

**FINAL DRAINAGE REPORT FOR
BRANDING IRON AT STERLING RANCH
FILING NO. 1**

EL PASO COUNTY, COLORADO

April 2018

Prepared for:
SR Land, LLC
20 Boulder Crescent, Suite 210
Colorado Springs, CO 80903

Prepared by:



CIVIL CONSULTANTS, INC.

20 Boulder Crescent, Suite 110
Colorado Springs, CO 80903
(719) 955-5485

Project #09-006
DSD Project # SF-17-024

**FINAL DRAINAGE REPORT FOR
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DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

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

BY: _____
James F Morley

TITLE: _____

DATE: _____

ADDRESS: SR Land, LLC
20 Boulder Crescent, Suite 210
Colorado Springs, CO 80903

EL PASO COUNTY'S STATEMENT

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

BY: _____ DATE: _____
Jennifer Irvine, P.E.
County Engineer / ECM Administrator

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FINAL DRAINAGE REPORT FOR BRANDING IRON AT STERLING RANCH FILING NO. 1

PURPOSE

The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site and to downstream facilities in a safe manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual and any conditions set forth by the approved master drainage development plans.

GENERAL LOCATION AND DESCRIPTION

Branding Iron at Sterling Ranch Filing No. 1 is located in the SE $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian, and the NE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian within unincorporated El Paso County, Colorado. The site is bound on the north by Homestead at Sterling Ranch Filing No.1. The property is bound to the east by Dines Boulevard and to the west by vacant industrial lots and a warehouse/storage site associated with the development of portions of the Barbarick Subdivision. An undeveloped parcel of land, proposed to be a future school site, within the Sterling Ranch development and future Sterling Ranch Road bound the proposed development to the south. Branding Iron at Sterling Ranch Filing No. 1 lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

Branding Iron at Sterling Ranch Filing No. 1 consists of 10.545 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from west to east at grade rates that vary between 2% and 4%.

Prior to development Branding Iron at Sterling Ranch Filing No. 1 was listed as AG for agricultural grazing land. Improvements proposed for the site include paved, streets, trails, and utilities as normally constructed for a residential development.

SOILS

The soils associated with the drainage area analyzed by this study consist of Pring Coarse Sandy Loam (71) as determined by the mapping provided by the Natural Resources Conservations Service Web Soil Survey. According the information available on the website, this soil has a Hydrologic Soil Group rating of "B". A map showing the proposed site, studied watershed and hydrologic soil group classification is included in the appendix of this report.

PREVIOUS STUDIES

This area was previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996. More recently the area has been studied in the "Master Development Drainage Report for Sterling Ranch Filing Nos. 1 & 2, and Final Drainage Report for Sterling Ranch Filing No.1" prepared by MS Civil Consultants, dated April 2017 (henceforth referred to as "Sterling Ranch Filing Nos. 1 & 2 MDDP") and the Sterling Ranch MDDP revised April 2018.

Please refer to the Sterling Ranch Filing Nos. 1 & 2 MDDP by MS Civil Consultants for detailed information regarding the historic conditions of the area and discussion regarding early overlot grading which altered the existing drainage patterns prior to the issuance of this report.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

As the Hydrologic calculations performed as a part of this analysis matched the hydraulic analysis conducted with the Sterling Ranch Filing Nos. 1 & 2 MDDP, there is no need to reproduce in duplicate the hydraulic calculations provided within the aforementioned study. As such, please refer to the hydraulic calculations located in the appendix of the Master Development Drainage Report for Sterling Ranch Filing Nos. 1 & 2, and Final Drainage Report for Sterling Ranch Filing No.1 prepared by MS Civil Consultants, dated April 2017 for the relevant data sheets detailing the hydraulic analysis.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0535 F, effective date March 17, 1997 and revised to reflect LOMR, 08-08-O541P, dated July 23, 2009. An annotated FIRM Panel is included in the Appendix.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual, Volumes I & II, dated November 1991, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County's Engineering Criteria Manual (ECM), 2008). In addition to the aforementioned ECMs, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates) have been utilized to aid in design of the Full Spectrum Detention Facilities when required.

EXISTING DRAINAGE CONDITIONS

The Branding Iron at Sterling Ranch Filing No. 1 site consists of 10.545 acres. According to the Sterling Ranch MDDP (Existing Condition Map), historically runoff from the site drained to the southern boundary of the Sterling Ranch property (portion of Basin EX-3A) before combining with offsite runoff prior to reaching Sand Creek Channel. With the approval of the Sterling Ranch Onsite Early Grading Plan, earthwork activities across the Sterling Ranch Phase I site have altered the onsite runoff conditions to direct flows easterly to the Dines Boulevard roadway corridor and ultimately to a planned Temporary Sediment

Basin located just the west of Sand Creek within the property, that allows for controlled discharge to the channel. Based upon the Sterling Ranch MDDP runoff from the planned site (portion of Basin SC3-13) will be treated by a Full Spectrum Detention Facility that will be constructed by formalizing the existing temporary sediment basin. A copy of the approved Sterling Ranch Phase I Onsite Early Grading and Erosion Control Plan is located in the appendix of this report.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

The proposed drainage plan for Branding Iron at Sterling Ranch will mimic and formalize the grading patterns established with both the Sterling Ranch MDDP and the Master Development Drainage Report for Sterling Ranch Filing Nos. 1 & 2, and Final Drainage Report for Sterling Ranch Filing No.1 and with its approval allow for the constructing the internal subdivision roadways, utilities, sidewalks and ultimately the placement of homes. With the prior approval of the Sterling Ranch Filing Nos. 1 & 2, and Final Drainage Report for Sterling Ranch Filing No.1, construction plans have been recently approved by El Paso County which have allowed for the construction of the adjacent Dines Boulevard, storm sewer infrastructure and the formalization of the adjacent Full Spectrum Detention Facilities (Pond Nos. 4 & 8) and outlet structures which are needed to collect and convey the developed drainage to the existing channel. It should be noted that the construction of these facilities are occurring during the writing of this report. The following detailed drainage discussion discusses the proposed development and ensures that no alternation of the planned improvements is necessary due to the assumptions meeting that of the previously submitted master development drainage plans.

