NEW DOC

FINAL DRAINAGE REPORT
for
THE RESERVE AT CORRAL BLUFFS – FILING NO. 1

Prepared for:

Corral Ranch Development Company
6 S. Tejon, Suite 515
Colorado Springs, CO 80903

RECEIVED
[illegible] 8 2013
EPC DEVELOPMENT SERVICES

Submit a Drainage Report or Letter for Filing 2.

Make sure these items are addressed in the Filing 2 drainage report.
1. Updated drainage and bridge fees for the lots (Lots 5 & 6) within Jimmy Camp Creek. Make sure to include a separate line item for the Jimmy Camp Creek surety fee.
2. Add a section regarding the 4-step process defined in ECM Appendix I.
3. Include the A2 & A3 culvert calculation and summarize the results. In other words identify the depth of over topping at the edge of shoulder during the 100yr and state if this is in conformance with the DCM.

March 4, 2013
Revised October 24, 2013

RECEIVED
OCT 28 2013
EPC DEVELOPMENT SERVICES

Prepared by:

JPS ENGINEERING

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JPS Project No. 081104

Add PCD File No. SF-18-010

RESERVE AT CORRAL BLUFFS
FINAL DRAINAGE REPORT
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APPENDICES

JPS ENGINEERING

THE RESERVE AT CORRAL BLUFFS
FINAL DRAINAGE REPORT
EXECUTIVE SUMMARY

A. Background

- The Reserve at Corral Bluffs is a proposed low-density rural residential subdivision of a 156.5-acre property located in the Corral Bluffs area in eastern El Paso County.
- The development plan consists of 31 residential lots with a minimum lot size of 5-acres.

B. General Drainage Concept

- Developed drainage within the site will be conveyed along gravel streets with roadside ditches and culverts, as well as grass-lined drainage swales following historic drainage patterns through the site.
- The majority of this development lies within the Curtis Ranch Drainage Basin, and the south and southwest areas of the site are located within the Jimmy Camp Creek Drainage Basin.
- Runoff from the majority of the developed site will flow in a northerly direction, feeding into existing natural swales at the north property boundary, ultimately reaching a tributary channel of the West Fork of Black Squirrel Creek.
- Runoff from the south and southwest parts of the site flows southwesterly towards tributary channels of Jimmy Camp Creek.

C. Drainage Impacts

- The proposed drainage patterns will remain consistent with historic conditions, and development of the proposed 5-acre rural residential lots will have an insignificant impact on existing downstream drainage swales.
- Drainage facilities within public road rights-of-way will be designed and constructed to El Paso County standards. The proposed public streets will be owned and maintained by the County.
- Drainage facilities such as swales running through private lots will be owned and maintained by the private lot owners.

<u>DRAINAGE STATEMENT</u>

<u>Engineer's Statement:</u>

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.

John P. Schwab, P.E. #29891

<u>Developer's Statement:</u>

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

By: ______________________ 10-28-13
Date

<u>El Paso County's Statement</u>

Filed in accordance with Section 51.1 of the El Paso County Land Development Code, as amended.

______________________ 10-31-13
County Engineer / Director Date

Conditions:

FLOODPLAIN STATEMENT

To the best of my knowledge and belief, no parts of the Reserve at Corral Bluffs Subdivision are located in a FEMA designated floodplain, as shown on FIRM Panels No. 08041C0575F and 08041C0780F, dated March 17, 1997.

John P. Schwab, P.E. #29891

I. GENERAL LOCATION AND DESCRIPTION

A. Background

The Reserve at Corral Bluffs is a proposed rural residential subdivision located in the Corral Bluffs area of eastern El Paso County, Colorado. The 156.5-acre property is comprised of several adjoining parcels (El Paso County Assessor's Numbers 43310-00-006, 43310-00-010, 43310-00-011, 43310-00-016, and 43310-00-017) located south and west of the current limits of Hoofprint Road, as shown in Figure A1 (Appendix A). The proposed Reserve at Corral Bluffs Subdivision will create a total of 31 rural residential lots with 5-acre minimum lot sizes. Filing No. 1 consists of six proposed lots on approximately 32.3-acres at the northwest corner of the property. Access to Filing No. 1 will be provided by extension of Hoofprint Road south into the site along the frontage of the six lots within Filing No.1, with a temporary cul-de-sac at the south end of the filing.

B. Scope

This report will provide a summary of site drainage issues impacting the proposed residential development. The report will analyze upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the El Paso County Drainage Criteria Manual, and the report is intended to fulfill the requirements for a "Final Drainage Report" in support of the Final Plat process for this property.

C. Site Location and Description

The Reserve at Corral Bluffs parcel is located in parts of the East Half of Section 31 and the West Half of Section 32, Township 13 South, Range 64 West of the 6th Principal Meridian. The site is currently a vacant meadow tract. The property is zoned A-5 and RR-5 (rural residential), allowing for 5–acre minimum lot sizes. A new public road extension of Hoofprint Road will be constructed through the subdivision, providing a connection between the two existing end points of Hoofprint Road. One additional new public road (Solberg Court) will extend to cul de sacs on both the northeast and southwest sides of Hoofprint Road. All of the proposed lots in the subdivision will have driveway access to either Hoofprint Road or Solberg Court. Subdivision improvements will include site grading, roadway construction, and utility improvements for the 31 proposed residential lots.

The parcel is bordered by rural residential properties to the north and northeast, with 5-acre minimum lot sizes. The adjoining lots on the north side of the property were previously platted as Corral Ranches Subdivision Filing No. 3 and No. 4. The properties along the western boundary are rural ranch properties with 35-acre minimum lot sizes.

The City of Colorado Springs purchased the bluffs to the south of the property as part of the City Open Space system. Waste Management owns the property to the southeast as part of the Colorado Springs Landfill operation.

Ground elevations within the site range from approximately 6,670 to 6,790 feet above mean sea level.

The majority of the developed site is located within the Curtis Ranch Drainage Basin, and the south and southwest parts of the property are located within the Jimmy Camp Creek Drainage Basin. The terrain is rolling with average grades ranging from 2 to 10 percent. The existing site is primarily vacant range land, with moderate coverage of prairie grass and shrubs.

D. General Soil Conditions

According to the Custom Soil Resource Report for this site provided by the Natural Resources Conservation Service (NRCS), on-site soils are comprised of the following soil types (see details in Appendix B):

- Type 3, "Ascalon sandy loam": well drained sandy loam soils, hydrologic soils group "B," (majority of east side of property and also northwest corner of property)
- Type 4, "Badland": weathered bedrock, alluvium derived from sandstone and shale and/or alluvium derived from sitltsone; hydrologic soils group "D," (south side of property)
- Type 13, "Bresser sandy loam": well drained sandy loam soils, hydrologic soils group "B," (majority of northwest area of property)
- Type 85, "Stapleton-Bernal sandy loams": well drained sandy loam soils, hydrologic soils group "B," (small area at western site boundary)

The existing drainage swales flowing through the site are generally characterized as stable, grass-lined channels.

E. References

City of Colorado Springs & El Paso County "Drainage Criteria Manual," revised October 12, 1994.

CDOT, "CDOT Drainage Design Manual," July, 1995.

El Paso County "Engineering Criteria Manual," January 9, 2006.

Entech Engineering, Inc., "Soils, Geology, Geologic Hazard and Wastewater Study, The Reserve at Corral Bluffs," January 23, 2012.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C0575-F and 08041C0780-F, March 17, 1997.

JPS Engineering, Inc., "Preliminary Drainage Report for The Reserve at Corral Bluffs," May 31, 2012.

Leigh Whitehead & Associates, Inc., "Final Drainage Report and Plan for Corral Ranches Subdivision Filing No. 10," May, 2003.

USDA Natural Resources Conservation Service, "Custom Soil Resource Report, Corral Bluffs," February, 2012.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The majority of the proposed development area lies within the Curtis Ranch Drainage Basin (CHWS 1000) as classified by El Paso County. Drainage from the northern parts of this site flows northerly to existing natural drainage swales, which drain northeasterly off-site towards a tributary channel of the West Fork of Black Squirrel Creek.

The south and southwest parts of the property lie within the Jimmy Camp Creek Basin (FOFO 2000). Drainage from the southwest parts of the site flows southwesterly towards tributary drainage channels flowing to the Corral Tributary of Jimmy Camp Creek.

B. Floodplain Impacts

The project site is located beyond the limits of any 100-year floodplain delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Numbers 08041C0575-F and 08041C0780-F, dated March 17, 1997, as depicted in Figure A2 (Appendix A).

C. Sub-Basin Description

The existing drainage basins lying in and around the proposed development are depicted in Figures EX1 and EX2 (Appendix A). The site is located on a ridge, so off-site drainage areas impacting the site are minimal. The site is impacted by one off-site drainage basin southeast of the property (Basin OA1). Drainage from the off-site basin flows northwesterly through the existing natural drainage channels within this site towards the north boundary of the site. The existing on-site topography has been delineated as six drainage basins, as shown in Figure EX2 (Appendix A). Drainage Basins A-D flow northerly towards the Curtis Ranch Drainage Basin at the north boundary of the site. Drainage Basins E and F flow southwesterly towards the Jimmy Camp Creek Basin at the south and west boundaries of the site.

The natural drainage patterns will be impacted through development by site grading and concentration of runoff in subdivision streets. Developed runoff will generally continue to follow historic paths.

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

No Drainage Basin Planning Study (DBPS) has been completed for the Curtis Ranch Drainage Basin. El Paso County has a DBPS in progress for Jimmy Camp Creek, but the study has not yet been completed. No Master Development Drainage Plans (MDDP's) were found for any adjacent subdivisions. We understand the previously platted subdivisions adjacent to the north boundary of this site (Corral Ranches Filing No. 3 and No. 4) were platted in the 1977-1978 timeframe, and no drainage reports for these subdivision filings were found on file with El Paso County.

B. Hydrologic Criteria

The tributary drainage basins impacting this site are all less than 100 acres, so Rational Method Hydrology procedures were utilized for calculation of peak flows. Rational Method hydrologic calculations were based on the following assumptions:

• Design storm (minor)	5-year	
• Design storm (major)	100-year	
• Time of Concentration – Overland Flow	"Airport" equation (300' max. developed)	
• Time of Concentration – Gutter/Ditch Flow	"SCS Upland" equation	
• Rainfall Intensities	El Paso County I-D-F Curve	
• Hydrologic soil type	B	
	C5	C100
• Runoff Coefficients - undeveloped:		
Existing pasture/range areas	0.25	0.35
• Runoff Coefficients - developed:		
Proposed lot areas (5-acre lots)	0.28	0.38

(see composite runoff coefficient calculations in Appendix C)

Composite runoff coefficient ("C-values") were calculated for the proposed 5-acre rural residential lots based on typical house footprints, typical gravel driveway lengths, and the proposed layout of new gravel public roads within the subdivision. The calculated values of $C_5 = 0.28$ and $C_{100} = 0.38$ are consistent with the runoff coefficients utilized in the previously approved "Final Drainage Report and Plan for Corral Ranches Subdivision Filing No. 10." Hydrologic calculations are enclosed in Appendix C, and peak design flows are identified on the drainage plan drawings.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

Development of the proposed subdivision will require site grading, roadway construction, and utility improvements serving 31 new residential lots, resulting in a marginal increase in impervious areas across the site. The general concept for management of developed storm runoff is to grade the home sites to provide positive drainage away from the building pads, and divert runoff to the proposed roadside ditches and existing grass-lined drainage swales flowing through the property.

The proposed rural residential subdivision development is an inherently low impact development (LID) approach based on the low densities proposed. Low impact development techniques associated with this subdivision include the following:

- Minimize overlot grading; roadways will be excavated to closely match existing grades, and existing vegetation will generally be preserved unless removal is specifically required for roadways, building pads, utility corridors, cut slopes, etc.
- New public roads will have rural cross-sections with grass-lined ditches to encourage infiltration of stormwater.

B. Specific Details

1. Existing Drainage Conditions

Historic drainage conditions are depicted on Figures EX1 and EX2. The site is currently a vacant range and meadow property. There are no significant existing drainage facilities within the property, and there are no existing irrigation facilities, utilities, or significant encumbrances impacting the site. The south end of the site has severe slopes falling towards the City of Colorado Springs Corral Bluffs Open Space, and the proposed development plan will minimize disturbance to the existing bluffs.

Off-site flows from Basin OA1 (southeast of the property) combine with on-site drainage from Basin A, flowing to Design Point #1 at the north boundary of the site. The previously developed subdivision north of this site (Corral Ranches Subdivision Filing No. 3) platted two 30-foot wide drainage easements across the downstream lots receiving flows from this site. The existing downstream drainage channels are grass-lined swales in stable condition. Historic peak flows at Design Point #7 (Basins OA1 and A1) are calculated as Q_5 = 21.7 cfs and Q_{100} = 54.1 cfs. Historic peak flows at Design Point #8 (Basin A2) are calculated as Q_5 = 30.6 cfs and Q_{100} = 76.1 cfs. Flows from Basins OA1, A1 and A2 combine at Design Point #1, with historic peak flows calculated as Q_5 = 45.4 cfs and Q_{100} = 113.1 cfs.

Drainage from Basin B flows northwesterly in an existing stable, grass-lined swale to Design Point #2, with historic peak flows calculated as Q_5 = 18.9 cfs and Q_{100} = 47.1 cfs.

Historic drainage from Basin C flows northeasterly in an existing stable, grass-lined swale to Design Point #3, with historic peak flows calculated as $Q_5 = 4.6$ cfs and $Q_{100} = 11.6$ cfs.

Drainage from Basin D also flows northeasterly in an existing stable, grass-lined swale to Design Point #4, with historic peak flows calculated as $Q_5 = 7.7$ cfs and $Q_{100} = 19.2$ cfs.

In the southwest part of the site, drainage from Basin E flows westerly in stable, grass-lined drainage swales towards the west boundary of the site, ultimately flowing to the Jimmy Camp Creek Basin. Historic peak flows at Design Point #5 are calculated as $Q_5 = 13.7$ cfs and $Q_{100} = 34.1$ cfs.

Historic drainage from Basin F in the southern part of the site drains southerly towards tributary channels flowing to the Jimmy Camp Creek Basin. Historic peak flows at Design Point #6 are calculated as $Q_5 = 38.0$ cfs and $Q_{100} = 94.7$ cfs.

2. Developed Drainage Conditions

The developed drainage basins and projected flows are shown on the Developed Drainage Plan (Figure D1, Appendix A). Off-site flows from Basin OA1 will enter the subdivision through a proposed Culvert OA1 (24" RCP) crossing the new extension of Hoofprint Road. Flows from Basin OA1 then combine with on-site drainage from Sub-Basin A1, and continue flowing northwesterly through the existing channel draining towards the north site boundary. A 30-foot wide drainage easement will be dedicated along the existing drainage channel crossing Lots 4, 7, and 8.

