Final Bridge Design Report

East Fork Jimmy Camp Creek at Lorson Boulevard

Lorson Ranch Development

CDR-18-002

El Paso County, Colorado

Prepared for:
Lorson Development
212 North Wahsatch Suite 301
Colorado Springs, Colorado 80903

Prepared by:

Kiowa
Engineering Corporation

1604 South 21st Street
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Kiowa Project No. 17001
January 5, 2018
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NRCS Soil Survey

Engineer's Statement:

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

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

3/30/18

Richard N. Wray
Registered Engineer #19310
For and on Behalf of Kiowa Engineering Corporation

Date

Developer's Statement:

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

BY: _____ 4/6/18

JEFF MARR

Printed

Date

ADDRESS: Lorson Development, LLC
212 North Wahsatch Suite 301
Colorado Springs, Colorado 80903

El Paso County:

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

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

Approved
by Elizabeth Nijkamp
El Paso County Planning and Community Development
on behalf of Jennifer Irvine, County Engineer, ECM Administrator
05/08/2018 2:04:58 PM

Date

I. General Location and Description

This report serves to summarize the design of the bridge at proposed Lorson Boulevard over the East Fork Jimmy Camp Creek (EFJCC), drainageway within the Lorson Ranch Development. It is proposed to construct a clear-span arch bridge with soil/riprap bank transitions at the inlet and outlet sides of the arch. The work along the drainageway will begin approximately 200 feet south of the centerline for future Lorson Boulevard and extend upstream of the arch approximately 210 feet. The location of the site is shown on Figure 1.

Prior to completion of the roadway and attendant drainageway facilities and acceptance by El Paso County, easements and or tracts will be dedicated for the purposes of maintenance access. The work will take place within three un-platted parcels of land that are within the ownership of Lorson Development. These parcels cover the future right-of-way for Lorson Boulevard and the drainageway north and south of the road's right-of-way. Operation and maintenance of the drainageway will be the responsibility of the Lorson Ranch Metropolitan District. Upon completion of a LOMR that accounts for the channel and bridge structures subject to this design, there will be no residential lots within future Lorson East filings will be platted into the 100-year floodplain.

The bridge over EFJCC at Lorson Boulevard is shown on the design plans. The bridge will be a clear-span precast structure that has the capacity to pass the 100-year discharge. The ultimate roadway right-of-way is proposed to be 64-feet. The structure will be 84-feet out-to-out. The structure is skewed at 15 degrees with the roadway's centerline. The roadway section shown on the design plans includes three lanes, Type III curb and gutter and 8-foot detached sidewalks. Protective guardrails as shown on the drawings have been designed in conformance with Colorado Department of Transportation M-standards. The use of a clear-span structure is consistent with the US Army Corps of Engineers 404 permit issued for the Lorson Ranch Development that requires that a natural invert be constructed. Once the bridge and roadway facilities are completed and accepted by El Paso County, El Paso County will assume maintenance responsibility for the structure and roadway.

The developer intends to request reimbursement for the cost to construct the bridge and drainageway facilities, or request credit against future drainage and bridge fees. Reimbursement will be processed in accordance with sections 1.7 and 3.3 of the Drainage Criteria Manual (DCM). The drainageway facilities will be operated and maintained by the Lorson Ranch Metropolitan District.

II. Project Background

EFJCC is a natural drainageway that stabilized in 2016 with bank linings and grade control structures shown on the design plans entitled "East Tributary of Jimmy Camp Creek" prepared by Core Engineering and approved by the County in 2015. The stabilization was required as part of the land development for The Meadows at Lorson Ranch Filing No. 3 subdivision. Selective sheets of the design drawings relevant to the Lorson bridge project are contained within Appendix A. The bridge at Lorson Boulevard is located at approximately station 15+00 of the Core Engineering design plan and profile.

In April 2015, the City of Colorado Springs adopted an update to the 1987 Jimmy Camp Creek DBPS. The primary findings and recommendations summarized in the updated 2015 DBPS was the updating of the watershed's hydrology and the recommendation for implementation of full spectrum detention (FSD) within the overall Jimmy Camp Creek watershed. The long-term stable slope estimated in the 2015 DBPS was used as the basis for the hydraulic design for the facilities shown on the Core Engineering design drawings. The long-term slope estimated the DBPS was .1 percent assuming no vertical grade control. The design slope assumed in the Core Engineering design was .3 percent. Present longitudinal slope at the site is approximately .25 percent.

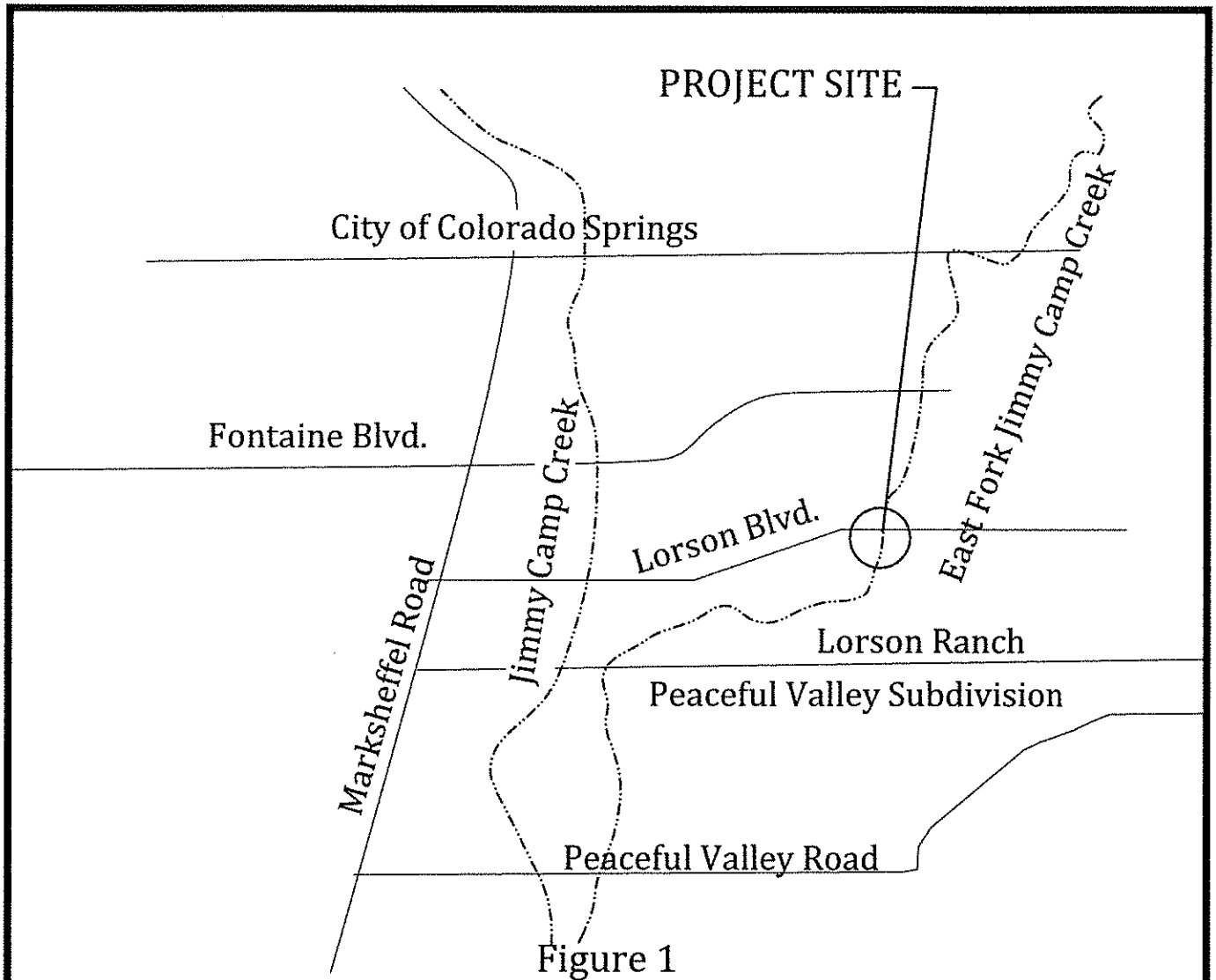


Figure 1
VICINITY MAP
SCALE: N.T.S.

