

**EPC STORMWATER REVIEW COMMENTS  
IN ORANGE BOXES WITH BLACK TEXT**

**Reviewed by:  
Glenn Reese, P.E.  
Stormwater Engineer I  
glennreese@elpasoco.com  
719-675-2654**

**SMALL SUBDIVISION FINAL DRAINAGE REPORT  
FOR  
CLOVERLEAF FILING NO. 1**

**JR Responses in  
Black/Red**

**Prepared For:**

**PT Cloverleaf, LLC  
1864 Woodmoor Drive, Suite 100  
Monument, CO 80920  
(719) 476-0800**

**December 1, 2020**

**Project No. 25158.01**

**Add text:  
PCD Filing No.: SF-21-014**

**Addressed**

**Prepared By:**

**JR Engineering, LLC  
5475 Tech Center Drive, Suite 235  
Colorado Springs, CO 80919  
719-593-2593**

SMALL SUBDIVISION FINAL DRAINAGE REPORT FOR  
CLOVERLEAF FILING NO. 1

**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 omissions on my part in preparing this report.

---

Mike Bramlett, Colorado P.E. # 32314  
For and On Behalf of JR Engineering, LLC

**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: PT Cloverleaf, LLC.

By: \_\_\_\_\_

Title: \_\_\_\_\_

Address: 1864 Woodmoor Drive, Suite 100  
Monument, CO 80920

**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 Engineering Criteria Manual, as amended.

---

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

---

Date

Conditions:

SMALL SUBDIVISION FINAL DRAINAGE REPORT FOR  
CLOVERLEAF FILING NO. 1

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## APPENDIX

- Appendix A – Vicinity Map, Soil Descriptions, FEMA Floodplain Map
- Appendix B – Rational Hydrologic Calculations
- Appendix C – Water Quality Calculations
- Appendix D – Reference Material
- Appendix E – Drainage Maps

Addressed: added a second reference to the approved report in this paragraph.

Update to state what approved plan this report is going to be consistent with. Include filing and PCD file no. and add reference to list of references.

## PURPOSE

This document is the Small Subdivision Final Drainage Report for Cloverleaf Filing No. 1, a replat of Woodmoor Greens, Tract F. The purpose of this report is to show that the proposed development is consistent with the original approved drainage plan and to update the previously approved plans to be in conformance with the current El Paso County drainage standards and criteria. Refer to Appendix D for the original drainage plan as represented in the *Woodmoor Greens Drainage Letter*, by Nelson, Haley, Patterson, and Quik, Inc., dated January 7, 1972.

## PROPERTY DESCRIPTION

The proposed Cloverleaf Filing No. 1, known as "Cloverleaf" from herein, is three individual lots located in Section 23, Township 11 South, Range 67 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The small subdivision will replat a portion of Tract F of Woodmoor Greens vacation L496-500. The three lots are numbered Lots 142, 143, and 144, and will be suburban lots consistent with the RS-2000 zoning. Lot 142 is approximately 0.51 acres, Lots 143 and 144 are approximately 0.50 acres. Lot 142 borders Leggins Way to the southeast while Lots 143 and 144 border Bowstring Road to the west. A vicinity map of the area is presented in Appendix A.

Each lot is currently unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, each lot slopes to the adjacent road (either Leggins Way or Bowstring Road).

Per an NRCS web soil survey of the area, Cloverleaf is made up of Type B soils. This Type B soil is a Tomah-Crowfoot loamy sand. This soil type has a moderate infiltration rate when thoroughly wet. It also consists of moderately deep or deep, moderately well drained or well-drained soil. A soil survey map has been presented in Appendix A.

There are no major drainageways or irrigation wells on the site. Each lot is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent annual-chance (or 500-year) flood. The FEMA map cor Addressed e has been presented in Appendix A.

Addressed

Update to 2021.

Addressed

Please update paragraph to include a firm map number and a revision date.

## EXISTING DRAINAGE CONDITIONS

Cloverleaf lies within the upper reaches of the Teachout Creek watershed basin. Although no DBPS currently exists for Teachout Creek, basin fees have been listed in the Interim Basin Section of the 2020 El Paso County Drainage Basin Fee list. Existing vegetation on the lots consists primarily of native grasses. The terrain is sloped generally to the adjacent roadside ditch and ranges from 2% to





## SMALL SUBDIVISION FINAL DRAINAGE REPORT FOR CLOVERLEAF FILING NO. 1

7%. Drainage from the site currently flows southwest through existing culverts to Lewis Palmer High School under Bowstring Road, into Teachout Creek, and eventually reaches Monument Creek.

Each of the three lots was analyzed in the existing condition as its own basin. The basin descriptions are below. Refer to Appendix E for the existing drainage map.

Basin EX-142 is approximately 0.51 acres and consists of prairie grasses. Flow from this basin ( $Q_5=0.1$  cfs,  $Q_{100}=1.1$  cfs) flows southwest to the adjacent properties and Leggins Way at design point (DP) EX142. The flow eventually reaches the existing 28" by 42" CMP culvert under Bowstring Road at Leggins Way and is routed under Bowstring Road to Lewis Palmer High School to the southwest.

Basin EX-143 is approximately 0.50 acres and consists of prairie grasses. Flow from this basin ( $Q_5=0.1$  cfs,  $Q_{100}=0.9$  cfs) flows west to the roadside ditch along the east side of Bowstring Road at DP-EX143. The roadside ditch routes the flow south to an existing 24" CMP culvert and is routed under Bowstring Road to Lewis Palmer High School to the south.

Basin EX-144 is approximately 0.50 acres and consists of prairie grasses. Flow from this basin ( $Q_5=0.1$  cfs,  $Q_{100}=0.9$  cfs) flows west to the roadside ditch along the east side of Bowstring Road at DP-EX144. The roadside ditch routes the flow south to an existing 24" CMP culvert and is routed under Bowstring Road to Lewis Palmer High School to the south.

## PROPOSED DRAINAGE CONDITIONS

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The proposed land use (single-family residential) is consistent with the anticipated land use in the approved Woodmoor Greens drainage report, dated January 7, 1972. Refer to Appendix D for the drainage report. Lot 142 was included in the Tract "F" open space shown in the Woodmoor Greens plat recorded on February 16, 1972. Refer to Appendix D for the plat. Lots 143 and 144 were initially portions of platted lots, as shown in the February 16, 1972 plat, and then were replatted to be included in the Tract "F" open space, as shown in the vacation and replat of lots 496 through 500, filed August 23, 1972. Refer to Appendix D for the vacation and replat.

The approved Woodmoor Greens drainage report assumed that each developed lot would have a 2,500 square foot house. However, the existing developed lots within Woodmoor Greens include between about 5,000 and 6,000 square feet of impervious area. For this report, the development of each proposed lot was assumed to add an impervious area equal to 25% of the total lot area, which is consistent with the existing developed lots. Per El Paso County drainage criteria, a sand filter on each of the three lots is proposed to provide water quality to offset the impervious area added as part of the development of the lots. Refer to Appendix C for the sizing calculations for the sand filters. When

Addressed: Section details consisting of berms and swales were added to the proposed drainage map to demonstrate the anticipated lot grading. In general, berms will be installed on the uphill sides of lots where offsite flows currently enter the lots. The berms will route the offsite runoff around the lots and back to their existing drainage paths on the downstream side. Swales will intercept on-site generated runoff and transport it to the proposed Full-Spectrum SF's.

Please explain how. Is there a berm around the property to prevent offsite flow from entering the site? It looks like the land to the east of lots 143 and 144 flows onto these lots.  
If needed, include tributary basins into the rational method calcs in Appendix B

did not require water quality for the permanent BMPs were proposed.

ion. The basin descriptions are below.

proposed sand filter and no offsite flow

will be tributary to the lot. Refer to Appendix E for the proposed drainage map. Basin and design point summary tables are provided after the basin descriptions. The approved Woodmoor Greens drainage report calculated runoff for the 25-year storm event. This report uses the 5-year and 100-year events to conform to current El Paso County drainage criteria.

Basin 142 is approximately 0.51 acres and will consist of prairie grasses and a single-family residential house and associated improvements (driveway and walks). Flow from this basin ( $Q_5=0.5$  cfs,  $Q_{100}=1.6$  cfs) will be routed via drainage ditches and overland flow to the sand filter at DP-142 located in the south corner of the lot. The sand filter will provide water quality and will discharge to the adjacent roadside ditch along the northwest side of Leggins Way. Once in the ditch, the flow will follow historic drainage patterns.

Basin 143 is approximately 0.50 acres and will consist of prairie grasses and a single-family residential house and associated improvements (driveway and walks). Flow from this basin ( $Q_5=0.5$  cfs,  $Q_{100}=1.5$  cfs) will be routed via drainage ditches and overland flow to the sand filter at DP-143 located in the southwest corner of the lot. The sand filter will provide water quality and will discharge to the adjacent roadside ditch along the east side of Bowstring Road. Once in the ditch, the flow will follow historic drainage patterns.

Basin 144 is approximately 0.50 acres and consists of prairie grasses and a single-family residential house and associated improvements (driveway and walks). Flow from this basin ( $Q_5=0.5$  cfs,  $Q_{100}=1.3$  cfs) will be routed via drainage ditches and overland flow to the sand filter at DP-143 located in the southwest corner of the lot. The sand filter will provide water quality and will discharge to the adjacent roadside ditch along the east side of Bowstring Road. Once in the ditch, the flow will follow historic drainage patterns.

Addressed: values have been updated to reflect "1/2 acre residential lots" per table 6-6

BASIN SUMMARY TABLE								DESIGN POINT SUMMARY TABLE		
Tributary Sub-basin	Area (acres)	Percent Impervious	$C_s$					DP	Q5	Q100
142	0.51	25%	0.29	0.50	11.9	0.5	1.6	142	0.5	1.6
143	0.50	25%	0.29	0.50	13.9	0.5	1.5	143	0.5	1.5
144	0.50	25%	0.29	0.50	18.4	0.5	1.3	144	0.5	1.3

Please update runoff coefficient columns to use values from table 6-6 in CSDCM. If coefficients are weighted, please specify in column titles.



## WATER QUALITY

The sand filters were designed to have a volume above the sand bed of the basin equal to the WQCV based on a 12-hour drain time. Refer to Appendix C for the sizing calculations. The sand filter on lot 142 is required to be 0.005 acre-feet, while the sand filters for the other two lots (143 and 144) are required to be 0.004 acre-feet. Each sand filter is proposed to have the same dimensions and provide 0.007 acre-feet of water quality. Refer to the detail shown on the proposed drainage map in Appendix E.

Each sand filter does not include an impermeable liner but includes an underdrain, so some infiltration is allowed (see the description for “Partial Infiltration Section” sand filter in *Urban Storm Drainage Criteria Manual Volume 3*, page SF-4 and SF-8). The WQCV will drain in 12 hours and the release rate will be controlled by a circular orifice within the slotted underdrain, which discharges to the adjacent roadside ditch. Any runoff in excess of the WQCV will be routed through a proposed 18-inch dome grate and drain basin and into the adjacent roadside ditch via the underdrain. Refer to Appendix C for the dome grate capacity calculation. Each sand filter also includes a spillway notch to allow stormwater to flow out of the sand filter and into the adjacent roadside ditch in the event that the dome grate becomes clogged. The sand filters will be owned and maintained by the property owners.

addressed

## DRAINAGE AND BRIDGE FEES

The site lies within the Teachout Creek Drainage Basin. Anticipated drainage and bridge fees are presented below and will be paid at time of platting (depending on date of plat submittal):

2020 DRAINAGE AND BRIDGE FEES – CLOVERLEAF FILING NO. 1				
Impervious Acres (ac)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Cloverleaf Drainage Fee	Cloverleaf Bridge Fee
0.38	\$5,245	\$788	\$1,994	\$300

Please update drainage basin and bridge fee calculations to use 2021 fees for impervious acre.

## SUMMARY

The proposed Cloverleaf Filing No. 1 development drainage improvements, including ditches and three sand filters were designed to meet or exceed the El Paso County L

The proposed development will not adversely affect the offsite drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

Addressed, statement added, release from site is at or below pre-development rates.

Update paragraph to compare historic vs developed runoff quantities. Is change in runoff negligible or not?



## REFERENCES

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1. El Paso County Drainage Criteria Manual Volume 1, El Paso County, CO, 1994.
  2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.
  3. Flood Insurance Study- El Paso County, Colorado & Incorporated Areas Vol 7 of 8, Federal Emergency Management Agency, December 7, 2018..
  4. Woodmoor Greens Drainage Letter, prepared by Nelson, Haley, Patterson, and Quirk, Inc., 1972.
- 

Update reference list to include latest revisions of EPC ECM, 2014 CSDCM, EPC DCM Vol. 1 and 2, and Cloverleaf preliminary drainage report.

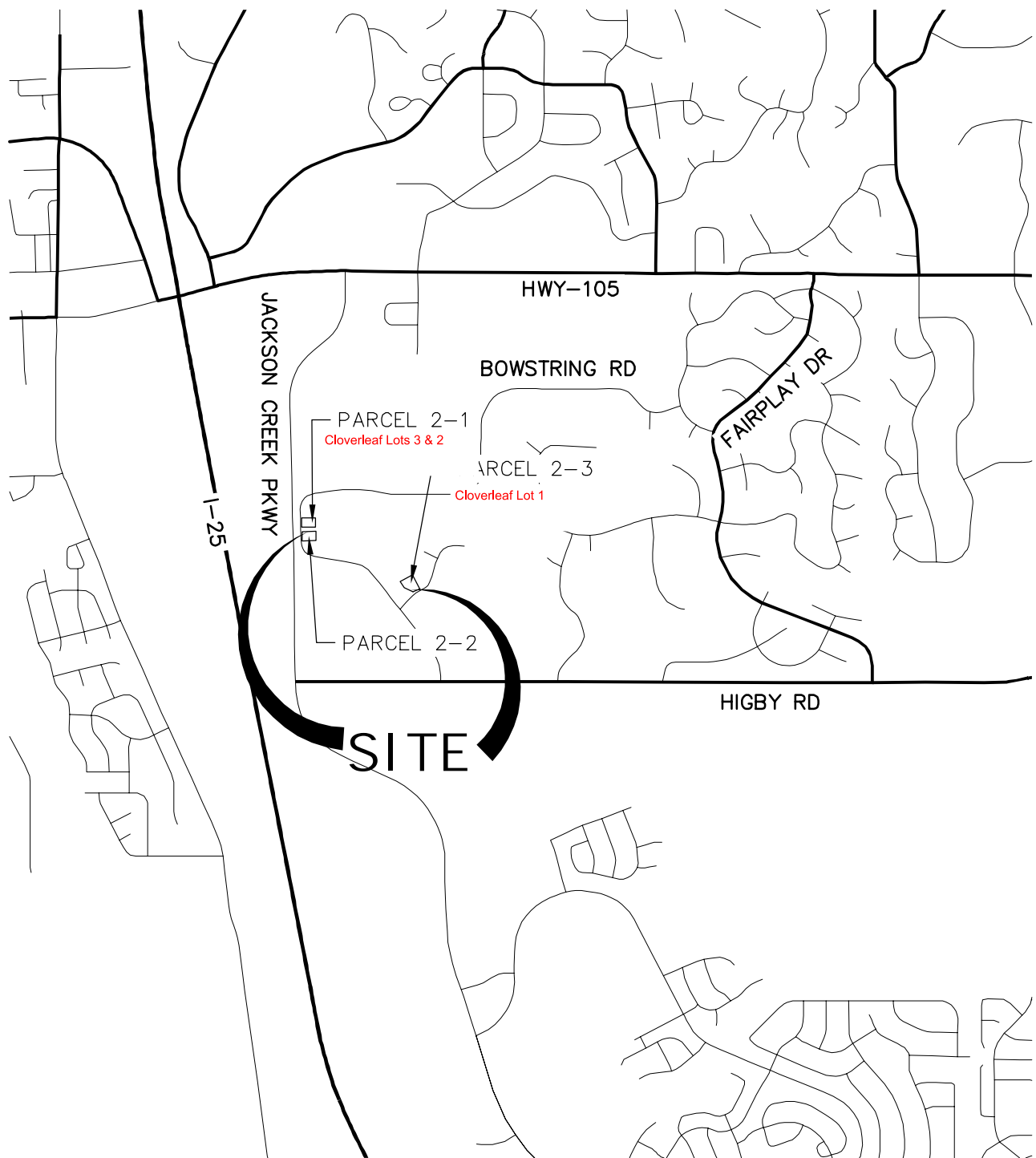
addressed

Please update report contents to include a four step process that clearly addresses each step. Reference ECM I.7.2.A for steps and what to include.

Justify why not providing full spectrum detention for these lots. Per USDCM Vol. 3, sand filter basins can be designed to include flood control volume.

Addressed,  
sand filter was revised to be "full spectrum"  
A Four Step Process section was added to this report.

