$

M) Depth of WQCV (H_{wocv})
(Estimate using actual stage-area-volume relationship and V_{wocv})

$$H_{wocv} = \text{feet}$$

N) Ensure Minimum 40 Hour Drain Time for WQCV

$$T_{Dwocv} = \text{hours}$$

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 4

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

8. Initial Surge Volume

- A) Depth of Initial Surge Volume
(Minimum recommended depth is 4 inches)
- B) Minimum Initial Surge Volume
(Minimum volume of 0.3% of the WQCV)
- C) Initial Surge Provided Above Micropool

$D_{IS} = 4.0$ in

$V_{IS} = 34.4$ cu ft

$V_s = 35.7$ 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: $A_t = 38.5 \cdot (e^{-0.065D}) \cdot A_d$

$A_t = 333$ 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_{rect})

$W_{rect} =$ 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

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 4 of 4

Designer: M. Larson
 Company: Classic Consulting
 Date: October 4, 2014
 Project: Windersmere
 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:

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:

INSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION :

(from lowest to highest)	6562.50
	6562.50
	6562.50
	6562.83
	6564.00
	6566.00
	6568.00
	6570.00

AREA (BTM to TOP):

	-	acres
	-	acres
435	0.01	acres
488	0.01	acres
4,247	0.10	acres
5,558	0.13	acres
6,866	0.16	acres
8,219	0.19	acres
	-	acres
	-	acres
	-	acres
	-	acres

PRELIMINARY SIZE:

$$\text{VOLUME} = 1/3\{(\text{EL2}-\text{EL1})\cdot(\text{A1}+\text{A2}+((\text{A1}\cdot\text{A2})^{.5}))\}$$

**CUMMULATIVE
VOLUME:**

-	AC-FT	from	6,563	to	6,563	-
-	AC-FT	from	6,563	to	6,563	0.00
0.00	AC-FT	from	6,563	to	6,563	0.06
0.05	AC-FT	from	6,563	to	6,564	0.28
0.22	AC-FT	from	6,564	to	6,566	0.56
0.28	AC-FT	from	6,566	to	6,568	0.90
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			SURFACE AREA (SF)
	AC-FT	=	CF	
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

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:
 INSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION :	
(from lowest to highest)	
	6562.50
	6562.50
	6562.50
	6562.83
	6564.00
	6566.00
	6568.00
	6570.00
	6571.00

AREA (BTM to TOP):		
	-	acres
	-	acres
	435	0.010 acres
	488	0.011 acres
	4,247	0.098 acres
	5,558	0.128 acres
	6,866	0.158 acres
	8,219	0.189 acres
	10,977	0.252 acres
	-	acres
	-	acres
	-	acres

PRELIMINARY SIZE:						CUMMULATIVE VOLUME:	
VOLUME =		$1/3\{(EL2-EL1)*(A1+A2+((A1*A2)^.5))\}$					
-	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			SURFACE AREA (SF)
	AC-FT	=	CF	
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

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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FIL-1	Modified Rational Hydrograph	4

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

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 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.00 ft ³ /s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	20.50 ft ³ /s	Time to Peak (Flow, In)	0.200 hours
Flow (Peak Outlet)	0.63 ft ³ /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 %

FILING NO. 1 - 5 YEAR

Subsection: Modified Rational Hydrograph

Return Event: 5 years

Label: FIL-1

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 (ft³/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)

FILING NO. 1 - 5 YEAR

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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 (ft ³ /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 (ft ³ /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 (ft ³ /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

100-YR - FILING NO. 1

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)	6,562.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.00 ft ³ /s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	46.07 ft ³ /s	Time to Peak (Flow, In)	0.200 hours
Flow (Peak Outlet)	9.77 ft ³ /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 %

100-YR - FILING NO. 1

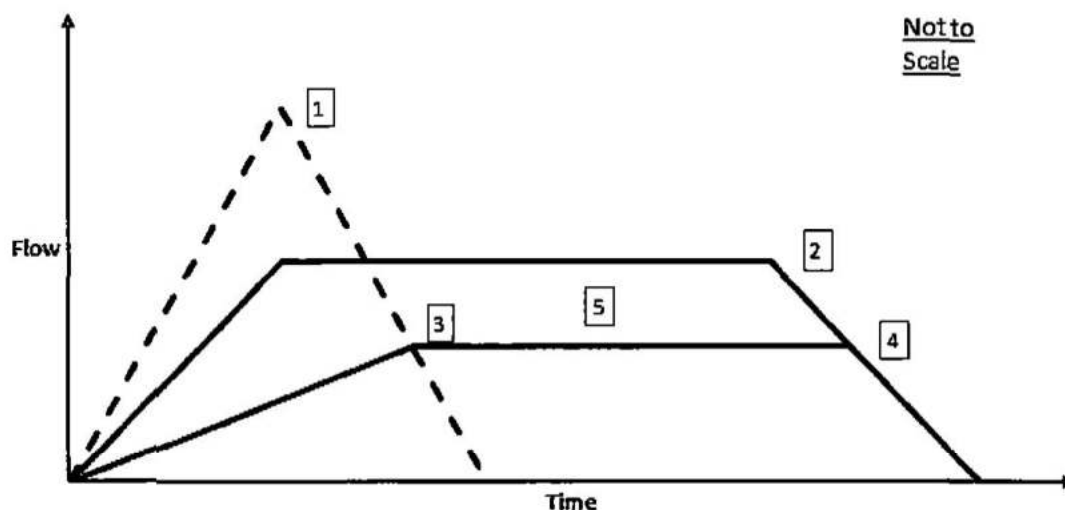
Subsection: Modified Rational Graph

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	ft ³ /s	Flow (Modified Rational, Critical)	46.07	ft ³ /s
[3]			[4]		
First Outflow Breakpoint (Modified Rational, Method T)	0.379 hours		Second Outflow Breakpoint (Modified Rational)	0.279	hours
Flow (Modified Rational, Allowable)	25.80 ft ³ /s		Flow (Modified Rational, Allowable)	25.80	ft ³ /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	ft ³ /s			

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Master Network Summary...2

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PO-1 (IN) (Level Pool Pond Routing Summary, 100 years)...3

**FILING NO. 2 –
FULL SPECTRUM EDB PRELIMINARY DESIGN**



Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

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_e
- B) Tributary Area's Imperviousness Ratio ($I = I_e / 100$)
- C) Contributing Watershed Area
- D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- E) Design Concept
(Select EURV when also designing for flood control)
- F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * I^2 - 1.19 * I + 0.78 * I) / 12 * Area * 1.2)$)
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_e * (V_{DESIGN} / 0.43))$)
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)
- I) Predominant Watershed NRCS Soil Group
- J) Excess Urban Runoff Volume (EURV) Design Volume
 For HSG A: $EURVA = (0.1878I - 0.0104) * Area$
 For HSG B: $EURVB = (0.1178I - 0.0042) * Area$
 For HSG C/D: $EURV_{C/D} = (0.1043I - 0.0031) * Area$

$I_e =$ 45.4 %

$I =$ 0.454

Area = 132.860 ac

$d_e =$ 0.42 in

Choose One

- ☐ Water Quality Capture Volume (WQCV)
☒ Excess Urban Runoff Volume (EURV)

$V_{DESIGN} =$ 2.577 ac-ft

$V_{DESIGN\ OTHER} =$ 2.518 ac-ft

$V_{DESIGN\ USER} =$ _____ ac-ft

Choose One

- ☐ A
☒ B
☐ C / D

EURV = 6.548 ac-ft

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.

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 4

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

5. Forebay

- A) Minimum Forebay Volume
($V_{MIN} = 3\%$ of the WQCV)
- B) Actual Forebay Volume
- C) Forebay Depth
($D_F = 30$ inch maximum)
- D) Forebay Discharge
- i) Undetained 100-year Peak Discharge
- ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
- E) Forebay Discharge Design

$V_{MIN} = 0.063$ ac-ft

$V_F = 0.070$ ac-ft

$D_F = 18.0$ in

$Q_{100} = 199.70$ cfs

$Q_F = 3.99$ cfs

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
- F) Slope of Trickle Channel

Choose One

- ☒ Concrete
☐ Soft Bottom

$S = 0.0050$ ft / ft

7. Micropool and Outlet Structure

- A) Depth of Micropool (2.5-feet minimum)
- B) Surface Area of Micropool (10 ft² minimum)
- C) Outlet Type
- D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.
- E) Volume to Drain Over Prescribed Time
- F) Drain Time
(Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours)
- G) Recommended Maximum Outlet Area per Row, (A_o)
- H) Orifice Dimensions:
- i) Circular Orifice Diameter or
- ii) Width of 2" High Rectangular Orifice
- I) Number of Columns
- J) Actual Design Outlet Area per Row (A_o)
- K) Number of Rows (n_r)
- L) Total Outlet Area (A_{ot})
- M) Depth of WQCV (H_{wocv})
(Estimate using actual stage-area-volume relationship and V_{wocv})
- N) Ensure Minimum 40 Hour Drain Time for WQCV

$D_M = 2.5$ ft

$A_M = 1000$ sq ft

Choose One

- ☒ Orifice Plate
☐ Other (Describe):

$H = 5.50$ feet

EURV = 6.548 ac-ft

$T_D = 72$ hours

$A_o = 3.73$ square inches

$D_{orifice} = 1 - 1/2$ inches
 $W_{orifice} =$ inches

$n_c = 2$ number

$A_o = 3.53$ square inches

$n_r = 16$ number

$A_{ot} = 58.3$ square inches

$H_{wocv} =$ feet

$T_{D\ wocv} =$ hours

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 4

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

8. Initial Surge Volume

- A) Depth of Initial Surge Volume
(Minimum recommended depth is 4 inches)
- B) Minimum Initial Surge Volume
(Minimum volume of 0.3% of the WQCV)
- C) Initial Surge Provided Above Micropool

$D_{IS} = 4.0$ in

$V_{IS} = 280.7$ cu ft

$V_s = 333.3$ cu ft

9. Trash Rack

- A) Type of Water Quality Office Used

Choose One
☒ Circular (up to 2" diameter)
☐ Rectangular (2" high)

- B) Water Quality Screen Open Area: $A_t \approx 38.5 \cdot (e^{-0.0050}) \cdot A_{wq}$

$A_t = 1,947$ 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_{rect})

$W_{rect} =$ inches

- ii) Width of Water Quality Screen Opening (W_{screen})

$W_{screen} =$ 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

$W_{rect} =$ inches

- vi) Minimum Bearing Bar Size

$W_{rect} =$ inches

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 4 of 4

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:

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:
 INSERT POND DESIGN SIZE INFO: (RED)

POND ELEVATION :	
(from lowest to highest)	
6571.00	
6571.00	
6572.00	
6574.00	
6576.00	
6576.50	

AREA (BTM to TOP):		
	-	acres
4,724	0.11	acres
7,502	0.17	acres
49,737	1.14	acres
135,006	3.10	acres
153,596	3.53	acres
	-	acres
	-	acres
	-	acres
	-	acres
	-	acres
	-	acres

PRELIMINARY SIZE:

$$VOLUME \approx \frac{1}{3} \{ (EL2-EL1) \cdot (A1+A2+((A1 \cdot A2)^{.5})) \}$$

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
-	AC-FT	from	-	to	-	6.98

*SIZING IS FOR PRELIMINARY PURPOSES ONLY.

VOLUME \approx **6.98 AC-FT**

APPROXIMATE SURFACE AREA REQUIREMENT

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

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

FILING 2 VOLUME TO SPILLWAY

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

POND ELEVATION :	
(from lowest to highest)	
	6571.00
	6571.00
	6572.00
	6574.00
	6576.00
	6578.00
	6579.00

AREA (BTM to TOP):		
	-	acres
4,724	0.108	acres
7,502	0.172	acres
49,737	1.142	acres
135,006	3.099	acres
198,782	4.563	acres
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.

$$VOLUME = 17.60 \text{ AC-FT}$$

APPROXIMATE SURFACE AREA REQUIREMENT

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

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
-------	--

Table of Contents

	Master Network Summary	2
PO-1 (IN)	Level Pool Pond Routing Summary	3
DP-24	Modified Rational Graph	4

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

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 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.00 ft ³ /s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary

Flow (Peak In)	171.74 ft ³ /s	Time to Peak (Flow, In)	0.450 hours
Flow (Peak Outlet)	3.21 ft ³ /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)

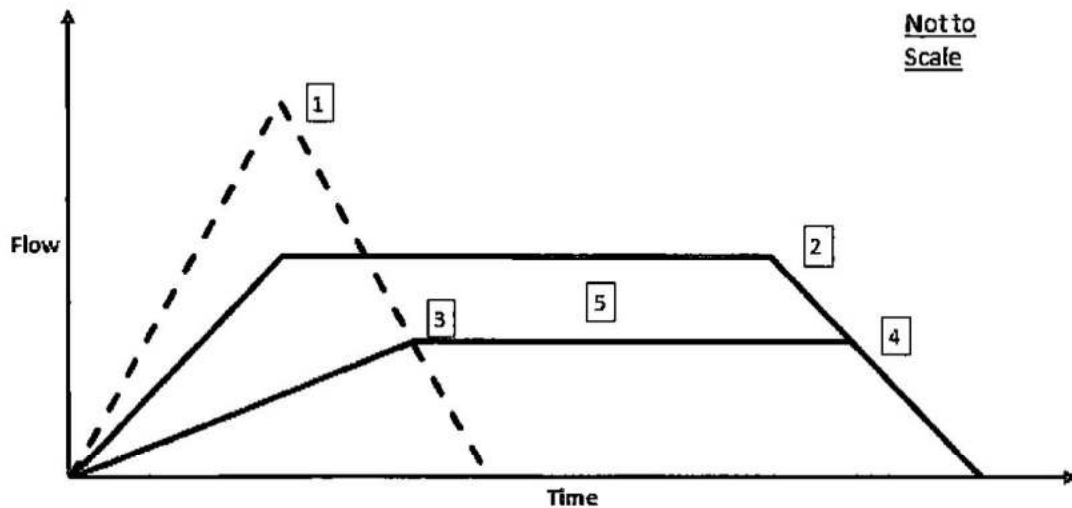
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.080 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.168 ac-ft
Volume (Retained)	1.893 ac-ft
Volume (Unrouted)	-0.018 ac-ft
Error (Mass Balance)	0.3 %

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	ft ³ /s	Flow (Modified Rational, Critical)	102.88	ft ³ /s

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

FILING NO. 2 - 5 YEAR

Index

D

DP-24 (Modified Rational Graph, 5 years)...4

M

Master Network Summary...2

P

PO-1 (IN) (Level Pool Pond Routing Summary, 5 years)...3

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
-------	--

Table of Contents

	Master Network Summary	2
PO-1 (IN)	Level Pool Pond Routing Summary	3
DP-24	Modified Rational Graph	4

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

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 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.00 ft ³ /s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary

Flow (Peak In)	327.44 ft ³ /s	Time to Peak (Flow, In)	0.450 hours
Flow (Peak Outlet)	80.66 ft ³ /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)