Detailed Drainage Discussion

The development of Branding Iron consists only of the five cul-de-sacs, roadways, and lots located within the filing boundary. As discussed the proposed development results in drainage patterns and flow values that are the same as those in the Sterling Ranch Filing Nos. 1 & 2 MDDP. The following DPs and Basins were determined using the Rational Method. Surface flow is designated as Design Points (DP). For comparison, the **asterisk (*)** symbol in the detailed drainage discussions below represents each Basin or Design Point as labeled in the Sterling Ranch Filing Nos. 1 & 2 MDDP.

Detailed Drainage Discussion (Design Points)

DP1, (Aka DP2*), 5.39 acres, consists of planned residential lots and streets (Basin OS3 (Aka Basin B*)) which have been assigned runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year events. The anticipated developed runoff of 8.0 cfs and 19.3 cfs has been calculated to reach DP1 in the 5 and 100 year events respectively. Developed surface runoff is routed via overlot grading to a temporary sediment basin (TSB) located at DP1. A temporary 36" pipe will function to convey runoff from the low point toward DP2.

DP2, (Aka DP5*), 0.80 acres, consists of 0.61 ac residential lots (Basin OS4 (Aka Basin G*)) which have been assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year events, and 0.19 acres of the west half of Dines Boulevard (Basin OS5 (Aka Basin H*)), which have been assigned runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year events. In addition to the aforementioned

basins, runoff also reaches DP2 as flow-by from an inlet located upstream of Design Point 2, within Dines (Sterling Ranch Filing Nos. 1&2 MDDP DP4). Developed runoff of 4.2 cfs and 19.7 cfs has been calculated to reach DP2 as shallow overland and as street flows. An existing 15' CDOT type R at-grade inlet (at DP2) will intercept flows of Q5=4.2 cfs and Q100=14.7 cfs prior to being conveyed under the roadway section, combining with flows at DP3, ultimately discharging into existing FSD Pond 4. Flow-by in the 100 year event of approximately 5.0 cfs will continue south, as planned, within Dines Boulevard.

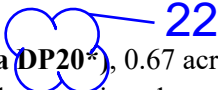
DP3, (Aka DP6*), 4.68 acres, consists of planned residential lots (Sterling Ranch Filing Nos. 1&2 MDDP Basins J and K) with assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, as well as portions of Wheatland Drive (Sterling Ranch Filing Nos. 1&2 MDDP Basin I) and Dines Boulevard (Basin OS6 (Aka Basin L*)) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year events. Developed runoff of Q5=14.1 cfs and Q100=26.7cfs has been calculated to reach DP3 as shallow overland and as street flows. An existing 15' CDOT type R at-grade inlet. (at DP3) will intercept flows of Q5=12.1 cfs and Q100=17.2 cfs, leaving the remaining flow-by of (Q5=2.0 cfs and Q100=9.5 cfs) to continue south via Dines Boulevard. The flow intercepted by the inlet is conveyed to existing FSD Pond 4. Refer to the SRMDDP for additional information regarding Pond 4.

DP4, (Aka DP18*), 9.74 acres, consists of streets and future residential lots located within Basins A, B, C, and D (Aka Basin GG*) all of which have been analyzed using coefficients of 0.38 for the 5-year and 0.55 for the 100-year and a portion of the west half of existing Dines Boulevard (Basin OS9 (Aka Basin II*)) with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year, as well as flow-by from DP2. A total developed runoff of Q5=14.1 cfs and Q100=41.6 cfs has been calculated to reach DP4 as shallow overland and as street flows. An existing 15' CDOT type R at-grade inlet at DP4 will intercept flows of Q5=12.1 cfs and Q100=21.1 cfs with flow-by of Q5=2.0 cfs and Q100=20.5 cfs. Runoff collected by the inlet is conveyed under Dines where it will combine with flows intercepted at DP5.

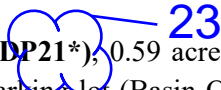
DP5, (Aka DP19*), 11.86 acres, consists of planned residential lots and streets (Basin OS-7 (Aka Basin HH*)) that have been assigned runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, and a portion of the east half of existing Dines Boulevard (Basin OS8 (Aka Basin JJ*)), with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year as well as flow-by from DP3. Developed runoff of Q5=20.5 cfs and Q100=52.0 cfs has been calculated to reach DP5 as shallow overland and as street flows. An existing 15' CDOT type R at-grade inlet at DP5 will intercept flows of Q5=15.0 cfs and Q100=23.2 cfs and allow for flow-by of Q5=5.5 cfs and Q100=28.8 cfs. The collected runoff combines with flows from DP4, prior to being discharged into existing FSD Pond 8.

DP6, (Aka DP20*), 2.19 acres, consists of proposed residential lots and streets (Basin E (Aka Basin KK*)) that have been assigned runoff coefficients of 0.38 for the 5-year and 0.55 for the 100-year, and the west half of a portion of existing Dines Boulevard (Basin OS10 (Aka Basin MM)), with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year as well as flow-by from DP4. Developed runoff of Q5=5.2 cfs and Q100=27.9 cfs has been calculated for to reach DP6 as shallow overland and as street flows. An existing 15' CDOT type R at-grade inlet at DP6 will intercept flows of Q5=5.2 cfs and Q100=17.6 cfs and allow flow-by of Q5=0.0 cfs and Q100=10.3 cfs. . Runoff collected by the inlet is conveyed under Dines where it will combine with flows intercepted at DP7, while the flow by continues downgradient in the west half of existing Dines Boulevard.

DP7, (Aka DP21*), 0.43 acres, consists of planned residential backyard lots (Basin OS11 (Aka Basin LL*)) that have been assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, and a portion of the east half of existing Dines Boulevard (Basin OS12 (Aka Basin NN*)), with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year as well as flow-by from DP5. Developed runoff of Q5=6.4 cfs and Q100=30.7 cfs has been calculated to reach DP7 as shallow overland and as street flows. An existing 15' CDOT type R at-grade inlet at DP7 will intercept flows of Q5=6.4 cfs and Q100=18.6 cfs and will allow for flow-by of Q5=0.0 cfs and Q100=12.1 cfs. The collected runoff combines with flows from DP6, prior to being discharged into existing FSD Pond 8, while the flow by continues south within the east half of Existing Dines Boulevard.