Flows from Basin A2 drain northwesterly to a proposed Culvert A2 (30" RCP) crossing the new public road (Solberg Court) between Lots 18 and 30. These flows continue northwesterly in a drainage easement across Lot 18, and then drain through proposed Culvert A3 (36" RCP), crossing a low point in the profile of the newly extended Hoofprint Road. Combined developed flows from Culvert A3 flow northerly in the existing grass-lined channel across Lots 9-12, ultimately reaching the existing drainage easement at the north boundary of the site. Drainage easements will be dedicated to protect the existing natural drainage swales crossing Lots 9-12. As noted on Figure D1, the existing stock pond within Lots 9 and 11 will be breached to eliminate potential future concerns with ownership and maintenance of the pond. Drainage from Basins OA1, A1, and A5 flows to Design Point #7, located at the north boundary of Lot 7, with developed peak flows calculated as $Q_5 = 23.0$ cfs and $Q_{100} = 55.8$ cfs. Drainage from Basins A2-A4 flows to Design Point #8 at the north boundary of Lot 12, with developed peak flows calculated as $Q_5 = 33.2$ cfs and $Q_{100} = 80.1$ cfs. Developed flows from Basins OA1 and A1-A5 combine at Design Point #1, with developed peak flows calculated as $Q_5 = 49.9$ cfs and $Q_{100} = 120.5$ cfs. The developed drainage impact at Design Points #7, #8, and #1 remains minimal based on the rural residential development plan for the site.

Developed flows from Basin B will continue to flow northwesterly to Design Point #2, with peak flows of Q_5 = 22.0 cfs and Q_{100} = 53.2 cfs.

Developed flows from Basin C will continue to flow northeasterly to Design Point #3, with peak flows of Q_5 = 5.3 cfs and Q_{100} = 12.7 cfs.

Developed flows from Basin D will continue to flow northeasterly to Design Point #4, with peak flows of Q_5 = 8.7 cfs and Q_{100} = 21.1 cfs.

In the southwest part of the site, developed drainage from Basin E will continue to flow westerly to Design Point #5, with developed peak flows calculated as Q_5 = 15.6 cfs and Q_{100} = 37.6 cfs.

As previously noted, the proposed development plan for the site will prohibit disturbance of the existing bluffs at the south end of the site. As such, developed drainage from Basin F will continue to flow towards the south boundary of the site, with developed peak flows matching the historic peak flows of Q_5 = 38.0 cfs and Q_{100} = 94.7 cfs.

C. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix C, the total developed flow from the site will slightly exceed historic flow from the site. The comparison of developed to historic discharges at key design points is summarized as follows:

Design Point	Historic Flow			Developed Flow			Comparison of Developed to Historic Flow
	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	
1	113.3	45.4	113.1	112.6	49.9	120.5	+4.5 cfs / +7.9 cfs (increase)
2	25.7	18.9	47.1	26.3	22.0	53.2	+3.1 cfs / +6.1 cfs (increase)
3	6.0	4.6	11.6	6.0	5.3	12.7	+0.7 cfs / +1.1 cfs (increase)
4	11.0	7.7	19.2	11.0	8.7	21.1	+0.4 cfs / +1.9 cfs (increase)
5	15.9	13.7	34.1	15.9	15.6	37.6	+1.9 cfs / +3.5 cfs (increase)
6	40.2	38.0	94.7	40.2	38.0	94.7	(no change)
7	54.2	21.7	54.1	51.9	23.0	55.6	+1.3 cfs / +1.5 cfs (increase)
8	59.0	30.6	76.1	60.6	33.2	80.1	+2.6 cfs / +4.0 cfs (increase)

The total increase in developed flow is estimated to be approximately 6.3 percent, and the maximum increase at any design point is less than 8 cfs, which represents a minimal increase. The minor increase in developed flow will be mitigated by proper erosion control measures within the site, including riprap outlet protection downstream of each of the new public culverts crossing the subdivision streets.

D. On-Site Drainage Facility Design

Developed sub-basins and proposed drainage improvements are depicted on the enclosed Developed Drainage Plan (Sheet D1). In accordance with El Paso County standards, new roadways will be graded with a minimum longitudinal slope of 1.0 percent. As shown on Sheet D1, the typical local road section will consist of a 34-foot gravel roadway width, 6:1 ditch slopes, and 2-foot deep ditches.

On-site drainage facilities will consist of roadside ditches, grass-lined channels, and culverts. Hydraulic calculations for sizing of on-site drainage facilities are enclosed in Appendix D and design criteria are summarized as follows:

1. Culverts

The internal road system will be graded to drain roadside ditches to low points along the road profile, where cross-culverts will convey developed flows into grass-lined channels following historic drainage paths. Culvert pipes will be specified as reinforced concrete pipe (RCP) with a minimum diameter of 18-inches. Preliminary culvert sizes have been tabulated in Appendix D based on a maximum headwater-to-depth ratio (HW/D) of 1.0 for the minor (5-year) design storm, and maximum allowable headwater depths in accordance with County roadway overtopping criteria for the major (100-year) design storm. Final culvert hydraulic calculations have been performed using the FHWA HY-8 software package, providing a detailed headwater depth analysis for each culvert crossing (see Appendix D). Riprap outlet protection will be provided at all culverts.

2. Open Channels

Drainage easements have been dedicated along major drainage channels following historic drainage paths through the subdivision. These channels will generally be grass-lined channels designed to convey 100-year flows, with a trapezoidal cross-section, variable bottom width and depth, 4:1 maximum side slopes, 1-foot minimum freeboard, and a minimum slope of 0.5 percent.

The proposed drainage channels will be sized utilizing Manning's equation for open channel flow, assuming a friction factor ("n") of 0.030 for dry-land grass channels. Maximum allowable velocities will be evaluated based on El Paso County drainage criteria, typically allowing for a maximum 100-year velocity of 5 feet per second. The proposed channels will generally be seeded with native grasses for erosion control. Riprap channel lining and/or erosion control mats will be provided where required based on erosive velocities. Ditch flows will be diverted to drainage channels at the nearest practical location to minimize excessive roadside ditch sizes. Primary drainage swales crossing proposed lots have been placed in drainage easements, with variable widths based on the required channel sections.

E. Analysis of Existing and Proposed Downstream Facilities

The majority of the proposed subdivision is located within Basins A-D, which drain to existing natural drainage channels flowing northerly through the site. The existing natural swales downstream of the property appear to be in stable condition. Development of this property as a rural residential subdivision in accordance with its current zoning will have an insignificant impact on downstream drainage facilities.

F. Anticipated Drainage Problems and Solutions

The overall drainage plan for the subdivision includes a system of roadside ditches, channels, and culverts to convey developed flows through the site. The primary drainage problems anticipated within this development will consist of maintenance of these channels and culverts. Care will need to be taken to implement proper erosion control measures in the proposed roadside ditches, channels, and swales. Ditches will be designed to meet allowable velocity criteria. Erosion control mats and/or riprap channel lining will be installed where necessary to minimize erosion concerns. Public road improvements and drainage improvements along the public roads will be dedicated to the County for maintenance upon completion and acceptance by the County. Proposed drainage facilities outside the public right-of-way will be owned and maintained by the individual lot owners, unless otherwise noted.

V. EROSION CONTROL / SEDIMENT CONTROL

Best management practices (BMP's) will be implemented for erosion control during and after construction. Erosion control measures will include installation of silt fence at the toe of disturbed slopes, straw bales protecting drainage ditches, vehicle tracking control pads at access points, riprap protection at culvert outlets, and revegetation of disturbed areas. Cut slopes will be stabilized during excavation as necessary and vegetation will be re-established as soon as possible for stabilization of the graded areas.

VI. COST ESTIMATE AND DRAINAGE FEES

The developer will finance all costs for proposed roadway and drainage improvements, and public facilities will be owned and maintained by El Paso County upon final acceptance.

This majority of the developed parcel (Basins A-D) is located in the Curtis Ranch Drainage Basin (CHWS 1000), which is an unstudied basin with no drainage basin fee or bridge fee requirement.

The south and southwesterly parts of this site (Basins E and F) are located within the Jimmy Camp Creek Drainage Basin (FOFO 2000), which has a 2012 drainage basin fee of $15,000 per impervious acre and a bridge fee of $672 per impervious acre. No significant development activity is proposed within Basin F, so the only development area impacted by Jimmy Camp Creek Drainage Basin fee requirements is the southwesterly area within Basin E. Applicable drainage basin fees within the Jimmy Camp Creek Drainage Basin are summarized as follows:

Average residential lot size = 5 acre/lot
Developed Residential Lot Area (Basin E) = 15.89 acres
Percent impervious = 5.16% (per Site-Specific Impervious Calculation in Appendix C)
Total Impervious area = (5.16% * 15.89 ac.) = 0.82 ac.
Adjusted Impervious area = (0.82 ac) * 75% = 0.615 ac.
(includes 25% reduction on drainage fees for 5-acre lots)
Drainage Basin Fee = (0.615 ac.) @ $15,000 ac. = $9,225.00

Bridge Fee = (0.82 ac.) @ $672 ac. = $551.04

The fees calculated above will apply to a future subdivision filing lying within the Jimmy Camp Creek Drainage Basin.

Filing No. 1 is located in the northwest part of the site, lying entirely within the Curtis Ranch Drainage Basin, so there are no drainage basin fees or bridge fees required for Filing No.1.

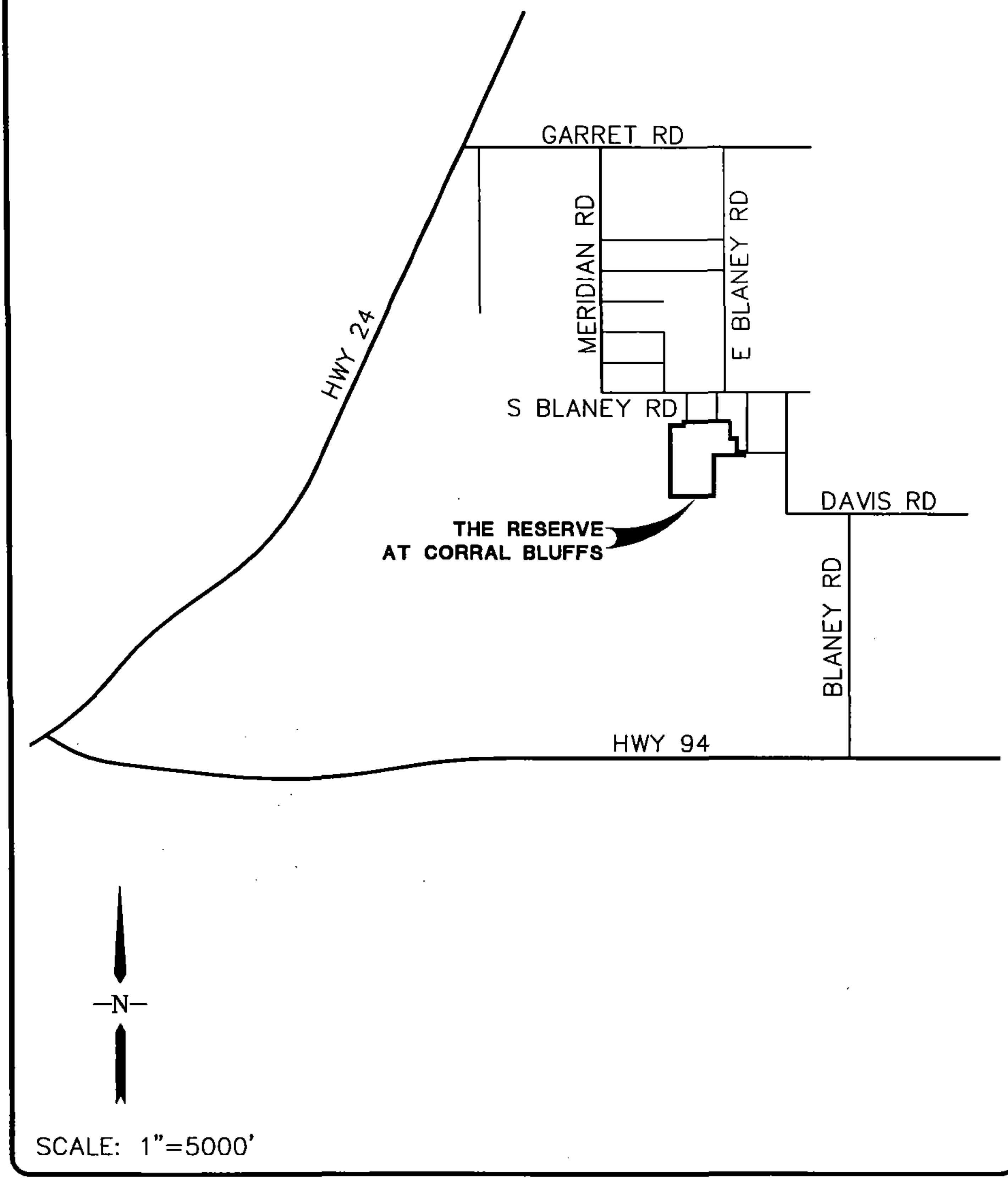
VII. SUMMARY

The Reserve at Corral Bluffs is a proposed rural residential subdivision consisting of 31 lots on a 156.5-acre parcel. The proposed rural residential subdivision of this parcel into 5-acre lots is consistent with the surrounding zoning and character of this site.

Development of the proposed subdivision is anticipated to result in a minimal increase in developed runoff from the site, and erosion control best management practices will be implemented to mitigate developed drainage impacts. The proposed drainage patterns will remain consistent with historic conditions, and new drainage facilities will be constructed on-site to El Paso County standards to safely convey runoff to adequate outfalls. Implementation and maintenance of proper erosion control measures will ensure that downstream properties are protected from potential adverse drainage impacts from this development.