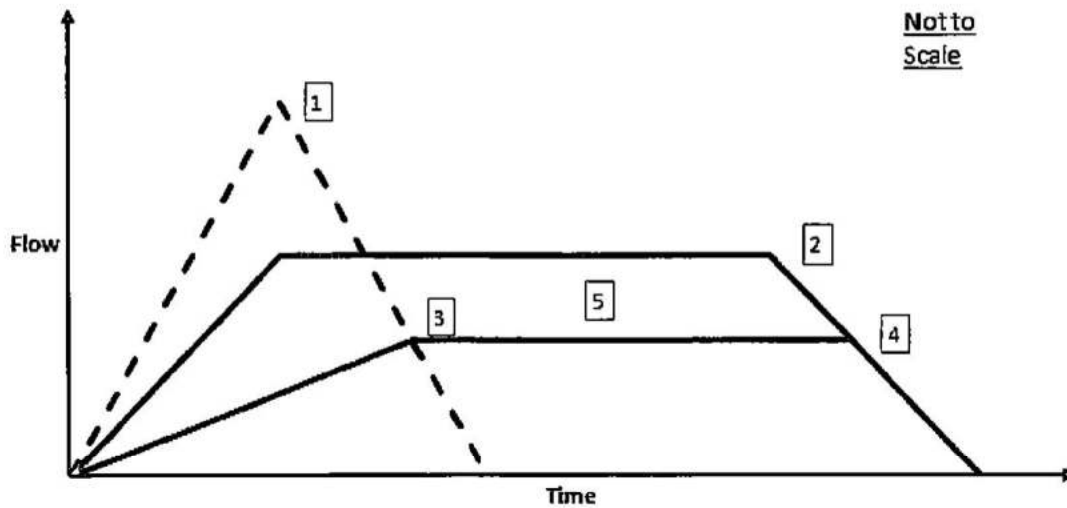
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	13.499 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	11.046 ac-ft
Volume (Retained)	2.415 ac-ft
Volume (Unrouted)	-0.038 ac-ft
Error (Mass Balance)	0.3 %

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	ft ³ /s	Flow (Modified Rational, Critical)	185.05	ft ³ /s
[3]			[4]		
First Outflow Breakpoint (Modified Rational, Method T)	0.612	hours	Second Outflow Breakpoint (Modified Rational)	0.568	hours
Flow (Modified Rational, Allowable)	137.00	ft ³ /s	Flow (Modified Rational, Allowable)	137.00	ft ³ /s
[5]			[6]		
			Storage (Modified Rational, Estimated)	2.134	ac-ft

FILING 2 - 100 YEAR

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DP-24 (Modified Rational Graph, 100 years)...4

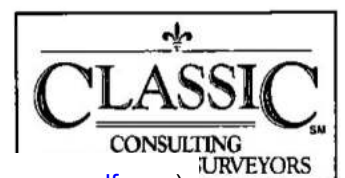
M

Master Network Summary...2

P

PO-1 (IN) (Level Pool Pond Routing Summary, 100 years)...3

COORESPONDANCE FROM YES! COMMUNITIES





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

DRAINAGE MAP



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

MDDP DP-1X
Q5 = 186 CFS
Q100 = 600 CFS
(SEE REPORT TEXT)

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

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

CHATEAU AT ANTELOPE
RIDGE FILING NO. 2
LOT 1

DESIGN POINT SUMMARY		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
4	7.2	14.6
6	18.4	42.6
7	20.0	41.6
8	5.6	11.2
19	6.7	12.5
20	3.7	8.0
24	111.3	199.7
25	117.5	215.1
26	138.3	266.9

WINDSPRING SPRINGS
DEVELOPMENT

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 MANNER ONLY. THE CONTRACTOR
SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING
UTILITIES PRIOR TO ANY EXCAVATION. 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

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

2005 Corporate Plaza, Suite 101
Colorado Springs, Colorado 80915
(719) 595-0090
(719) 595-0796 (fax)

WINDERMERE

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

DESIGNED BY	MAL	SCALE	DATE
DRAWN BY	MAL	(H) 1" = 100'	09/01/14
CHECKED BY	(V) 1" = N/A	SHEET 1 OF 1	JOB NO. 2243.000



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	
O	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	3.8	
NC-2	6.7	12.5	
WS	47.3	66.4	
CT	90.8	184.7	

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

MDDP DP-1C
Q5 = 250 CFS
Q100 = 862 CFS

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	SWO/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	22.4	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 MARKSHEET NO.

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"

WINDERMERE SPRINGS DEVELOPMENT

PROPOSED FULL SPECTRUM DETENTION FACILITY INFORMATION

FACILITY/D.P.	ELEV./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

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

NO.	REVISION	DATE

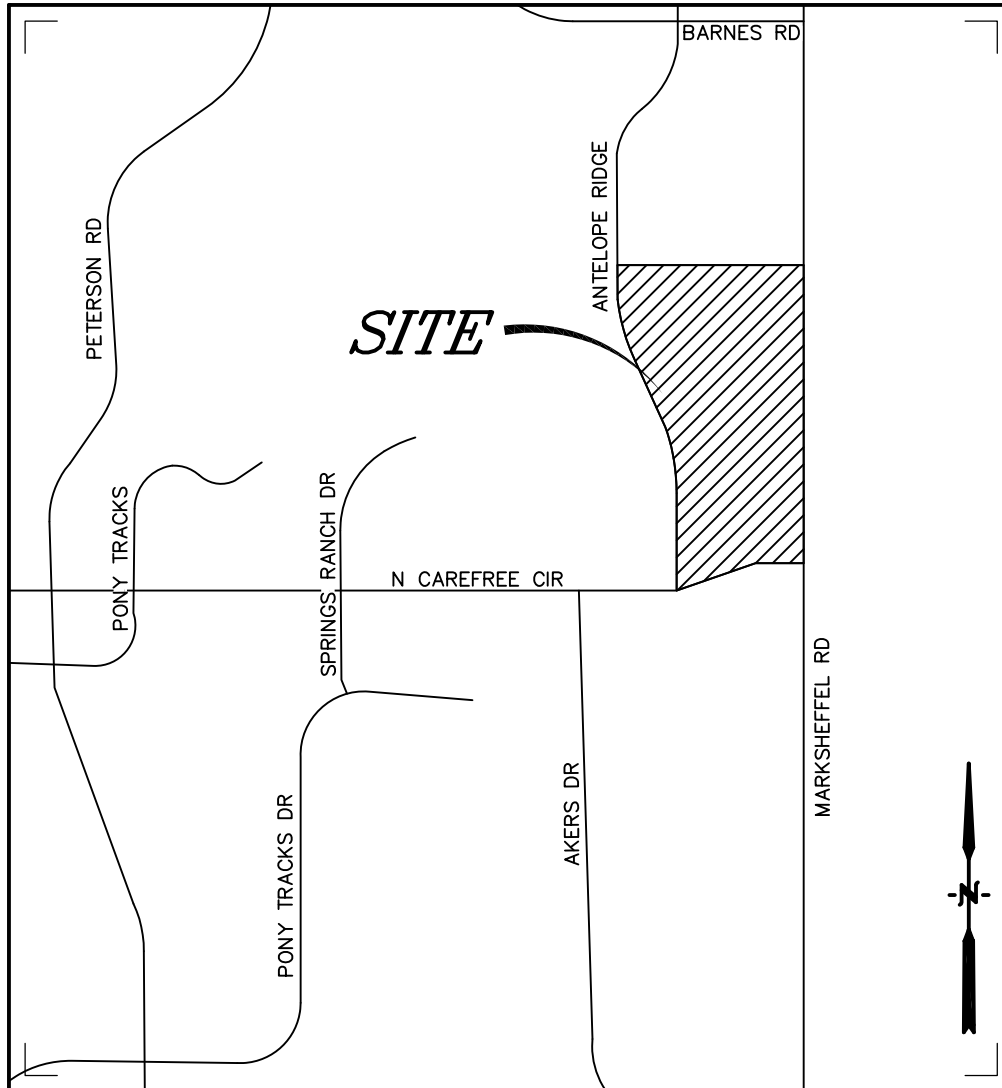
REVIEW:
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF
CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

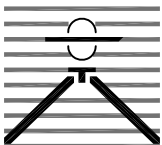
WINDERMERE
DEVELOPED CONDITIONS DRAINAGE MAP
PRELIMINARY DRAINAGE REPORT WINDERMERE
FINAL DRAINAGE REPORT WINDERMERE FL NO. 1

DESIGNED BY: MAL
SCALE: (H) 1"= 100'
DRAWN BY: MAL
DATE: 09/05/14
CHECKED BY: (V) 1"= N/A
JOB NO.: 2241.000

KYLE R. CAMPBELL, COLORADO P.E. #25784
6305 Conquest Drive, Suite 101
Colorado Springs, Colorado 80919
(719) 785-0790
(719) 785-0790 (cell)



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

Hydrologic Soil Group—El Paso County Area, Colorado




**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

7/3/2018
Page 1 of 4

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

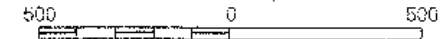
Component Percent Cutoff: None Specified



080060



APPROXIMATE SCALE IN FEET



29

SITE

ZONE X

ZONE

ZONE X

ZONE X

ZONE X

ZONE AE

6548

6545

6548

6543

6545

6537

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

COMMUNITY	NUMBER	PANEL	SUFFIX
LULCING SPRINGS, CITY OF	080053	0543	-
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0543	-

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.nisc.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

A handwritten signature in blue ink that reads "Craig P. Schellbach".

Craig P. Schellbach, PE
Development Manager

c: Mike Askins

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



PROJECT INFORMATION								
PROJECT:	Windermere							
PROJECT NO:	21187-01							
DESIGN BY:	SBN							
REV. BY:	TDM							
AGENCY:	El Paso County							
REPORT TYPE:	Final							
DATE:	3/8/2021							
Soil Type: A								
				C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn					0.15		0.50	0
Residential (<1/8 acre)					0.45		0.59	65
Asphalt/Sidewalk					0.90		0.96	100
PROPOSED								
SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV	
			C2	C5	C10	C100		
A1	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	1.56		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL A1		1.56						
A2	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	4.61		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL A2		4.61						
A3	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	2.18		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL A3		2.18						
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)	3.73		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL A6		3.73						
A7	Landscape/Lawn	0.00		0.15		0.50	0	
	Residential (<1/8 acre)	1.56		0.45		0.59	65	
	Asphalt/Sidewalk	0.00		0.90		0.96	100	
	WEIGHTED AVERAGE			0.45		0.59	65%	
TOTAL A7		1.56						
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						



Drexel, Barrell & Co.

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)	2.67		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A11		2.67					
A12	Landscape/Lawn	7.50		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		9.46					
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)	4.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B3		4.00					
B4	Landscape/Lawn	0.43		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		0.43					
C1	Landscape/Lawn	3.25		0.15		0.50	0
	Residential (<1/8 acre)	0.99		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.22		0.52	15%
TOTAL C1		4.24					
C2	Landscape/Lawn	0.50		0.15		0.50	0
	Residential (<1/8 acre)	0.33		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.27		0.54	26%
TOTAL C2		0.83					
C3	Landscape/Lawn	0.74		0.15		0.50	0
	Residential (<1/8 acre)	0.66		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.29		0.54	31%
TOTAL C3		1.40					
C4	Landscape/Lawn	0.11		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 C4		0.11					
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		55.15		0.38		0.57	50.2%
ONSITE TO NORTH POND		37.58					52.0%
OFFSITE BASINS TO NORTH POND		95.57					36.3%
TOTAL TO NORTH POND		133.15					40.7%
AREA TO SOUTH POND		10.99					62.5%

PROJECT INFORMATION

PROJECT: Windermere
 PROJECT NO: 21187-01
 DESIGN BY: SBN
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/8/2021



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 _s	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	1.56	100	12	12.0	5.3	20	5	25.0	15.5	0.0					5.3	5	5.3
	8	0.61	0.71	13.59																18.7
A2	B	0.45	0.59	4.61	100	5	5.1	7.1	1051	21	2.0	8.3	2.1					9.2	5	9.2
A3		0.56	0.67	2.18	35	1	3.5	4.0	600	16	2.6	9.4	1.1					5.0	5	5.0
	C	0.56	0.67	20.38										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	21.39										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	3.73	100	3	3.0	8.4	790	32	4.0	11.7	1.1					9.6	5	9.6
	F	0.53	0.65	27.10										90	3.5	14.3	0.1	20.4	5	20.4
A7	G	0.45	0.59	1.56	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	6.38										300	1.0	5.9	0.9	8.1	5	8.1
	K	0.52	0.64	33.48										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	37.48										115	1.0	9.3	0.2	21.0	5	21.0
A11		0.45	0.59	2.67	40	1	1.5	6.7	945	40	4.2	12.0	1.3					8.0	5	8.0
	M	0.51	0.63	40.15										35	1.0	9.3	0.1	21.1	5	21.1
A12		0.21	0.52	9.46	100	30	29.6	5.4	1005	18	1.8	8.3	2.0					7.4	5	7.4
	N	0.45	0.61	49.61					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	4.00	100	5	5.3	7.0	825	21	2.5	9.3	1.5					8.4	5	8.4
B4		0.15	0.50	0.43	85	24	28.5	5.4	75	4	5.3	14.3	0.1					5.5	5	5.5
	R	0.44	0.59	10.99					75	4	5.3	14.3	0.1	70	25.0	29.3	0.0	8.6	5	8.6
C2		0.27	0.54	0.83	60	12	20.0	4.4	455	15	3.3	5.6	1.3					5.8	5	5.8

	S	0.46	0.67	1.36										105	2.0	8.3	0.2	8.8	5	8.8
C1	T	0.22	0.52	4.24	100	13	13.0	7.0	90	7	7.8	8.7	0.2					7.2	5	7.2
C3	U	0.29	0.54	1.40	100	5	5.5	8.6	75	2	2.1	4.5	0.3					8.9	5	8.9
C4	V	0.15	0.50	0.11	35	6	15.9	4.2										4.2	5	5.0
NC2	19	0.55	0.72	3.01					625	25	4.0	11.7	0.9					9.7	5	9.7
	J1	0.52	0.71	4.37										90	2	6.83	0.2	10.0	5	10.0
NC1		0.85	0.93	0.43	45	1	2.2	2.4	185	4	2.2	8.7	0.4					0.4	5	5.0
	20	0.55	0.73	4.80										45	2	9.60	0.1	10.0	5	10.0

PROJECT INFORMATION

PROJECT: Windermere
 PROJECT NO: 21187-01
 DESIGN BY: SBN
 REV. BY: TDM
 AGENCY: El Paso County
 REPORT TYPE: Final
 DATE: 3/8/2021

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED		RUNOFF		5 YR STORM			
BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF		C * A	I (IN/HR)	Q (CFS)
			RUNOFF COEFF	t _c (MIN)			
A1	A	1.56	0.45	5.3	0.70	5.02	3.5
	8	13.59	0.61	18.7	8.33	3.12	26.0
A2	B	4.61	0.45	9.2	2.07	4.23	8.8
A3		2.18	0.56	5.0	1.22	5.10	6.2
	C	20.38	0.56	20.1	11.38	3.01	34.2
A4		1.01	0.45	12.4	0.45	3.76	1.7
	D	21.39	0.55	20.3	11.84	2.99	35.4
A5	E	1.98	0.45	6.0	0.89	4.85	4.3
A6		3.73	0.45	9.6	1.68	4.17	7.0
	F	27.10	0.53	20.4	14.41	2.98	43.0
A7	G	1.56	0.45	9.1	0.70	4.26	3.0
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	6.38	0.45	8.1	2.87	4.42	12.7
	K	33.48	0.52	20.8	17.28	2.96	51.1
A10		4.00	0.45	9.7	1.80	4.16	7.5
	L	37.48	0.51	21.0	19.08	2.94	56.1
A11		2.67	0.45	8.0	1.20	4.45	5.3
	M	40.15	0.51	21.1	20.28	2.94	59.5
A12		9.46	0.21	7.4	2.01	4.56	9.2
	N	49.61	0.45	21.8	22.29	2.88	175.6
North Pond Release							1.8
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	4.00	0.45	8.4	1.80	4.36	7.9
B4		0.43	0.15	5.5	0.06	4.99	0.3
	R	10.99	0.44	8.6	4.82	4.34	20.9
South Pond Release							0.3
C2		0.83	0.27	5.8	0.22	4.91	1.1
	S						10.3
C1		4.24	0.22	7.2	0.93	4.61	4.3
	T						191.1
C3	U	1.40	0.29	8.9	0.41	4.29	1.8
C4	V	0.11	0.15	5.0	0.02	5.10	0.1
NC2	19	3.01	0.55	9.7	1.65	4.14	6.9
	J1	4.37	0.52	10.0	2.29	4.11	19.7
NC1		0.43	0.85	5.0	0.36	5.10	1.9
	20	4.80	0.55	10.0	2.65	4.09	21.2