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DP8, (Aka DP20*), 0.67 acres, consists of proposed rear half of residential lots (Basin G (Aka Basin OO*)) that have been assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year, and the west half of a portion of existing Dines Boulevard (Basin OS14 (Aka Basin PP)), with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year as well as flow-by from DP6. Developed runoff of Q5=5.2 cfs and Q100=27.9 cfs has been calculated for to reach DP8 as shallow overland and as street flows. An existing 10' CDOT type R sump inlet at DP8 will intercept flows of Q5=1.4 cfs and Q100=13.2 cfs. Runoff collected by the inlet is conveyed under Dines where it will combine with flows intercepted at DP9.

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DP9, (Aka DP21*), 0.59 acres, consists a portion of the east half of existing Dines Boulevard and mail kiosk and parking lot (Basin OS15 (Aka Basin QQ*)), with runoff coefficients of 0.90 for the 5-year and 0.96 for the 100-year as well as flow-by from DP7. Developed runoff of Q5=2.0 cfs and Q100=15.9 cfs has been calculated to reach DP9 as shallow overland and as street flows. An existing 10' CDOT type R sump inlet at DP9 will intercept flows of Q5=2.0 cfs and Q100=15.9 cfs. The collected runoff combines with flows from DP8, prior to being discharged into existing FSD Pond 8.

Detailed Drainage Discussion (Drainage Basins)

Basin OS2, (Aka Basin O*), 0.57 acres, consists of planned residential backyard lots located along the north boundary of Branding Iron Filing No.1 with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of Q5=0.5 cfs and Q100=1.8 cfs has been calculated for Basin OS2. Runoff from Basin OS2 travels to DP4 where it is intercepted by an existing 15' CDOT type R at-grade inlet.

Basins F and G, (Aka Basins XX* & OO*), 0.69 acres, consists of proposed residential backyard lots located along the south boundary of Branding Iron Filing No. 1 with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed runoff of, Q5=0.4 cfs and Q100=1.3 cfs (Basin F), and Q5=0.3 cfs and Q100=1.0 cfs (Basin G), has been calculated for the two basins. Runoff from Basin G travels to Dines Boulevard and DP8 where it is intercepted by an existing 10' CDOT type R sump inlet. Runoff from the Basin F discharges to the planned school per the Sterling Ranch Filing Nos. 1&2 MDDP. The limited developed flows from Basin F that are discharged to the south are considerably less than the historic flows previously directed to the future school site as can be seen by noting Basin EX-3A in the Sterling Ranch MDDP Existing Conditions Map.

Basin OS1, (Aka Basin N*), 2.08 acres, is located primarily north of the northwest corner of Branding Iron Filing No. 1. Basin OS1 consists, of a portion of Lot 46, a portion of Sterling Ranch Filing No. 1 Tract L, and a portion of a planned residential subdivision to the north. Basin OS1 has runoff coefficients of 0.22 for

the 5-year and 0.46 for the 100-year and once developed is anticipated to discharge runoff of $Q_5=1.6$ cfs and $Q_{100}=5.7$ cfs. Sheet flow from Basin OS1 travels to the south within an existing swale located between Barbarick Subdivision and Branding Iron Filing No.1 in accordance with the Sterling Ranch Filing Nos. 1 & 2 MDDP.

Basin OS13, (Aka Basin YY*), 2.40 acres, is located outside and alongside the western boundary of Branding Iron Filing No. 1. Basin OS13 consists of a portion of Sterling Ranch Filing No. 1 Tract L and will remain primarily undeveloped with the exception of a new pedestrian trail and thus has been assigned runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. The anticipated developed runoff from Basin OS13 is $Q_5=2.0$ cfs and $Q_{100}=7.0$ cfs. Proposed runoff from Basins OS13 and OS1 will discharge along the boundary of Filing 1 and the Barbarick Subdivision in accordance per the Sterling Ranch Filing Nos. 1&2 MDDP. Flows reaching the southern boundary of the site, will be conveyed to the west via an existing swale which crosses the future school site and offsite portions of future Sterling Ranch as was the case in the historic condition. As the combined total area directed to the existing swale is considerably smaller than in the existing condition which can be seen by comparing the Branding Iron Filing No.1 Proposed conditions Drainage map against the Sterling Ranch MDDP Existing Conditions Map, and thus no additional improvements are anticipated. Both Tract L and the swale will be maintained by the Sterling Ranch Metropolitan District.

Water Quality/Full Spectrum Detention Facilities

With the exception of the outer permeable western and southern edges of the development the majority of the developed runoff from Branding Iron Filing No. 1 is collected within the internal streets and conveyed via existing storm sewer systems to the existing Full Spectrum Detention Facility Pond 8 that was approved for construction as a portion of the Sterling Ranch Filing No.1 improvements. Pond 8 will provide 0.46 acre feet of water quality and 2.90 acres of full spectrum detention for approximately 29 acres of Sterling Ranch development of which the Branding Iron Filing No.1 is a portion. The pond initially sized and designed within Sterling Ranch Filing Nos. 1&2 MDDP using the Detention Design UD-Detention v3.05 workbook. It should be noted that this drainage report and the SR Filing 1 and 2 MDDP were developed concurrently. Thus the larger scale concept planning was very finite and thus allowed for the developed flow rates to align between the two documents and thereby not requiring modifications to facility which is often common between conceptual and final design. Refer to the approved Sterling Ranch Filing No. 1 Storm Sewer Plans for additional details of FSD Pond 8.

EROSION CONTROL

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. EPC approved “Early Grading Plan for Sterling Ranch Phase I Onsite Grading & Erosion Control”, November 18, 2015. And “Early Grading Plan for Sterling Ranch Phase I Offsite Grading & Erosion Control”, December 3, 2015. Grading and Erosion control operations are currently underway (August 2016). Grading and Erosion Control will cease with the final development of the site in the next 12-36 months.