**Appendix A**  
**Vicinity Map, Soil Descriptions, FEMA Floodplain Map**



2000 1000 0 2000



ORIGINAL SCALE: 1" = 2000'

VICINITY MAP  
CLOVERLEAF FILING 1  
JOB NO. 25158.01  
11/24/2020  
SHEET 1 OF 1



**J-R ENGINEERING**

A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593  
Fort Collins 970-491-9888 • [www.jrengineering.com](http://www.jrengineering.com)



# National Flood Hazard Layer FIRMette

104°51'40"W 39°5'16"N



## Legend

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

**SPECIAL FLOOD HAZARD AREAS**

Without Base Flood Elevation (BFE)  
Zone A, V, AE, AH, VE, AR  
With BFE or Depth  
Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**

0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile  
Future Conditions 1% Annual Chance Flood Hazard  
Area with Reduced Flood Risk due to Levee. See Notes.  
Area with Flood Risk due to Levee

**OTHER AREAS**

Area of Minimal Flood Hazard  
Effective LOMRs  
Area of Undetermined Flood Hazard  
Channel, Culvert, or Storm Sewer  
Levee, Dike, or Floodwall

**OTHER FEATURES**

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

**MAP PANELS**

Digital Data Available  
No Digital Data Available  
Unmapped

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/24/2020 at 3:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

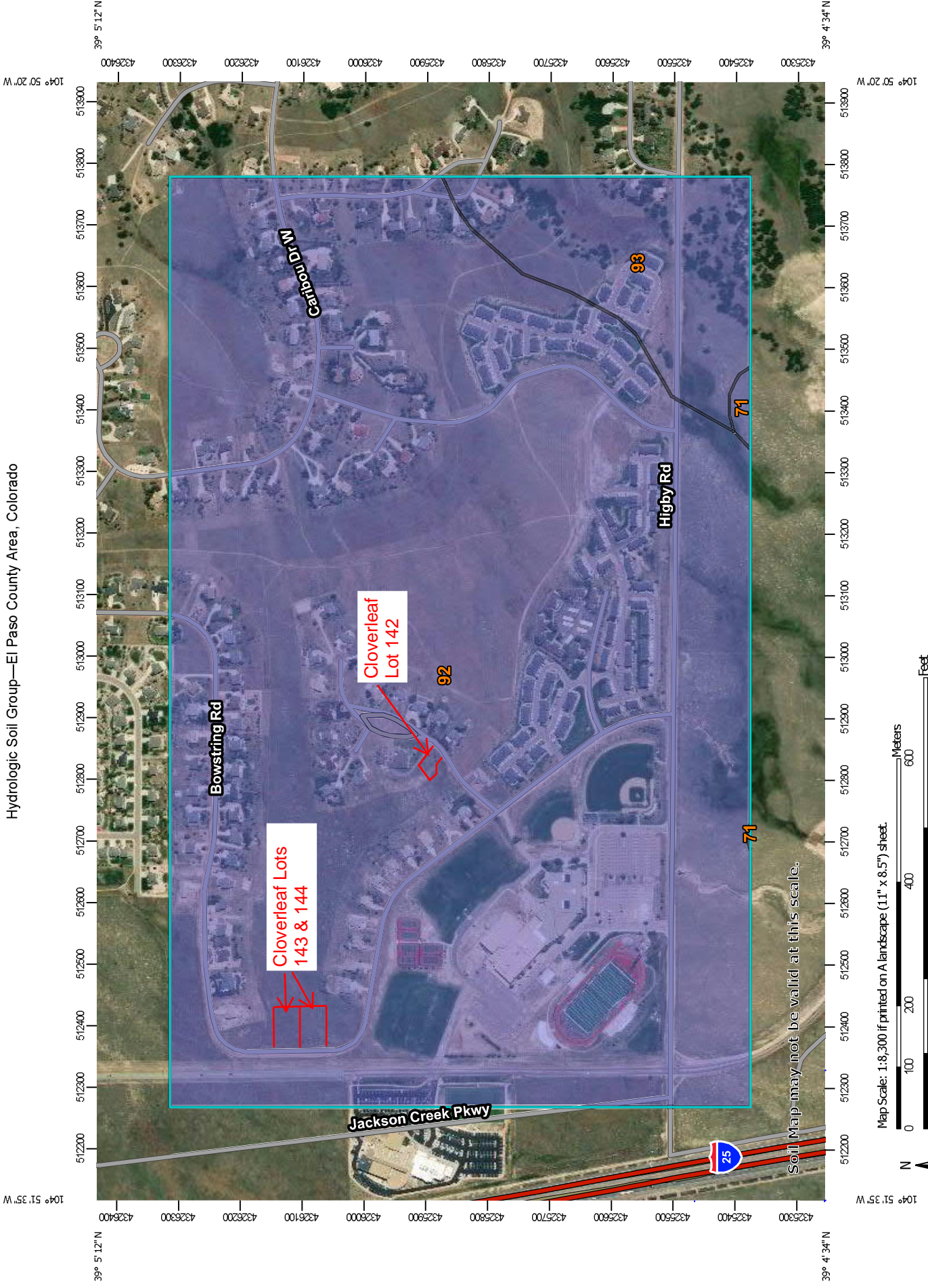


USGS The National Map: Orthoimagery: Data refreshed: October, 2020.

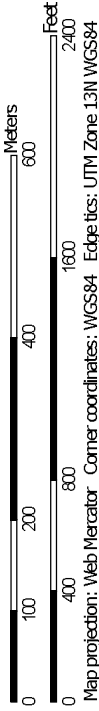


104°51'21"W 39°4'48"N






Map Scale: 1:8,300 if printed on A landscape (11" x 8.5") sheet.













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


**Water Features**


 Streams and Canals


**Transportation**

 Rails


 Interstate Highways

 US Routes


 Major Roads

 Local Roads


**Background**

 Aerial Photography


**C**

 C


**C/D**

 C/D

**D**

 D

**Not rated or not available**

 Not rated or not available

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 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 4, 2010—Oct 16, 2017

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
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	0.8	0.2%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	323.0	91.8%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	28.1	8.0%
Totals for Area of Interest			352.0	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

*Tie-break Rule:* Higher

# National Flood Hazard Layer FIRMette



104°51'40"W 39°5'16"N



USGS The National Map: Orthoimagery. Data refreshed October, 2020.

0 250 500 1,000 1,500 2,000 Feet 1:6,000

104°51'2"W 39°4'48"N

## Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



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

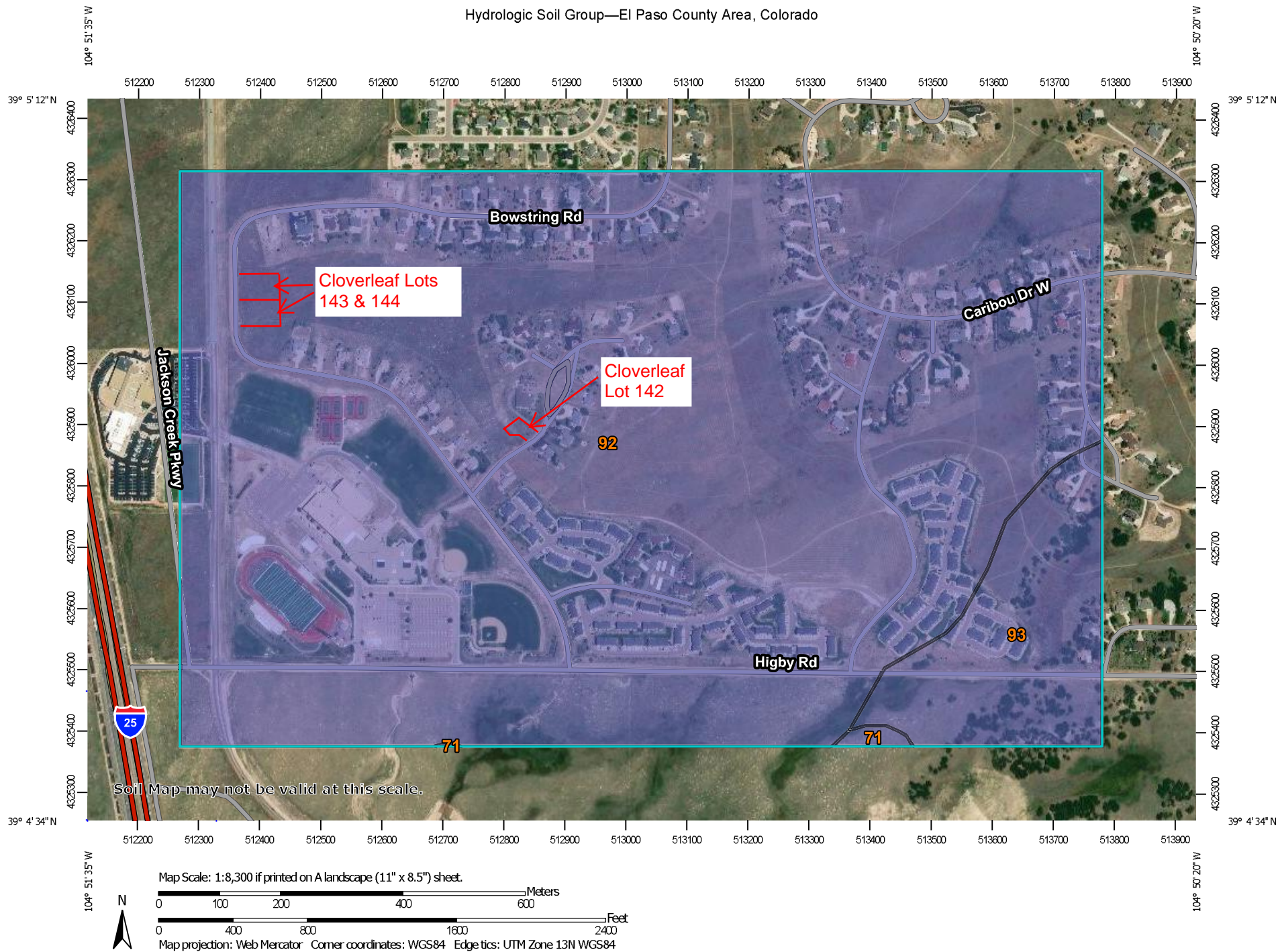
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The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **11/24/2020 at 3:51 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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# Hydrologic Soil Group—El Paso County Area, Colorado



## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





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

#### Soil Rating Lines


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

#### Soil Rating Points

 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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**Warning:** Soil Map may not be valid at this scale.

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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)

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 Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 4, 2010—Oct 16, 2017

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## Hydrologic Soil Group

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<b>Totals for Area of Interest</b>			<b>352.0</b>	<b>100.0%</b>

## 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

*Tie-break Rule:* Higher



## **Appendix B**

### **Rational Hydrologic Calculations**

# COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS - EXISTING CONDITIONS

Subdivision: Cloverleaf Filing No. 1      Project Name: Cloverleaf Fil. 1 - Existing Conditions  
 Location: Colorado Springs      Project No.: 2000-5158.01  
    Calculated By: RPD  
    Checked By: \_\_\_\_\_  
    Date: 11/25/20

Basin ID	Total Area (ac)	Pasture/Meadow (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	
EX-142	0.51	0.08	0.35	0.51	0.0%	0.08	0.35	0.0%
EX-143	0.50	0.08	0.35	0.50	0.0%	0.08	0.35	0.0%
EX-144	0.50	0.08	0.35	0.50	0.0%	0.08	0.35	0.0%
TOTAL	1.51							0.0%

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Cloverleaf Filing No. 1  
Location: Colorado Springs

Project Name: Cloverleaf Fil. 1 - Existing Conditions  
Project No.: 2000-5158.01  
Calculated By: RPD  
Checked By:  
Date: 11/25/20

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
EX-142	0.51	B	0%	0.08	0.35	191	5.1%	14.8	0	1.0%	15.0	1.5	0.0	14.8	191.0	26.0	14.8
EX-143	0.50	B	0%	0.08	0.35	201	3.4%	17.4	0	1.0%	15.0	1.5	0.0	17.4	201.0	26.0	17.4
EX-144	0.50	B	0%	0.08	0.35	217	1.6%	23.0	0	1.0%	15.0	1.5	0.0	23.0	217.0	26.0	23.0

## NOTES:

$$t_c = t_i + t_t$$

Equation 6-2 
$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

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

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)

C<sub>5</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>i</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-4 
$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

Where:

t<sub>c</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>t</sub> = slope of the channelized flow path (ft/ft).

Use a minimum t<sub>c</sub> value of 5 minutes for urbanized areas and a minimum t<sub>c</sub> value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: Cloverleaf Filing No. 1  
Location: Colorado Springs  
Design Storm: 5-Year

Project Name: Cloverleaf Fil. 1 - Existing Conditions

Project No.: 2000-5158.1

Calculated By: RPD

Checked By:

Date: 11/25/20[illegible]

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: Cloverleaf Filing No. 1  
Location: Colorado Springs  
Design Storm: 100-Year

Project Name: Cloverleaf Fil. 1 - Existing Conditions  
Project No.: 2000-5158  
Calculated By: RPD  
Checked By:  
Date: 11/25/20

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	$t_c$ (min)	$C \cdot A$ (ac)	$I$ (in/hr)	$Q$ (cfs)	$t_c$ (min)	$C \cdot A$ (ac)	$I$ (in/hr)	$Q$ (cfs)	$Q_{street}$ (cfs)	$C \cdot A$ (ac)	Slope (%)	$Q_{pipe}$ (cfs)	$C \cdot A$ (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	$t_t$ (min)	
	EX142	EX-142	0.51	0.35	14.8	0.18	5.94	1.1															Runoff from Basin EX-142 routed to DP-EX142 via overland flow.
	EX143	EX-143	0.50	0.35	17.4	0.17	5.54	0.9															Runoff from Basin EX-143 routed to DP-EX143 via overland flow.
	EX144	EX-144	0.50	0.35	23.0	0.18	4.83	0.9															Runoff from Basin EX-144 routed to DP-EX144 via overland flow.

## COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS - PROPOSED CONDITIONS

Subdivision: Cloverleaf Filing No. 1  
 Location: Colorado Springs

Project Name: Cloverleaf Fil. 1 - Proposed Conditions  
 Project No.: 2000-5158.01  
 Calculated By: RPD  
 Checked By: \_\_\_\_\_  
 Date: 11/25/20

Basin ID	Total Area (ac)	Pasture/Meadow (0% Impervious)				(100% Impervious)				Basins Total Weighted C		Basins Total Weighted % Imp.
		C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	C <sub>5</sub>	C <sub>100</sub>	Area (ac)	Weighted % Imp.	Values		
										C <sub>5</sub>	C <sub>100</sub>	
142	0.51	0.08	0.35	0.38	0.0%	0.90	0.96	0.13	25.0%	0.29	0.50	25.0%
143	0.50	0.08	0.35	0.37	0.0%	0.90	0.96	0.12	25.0%	0.29	0.50	25.0%
144	0.50	0.08	0.35	0.38	0.0%	0.90	0.96	0.13	25.0%	0.29	0.50	25.0%
TOTAL	1.51											25.0%

# STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Cloverleaf Filing No. 1  
Location: Colorado Springs

Project Name: Cloverleaf Fil. 1 - Proposed Conditions  
Project No.: 2000-5158.01  
Calculated By: RPD  
Checked By:  
Date: 11/25/20

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t <sub>c</sub> CHECK			FINAL
DATA						(T <sub>i</sub> )			(T <sub>t</sub> )					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C <sub>5</sub>	C <sub>100</sub>	L (ft)	S <sub>o</sub> (%)	t <sub>i</sub> (min)	L <sub>t</sub> (ft)	S <sub>t</sub> (%)	K	VEL. (ft/s)	t <sub>t</sub> (min)	COMP. t <sub>c</sub> (min)	TOTAL LENGTH (ft)	Urbanized t <sub>c</sub> (min)	
142	0.51	B	25%	0.29	0.50	191	5.1%	11.9	0	1.0%	15.0	1.5	0.0	11.9	191.0	21.8	11.9
143	0.50	B	25%	0.29	0.50	201	3.4%	13.9	0	1.0%	15.0	1.5	0.0	13.9	201.0	21.8	13.9
144	0.50	B	25%	0.29	0.50	217	1.6%	18.4	0	1.0%	15.0	1.5	0.0	18.4	217.0	21.8	18.4

## NOTES:

$$t_c = t_i + t_t$$

Equation 6-2 
$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Where:

t<sub>c</sub> = computed time of concentration (minutes)

t<sub>i</sub> = overland (initial) flow time (minutes)

t<sub>t</sub> = channelized flow time (minutes).

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

Where:

t<sub>i</sub> = overland (initial) flow time (minutes)

C<sub>5</sub> = runoff coefficient for 5-year frequency (from Table 6-4)

L<sub>i</sub> = length of overland flow (ft)

S<sub>o</sub> = average slope along the overland flow path (ft/ft).

Equation 6-4 
$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

t<sub>t</sub> = channelized flow time (travel time, min)

L<sub>t</sub> = waterway length (ft)

S<sub>o</sub> = waterway slope (ft/ft)

V<sub>t</sub> = travel time velocity (ft/sec) = K√S<sub>o</sub>

K = NRCS conveyance factor (see Table 6-2).

Where:

t<sub>c</sub> = minimum time of concentration for first design point when less than t<sub>c</sub> from Equation 6-1.

L<sub>t</sub> = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S<sub>t</sub> = slope of the channelized flow path (ft/ft).