Though the 2015 DBPS was never adopted by El Paso County, the County is now requiring development to provide for FSD, as is the City of Colorado Springs. The implementation of FSD is being accomplished in the County through the adoption of Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual, Volume 1.

III. Previous Reports and Jurisdictional Requirements

The basis for the development of the design has been developed from referencing the following reports:

1. ***Lorson Ranch Master Development Drainage Plan (MDDP), prepared by Core Engineering, latest version (not approved by El Paso County).***
2. ***Jimmy Camp Creek Drainage Basin Planning Study (DBPS), prepared by Kiowa Engineering, 2015 (not approved by El Paso County).***
3. ***City of Colorado Springs and El Paso County Drainage Criteria Manual, 1987.***
4. ***El Paso County Engineering Criteria Manual, most current version.***
5. ***City of Colorado Springs Drainage Criteria Manual, Chapters 6 and 12, adopted by the County in 2015.***
6. ***The City of Colorado Springs and El Paso County Flood Insurance Study (FIS), prepared by the Federal Emergency Management Agency, effective 1997.***
7. ***East Fork Jimmy Camp Creek Conditional Letter of Map Revision, Case Number 17-08-1043P, approval pending January 2018.***
8. ***Construction Plans for East Fork Jimmy Camp Creek prepared by Core Engineering, July 2015.***

Reference 7 provides for the existing condition floodplain and floodway for the segment of EFJCC subject to this design. The existing condition floodplain has been shown on the design drawings, and has been modified to show the effects of the bridge crossing at Lorson Boulevard. Because the bridge structure and channel stabilization measures will occur within the regulatory floodplain and floodway, a Conditional Letter of Map Revision (CLOMR), will need to be processed through FEMA as part of gaining the necessary construction approvals for the project. It is anticipated that the CLOMR will be approved in January 2018. The bridge structure shown on the design plans was reflected in the CLOMR.

Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs DCM was made part of Reference 3 by El Paso County Board of County Commissioners Resolution 15-042.

IV. Site Description

The EFJCC floodplain within the design reach is well vegetated with native grasses that are in fair to good condition that exists on the floodplain overbanks and within the greater valley in general. There is very little evidence of active invert degradation or bank sloughing either upstream or downstream of the proposed arch bridge. Current longitudinal slope through the project is .25 percent. There is presently no base flow in this segment. Topography used in the design was compiled at a one-foot contour interval and is dated 2015. The topography reflects the channel stabilization measure constructed in 2016 (Reference 8). There are presently no encroachments into the floodplain or channel thread associated with man-made structures. There is presently no existing water, wastewater, gas or electric utilities that impact the construction of the proposed bridge

however an existing sanitary sewer main along the west overbank of the drainageway that will need to be protected from disturbance. A future water line is proposed at Lorson Boulevard. The future water line has been shown on the design plans. Approval of the water and wastewater design plans would ultimately come from Widefield Water and Sanitation District.

V. Hydrology

Hydrology for use in determining the hydraulics for the bridge structure shown on the plans were obtained from Reference 7. The 100-year discharges shown in Reference 7 is 5,200 cubic feet per second. Watershed area at Lorson Boulevard is approximately 10.3 square miles. The watershed above Lorson Boulevard is mostly undeveloped. Provided on Table 1 is a summary of the peak flows for existing watershed development conditions for References 2 and 7

The assumption that FSD will be required for all future development is reflected in the use of the FIS discharges in this design. There is a good correlation between the FIS and DBPS 100-year discharges for the segment of EFJCC subject to this design. Use of the existing basin condition flow rates is consistent with the requirements set forth in the annexation agreement between the owners of Banning-Lewis Ranch and the City of Colorado Springs. The future FSD's within Banning-Lewis Ranch will be publicly operated and maintained facilities. The plan and profile that summarize the peak discharges from Reference 2 are included in the Appendix.

VI. Hydraulics

The hydraulic design of the drainageway and bridge as presented on the plans was carried out using the US Army Corps of Engineers HEC-RAS modeling system. The HEC-RAS model was used to determine the 100-year hydraulic grade line shown on the plan and profiles. The 100-year profile for the FIS hydrology has been determined. The location for the proposed 100-year floodplain using FIS hydrology has been presented on the plan view of the design plans and on the grading plan. Contained within the Appendix of this report are CLOMR work maps that show the proposed (pre-project) 100-year floodplains using the FIS hydrology. The location for selected HEC-RAS cross-sections are shown on the design profile. The HEC-RAS cross-sections are presented on the floodplain work maps contained in Appendix A. The summary output and cross-section plots for the HEC-RAS models have been included in the Appendix of this memorandum.

Based upon the hydraulic analysis the EFJCC channel at the site of the proposed bridge operates at normal depths of flow, thereby eliminating channel instability associated with super-critical flow conditions. Velocities for the 100-year discharge range from 3.2 to 5.1 feet per second. Calculations related to the sizing of the soil/riprap bank and channel sections are contained within the Appendix of the report. The top of the bank where selective linings have been proposed reflect the freeboard criteria per Reference 3.

VII. Design Elements

Presented on the plans associated with this design memorandum are the proposed bridge and drainageway stabilization measures. Design criteria for the project are summarized as follows:

TABLE 1: SUMMARY OF DESIGN DISCHARGES
PROJECT: EAST FORK JIMMY CAMP CREEK AT LORSON BOULEVARD
PROJECT NO: 17001

DESIGN POINT	LOCATION	EL PASO COUNTY FIS (1)		JIMMY CAMP CREEK DBPS	
		10-YEAR (CFS)	100-YEAR (CFS)	10-YEAR (CFS)	100-YEAR (CFS)
A	800 FT UPSTREAM OF LORSON BOULEVARD	2600	5200	1850	4260
B	1500 FT DOWNSTREAM OF LORSON BOULEVARD	2800	5500	1970	4530

(1) FIS DISCHARGES USED FOR THE DESIGN OF BRIDGE AND DRAINAGEWAY FACILITIES
(2) ALL DISCHARGES LISTED IN TABLE 1 ARE FOR THE EXISTING WATERSHED CONDITIONS

Channel design slope:	.25 percent
Permissible shear stress: main channel	
Type M riprap	5.0 psf
Culvert HW to depth ratio:	1.2
Culvert freeboard at inlet	2 feet

A geotechnical investigation was conducted to support the design of the foundation for the bridge at Lorson Boulevard. The geotechnical report is included within the Appendix. Two soil borings were drilled at near the location of the proposed footings for the bridge. Because of the depth to bedrock, deep foundations are proposed using driven H-piles. Claystone bedrock was encountered at a depth of 44 feet in test boring 4. The top of piling as designed will be approximately 5-feet below the existing invert of the drainageway. A precast bridge section has been chosen that has a 48-foot clear span and a 13-foot rise. The 100-year discharge can be passed through the bridge at a headwater to depth ratio of 1. Bridge velocity during a 100-year event is estimated at between 11.3 and 15.0 feet per second. The soil borings have been included in this report within Appendix D.

Maintenance access to the north side of the proposed bridge will be provided by means of an all-weather trail down the existing west channel bank. Access trail will be a minimum of 12-feet in width.

VIII. Construction Permitting

The following permits are anticipated to allow for the construction of the project as shown on the design plans. A copy of the Lorson Ranch 404 Permit is included within the Appendix.

Notification of project in conformance with 404 permit - USACOE

Floodplain Development Permit – Regional Building Department

Grading and Erosion Control Permit (ESQCP) – El Paso County

Construction Stormwater Discharge Permit – CDPHE

MS-4 Construction Permit- El Paso Count

Conditional Letter of Map Revision - FEMA

IX. Drainage and Bridge Fees

The Lorson Ranch Development and specifically Lorson Ranch East lies wholly within the Jimmy Camp Creek drainage basin. Drainage and bridge fees have been established by the County for the Jimmy Camp Creek drainage basin for assessment against platted land within the watershed. The drainageway transitions will be public and are considered reimbursable or creditable against drainage fees owed when land within Lorson East is platted pending approval through the DCM reimbursement process. Construction of the bridge at Lorson Boulevard will be creditable against bridge fees owed pending approval through the DCM reimbursement process.