PROJECT INFORMATION

PROJECT: Windermere
 PROJECT NO: 21187-01
 DESIGN BY: SBN
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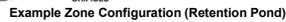


RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED		RUNOFF		100 YR STORM		P1=		2.67			
BASIN (S)	DESIGN POINT	AREA (AC)	DIRECT RUNOFF		C * A	I (IN/HR)	Q (CFS)	PIPE SIZING			
			RUNOFF COEFF	t _c (MIN)				n	Slope (ft/ft)	Calculated Pipe Dia (ft)	Used Pipe (in)
A1	A	1.56	0.59	5.3	0.92	8.94	8.2				
	8	13.59	0.71	18.7	9.68	5.55	53.7	0.016	0.005	3.4	36
A2	B	4.61	0.59	9.2	2.72	7.54	20.5	0.016	0.01	2.1	24
A3		2.18	0.67	5.0	1.46	9.08	13.3				
	C	20.38	0.67	20.1	13.69	5.35	73.3	0.016	0.04	2.6	36
A4		1.01	0.59	12.4	0.60	6.69	4.0				
	D	21.39	0.67	20.3	14.28	5.32	76.0	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		3.73	0.59	9.6	2.20	7.43	16.3				
	F	27.10	0.65	20.4	17.65	5.31	93.7	0.016	0.035	2.9	36
A7	G	1.56	0.59	9.1	0.92	7.57	7.0	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	6.38	0.59	8.1	3.76	7.87	29.6	0.016	0.009	2.3	30
	K	33.48	0.64	20.8	21.42	5.26	112.7	0.016	0.01	3.9	48
A10		4.00	0.59	9.7	2.36	7.40	17.5				
	L	37.48	0.63	21.0	23.78	5.23	124.4	0.016	0.01	4.1	48
A11		2.67	0.59	8.0	1.58	7.91	12.5				
	M	40.15	0.63	21.1	25.35	5.23	132.5	0.016	0.035	3.3	48
A12		9.46	0.52	7.4	4.91	8.12	39.9				
	N	49.61	0.61	21.8	30.26	5.13	355.1				
North Pond Release							66.0	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	4.00	0.59	8.4	2.36	7.77	18.3	0.016	0.25	0.9	24
B4		0.43	0.50	5.5	0.22	8.88	1.9				
	R	10.99	0.59	8.6	6.45	7.73	49.8				
South Pond Release							5.3	0.016	0.02	1.1	18
C2		0.83	0.54	5.8	0.44	8.74	3.9				
	S						27.2	0.016	0.005	2.7	24
C1		4.24	0.52	7.2	2.21	8.20	18.1				
	T						684.1				
C3	U	1.40	0.54	8.9	0.76	7.63	5.8				
C4	V	0.11	0.50	5.0	0.06	9.09	0.5				
NC2	19	3.01	0.72	9.7	2.18	7.37	16.1				
	J1	4.37	0.71	10.0	3.09	7.31	49.8				
NC1		0.43	0.93	5.0	0.40	9.09	3.6				
	20	4.80	0.73	10.0	3.49	7.29	52.6				

MHFD-Detention, Version 4.03 (May 2020)

Basin ID:



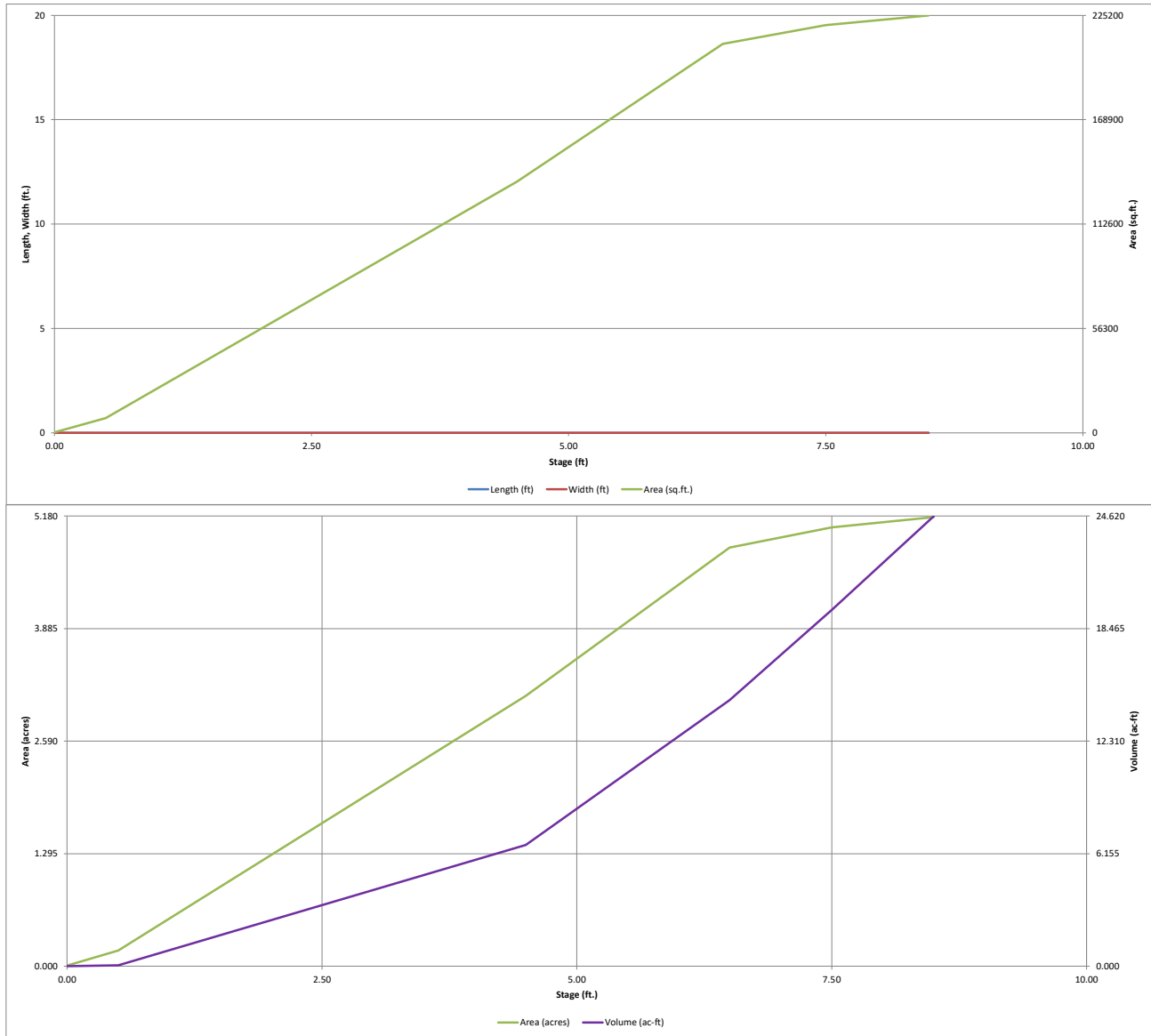
	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.49	inches

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

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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

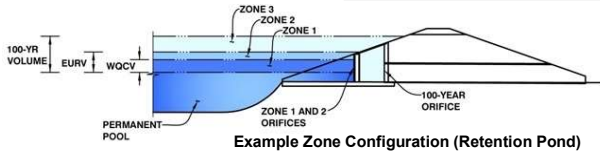


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere North - INTERIM**

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.33	1.602	Orifice Plate
Zone 2 (EURV)	3.39	2.019	Orifice Plate
Zone 3 (100-year)	4.61	3.329	Weir&Pipe (Circular)
Total (all zones)		6.950	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = _____ ft²
Underdrain Orifice Centroid = _____ 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 = 4.26 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 17.00 inches
Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate
WQ Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	1.42	2.84					
Orifice Area (sq. inches)	9.85	8.00	4.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected
Invert of Vertical Orifice =	N/A	N/A
Depth at top of Zone using Vertical Orifice =	N/A	N/A
Vertical Orifice Diameter =	N/A	N/A

ft (relative to basin bottom at Stage = 0 ft)
ft (relative to basin bottom at Stage = 0 ft)
inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = N/A ft²
Vertical Orifice Centroid = N/A feet

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

	Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, H _o =	4.30	N/A
Overflow Weir Front Edge Length =	6.75	N/A
Overflow Weir Grate Slope =	0.00	N/A
Horiz. Length of Weir Sides =	6.75	N/A
Overflow Grate Open Area % =	70%	N/A
Debris Clogging % =	50%	N/A

ft (relative to basin bottom at Stage = 0 ft)
feet
H:V
feet
%, grate open area/total area
%

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_u = 4.30 feet
Overflow Weir Slope Length = 6.75 feet
Grate Open Area / 100-yr Orifice Area = 4.51
Overflow Grate Open Area w/o Debris = 31.89 ft²
Overflow Grate Open Area w/ Debris = 15.95 ft²

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 =	0.00	N/A
Circular Orifice Diameter =	36.00	N/A

ft (distance below basin bottom at Stage = 0 ft)
inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = 7.07 ft²
Outlet Orifice Centroid = 1.50 feet
Half-Central Angle of Restrictor Plate on Pipe = N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 6.00 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 70.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.92 feet
Stage at Top of Freeboard = 7.92 feet
Basin Area at Top of Freeboard = 5.10 acres
Basin Volume at Top of Freeboard = 21.63 acre-ft

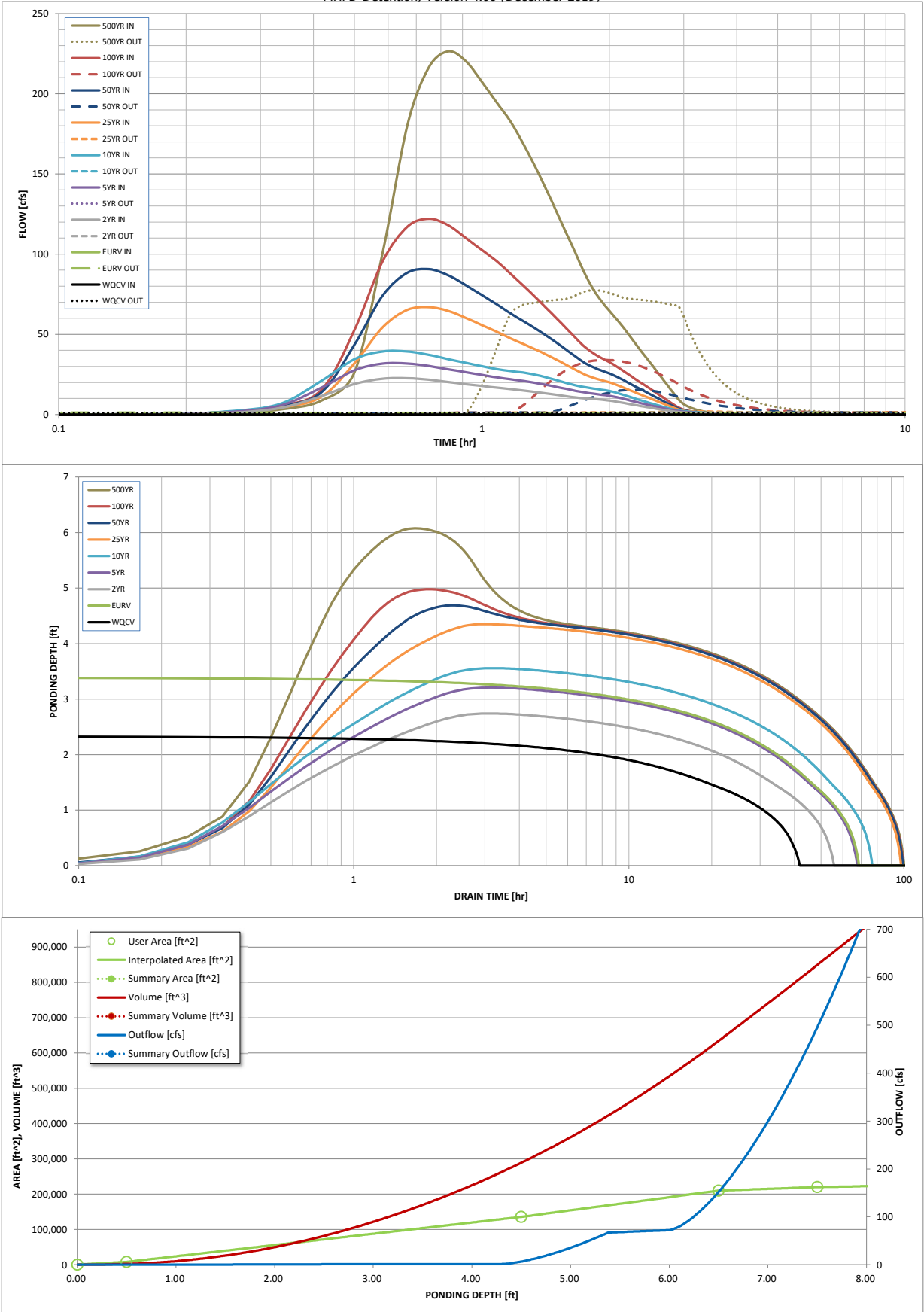
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
One-Hour Rainfall Depth (in) =	1.602	3.621	2.490	3.458	4.288	6.502	8.568	11.344	21.093
CUHP Runoff Volume (acre-ft) =	N/A	N/A	2.490	3.458	4.288	6.502	8.568	11.344	21.093
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.8	1.5	2.2	19.7	39.5	65.5	155.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.30	0.49	1.17
Peak Inflow Q (cfs) =	N/A	N/A	22.7	31.8	39.4	67.0	90.6	122.0	226.5
Peak Outflow Q (cfs) =	0.8	1.1	0.9	1.0	1.1	2.0	15.5	34.0	77.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.5	0.1	0.4	0.5	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.4	1.0	2.2
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	63	51	62	70	88	87	85	77
Time to Drain 99% of Inflow Volume (hours) =	40	66	54	65	74	93	94	93	90
Maximum Ponding Depth (ft) =	2.33	3.39	2.74	3.21	3.56	4.35	4.69	4.98	6.08
Area at Maximum Ponding Depth (acres) =	1.52	2.30	1.82	2.16	2.42	3.00	3.26	3.51	4.45
Maximum Volume Stored (acre-ft) =	1.606	3.631	2.292	3.208	4.008	6.175	7.207	8.190	12.569

