

**MDDP Amendment/Preliminary Drainage report
for
The Crest at Woodmen
Phase 3 Southeast**

**1005 East Woodmen Road
Colorado Springs, Colorado 80920**

Prepared for:
Crest at Woodmen, LLC
431 North Weber Street
Colorado Springs, Colorado 80903



1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

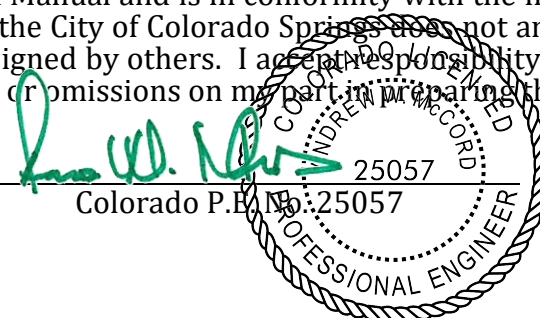
Kiowa Project No. 20020
June 5, 2020

**Signature Page
The Crest at Woodmen**

Engineer's Statement

This report and plan for the drainage design of The Crest at Woodmen Filing No. 7 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Signature (Affix Seal): _____



Colorado P.E. No. 25057

June 5, 2020
Date

Developer's Statement

Crest at Woodmen, LLC hereby certifies that the drainage facilities for The Crest at Woodmen Filing No. 7 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of The Crest at Woodmen Filing No. 7, guarantee that final drainage design review will absolve Crest at Woodmen, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Name of Developer: The Crest at Woodmen LLC

David A. Joseph Digitally signed by David A. Joseph; DN: cn=D.A. Joseph, o=Crest at Woodmen LLC, ou=Colorado Springs, email=D.A. Joseph@crestatwoodmen.com, c=US
Authorized Signature _____ Date June 5, 2020

Printed Name: David A. Joseph

Title: Director Colorado Construction Management and Strategy

Address: 431 N. Weber St. Colorado Springs, CO 80903

City of Colorado Springs Statement:

Filed in accordance with Section 7.7.906 of the code of the City of Colorado Springs, 2001, as amended.

For City Engineer Date

Conditions:

I. Purpose

The purpose of this Amendment for The Crest at Woodmen Filing No. 7 is to amend the previously approved MDDP Amendment/Preliminary Drainage Report for The Crest at Woodmen Phase 1 West, Phase 2 East, Phase 3 Southeast. Specifically, to analyze the drainage patterns and proposed storm sewer facilities to ensure their design adequacy after a revision to the site layout for the Phase 3 Southeast portion of the site. This amendment was prepared in support of a concept plan for the property.

II. General Property Description

The site is located at 1005 East Woodmen Road, Colorado Springs, CO 80920, which is platted as The Crest at Woodmen, in the southwest quarter of Section 8, Township 13 South, Range 66 West of the 6th Principal Meridian, in El Paso County. Existing development consists of public and private roadways, paved access drives/parking areas and several commercial/retail buildings. The Phase 3 Southeast portion of the property contains approximately 42.39 acres. Figure 1 depicts the amended layout and proposed storm sewer facilities for the Phase 3 Southeast portion of the site.

III. Drainage Design Criteria

Topography for the site was compiled using a two-foot contour interval and is presented at a horizontal scale of 1-inch to 100-feet on Figure 1, which can be found in the Appendix. City of Colorado Springs DCM calculations were performed assuming Hydrologic Soil Group B.

IV. Drainage Characteristics

The Phase 3 Southeast portion of the site lies entirely within the Cottonwood Creek drainage basin and generally drains towards the southwest at approximate slopes of 1.0% to 30%, currently sheet flowing into Cottonwood creek at the south property line. The Concept Plan amends the layout of the site by revising the private access drives and parking alignments. Ultimate drainage of this area remains generally as that shown in the previously approved MDDP Amendment/Preliminary Drainage Report for The Crest at Woodmen Phase 1 West, Phase 2 East, Phase 3 Southeast. Runoff will be conveyed via gutter flow and proposed storm sewers to the proposed private full spectrum detention basin (Pond A) located in the south central portion of the property. There are no revisions to the detention basin proposed at this time with this MDDP Amendment. See Drainage Map D1, from the previous report, at the end of this report.