Use a minimum t<sub>c</sub> value of 5 minutes for urbanized areas and a minimum t<sub>c</sub> value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision: Cloverleaf Filing No. 1  
Location: Colorado Springs  
Design Storm: 5-Year

Project Name: Cloverleaf Fil. 1 - Proposed Conditions

Project No.: 2000-5158.1

Calculated By: RPD

Checked By:

Date: 11/25/20[illegible]



# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

### (RATIONAL METHOD PROCEDURE)

Subdivision: Cloverleaf Filing No. 1  
Location: Colorado Springs  
Design Storm: 100-Year

Project Name: Cloverleaf Fil. 1 - Proposed Conditions

Project No.: 2000-5158.1

Calculated By: RPD

Checked By:

Date: 11/25/20[illegible]

## **Appendix C**

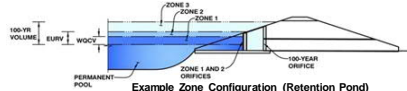
### **Water Quality Calculations**

## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Cloverleaf Filing No. 1

Basin ID: Lot 142



**Example Zone Configuration (Retention Pond)**

#### Required Volume Calculation

Selected BMP Type =	<b>SF</b>	
Watershed Area =	0.51	acres
Watershed Length =	191	ft
Watershed Slope =	0.051	ft/ft
Watershed Imperviousness =	25.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.005	acre-feet
Excess Urban Runoff Volume (EURV) =	0.013	acre-feet
2-yr Runoff Volume (P1 = 1.75 in.) =	0.010	acre-feet
5-yr Runoff Volume (P1 = 1.91 in.) =	0.014	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.023	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.041	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.052	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	0.067	acre-feet
500-yr Runoff Volume (P1 = 3 in.) =	0.093	acre-feet
Approximate 2-yr Detention Volume =	0.009	acre-feet
Approximate 5-yr Detention Volume =	0.013	acre-feet
Approximate 10-yr Detention Volume =	0.020	acre-feet
Approximate 25-yr Detention Volume =	0.024	acre-feet
Approximate 50-yr Detention Volume =	0.025	acre-feet
Approximate 100-yr Detention Volume =	0.030	acre-feet

Water Quality Capture Volume (WQCV) =	0.006	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.013	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.010	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.51 in.) =	0.014	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.023	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.041	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.052	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.067	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3 in.) =	0.093	acre-feet	3.00 inches

### Stage-Storage Calculation

Variable	Unit	Value
Zone 1 Volume ( $V_{QCV}$ )	acre-feet	0.005
Select Zone 2 Storage Volume (Optional)	acre-feet	0.005
Select Zone 3 Storage Volume (Optional)	acre-feet	0.005
Total Detention Basin Volume	acre-feet	0.005
Initial Surcharge Volume ( $ISV$ )	acre-ft <sup>3</sup>	N/A
Initial Surcharge Depth ( $ISD$ )	ft	user
Total Available Detention Depth ( $H_{DAV}$ )	ft	user
Depth of Trickle Channel ( $H_{TC}$ )	ft	user
Slope of Trickle Channel ( $S_{TC}$ )	ft/ft	N/A
Slopes of Main Basin Sides ( $S_{MAIN}$ )	H:V	user
Basin Length-to-Width Ratio ( $R_{L/W}$ )		user
Initial Surcharge Area ( $A_{ISD}$ )	acre-ft <sup>2</sup>	user
Surcharge Volume Length ( $L_{SD}$ )	ft	user
Surcharge Volume Width ( $W_{SD}$ )	ft	user
Depth of Basin Floor ( $H_{1(OCB)}$ )	ft	user
Length of Basin Floor ( $L_{1(OCB)}$ )	ft	user
Width of Basin Floor ( $W_{1(OCB)}$ )	ft	user
Area of Basin Floor ( $A_{1(OCB)}$ )	acre-ft <sup>2</sup>	user
Volume of Basin Floor ( $V_{1(OCB)}$ )	acre-ft <sup>3</sup>	user
Depth of Main Basin ( $H_{MAIN}$ )	ft	user
Length of Main Basin ( $L_{MAIN}$ )	ft	user
Width of Main Basin ( $W_{MAIN}$ )	ft	user
Area of Main Basin ( $A_{MAIN}$ )	acre-ft <sup>2</sup>	user
Volume of Main Basin ( $V_{MAIN}$ )	acre-ft <sup>3</sup>	user
Calculated Total Basin Volume ( $V_{DAV}$ )	acre-feet	user

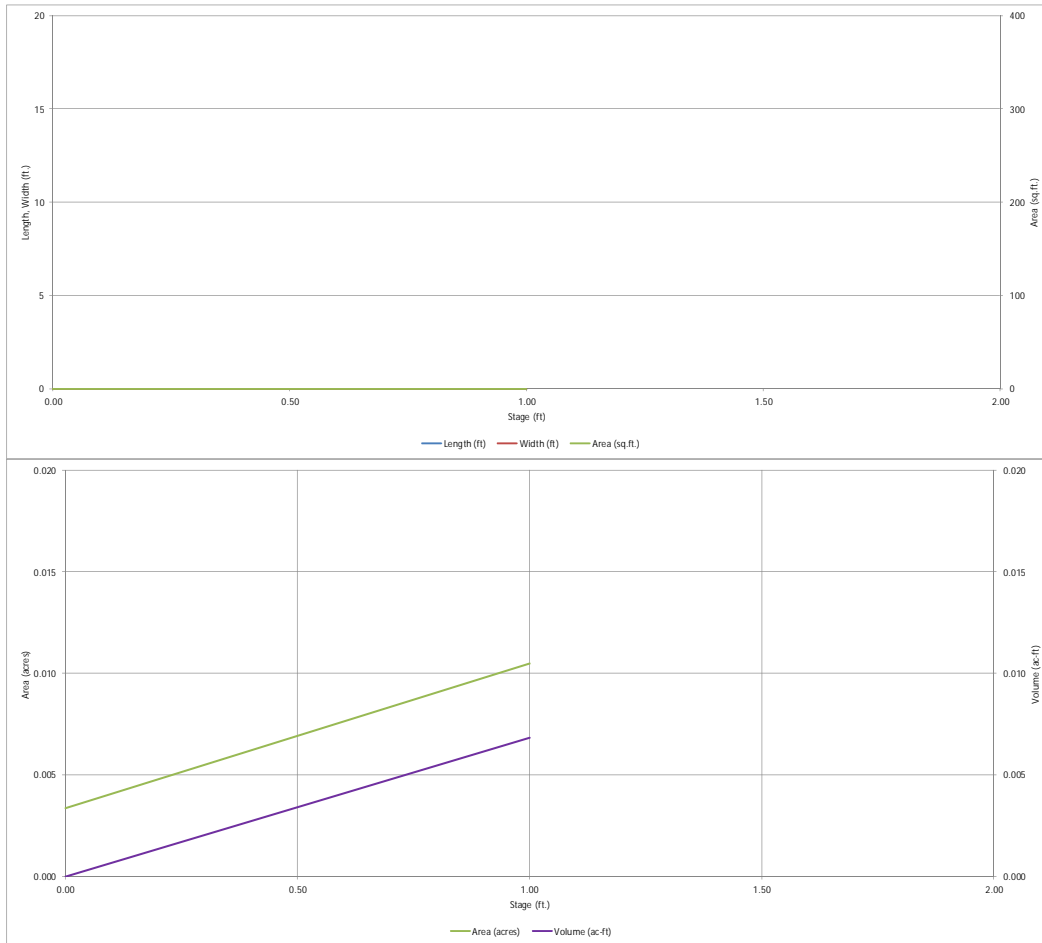
Select Zone 2 Storage Volume (Optional) =  acre-feet  
 Select Zone 3 Storage Volume (Optional) =  acre-feet  
 Total Detention Basin Volume = 0.005 acre-feet

Total detention volume is less than 100-year volume.

[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



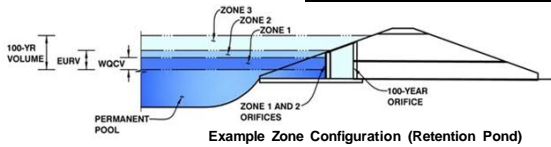
If applicable, input the overflow domed grate and 4" outlet pipe calcs into this sheet so all calcs are in one place.

This sheet was revised to include a full-spectrum design. Please note the drain time was limited by the required orifice diameter per your comment on the proposed drainage map.

UD-Detention, Version 3.07 (February 2017)

Project: Cloverleaf Filling No. 1

Basin ID: Lot 142



Example Zone Configuration (Retention Pond)

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

Underdrain Orifice Invert Depth = 1.80 ft (distance below the filtration media surface)  
Underdrain Orifice Diameter = 0.31 inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = 0.0 ft<sup>2</sup>  
Underdrain Orifice Centroid = 0.01 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 = inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft<sup>2</sup>  
Elliptical Half-Width = N/A feet  
Elliptical Slot Centroid = N/A feet  
Elliptical Slot Area = N/A ft<sup>2</sup>

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

	Row 1 (optional)	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)								
Orifice Area (sq. inches)								
	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 = Not Selected ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice = Not Selected ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter = Not Selected inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = Not Selected ft<sup>2</sup>  
Vertical Orifice Centroid = Not Selected feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> = Not Selected ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length = Not Selected feet  
Overflow Weir Slope = Not Selected H:V (enter zero for flat grate)  
Horiz. Length of Weir Sides = Not Selected feet  
Overflow Grate Open Area % = Not Selected %, grate open area/total area  
Debris Clogging % = Not Selected %

Calculated Parameters for Overflow Weir

Height of Grate Upper Edge, H<sub>u</sub> = Not Selected feet  
Over Flow Weir Slope Length = Not Selected feet  
Grate Open Area / 100-yr Orifice Area = Not Selected should be ≥ 4  
Overflow Grate Open Area w/o Debris = Not Selected ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris = Not Selected ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe = Not Selected ft (distance below the filtration media surface)  
Circular Orifice Diameter = Not Selected inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = Not Selected ft<sup>2</sup>  
Outlet Orifice Centroid = Not Selected feet  
Half-Central Angle of Restrictor Plate on Pipe = N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = Not Selected ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length = Not Selected feet  
Spillway End Slopes = Not Selected H:V  
Freeboard above Max Water Surface = Not Selected feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = Not Selected feet  
Stage at Top of Freeboard = Not Selected feet  
Basin Area at Top of Freeboard = Not Selected acres

#### Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.00
One-Hour Rainfall Depth (in) =	0.005	0.013	0.010	0.014	0.023	0.041	0.052	0.067	0.093
Calculated Runoff Volume (acre-ft) =									
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.004	0.012	0.009	0.014	0.022	0.040	0.051	0.067	0.093
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.25	0.81	1.12	1.49	2.09
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.4	0.6	0.8	1.1
Peak Inflow Q (cfs) =	0.1	0.3	0.2	0.3	0.5	0.8	1.1	1.4	1.9
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.0	0.0	0.0	0.0	0.0
Structure Controlling Flow =	Filtration Media	Filtration Media	Filtration Media	Filtration Media	Filtration Media	Filtration Media	Filtration Media	Filtration Media	Filtration Media
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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) =	12	36	28	28	28	28	28	28	28
Time to Drain 99% of Inflow Volume (hours) =	12	36	28	28	28	28	28	28	28
Maximum Ponding Depth (ft) =	0.59	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Area at Maximum Ponding Depth (acres) =	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.003	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007

Addressed

Complete this section and revise detail on plans if necessary.

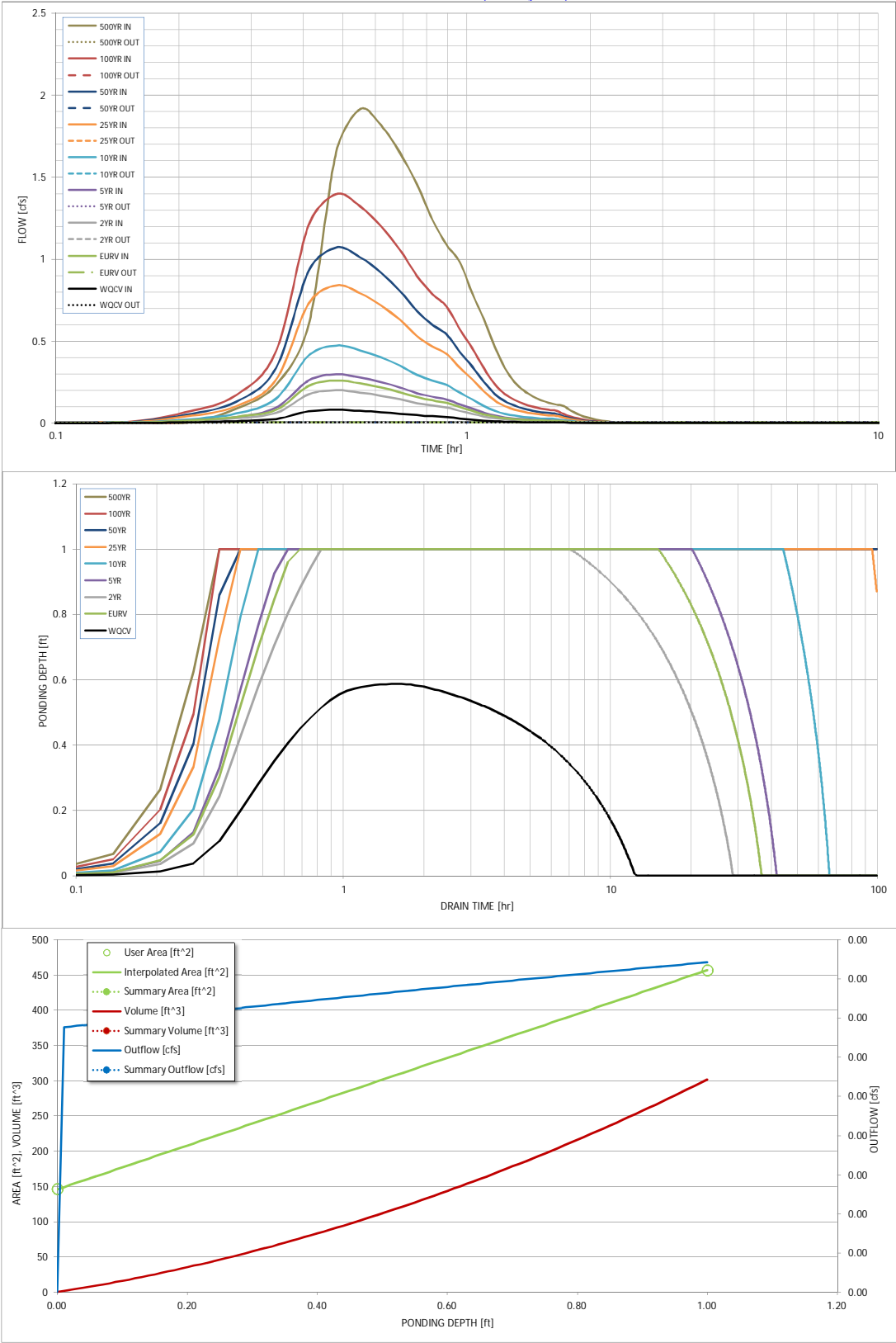
Addressed, all storms were designed to be as close to a 1:1 pre-dev inflow versus outflow ratio as possible

At depth of 1ft, the overflow grate (not filtration media) would be utilized up to 100-yr storm (according to calcs on page 49) and then the spillway for the 500yr. Revise accordingly for each SF.

From EURV to 500-yr storm, there is not much detention happening since the overflow grate is being utilized. For these storms, the inflow should almost equal the outflow. Meaning that the Peak Outflow for these storms should be greater than 0.0. Please revise.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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





## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

### 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]

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

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

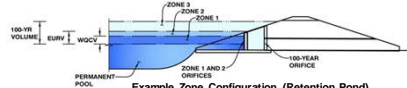
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Cloverleaf Filing No. 1

Basin ID: Lot 143



**POOL**      **Example Zone Configuration (Retention Pond)**

#### Required Volume Calculation

Selected BMP Type =	SF	
Watershed Area =	0.51	acres
Watershed Length =	191	ft
Watershed Slope =	0.042	ft/ft
Watershed Imperviousness =	25.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.005	acre-feet
Excess Urban Runoff Volume (EURV) =	0.013	acre-feet
2-yr Runoff Volume (P = 1.15 in.) =	0.010	acre-feet
5-yr Runoff Volume (P = 1.79 in.) =	0.014	acre-feet
10-yr Runoff Volume (P = 1.97 in.) =	0.023	acre-feet
25-yr Runoff Volume (P = 2.31 in.) =	0.041	acre-feet
50-yr Runoff Volume (P = 2.25 in.) =	0.052	acre-feet
100-yr Runoff Volume (P = 2.52 in.) =	0.067	acre-feet
500-yr Runoff Volume (P = 3 in.) =	0.093	acre-feet
Approximate 2-yr Detention Volume =	0.009	acre-feet
Approximate 5-yr Detention Volume =	0.013	acre-feet
Approximate 10-yr Detention Volume =	0.020	acre-feet
Approximate 25-yr Detention Volume =	0.024	acre-feet
Approximate 50-yr Detention Volume =	0.025	acre-feet
Approximate 100-yr Detention Volume =	0.030	acre-feet

Water Quality Capture Volume (WQCV) =	0.006	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EVRV) =	0.013	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.010	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.014	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.023	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.041	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.052	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.067	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3 in.) =	0.093	acre-feet	3.00 inches

### Stage-Storage Calculation

Zone 1 Volume ( $V_{QCV}$ )		0.005	acre-feet
Select Zone 2 Storage Volume (Optional)			
Select Zone 3 Storage Volume (Optional)			
Total Detention Basin Volume	$V_m$	0.005	acre-feet
Initial Surcharge Volume ( $ISV$ )		N/A	ft <sup>3</sup>
Initial Surcharge Depth ( $ISD$ )		user	ft
Total Available Detention Depth ( $H_{DAV}$ )		user	ft
Depth of Trickle Channel ( $H_{TC}$ )		user	ft
Slope of Trickle Channel ( $S_{TC}$ )		N/A	ft/ft
Slopes of Main Basin Sides ( $S_{MAIN}$ )		user	H/V
Basin Length-to-Width Ratio ( $R_{L/W}$ )		user	
Initial Surcharge Area ( $A_{ISD}$ )		user	ft <sup>2</sup>
Surcharge Volume Length ( $L_{SD}$ )		user	ft
Surcharge Volume Width ( $W_{SD}$ )		user	ft
Depth of Basin Floor ( $H_{1(OC)}$ )		user	ft
Length of Basin Floor ( $L_{1(OC)}$ )		user	ft
Width of Basin Floor ( $W_{1(OC)}$ )		user	ft
Area of Basin Floor ( $A_{1(OC)}$ )		user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{1(OC)}$ )		user	ft <sup>3</sup>
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 <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ )		user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{DAV}$ )		user	acre-feet