APPENDIX A

FIGURES



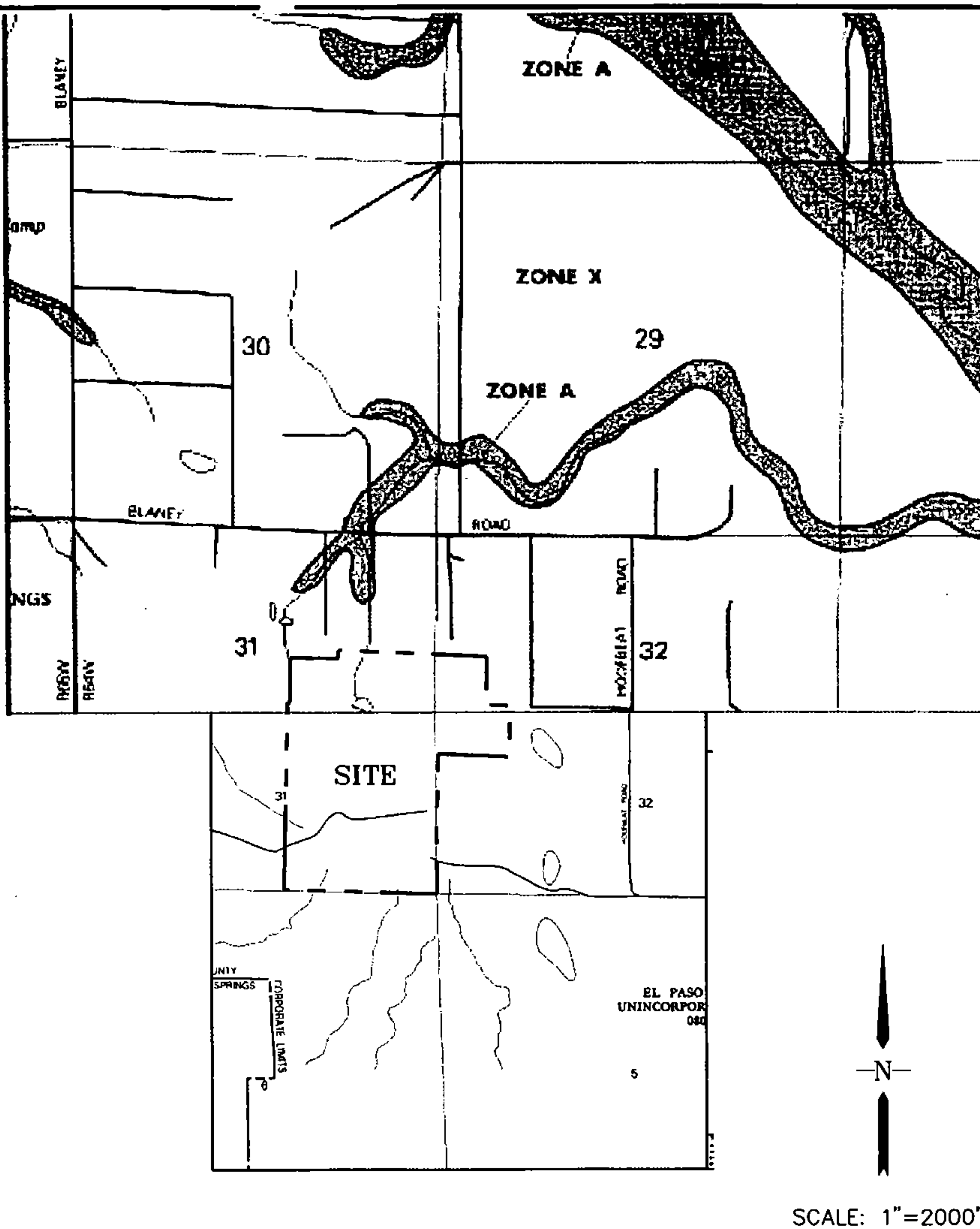
VICINITY MAP

JPS ENGINEERING

THE RESERVE AT CORRAL BLUFFS

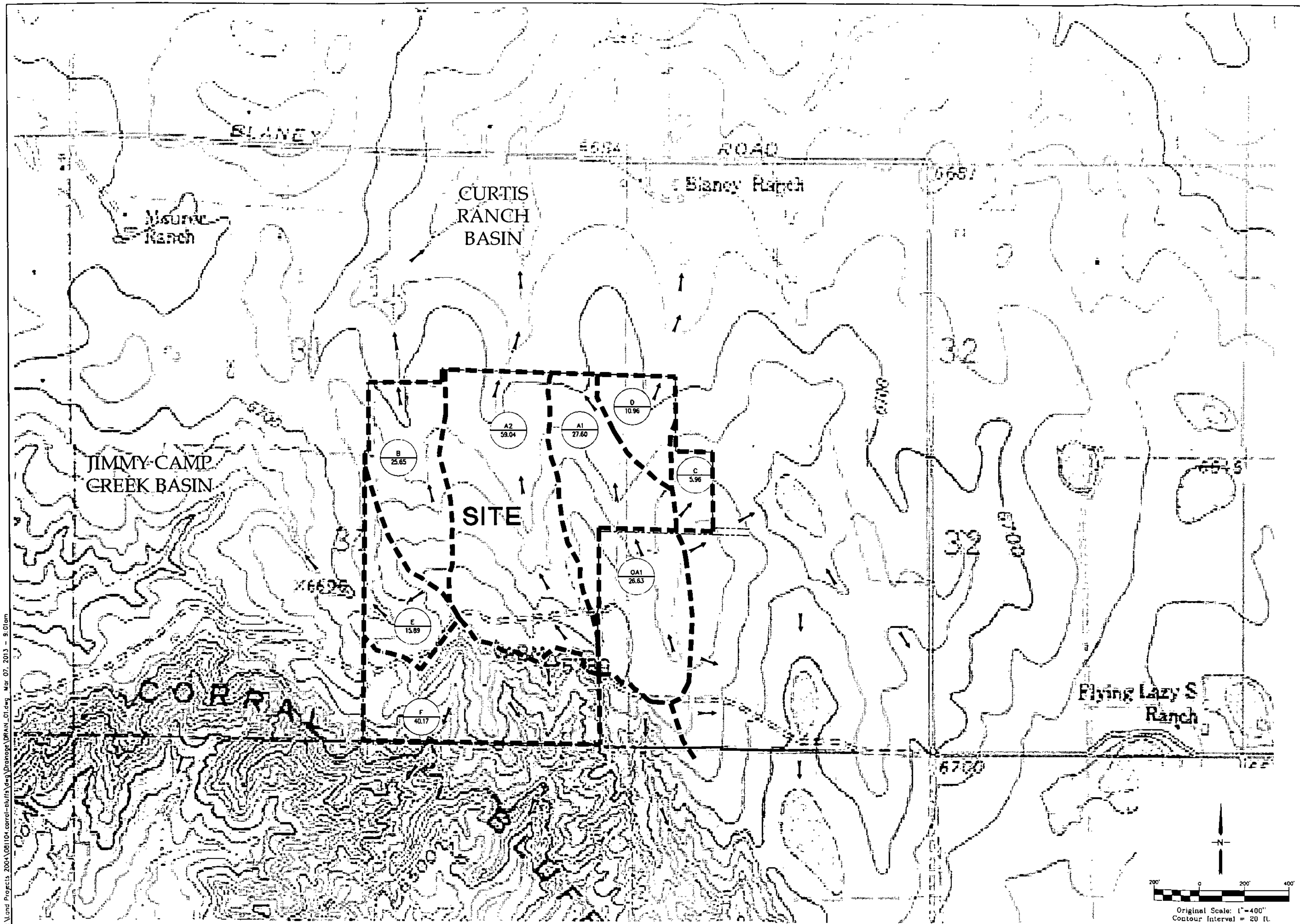
FIGURE A1

JPS PROJ NO. 081104



EL PASO COUNTY FIRM PANELS 08041C0575 F, 08041C0780 F

FLOODPLAIN MAP	JPS ENGINEERING	THE RESERVE AT CORRAL BLUFFS
		FIGURE A2 JPS PROJ NO. 081104



THE RESERVE AT CORRAL BLUFFS

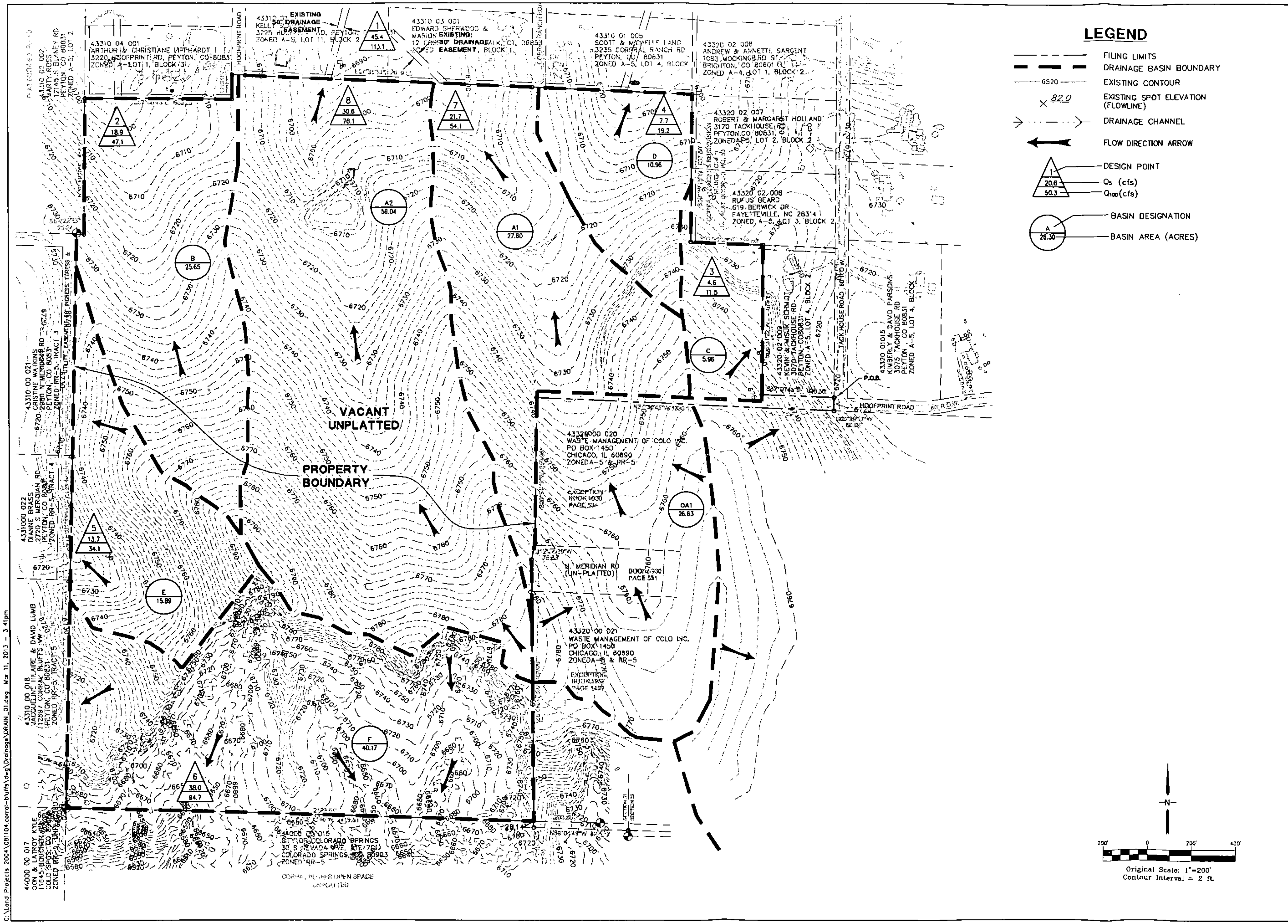
MAJOR BASIN/HISTORIC DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

No.	REVISION	BY	DATE

HORZ. SCALE: 1" = 400'	DRAWN: MSP
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LWA	CHECKED: JPS
CREATED: 01/30/12	LAST MODIFIED: 3/1/13
PROJECT NO: 081104	MODIFIED BY: MSP

SHEET: EX1



THE RESERVE AT CORRAL BLUFFS

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No.	REVISION	BY	DATE

HISTORIC DRAINAGE PLAN

HORZ. SCALE: 1" = 200'	DRAWN: MSP
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LWA	CHECKED: JPS
CREATED: 01/30/12	LAST MODIFIED: 3/1/13
PROJECT NO: 081104	MODIFIED BY: MSP
SHEET: EX2	

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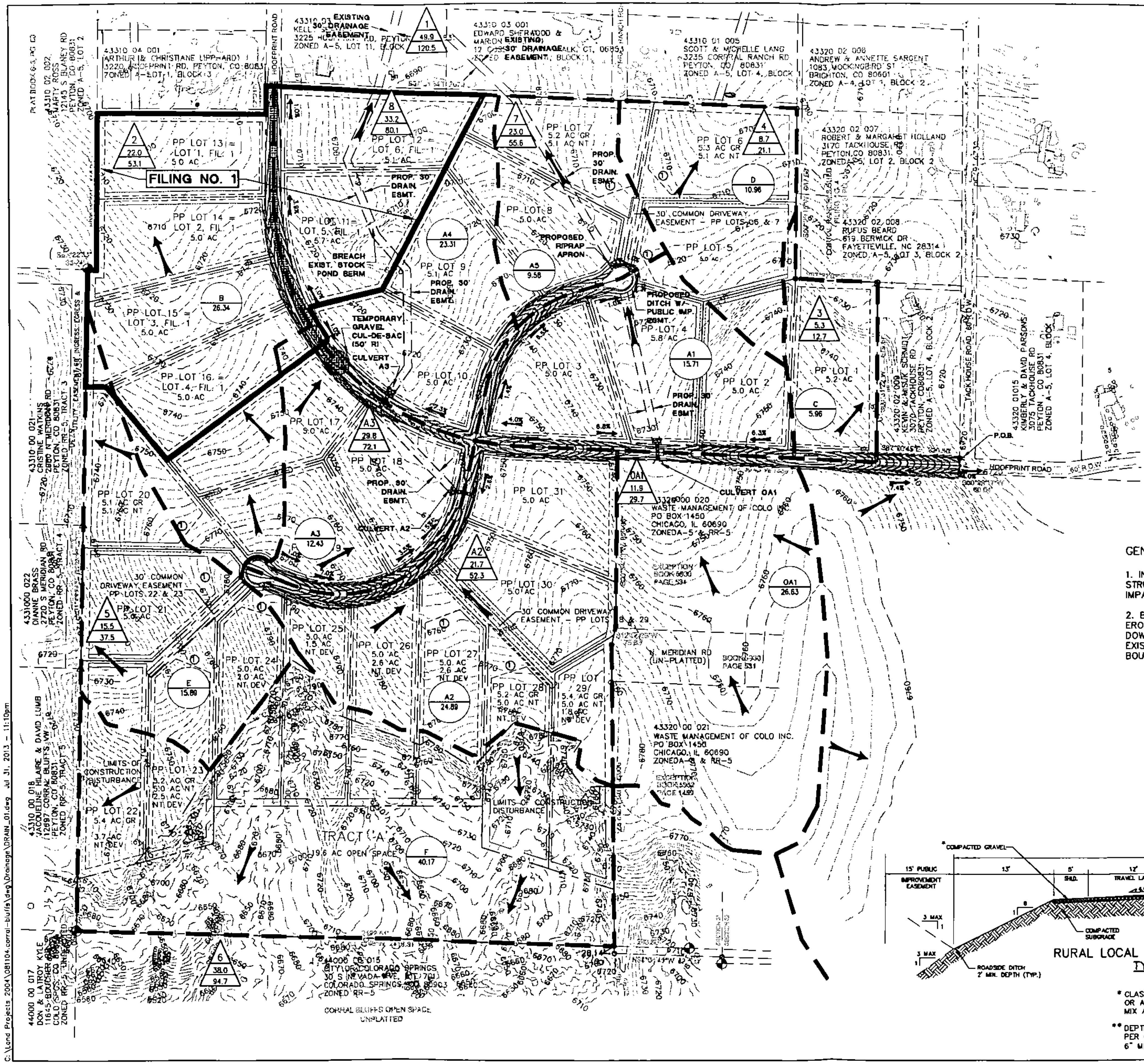


LEGEND

- FILING LIMITS
- DRAINAGE BASIN BOUNDARY
- 6520 — EXISTING CONTOUR
- ×82.0 PROPOSED SPOT ELEVATION (FLOWLINE)
- ×82.0 EXISTING SPOT ELEVATION (FLOWLINE)
- DRAINAGE CHANNEL
- PROPOSED FLOW DIRECTION ARROW
- PROPOSED CULVERT W/ FLARED END SECTIONS
- DESIGN POINT (1; 20.6 — Q_5 (cfs); 50.3 — Q_{100}(cfs))
- BASIN DESIGNATION (A)
- BASIN AREA (ACRES) (26.30)

GENERAL DRAINAGE NOTES:

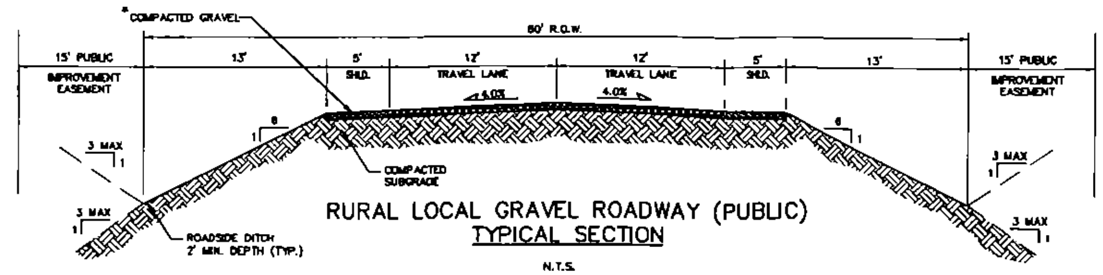
1. INDIVIDUAL BUILDERS SHALL PROVIDE POSITIVE DRAINAGE AWAY FROM STRUCTURES AND ACCOUNT FOR POTENTIAL CROSS-LOT DRAINAGE IMPACTS WITHIN EACH LOT.