Address WQCV deviation (maintenance of vegetated buffer/swale to be addressed in deviation request)

CONSTRUCTION COST OPINION – BRANDING IRON AT STERLING RANCH FIL. NO. 1

Drainage Facilities:

There are no planned improvements with the development of Branding Iron at Sterling Ranch Filing No. 1. Construction costs have been accounted for in the “Master Development Drainage Report for Sterling Ranch Filing Nos. 1 & 2 , and Final Drainage Report for Sterling Ranch Filing No.1” prepared by MS Civil Consultants, dated April 2017. Please see Drainage and Bridge Fees below.

DRAINAGE & BRIDGE FEES – BRANDING IRON AT STERLING RANCH FIL. NO. 1

This site is within the Sand Creek Drainage Basin. The 2017 Drainage and Bridge Fees per El Paso County for the BRANDING IRON AT STERLING RANCH FILING NO. 1 site are as follows: **recalculate**

Per Branding Iron at Sterling Ranch Filing No. 1 Plat – **Total Area 10.545 Acres**

FILING NO. 1 FEES:

Drainage Fees: 10.545 x 46% \$ 16,270.00 =
Bridge Fees: 10.545 x 46% \$ 4,929.00 =

\$ 78,920.89
 \$ 23,909.10
Total \$ 102,829.99

SUMMARY This should be 49-50% with average lot size of 7160 sq. ft. (by interpolation of DCM update values below). If house footprints and impervious areas are to be limited please describe.

Developed runoff from Branding Iron Filing No.1 will be conveyed into the existing drainage systems shown on the enclosed Drainage Map. The majority of the stormwater will be conveyed to the south within the proposed rights of way and public storm sewer systems to the Existing Pond No. 8 which will provide full spectrum detention. As a portion of the design the pond will discharge runoff to Sand Creek at rates that are equivalent or less than the pre-developed condition in patterns that concur with the both the Sterling Ranch MDDP and the Sterling Ranch filing No.1 and 2 MDDP. As such, the development of this site will not adversely affect the surrounding development and is anticipated to have no negative impact to downstream facilities. The detention facilities treating the runoff from Branding Iron Filing No.1 and the surface and subsurface improvements to convey runoff located outside the public right of way shall be owned and maintained by the Sterling Ranch Metropolitan District.

Table 6-6. Runoff Coefficients for Rational Method
 (Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

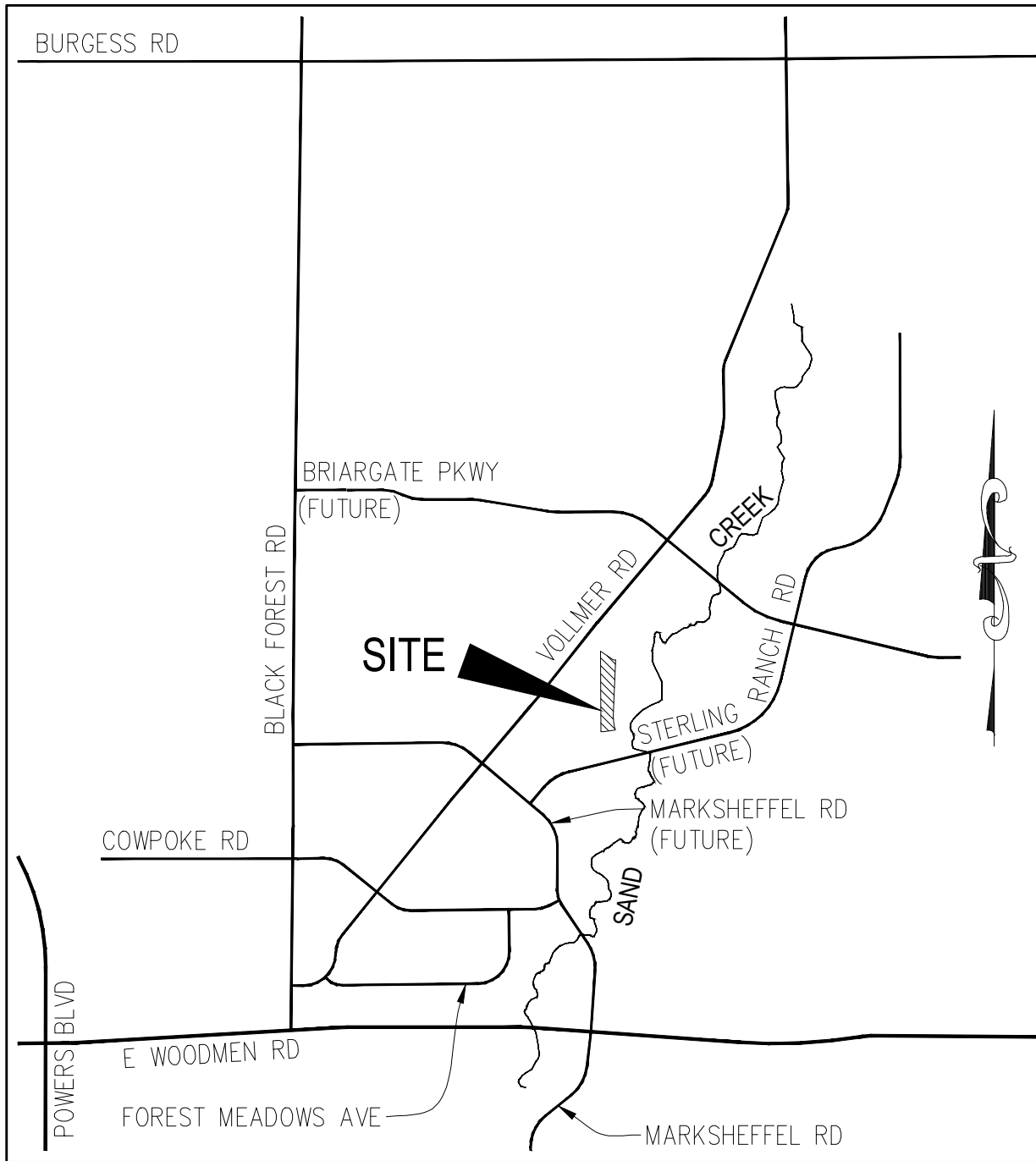
Use	Sq. Ft.	Imperv
Undisturbed/Good Forest		0.0
40-Ac.	1,742,400	2.0
10-Ac.	435,600	4.0
		5.0
5.0-Ac.	217,800	7.0
2.5-Ac.	108,900	11.0
2.0-Ac.	87,120	12.0
1.5-Ac.	65,340	16.0
1.0-Ac.	43,560	20.0
1/2-Ac.	21,780	25.0
1/3-Ac.	14,520	30.0
1/4-Ac.	10,890	38.0
	10,000	40.8
	9,000	43.9
	7,500	48.6
		49.0
	7,050	50.0
1/8-Ac.	5,445	55.0
		60.0
Townhome		65.0
	8335	46.00
	7160	49.65