V. Proposed Basins (Amended)

New basin designations were required as a result of the revised site layout. Basins A3 and A22 have not been altered from the previous report. Basins A1, A2 and Basins A4 through A21 have been altered and are depicted on Figure 1 and described as follows:

Basin A1 (2.82 AC, $Q_5=11.8$ cfs, $Q_{100}=21.5$ cfs): a basin defining an area of future commercial development. With future development, runoff from this basin will tie into a proposed future storm inlet near the southwest corner of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A2 (1.08 AC, $Q_5=4.5$ cfs, $Q_{100}=8.2$ cfs): a basin defining an area of future commercial development. With future development, runoff from this basin will tie into a proposed 4' D-10-R inlet near the southwest corner of this basin. Flow will be routed to proposed Pond A via an existing storm sewer system. This existing storm sewer system will need to be upgraded per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A4 (3.91 AC, $Q_5=15.2$ cfs, $Q_{100}=27.8$ cfs): a basin defining an area of future commercial development that includes a portion of an existing retail building. With future development, runoff from this basin will tie into the two existing 4' D-10-R inlets near the central portion of this basin. Flow will be routed to proposed Pond A via an existing storm sewer system. This existing storm sewer system will need to be upgraded per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A5 (0.25 AC, $Q_5=1.1$ cfs, $Q_{100}=1.9$ cfs): a basin defining an area of future private access drive. With future development, runoff from this basin will tie into a proposed 4' D-10-R inlet located near the southwest corner of Basin A6. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A6 (1.88 AC, $Q_5=7.9$ cfs, $Q_{100}=14.4$ cfs): a basin defining an area of future retail/office development. With future development, runoff from this basin will tie into the proposed future storm inlet near the southwest corner of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A7 (1.21 AC, $Q_5=5.1$ cfs, $Q_{100}=9.2$ cfs): a basin defining an area of future commercial development. With future development, runoff from this basin will tie into the existing 4' D-10-R inlet near the south central portion of this basin. Flow will be routed to proposed Pond A via a new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A8 (2.04 AC, $Q_5=8.5$ cfs, $Q_{100}=15.6$ cfs): a basin defining an area of future commercial development. With future development, runoff from this basin will tie into the proposed 4' D-10-R inlet near the east central portion of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A9 (0.79 AC, $Q_5=3.2$ cfs, $Q_{100}=5.8$ cfs): a basin defining an area of future private access drive. With future development, runoff from this basin will tie into the proposed 4' D-10-R inlet located at the south end of this basin (a low point in the private access drive). Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A10 (4.69 AC, $Q_5=18.1$ cfs, $Q_{100}=33.0$ cfs): a basin defining an area of future commercial development that includes a portion of an existing retail building. With future development, runoff from this basin will tie into the two existing 12' D-10-R inlets near the south central portion of this basin. Flow will be routed to proposed Pond A via the existing 36-inch storm sewer system and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A11 (1.99 AC, $Q_5=8.3$ cfs, $Q_{100}=15.2$ cfs): a basin defining an area of an existing retail building. Runoff from this basin will tie into the proposed 48-inch storm sewer system just east of this basin. Flow will be routed to proposed Pond A via the existing 36-inch storm sewer system and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A12 (3.35 AC, $Q_5=14.0$ cfs, $Q_{100}=25.6$ cfs): a basin defining an area of future retail/office development. With future development, runoff from this basin will tie into the proposed future storm inlet near the southwest corner of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A13 (6.32 AC, $Q_5=13.0$ cfs, $Q_{100}=28.6$ cfs): a basin defining an area of future multi-family residential development. With future development, runoff from this basin will tie into the proposed future storm inlet near the west central portion of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A14 (0.04 AC, $Q_5=0.2$ cfs, $Q_{100}=0.3$ cfs): a basin defining an area of a proposed loading dock. Runoff from this basin will tie into the existing 36-inch storm sewer system just east of this basin. Flow will be routed to proposed Pond A via the existing 36-inch storm sewer system and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A15 (0.96 AC, $Q_5=4.0$ cfs, $Q_{100}=7.3$ cfs): a basin defining an area of future parking and drive aisles. With future development, runoff from this basin will tie into the proposed 4' D-10-R inlet near the south central portion of this basin. Flow will be routed to proposed Pond A via the existing 42-inch storm sewer system and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A16 (0.25 AC, $Q_5=1.1$ cfs, $Q_{100}=1.9$ cfs): a basin defining an area of future parking, drive aisles and a portion of the future access drive. With future development, runoff from this basin will tie into the proposed 4' D-10-R inlet near the south end of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A17 (6.32 AC, $Q_5=13.0$ cfs, $Q_{100}=28.6$ cfs): a basin defining an area of future multi-family residential development. With future development, runoff from this basin will tie into the proposed future storm inlet near the west central portion of this basin. Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A18 (1.94 AC, $Q_5=8.0$ cfs, $Q_{100}=14.5$ cfs): a basin defining an area of future parking, drive aisles and a portion of the future access drive. With future development, runoff from this basin will tie into the proposed 8' D-10-R inlet near the central portion of this basin (a low point in the private access drive). Flow will be routed to proposed Pond A via a new storm sewer system designed with a future drainage report and a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A19 (0.28 AC, $Q_5=1.2$ cfs, $Q_{100}=2.2$ cfs): a basin defining an area of future parking and drive aisles. With future development, runoff from this basin will tie into the proposed 4' D-10-R inlet near the west central portion of this basin. Flow will be routed to proposed Pond A via a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A20 (0.83 AC, $Q_5=3.5$ cfs, $Q_{100}=6.4$ cfs): a basin defining an area of future parking and drive aisles. With future development, runoff from this basin will tie into the proposed 4' D-10-R inlet near the south central portion of this basin. Flow will be routed to proposed Pond A via a proposed new storm sewer system per the design proposed in The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A.