The current 2017 drainage and bridge fees for the Jimmy Camp Creek drainage basin are as follows:

Drainage Fee:	$16,270 per all impervious acres
Drainage Fee Escrow (BOCC Reas.16-320)	$7,285 per acre
Total Drainage Fee	$23,555 per acre
Bridge Fee:	$761 per acre

X. Phasing

Construction of the drainage and bridge facilities shown on the plans is to be completed all at once and no phasing of the construction is proposed. The construction will commence prior to or concurrent with the development of the first filing within Lorson East. Plans are to commence with construction in Spring 2018 with substantial completion in Fall 2018.

Appendix A

Hydrologic and Hydraulic Calculations

PROFILE STA

HEC-RAS Plan: Prop Cond River: East Tributary Reach: Main Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Reach	10350	500yr	6450.00	5697.80	5708.06	5703.71	5708.23	0.000433	3.68	2067.36	330.29	0.25
Main Reach	10066.15	10yr	2600.00	5696.90	5702.04	5700.39	5702.52	0.002008	5.54	469.51	245.11	0.50
Main Reach	10066.15	50yr	4300.00	5696.90	5704.80	5701.53	5705.19	0.001037	5.01	858.15	301.46	0.38
Main Reach	10066.15	100yr	5200.00	5696.90	5706.10	5702.08	5706.22	0.000360	3.21	2061.78	392.05	0.23
Main Reach	10066.15	500yr	6450.00	5696.90	5708.03	5702.73	5708.12	0.000209	2.82	3082.55	600.52	0.17
Main Reach	9892	10yr	2600.00	5695.87	5701.97	5699.17	5702.23	0.000889	4.14	628.71	245.85	0.34
Main Reach	9892	50yr	4300.00	5695.87	5704.77	5700.29	5705.02	0.000568	4.03	1067.27	318.09	0.29
Main Reach	9892	100yr	5200.00	5695.87	5706.06	5700.82	5706.16	0.000258	2.90	2199.29	478.34	0.20
Main Reach	9892	500yr	6450.00	5695.87	5708.00	5701.47	5708.09	0.000162	2.62	3321.94	687.54	0.16
Main Reach	9682	10yr	2600.00	5693.93	5701.93	5697.49	5702.06	0.000385	3.06	849.69	157.13	0.23
Main Reach	9682	50yr	4300.00	5693.93	5704.75	5698.69	5704.90	0.000309	3.20	1353.03	218.82	0.21
Main Reach	9682	100yr	5200.00	5693.93	5705.94	5699.23	5706.10	0.000286	3.27	1645.58	453.77	0.21
Main Reach	9682	500yr	6450.00	5693.93	5707.92	5699.91	5708.05	0.000183	2.94	2832.11	633.98	0.17
Main Reach	9573	10yr	2600.00	5693.86	5700.78	5698.42	5701.75	0.001953	7.90	329.18	77.14	0.53
Main Reach	9573	50yr	4300.00	5693.86	5702.84	5700.20	5704.41	0.002224	10.04	428.13	77.94	0.59
Main Reach	9573	100yr	5200.00	5693.86	5703.49	5701.07	5705.48	0.002575	11.32	459.20	78.21	0.65
Main Reach	9573	500yr	6450.00	5693.86	5705.74	5702.16	5707.37	0.002334	11.98	538.22	79.58	0.63
Main Reach	9518		Bridge									
Main Reach	9459	10yr	2600.00	5693.79	5700.15	5698.38	5701.31	0.002845	8.65	300.53	81.24	0.61
Main Reach	9459	50yr	4300.00	5693.79	5700.98	5700.16	5703.46	0.004778	12.63	340.37	81.93	0.84
Main Reach	9459	100yr	5200.00	5693.79	5701.09	5701.01	5704.60	0.006645	15.05	345.55	82.03	0.99
Main Reach	9459	500yr	6450.00	5693.79	5702.13	5702.13	5706.26	0.006524	16.31	395.40	82.95	1.00
Main Reach	9350	10yr	2600.00	5693.72	5700.51	5697.05	5700.71	0.000596	3.58	726.96	149.18	0.29
Main Reach	9350	50yr	4300.00	5693.72	5701.88	5698.16	5702.21	0.000797	4.56	942.96	166.64	0.34
Main Reach	9350	100yr	5200.00	5693.72	5702.44	5698.67	5702.83	0.000896	5.01	1037.46	172.75	0.36
Main Reach	9350	500yr	6450.00	5693.72	5703.14	5699.32	5703.62	0.001011	5.56	1161.09	180.21	0.39
Main Reach	9224.70	10yr	2600.00	5693.10	5700.47	5696.36	5700.63	0.000435	3.16	823.93	157.66	0.24
Main Reach	9224.70	50yr	4300.00	5693.10	5701.83	5697.49	5702.09	0.000615	4.10	1049.44	175.12	0.29
Main Reach	9224.70	100yr	5200.00	5693.10	5702.38	5698.00	5702.70	0.000694	4.53	1150.86	204.50	0.31
Main Reach	9224.70	500yr	6450.00	5693.10	5703.07	5698.64	5703.46	0.000771	5.04	1350.08	357.83	0.33
Main Reach	9000	10yr	2600.00	5692.00	5700.42	5695.42	5700.54	0.000292	2.76	944.84	174.71	0.20
Main Reach	9000	50yr	4300.00	5692.00	5701.75	5696.58	5701.96	0.000428	3.66	1210.91	225.82	0.25
Main Reach	9000	100yr	5200.00	5692.00	5702.29	5697.11	5702.55	0.000489	4.07	1340.32	247.90	0.27
Main Reach	9000	500yr	6450.00	5692.00	5702.98	5697.77	5703.29	0.000553	4.54	1517.57	266.06	0.28
Main Reach	8850	10yr	2600.00	5691.80	5700.41	5694.98	5700.49	0.000187	2.15	1228.94	398.97	0.16
Main Reach	8850	50yr	4300.00	5691.80	5701.78	5696.02	5701.86	0.000220	2.61	1986.46	552.02	0.18
Main Reach	8850	100yr	5200.00	5691.80	5702.34	5696.37	5702.45	0.000233	2.80	2315.92	603.04	0.18
Main Reach	8850	500yr	6450.00	5691.80	5703.07	5697.08	5703.18	0.000238	2.98	2760.84	638.13	0.18
Main Reach	8650	10yr	2600.00	5691.10	5700.35	5694.88	5700.45	0.000148	2.53	1072.98	224.57	0.18
Main Reach	8650	50yr	4300.00	5691.10	5701.68	5696.05	5701.83	0.000213	3.36	1374.93	237.51	0.22
Main Reach	8650	100yr	5200.00	5691.10	5702.19	5696.60	5702.40	0.000245	3.75	1501.79	244.55	0.24
Main Reach	8650	500yr	6450.00	5691.10	5702.85	5697.25	5703.12	0.000279	4.23	1669.88	258.34	0.26
Main Reach	8521.53	10yr	2600.00	5690.90	5700.32	5695.46	5700.42	0.000398	2.58	1006.11	229.04	0.22
Main Reach	8521.53	50yr	4300.00	5690.90	5701.62	5696.84	5701.79	0.000478	3.28	1312.57	240.69	0.25
Main Reach	8521.53	100yr	5200.00	5690.90	5702.15	5697.44	5702.35	0.000524	3.61	1440.35	247.26	0.26
Main Reach	8521.53	500yr	6450.00	5690.90	5702.81	5698.17	5703.07	0.000572	4.02	1610.77	262.61	0.28
Main Reach	8430	10yr	2600.00	5688.80	5699.61	5697.97	5700.29	0.002941	9.28	650.38	198.11	0.51
Main Reach	8430	50yr	4300.00	5688.80	5700.76	5699.93	5701.62	0.003743	11.25	889.75	220.26	0.59
Main Reach	8430	100yr	5200.00	5688.80	5701.18	5700.34	5702.17	0.004241	12.27	984.00	229.17	0.63
Main Reach	8430	500yr	6450.00	5688.80	5701.77	5700.96	5702.87	0.004645	13.26	1122.47	241.48	0.66
Main Reach	8350	10yr	2600.00	5687.90	5698.72	5698.72	5699.90	0.006286	14.33	526.88	180.84	0.77
Main Reach	8350	50yr	4300.00	5687.90	5699.73	5699.73	5701.15	0.007764	16.94	726.13	210.45	0.87
Main Reach	8350	100yr	5200.00	5687.90	5700.24	5700.24	5701.67	0.007880	17.55	836.63	224.22	0.88
Main Reach	8350	500yr	6450.00	5687.90	5700.73	5700.72	5702.31	0.008701	18.93	949.08	236.46	0.93
Main Reach	8200	10yr	2600.00	5685.90	5697.87	5694.16	5698.67	0.002003	8.67	639.01	202.91	0.44
Main Reach	8200	50yr	4300.00	5685.90	5698.91	5695.83	5700.10	0.003030	11.28	873.20	239.10	0.55
Main Reach	8200	100yr	5200.00	5685.90	5699.34	5695.96	5700.69	0.003499	12.39	976.96	249.94	0.60
Main Reach	8200	500yr	6450.00	5685.90	5699.99	5699.55	5701.44	0.003795	13.32	1144.96	265.53	0.63
Main Reach	8000	10yr	2600.00	5685.30	5697.50	5693.80	5698.19	0.002630	9.84	769.09	243.86	0.50
Main Reach	8000	50yr	4600.00	5685.30	5698.49	5697.96	5699.38	0.003529	12.02	1020.99	262.77	0.59
Main Reach	8000	100yr	5500.00	5685.30	5698.90	5698.34	5699.88	0.003864	12.85	1130.61	269.85	0.62
Main Reach	8000	500yr	6900.00	5685.30	5699.49	5698.85	5700.55	0.004255	13.88	1292.23	279.98	0.66
Main Reach	7924	10yr	2600.00	5685.00	5696.75	5696.75	5697.90	0.004644	12.47	635.03	240.66	0.68