REFERENCES

- 1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
- 2.) "Urban Storm Drainage Criteria Manuals, Volumes 1-3"
- 3.) NRSC Web Soil Survey Map for El Paso County. <http://websoilsurvey.nrcs.usda.gov>
- 4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date March 17, 1997.
- 5.) "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996
- 6.) "Sterling Ranch-Phase 1 Offsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 7.) "Sterling Ranch-Phase 1 Onsite Grading, Early Grading & Erosion Control Plans", prepared by M&S Civil Consultants, Inc., dated November 2015
- 8.) "Master Development Drainage Report for Sterling Ranch Filing Nos. 1&2 and Final Drainage Report for Sterling Ranch Filing No. 1", prepared by M&S Civil Consultants, Inc., dated April 2017
- 9.) "Master Development Drainage Report for Sterling Ranch, prepared by M&S Civil Consultants, Inc., dated April 2018

APPENDIX

VICINITY MAP



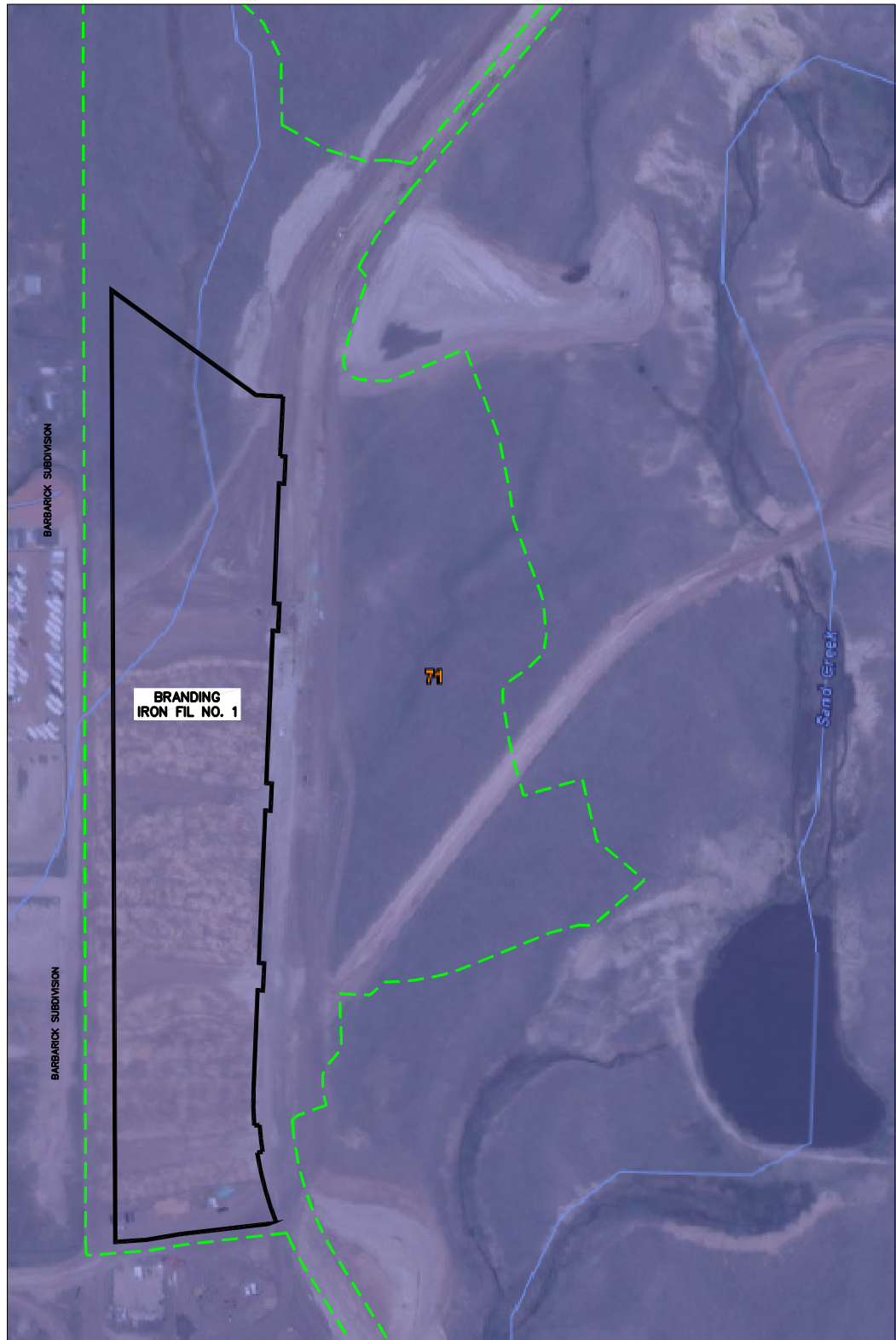
VICINITY MAP

N.T.S.