2. BUILDERS AND PROPERTY OWNERS SHALL IMPLEMENT & MAINTAIN EROSION CONTROL BEST MANAGEMENT PRACTICES FOR PROTECTION OF DOWNSTREAM PROPERTIES AND FACILITIES INCLUDING PROTECTION OF EXISTING GRASS BUFFER STRIPS ALONG THE DOWNSTREAM PROPERTY BOUNDARIES.

N

200' 0 200' 400'

Original Scale: 1"=200'
Contour Interval = 2 ft.



RURAL LOCAL GRAVEL ROADWAY (PUBLIC)
TYPICAL SECTION

N.T.S.

* CLASS 6 BASE COURSE OR ALTERNATIVE GRAVEL MIX APPROVED BY EL PASO COUNTY

** DEPTH OF GRAVEL TO BE DETERMINED PER COUNTY GENERAL NOTE #10, WITH 6" MINIMUM DEPTH

THE RESERVE AT CORRAL BLUFFS SUBDIVISION

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

No.	REVISION	BY	DATE

DEVELOPED DRAINAGE PLAN

HORZ. SCALE: 1"=200'	DRAWN: MSP
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LWA	CHECKED: JPS
CREATED: 01/30/12	LAST MODIFIED: 7/31/13
PROJECT NO. 081104	MODIFIED BY: MSP
SHEET:	D1

C:\Land Projects 2004\081104.corral-bluffs\dwg\Drainage\DRAIN_01.dwg Jul 31, 2013 - 11:10pm

APPENDIX B

SCS SOILS INFORMATION

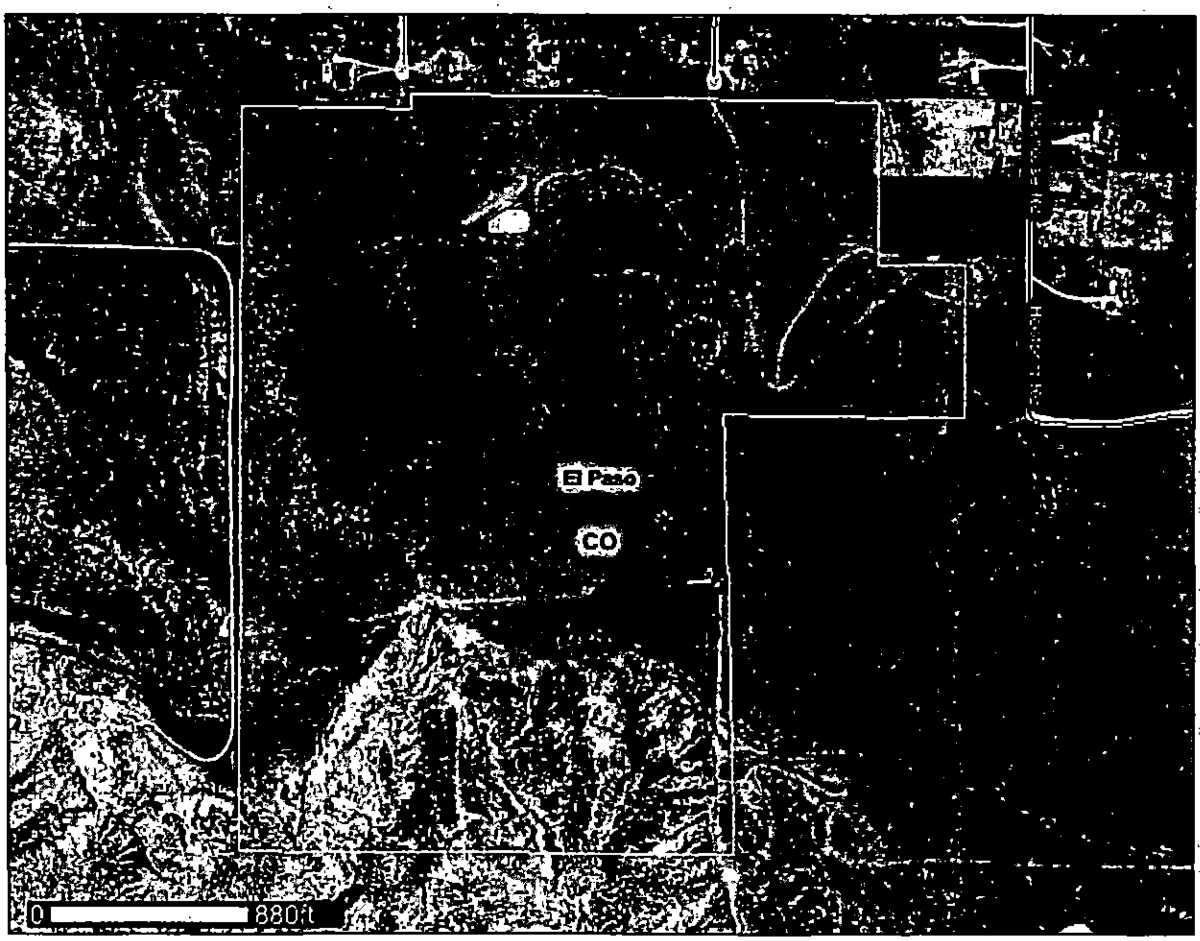
USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado



February 13, 2012

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:7,520 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

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 8, Apr 6, 2011

Date(s) aerial images were photographed: 7/29/2005

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

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
3	Ascalon sandy loam, 3 to 9 percent slopes	56.3	30.1%
4	Badland	34.7	18.6%
13	Bresser sandy loam, 5 to 9 percent slopes	94.1	50.3%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	2.0	1.1%
Totals for Area of Interest		**187.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

3—Ascalon sandy loam, 3 to 9 percent slopes

Map Unit Setting

Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 150 days

Map Unit Composition

Ascalon and similar soils: 85 percent

Description of Ascalon

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian deposits

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: Sandy Plains (R069XY026CO)
Other vegetative classification: SANDY PLAINS (069BY026CO)

Typical profile

0 to 8 inches: Sandy loam
8 to 21 inches: Sandy clay loam
21 to 27 inches: Sandy loam
27 to 48 inches: Sandy loam
48 to 60 inches: Loamy sand

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

4—Badland

Map Unit Setting

Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 150 days

Map Unit Composition

Badland: 95 percent

Description of Badland

Setting

Landform: Erosion remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone and shale and/or alluvium derived from siltstone

Properties and qualities

Slope: 1 to 10 percent
Depth to restrictive feature: 0 to 3 inches to paralithic bedrock
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability (nonirrigated): 8e

Typical profile

0 to 60 inches: Weathered bedrock

Minor Components

Other soils

Percent of map unit:

13—Bresser sandy loam, 5 to 9 percent slopes

Map Unit Setting

Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days

Map Unit Composition

Bresser and similar soils: 85 percent

Description of Bresser

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: Sandy Foothill (R049BY210CO)

Typical profile

0 to 8 inches: Sandy loam
8 to 27 inches: Sandy clay loam
27 to 36 inches: Sandy loam
36 to 60 inches: Loamy coarse sand

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

85—Stapleton-Bernal sandy loams, 3 to 20 percent slopes

Map Unit Setting

Elevation: 6,500 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days

Map Unit Composition

Stapleton and similar soils: 40 percent
Bernal and similar soils: 30 percent

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability (nonirrigated): 4e
Ecological site: Gravelly Foothill (R049BY214CO)

Typical profile

0 to 11 inches: Sandy loam
11 to 17 inches: Gravelly sandy loam
17 to 60 inches: Gravelly loamy sand

Description of Bernal

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone

Properties and qualities

Slope: 3 to 20 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.8 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: Shallow Foothill (R049BY204CO)

Typical profile

0 to 4 inches: Sandy loam
4 to 11 inches: Sandy clay loam
11 to 13 inches: Sandy loam
13 to 17 inches: Unweathered bedrock

Minor Components

Other soils

Percent of map unit:

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

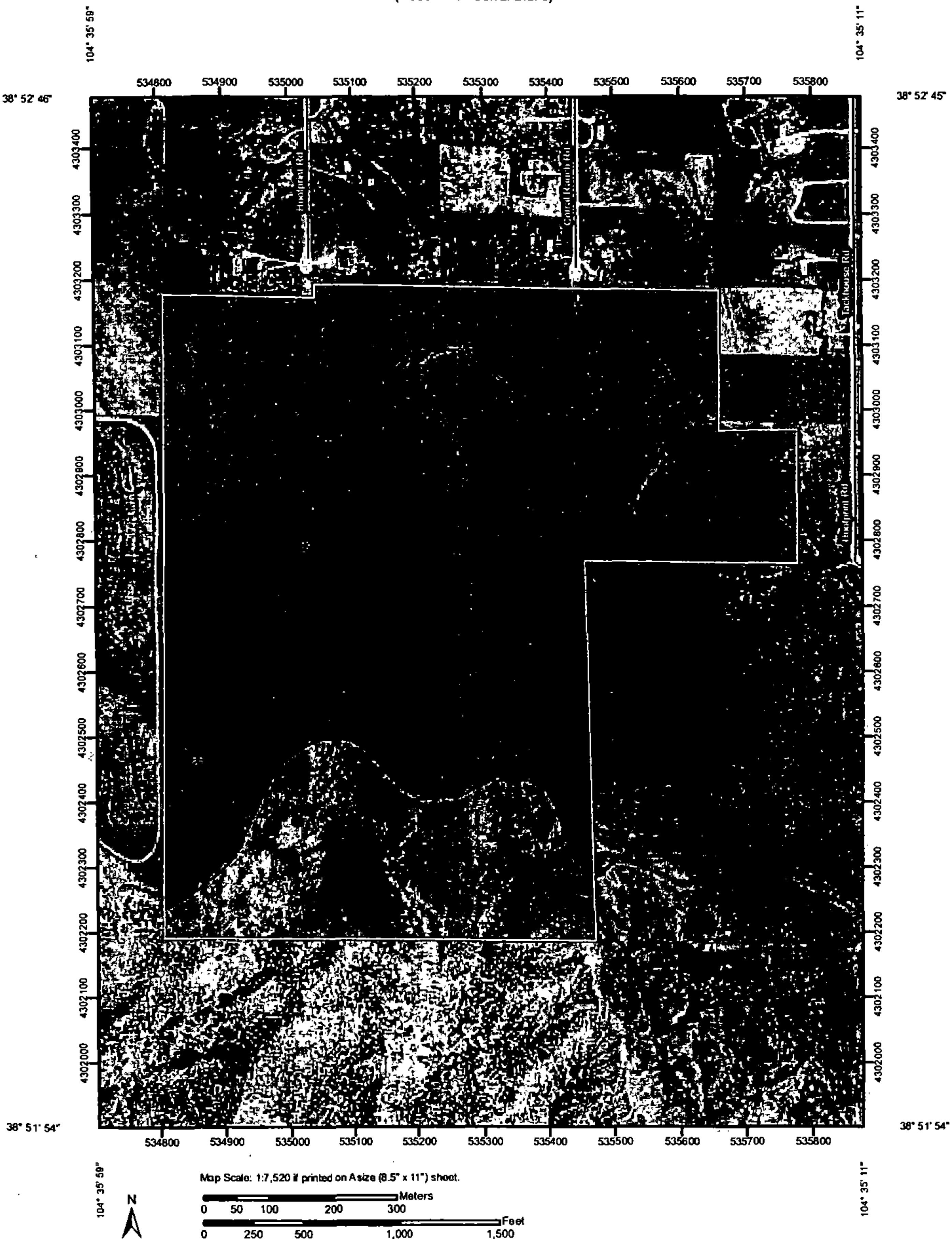
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

Hydrologic Soil Group—El Paso County Area, Colorado
(Reserve at Corral Bluffs)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:7,520 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

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 8, Apr 6, 2011

Date(s) aerial images were photographed: 7/29/2005

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
3	Ascalon sandy loam, 3 to 9 percent slopes	B	56.3	30.1%
4	Badland	D	34.7	18.6%
13	Bresser sandy loam, 5 to 9 percent slopes	B	94.1	50.3%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	2.0	1.1%
Totals for Area of Interest			187.2	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

APPENDIX C

HYDROLOGIC CALCULATIONS

7.4 HYDROLOGIC PROCEDURE SELECTION

7.4.1 Overview

Streamflow measurements for determining a flood frequency relationship at or near a site are usually unavailable. In such cases, it is accepted practice to estimate peak runoff rates and hydrographs using statistical or empirical methods. In general, results from using several methods should be compared, not averaged. The discharge that best reflects local project conditions, with the reasons documented, will be used.

7.4.2 Peak Flow Rates or Hydrographs

A consideration of peak runoff rates for design conditions is generally adequate for conveyance systems such as storm drains or open channels. However, if the design must include flood routing, a hydrograph is required. Although hydrograph development (more complex than estimating peak runoff rates) is often accomplished using computer programs, some methods are adaptable to desktop procedures. See the AASHTO Model Drainage Manual, Chapter 7 Appendix.