13+75

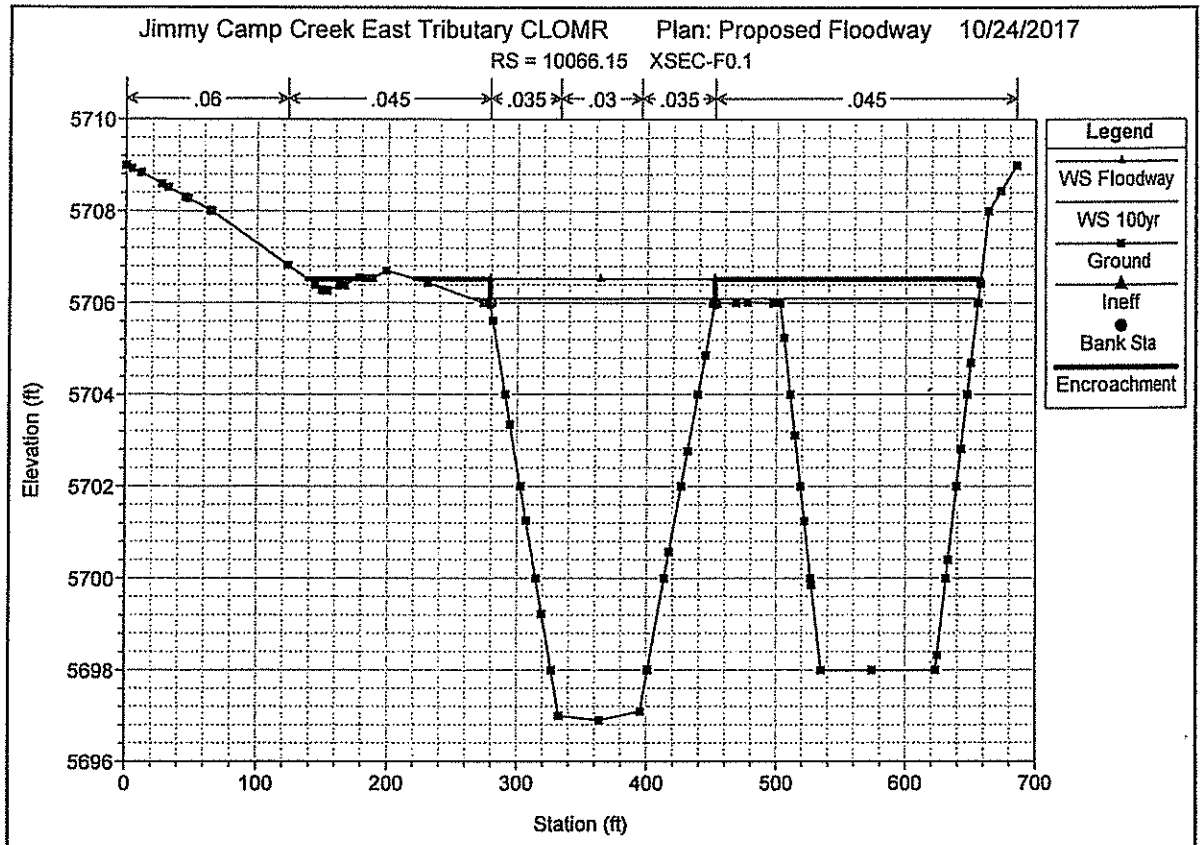
11+75

10+67

LOZSON BLVD.