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.54
	0:15:00	0.00	0.00	0.91	1.47	1.84	1.25	1.65	1.55	3.11
	0:20:00	0.00	0.00	4.01	5.49	6.58	4.24	5.09	5.31	8.55
	0:25:00	0.00	0.00	11.35	16.56	20.89	10.88	13.63	15.09	26.20
	0:30:00	0.00	0.00	19.01	27.62	34.57	31.94	43.54	52.69	101.40
	0:35:00	0.00	0.00	22.34	31.76	39.35	54.51	74.24	95.73	180.28
	0:40:00	0.00	0.00	22.67	31.80	39.30	65.22	88.41	117.03	216.70
	0:45:00	0.00	0.00	21.69	30.22	37.20	66.95	90.60	122.02	226.46
	0:50:00	0.00	0.00	20.22	28.16	34.50	64.58	86.76	117.96	220.31
	0:55:00	0.00	0.00	18.92	26.36	32.21	60.23	80.57	110.01	207.40
	1:00:00	0.00	0.00	17.79	24.71	30.16	55.72	74.38	102.45	194.54
	1:05:00	0.00	0.00	16.78	23.16	28.33	51.68	68.76	95.67	182.97
	1:10:00	0.00	0.00	15.87	22.02	27.12	47.60	63.18	87.96	169.18
	1:15:00	0.00	0.00	14.98	20.96	26.16	44.06	58.40	80.56	155.02
	1:20:00	0.00	0.00	14.07	19.77	24.92	40.80	53.91	73.59	140.87
	1:25:00	0.00	0.00	13.17	18.50	23.28	37.54	49.41	66.69	126.60
	1:30:00	0.00	0.00	12.26	17.21	21.46	34.22	44.85	60.06	113.04
	1:35:00	0.00	0.00	11.39	15.97	19.68	30.95	40.37	53.70	100.08
	1:40:00	0.00	0.00	10.61	14.71	18.06	27.79	36.03	47.60	87.87
	1:45:00	0.00	0.00	10.07	13.73	17.01	24.91	32.14	42.14	77.98
	1:50:00	0.00	0.00	9.70	12.98	16.23	22.90	29.47	38.25	70.70
	1:55:00	0.00	0.00	9.23	12.31	15.48	21.39	27.41	35.28	64.65
	2:00:00	0.00	0.00	8.66	11.64	14.65	20.07	25.63	32.67	59.23
	2:05:00	0.00	0.00	7.94	10.73	13.48	18.47	23.52	29.86	53.65
	2:10:00	0.00	0.00	7.13	9.65	12.09	16.67	21.21	26.86	47.92
	2:15:00	0.00	0.00	6.34	8.58	10.73	14.89	18.92	23.95	42.40
	2:20:00	0.00	0.00	5.59	7.56	9.43	13.17	16.70	21.16	37.17
	2:25:00	0.00	0.00	4.89	6.60	8.21	11.54	14.61	18.52	32.19
	2:30:00	0.00	0.00	4.24	5.70	7.07	9.99	12.59	15.97	27.34
	2:35:00	0.00	0.00	3.61	4.85	6.00	8.48	10.64	13.46	22.58
	2:40:00	0.00	0.00	3.01	4.03	4.98	7.02	8.74	11.00	17.92
	2:45:00	0.00	0.00	2.45	3.26	4.02	5.63	6.91	8.61	13.41
	2:50:00	0.00	0.00	1.94	2.56	3.16	4.30	5.17	6.32	9.23
	2:55:00	0.00	0.00	1.54	2.03	2.54	3.10	3.61	4.26	6.44
	3:00:00	0.00	0.00	1.27	1.68	2.12	2.30	2.66	3.01	4.71
	3:05:00	0.00	0.00	1.07	1.42	1.80	1.80	2.07	2.28	3.50
	3:10:00	0.00	0.00	0.91	1.20	1.52	1.46	1.67	1.76	2.62
	3:15:00	0.00	0.00	0.78	1.02	1.29	1.19	1.35	1.38	1.97
	3:20:00	0.00	0.00	0.66	0.86	1.09	0.99	1.12	1.09	1.47
	3:25:00	0.00	0.00	0.56	0.72	0.91	0.81	0.91	0.85	1.10
	3:30:00	0.00	0.00	0.46	0.60	0.75	0.66	0.74	0.67	0.86
	3:35:00	0.00	0.00	0.38	0.49	0.61	0.54	0.60	0.55	0.69
	3:40:00	0.00	0.00	0.31	0.39	0.48	0.44	0.48	0.44	0.55
	3:45:00	0.00	0.00	0.25	0.31	0.38	0.35	0.38	0.36	0.43
	3:50:00	0.00	0.00	0.19	0.24	0.30	0.27	0.29	0.28	0.33
	3:55:00	0.00	0.00	0.14	0.18	0.22	0.20	0.22	0.21	0.24
	4:00:00	0.00	0.00	0.10	0.13	0.16	0.15	0.16	0.15	0.16
	4:05:00	0.00	0.00	0.07	0.09	0.11	0.10	0.11	0.10	0.10
	4:10:00	0.00	0.00	0.04	0.05	0.07	0.06	0.06	0.06	0.05
	4:15:00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.02
	4:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

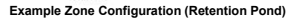
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

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

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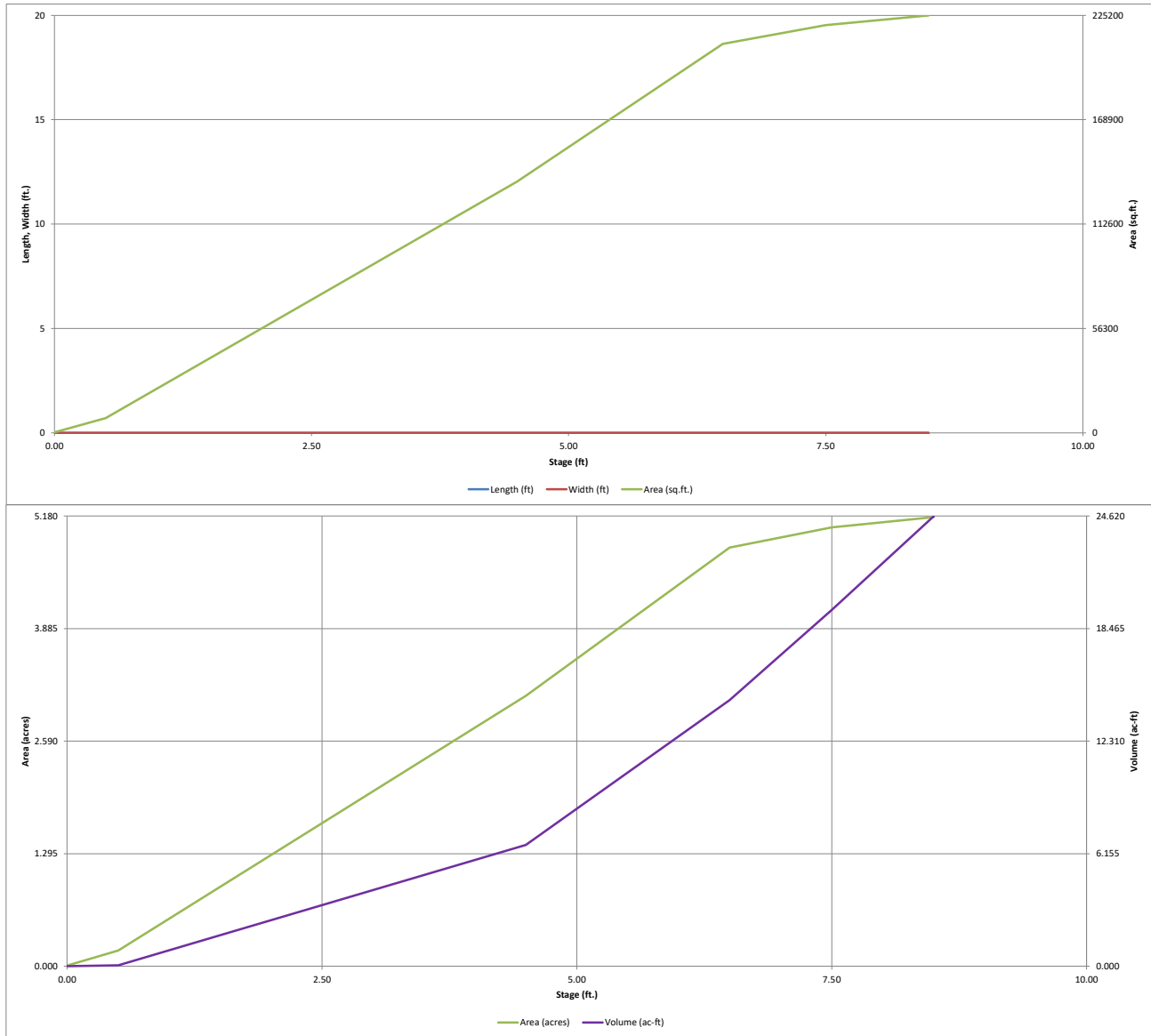
MHFD-Detention, Version 4.03 (May 2020)

Basin ID:



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

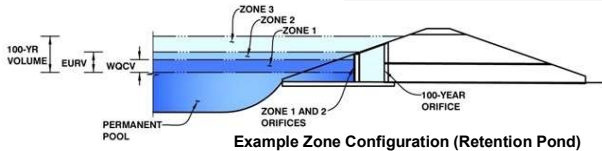


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere North**

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.59	2.016	Orifice Plate
Zone 2 (EURV)	4.26	3.883	Orifice Plate
Zone 3 (100-year)	5.45	4.043	Weir&Pipe (Circular)
Total (all zones)		9.941	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = _____ ft²
Underdrain Orifice Centroid = _____ 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 = 4.26 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 17.00 inches
Orifice Plate: Orifice Area per Row = 11.00 sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row = 7.639E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	1.42	2.84					
Orifice Area (sq. inches)	11.00	11.00	11.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = _____ ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = _____ ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = _____ inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = _____ ft²
Vertical Orifice Centroid = _____ feet

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

Overflow Weir Front Edge Height, H_o = 4.30 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 6.75 feet
Overflow Weir Grate Slope = 0.00 H:V
Horiz. Length of Weir Sides = 6.75 feet
Overflow Grate Open Area % = 70%
Debris Clogging % = 50%

Height of Grate Upper Edge, H_u = 4.30 feet
Overflow Weir Slope Length = 6.75 feet
Grate Open Area / 100-yr Orifice Area = 4.51
Overflow Grate Open Area w/o Debris = 31.89 ft²
Overflow Grate Open Area w/ Debris = 15.95 ft²

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

Depth to Invert of Outlet Pipe = 0.00 ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter = 36.00 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = 7.07 ft²
Outlet Orifice Centroid = 1.50 feet
Half-Central Angle of Restrictor Plate on Pipe = N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 6.00 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 70.00 feet
Spillway End Slopes = 4:00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = 0.92 feet
Stage at Top of Freeboard = 7.92 feet
Basin Area at Top of Freeboard = 5.10 acres
Basin Volume at Top of Freeboard = 21.63 acre-ft

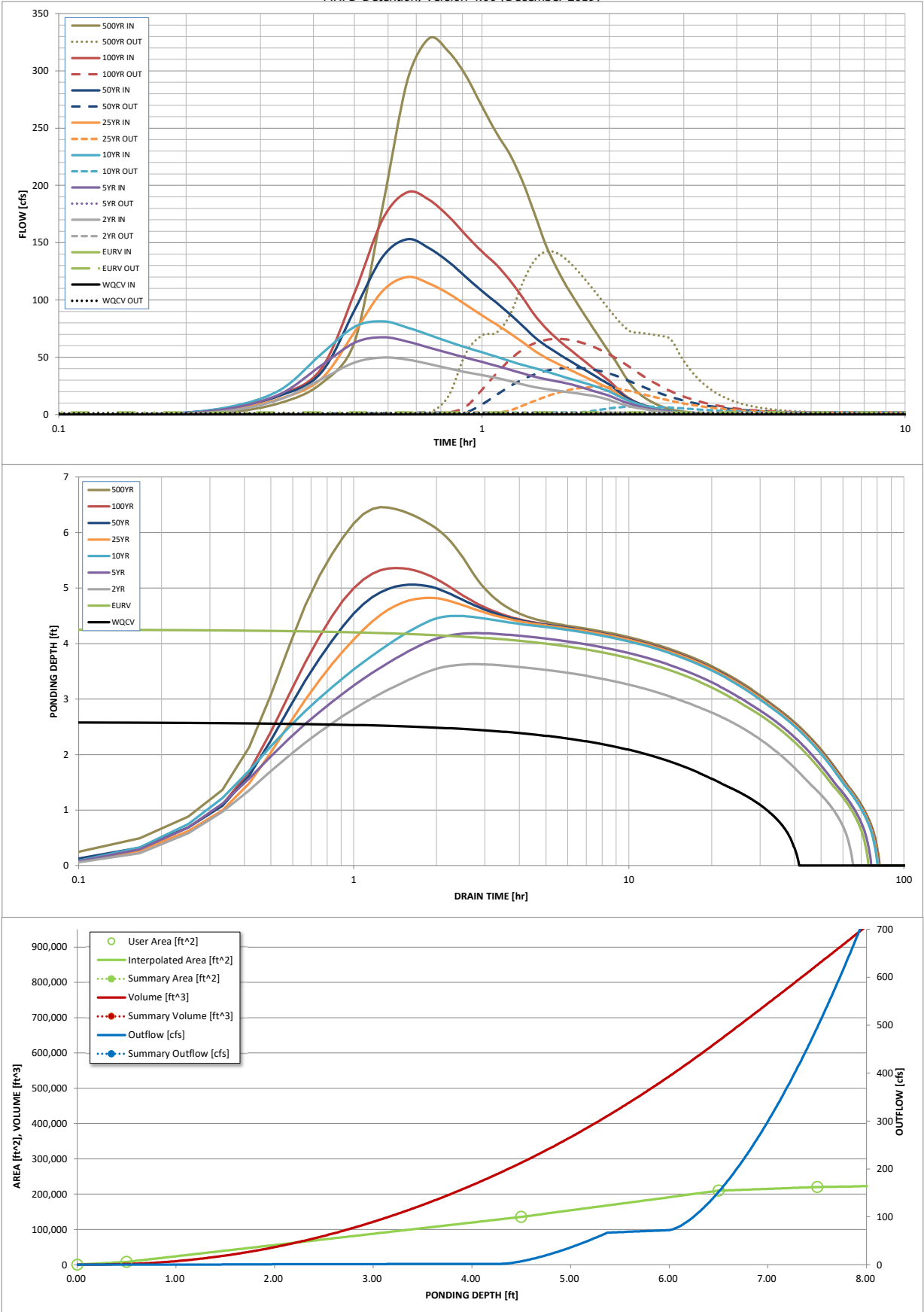
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
One-Hour Rainfall Depth (in) =	2.016	5.899	4.497	6.048	7.280	9.553	11.773	14.673	24.739
CUHP Runoff Volume (acre-ft) =	N/A	N/A	4.497	6.048	7.280	9.553	11.773	14.673	24.739
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.8	1.5	2.2	19.7	39.5	65.5	155.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.30	0.49	1.17
Peak Inflow Q (cfs) =	N/A	N/A	49.7	67.5	81.3	119.9	153.1	194.1	328.3
Peak Outflow Q (cfs) =	1.0	1.8	1.6	1.8	7.1	24.1	40.8	66.0	142.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	3.3	1.2	1.0	1.0	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	0.7	1.2	2.0	2.3
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	66	59	68	71	69	67	65	58
Time to Drain 99% of Inflow Volume (hours) =	40	71	63	73	76	76	75	74	71
Maximum Ponding Depth (ft) =	2.59	4.26	3.63	4.19	4.50	4.82	5.06	5.36	6.46
Area at Maximum Ponding Depth (acres) =	1.71	2.94	2.47	2.88	3.10	3.38	3.59	3.84	4.77
Maximum Volume Stored (acre-ft) =	2.027	5.908	4.179	5.675	6.602	7.673	8.510	9.625	14.322