7.4.3 Time of Concentration

The time of concentration, T_c, is defined as the time it takes a drop of rain falling on the hydraulically most remote point in the watershed to travel through the watershed to the first design point. It is a very important parameter at which the entire drainage basin is contributing runoff to the design point. The time of concentration usually has two components. The first is the initial time, T_i; which is the time runoff is sheet flowing. The travel time, T_t, is the time runoff is in a channel.

$$T_c = T_i + T_c$$

For overland flow in a small basin:

$$T_i = \frac{1.8\,(1.1 - C)\,D^{0.5}}{S^{0.33}}$$

where

T_i = minutes
C = runoff coefficient as defined in the rational equation
D = distance of flow path in feet
(500 ft. max. non-urban areas)
(300 ft. max. urban areas)
S = average slope of basin in %

See Figure 7-1.

For channel flow:

$$T_t = \left[\frac{11.9 \ L^3}{H} \right]^{0.385}$$

where

T_t = hours
L = distance of flow path in miles
H = elevation difference from beginning of defined channel flow to the site in feet.

or when a channel velocity is known:

$$T_t = \frac{L}{60 \ V}$$

where

T_t = minutes
V = channel velocity in feet per second (meters per second)
L = distance in feet (meters)

See Figure 7-2.

In urban watersheds, the time of concentration at the first design point (including both channel and overland flow), shall not exceed the following:

$$T_c = \frac{L}{180} + 10$$

TABLE 5-1

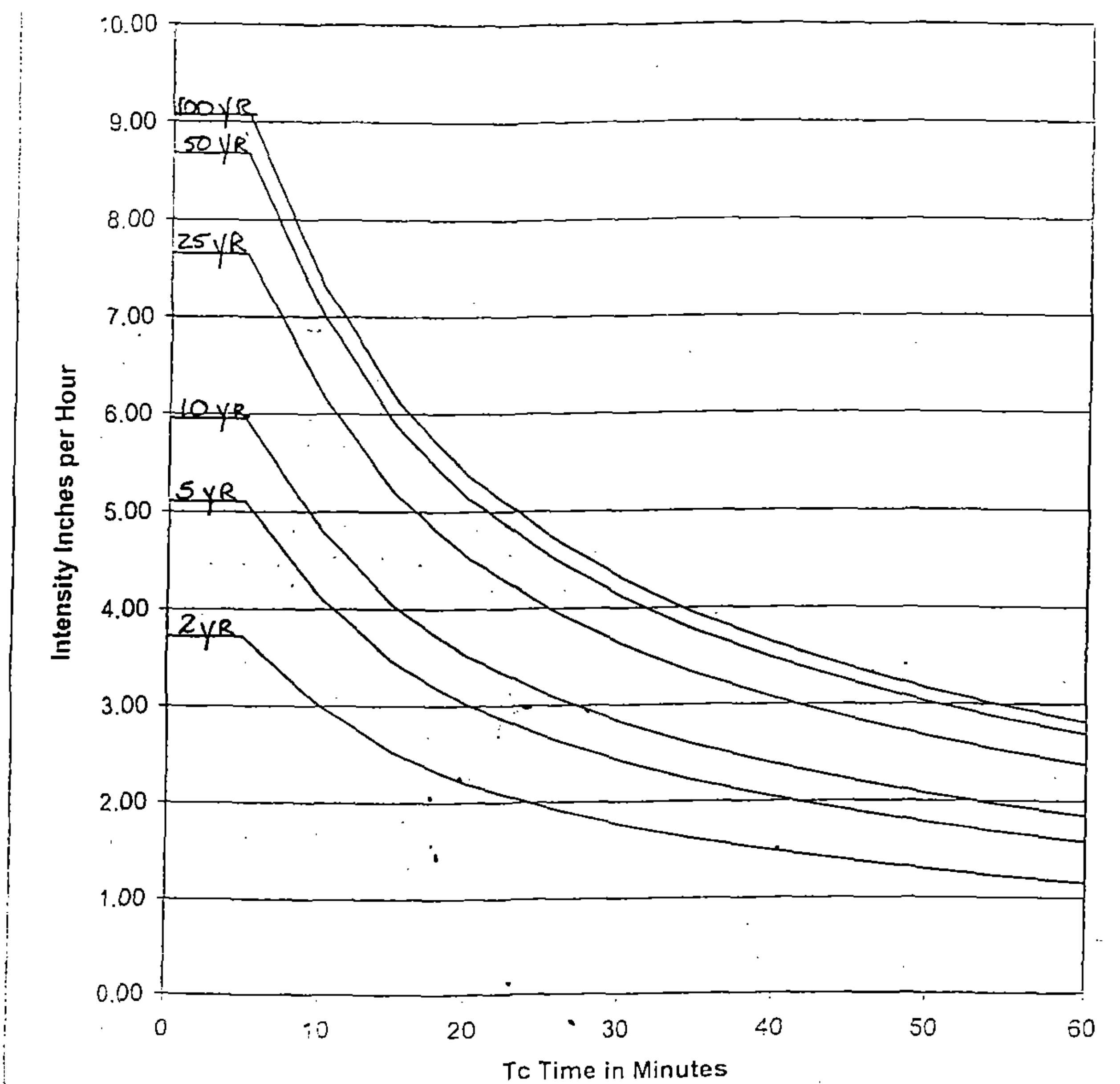
RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90

Storm Rainfall Time Intensity-Frequency Curves



Rainfall Depth - Duration - Frequency Table derived from Rainfall Atlas III for Colorado

Resource: Guo, James C.Y., (2001) "Urban Storm Water Modeling", Chapter 5: Runoff Prediction for Small Catchment, published by Auraria Campus Book Company, University of Colorado at Denver, Denver, Colorado.

THE RESERVE AT CORRAL BLUFFS
COMPOSITE RUNOFF COEFFICIENTS - TYPICAL 5-ACRE DEVELOPED RESIDENTIAL AREA

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
5-ACRE LOTS	5.00	B	5.16	IMPERVIOUS	0.9	94.84	LAWN/MEADOW	0.25				0.284

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
5-ACRE LOTS	5.00	B	5.16	IMPERVIOUS	0.95	94.84	LAWN/MEADOW	0.35				0.381

THE RESERVE AT CORRAL BLUFFS
BASINS A-E
IMPERVIOUS AREA ASSUMPTIONS:

HOUSE FOOTPRINT =	3000	SF
DRIVEWAY GRAVEL (250 LF * 12' W) =	3000	SF
GRAVEL IMPERVIOUS PERCENT =	0.8	
DRIVEWAY IMPERVIOUS AREA =	2400	SF
SUBTOTAL IMPERVIOUS AREA PER LOT =	5400	SF
TOTAL NUMBER OF LOTS =	31	EA
TOTAL LOT IMPERVIOUS AREA =	3.84	AC
TOTAL ROADWAY LENGTH =	5847	LF
TYPICAL ROAD WIDTH =	34	FT
TOTAL ROADWAY GRAVEL AREA =	4.6	AC
GRAVEL IMPERVIOUS PERCENT =	0.8	
TOTAL ROADWAY IMPERVIOUS AREA =	3.7	AC
TOTAL SUBDIVISION IMPERVIOUS AREA =	7.49	AC
TOTAL BASIN AREA =	145.1	AC
% IMPERVIOUS =	**5.16%**	

THE RESERVE AT CORRAL BLUFFS
RATIONAL METHOD
HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	Overland Flow LENGTH (FT)	Overland Flow SLOPE (%)	Overland Flow Tco[1] (MIN)	Channel flow HIGH ELEV. (FT)	Channel flow LOW ELEV. (FT)	Channel flow H (FT)	Channel flow CHANNEL LENGTH (FT)	Channel flow CHANNEL LENGTH (MI)	Channel flow SLOPE (%)	Channel flow Tt[1] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
OA1	OA1	26.63	0.25	0.35	1000	1.2	45.5	6758	6733	25	630	0.12	4.0%	3.87	49.4	1.79	3.19	11.94	29.75
A		86.64	0.25	0.35			0.0	6733	6697	36	1550	0.29	2.3%	9.51	9.5				
OA1,A	1	113.27	0.25	0.35											58.9	1.60	2.85	45.37	113.05
B	2	25.65	0.25	0.35	300	8.0	13.3	6760	6696	64	1550	0.29	4.1%	7.62	20.9	2.95	5.25	18.91	47.12
C	3	5.96	0.25	0.35	300	4.7	15.8	6742	6729	13	400	0.08	3.3%	2.95	18.8	3.11	5.54	4.64	11.55
D	4	10.96	0.25	0.35	300	3.3	17.8	6744	6696	48	1000	0.19	4.8%	5.13	22.9	2.81	5.00	7.69	19.17
E	5	15.89	0.25	0.35	300	8.0	13.3	6760	6720	40	400	0.08	10.0%	1.91	15.2	3.44	6.13	13.68	34.10
F	6	40.17	0.25	0.35	300	25.3	9.0	6720	6600	120	900	0.17	13.3%	3.19	12.2	3.79	6.74	38.01	94.73

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	Overland Flow LENGTH (FT)	Overland Flow SLOPE (%)	Overland Flow Tco[1] (MIN)	Channel flow HIGH ELEV. (FT)	Channel flow LOW ELEV. (FT)	Channel flow H (FT)	Channel flow CHANNEL LENGTH (FT)	Channel flow CHANNEL LENGTH (MI)	Channel flow SLOPE (%)	Channel flow Tt[1] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
OA1	OA1	26.63	0.25	0.35	1000	1.2	45.5	6758	6733	25	630	0.12	4.0%	3.87	49.4	1.79	3.19	11.94	29.75
A1		15.71	0.28	0.38			0.0	6733	6715	18	650	0.12	2.8%	4.55	4.6				
OA1,A1	A1	42.34	0.28	0.38											54.0	1.70	3.02	20.10	48.56
A2	A2	24.89	0.28	0.38	300	5.0	15.0	6762	6740	22	600	0.11	3.7%	3.84	18.8	3.11	5.53	21.67	52.35
A3		12.43	0.28	0.38			0.0	6740	6731	9	400	0.08	2.3%	3.39	3.4				
A2,A3	A3	37.32	0.28	0.38											22.2	2.86	5.09	29.85	72.12
A4		32.89	0.28	0.38			0.0	6715	6697	18	900	0.17	2.0%	6.63	6.6				
OA1,A1-A4	1	112.55	0.28	0.38											60.8	1.58	2.82	49.89	120.52
B	2	26.34	0.28	0.38	300	8.0	12.8	6760	6696	64	1550	0.29	4.1%	7.62	20.4	2.98	5.31	22.00	53.15
C	3	5.96	0.28	0.38	300	4.7	15.3	6742	6729	13	400	0.08	3.3%	2.95	18.2	3.16	5.62	5.27	12.73
D	4	10.96	0.28	0.38	300	3.3	17.2	6744	6696	48	1000	0.19	4.8%	5.13	22.3	2.85	5.07	8.74	21.12
E	5	15.89	0.28	0.38	300	8.0	12.8	6760	6720	40	400	0.08	10.0%	1.91	14.7	3.49	6.22	15.55	37.55
F	6	40.17	0.25	0.35	300	25.3	9.0	6720	6600	120	900	0.17	13.3%	3.19	12.2	3.79	6.74	38.01	94.73

1) OVERLAND FLOW Tco = (1.8*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS CHANNEL TRAVEL TIME, Tt = ((11.9*L^3)/H)^(0.385)
3) MANNING'S CH K = 0.70 FOR MEADOW / FOREST
4) Tc = Tco + Tt K = 1.0 FOR BARE SOIL
*** IF TOTAL TIME K = 1.5 FOR GRASS CHANNEL
5) INTENSITY BA K = 2.0 FOR PAVEMENT
I = (A * P) / B + Td)^C
5-YEAR VALUES: A = 26.65; P1 = 1.5 IN (1-HOUR DEPTH); B = 10.0; C = 0.76
100-YEAR VALUES: A = 26.65; P = 2.67 IN (1-HOUR DEPTH); B = 10.0; C = 0.76
6) Q = CIA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

El Paso County Drainage Basin Fees

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2012 Drainage Fee	2012 Bridge Fee

Drainage Basins with DBPS's:

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2012 Drainage Fee	2012 Bridge Fee
CHWS1200	Chico Creek	2001	Bennett Ranch	$9,058	$640
FOFO2000	Chico Creek	2001	West Fork Jimmy Camp Creek	$9,847	$2,914
CHWS1400	Chico Creek	2000	Falcon	$7,780	$2,987
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$15,000	$1,857
FOFO2800	Fountain Creek	1988*	Widefield	$15,000	$0
FOFO2900	Fountain Creek	1988*	Security	$15,000	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$15,000	$216
FOFO3100/FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$8,772	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$10,373	$787
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$15,000	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$15,000	$4,357
FOFO4200	Fountain Creek	1977	Spring Creek	$7,459	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$14,605	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$15,000	$787
FOFO5400	Fountain Creek	1977	21st Street	$4,326	$0
FOFO5600	Fountain Creek	1964	19th Street	$2,831	$0
FOFO5800	Fountain Creek	1964	Camp Creek	$1,594	$0
FOMO0400	Monument Creek	1986*	Mesa	$7,522	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$9,044	$199
FOMO1200	Monument Creek	1977	Templeton Gap	$9,285	$216
FOMO1400	Monument Creek	1976	Pope's Bluff	$2,881	$491
FOMO1600	Monument Creek	1976	South Rockrimmon	$3,381	$0
FOMO1800	Monument Creek	1973	North Rockrimmon	$4,326	$0
FOMO2000	Monument Creek	1971	Pulpit Rock	$4,769	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$15,000	$787
FOMO2400	Monument Creek	1966	Dry Creek	$11,353	$411
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$6,529	$411
FOMO3700	Monument Creek	1987*	Middle Tributary	$12,001	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$15,000	$0
FOMO4000	Monument Creek	1996	Smith Creek	$5,863	$787
FOMO4200	Monument Creek	1989*	Black Forest	$15,000	$392
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$15,000	$787
FOMO5300	Fountain Creek	1993*	Crystal Creek	$15,000	$787

Miscellaneous Drainage Basins: [1]

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2012 Drainage Fee	2012 Bridge Fee
CHBS0800	Chico Creek		Book Ranch	$13,494	$1,953
CHEC0400	Chico Creek		Upper East Chico	$7,352	$213
CHMS0200	Chico Creek		Haegler Ranch	$14,806	$0
CHWS0200	Chico Creek		Telephone Exchange	$8,077	$189
CHWS0400	Chico Creek		Livestock company	$13,305	$158
CHWS0600	Chico Creek		West Squirrel	$693	$2,878
CHWS0800	Chico Creek		Solberg Ranch	$14,806	$0
FOFO1200	Chico Creek		Crooked Canyon	$4,342	$0
FOFO1400	Chico Creek		Calhan Reservoir	$3,625	$211
FOFO1600	Chico Creek		Sand Canyon	$2,619	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek [3]	$15,000	$672
FOFO2200	Fountain Creek		Fort Carson	$11,353	$411
FOFO2700	Fountain Creek		West Little Johnson	$948	$0
FOFO3800	Fountain Creek		Stratton	$6,898	$308
FOFO5000	Fountain Creek		Midland	$11,353	$411
FOFO6000	Fountain Creek		Palmer Trail	$11,353	$411
FOFO6800	Fountain Creek		Black Canyon	$11,353	$411
FOFO7200	Fountain Creek		Williams Canyon	$11,353	$411
FOMO4600	Monument Creek		Beaver Creek	$8,598	$0
FOMO3000	Monument Creek		Kettle Creek	$7,766	$0
FOMO3400	Monument Creek		Elkhorn	$1,305	$0
FOMO5000	Monument Creek		Monument Rock	$6,234	$0
FOMO5400	Monument Creek		Palmer Lake	$9,967	$0
FOMO5600	Monument Creek		Raspberry Mountain	$3,353	$0
PLPL0200	Monument Creek		Bald Mountain	$7,145	$0

Interim Drainage Basins: [2]

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2012 Drainage Fee	2012 Bridge Fee
FOFO1800	Fountain Creek		Little Fountain Creek	$1,839	$0
FOMO4400	Monument Creek		Jackson Creek	$5,692	$0
FOMO4800	Monument Creek		Teachout Creek	$3,953	$594

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies of the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee of $15,000 a surety in the amount of $7,000 per impervious acre shall be provided to secure payment of additional fees in the event that the DBPS results in a fee greater than $15,000. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326, September 14, 2006.