SOILS MAP



NOT TO SCALE



HYDROLOGIC
TYPE B SOILS



ANALYZED
WATERSHED



SUBDIVISION
BOUNDARY




SUMMARY BY MAP UNIT – EL PASO COUNTY AREA COLORADO (C0625)		
MAP UNIT SYMBOL	MAP UNIT NAME	RATING
71	PRING COARSE SANDY LOAM, 3 TO 8 PERCENT SLOPES	B

BRANDING IRON
AT STERLING
RANCH
SOILS MAP



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines

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

Soil Rating Points





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

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


Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	13.1	100.0%
Totals for Area of Interest			13.1	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

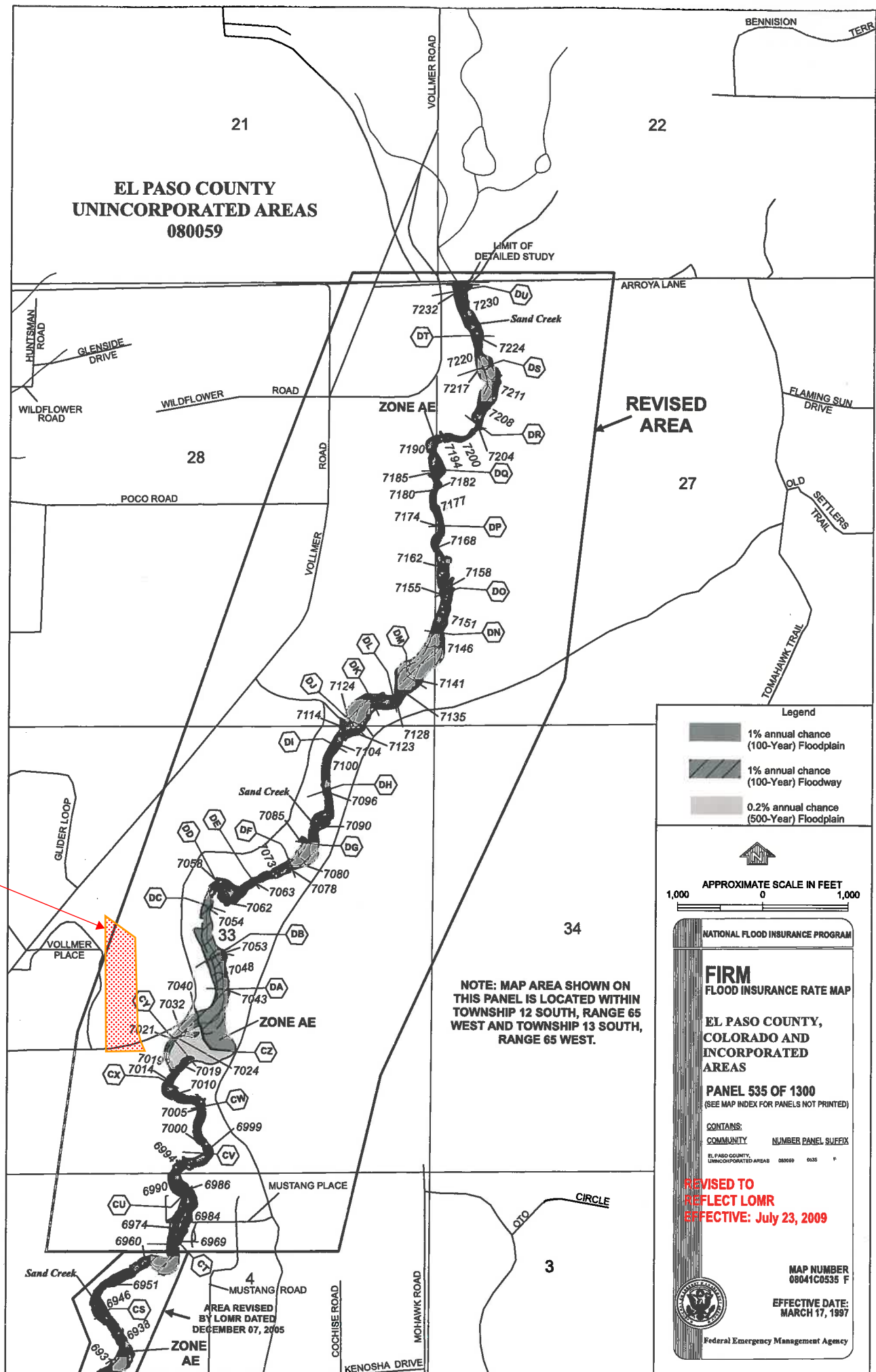
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FIRM PANEL W/ REVISED LOMR

EL PASO COUNTY
UNINCORPORATED AREAS
080059



SITE



AREA REVISED
BY LOMR DATED
DECEMBER 07, 2005

NOTE: MAP AREA SHOWN ON
THIS PANEL IS LOCATED WITHIN
TOWNSHIP 12 SOUTH, RANGE 65
WEST AND TOWNSHIP 13 SOUTH,
RANGE 65 WEST.

Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

1,000 0 1,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED
AREAS

PANEL 535 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY UNINCORPORATED AREAS 080059 0335 F

**REVISED TO
REFLECT LOMR
EFFECTIVE: July 23, 2009**

MAP NUMBER
08041C0535 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

BRANDING IRON AT STERLING RANCH FILING NO. 1

FINAL DRAINAGE REPORT

(Area Drainage Summary)