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.04	1.79
	0:15:00	0.00	0.00	3.08	5.00	6.25	4.23	5.56	5.23	10.12
	0:20:00	0.00	0.00	13.14	17.90	21.44	13.80	16.49	17.30	26.88
	0:25:00	0.00	0.00	30.66	42.63	52.55	30.88	36.34	39.63	63.05
	0:30:00	0.00	0.00	45.29	62.58	76.42	71.90	90.87	105.93	182.48
	0:35:00	0.00	0.00	49.73	67.51	81.32	107.92	137.85	170.57	291.56
	0:40:00	0.00	0.00	47.91	63.71	75.93	119.95	153.06	194.08	328.34
	0:45:00	0.00	0.00	44.07	58.40	69.54	114.40	145.18	187.45	316.92
	0:50:00	0.00	0.00	40.20	53.69	63.58	105.69	133.45	173.09	295.78
	0:55:00	0.00	0.00	36.96	49.53	58.54	95.83	120.06	156.63	269.02
	1:00:00	0.00	0.00	34.36	45.90	54.36	86.58	107.86	142.18	245.44
	1:05:00	0.00	0.00	31.94	42.41	50.36	78.54	97.42	130.44	226.56
	1:10:00	0.00	0.00	29.07	39.07	46.52	70.75	87.32	116.74	202.55
	1:15:00	0.00	0.00	26.20	35.81	43.15	62.99	77.18	101.65	174.91
	1:20:00	0.00	0.00	23.94	33.02	40.41	55.46	67.36	86.68	147.99
	1:25:00	0.00	0.00	22.32	30.87	37.66	49.65	60.11	75.37	128.19
	1:30:00	0.00	0.00	20.99	29.03	34.83	44.84	54.08	66.61	112.29
	1:35:00	0.00	0.00	19.78	27.32	32.19	40.54	48.71	59.23	98.82
	1:40:00	0.00	0.00	18.61	25.24	29.74	36.55	43.71	52.56	86.64
	1:45:00	0.00	0.00	17.44	22.91	27.40	32.88	39.08	46.30	75.30
	1:50:00	0.00	0.00	16.27	20.63	25.12	29.34	34.59	40.27	64.48
	1:55:00	0.00	0.00	14.58	18.46	22.72	25.91	30.27	34.55	54.33
	2:00:00	0.00	0.00	12.67	16.36	20.15	22.71	26.24	29.27	45.03
	2:05:00	0.00	0.00	10.49	13.70	16.81	18.57	21.17	23.09	34.65
	2:10:00	0.00	0.00	8.50	11.14	13.76	14.27	16.13	17.24	25.81
	2:15:00	0.00	0.00	6.92	9.08	11.30	11.13	12.53	13.11	19.56
	2:20:00	0.00	0.00	5.68	7.45	9.30	8.91	10.00	10.25	15.09
	2:25:00	0.00	0.00	4.66	6.10	7.63	7.17	8.02	8.04	11.62
	2:30:00	0.00	0.00	3.81	4.99	6.23	5.77	6.44	6.31	8.96
	2:35:00	0.00	0.00	3.09	4.06	5.04	4.63	5.16	4.92	6.83
	2:40:00	0.00	0.00	2.48	3.26	4.02	3.67	4.08	3.80	5.17
	2:45:00	0.00	0.00	2.00	2.59	3.18	2.89	3.20	2.95	3.99
	2:50:00	0.00	0.00	1.61	2.04	2.51	2.27	2.51	2.33	3.13
	2:55:00	0.00	0.00	1.29	1.62	1.99	1.81	2.00	1.87	2.52
	3:00:00	0.00	0.00	1.01	1.27	1.56	1.43	1.58	1.48	1.98
	3:05:00	0.00	0.00	0.77	0.96	1.20	1.10	1.21	1.14	1.51
	3:10:00	0.00	0.00	0.56	0.71	0.89	0.82	0.90	0.84	1.10
	3:15:00	0.00	0.00	0.39	0.50	0.62	0.58	0.63	0.59	0.76
	3:20:00	0.00	0.00	0.25	0.33	0.40	0.38	0.41	0.38	0.48
	3:25:00	0.00	0.00	0.14	0.20	0.23	0.22	0.24	0.22	0.26
	3:30:00	0.00	0.00	0.06	0.11	0.11	0.11	0.11	0.10	0.11
	3:35:00	0.00	0.00	0.02	0.04	0.03	0.03	0.03	0.03	0.02
	3:40:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

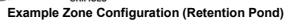
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

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

[illegible]

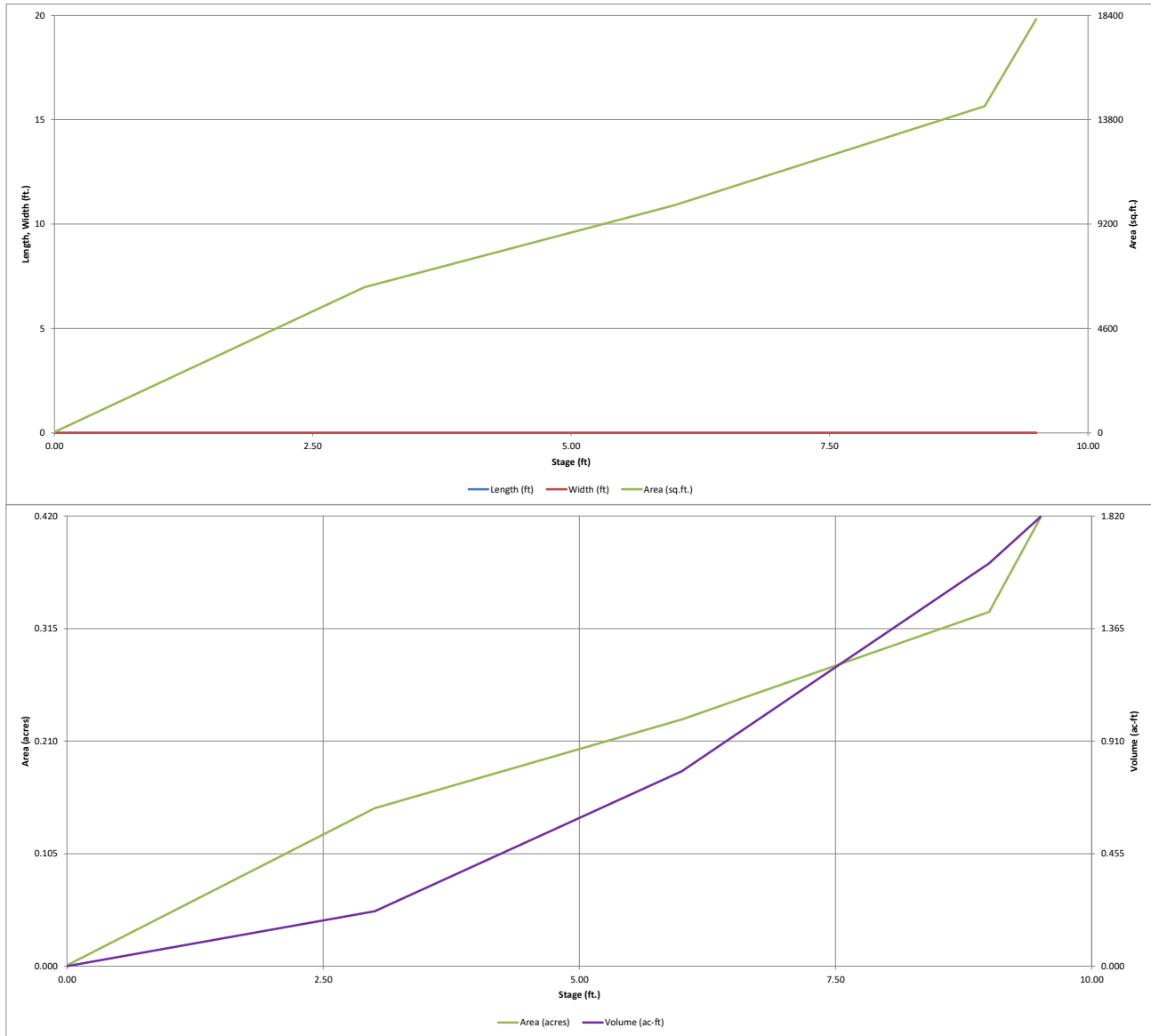
MHFD-Detention, Version 4.03 (May 2020)

Basin ID:



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

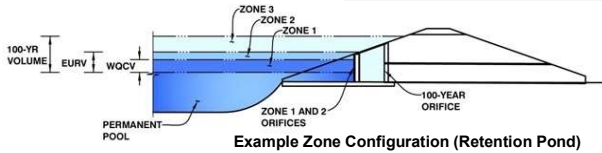


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere South - INTERIM**

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.17	0.117	Orifice Plate
Zone 2 (EURV)	3.09	0.118	Orifice Plate
Zone 3 (100-year)	4.57	0.251	Weir&Pipe (Circular)
Total (all zones)		0.486	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = _____ ft²
Underdrain Orifice Centroid = _____ 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 = 3.09 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 12.40 inches
Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate
WQ Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	1.03	2.06					
Orifice Area (sq. inches)	0.70	0.70	0.70					

	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)

Invert of Vertical Orifice = _____ ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = _____ ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = _____ inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = _____ ft²
Vertical Orifice Centroid = _____ feet

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

Overflow Weir Front Edge Height, H_o = 6.75 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 3.00 feet
Overflow Weir Grate Slope = 0.00 H:V
Horiz. Length of Weir Sides = 3.00 feet
Overflow Grate Open Area % = 70%
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_u = 6.75 feet
Overflow Weir Slope Length = 3.00 feet
Grate Open Area / 100-yr Orifice Area = 2.01
Overflow Grate Open Area w/o Debris = 6.30 ft²
Overflow Grate Open Area w/ Debris = 3.15 ft²

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

Depth to Invert of Outlet Pipe = 2.83 ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter = 24.00 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = 3.14 ft²
Outlet Orifice Centroid = 1.00 feet
Half-Central Angle of Restrictor Plate on Pipe = N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 7.65 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 15.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.45 feet
Stage at Top of Freeboard = 9.10 feet
Basin Area at Top of Freeboard = 0.35 acres
Basin Volume at Top of Freeboard = 1.66 acre-ft

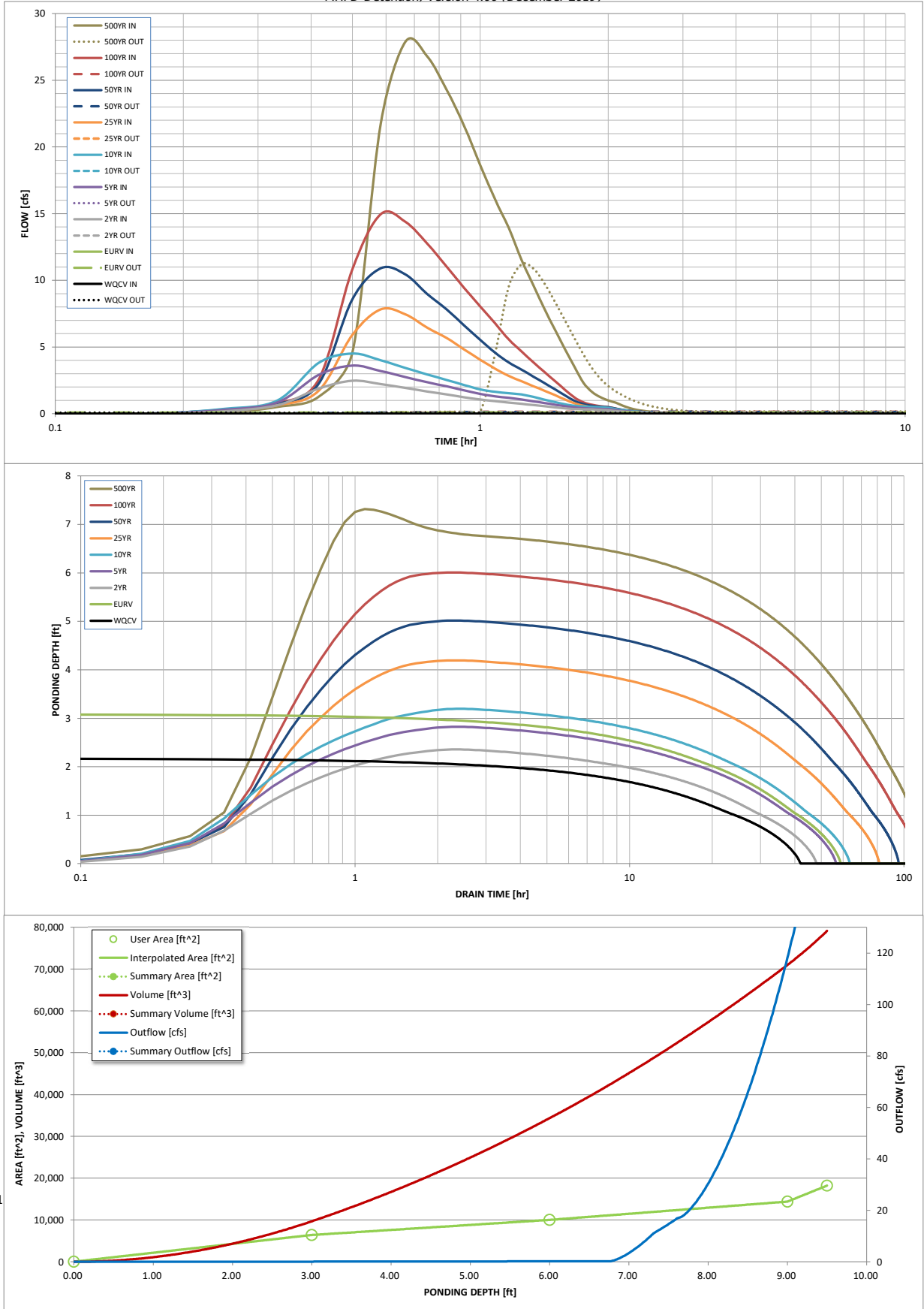
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
One-Hour Rainfall Depth (in) =	0.117	0.235	0.150	0.212	0.269	0.438	0.598	0.816	1.585
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.150	0.212	0.269	0.438	0.598	0.816	1.585
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.3	0.3	3.1	5.9	9.6	21.6
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.28	0.54	0.87	1.97
Peak Inflow Q (cfs) =	N/A	N/A	2.5	3.6	4.5	7.8	10.9	15.0	27.9
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	11.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.3	0.0	0.0	0.0	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Weir
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.8
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	52	43	50	56	70	82	96	102
Time to Drain 99% of Inflow Volume (hours) =	40	56	46	54	60	77	90	106	115
Maximum Ponding Depth (ft) =	2.18	3.09	2.36	2.82	3.19	4.19	5.02	6.01	7.32
Area at Maximum Ponding Depth (acres) =	0.11	0.15	0.12	0.14	0.15	0.18	0.20	0.23	0.27
Maximum Volume Stored (acre-ft) =	0.118	0.236	0.137	0.197	0.251	0.417	0.574	0.789	1.119