9+50

8+16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Legend
WS Floodway
WS 100yr
Ground
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Elevation (ft)
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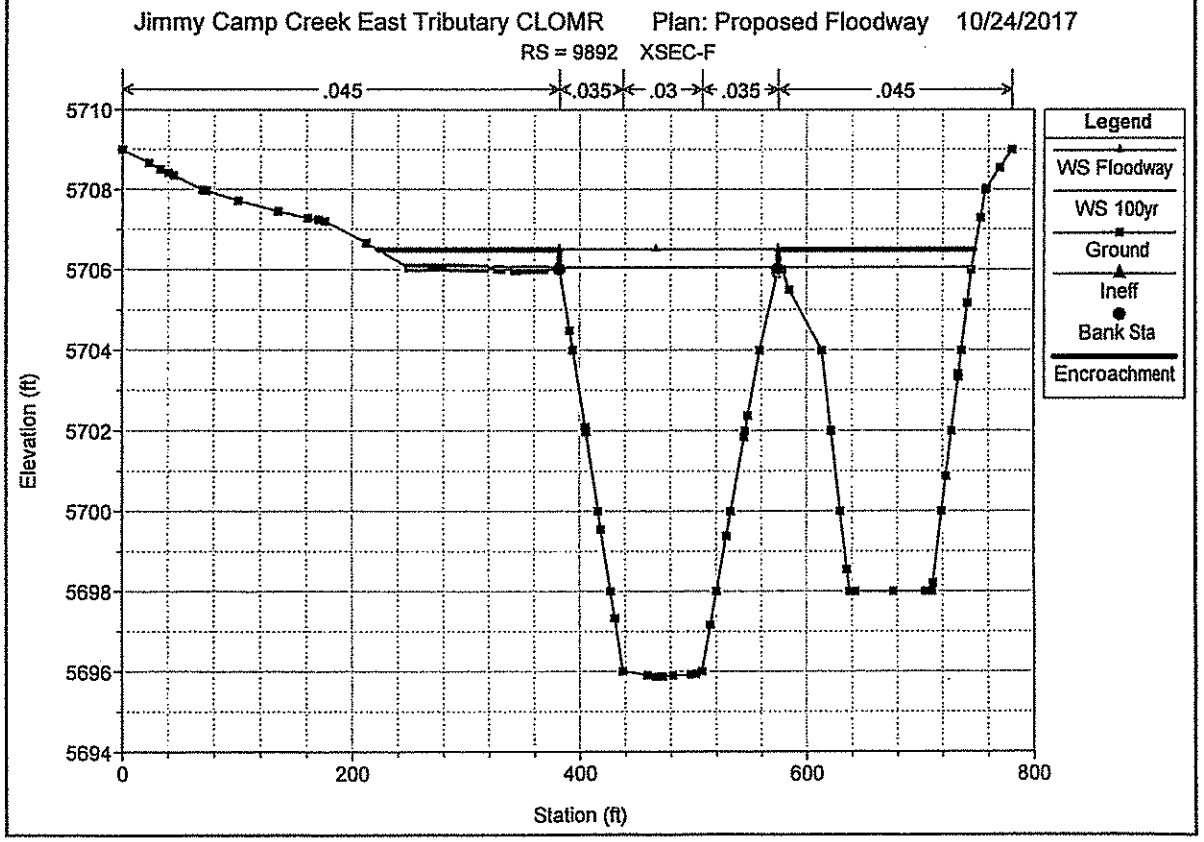
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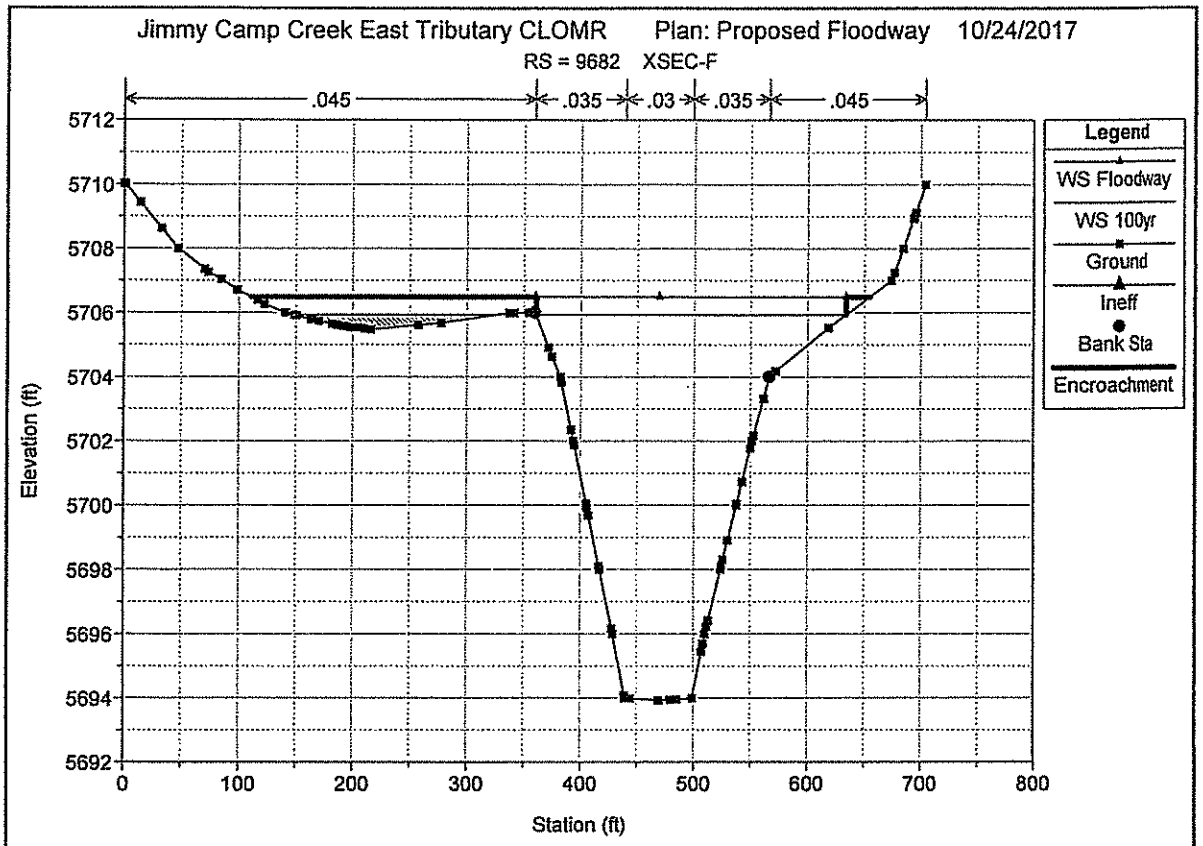
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)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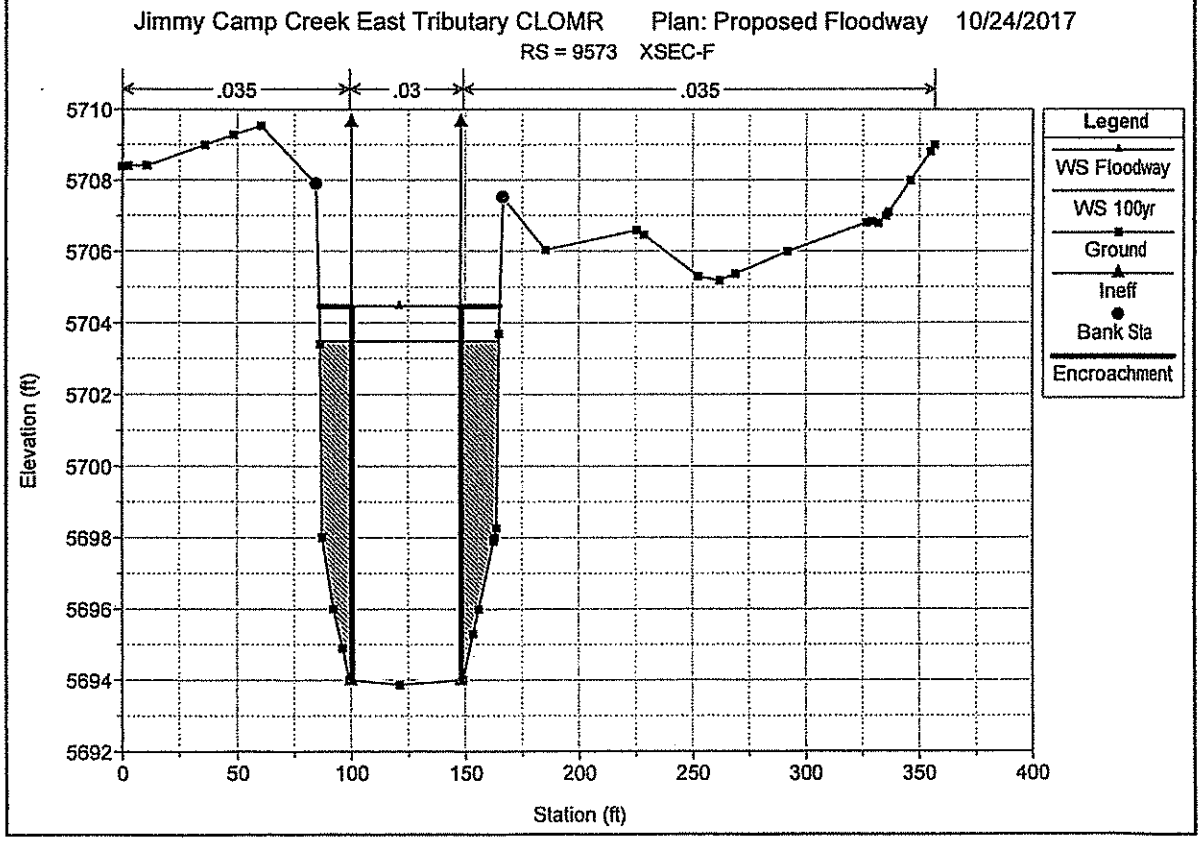
.045
.035
.03
.035
.045
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Floodway 10/24/2017
RS = 9573 XSEC-F