Basin A21 (0.44 AC, $Q_5=1.8$ cfs, $Q_{100}=3.3$ cfs): a basin defining an area of future parking and drive aisles. With future development, runoff from this basin will tie into a proposed 4' D-10-R inlet near the south central portion of this basin. Flow will be routed to proposed Pond A.

VI. Summary and Conclusion

This report along with its findings are in general conformance with the previously approved MDDP Amendment/Preliminary Drainage Report for The Crest at Woodmen Phase 1 West, Phase 2 East, Phase 3 Southeast as well as The Amendment to the Final Drainage Report for The Crest at Woodmen Phase 2 East and Phase 3 Southeast Redevelopment Lot 2, Looart Subdivision Filing No. 6A. Runoff from The Crest at Woodmen Filing No. 7 (Phase 3), will not have any adverse impacts on existing or proposed downstream drainage facilities or surrounding developments.

APPENDIX

**Amended Basin Runoff Calculations
Figure 1 - Amended Phase 3 Drainage Plan
Previous Drainage Map D1**

Crest at Woodmen
Runoff Coefficient and Percent Impervious Calculation

Basin	Basin or DP Area (DP contributing basins)			Soil Type	BD Area 1 Land Use				US1 Area 2 Land Use				RO Area 3 Land Use				LA Area 4 Land Use				Basin % Imperv	Basin Runoff Coefficient	
					% Imperv	Land Use Area	% Area	Comp Land Use % Imp	% Imperv	Land Use Area	% Area	Comp Land Use % Imp	% Imperv	Land Use Area	% Area	Comp Land Use % Imp	% Imperv	Land Use Area	% Area	Comp Land Use % Imp		C ₅	C ₁₀₀
A1	123,015 sf	2.82ac	B	95%	2.82ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A2	46,957 sf	1.08ac	B	95%	1.08ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A4	170,172 sf	3.91ac	B	95%	3.91ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A5	10,926 sf	0.25ac	B	95%	0.25ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A6	81,868 sf	1.88ac	B	95%	1.88ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A7	52,728 sf	1.21ac	B	95%	1.21ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A8	88,776 sf	2.04ac	B	95%	2.04ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A9	34,350 sf	0.79ac	B	95%	0.79ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A10	204,185 sf	4.69ac	B	95%	4.69ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A11	86,676 sf	1.99ac	B	95%	1.99ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A12	145,775 sf	3.35ac	B	95%	3.35ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A13	275,197 sf	6.32ac	B	95%	0.00ac	0%	0%	65%	6.32ac	100%	65%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	65.0%	0.45	0.59	
A14	1,667 sf	0.04ac	B	95%	0.04ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A15	41,806 sf	0.96ac	B	95%	0.96ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A16	11,010 sf	0.25ac	B	95%	0.25ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A17	318,730 sf	7.32ac	B	95%	0.00ac	0%	0%	65%	7.32ac	100%	65%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	65.0%	0.45	0.59	
A18	84,671 sf	1.94ac	B	95%	1.94ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A19	12,389 sf	0.28ac	B	95%	0.28ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A20	36,354 sf	0.83ac	B	95%	0.83ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	
A21	19,090 sf	0.44ac	B	95%	0.44ac	100%	95%	65%	0.00ac	0%	0%	90%	0.00ac	0%	0%	0%	0.00ac	0%	0%	95.0%	0.81	0.88	