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.10
	0:15:00	0.00	0.00	0.18	0.29	0.36	0.25	0.31	0.30	0.51
	0:20:00	0.00	0.00	0.64	0.84	0.99	0.63	0.73	0.78	1.27
	0:25:00	0.00	0.00	1.88	2.91	3.80	1.71	2.23	2.54	4.60
	0:30:00	0.00	0.00	2.47	3.61	4.51	5.91	8.58	10.83	21.75
	0:35:00	0.00	0.00	2.22	3.20	4.01	7.82	10.90	14.96	27.90
	0:40:00	0.00	0.00	1.94	2.74	3.43	7.45	10.44	14.37	26.80
	0:45:00	0.00	0.00	1.66	2.36	2.95	6.45	8.97	12.77	24.29
	0:50:00	0.00	0.00	1.44	2.05	2.53	5.68	7.82	11.02	21.57
	0:55:00	0.00	0.00	1.24	1.75	2.15	4.81	6.61	9.43	18.63
	1:00:00	0.00	0.00	1.06	1.48	1.82	4.05	5.53	8.03	16.07
	1:05:00	0.00	0.00	0.94	1.30	1.64	3.38	4.58	6.78	13.93
	1:10:00	0.00	0.00	0.84	1.19	1.53	2.83	3.84	5.57	11.53
	1:15:00	0.00	0.00	0.74	1.06	1.44	2.43	3.31	4.67	9.63
	1:20:00	0.00	0.00	0.65	0.93	1.26	2.06	2.79	3.85	7.85
	1:25:00	0.00	0.00	0.56	0.80	1.06	1.72	2.30	3.12	6.27
	1:30:00	0.00	0.00	0.48	0.68	0.87	1.38	1.82	2.43	4.84
	1:35:00	0.00	0.00	0.40	0.57	0.70	1.06	1.37	1.79	3.50
	1:40:00	0.00	0.00	0.35	0.47	0.59	0.78	0.97	1.21	2.31
	1:45:00	0.00	0.00	0.33	0.42	0.54	0.59	0.72	0.85	1.63
	1:50:00	0.00	0.00	0.32	0.39	0.51	0.50	0.59	0.67	1.24
	1:55:00	0.00	0.00	0.29	0.36	0.48	0.45	0.53	0.56	0.99
	2:00:00	0.00	0.00	0.26	0.34	0.44	0.42	0.48	0.50	0.83
	2:05:00	0.00	0.00	0.20	0.27	0.35	0.33	0.38	0.37	0.60
	2:10:00	0.00	0.00	0.16	0.21	0.27	0.25	0.29	0.27	0.42
	2:15:00	0.00	0.00	0.12	0.16	0.21	0.19	0.22	0.20	0.29
	2:20:00	0.00	0.00	0.09	0.12	0.16	0.14	0.16	0.15	0.21
	2:25:00	0.00	0.00	0.07	0.09	0.12	0.11	0.12	0.12	0.16
	2:30:00	0.00	0.00	0.05	0.07	0.09	0.08	0.09	0.09	0.12
	2:35:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.06	0.09
	2:40:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.07
	2:45:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.05
	2:50:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.03
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	3:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

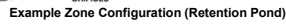
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

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

[illegible]

MHFD-Detention, Version 4.03 (May 2020)

Basin ID:



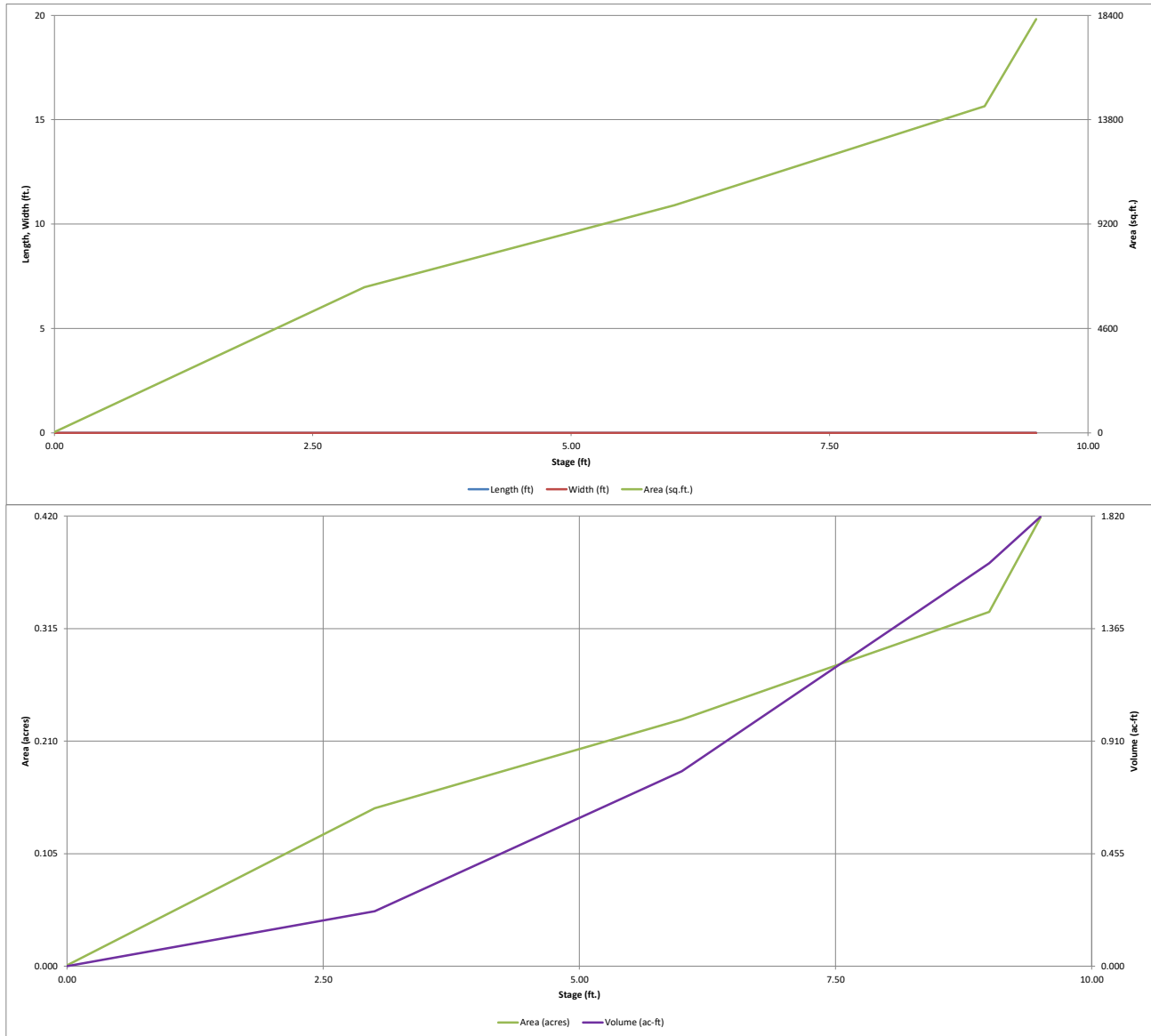
	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.49	inches

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

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

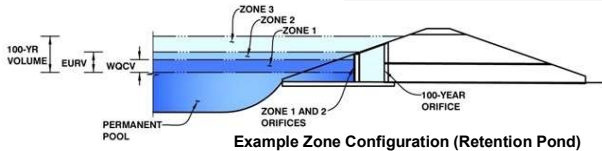


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere South - FINAL**

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.02	0.224	Orifice Plate
Zone 2 (EURV)	6.24	0.619	Orifice Plate
Zone 3 (100-year)	7.84	0.425	Weir&Pipe (Circular)
Total (all zones)		1.269	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 1-5/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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	2.08	4.16					
Orifice Area (sq. inches)	1.33	1.33	1.33					

	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)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Open Area % = %
Debris Clogging % = %

Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area = ft²
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

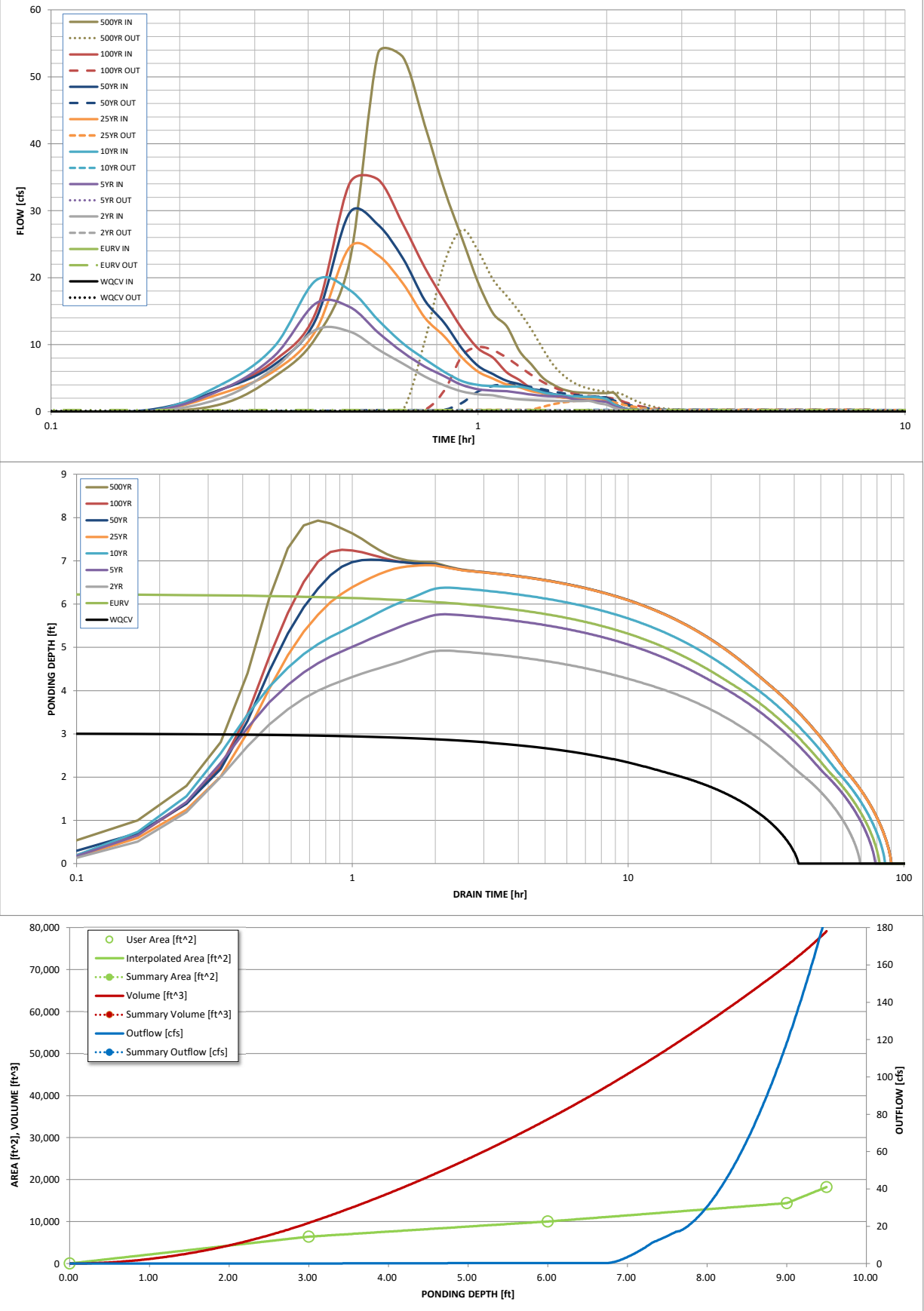
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
One-Hour Rainfall Depth (in) =	0.224	0.844	0.586	0.771	0.918	1.115	1.308	1.545	2.367
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.586	0.771	0.918	1.115	1.308	1.545	2.367
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.3	0.3	3.1	5.9	9.6	21.6
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.28	0.54	0.87	1.97
Peak Inflow Q (cfs) =	N/A	N/A	12.2	16.1	19.6	24.5	29.7	34.7	53.5
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.2	0.3	1.8	4.1	9.6	27.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.8	0.6	0.7	1.0	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.6	1.5	3.1
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	72	62	70	76	79	77	76	70
Time to Drain 99% of Inflow Volume (hours) =	40	78	66	75	81	85	84	84	81
Maximum Ponding Depth (ft) =	3.02	6.24	4.92	5.76	6.38	6.90	7.03	7.26	7.93
Area at Maximum Ponding Depth (acres) =	0.15	0.24	0.20	0.22	0.24	0.26	0.26	0.27	0.29
Maximum Volume Stored (acre-ft) =	0.225	0.845	0.556	0.734	0.879	1.007	1.041	1.103	1.295

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.02	1.13
	0:15:00	0.00	0.00	2.00	3.25	4.03	2.71	3.31	3.30	5.21
	0:20:00	0.00	0.00	6.51	8.34	9.73	6.09	7.01	7.62	10.97
	0:25:00	0.00	0.00	12.20	16.15	19.57	12.07	13.69	14.75	22.40
	0:30:00	0.00	0.00	11.98	15.63	18.17	24.52	29.71	34.07	53.50
	0:35:00	0.00	0.00	9.28	11.84	13.69	23.34	27.89	34.65	52.94
	0:40:00	0.00	0.00	7.18	8.86	10.18	19.12	22.87	27.99	42.83
	0:45:00	0.00	0.00	5.25	6.74	7.87	14.04	16.65	21.53	33.21
	0:50:00	0.00	0.00	3.94	5.29	5.96	11.25	13.27	16.60	25.93
	0:55:00	0.00	0.00	3.02	3.98	4.58	8.10	9.44	12.43	19.32
	1:00:00	0.00	0.00	2.59	3.36	3.99	5.97	6.83	9.44	14.71
	1:05:00	0.00	0.00	2.44	3.14	3.82	4.92	5.60	8.07	12.77
	1:10:00	0.00	0.00	2.05	3.05	3.75	4.06	4.60	5.88	9.06
	1:15:00	0.00	0.00	1.85	2.81	3.73	3.63	4.10	4.70	7.05
	1:20:00	0.00	0.00	1.72	2.54	3.38	3.05	3.43	3.46	5.06
	1:25:00	0.00	0.00	1.66	2.38	2.88	2.75	3.10	2.80	4.02
	1:30:00	0.00	0.00	1.61	2.30	2.59	2.34	2.63	2.37	3.33
	1:35:00	0.00	0.00	1.59	2.24	2.41	2.11	2.37	2.14	2.96
	1:40:00	0.00	0.00	1.58	1.91	2.30	1.98	2.23	2.05	2.84
	1:45:00	0.00	0.00	1.58	1.73	2.24	1.91	2.15	2.01	2.78
	1:50:00	0.00	0.00	1.58	1.62	2.21	1.88	2.11	2.01	2.78
	1:55:00	0.00	0.00	1.25	1.56	2.11	1.86	2.10	2.01	2.78
	2:00:00	0.00	0.00	1.06	1.44	1.86	1.86	2.09	2.01	2.78
	2:05:00	0.00	0.00	0.60	0.82	1.07	1.07	1.20	1.15	1.59
	2:10:00	0.00	0.00	0.34	0.47	0.60	0.61	0.69	0.66	0.91
	2:15:00	0.00	0.00	0.17	0.25	0.32	0.32	0.36	0.35	0.48
	2:20:00	0.00	0.00	0.08	0.13	0.16	0.17	0.19	0.18	0.24
	2:25:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.09
	2:30:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