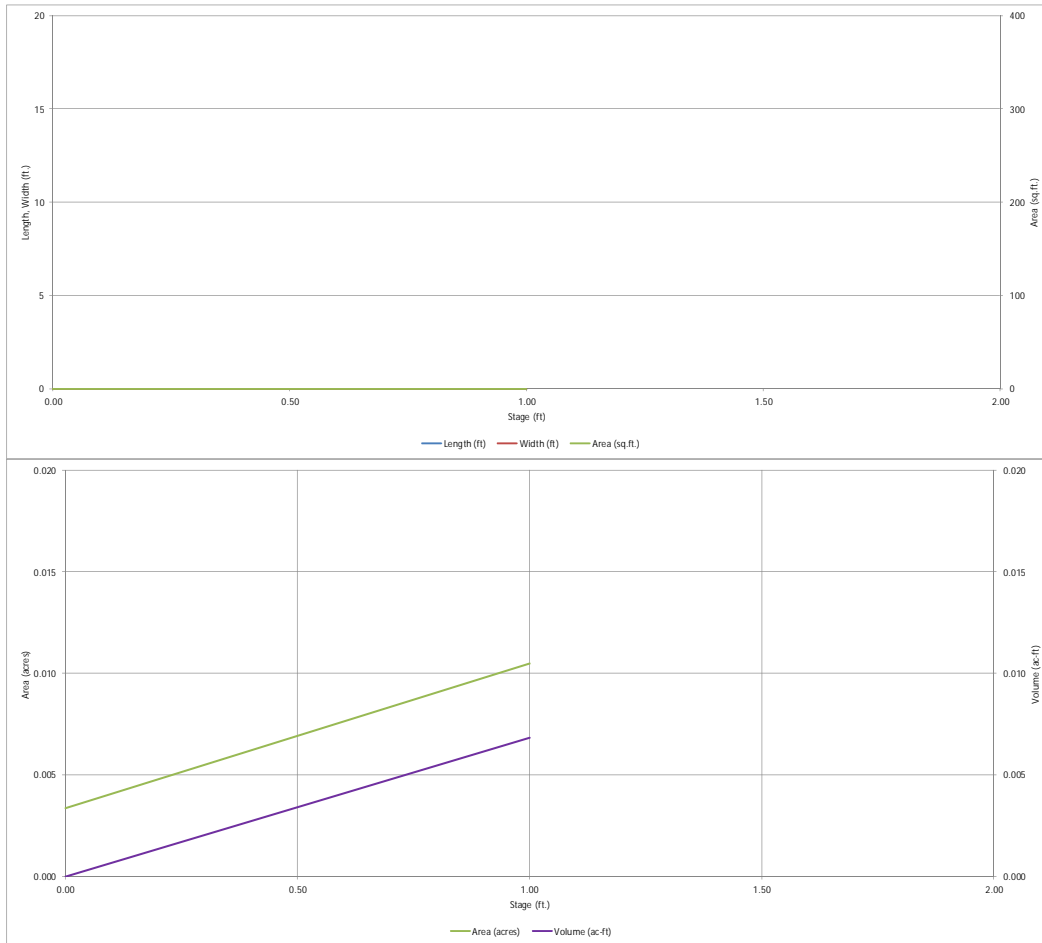
Select Zone 2 Storage Volume (Optional) =		acre-feet	Total detention volume is less than 100-year volume.
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.005	acre-feet	

Depth Increment =  ft

[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

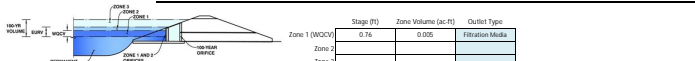
UD-Detention, Version 3.07 (February 2017)



## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Cloverleaf Filing No. 1  
Basin ID: Lot 143



Example Zone Configuration (Retention Pond)

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)		Calculated Parameters for Underdrain	
Underdrain Orifice Invert Depth =	1.80 ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0 in <sup>2</sup>
Underdrain Orifice Diameter =	0.31 inches	Underdrain Orifice Control =	0.01 feet

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)		Calculated Parameters for Underdrain	
Underdrain Orifice Invert Depth =	1.80 ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0 ft <sup>2</sup>
Underdrain Orifice Diameter =	0.75 inches	Underdrain Orifice Control =	0.01 feet

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

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

Invert of Lowest Orifice	ft (relative to basin bottom at Stage = 6 ft)	WG Orifice Area per Row	N/A	ft <sup>2</sup>
Depth at top of Zone using Orifice Plate	ft (relative to basin bottom at Stage = 6 ft)	Elliptical Half-Width	N/A	feet
Orifice Plate: Orifice Vertical Spacing	inches	Elliptical Slot Centroid	N/A	feet
Orifice Plate: Orifice Area per Row	inches	Elliptical Slot Area	N/A	ft <sup>2</sup>

Invert of Lowest Orifice	ft (relative to basin bottom at Stage = 6 ft)	WG Orifice Area per Row	N/A	ft <sup>2</sup>
Depth at top of Zone using Orifice Plate	ft (relative to basin bottom at Stage = 6 ft)	Elliptical Half-Width	N/A	feet
Orifice Plate: Orifice Vertical Spacing	inches	Elliptical Slot Centroid	N/A	feet
Orifice Plate: Orifice Area per Row	inches	Elliptical Slot Area	N/A	ft <sup>2</sup>

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

Stage of Office Centroid (ft)	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Office Area (sq. inches)								
Stage of Office Centroid (ft)	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Office Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)	Calculated Parameters for Vertical Orifice
--	--

User Input: Vertical Orifice (Circular or Rectangular)	Calculated Parameters for Vertical Orifice
--	--

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)		Vertical Orifice Area =		ft <sup>2</sup>
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)		Vertical Orifice Centroid =		ft
Vertical Orifice Diameter =			inches				

	Not Selected	Not Selected			Not Selected	Not Selected
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)		Vertical Orifice Area =	ft <sup>2</sup>
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)		Vertical Orifice Control =	Root

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

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

	Not Selected	Not Selected		Not Selected	Not Selected	
Overflow Weir Front Edge Height, H <sub>o</sub>			H <sub>o</sub> (relative to basin bottom at Stage = 0 ft)			feet
Overflow Weir Front Edge Length			feet	Overflow Weir Slope Length		feet
Overflow Weir Slope			ft/ft (enter zero for flat grade)	Grate Open Area w/ 100% Orifice Area		should be $\geq 4$
Horizontal Length of Weir Slope				Overflow Grate Open Area w/o Debris		ft <sup>2</sup>
Overflow Grate Open Area %			% grate open area/total area	Overflow Grate Open Area w/ Debris		ft <sup>2</sup>
Debris Clogging %			%			

	Not Selected	Not Selected		Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho			ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H <sub>u</sub>		feet
Overflow Weir Front Edge Length -			ft	Overflow Weir Slope Length -		feet
Overflow Weir Slope -			H/V (enter zero for flat grate)	Grate Open Area / 100 x Grate Area -		should be $\geq 4$
Horiz. Length of Weir Sides -			ft	Overflow Grate Open Area w/o Debris -		sq'
Overflow Grate Open Area % -			% (grate open area/total area)	Overflow Grate Open Area w/ Debris -		sq'

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

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

	Not Selected	Not Selected		Not Selected	Not Selected
Depth to Invert of Outlet Pipe =		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =		ft <sup>2</sup>
Circular Orifice Diameter =		inches	Outlet Orifice Control =		feet

Depth to Invert of Outlet Pipe =	Not Selected	Not Selected	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	Not Selected	Not Selected	ft <sup>2</sup>
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal) Calculated Parameters for Spillway

User Input: Emergency Spillway (Rectangular or Trapezoidal) Calculated Parameters for Spillway

Spillway Invert Stage =	<input type="text"/>	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth =	<input type="text"/>	feet
Spillway Crest Length =	<input type="text"/>	feet	Stage at Top of Freeboard =	<input type="text"/>	feet
Spillway End Slopes =	<input type="text"/>	H:V	Basin Area at Top of Freeboard =	<input type="text"/>	acres
Freeboard above Max Water Surface =	<input type="text"/>	feet			

Spillway Invert Stage =	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth =	feet
Spillway Crest Length =	feet	Stage at Top of Freeboard =	feet
Spillway End Slopes =	H:V	Basin Area at Top of Freeboard =	acres

Routed Hydrograph Results

[illegible]







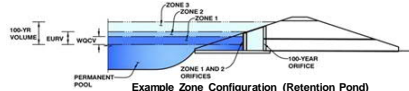


## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Cloverleaf Filing No. 1

Basin ID: Lot 144



**Example Zone Configuration (Retention Pond)**

#### Required Volume Calculation

Selected BMP Type =	<b>SF</b>
Watershed Area =	0.50 acres
Watershed Length =	217 ft
Watershed Slope =	0.016 ft/ft
Watershed Imperviousness =	25.00% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Desired WQCV Drain Time =	12.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQCV) =	0.004 acre-feet
Excess Urban Runoff Volume (EURV) =	0.013 acre-feet
2-yr Runoff Volume (P = 1.15 in.) =	0.010 acre-feet
5-yr Runoff Volume (P = 1.79 in.) =	0.014 acre-feet
10-yr Runoff Volume (P = 1.97 in.) =	0.022 acre-feet
25-yr Runoff Volume (P = 2.1 in.) =	0.040 acre-feet
50-yr Runoff Volume (P = 2.25 in.) =	0.051 acre-feet
100-yr Runoff Volume (P = 2.52 in.) =	0.066 acre-feet
500-yr Runoff Volume (P = 3 in.) =	0.092 acre-feet
Approximate 2-yr Detention Volume =	0.009 acre-feet
Approximate 5-yr Detention Volume =	0.013 acre-feet
Approximate 10-yr Detention Volume =	0.020 acre-feet
Approximate 25-yr Detention Volume =	0.023 acre-feet
Approximate 50-yr Detention Volume =	0.025 acre-feet
Approximate 100-yr Detention Volume =	0.030 acre-feet

Water Quality Capture Volume (WQCV)		Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV)	0.013	
2-yr Runoff Volume (P1 = 1.19 in.)	0.010	1.19 inches
5-yr Runoff Volume (P1 = 1.51 in.)	0.014	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.)	0.022	1.75 inches
25-yr Runoff Volume (P1 = 2 in.)	0.040	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.)	0.051	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.)	0.066	2.52 inches
500-yr Runoff Volume (P1 = 3 in.)	0.092	3.00 inches

### Stage-Storage Calculation

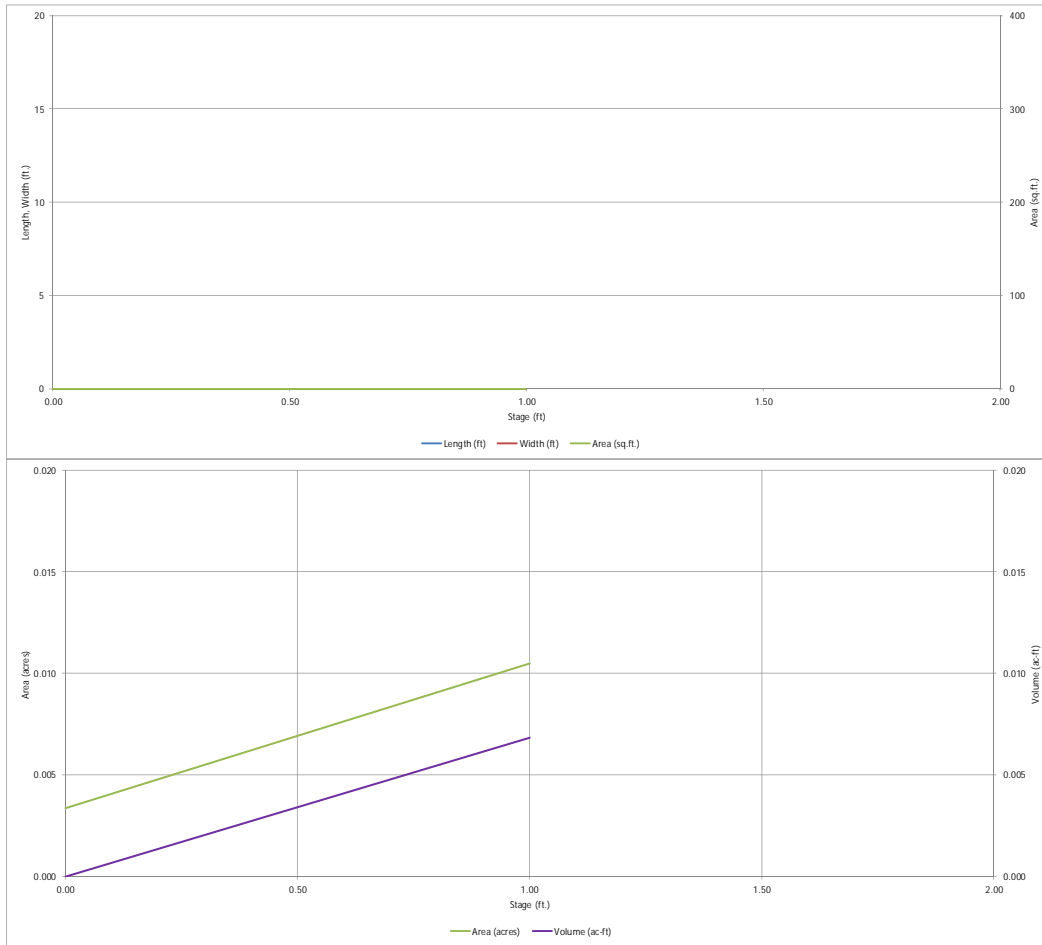
Zone 1 Volume ( $V_{QCV}$ )	0.004	acre-feet
Select Zone 2 Storage Volume (Optional)		acre-feet
Select Zone 3 Storage Volume (Optional)		acre-feet
Total Detention Basin Volume	0.004	acre-feet
Initial Surcharge Volume ( $ISV$ )	N/A	ft <sup>3</sup>
Initial Surcharge Depth ( $ISD$ )	user	ft
Total Available Detention Depth ( $H_{DAV}$ )	user	ft
Depth of Trickle Channel ( $H_{TC}$ )	user	ft
Slope of Trickle Channel ( $S_{TC}$ )	N/A	ft/ft
Slopes of Main Basin Sides ( $S_{MAIN}$ )	user	H:V
Basin Length-to-Width Ratio ( $R_{L/W}$ )	user	
Initial Surcharge Area ( $A_{ISD}$ )	user	ft <sup>2</sup>
Surcharge Volume Length ( $L_{ISD}$ )	user	ft
Surcharge Volume Width ( $W_{ISD}$ )	user	ft
Depth of Basin Floor ( $H_{1(OCB)}$ )	user	ft
Length of Basin Floor ( $L_{1(OCB)}$ )	user	ft
Width of Basin Floor ( $W_{1(OCB)}$ )	user	ft
Area of Basin Floor ( $A_{1(OCB)}$ )	user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{1(OCB)}$ )	user	ft <sup>3</sup>
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 <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ )	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{TBL}$ )	USER	acre-feet

Select Zone 2 Storage Volume (Optional) =		acre-feet	Total detention volume is less than 100-year volume.
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.004	acre-feet	

[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

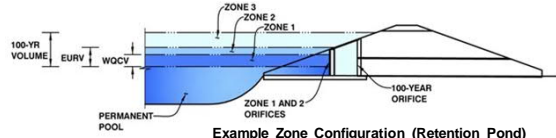


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Cloverleaf Filing No. 1

Basin ID: Lot 144



**Example Zone Configuration (Retention Pond)**

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	0.75	0.004	Filtration Media
Zone 2			
Zone 3			
		0.004	Total

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

Underdrain Orifice Invert Depth = 1.80 ft (distance below the

Underdrain Orifice Diameter = 0.31 inches

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

Underdrain Orifice Invert Depth = 1.80 ft (distance below the filtration media surface)

Underdrain Orifice Area = 0.0 ft<sup>2</sup>

Underdrain Orifice Diameter =	0.31	inches	Underdrain Orifice Centroid =	0.01	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) Calculated Parameters for Plate

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)      WQ Orifice Area per Row =  N/A ft<sup>2</sup>

Depth at top of Zone using Orifice Plate =	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
--	---	-------------------------	-----	------

Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =		feet
---	--	--------	----------------------------	--	------

Orifice Plate: Orifice Area per Row =		inches	Elliptical Slot Area =		ft <sup>2</sup>
---------------------------------------	--	--------	------------------------	--	-----------------

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) Calculated Parameters for Plate

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)      WQ Orifice Area per Row =  N/A ft<sup>2</sup>

Depth at top of Zone using Orifice Plate =	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
--	---	-------------------------	-----	------

Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =		feet
---	--	--------	----------------------------	--	------

Orifice Plate: Orifice Area per Row =		inches	Elliptical Slot Area =		ft <sup>2</sup>
---------------------------------------	--	--------	------------------------	--	-----------------

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

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

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

User Input: Vertical Orifice (Circular or Rectangular)	Calculated Parameters for Vertical Orifice

User Input: Vertical Orifice (Circular or Rectangular)		Calculated Parameters for Vertical Orifice	
Orifice Diameter (mm)		Flow Rate (L/min)	
Orifice Area (mm <sup>2</sup> )		Velocity (m/s)	
Discharge Coefficient (C <sub>d</sub> )		Head Loss (m)	
Flow Rate (L/min)		Pressure Drop (Pa)	
Velocity (m/s)		Reynolds Number (Re)	
Head Loss (m)		Friction Factor (f)	
Pressure Drop (Pa)		Flow Regime	
Reynolds Number (Re)			
Friction Factor (f)			
Flow Regime			

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

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

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

Overflow Weir Front Edge Height, $H_o$ =	Not Selected	Not Selected	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, $H_i$ =	Not Selected	Not Selected	feet
Overflow Weir Front Edge Length =			feet	Overflow Weir Slope Length =			feet
Overflow Weir Slope =			H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =			should be $\geq 4$
Horiz. Length of Weir Sides =			feet	Overflow Grate Open Area w/o Debris =			ft <sup>2</sup>
Overflow Grate Open Area % =			%, grate open area/total area	Overflow Grate Open Area w/ Debris =			ft <sup>2</sup>
Debris Clogging % =			%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	
Not Selected	Not Selected	Not Selected	Not Selected