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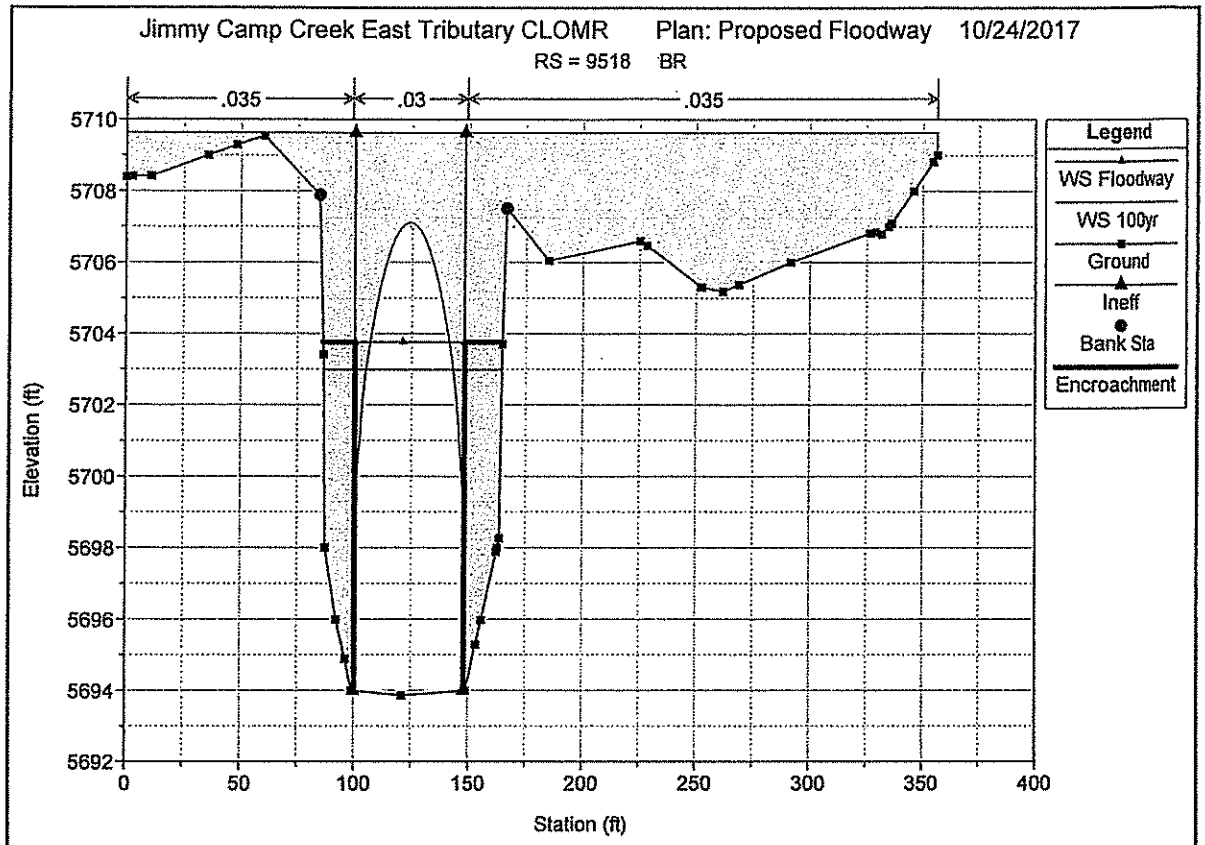
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Floodway 10/24/2017
RS = 9518 BR
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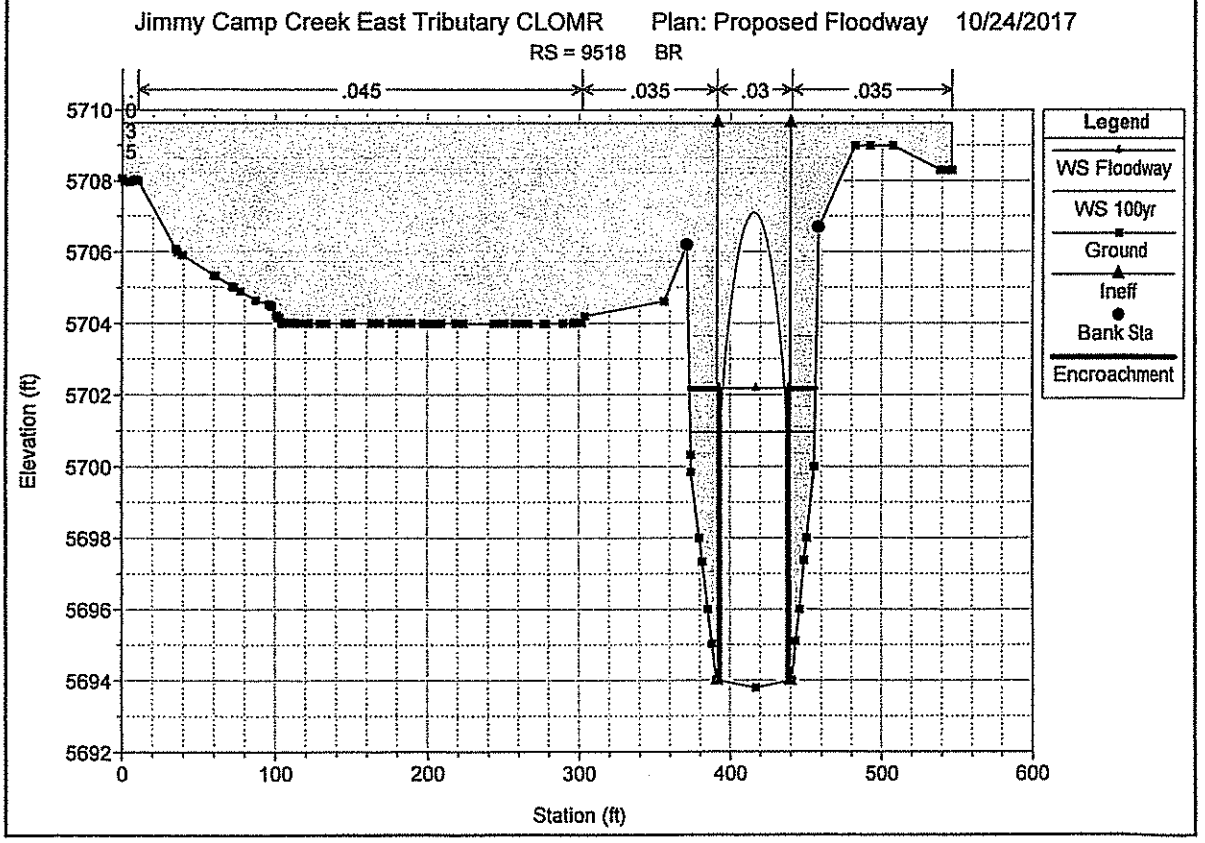
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Floodway 10/24/2017
RS = 9518 BR
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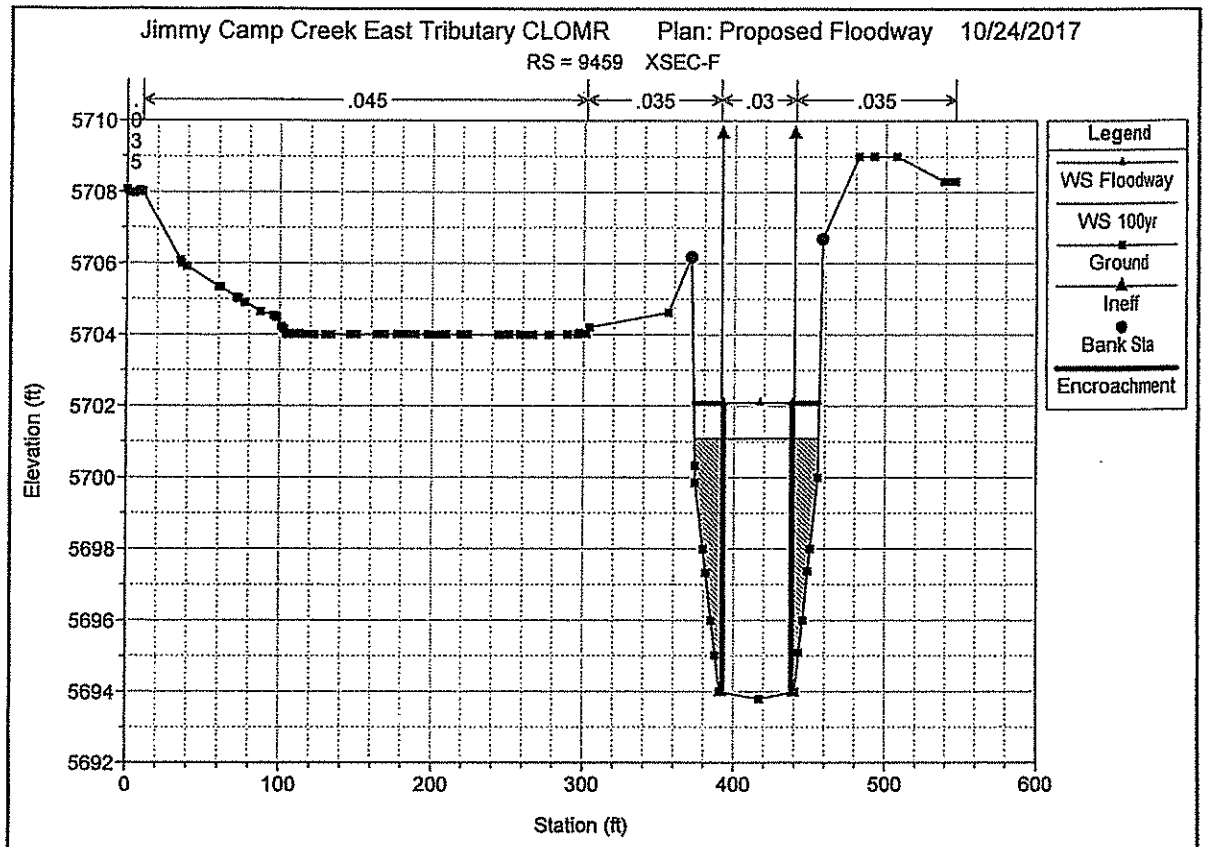
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)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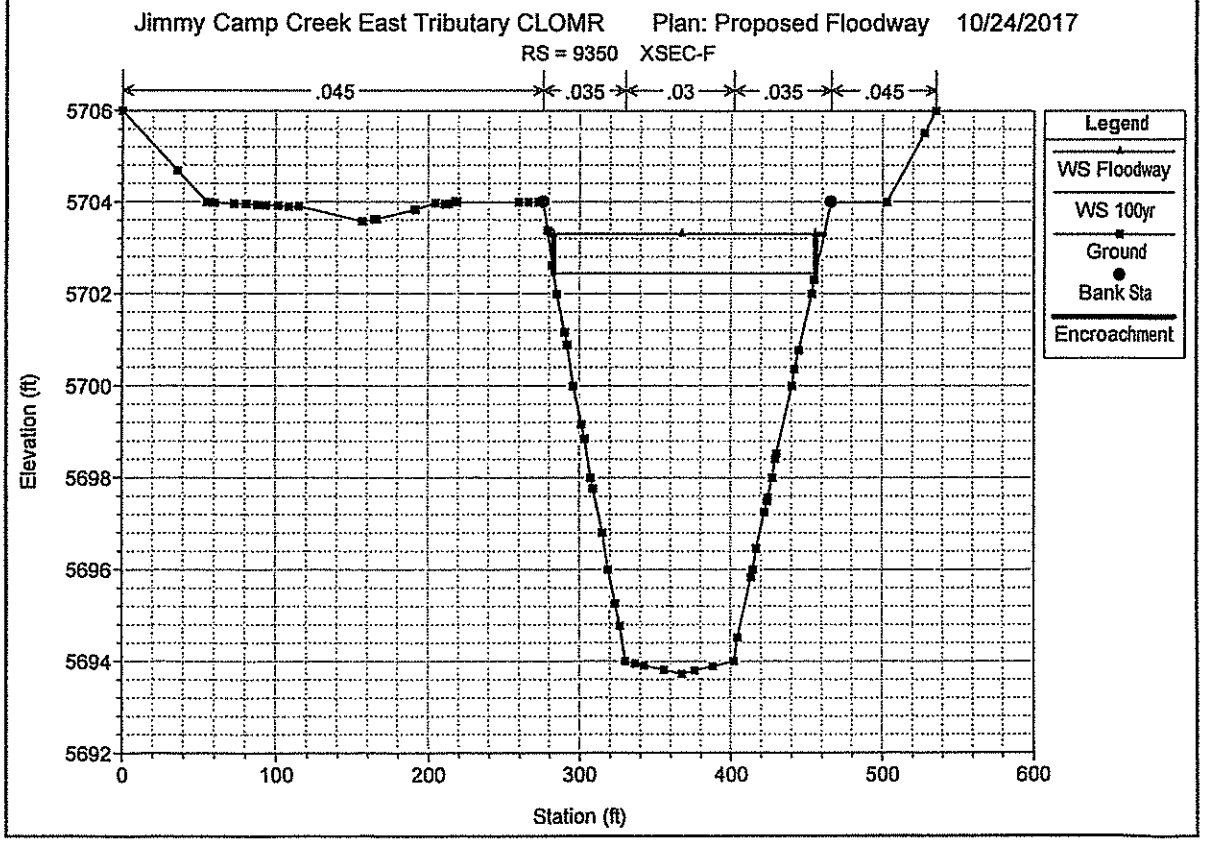
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)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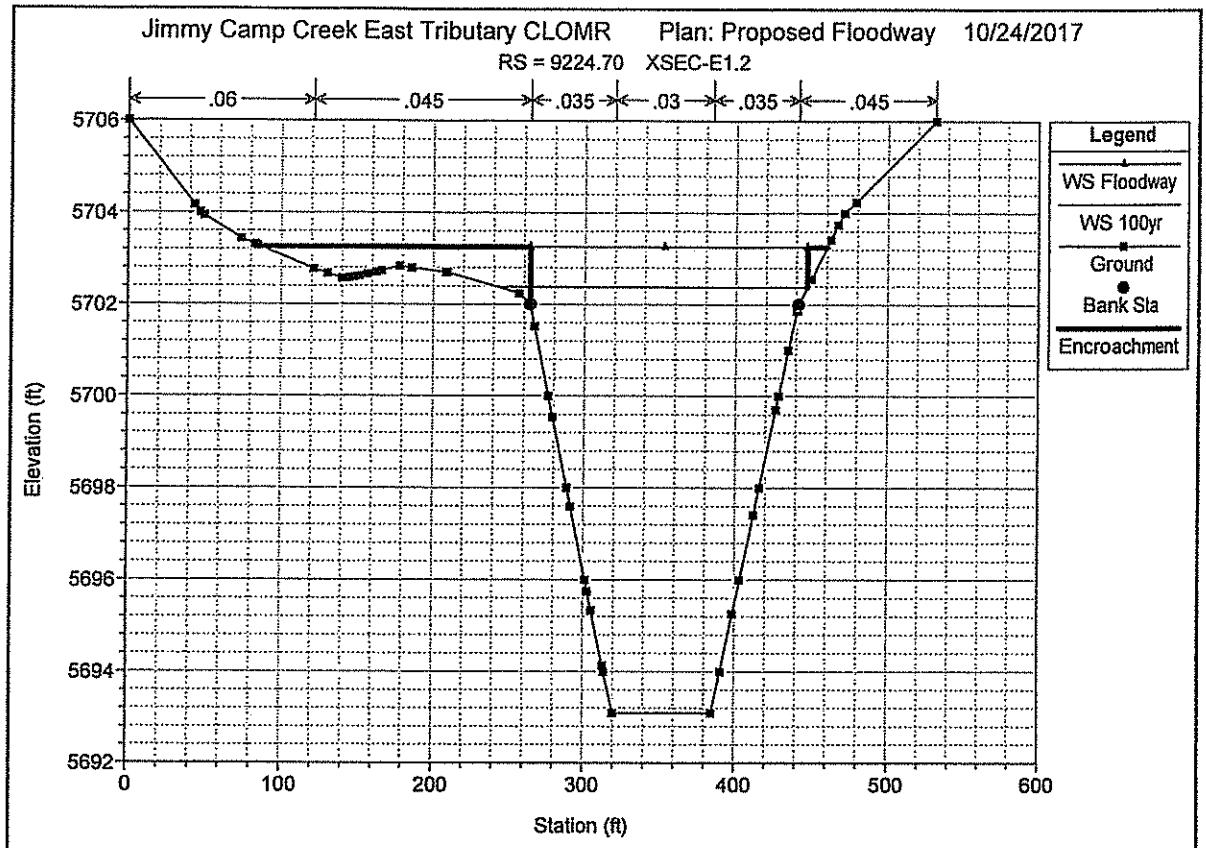