APPENDIX D

HYDRAULIC CALCULATIONS

RESERVE AT CORRAL BLUFFS
CULVERT DESIGN SUMMARY

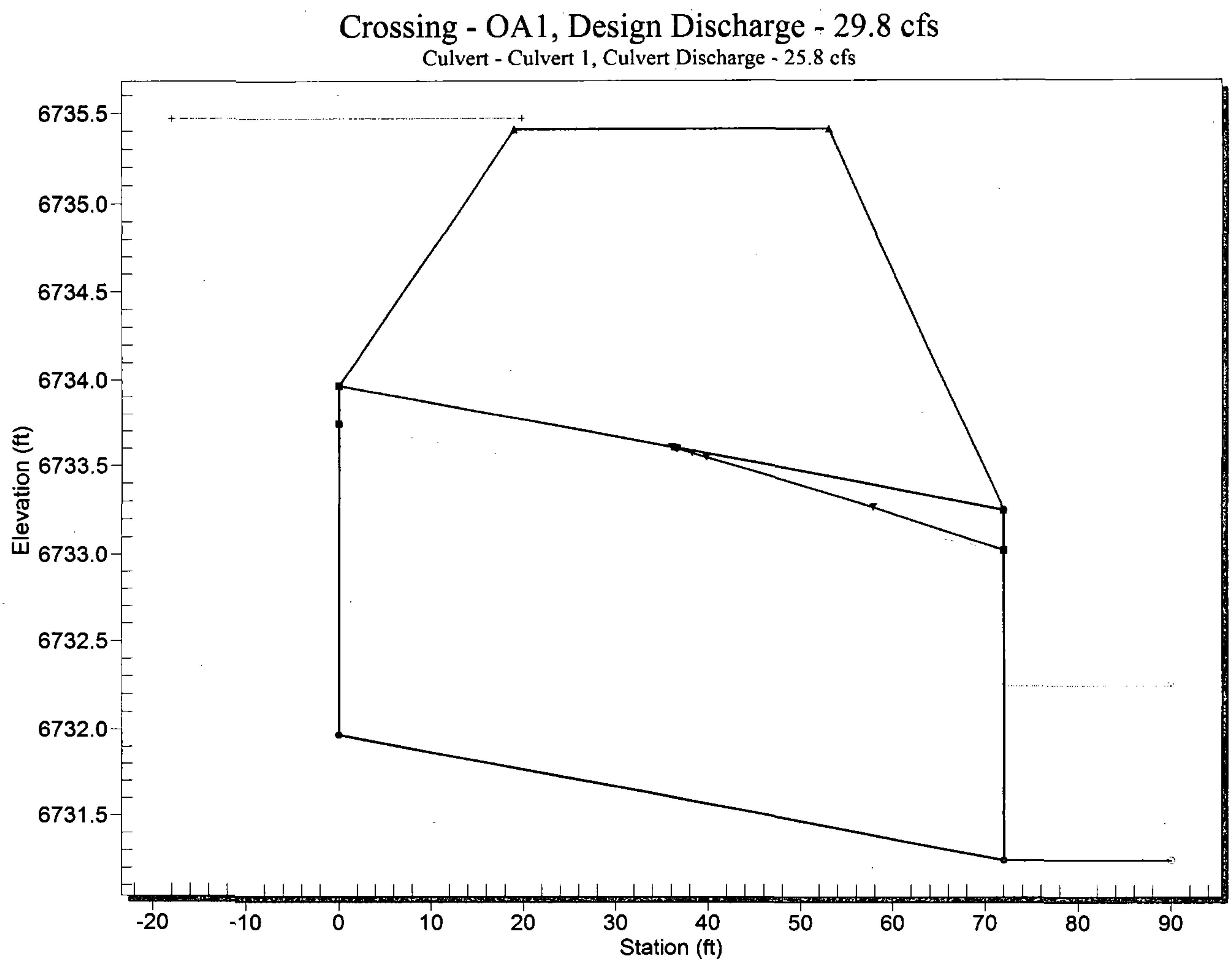
BASIN	DESIGN POINT	RD CL ELEV	INV IN ELEV	PIPE DIA (FT)	Q5 (CFS)	MAX ALLOWABLE HEADWATER	CALC HW ELEV	Q100 (CFS)	MAX ALLOWABLE HEADWATER	CALC HW ELEV
OA1	OA1	6735.41	6731.97	2.0	11.9	6733.97	6733.77	29.80	6735.73	6735.47
A2	A2	6739.74	6735.76	2.5	21.7	6738.26	6738.07	52.40	6740.06	6739.85
A3	A3	6728.38	6723.93	3.0	29.9	6726.93	6726.49	72.10	6728.70	6728.49

HY-8 Analysis Results

Crossing Summary Table

Culvert Crossing: OA1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6733.77	11.90	11.90	0.00	1
6733.94	13.69	13.69	0.00	1
6734.11	15.48	15.48	0.00	1
6734.30	17.27	17.27	0.00	1
6734.51	19.06	19.06	0.00	1
6734.73	20.85	20.85	0.00	1
6734.98	22.64	22.64	0.00	1
6735.25	24.43	24.43	0.00	1
6735.43	26.22	25.53	0.56	19
6735.45	28.01	25.69	2.22	5
6735.47	29.80	25.80	3.90	4
6735.41	25.43	25.43	0.00	Overtopping


Crossing - OA1, Design Discharge - 29.8 cfs
Culvert - Culvert 1, Culvert Discharge - 25.8 cfs
Elevation (ft)
6735.5
6735.0
6734.5
6734.0
6733.5
6733.0
6732.5
6732.0
6731.5
Station (ft)
-20
-10
0
10
20
30
40
50
60
70
80
90

HY-8 Analysis Results

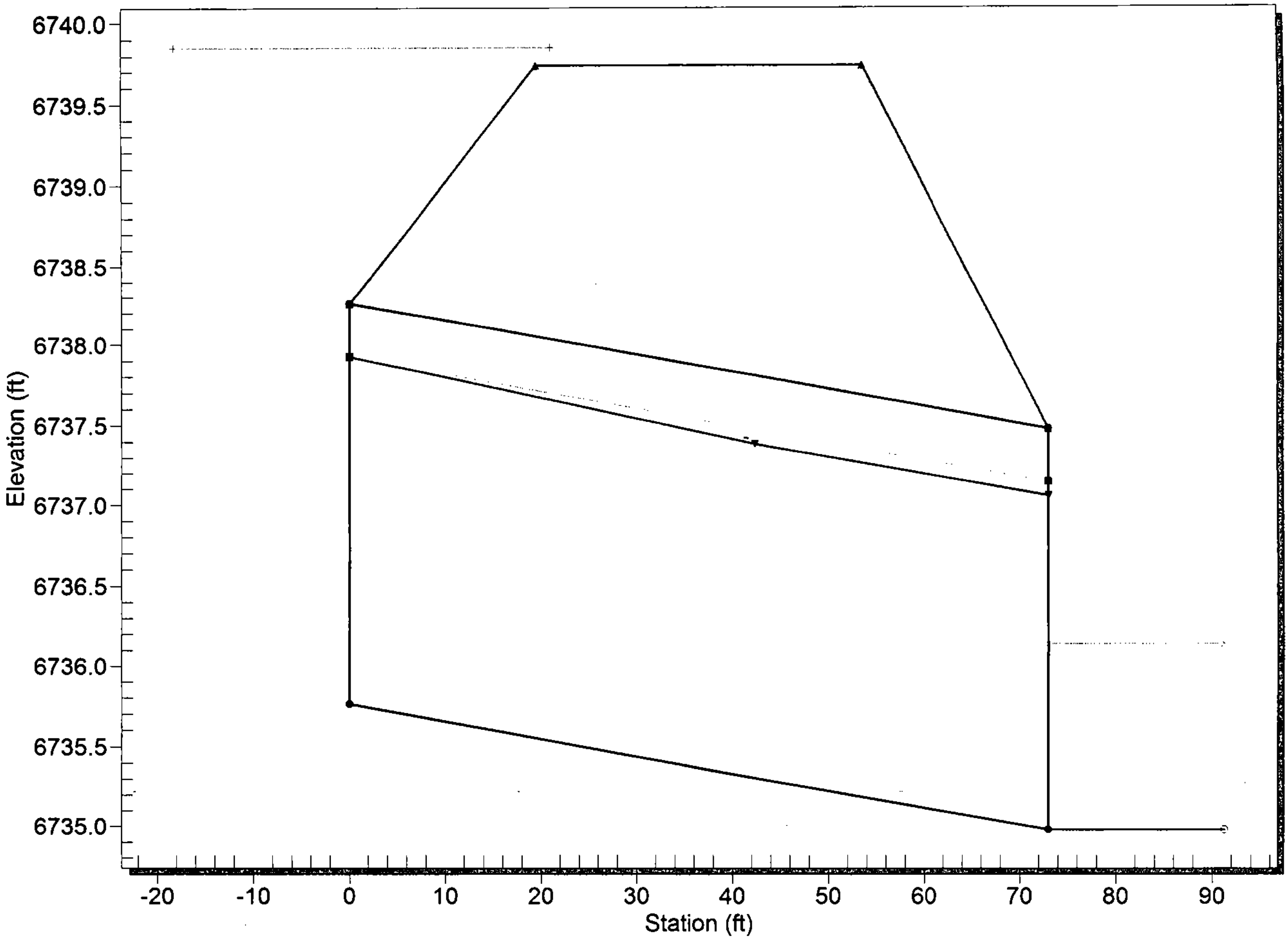
Crossing Summary Table

Culvert Crossing: A2

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6738.07	21.70	21.70	0.00	1
6738.28	24.77	24.77	0.00	1
6738.50	27.84	27.84	0.00	1
6738.73	30.91	30.91	0.00	1
6738.99	33.98	33.98	0.00	1
6739.27	37.05	37.05	0.00	1
6739.58	40.12	40.12	0.00	1
6739.77	43.19	41.87	1.18	16
6739.80	46.26	42.18	3.93	5
6739.83	49.33	42.42	6.74	4
6739.85	52.40	42.63	9.67	4
6739.74	41.61	41.61	0.00	Overtopping