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

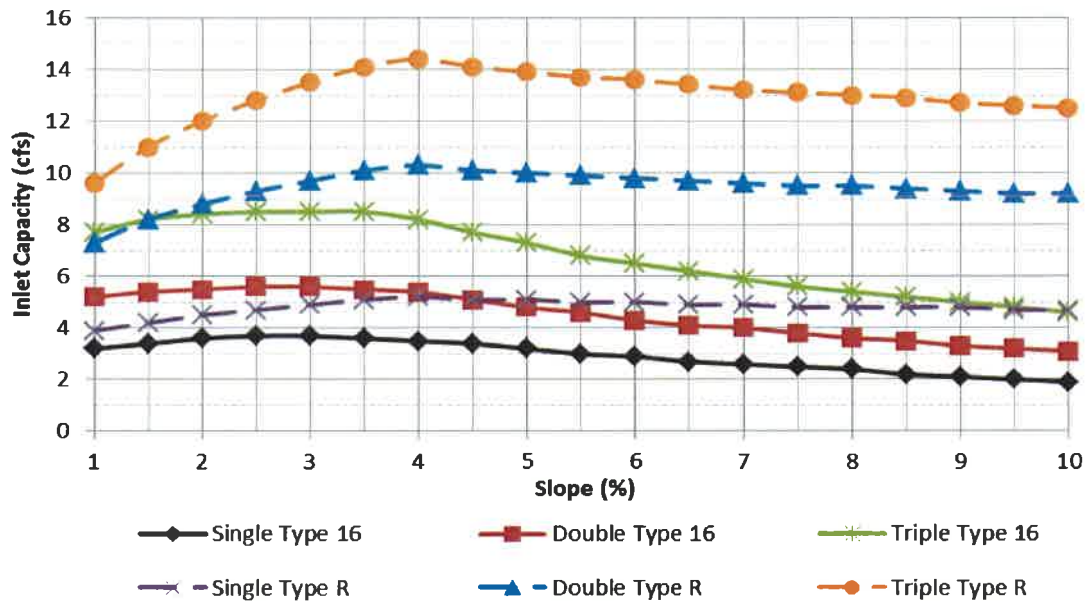
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

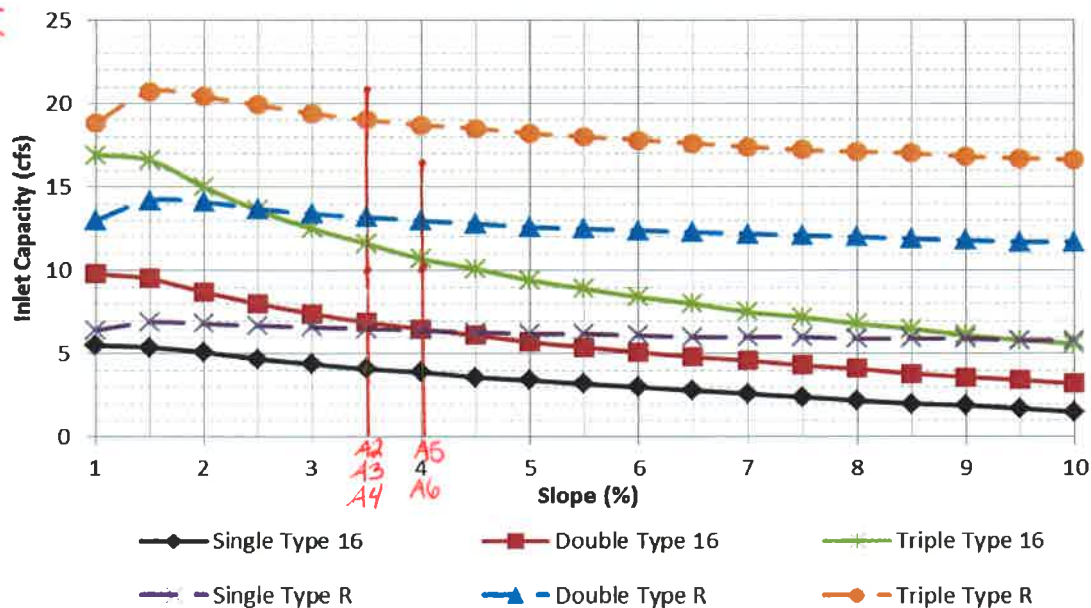
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

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

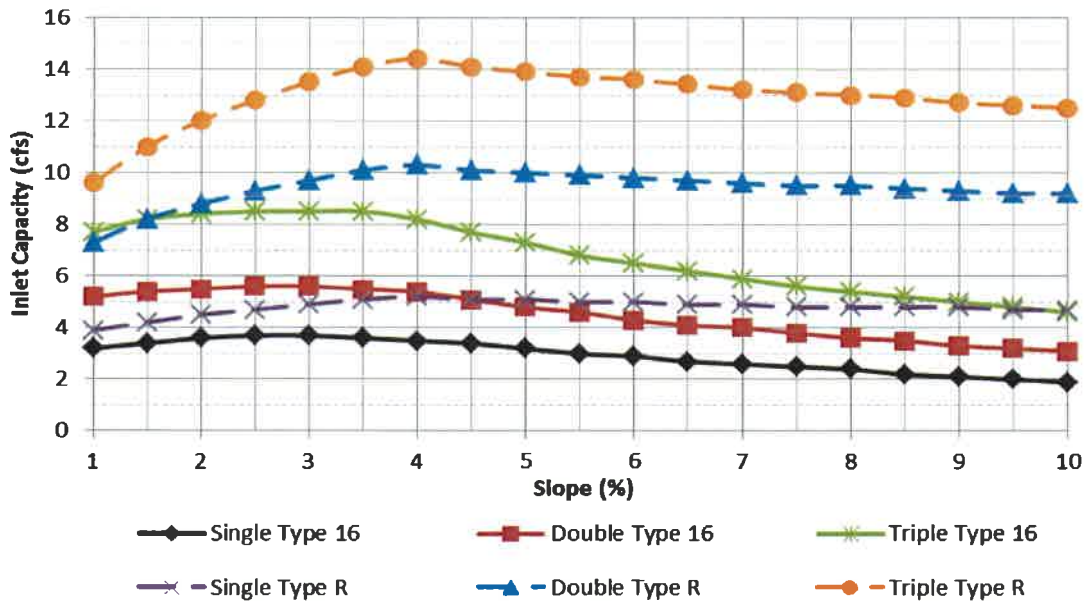


The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow 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.

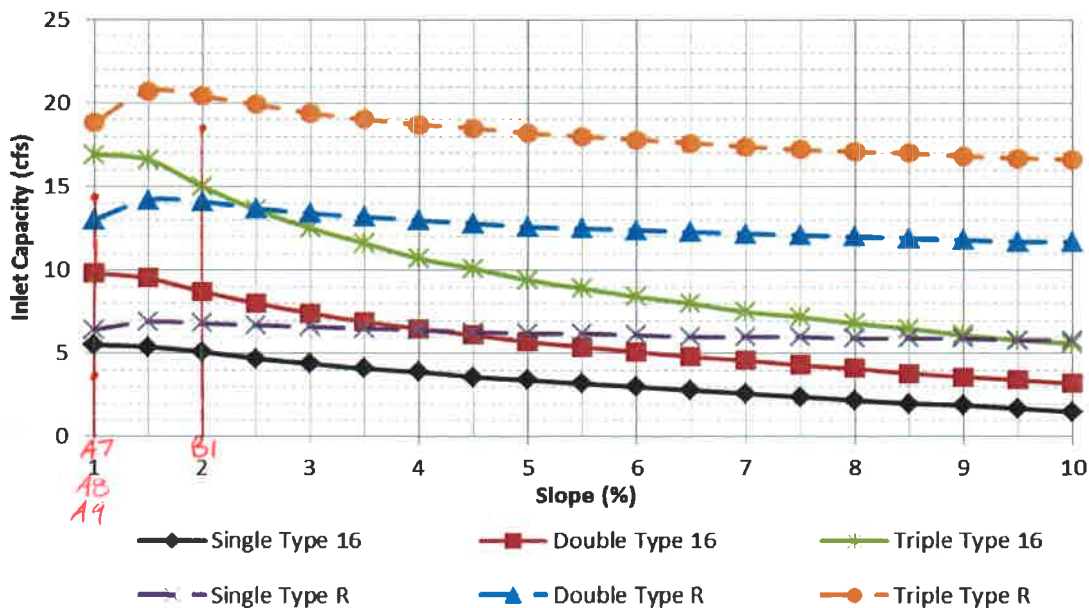
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

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

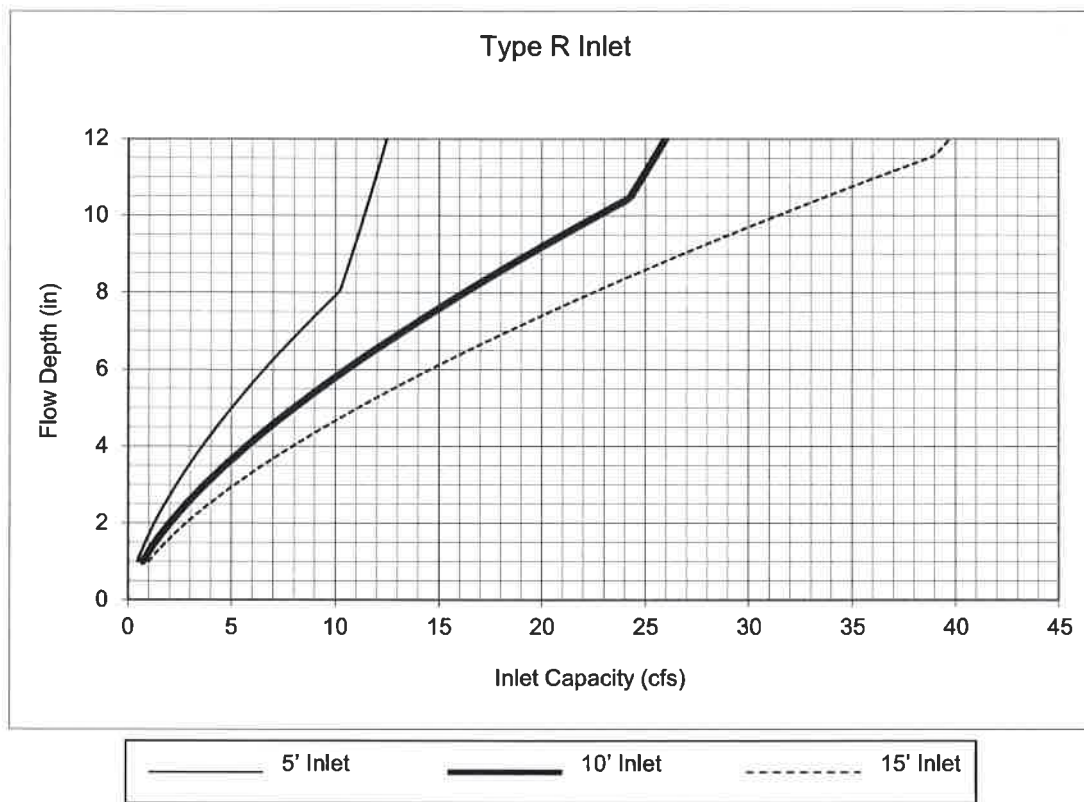
Minor Storm



Major Storm



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.

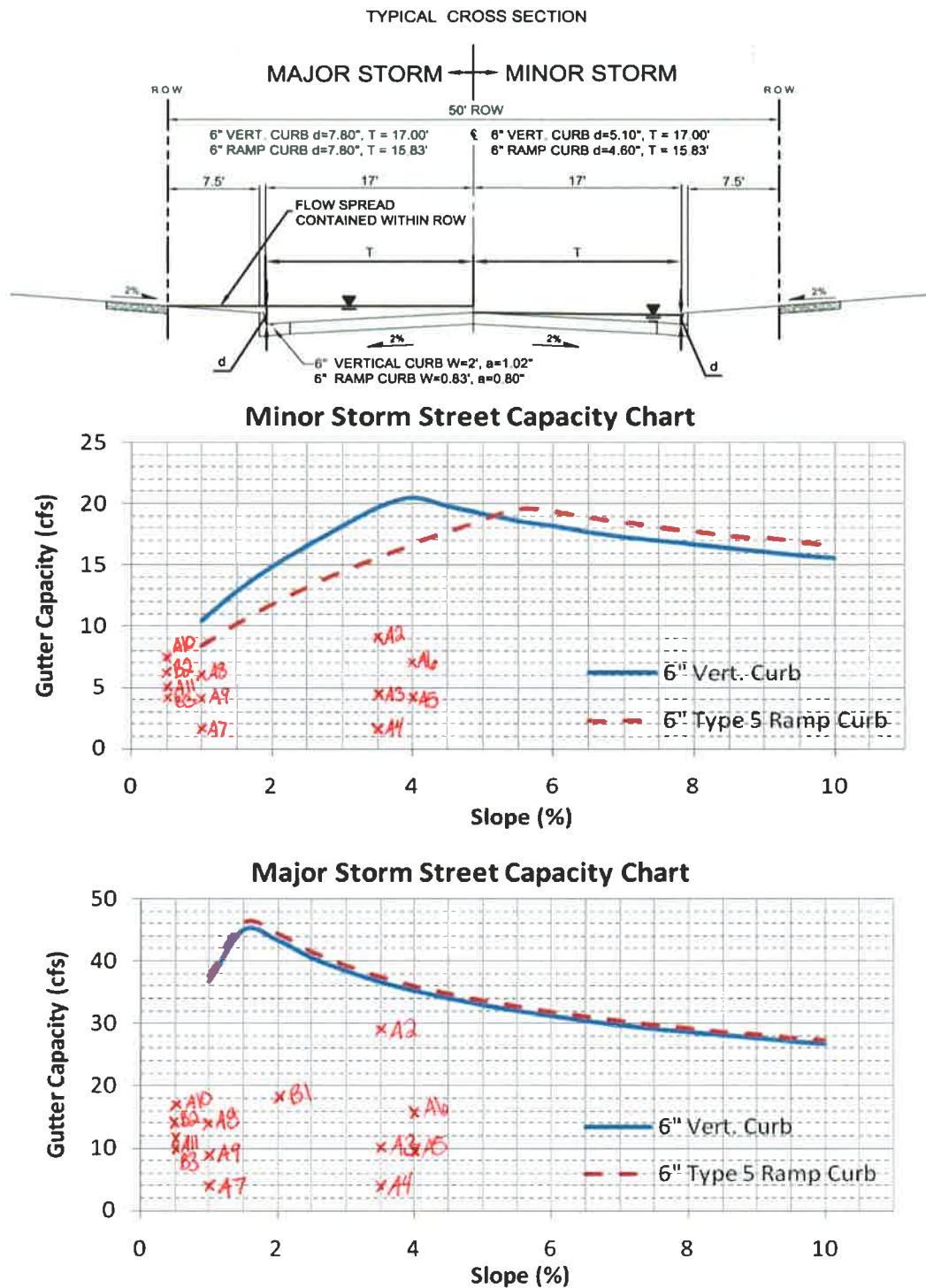
Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet

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

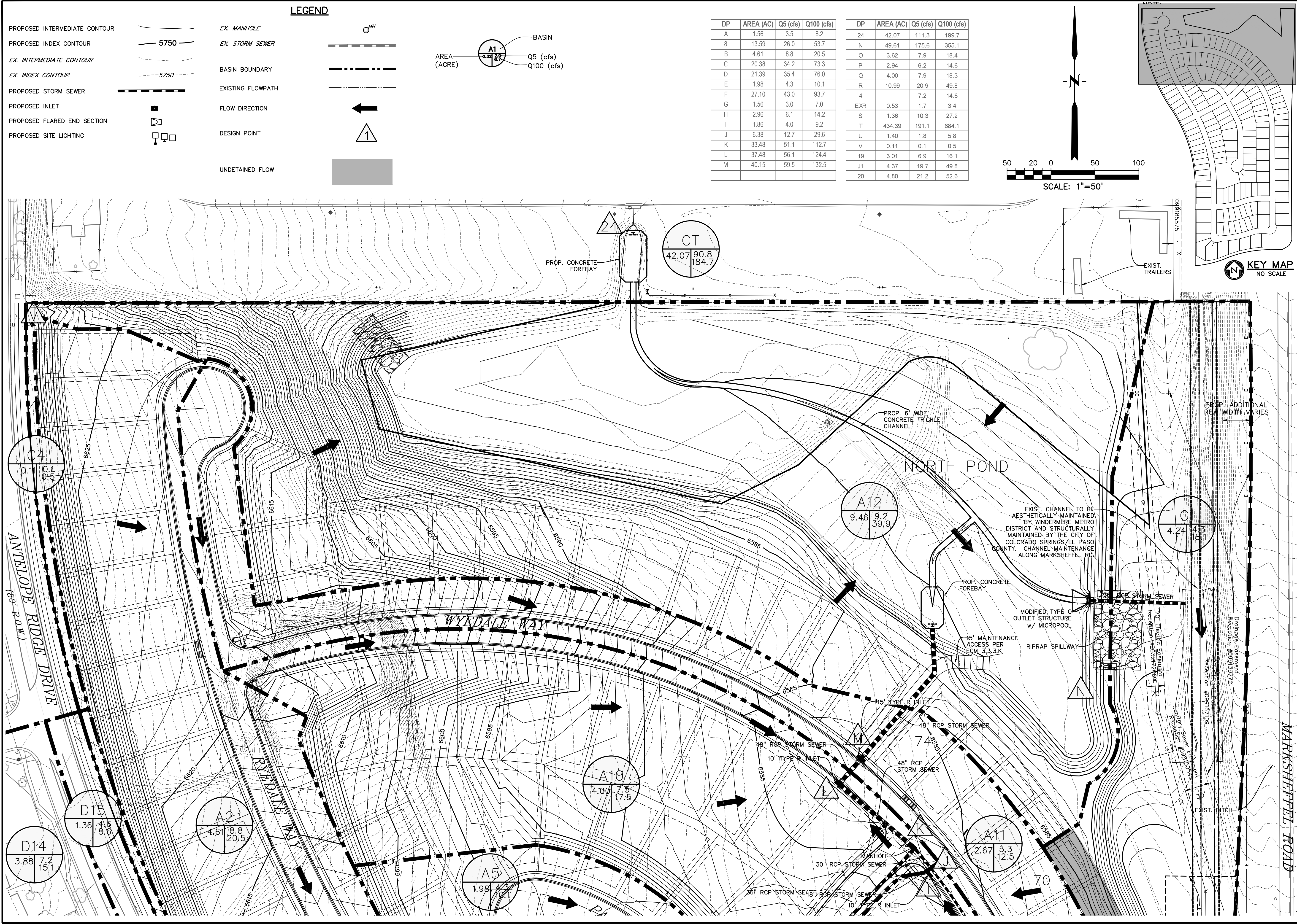
Notes:

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 contained 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.



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

ISSUE	DATE
INITIAL ISSUE	2/6/18
LATEST ISSUE	3/8/21

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.

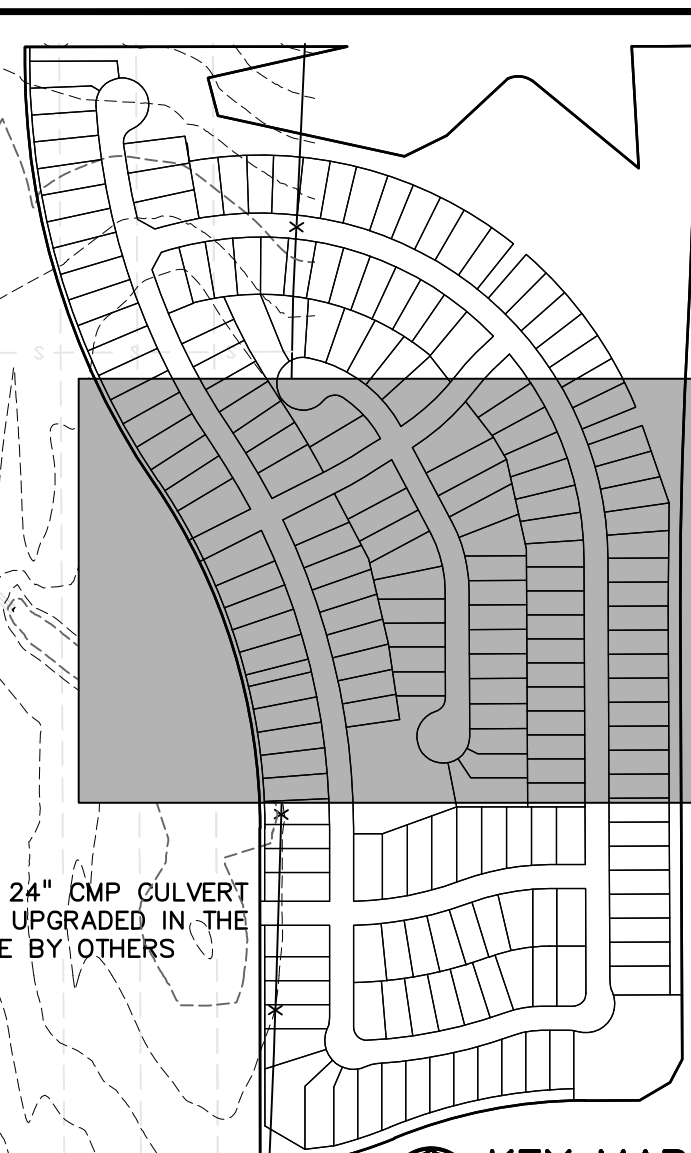
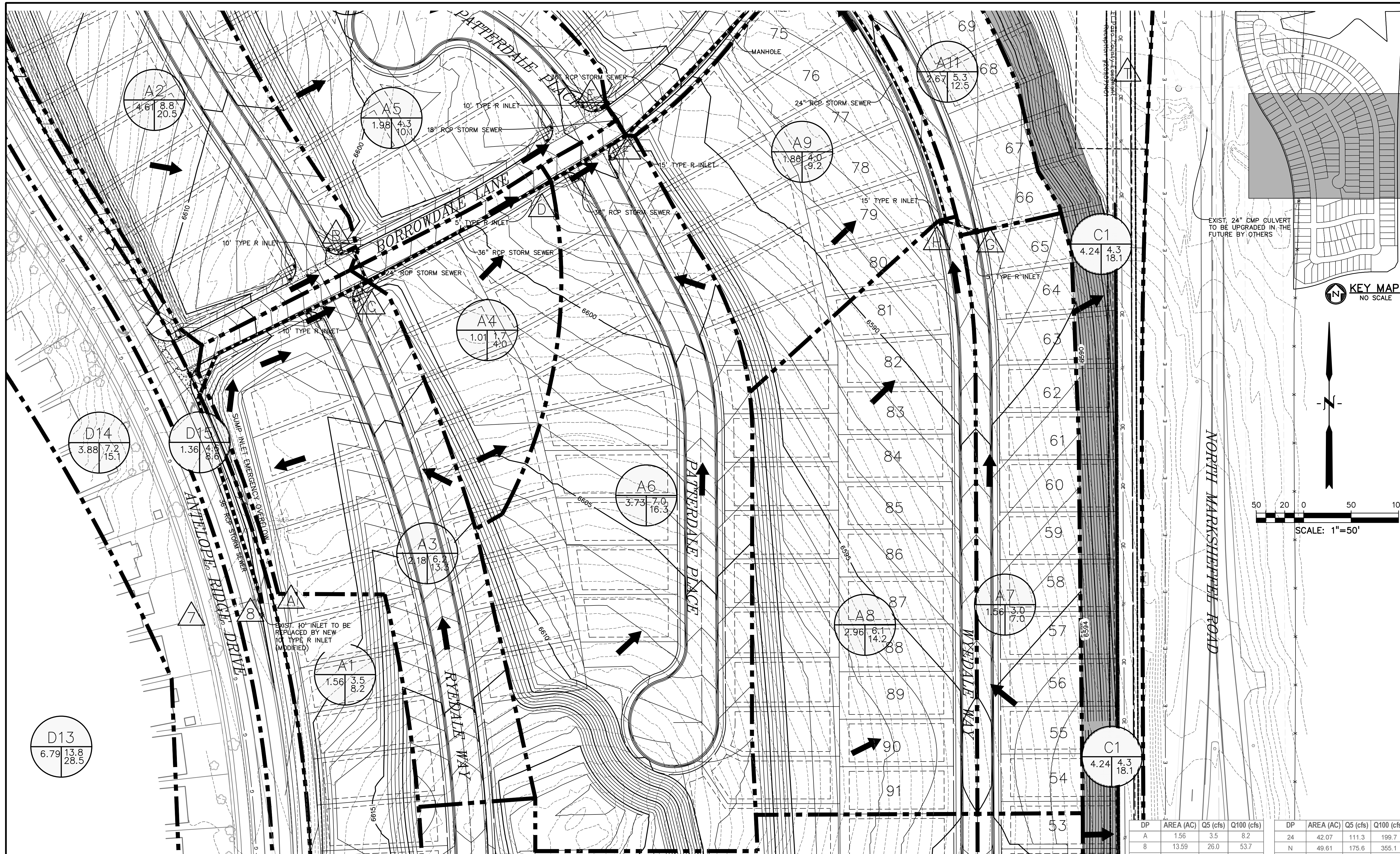
DRAWING SCALE:
HORIZONTAL: 1" = 100'
VERTICAL: N/A

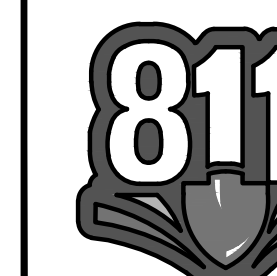
PROPOSED DRAINAGE MAP

PROJECT NO. 21187-01CSCV
DRAWING NO.

DR

SHEET: 1 OF 3





**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.

PROPOSED INTERMEDIATE CONTOUR

PROPOSED INDEX CONTOUR

EX. INTERMEDIATE CONTOUR

EX. INDEX CONTOUR

PROPOSED STORM SEWER

PROPOSED INLET

PROPOSED FLARED END SECTION

PROPOSED SITE LIGHTING

EX. MANHOLE

EX. STORM SEWER

BASIN BOUNDARY

FLOW DIRECTION

DESIGN POINT

LEGEND

AREA (ACRE)

Q5 (cfs)

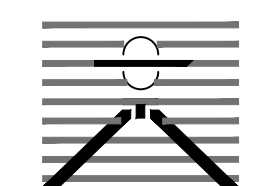
Q100 (cfs)

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

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	1.56	3.5	8.2
B	13.59	26.0	53.7
C	20.38	34.2	73.3
D	21.39	35.4	76.0
E	1.98	4.3	10.1
F	27.10	43.0	93.7
G	1.56	3.0	7.0
H	2.96	6.1	14.2
I	1.86	4.0	9.2
J	6.38	12.7	29.6
K	33.48	51.1	112.7
L	37.48	56.1	124.4
M	40.15	59.5	132.5

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
24	42.07	111.3	199.7
N	49.61	175.6	355.1
O	3.62	7.9	18.4
P	2.94	6.2	14.6
Q	4.00	7.9	18.3
R	10.99	20.9	49.8
4		7.2	14.6
EXR	0.53	1.7	3.4
S	1.36	10.3	27.2
T	434.39	191.1	684.1
U	1.40	1.8	5.8
V	0.11	0.1	0.5
19	3.01	6.9	16.1
J1	4.37	19.7	49.8
20	4.80	21.2	52.6

PREPARED BY:



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

ISSUE	DATE
INITIAL ISSUE	2/6/18
LATEST ISSUE	3/8/21

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.

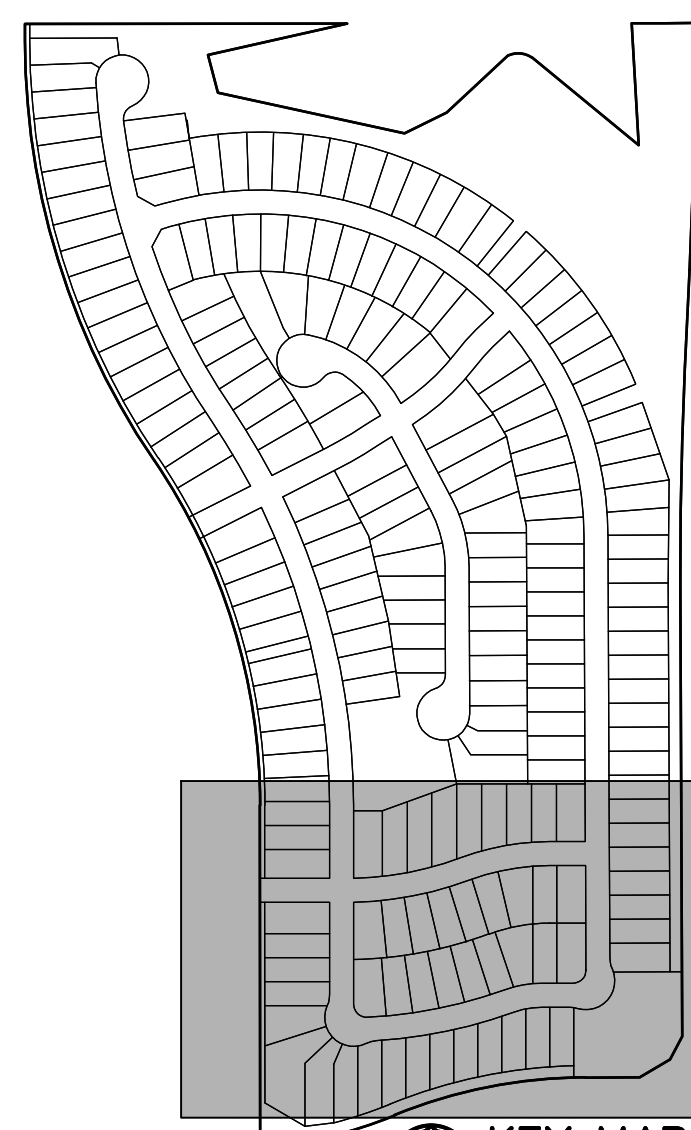
DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED
DRAINAGE MAP

PROJECT NO. 21187-01CSCV
DRAWING NO.

DR

SHEET: 2 OF 3



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

ISSUE	DATE
INITIAL ISSUE	2/6/18
LATEST ISSUE	3/8/21

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

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

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A	1.56	3.5	8.2
B	13.59	26.0	53.7
C	4.61	8.8	20.5
D	21.39	34.2	73.3
E	1.98	4.3	10.1
F	27.10	43.0	93.7
G	1.56	3.0	7.0
H	2.96	6.1	14.2
I	1.86	4.0	9.2
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L	37.48	56.1	124.4
M	40.15	59.5	132.5

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
24	42.07	111.3	199.7
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EXR	0.53	1.7	3.4
S	1.36	10.3	27.2
T	434.39	191.1	684.1
U	1.40	1.8	5.8
V	0.11	0.1	0.5
19	3.01	6.9	16.1
J1	4.37	19.7	49.8
20	4.80	21.2	52.6

LEGEND

- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR
- EX. INTERMEDIATE CONTOUR
- EX. INDEX CONTOUR
- 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)
- BASIN
- Q5 (cfs)
- Q100 (cfs)

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Call before you dig.
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BEFORE YOU DIG, GRADE, OR
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