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	
Not Selected	Not Selected	Not Selected	Not Selected

Not Selected		Not Selected		Not Selected		Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =			ft <sup>2</sup>
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal) Calculated Parameters for Spillway

User Input: Emergency Spillway (Rectangular or Trapezoidal) Calculated Parameters for Spillway

Spillway Invert Stage=  ft (relative to basin bottom at Stage = 0 ft)      Spillway Design Flow Depth=  feet

Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
-------------------------	--	------	-----------------------------	--	------

Spillway End Slopes =  H:V

Basin Area at Top of Freeboard =  acres

Freeboard above Max Water Surface =  feet

Spillway Invert Stage=  ft (relative to basin bottom at Stage = 0 ft)      Spillway Design Flow Depth=  feet

Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
-------------------------	--	------	-----------------------------	--	------

Spillway End Slopes =  H:V

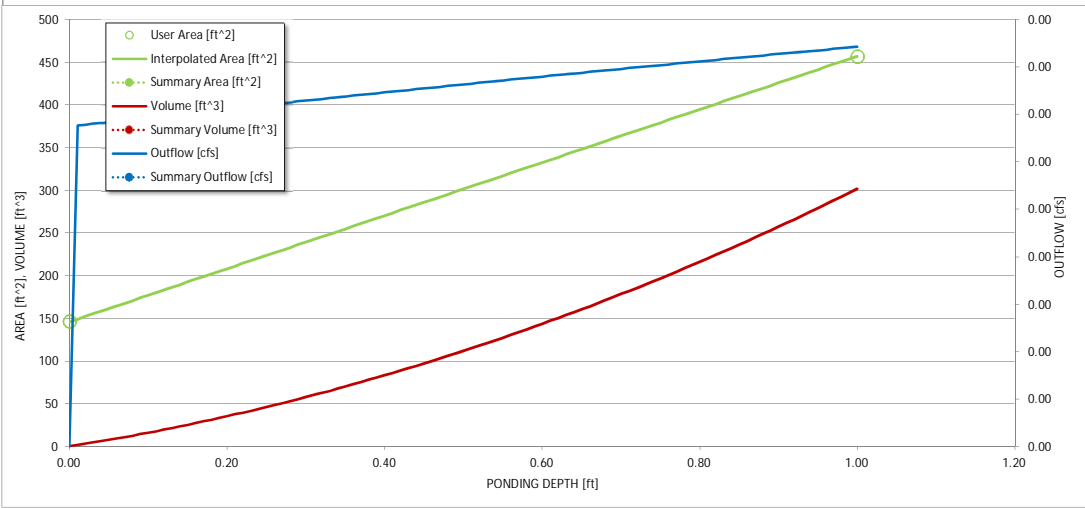
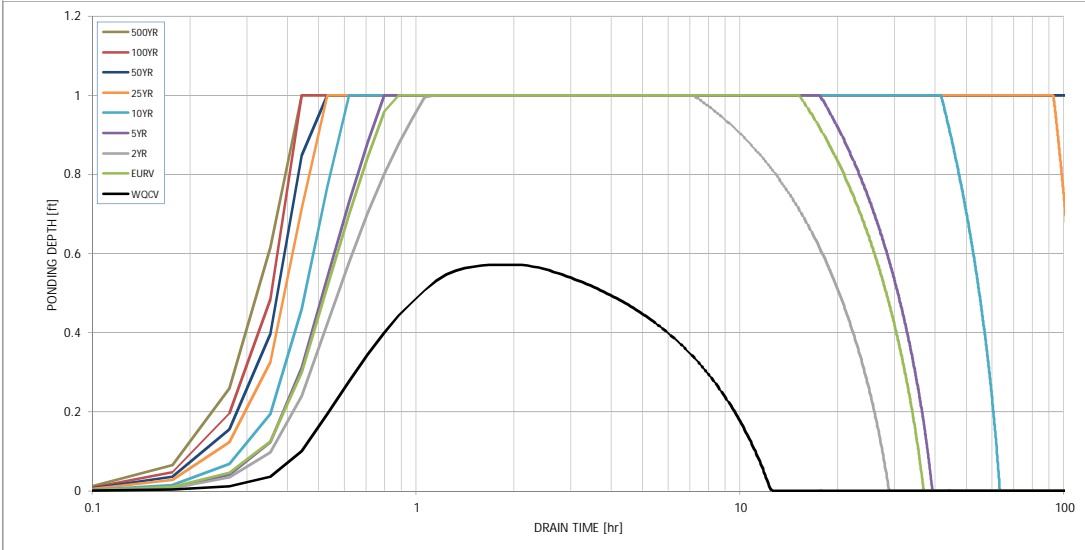
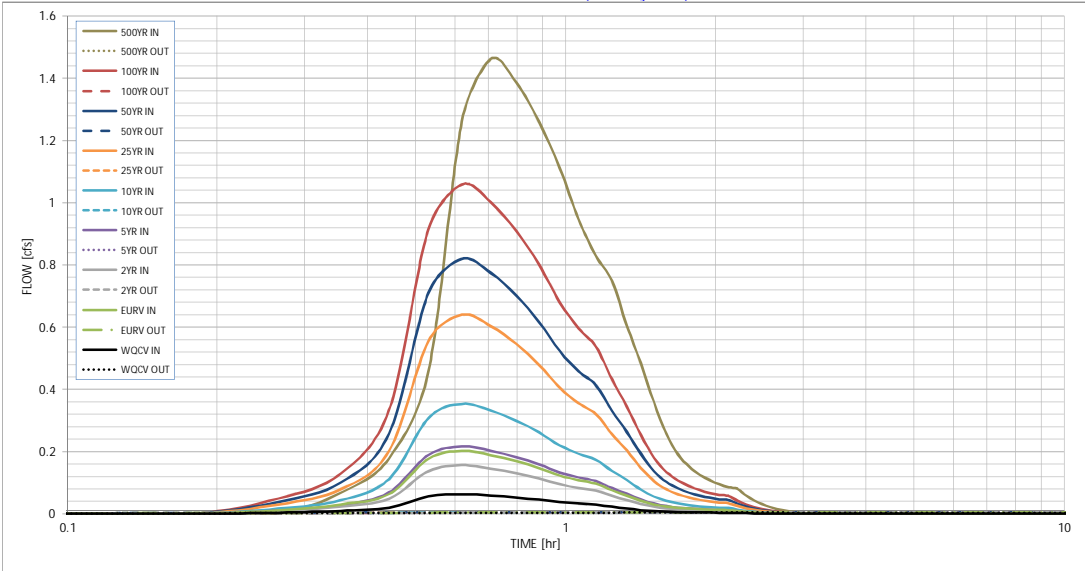
Basin Area at Top of Freeboard =  acres

## Routed Hydrograph Results

[illegible]

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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



## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

### 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]

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

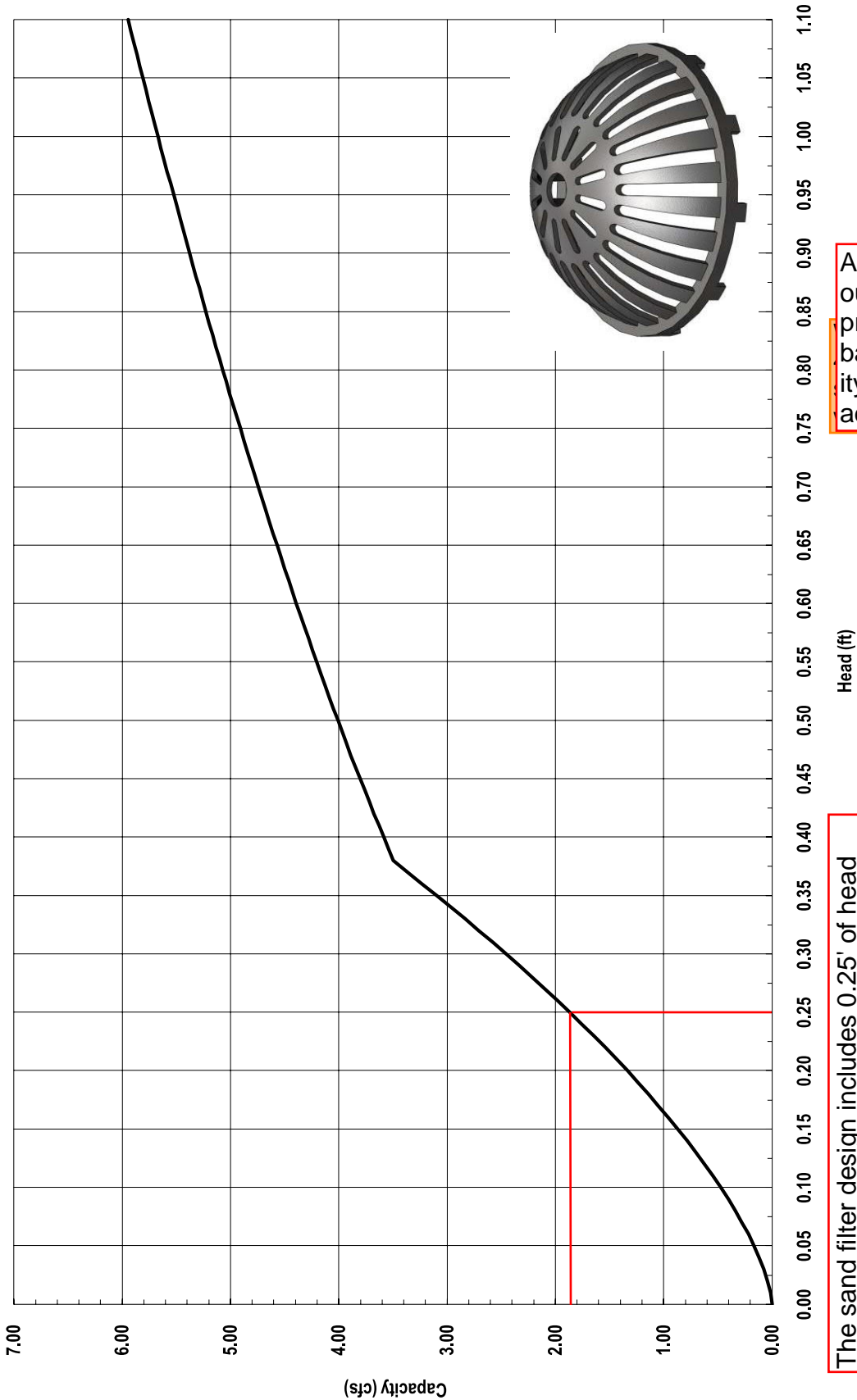
Also include the invert of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

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



**SAND FILTER OVERFLOW INLET CAPACITY**

Nyloplast 18" Dome Grate Inlet Capacity Chart



Addressed, a 12" outlet pipe is now proposed for each basin and a capacity calc has been added.

The sand filter design includes 0.25' of head over the dome grate, which corresponds to about 1.8 cfs of capacity. The 100-year flow into the sand filters ranges from 1.3 to 1.6 cfs, so an 18" dome grate has adequate capacity.

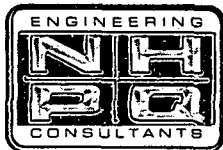


**Nyloplast®**

3130 Verona Avenue • Buford, GA 30518  
(866) 886-8479 / (770) 932-2443 • Fax: (770) 932-2490  
© Nyloplast Inlet Capacity Charts June 2012

## **Appendix D**

### **Reference Material**



**NELSON, HALEY, PATTERSON AND QUIRK, INC.**  
THE MINE SHOPPING CENTER, BOX 547, MONUMENT, COLORADO 80132 481-3533

January 7, 1972

Mr. Thomas Russell  
El Paso County Engineer  
County Office Building  
Colorado Springs, Colorado

Dear Mr. Russell:

In compliance with the subdivision regulations of El Paso County, Colorado, we are transmitting the following drainage plan and report for the Woodmoor Greens Subdivision. The Woodmoor Greens is a development of the Woodmoor Corporation, located in the Northeast quarter of Section 23, the North half of Section 24 and the South 1/2 Southwest 1/4 of Section 13, all in T.11 South, Range 67 West of the 6th Principal Meridian and contains 245.51 acres.

The Woodmoor Greens subdivision lies North of the Higby County Road and adjacent to the West boundary of Woodmoor Summit and Nugget. This proposed subdivision will contain 222 single-family residences and a future golf course.

Existing Conditions:

The Woodmoor Green's area has an existing ground cover composed of medium to dense native grasses. The soil in this area is generally sandy in nature, allowing for a medium infiltration rate. The historical drainage pattern for this area is as follows: Runoff flowing Westerly and Southwesterly from the Woodmoor Summit and Woodmoor Nugget flows through the Woodmoor Greens area, into Teachout Creek and eventually reaches Monument Creek.

Developed Conditions

The future surface runoff of the developed Woodmoor Greens Subdivision will follow the historical drainage pattern of the area. The developed runoff generated from this subdivision was calculated on the basis of the Rational Formula.

Mr. Thomas Russell - Page 2 continued

$Q = CiA$ , where

$Q$  = The surface runoff in cubic feet per second

$C$  = Runoff factor based upon character of soil  
and percentage of impervious area

$i$  = Intensity of rainfall

$A$  = Contributing area

The runoff factor  $C$  is based upon the following calculations:

222 lots X 2,500 square feet per house ÷ 43,560 = 12.74  
acres

12.74 acres of impervious area X 0.90 = 11.50

232.77 acres with grass cover X 0.30 = 69.71

245.51 acres 81.21

$C = 81.21 ÷ 245.51 = 0.33$

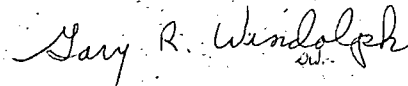
A design storm of 25 years was used in calculations.  
(Exhibit 2).

During the construction of roadways in the Woodmoor Greens  
Subdivision, corrugated metal pipe culverts will be installed  
at street intersections and natural drainage ways to accommodate  
the expected runoff (refer to exhibit 2).

Should there be any questions relative to this report, please  
contact us at your convenience.

Very truly yours,

NELSON, HALEY, PATTERSON AND QUIRK



Gary R. Windolph, P. E.

GRW:dw

EXHIBIT 2

AREA NO.	ACREAGE	INTENSITY	Q
1	0.60	3.67	0.7
2	15.2	1.98	9.93
3	110.0	1.73	62.8
4	2.8	3.35	3.1
5	2.8	3.19	2.9
6	16.5 + 9.7	1.55	13.4
7	1.6 + #8	1.73	3.4
8	2.5 + #9	2.31	3.3
9	1.8	3.80	2.3
10	1.0	4.20	1.4
11	3.5	3.12	3.6
12	19.8	2.31	13.7
13	7.9	2.89	7.6
14	5.2 + 9.5 Ac	1.98	29.10
15	1.0	3.55	1.2
16	9.0	2.60	7.7

WOODMOOR GREENS  
A PART OF SECTIONS 13 , 23 , AND 24 T-11-S, R-67-W  
EL PASO COUNTY, COLORADO

NELSON, HALEY, PATTERSON, and QUIRK INC.  
ENGINEERING CONSULTANTS

KNOW ALL MEN BY THESE PRESENTS:  
That the Woodmoor Corporation, a Colorado Corporation, Steven N. Arnold, President,  
John J. Wilkinson, Secretary, James E. Higby, Holder of a Deed of Trust, being the parties in  
interest to the following described tract of land.  
TO WIT: That portion of the Northeast and Northwest 1/4 of Section 24, the  
Northeast 1/4 of Section 23, and the South 1/2 of the Southwest 1/4 of Section 13,  
Range 67 West of the 6th Principal Meridian, County of El Paso, State of  
Colorado, described as follows:

BEGINNING at a point which bears S 89° 39' 40" W, 2523.76 feet from the S.E. corner of the N.E. 1/4  
of Sec. 24, T. 11 S. R. 67 W. 6th Principal Meridian, (all bearings in this description are relative to those shown on  
the plat of "Woodmoor Summit" as recorded in Book \_\_\_\_\_ Page \_\_\_\_\_ of the Records of El Paso County, Thence  
S 89° 39' 40" W, 510.00 feet, Thence N 00° 20' 20" W, 40.00 feet, Thence N 18° 22' 53" E, 159.63 feet,  
Thence N 00° 20' 20" W, 155.00 feet, Thence N 43° 54' 43" E, 77.60 feet, Thence N 46° 05' 17" W, 50.00  
feet, Thence N 43° 54' 43" E, 50.00 feet, Thence S 46° 05' 17" E, 50.00 feet, Thence N 43° 54' 43" E,  
110.00 feet, Thence N 21° 28' 19" E, 262.60 feet, Thence N 71° 02' 53" W, 230.00 feet, Thence  
N 42° 52' 49" W, 205.00 feet, Thence N 01° 51' 26" W, 190.00 feet, Thence N 04° 57' 36" E, 135.00 feet,  
Thence N 04° 36' 23" W, 360.40 feet, Thence N 02° 42' 39" E, 121.86 feet, Thence S 70° 23' 25" W,  
375.00 feet, Thence S 01° 44' 16" E, 190.00 feet, Thence S 65° 04' 36" W, 480.00 feet, Thence  
S 58° 43' 47" W, 177.04 feet, Thence S 84° 38' 53" W, 60.01 feet, Thence N 73° 47' 54" W, 180.00 feet,  
Thence N 41° 14' 28" W, 175.00 feet, Thence N 19° 02' 15" W, 185.00 feet, Thence N 13° 02' 08" W, 370.00  
feet, Thence W 00° 51' 43" W, 265.00 feet, Thence N 09° 23' 11" W, 350.00 feet, Thence N 88° 34' 02" E,  
222.14 feet, Thence N 09° 23' 11" W, 30.29 feet, Thence S 88° 34' 02" W, 222.14 feet, Thence  
N 09° 23' 11" W, 490.00 feet, Thence N 05° 56' 39" W, 210.00 feet, Thence N 11° 56' 55" W, 256.68  
feet, Thence S 41° 10' 02" W, 152.42 feet, Thence S 00° 19' 43" E, 904.96 feet, Thence S 45° 59' 17" W,  
137.34 feet, Thence S 44° 00' 43" E, 50.00 feet, Thence S 45° 59' 17" W, 50.00 feet, Thence N 44° 00' 43" W,  
50.00 feet, Thence S 45° 59' 17" W, 136.84 feet, Thence S 07° 42' 03" E, 250.46 feet, Thence  
S 17° 32' 19" E, 222.34 feet, Thence S 51° 33' 29" W, 451.97 feet, Thence S 25° 51' 49" W, 511.20 feet,  
Thence S 80° 49' 05" W, 283.86 feet, Thence S 48° 08' 31" W, 255.30 feet, Thence S 51° 32' 57" W, 60.00  
feet, Thence N 38° 27' 03" W, 730.00 feet, to a point on a curve to the left, said curve having a Radius of  
310.00 feet and Delta of 42° 36' 04". Thence along the Arc of said curve, 230.49 feet, Thence N 81° 03' 06" W,  
573.30 feet to a point on a curve to the right, said curve having a Radius of 190.00 feet and Delta of 79° 22' 30".  
Thence along the Arc of said curve, 263.22 feet, Thence N 01° 40' 36" W, 483.36 feet to a point on a curve to  
the right, said curve having a Radius of 190.00 feet and Delta of 82° 35' 54". Thence along the Arc of said curve,  
273.91 feet, Thence N 80° 55' 18" E, 370.48 feet to a point on a curve to the right, said curve having a Radius  
of 430.00 feet and Delta of 08° 26' 10". Thence along the Arc of said curve 63.31 feet, Thence N 89° 21' 28" E,  
183.24 feet, Thence N 00° 38' 32" W, 130.00 feet, Thence N 89° 21' 28" E, 1440.04 feet, Thence  
N 00° 19' 43" W, 1321.09 feet, Thence N 89° 38' 50" E, 2513.53 feet to the N.W. corner of "Woodmoor Nugget"  
as recorded in Book 7-2 Page 6-7 of The Records of El Paso County, Thence S 00° 39' 14" E, 1016.58  
feet, Thence N 89° 51' 40" E, 638.06 feet, Thence S 14° 25' 04" E, 261.62 feet, Thence N 75° 34' 56" E, 80.00  
feet, Thence S 14° 25' 04" E, 75.00 feet to a point on a curve to the right, said curve having a Radius of 1040.00  
feet and Delta of 30° 56' 35". Thence along the Arc of said curve 561.66 feet, Thence N 73° 28' 29" W, Radially,  
80.00 feet to a point on a curve to the right, said curve having a Radius of 960.00 feet and Delta of 03° 19' 58".  
Thence along the Arc of said curve 55.64 feet to a point on a reverse curve to the left, said curve having a Radius  
of 540.00 feet and Delta of 28° 14' 16". Thence along the Arc of said curve 266.13 feet to a point on a compound  
curve to the left, said curve having a Radius of 1040.00 feet and Delta of 00° 47' 51". Thence along the Arc of  
said curve 14.47 feet, Thence S 80° 49' 23" W, 272.76 feet, Thence S 19° 58' 10" E, 275.47 feet, Thence  
S 22° 05' 36" E, 134.73 feet, Thence S 32° 26' 40" E, 145.00 feet, Thence S 41° 53' 46" E, 418.00 feet, Thence  
S 63° 16' 03" E, 60.00 feet, Thence S 03° 05' 33" W, 345.41 feet, Thence S 75° 23' 35" W, 55.00 feet, Thence  
S 85° 41' 53" W, 584.00 feet, Thence S 04° 04' 33" W, 520.00 feet to the point of beginning, said description  
containing 245.51 Acres.

DEDICATION:  
The above parties in interest have caused said tract of land to be platted into lots, streets, and  
easements as shown on the plat, which plat sets forth the boundary and dimensions thereof. Said lots as platted  
shall be known as "Woodmoor Greens." All streets so platted are hereby dedicated to public use. The aforementioned  
parties in interest do hereby covenant and agree that they will, at their own expense, grade and gravel all platted  
streets, and provide proper drainage for same, all to the satisfaction of the Board of County Commissioners of  
El Paso County, Colorado, and upon acceptance by resolution, all streets and drainage ways so dedicated will become  
matters of maintenance by El Paso County, Colorado.

IN WITNESS WHEREOF: The undersigned have executed their presents this 14 day of January, 1972 A. D.

THE WOODMOOR CORPORATION  
Steven N. Arnold      John J. Wilkinson  
Steven N. Arnold, President      John J. Wilkinson, Secretary

HOLDER OF DEED OF TRUST  
James E. Higby  
James E. Higby

STATE OF COLORADO  
COUNTY OF EL PASO

The above and foregoing instrument was acknowledged before me this 8th day of January, 1972 A. D.  
by the Woodmoor Corporation by Steven N. Arnold, Pres. and John J. Wilkinson, Secretary.

Witness my HAND and OFFICIAL SEAL Doris L. Egge  
NOTARY PUBLIC

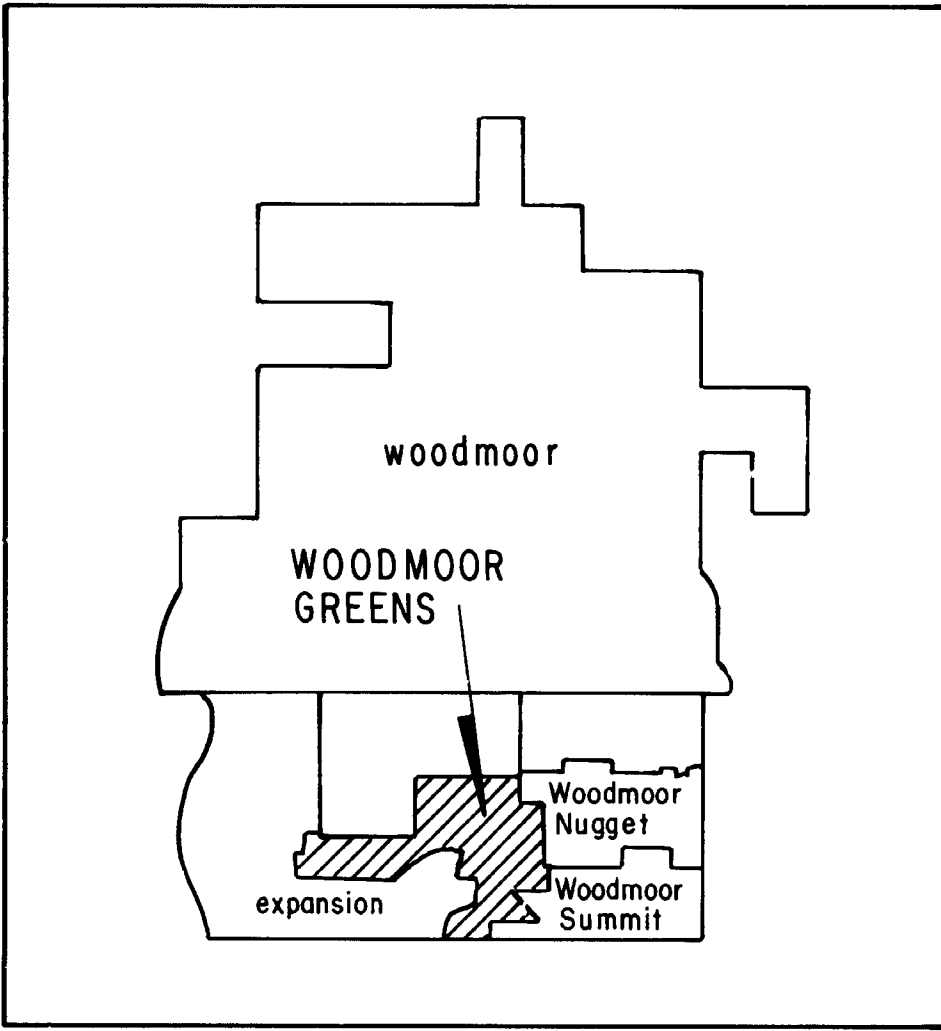
My Commission Expires: October 23, 1973

STATE OF COLORADO  
COUNTY OF EL PASO

The above and foregoing instrument was acknowledged before me this 8th day of January, 1972 A. D.  
by James E. Higby, Holder of Deed of Trust.

Witness my HAND and OFFICIAL SEAL Doris L. Egge  
NOTARY PUBLIC

My Commission Expires: October 23, 1973



VICINITY MAP

PROTECTIVE COVENANTS FOR WOODMOOR GREENS

1. In non-vehicular easements, as abbreviated on the plat, N.V.E., the Woodmoor Corporation reserves the right to construct gravel surfaced pathways for non-vehicular community use, which shall be for the sole and exclusive use of owners within the subdivision. The Woodmoor Corporation will maintain improvements on non-vehicular easements until a Home Owners Association assumes responsibility for maintenance.
2. Private driveways shall not be permitted access to Fairplay Drive or Higby Road.
3. The Woodmoor Corporation will maintain median strips in the road rights of ways until maintenance is assumed by the Home Owners Association.

I, Thomas J. Russell, County Engineer, El Paso County, Colorado, do hereby approve the accompanying plat as to drainage of the streets as shown hereon.

Thomas J. Russell  
County Engineer

Approved by the El Paso County Planning Commission this 14 day of February, 1972 A.D.

Shane D. Hann  
Chairman

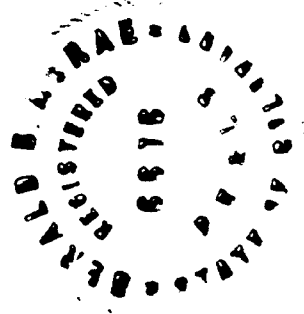
Approved by the El Paso County Planning Department this 9th day of February, 1972 A.D.

Dee E. Eriksen  
County Planning Engineer

CERTIFICATION:

The undersigned Registered Land Surveyor in the State of Colorado does hereby certify that the accompanying plat was calculated and prepared under his supervision in accordance with Chapter 136 of the Colorado Revised Statutes, as amended July 1, 1968, and that said plat does accurately show the described tract of land and the subdivision thereof to the best of his knowledge and belief.

Donald E. Morse  
Registered Land Surveyor  
State of Colorado 6816



NOTES:

WATER AND SANITATION TO BE PROVIDED BY THE WOODMOOR WATER AND SANITATION DISTRICT.

Utility and Drainage Easements -- All side and rear lot lines are subject to a 16-foot easement, lying 8 feet on either side of said lot lines and 16 feet along and adjacent to all boundary lines, except those side lot lines adjacent to public streets.

- DESIGNATES BOUNDARY MONUMENTS FOUND--  
1/2" rebar with plastic cap stamped "N.H.P.Q. #2682"
- ⊙ DESIGNATES BOUNDARY MONUMENTS SET--  
1/2" rebar with plastic cap stamped "N.H.P.Q. #2682"

STATE OF COLORADO  
COUNTY OF EL PASO

I hereby certify that this instrument was filed for record in my office at 905 o'clock  
A.M., this 16 day of February, 1972, A.D. and is duly recorded in Plat Book 24-2  
at Page 51 of the Records of El Paso County, Colorado.

RECEPTION NO: 863562

HARRIET BEALS, Recorder

FEE: \$70.00

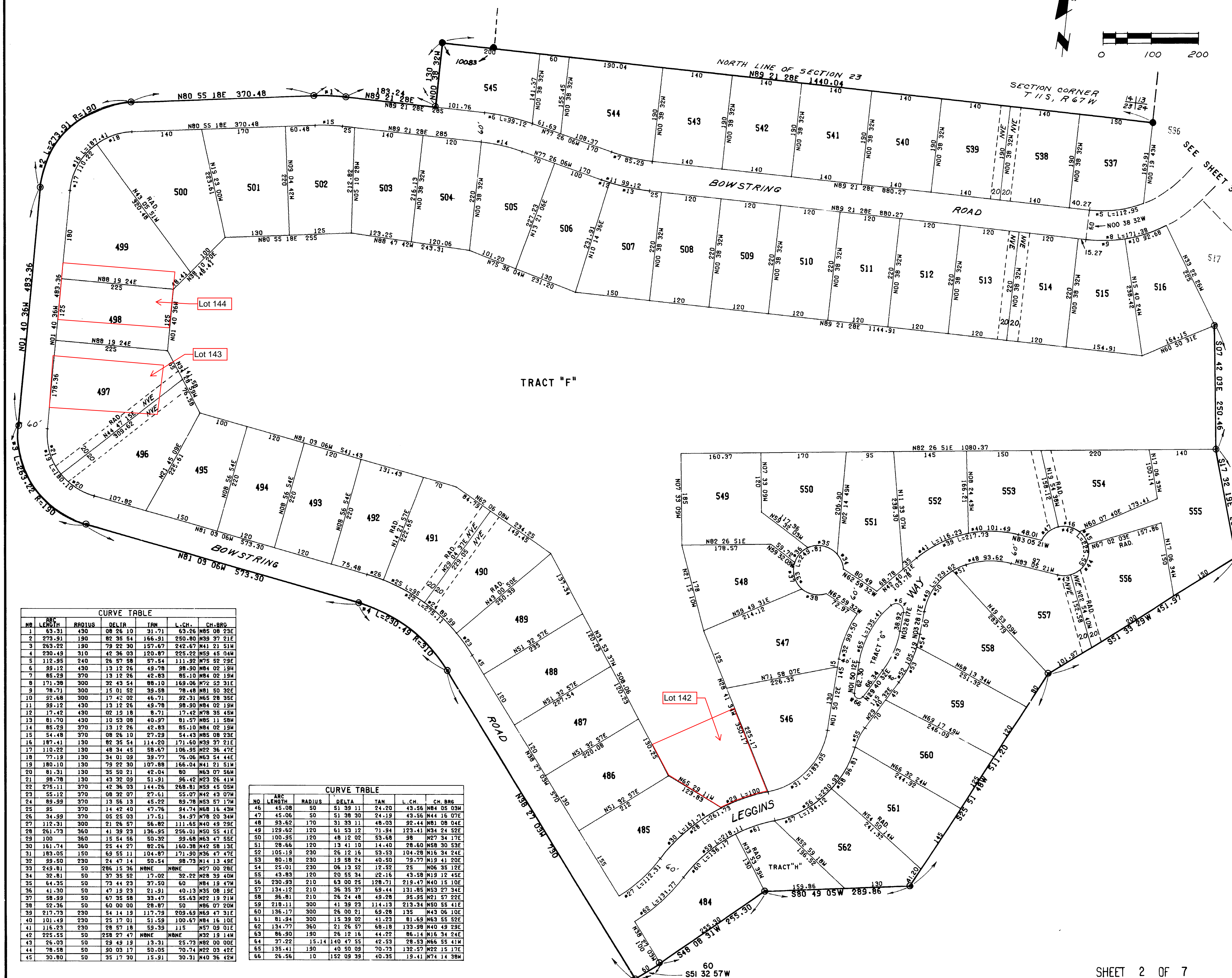
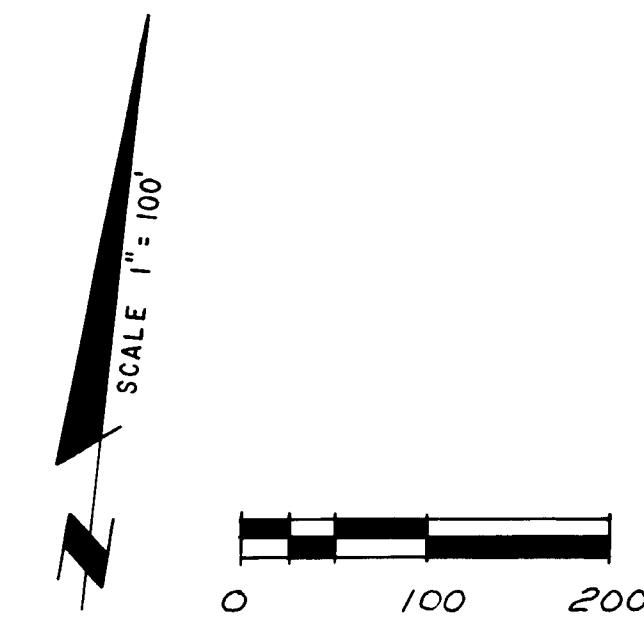
By Lucille Anderson  
Deputy