Basin Runoff Coefficient is a weighted average									
Runoff Coefficients and Percents Impervious (City DCM Table 6-6)									
Hydrologic Soil Type:	B	Runoff Coef Calc Method							Weighted
Land Use	Abb	%	C ₂	C ₅	C ₁₀	C ₂₅	C ₅₀	C ₁₀₀	%Imp
Business: Commercial	BD	95%	0.79	0.81	0.83	0.85	0.87	0.88	
Business: Neighborhood	BS	70%	0.45	0.49	0.53	0.58	0.60	0.62	
Drives and Walks	DR	100%	0.89	0.90	0.92	0.94	0.95	0.96	A
Streets - Gravel (Packed)	GR	80%	0.57	0.59	0.63	0.66	0.68	0.70	B
Historic Flow Analysis	HI	2%	0.03	0.09	0.17	0.26	0.48	0.51	C
Lawns	LA	0%	0.02	0.08	0.15	0.25	0.30	0.35	D
Off-site flow-Undeveloped	OF	45%	0.26	0.32	0.38	0.44	0.48	0.51	
Park	PA	7%	0.05	0.12	0.20	0.30	0.34	0.39	
Streets - Paved	PV	100%	0.89	0.90	0.92	0.94	0.95	0.96	
Roofs	RO	90%	0.71	0.73	0.75	0.78	0.80	0.81	
User Input 1 - Residential	US1	65%	0.41	0.45	0.49	0.54	0.57	0.59	

Equation:

$$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \dots + C_iA_i) / A_t$$

(City of Colorado Springs DCM Equation 6-6) Where:

C_c = composite runoff coefficient for total area

C_i = runoff coefficient for subarea (surface type or land use)