.035
.03
.035
.045
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Floodway 10/24/2017
RS = 9224.70 XSEC-E1.2
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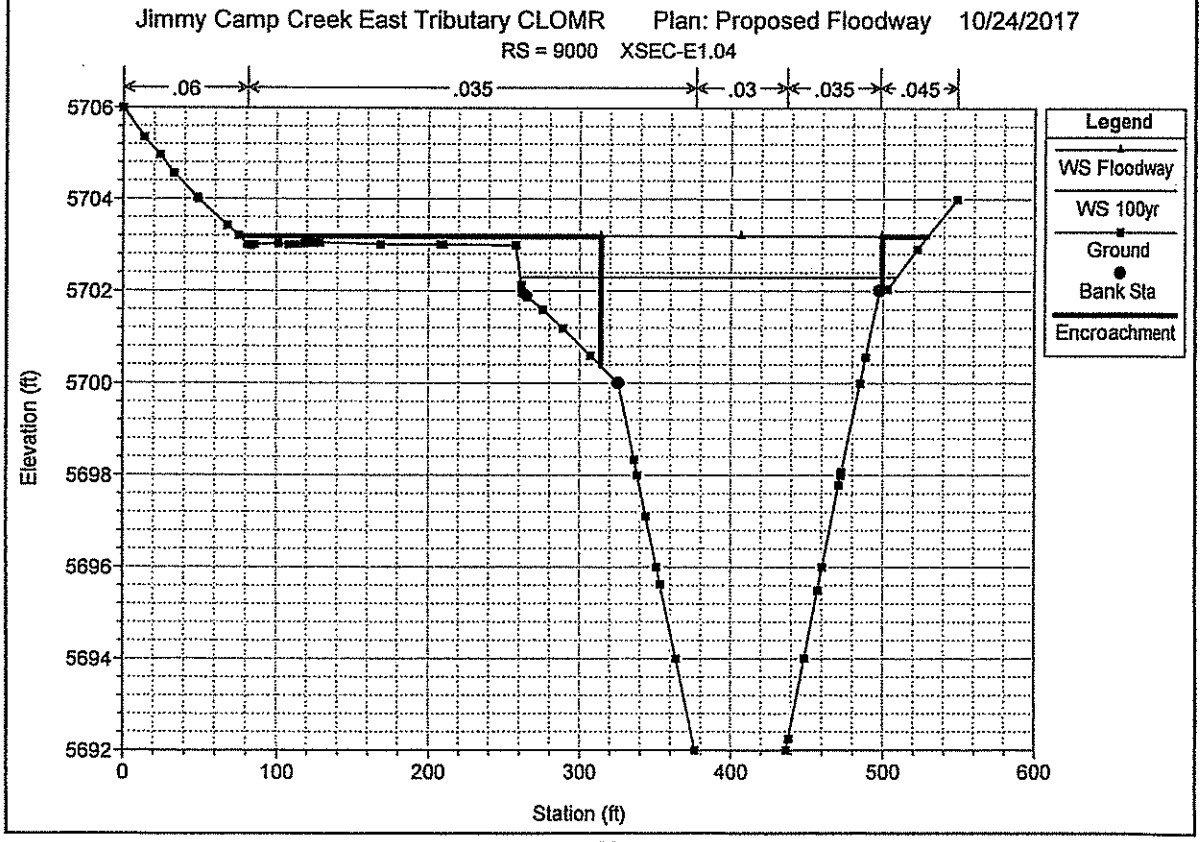
.045
.035
.03
.035
.045
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
5706
5704
5702
5700
5698
5696
5694
5692
0
100
200
300
400
500
600
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Floodway 10/24/2017
RS = 9000 XSEC-E1.04
.06
.035
.03
.035
.045
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
5706
5704
5702
5700
5698
5696
5694
5692
0
100
200
300
400
500
600
Station (ft)