<i>From Area Runoff Coefficient Summary</i>				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		<small>From DCM Table 5-1</small>															
Proposed Area Drainage Summary																	
A	1.77	0.38	0.55	0.38	100	2	10.3	282	1.8%	3.0	1.5	11.9	12.1	3.9	6.5	2.6	6.3
B	2.09	0.38	0.55	0.38	100	2	10.3	243	1.2%	3.0	1.3	11.7	11.9	3.9	6.5	3.1	7.5
C	2.20	0.38	0.55	0.38	100	2	10.3	232	2.2%	3.0	1.3	11.6	11.8	3.9	6.6	3.3	7.9
D	2.09	0.38	0.55	0.38	100	2	10.3	227	1.1%	3.0	1.2	11.6	11.8	3.9	6.6	3.1	7.5
E	1.97	0.38	0.55	0.38	100	2	10.3	206	1.0%	3.0	1.1	11.5	11.7	3.9	6.6	2.9	7.1
F	0.39	0.22	0.46	0.22	85	4	8.8	0	2.0%	3.0	0.0	8.8	10.5	4.3	7.3	0.4	1.3
G	0.30	0.22	0.46	0.22	100	4	10.1	0	2.0%	3.0	0.0	10.1	10.6	4.1	6.9	0.3	1.0
OS1	2.08	0.22	0.46	0.22	75	1.5	10.9	818	2.9%	3.0	4.5	15.4	15.0	3.5	5.9	1.6	5.7
OS2	0.57	0.22	0.46	0.22	100	4	10.1	0	2.7%	3.0	0.0	10.1	10.6	4.1	6.9	0.5	1.8
OS3	5.39	0.38	0.55	0.38	60	1.2	8.0	1381	2.8%	3.0	7.6	16.3	18.0	3.4	5.7	8.0	19.3
OS4	0.61	0.22	0.46	0.22	100	2	12.6	0	2.2%	3.0	0.0	12.6	10.6	4.0	6.8	0.5	1.9
OS5	0.19	0.90	0.96	0.90	10	0.2	0.9	280	2.1%	3.0	1.5	5.0	11.6	5.2	8.7	0.9	1.6
OS6	1.54	0.90	0.96	0.90	10	0.2	0.9	1805	2.1%	3.0	9.9	10.8	20.1	4.0	6.7	5.6	10.0
OS7	10.87	0.38	0.55	0.38	100	2	10.3	516	1.9%	3.0	2.8	13.2	13.4	3.7	6.2	15.3	37.3
OS8	0.99	0.90	0.96	0.90	10	0.2	0.9	1349	2.2%	3.0	7.4	8.3	17.6	4.4	7.4	3.9	7.0
OS9	1.02	0.90	0.96	0.90	10	0.2	0.9	1349	2.2%	3.0	7.4	8.3	17.6	4.4	7.4	4.0	7.2
OS10	0.22	0.90	0.96	0.90	10	0.2	0.9	286	2.1%	3.0	1.6	5.0	11.6	5.2	8.7	1.0	1.8
OS11	0.23	0.22	0.46	0.22	95	4	9.6	0	2.0%	3.0	0.0	9.6	10.5	4.2	7.0	0.2	0.7
OS12	0.20	0.90	0.96	0.90	10	0.2	0.9	286	2.1%	3.0	1.6	5.0	11.6	5.2	8.7	0.9	1.7
OS13	2.40	0.22	0.46	0.22	100	2	12.6	0	0.5%	2.3	0.0	12.6	10.6	3.8	6.3	2.0	7.0
OS14	0.37	0.90	0.96	0.90	10	0.2	0.9	400	1.5%	3.0	2.2	5.0	12.3	5.2	8.7	1.7	3.1
OS15	0.59	0.90	0.96	0.90	10	0.2	0.9	400	1.5%	3.0	2.2	5.0	12.3	5.2	8.7	2.7	4.9

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: ET
 Date: 4/10/2018
 Checked by: VAS

BRANDING IRON AT STERLING RANCH FILING NO. 1
FINAL DRAINAGE REPORT
(Basin Routing Summary)

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T _t)	INTENSITY **		TOTAL FLOWS		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
		PROPOSED DRAINAGE BASIN ROUTING SUMMARY															
1	OS3	2.34	3.39									16.3	3.4	5.7	8.0	19.3	36" FES/TSB
2	OS4, OS5, Sterling Ranch Filing Nos. 1&2 MDDP* Flowby DP4	1.07	3.02									11.7	3.9	6.5	4.2	19.7	EX 15' AT-GRADE INLET
3	OS6, Sterling Ranch Filing Nos. 1&2 MDDP* Basins I, J, K	3.50	3.97									10.8	4.0	6.7	14.1	26.7	EX 15' AT-GRADE INLET
4	A, B, C, OS2, OS9, Flowby DP2	4.14	7.30									16.3	3.4	5.7	14.1	41.6	EX 15' AT-GRADE INLET
5	OS7, OS8 FLOWBY DP 3	5.53	8.34									13.2	3.7	6.2	20.5	52.0	EX 15' AT-GRADE INLET
6	E, OS10 FLOWBY DP 4	1.53	4.89									16.3	3.4	5.7	5.2	27.9	EX 15' AT-GRADE INLET
7	OS11, OS12 FLOWBY DP 5	1.72	4.92									13.2	3.7	6.2	6.4	30.7	EX 15' AT-GRADE INLET
8	G, OS14, FLOWBY DP 6	0.40	2.31									16.3	3.4	5.7	1.4	13.2	EX 10' SUMP INLET
9	OS15, FLOWBY DP 7	0.53	2.54									13.2	3.7	6.2	2.0	15.9	EX 10' SUMP INLET

* For detailed information on Design Points, Basins, or Flowby see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017

** Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: ET
Date: 4/10/2017
Checked by: VAS

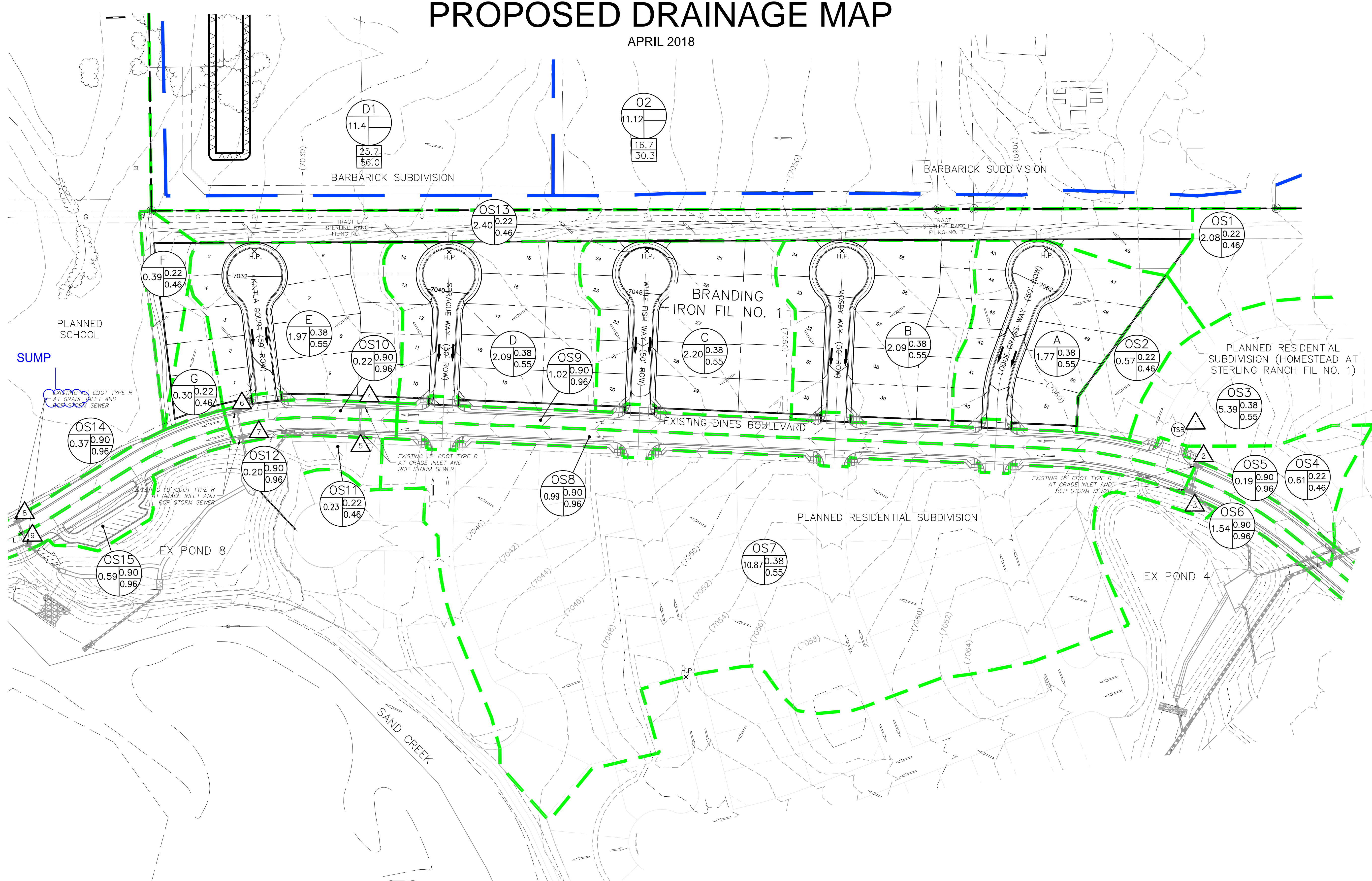
DRAINAGE MAP

BRANDING IRON AT STERLING RANCH FILING NO. 1

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

APRIL 2018



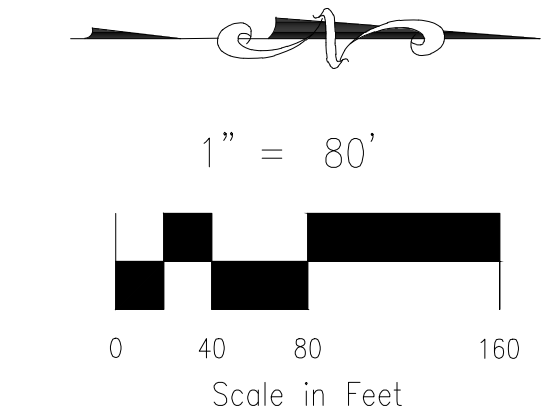
LEGEND

- BASIN DESIGNATION: Z 25 .25 .35 C5 C100
- ACRES: 25 .25 .35
- PIPE RUN REFERENCE LABEL: 4
- SURFACE DESIGN POINT: 6
- BASIN BOUNDARY:
- EXISTING CONTOUR: (6920)
- PROP CONTOUR: 6920
- BRANDING IRON FILING NO. 1 BOUNDARY:
- EXISTING STORM SEWER PIPE:
- CROSSSPAN:
- INLET:
- EXISTING FLOW DIRECTION:
- FLOW DIRECTION:
- FLARED END SECTION:
- H.P. X:
- L.P. X:
- TEMPORARY SEDIMENT BASIN: TSB

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q ₅	Q ₁₀₀
A	1.77	2.6	6.3
B	2.09	3.1	7.5
C	2.20	3.3	7.9
D	2.09	3.1	7.5
E	1.97	2.9	7.1
F	0.39	0.4	1.3
G	0.30	0.3	1.0
OS1	2.08	1.6	5.7
OS2	0.57	0.5	1.8
OS3	5.39	8.0	19.3
OS4	0.61	0.5	1.9
OS5	0.19	0.9	1.6
OS6	1.54	5.6	10.0
OS7	10.87	15.3	37.3
OS8	0.99	3.9	7.0
OS9	1.02	4.0	7.2
OS10	0.22	1.0	1.8
OS11	0.23	0.2	0.7
OS12	0.20	0.9	1.7
OS13	2.40	2.0	7.0
OS14	0.37	1.7	3.1
OS15	0.59	2.7	4.9

DESIGN POINT SUMMARY				
DESIGN POINT	Q ₅	Q ₁₀₀	BASIN	STRUCTURE
1	8.0	19.3	OS3	TEMPORARY SEDIMENT BASIN W/ TEMP. 36" FCS
2	4.2	19.7	OS4, OS5, Sterling Ranch Filing Nos. 1&2 MDDP* Flowby DP4	EX 15" AT-GRADE INLET
3	14.1	26.7	OS6, Sterling Ranch Filing Nos. 1&2 MDDP* Basins I, J, K	EX 15" AT-GRADE INLET
4	14.1	41.6	A, B, C, OS2, OS9, Flowby DP2	EX 15" AT-GRADE INLET
5	20.5	52.0	OS7, OS8, Flowby DP3	EX 15" AT-GRADE INLET
6	5.2	27.9	E, OS10, Flowby DP4	EX 15" AT-GRADE INLET
7	6.4	30.7	OS11, OS12, Flowby DP5	EX 15" AT-GRADE INLET
8	1.4	13.2	G, OS14, Flowby DP6	EX 10' SUMP INLET
9	2.0	15.9	OS15, Flowby DP7	EX 10' SUMP INLET

* For detailed information on Design Points, Basins, or Flowby see Sterling Ranch Filing Nos. 1&2 MDDP prepared by MS Civil Consultants, dated April 2017



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M&S
CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

BRANDING IRON AT SR FIL NO. 1
PROPOSED DRAINAGE MAP
PROJECT NO. 09-006
SCALE: HORIZONTAL: 1"=80' VERTICAL: N/A
DATE: 4/10/2018
DESIGNED BY: CMN
DRAWN BY: CMN
CHECKED BY: VAS
SHEET 1 OF 1
PDM

File: 0:\08006A\Sterling Ranch No 3\Map\Eng Exhibit\Proposed Drainage Map.dwg Plotstamp: 4/12/2018 9:23 AM