A_i = area of surface type corresponding to C_i

A_t = total area of all sub areas

i = number of surface types in the drainage area

Crest at Woodmen
Time of Concentration Calculation

Sub-Basin Data					Time of Concentration Estimate										t _c (1st DP in Urban Catchments)		Final t _c
Basin	Contributing Basins	Area	C ₅	i	Initial/Overland Time (t _i)			Travel Time (t _t)					Comp.	Total Length	t _c (1st DP)		
					Length	Slope	t _i	Length	Slope	Land Type	K	Velocity	t _t			t _c	
A1	A1	2.82ac	0.81	95.0%	85lf	10.7%	2.2 min.	380lf	1.0%	PV	20	2.0 ft/sec	3.2 min.	5.4 min.	465lf	5.1 min.	5.1 min.
A2	A2	1.08ac	0.81	95.0%	25lf	5.7%	1.5 min.	657lf	5.7%	PV	20	4.8 ft/sec	2.3 min.	5.0 min.	682lf	5.1 min.	5.0 min.
A4	A4	3.91ac	0.81	95.0%	47lf	2.1%	2.8 min.	780lf	2.3%	PV	20	3.0 ft/sec	4.3 min.	7.1 min.	827lf	6.4 min.	6.4 min.
A5	A5	0.25ac	0.81	95.0%	25lf	5.7%	1.5 min.	594lf	4.2%	PV	20	4.1 ft/sec	2.4 min.	5.0 min.	619lf	5.2 min.	5.0 min.
A6	A6	1.88ac	0.81	95.0%	66lf	12.0%	1.9 min.	244lf	1.5%	PV	20	2.4 ft/sec	1.7 min.	5.0 min.	310lf	4.5 min.	5.0 min.
A7	A7	1.21ac	0.81	95.0%	36lf	4.2%	2.0 min.	308lf	1.0%	PV	20	2.0 ft/sec	2.6 min.	5.0 min.	344lf	5.2 min.	5.0 min.
A8	A8	2.04ac	0.81	95.0%	100lf	1.0%	5.3 min.	204lf	2.0%	PV	20	2.8 ft/sec	1.2 min.	6.5 min.	304lf	4.9 min.	5.0 min.
A9	A9	0.79ac	0.81	95.0%	100lf	2.4%	4.0 min.	568lf	2.4%	PV	20	3.1 ft/sec	3.1 min.	7.0 min.	668lf	5.8 min.	5.8 min.
A10	A10	4.69ac	0.81	95.0%	100lf	1.0%	5.3 min.	535lf	1.2%	PV	20	2.2 ft/sec	4.1 min.	9.4 min.	635lf	6.6 min.	6.6 min.
A11	A11	1.99ac	0.81	95.0%	100lf	1.0%	5.3 min.	150lf	1.0%	PV	20	2.0 ft/sec	1.3 min.	6.6 min.	250lf	4.9 min.	5.0 min.
A12	A12	3.35ac	0.81	95.0%	67lf	18.0%	1.7 min.	605lf	2.3%	PV	20	3.0 ft/sec	3.3 min.	5.0 min.	672lf	5.4 min.	5.0 min.
A13	A13	6.32ac	0.45	65.0%	76lf	15.7%	4.1 min.	503lf	1.6%	PV	20	2.5 ft/sec	3.3 min.	7.5 min.	579lf	10.1 min.	7.5 min.
A14	A14	0.04ac	0.81	95.0%	48lf	2.0%	2.9 min.	0lf	0.0%	PV	20	0.0 ft/sec	0.0 min.	5.0 min.	48lf	3.9 min.	5.0 min.
A15	A15	0.96ac	0.81	95.0%	100lf	2.8%	3.8 min.	150lf	2.8%	PV	20	3.3 ft/sec	0.7 min.	5.0 min.	250lf	4.5 min.	5.0 min.
A16	A16	0.25ac	0.81	95.0%	100lf	3.5%	3.5 min.	124lf	2.5%	PV	20	3.2 ft/sec	0.7 min.	5.0 min.	224lf	4.4 min.	5.0 min.
A17	A17	7.32ac	0.45	65.0%	100lf	3.0%	8.3 min.	491lf	1.0%	PV	20	2.0 ft/sec	4.1 min.	12.3 min.	591lf	11.3 min.	11.3 min.
A18	A18	1.94ac	0.81	95.0%	100lf	1.0%	5.3 min.	310lf	1.6%	PV	20	2.5 ft/sec	2.0 min.	7.4 min.	410lf	5.4 min.	5.4 min.
A19	A19	0.28ac	0.81	95.0%	62lf	1.7%	3.5 min.	55lf	1.7%	PV	20	2.6 ft/sec	0.4 min.	5.0 min.	117lf	4.2 min.	5.0 min.
A20	A20	0.83ac	0.81	95.0%	91lf	1.1%	4.9 min.	147lf	1.4%	PV	20	2.4 ft/sec	1.0 min.	5.9 min.	238lf	4.8 min.	5.0 min.
A21	A21	0.44ac	0.81	95.0%	95lf	2.6%	3.8 min.	79lf	1.9%	PV	20	2.8 ft/sec	0.5 min.	5.0 min.	174lf	4.3 min.	5.0 min.

City DCM Table 6-7

Type of Land Surface	Land Type	C _v
Grassed Waterway	GW	15
Heavy Meadow	HM	2.5
Nearly Bare Ground	NBG	10
Paved Area	PV	20
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Tillage/Fields	TF	5

Equations:

$$t_i (\text{Overland}) = 0.395(1.1 - C_5)L^{0.5} S^{-0.333}$$

(DCM Equation 6-8) Where:

C₅ = Runoff coefficient for 5-year

L = Length of overland flow (ft)

S = Average basin slope (ft/ft)

$$t_t = L_t / 60KS^{0.5} \text{ Where:}$$

t_t = Channelized flow time (travel time)(min.)

L_t = Waterway length (ft)

K = Conveyance Factor (see DCM Table 6-7)

S = Watercourse slope (ft/ft)

$$t_c (\text{1st DP}) = (18-15i) + L_t / (60 (24i+12)S^{0.5}) \text{ Where:}$$

t_c (1st DP) = First DP Time of Concentration in urban catchments

L_t = Length of Flow Path

i = imperviousness (expressed as a decimal)