Crossing - A2, Design Discharge - 52.4 cfs

Culvert - Culvert 1, Culvert Discharge - 42.6 cfs



HY-8 Analysis Results

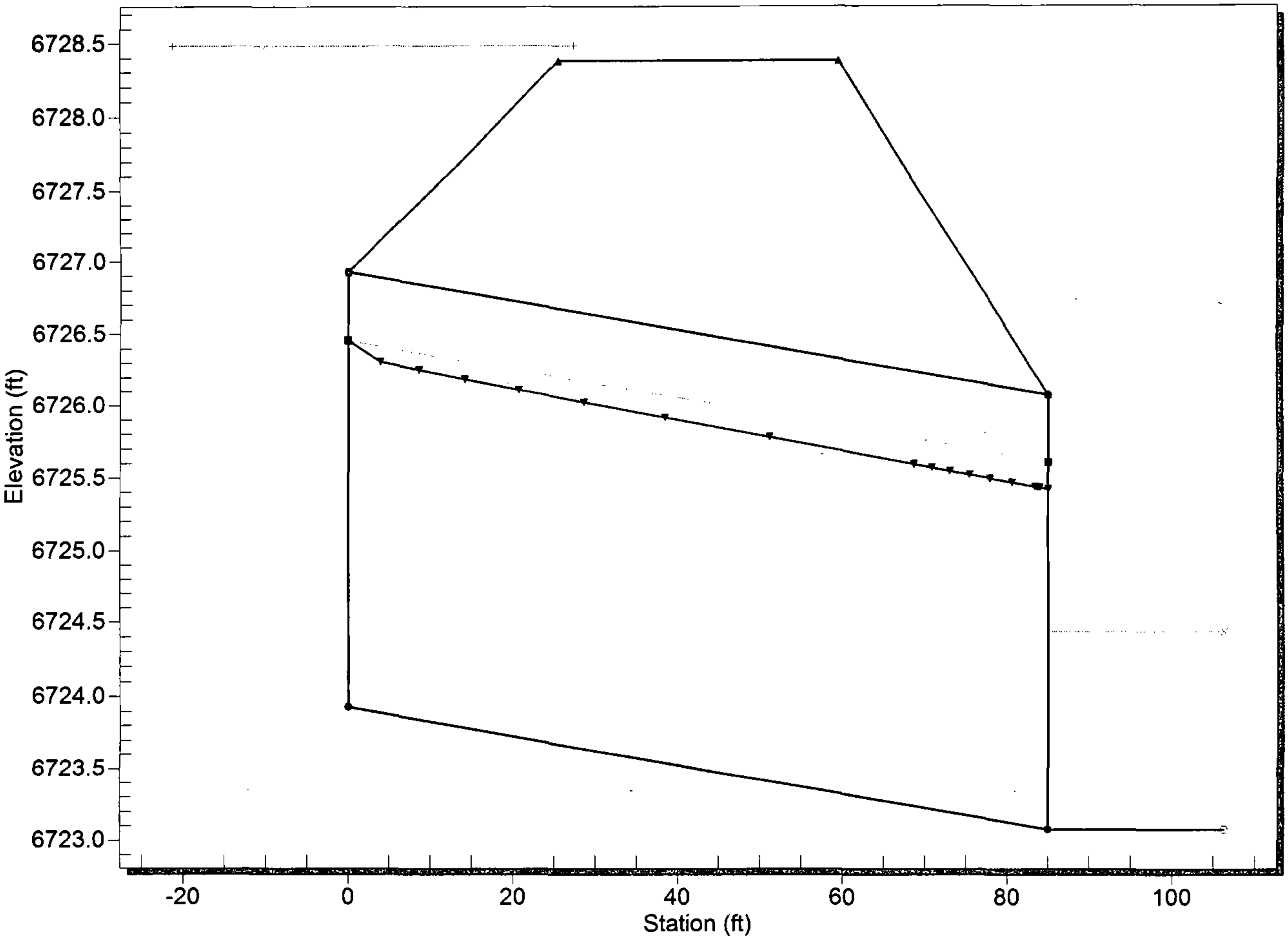
Crossing Summary Table

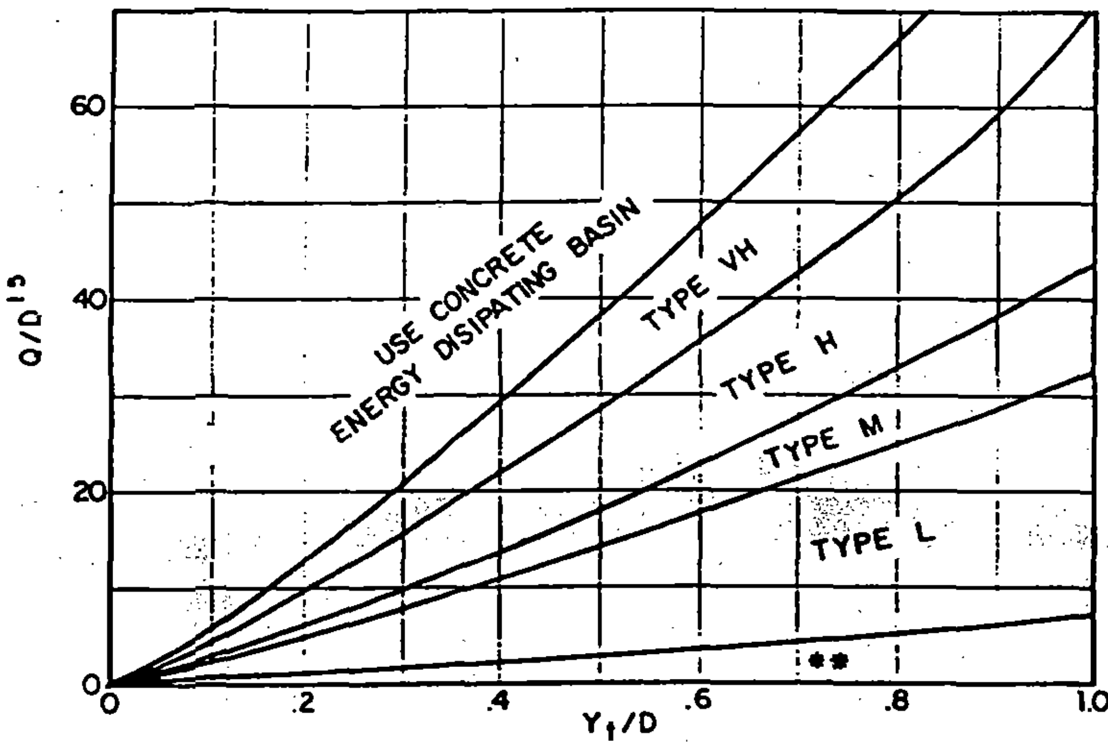
Culvert Crossing: A3

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6726.49	29.90	29.90	0.00	1
6726.70	34.12	34.12	0.00	1
6726.92	38.34	38.34	0.00	1
6727.14	42.56	42.56	0.00	1
6727.38	46.78	46.78	0.00	1
6727.64	51.00	51.00	0.00	1
6727.92	55.22	55.22	0.00	1
6728.22	59.44	59.44	0.00	1
6728.41	63.66	62.00	1.50	15
6728.46	67.88	62.54	5.25	6
6728.49	72.10	62.95	9.07	5
6728.38	61.57	61.57	0.00	Overtopping

Crossing - A3, Design Discharge - 72.1 cfs

Culvert - Culvert 1, Culvert Discharge - 63.0 cfs





Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

TABLE 10-2 (Continued)

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

Type of Channel and Description	Minimum	Normal	Maximum
c. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
d. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
e. Asphalt			
1. Smooth		0.013	
2. Rough		0.016	
f. Grassed	0.030	0.040	0.050

TABLE 10-3

MAXIMUM PERMISSIBLE DESIGN
OPEN CHANNEL FLOW VELOCITIES IN EARTH*

Soil Types	Permissible Mean Channel Velocity (ft/sec)
Fine Sand (noncolloidal)	2.0
Coarse Sand (noncolloidal)	4.0
Sandy Loam (noncolloidal)	2.5
Silt Loam (noncolloidal)	3.0
Ordinary Firm Loam	3.5
Silty Clay	3.5
Fine Gravel	5.0
Stiff Clay (very colloidal)	5.0
Graded, Loam to Cobbles (noncolloidal)	5.0
Graded, Silt to Cobbles (colloidal)	5.5
Alluvial Silts (noncolloidal)	3.5
Alluvial Silts (colloidal)	5.0
Coarse Gravel (noncolloidal)	6.0
Cobbles and Shingles	5.5
Hard Shales and Hard Pans	6.0
Soft Shales	3.5
Soft Sandstone	8.0
Sound rock (usu. igneous or hard metamorphic)	20.0

* These velocities shall be used in conjunction with scour calculations and as approved by City/County.

THE RESERVE AT CORRAL BLUFFS
CHANNEL CALCULATIONS
DEVELOPED FLOWS

EXISTING / PROPOSED CHANNELS

CHANNEL	DESIGN POINT	EXISTING SLOPE (%)	BOTTOM WIDTH (B, FT)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	EASEMENT WIDTH (ft)	Q100 FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	CHANNEL LINING
A1	OA1	2.5	10	10:1	2.0	0.030	30	29.8	0.49	4.00	**GRASS**
A3	A2	4.0	10	30:1	2.0	0.030	30	52.4	0.48	4.50	**GRASS**
A4	A3	3.2	20	25:1	2.0	0.030	30	72.1	0.50	4.50	**GRASS**
A1A	A1	2.2	10	10:1	2.0	0.030	30	48.6	0.70	4.40	**GRASS**

1) Channel flow calculations based on Manning's Equation
2) Channel depth includes 1' minimum freeboard
3) n = 0.03 for grass-lined non-irrigated channels (minimum)
4) n = 0.045 for riprap-lined channels
5) Vmax = 5.0 fps per El Paso County criteria (p. 10-13) for fescue (dry land grass) for 100-year flows
6) Vmax = 8.0 fps with Erosion Control Blankets (NAG C350 or equal)

Channel A1

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Chann
Flow Element	Trapezoidal Chann
Method	*Manning's Formula*
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	Grass-Lined
Slope	025000	ft/ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	10.00	ft
Discharge	29.80	cfs $= Q_{100}$

Results		
Depth	0.49	ft
Flow Area	7.4	ft²
Wetted Perim	19.93	ft
Top Width	19.88	ft
Critical Depth	0.54	ft
Critical Slope	0.017866	ft/ft
Velocity	4.04	ft/s < 5 fps
Velocity Head	0.25	ft
Specific Enerç	0.75	ft
Froude Numb	1.17	
Flow Type	Supercritical	

Channel A5

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	040000	ft/ft
Left Side Slope	30.00	H : V
Right Side Slope	30.00	H : V
Bottom Width	10.00	ft
Discharge	52.40	cfs = Q100

Results		
Depth	0.48	ft
Flow Area	11.7	ft²
Wetted Perim	38.87	ft
Top Width	38.85	ft
Critical Depth	0.57	ft
Critical Slope	0.018600	ft/ft
Velocity	4.46	ft/s ✓
Velocity Head	0.31	ft
Specific Energ	0.79	ft
Froude Numb	1.43	
Flow Type	Supercritical	

Channel MT

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Chann(
Flow Element	Trapezoidal Chann(
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	032000	ft/ft
Left Side Slope	25.00	H : V
Right Side Slope	25.00	H : V
Bottom Width	20.00	ft
Discharge	72.10	cfs = Q100

Results		
Depth	0.50	ft
Flow Area	16.1	ft²
Wetted Perim(	44.86	ft
Top Width	44.84	ft
Critical Depth	0.58	ft
Critical Slope	0.017704	ft/ft
Velocity	4.48	ft/s ✓
Velocity Head	0.31	ft
Specific Enerç	0.81	ft
Froude Numb(	1.32	
Flow Type	Supercritical	

Channel N/M

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Chann(
Flow Element	Trapezoidal Chann(
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	022000	ft/ft
Left Side Slope	10.00	H : V
Right Side Slope	10.00	H : V
Bottom Width	10.00	ft
Discharge	48.60	cfs = Q100

Results		
Depth	0.66	ft
Flow Area	10.9	ft²
Wetted Perim(	23.25	ft
Top Width	23.18	ft
Critical Depth	0.71	ft
Critical Slope	0.016578	ft/ft
Velocity	4.44	ft/s ✓
Velocity Head	0.31	ft
Specific Ener(	0.97	ft
Froude Numb(	1.14	
Flow Type	Supercritical	

Worksheet
Worksheet for Triangular Channel

Sample Ditch Calculation
Hootprint Road
STA 1+80-6+40, E

Project Description	
Worksheet	Triangular Channe
Flow Element	Triangular Channe
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	Grass-Lined
Slope	010000 ft/ft	
Left Side Slope	6.00 H : V	
Right Side Slope	3.00 H : V	
Discharge	7.40 cfs	$= Q_{100}$

Results		
Depth	0.79 ft	
Flow Area	2.8 ft²	
Wetted Perim	7.32 ft	
Top Width	7.13 ft	
Critical Depth	0.70 ft	
Critical Slope	0.019288 ft/ft	
Velocity	2.62 ft/s	< 5 fps OK
Velocity Head	0.11 ft	
Specific Energ	0.90 ft	
Froude Numb	0.73	
Flow Type	Subcritical	