# WOODMOOR GREENS

A PART OF SECTIONS 13, 23, AND 24 T-11-S, R-67-W  
EL PASO COUNTY, COLORADO

NELSON, HALEY, PATTERSON, and QUIRK INC.  
ENGINEERING CONSULTANTS

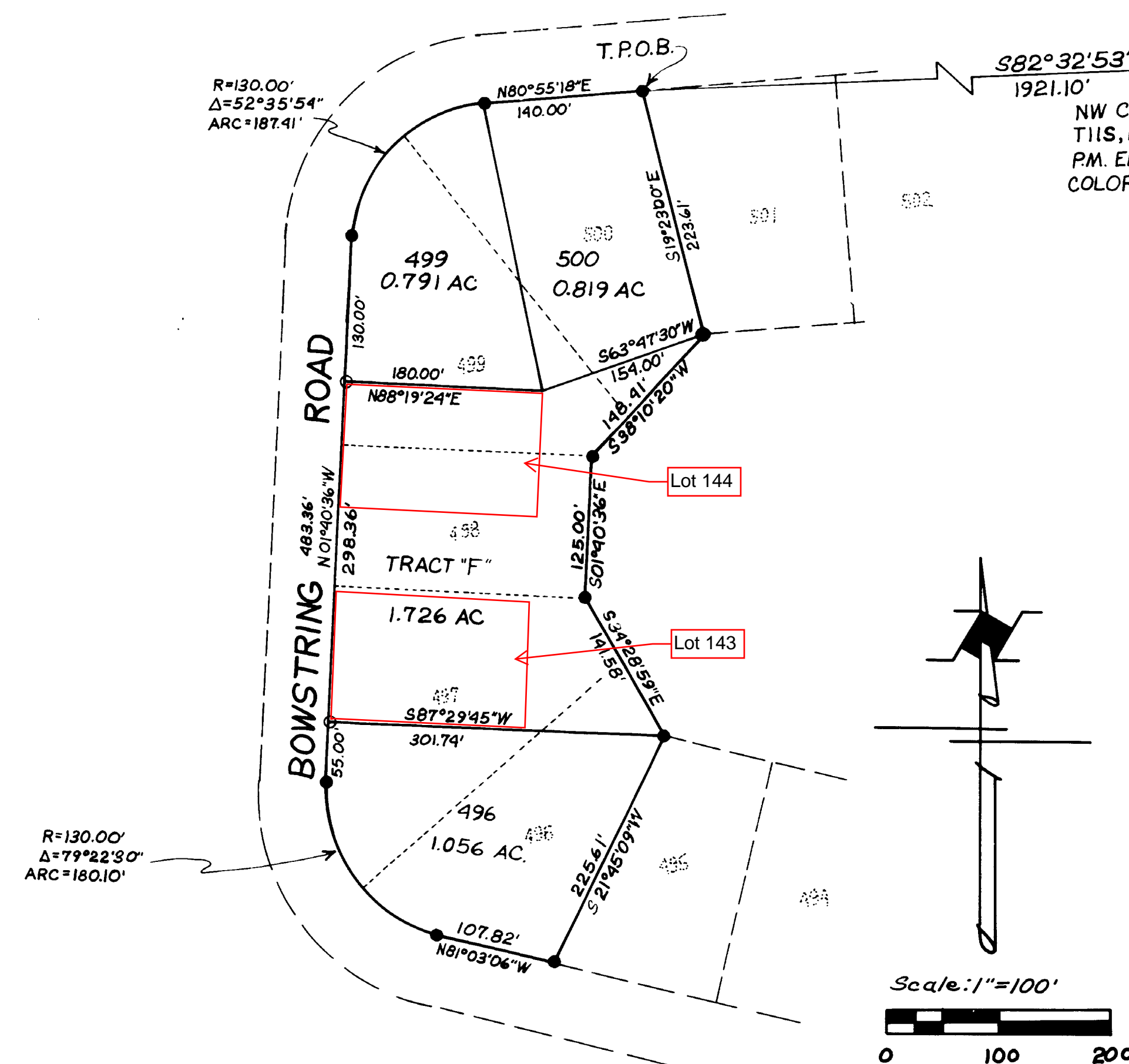
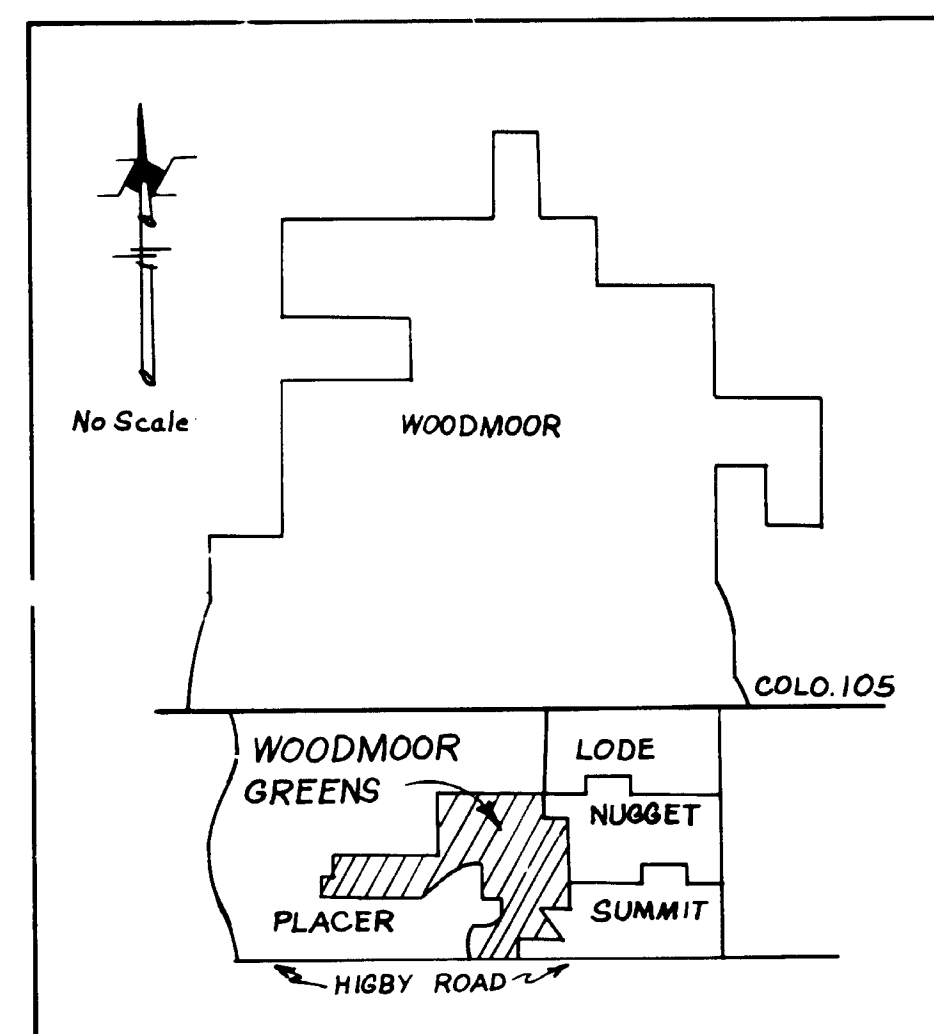


NO.	LENGTH	RADIUS	DELTA	TAN	L.C.H.	CH. BEG.
1	63.31	430	08 26 10	31.71	63.26	M85 08 23E
2	273.31	130	02 35 54	166.91	260.80	M39 37 21E
3	263.22	130	02 35 54	166.91	260.80	M41 21 51W
4	230.49	310	42 36 03	120.87	225.22	M59 45 04W
5	112.95	240	26 57 58	57.54	111.92	M75 82 75E
6	99.12	430	13 12 26	49.78	98.90	M84 02 19W
7	85.29	370	13 12 26	42.83	85.10	M84 02 19W
8	171.30	300	32 43 54	88.10	169.06	M72 53 31E
9	78.71	300	15 01 52	39.58	78.48	M81 30 32E
10	82.68	300	17 42 02	46.71	82.31	M65 28 35E
11	99.12	430	13 12 26	49.78	98.90	M84 02 19W
12	17.42	430	02 35 54	8.71	17.42	M78 35 45W
13	81.70	430	10 53 08	40.97	81.57	M85 11 58W
14	85.29	370	13 12 26	42.83	85.10	M84 02 19W
15	54.48	370	08 26 10	27.29	54.43	M85 08 23E
16	107.41	130	02 35 54	114.20	171.60	M39 37 21E
17	110.22	130	02 35 54	106.67	106.95	M22 36 47E
18	77.19	130	02 35 54	76.06	76.06	M63 54 44E
19	180.10	130	02 35 54	107.88	166.04	M41 21 51W
20	81.31	130	02 35 54	42.04	80	M63 07 56W
21	98.78	130	02 35 54	51.91	96.42	M23 26 41W
22	275.11	370	02 35 54	144.26	268.81	M59 45 04W
23	55.12	370	02 35 54	27.61	55.07	M42 43 07W
24	89.99	370	13 56 13	45.22	89.78	M53 57 17W
25	95	370	14 42 40	47.76	94.74	M68 16 43W
26	34.99	370	05 25 03	17.51	34.97	M78 20 34W
27	112.31	300	21 35 57	56.82	111.48	M40 49 29E
28	261.73	360	41 39 23	136.18	256.01	M50 55 41E
29	100	360	15 54 56	50.32	99.68	M63 47 55E
30	161.74	360	25 44 27	82.26	160.38	M42 58 13E
31	183.05	150	63 55 11	104.87	171.90	M36 47 47E
32	99.50	230	24 47 14	50.54	98.73	M14 13 49E
33	249.81	50	286 15 36	NONE	NONE	M27 00 28E
34	32.81	50	37 35 52	17.02	32.22	M28 39 40W
35	64.35	50	73 44 23	37.50	60	M84 19 47W
36	41.30	50	47 19 23	21.91	40.13	M35 08 19E
37	88.99	50	67 35 58	33.47	86.63	M22 19 21W
38	52.36	50	60 00 00	28.87	50	M86 07 20W
39	217.73	230	54 14 19	117.79	209.69	M69 47 31E
40	101.49	230	25 17 01	51.59	100.67	M84 16 10E
41	116.23	230	28 57 18	59.39	115	M57 09 01E
42	225.55	50	238 27 47	NONE	NONE	M32 19 44W
43	26.03	50	29 49 19	13.31	25.73	M82 00 00E
44	78.58	50	30 03 17	50.05	70.74	M22 03 42E
45	30.80	50	35 17 30	15.91	30.31	M40 36 42W

NO.	LENGTH	RADIUS	DELTA	TAN	L.C.H.	CH. BEG.
46	45.08	50	51 39 11	24.20	43.56	M84 05 03W
47	45.06	50	51 38 30	24.19	43.56	M44 16 07E
48	93.62	170	31 33 11	48.03	92.44	M81 08 04E
49	129.62	120	61 53 12	71.94	123.41	M34 24 52E
50	100.95	120	48 12 02	53.68	98	M27 34 17E
51	29.66	120	13 41 10	14.40	28.60	M58 30 53E
52	105.19	230	26 12 16	53.53	104.28	M16 34 24E
53	80.18	230	19 58 24	40.50	79.77	M19 41 20E
54	25.01	230	06 13 52	12.92	25	M06 35 12E
55	43.83	120	20 55 34	22.16	43.58	M19 12 45E
56	230.93	210	63 00 25	128.71	219.47	M40 15 10E
57	134.12	210	36 35 37	69.44	131.85	M53 27 34E
58	95.81	210	26 24 48	49.28	95.95	M21 57 22E
59	218.11	300	41 39 23	114.13	213.34	M50 55 41E
60	136.17	300	26 00 21	69.28	135	M43 06 10E
61	81.94	300	15 39 02	41.23	81.69	M63 55 52E
62	134.77	360	21 26 57	68.18	133.98	M40 49 29E
63	86.90	190	26 12 16	44.22	86.14	M16 34 24E
64	37.22	15.14	140 47 55	42.53	28.53	M66 55 41W
65	135.41	190	40 50 09	70.73	132.57	M22 15 17E
66	26.56	10	152 09 39	40.35	19.41	M74 14 38W



## WOODMOOR GREENS

A PART OF SECTION 23, T11S, R67W OF 6th P.M.  
EL PASO COUNTY, COLORADONELSON, HALEY, PATTERSON and QUIRK INC.  
ENGINEERING CONSULTANTS

KNOW ALL MEN BY THESE PRESENTS:

THAT THE WOODMOOR CORPORATION, A COLORADO CORPORATION, IN INTEREST TO THE FOLLOWING DESCRIBED TRACT OF LAND, TO WIT: A VACATION AND REPLAT OF LOTS 496, 499, 500 OF WOODMOOR GREENS AS FILED AND RECORDED IN BOOK U-2 PAGE 51 OF THE RECORDS OF EL PASO COUNTY, COLORADO, SAID LOTS ALSO BEING LOCATED IN THE NORTHWEST QUARTER OF NORTHEAST QUARTER (NW1/4NE1/4) OF SECTION 23, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO, DESCRIBED IN PARTICULAR AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER (NW COR) SAID SECTION 23 AND CONSIDERING THE NORTH LINE OF THE NORTHEAST QUARTER (NE1/4) OF SAID SECTION 23 TO BEAR NORTH 89° 21' 28" EAST, ALL BEARINGS CONTAINED THEREIN BEING RELATIVE THERETO:

TRENCHE SOUTH 82° 32' 53" WEST, 1921.10 FEET TO THE TRUE POINT OF BEGINNING, SAID POINT ALSO BEING THE NORTHEAST CORNER (NE COR) OF SAID LOT 500;

TRENCHE SOUTH 19° 23' 00" EAST, 223.61 FEET;

TRENCHE SOUTH 38° 10' 20" WEST, 148.41 FEET;

TRENCHE SOUTH 01° 40' 36" EAST, 125.00 FEET;

TRENCHE SOUTH 34° 28' 59" EAST, 141.58 FEET;

TRENCHE SOUTH 21° 45' 09" WEST, 225.61 FEET;

TRENCHE NORTH 81° 03' 06" WEST, 107.82 FEET TO A POINT OF CURVATURE;

TRENCHE ALONG THE ARC OF A CURVE TO THE RIGHT 180.10 FEET, SAID CURVE HAVING A RADIUS OF 130.00 FEET AND A LONG CHORD WHICH BEARS NORTH 41° 51' 51" WEST, 166.04 FEET TO A POINT OF TANGENCY;

TRENCHE NORTH 01° 40' 36" WEST, 483.36 FEET TO A POINT OF CURVATURE;

TRENCHE ALONG THE ARC OF A CURVE TO THE RIGHT 187.41 FEET, SAID CURVE HAVING A RADIUS OF 130.00 FEET AND A LONG CHORD WHICH BEARS NORTH 39° 37' 21" EAST, 171.60 FEET TO A POINT OF TANGENCY;

TRENCHE NORTH 80° 55' 18" EAST, 140.00 FEET TO THE TRUE POINT OF BEGINNING

SAID PARCEL CONTAINS 4.382 ACRES.

## DEDICATION:

THE ABOVE PARTIES IN INTEREST HAVE CAUSED SAID TRACT OF LAND TO BE PLATTED INTO LOTS, STREETS, AND EASEMENTS AS SHOWN ON THE PLAT, WHICH PLAT SETS FORTH THE BOUNDARY AND DIMENSIONS THEREOF. SAID LOTS AS PLATTED SHALL BE KNOWN AS "A REPLAT OF LOTS 496-500 WOODMOOR GREENS". ALL STREETS SO PLATTED ARE HEREBY DEDICATED TO PUBLIC USE. THE AFOREMENTIONED PARTIES IN INTEREST DO HEREBY COVENANT AND AGREE THAT THEY WILL AT THEIR OWN EXPENSE, GRADE AND GRAVEL ALL PLATTED STREETS, AND PROVIDE PROPER DRAINAGE FOR SAME, ALL TO THE SATISFACTION OF THE BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY, COLORADO, AND UPON ACCEPTANCE BY RESOLUTION, ALL STREETS AND DRAINAGE WAYS SO DEDICATED WILL BECOME MATTERS OF MAINTENANCE BY EL PASO COUNTY, COLORADO.

IN WITNESS WHEREOF: THE UNDERSIGNED HAVE EXECUTED THEIR PRESENTS THIS 18 DAY OF July, 1972 A.D.

THE WOODMOOR CORPORATION

JOHN A. THOMPSON EXEC. V.P.

DALE L. WHEELER, AST. SECRETARY

HOLDERS OF DEED OF TRUST

JAMES E. HIGBY

STATE OF COLORADO  
COUNTY OF EL PASO

THE ABOVE AND FOREGOING INSTRUMENT WAS ACKNOWLEDGED BEFORE ME THIS 15th DAY OF July, 1972 A.D. BY THE WOODMOOR CORPORATION BY JOHN A. THOMPSON, EXEC. V.P.

DALE L. WHEELER, AST. SECRETARY.  
WITNESS MY HAND AND OFFICIAL SEAL Betty A. Brock NOTARY PUBLIC MY COMMISSION EXPIRES: October 26, 1975

STATE OF COLORADO  
COUNTY OF EL PASO

THE ABOVE AND FOREGOING INSTRUMENT WAS ACKNOWLEDGED BEFORE ME THIS 19th DAY OF July, 1972 A.D. BY JAMES E. HIGBY, HOLDER OF DEED OF TRUST.

WITNESS MY HAND AND OFFICIAL SEAL Betty A. Brock NOTARY PUBLIC MY COMMISSION EXPIRES: October 26, 1975

## PROTECTIVE COVENANTS FOR WOODMOOR GREENS

1. IN NON-VEHICULAR EASEMENTS, AS ABBREVIATED ON THE PLAT, N.V.E., THE WOODMOOR CORPORATION RESERVES THE RIGHT TO CONSTRUCT GRAVEL SURFACED PATHWAYS FOR NON-VEHICULAR COMMUNITY USE, WHICH SHALL BE FOR THE SOLE AND EXCLUSIVE USE OF OWNERS WITHIN THE SUBDIVISION. THE WOODMOOR CORPORATION WILL MAINTAIN IMPROVEMENTS ON NON-VEHICULAR EASEMENTS UNTIL A HOME OWNERS ASSOCIATION ASSUMES RESPONSIBILITY FOR MAINTENANCE.
2. PRIVATE DRIVEWAYS SHALL NOT BE PERMITTED ACCESS TO FAIRPLAY DRIVE OR HIGBY ROAD.
3. THE WOODMOOR CORPORATION WILL MAINTAIN MEDIAN STRIPS IN THE ROAD RIGHTS OF WAYS UNTIL MAINTENANCE IS ASSUMED BY THE HOME OWNERS ASSOCIATION.