**Crest at Woodmen
Runoff Calculation**

Basin	Contributing Basins	Drainage Area	C ₅	C ₁₀₀	Time of Concentration	Rainfall Intensity		Runoff		Basin
						i ₅	i ₁₀₀	Q ₅	Q ₁₀₀	
A1	A1	2.82 ac	0.81	0.88	5.1 min.	5.1 in/hr	8.6 in/hr	11.8 cfs	21.5 cfs	A1
A2	A2	1.08 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	4.5 cfs	8.2 cfs	A2
A4	A4	3.91 ac	0.81	0.88	6.4 min.	4.8 in/hr	8.1 in/hr	15.2 cfs	27.8 cfs	A4
A5	A5	0.25 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	1.1 cfs	1.9 cfs	A5
A6	A6	1.88 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	7.9 cfs	14.4 cfs	A6
A7	A7	1.21 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	5.1 cfs	9.2 cfs	A7
A8	A8	2.04 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	8.5 cfs	15.6 cfs	A8
A9	A9	0.79 ac	0.81	0.88	5.8 min.	4.9 in/hr	8.3 in/hr	3.2 cfs	5.8 cfs	A9
A10	A10	4.69 ac	0.81	0.88	6.6 min.	4.8 in/hr	8.0 in/hr	18.1 cfs	33.0 cfs	A10
A11	A11	1.99 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	8.3 cfs	15.2 cfs	A11
A12	A12	3.35 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	14.0 cfs	25.6 cfs	A12
A13	A13	6.32 ac	0.45	0.59	7.5 min.	4.6 in/hr	7.7 in/hr	13.0 cfs	28.6 cfs	A13
A14	A14	0.04 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	0.2 cfs	0.3 cfs	A14
A15	A15	0.96 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	4.0 cfs	7.3 cfs	A15
A16	A16	0.25 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	1.1 cfs	1.9 cfs	A16
A17	A17	7.32 ac	0.45	0.59	11.3 min.	3.9 in/hr	6.6 in/hr	13.0 cfs	28.6 cfs	A17
A18	A18	1.94 ac	0.81	0.88	5.4 min.	5.1 in/hr	8.5 in/hr	8.0 cfs	14.5 cfs	A18
A19	A19	0.28 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	1.2 cfs	2.2 cfs	A19
A20	A20	0.83 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	3.5 cfs	6.4 cfs	A20
A21	A21	0.44 ac	0.81	0.88	5.0 min.	5.2 in/hr	8.7 in/hr	1.8 cfs	3.3 cfs	A21

Equations (taken from Fig 6-5, City of Colorado Springs DCM):