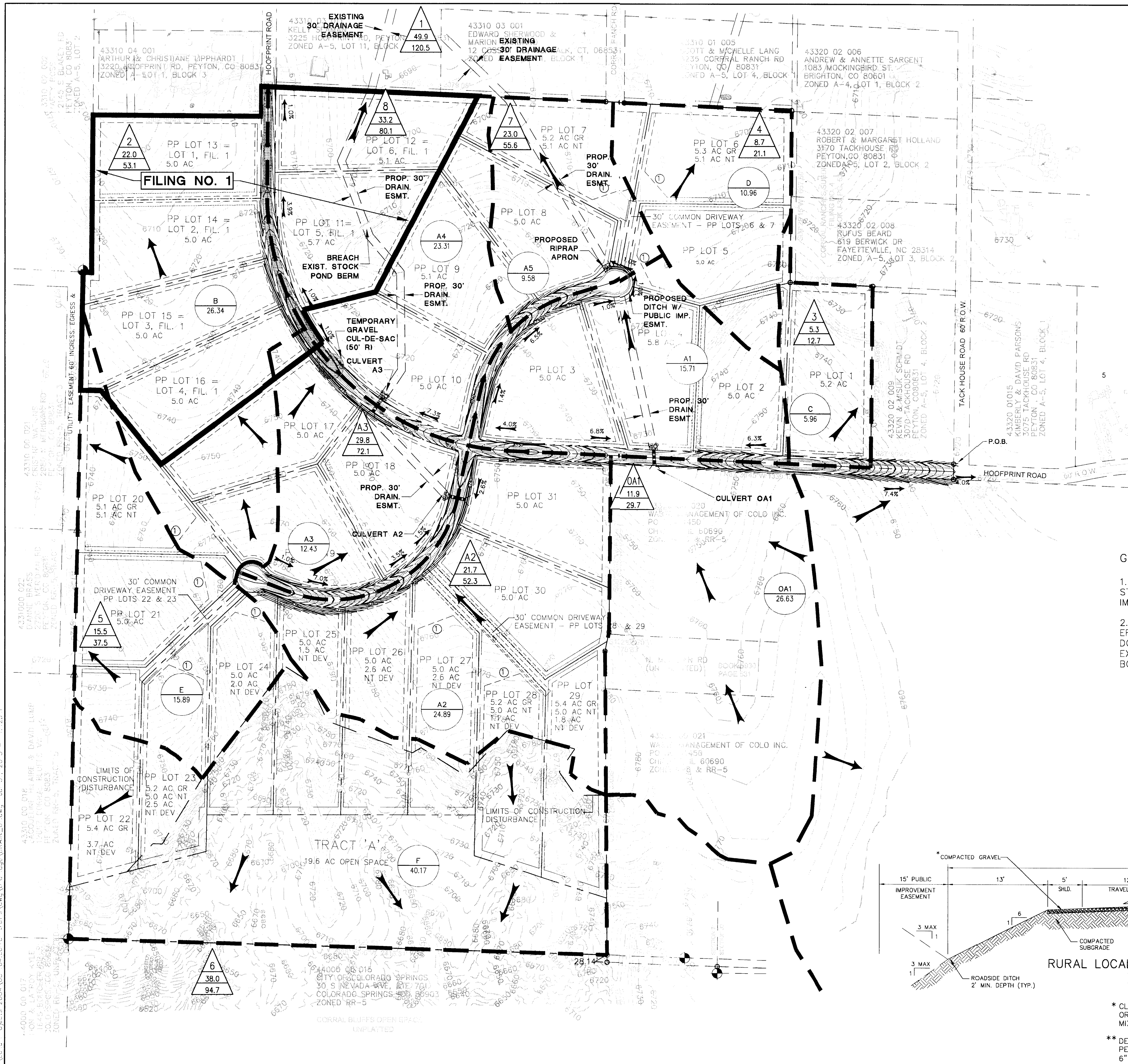
THE RESERVE AT CORRAL BLUFFS
DITCH CALCULATION SUMMARY

PROPOSED ROADSIDE DITCHES

ROADWAY	FROM STA	TO STA	SIDE	PROPOSED SLOPE (%)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	ROW WIDTH (ft)	BASIN	Q100 FLOW (CFS)	DITCH FLOW % OF BASIN	DITCH FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	DITCH LINING
HOOFPRINT ROAD	1+80	6+40	E	1.00	6:1/3:1	2.0	0.030	60	A4	74.4	10	7.4	0.79	2.6	GRASS
HOOFPRINT ROAD	1+80	6+40	W	1.00	6:1/3:1	2.0	0.030	60	B	53.2	10	5.3	0.70	2.4	GRASS
HOOFPRINT ROAD	6+40	9:50	E	3.90	6:1/3:1	2.0	0.030	60	A4	74.4	10	7.4	0.61	4.4	GRASS
HOOFPRINT ROAD	6+40	9:50	W	3.90	6:1/3:1	2.0	0.030	60	B	53.2	15	8.0	0.63	4.5	GRASS
HOOFPRINT ROAD	9:50	12+00	E	1.00	6:1/3:1	2.0	0.030	60	A4	74.4	15	11.2	0.92	2.9	GRASS
HOOFPRINT ROAD	9:50	12+00	W	1.00	6:1/3:1	2.0	0.030	60	B	53.2	20	10.6	0.91	2.9	GRASS
HOOFPRINT ROAD	12+00	15+88	N	1.00	6:1/3:1	2.0	0.030	60	A4	74.4	10	7.4	0.79	2.6	GRASS
HOOFPRINT ROAD	12+00	15+88	S	1.00	6:1/3:1	2.0	0.030	60	A3	42.5	10	4.3	0.65	2.3	GRASS
HOOFPRINT ROAD	15+88	19+00	N	6.80	6:1/3:1	2.0	0.030	60	A4	74.4	10	7.4	0.55	5.4	GRASS/ECB
HOOFPRINT ROAD	15+88	19+00	S	6.80	6:1/3:1	2.0	0.030	60	A3	42.5	20	8.5	0.58	5.6	GRASS/ECB
HOOFPRINT ROAD	19+00	19+82	N	4.00	6:1/3:1	2.0	0.030	60	A4	74.4	10	7.4	0.61	4.4	GRASS
HOOFPRINT ROAD	19+00	19+82	S	4.00	6:1/3:1	2.0	0.030	60	A3	42.5	15	6.4	0.58	4.3	GRASS
HOOFPRINT ROAD	19+82	22+50	N	4.00	6:1/3:1	2.0	0.030	60	A1	55.5	10	5.6	0.55	4.1	GRASS
HOOFPRINT ROAD	19+82	22+50	S	4.00	6:1/3:1	2.0	0.030	60	A2	52.4	15	7.9	0.63	4.5	GRASS
HOOFPRINT ROAD	22+50	27+01	N	6.79	6:1/3:1	2.0	0.030	60	A1	55.5	10	5.6	0.50	5.0	GRASS/ECB
HOOFPRINT ROAD	22+50	27+01	S	6.79	6:1/3:1	2.0	0.030	60	OA1	29.8	10	3.0	0.39	4.3	GRASS
HOOFPRINT ROAD	27+01	33+00	N	6.30	6:1/3:1	2.0	0.030	60	A1	55.5	15	8.3	0.59	5.4	GRASS/ECB
HOOFPRINT ROAD	27+01	33+00	S	6.30	6:1/3:1	2.0	0.030	60	OA1	29.8	15	4.5	0.47	4.6	GRASS
HOOFPRINT ROAD	33+00	38+50	N	7.36	6:1/3:1	2.0	0.030	60	C	12.7	15	1.9	0.33	4.0	GRASS

PROPOSED ROADSIDE DITCHES

ROADWAY	FROM STA	TO STA	SIDE	PROPOSED SLOPE (%)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	ROW WIDTH (ft)	BASIN	Q100 FLOW (CFS)	DITCH FLOW % OF BASIN	DITCH FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	DITCH LINING
SOLBERG COURT	1+50	4+60	N	1.00	6:1/3:1	2.0	0.030	60	A3	42.5	10	4.3	0.65	2.3	GRASS
SOLBERG COURT	1+50	4+60	S	1.00	6:1/3:1	2.0	0.030	60	A2	52.4	10	5.2	0.69	2.4	GRASS
SOLBERG COURT	4+60	8+50	N	7.90	6:1/3:1	2.0	0.030	60	A3	42.5	10	4.3	0.44	5.0	GRASS/ECB
SOLBERG COURT	4+60	8+50	S	7.90	6:1/3:1	2.0	0.030	60	A2	52.4	15	7.9	0.55	5.8	GRASS/ECB
SOLBERG COURT	8+50	10+30	N	3.50	6:1/3:1	2.0	0.030	60	A3	42.5	20	8.5	0.66	4.3	GRASS
SOLBERG COURT	8+50	10+30	S	3.50	6:1/3:1	2.0	0.030	60	A2	52.4	50	26.2	1.00	5.8	GRASS/ECB
SOLBERG COURT	10+30	12+20	W	1.50	6:1/3:1	2.0	0.030	60	A3	42.5	25	10.6	0.84	3.3	GRASS
SOLBERG COURT	10+30	12+20	E	1.50	6:1/3:1	2.0	0.030	60	A2	52.4	70	36.7	1.30	4.6	GRASS
SOLBERG COURT	12+20	14+30	W	1.75	6:1/3:1	2.0	0.030	60	A3	42.5	10	4.3	0.58	2.8	GRASS
SOLBERG COURT	12+20	14+30	E	1.75	6:1/3:1	2.0	0.030	60	A2	52.4	15	7.9	0.73	3.3	GRASS
SOLBERG COURT	14+30	19+10	W	1.00	6:1/3:1	2.0	0.030	60	A4	74.4	15	11.2	0.92	2.9	GRASS
SOLBERG COURT	14+30	19+10	E	1.00	6:1/3:1	2.0	0.030	60	A1	55.5	20	11.1	0.92	2.9	GRASS
SOLBERG COURT	19+10	22+50	N	6.67	6:1/3:1	2.0	0.030	60	A5	30.7	15	4.6	0.46	4.8	GRASS
SOLBERG COURT	19+10	22+50	S	6.67	6:1/3:1	2.0	0.030	60	A1	55.5	30	16.7	0.75	6.6	GRASS/ECB
SOLBERG COURT	22+50	24+20	N	1.00	6:1/3:1	2.0	0.030	60	A5	30.7	20	6.1	0.74	2.5	GRASS
SOLBERG COURT	22+50	24+20	S	1.00	6:1/3:1	2.0	0.030	60	A1	50.0	20	10.0	0.89	2.8	GRASS



LEGEND

- FILING LIMITS
- DRAINAGE BASIN BOUNDARY
- 6520 — EXISTING CONTOR
- 82.0 — PROPOSED SPOTELEVATION (FLOWLINE)
- 82.0 — EXISTING SPOT EEVATION (FLOWLINE)
- DRAINAGE CHANEL
- PROPOSED FLOW IRECTION ARROW
- PROPOSED CULVRT W/ FLARED END SETIONS
- 1 — DESIGN POINT; 20.6 — Q_5 (cfs); 50.3 — Q_{100} (cfs)
- A — BASIN DESIGNATION; 26.30 — BASIN AREA (ACRES)

GENERAL DRAINAGE NOTES:

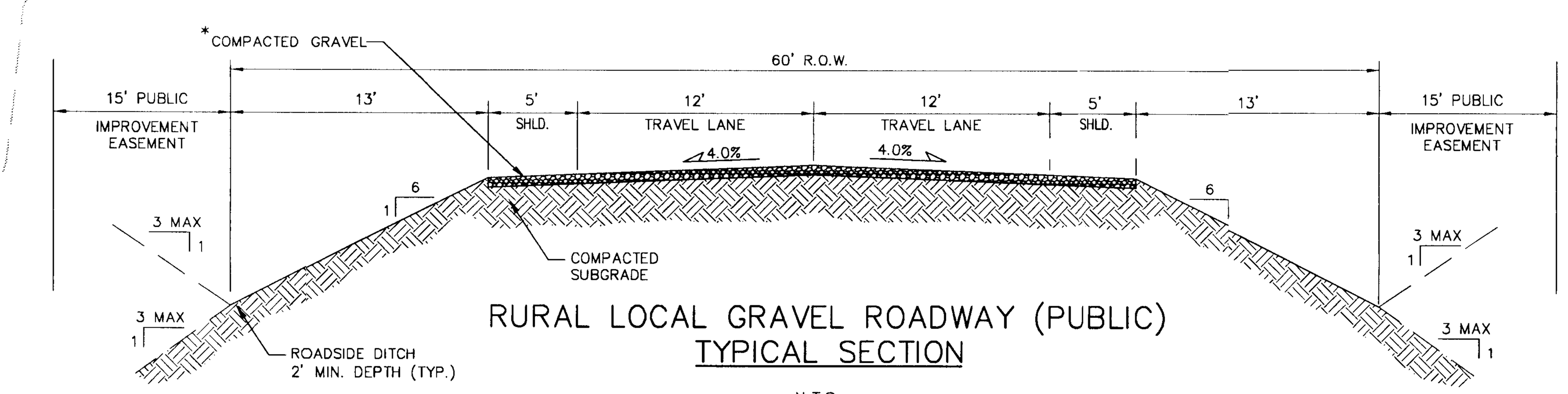
1. INDIVIDUAL BUILDERS SHALL PROVIDE POSIIVE DRAINAGE AWAY FROM STRUCTURES AND ACCOUNT FOR POTENTIAL ROSS-LOT DRAINAGE IMPACTS WITHIN EACH LOT.

2. BUILDERS AND PROPERTY OWNERS SHALL MPLEMENT & MAINTAIN EROSION CONTROL BEST MANAGEMENT PRACTCES FOR PROTECTION OF DOWNSTREAM PROPERTIES AND FACILITIES INCUDING PROTECTION OF EXISTING GRASS BUFFER STRIPS ALONG THE DOWNSTREAM PROPERTY BOUNDARIES.

N

200' 0 200' 400'

Original Scale: 1"=200'
Contour Interval = 2 ft.



RURAL LOCAL GRAVEL ROADWAY (PUBLIC)
TYPICAL SECTION

N.T.S.

* CLASS 6 BASE COURSE OR ALTERNATIVE GRAVEL MIX APPROVED BY EL PASO COUNTY

** DEPTH OF GRAVEL TO BE DETERMINED PER COUNTY GENERAL NOTE #10, WITH 6" MINIMUM DEPTH

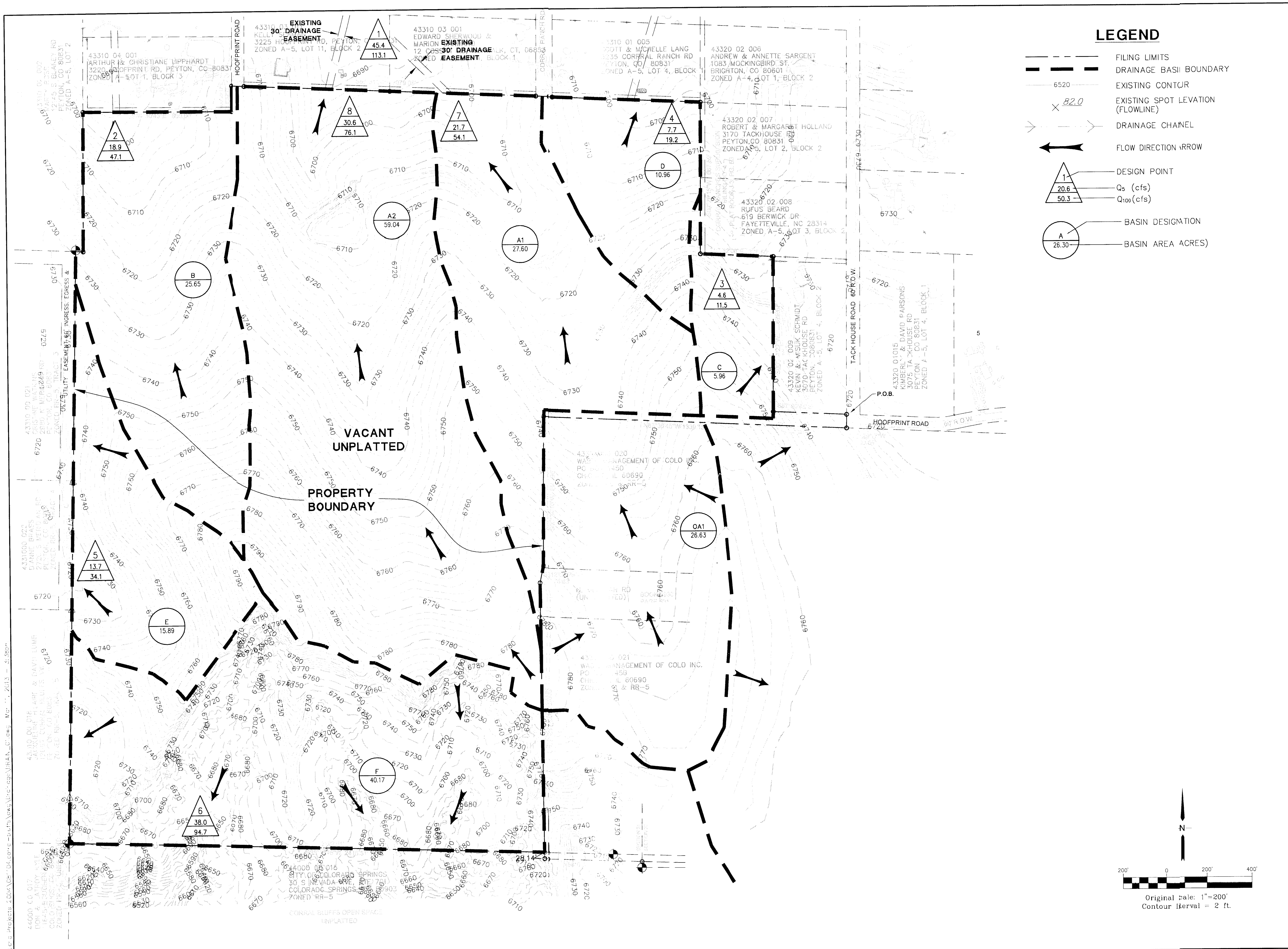
THE RESERVE AT CORRAL BLUFFS SUBDIVISION

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

No.	REVISION	BY	DATE

HORZ. SCALE:	1"= 200'	DRAWN:	MSP
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LWA	CHECKED:	JPS
CREATED:	01/30/12	LAST MODIFIED:	7/31/13
PROJECT NO:	081104	MODIFIED BY:	MSP
SHEET:	D1		



THE RESERVE AT CORRAL BLUFFS

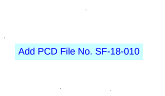
HISTORIC DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

HORZ. SCALE:	1" = 200'	DRAWN:	MSP
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LWA	CHECKED:	JPS
CREATED:	01/30/12	LAST MODIFIED:	3/1/13
PROJECT NO:	081104	MODIFIED BY:	MSP
SHEET:	EX2		

Markup Summary

dsdlaforce (2)



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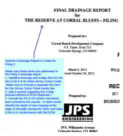

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Author: dsdlaforce
Date: 4/30/2018 2:39:38 PM
Color:

Submit a Drainage Report or Letter for Filing 2.

Make sure these items are addressed in the Filing 2 drainage report.
1. Updated drainage and bridge fees for the lots (Lots 5 & 6) within Jimmy Camp Creek. Make sure to include a separate line item for the Jimmy Camp Creek surety fee.
2. Add a section regarding the 4-step process defined in ECM Appendix I.
3. Include the A2 & A3 culvert calculation and summarize the results. In other words identify the depth of over topping at the edge of shoulder during the 100yr and state if this is in conformance with the DCM.