1. THOMAS J. RUSSELL, COUNTY ENGINEER, EL PASO COUNTY, COLORADO, DO HEREBY APPROVE THE ACCOMPANYING PLAT AS TO DRAINAGE OF THE STREETS AS SHOWN HEREON.

COUNTY ENGINEER

APPROVED BY THE EL PASO COUNTY PLANNING COMMISSION THIS 9th DAY OF August, 1972, A.D.

CHAIRMAN

APPROVED BY THE EL PASO COUNTY PLANNING DEPARTMENT THIS 22 DAY OF August, 1972, A.D.

CHIEF CLERK

## CERTIFICATION:

THE UNDERSIGNED REGISTERED LAND SURVEYOR IN THE STATE OF COLORADO DOES HEREBY CERTIFY THAT THE ACCOMPANYING PLAT WAS CALCULATED AND PREPARED UNDER HIS SUPERVISION IN ACCORDANCE WITH CHAPTER 136 OF THE COLORADO REVISED STATUTES, AS AMENDED JULY 1, 1968, AND THAT SAID PLAT DOES ACCURATELY SHOW THE DESCRIBED TRACT OF LAND AND THE SUBDIVISION THEREOF TO THE BEST OF HIS KNOWLEDGE AND BELIEF.

Ronald B. McRae  
REGISTERED LAND SURVEYOR  
STATE OF COLORADO, 6616

## NOTES:

WATER AND SANITATION TO BE PROVIDED BY THE WOODMOOR WATER AND SANITATION DISTRICT.

UTILITY AND DRAINAGE EASEMENTS -- ALL SIDE AND REAR LOT LINES ARE SUBJECT TO A 16-FOOT EASEMENT, LYING 8 FEET ON EITHER SIDE OF LOT LINES AND 16 FEET ALONG AND ADJACENT TO ALL BOUNDARY LINES, EXCEPT THOSE SIDE LOT LINES ADJACENT TO PUBLIC STREETS.

- DESIGNATES BOUNDARY MONUMENTS FOUND--  
1/2" REBAR WITH PLASTIC CAP STAMPED "N.H.P.Q. -2682"
- ⊙ DESIGNATES BOUNDARY MONUMENTS SET--  
1/2" REBAR WITH PLASTIC CAP STAMPED "N.H.P.Q. -2682"

STATE OF COLORADO  
COUNTY OF EL PASO

I HEREBY CERTIFY THAT THIS INSTRUMENT WAS FILED FOR RECORD IN MY OFFICE AT 3:36 O'CLOCK P.M. THIS 23rd DAY OF August, 1972, A.D. AND IS DULY RECORDED IN PLAT BOOK U-2 AT PAGE 26 OF THE RECORDS OF EL PASO COUNTY, COLORADO.

RECEPTION NO: 912153FEE: \$10.00

HARRIET BEALS, RECORDER

BY: Dorothy Rosemond  
DEPUTY

APPROVED BY THE EL PASO COUNTY BOARD OF COMMISSIONERS THIS 14th DAY OF August, 1972 A.D.

CHAIRMAN

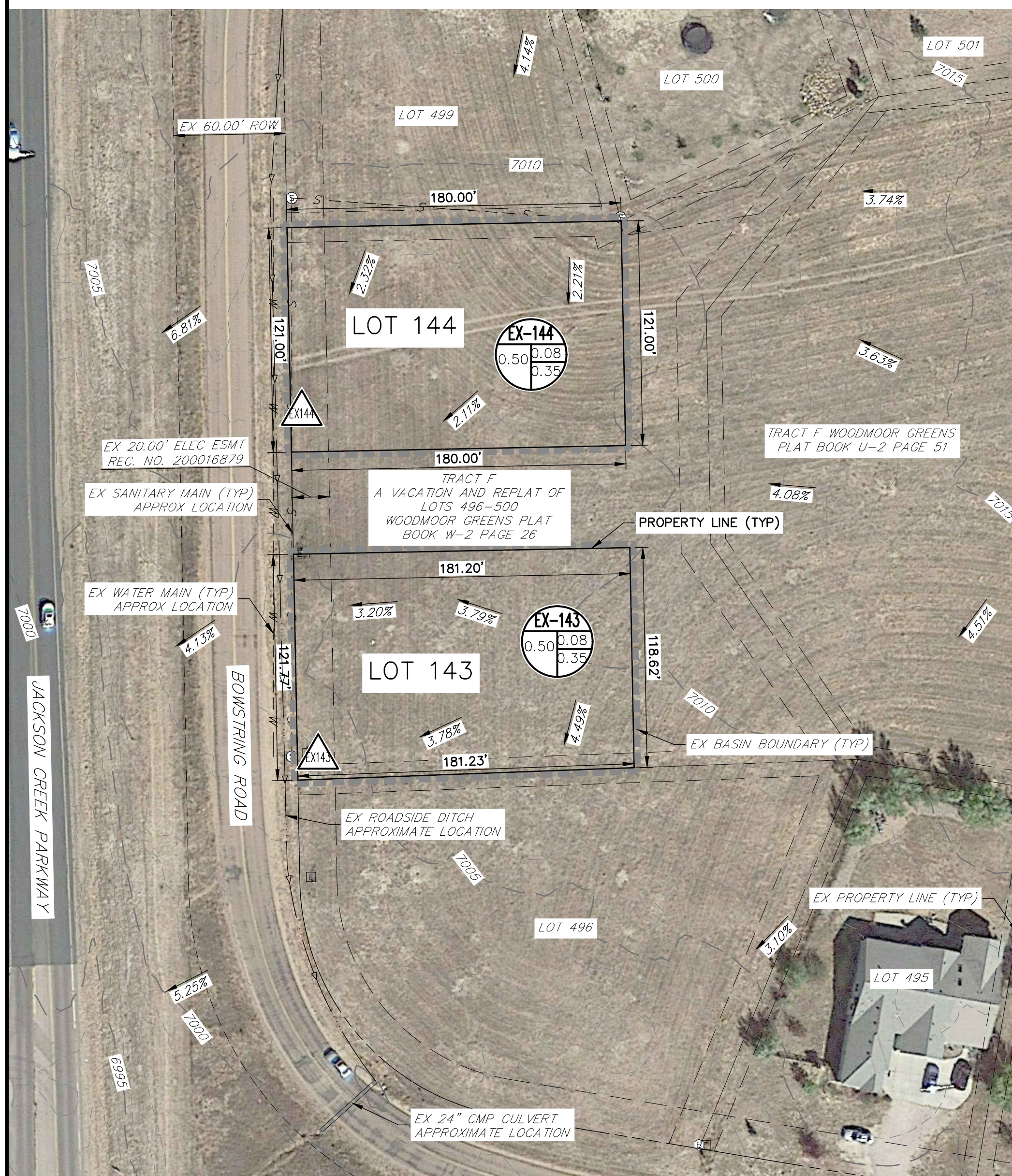
## **Appendix E**

### **Drainage Maps**



# CLOVERLEAF FILING NO. 1

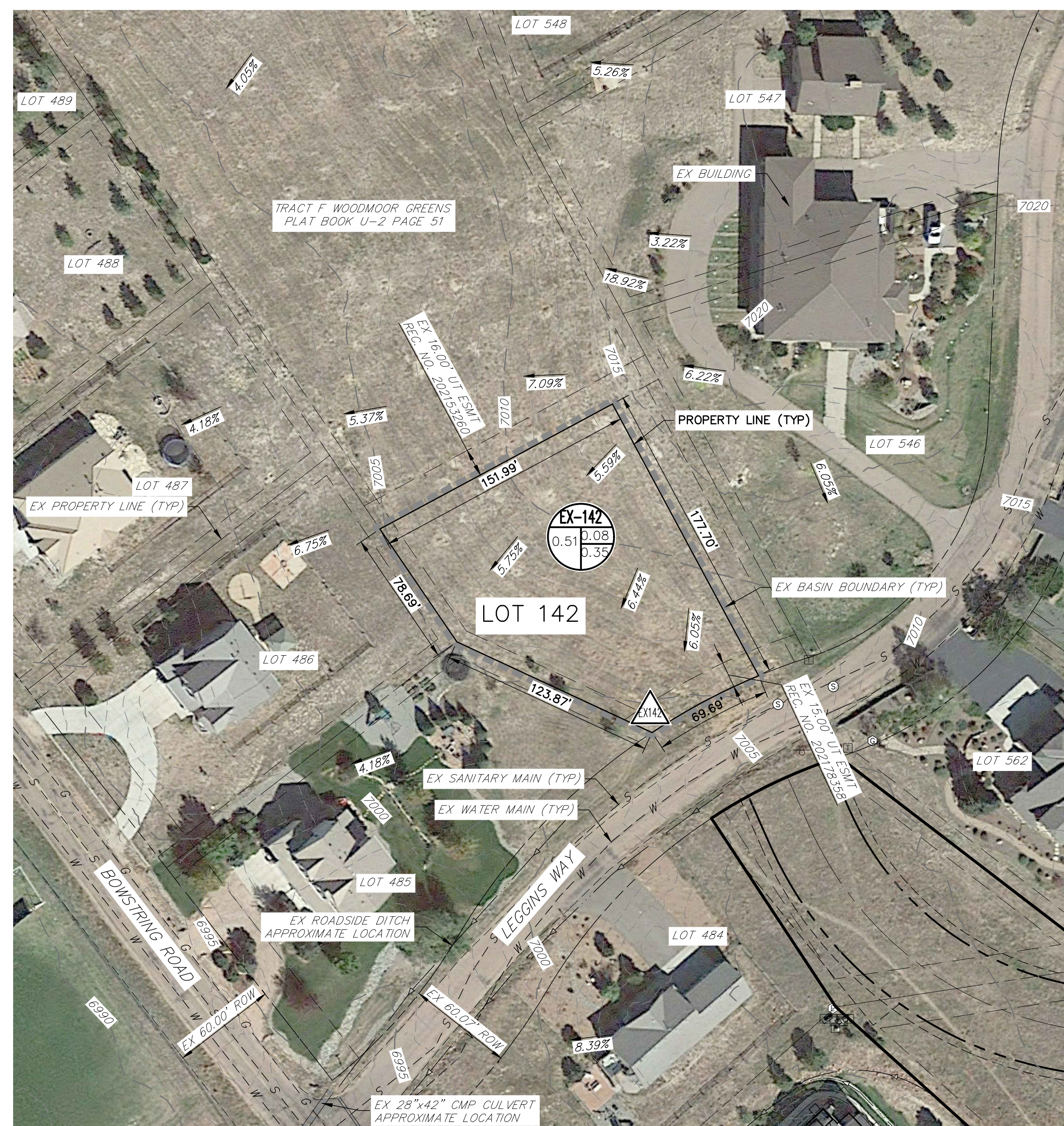
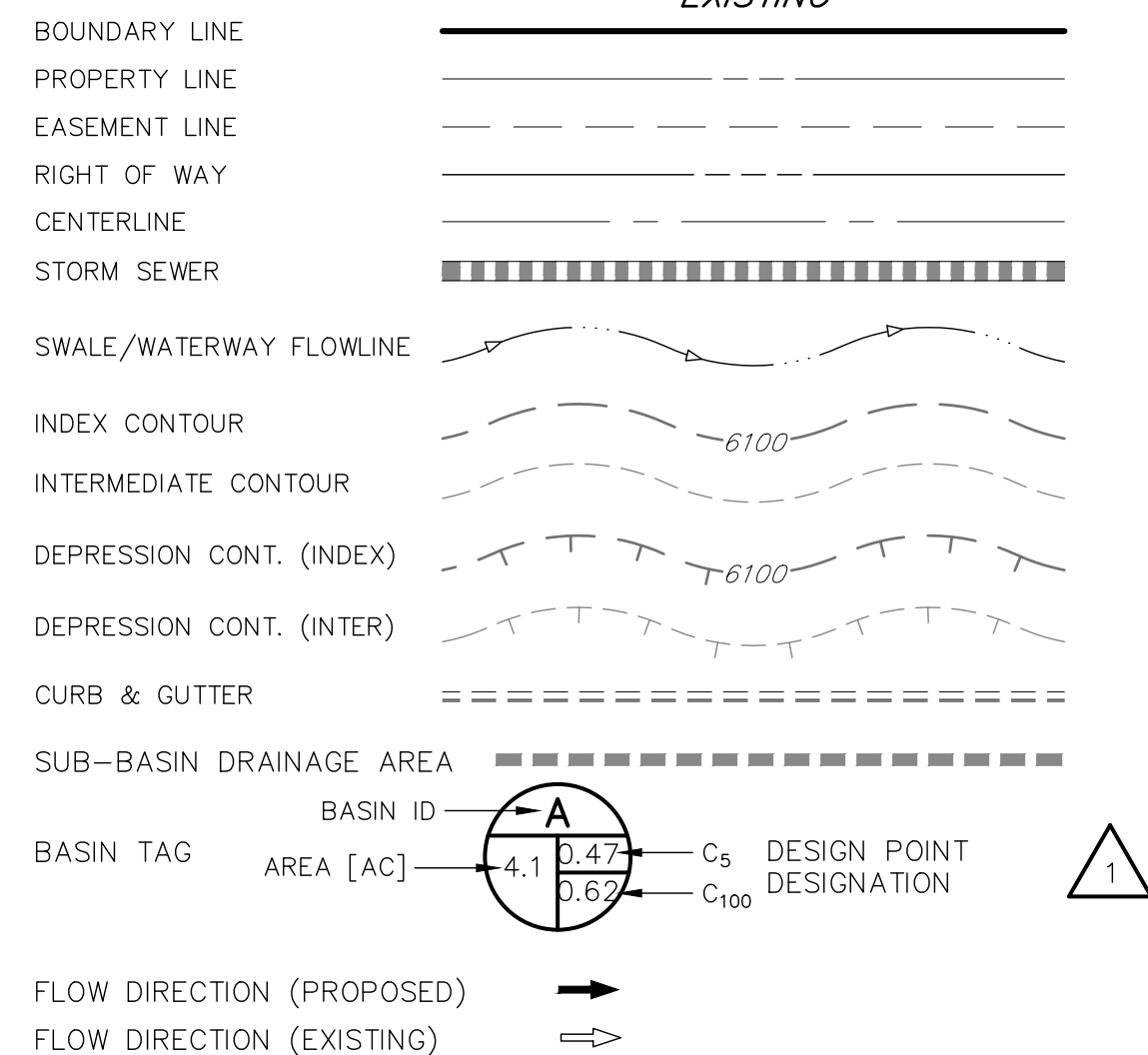
## EXISTING DRAINAGE MAP



LOTS 143 & 144  
0.50 AC EACH

### LAYER LINETYPE LEGEND

*EXISTING*



LOT 142  
0.51 AC

JACKSON CREEK PARKWAY

LOTS 143 & 144

BOWSTRING ROAD

PARCEL 2-1

PARCEL 2-2

PARCEL 2-3

PARCEL 2-4

CARIBOU ROAD

CLOVERLEAF ROAD

HIGBY ROAD

LOT 142

LEWIS PALMER HIGH SCHOOL

LEGIONSWAY

SITE

1-25

KEY MAP

KEY MAP

---

SCALE: N.T.S.

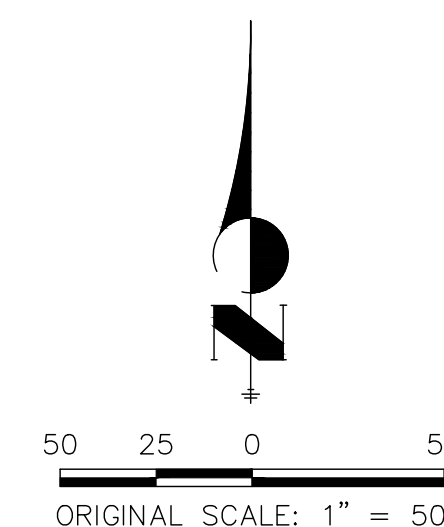


BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C <sub>5</sub>	C <sub>100</sub>	t <sub>c</sub> (min)	Q <sub>5</sub> (cfs)	Q <sub>100</sub> (cfs)
EX-142	0.5	0%	0.08	0.35	14.8	0.1	1.1
EX-143	0.5	0%	0.08	0.35	17.4	0.1	0.9
EX-144	0.5	0%	0.08	0.35	23.0	0.1	0.9

DESIGN POINT SUMMARY TABLE		
DP	Q5	Q100
EX142	0.1	1.1
EX143	0.1	0.9
EX144	0.1	0.9

### **ISOLATED LOTS PRELIMINARY GRADING & UTILITY NOTES**

1. PROPOSED LOT GRADING IS NOT SHOWN ON THESE PLANS AND WILL ROUTE STORMWATER RUNOFF FROM EACH LOT TO THE PROPOSED SAND FILTER ON EACH LOT.
2. PROPOSED WATER AND SANITARY SERVICES ARE NOT SHOWN ON THESE PLANS AND WILL CONNECT TO THE EXISTING PUBLIC MAINS WITHIN THE ADJACENT ROADWAY.



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

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION

PREPARED FOR  
**PT CLOVERLEAF, LLC**  
864 WOODMOOR DRIVE, SUITE 100  
COLORADO SPRINGS, CO 80920  
ATTN: JOE DESJARDIN  
719-476-0800

 **J.R. ENGINEERING**  
A Westrian Company

Central 303-740-9383 • Colorado Springs 719-593-2598  
Fort Collins 970-491-9888 • [www.jrenengineering.com](http://www.jrenengineering.com)

JOB NO.	25158.0	SHEET 1 OF 1		CLOVERLEAF FILING NO. 1								H-SCALE	1"=50'	No.	REVISION	BY	DATE
		EXISTING DRAINAGE MAP								V-SCALE	N/A						
										DATE	12/01/20						
										DESIGNED BY	RPD						
										DRAWN BY	RPD						
								CHECKED BY									