$$i_2 = -1.19 \ln(T_c) + 6.035$$

$$i_5 = -1.50 \ln(T_c) + 7.583$$

$$i_{10} = -1.75 \ln(T_c) + 8.847$$

$$i_{100} = -2.52 \ln(T_c) + 12.738$$

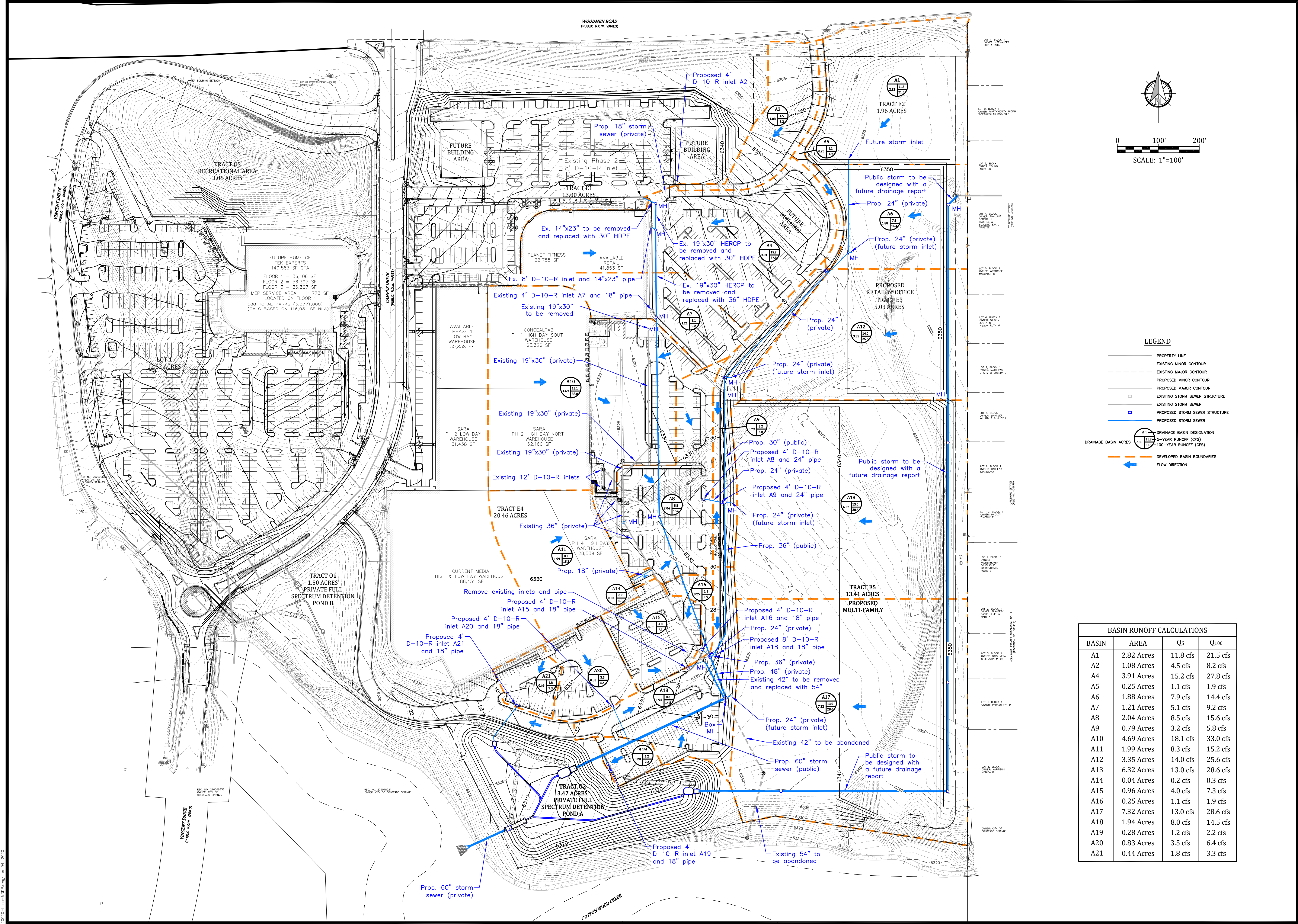
$$Q = CiA$$

Q = Peak Runoff Rate (cubic feet/second)

C = Runoff coef representing a ration of peak runoff rate to ave rainfall intensity for a duration equal to the runoff time of concentration.

i = average rainfall intensity in inches per hour

A = Drainage area in acres



BASIN RUNOFF CALCULATIONS			
BASIN	AREA	Q ₅	Q ₁₀₀
A1	2.82 Acres	11.8 cfs	21.5 cfs
A2	1.08 Acres	4.5 cfs	8.2 cfs
A4	3.91 Acres	15.2 cfs	27.8 cfs
A5	0.25 Acres	1.1 cfs	1.9 cfs
A6	1.88 Acres	7.9 cfs	14.4 cfs
A7	1.21 Acres	5.1 cfs	9.2 cfs
A8	2.04 Acres	8.5 cfs	15.6 cfs
A9	0.79 Acres	3.2 cfs	5.8 cfs
A10	4.69 Acres	18.1 cfs	33.0 cfs
A11	1.99 Acres	8.3 cfs	15.2 cfs
A12	3.35 Acres	14.0 cfs	25.6 cfs
A13	6.32 Acres	13.0 cfs	28.6 cfs
A14	0.04 Acres	0.2 cfs	0.3 cfs
A15	0.96 Acres	4.0 cfs	7.3 cfs
A16	0.25 Acres	1.1 cfs	1.9 cfs
A17	7.32 Acres	13.0 cfs	28.6 cfs
A18	1.94 Acres	8.0 cfs	14.5 cfs
A19	0.28 Acres	1.2 cfs	2.2 cfs
A20	0.83 Acres	3.5 cfs	6.4 cfs
A21	0.44 Acres	1.8 cfs	3.3 cfs

CREST AT WOODMEN
MDDP AMENDMENT FOR THE CREST AT WOODMEN
PHASE 3 SOUTHEAST DRAINAGE PLAN
1005 East Woodmen Road, Colorado Springs, CO 80920

Project No.:	20020
Date:	June 5, 2020
Design:	NRK
Drawn:	CAD
Check:	AWMc
Revisions:	

FIGURE 1