KIOWA ENGINEERING CORPORATION

JOB Larsen Blvd Bridge
SHEET NO. 17001 OF
CALCULATED BY RHW DATE
CHECKED BY DATE 12-10-12
SCALE Hydraulics

Riprap Sizing - CRITERIA 1987 DCM

Bridge Velocity @ inlet outlet.

100 year 11.3 → 15.2 *

Channel Slope through bridge = .26%

$$\frac{VS^{.17}}{(S_s-1)^{.66}} \quad w/\ S=2.6 \Rightarrow \frac{VS^{.17}}{1.36}$$

using 14 fps: $\frac{(15.2)(.0026)^{.17}}{1.36} = \frac{5.53}{1.36} = 4.0$

lower end of Type M (Table 10-6 DCM)

use Type M Soil Riprap For Banks

use " " Void Filled Riprap for invert

* Vel = 15.2 fps HEC RAS River Station 9459

Stream Station 9+50 +/-

TABLE 10-6

RIPRAP REQUIREMENTS FOR CHANNEL LININGS **

$VS^{0.17}/(S_s-1)^{0.66}$* ($ft^{1}/2/sec$)	Rock Type ***
1.4 to 3.2	VL
3.3 to 3.9	L
4.0 to 4.5	M
4.6 to 5.5	H
5.6 to 6.4	VH

* where:

V = mean channel flow velocity, in fps;

S = longitudinal channel slope, in feet per foot (ft/ft); and

S_s = specific gravity of stone (minimum S_s = 2.50)

** Table valid only for Froude number of 0.8 or less and side slopes no steeper than 2h:1v.

*** Type VL and L riprap may be buried after placement to reduce vandalism.

KIOWA ENGINEERING CORPORATION

JOB Lorson Blvd Bridge
SHEET NO. PW 17001 OF 1 / 1
CALCULATED BY [illegible] DATE 12-10-17
CHECKED BY DATE
SCALE Hydraulics

Freeboard Calcs: $FB = 1.025(V)\,d^{.33}$ (1987 DCM)

Stream Sta	HEC Ras Sta	V100 (fps)	d (ft)	FB (ft)
11+75	9692	3.3	12'	1.2
13+75	9892	4.2	10'	1.2

Stream Sta	100-YR WSEL	FB	TOP OF BRIDGE
11+75	5.9	1.2	5707.1
13+75	6.1	1.2	5707.3

CONSPAN® BRIDGE SYSTEMS

Standard CON/SPAN® Bridge Units

RISE	WATERWAY AREA (FT²) SPAN (FEET) 12	14	16	20	24	28	32	36	42	48	54	60	WEIGHT (TONS/FT) SPAN (FEET) 12	14	16	20	24	28	32	36	42	48	54	60
3	30	-	-	-	-	-	-	-	-	-	-	-	.94	-	-	-	-	-	-	-	-	-	-	-
4	43	50	55	65	-	-	-	-	-	-	-	-	1.04	1.14	1.59	1.73	-	-	-	-	-	-	-	-
5	54	64	71	85	95	-	-	-	-	-	-	-	1.14	1.24	1.71	1.86	2.05	-	-	-	-	-	-	-
6	66	78	87	105	119	129	-	-	-	-	-	-	1.24	1.34	1.83	1.99	2.18	2.36	-	-	-	-	-	-
7	78	92	103	125	143	157	184	-	-	-	-	-	1.34	1.44	1.96	2.12	2.31	2.49	2.56	-	-	-	-	-
8	90	106	119	145	167	185	216	237	-	-	-	-	1.44	1.54	2.09	2.24	2.44	2.74	2.71	4.06	-	-	-	-
9	102	120	135	165	191	213	248	268	-	-	-	-	1.54	1.64	2.21	2.36	2.57	2.79	2.86	4.29	-	-	-	-
10	114	134	151	185	215	241	280	304	334	387	435	-	1.64	1.74	2.32	2.49	2.69	2.44	4.01	4.40	4.87	5.27	6.52	-
11	-	-	-	-	239	269	312	340	375	435	489	-	-	-	-	-	2.81	3.59	4.16	4.38	5.04	5.45	6.72	-
12	-	-	-	-	-	-	344	376	418	483	543	598	-	-	-	-	-	-	4.31	4.76	5.21	5.67	6.92	7.76
13	-	-	-	-	-	-	-	412	460	531	599	658	-	-	-	-	-	-	-	4.93	5.38	5.88	7.12	7.98
14	-	-	-	-	-	-	-	448	501	579	652	698	-	-	-	-	-	-	-	5.11	5.58	6.08	7.32	8.31

ARCH LAY LENGTHS
- 12"-24" SPAN: 8'-0" LAY LENGTH
- 28"-42" SPAN: 9'-11 3/4" LAY LENGTH
- 48"-60" SPAN: 11'-7 3/4" LAY LENGTH

(41 Joints between Precast Concrete Units)

i-SERIES

MODEL	Span (ft)	Effective Rise (ft)	Waterway Area (sf)	1' Cover Total Precast Weight (Tons/ft)	5' Cover Total Precast Weight (Tons/ft)	10' Cover Total Precast Weight (Tons/ft)
i1203	12.00	3.00	30.00	1.65	1.65	1.65
i1204	12.00	4.00	42.00	1.75		1.75
i1205	12.00	5.00	54.00	1.85		1.85
i1206	12.00	6.00	66.00	1.95		1.95
i1207	12.00	7.00	78.00	2.05		2.07
i1208	12.00	8.00	90.00	2.15		2.17
i1209	12.00	9.00	102.00	2.25		2.27
i1209.83	12.00	9.83	111.96			2.35
i1210	12.00	10.00	114.00	2.35		
i1403	14.00	3.00	36.00	1.83	1.83	1.83
i1404	14.00	4.00	50.00	1.93		1.93
i1405	14.00	5.00	64.00	2.03		2.05
i1406	14.00	6.00	78.00	2.13		2.15
i1407	14.00	7.00	92.00	2.23		2.25
i1408	14.00	8.00	106.00	2.33		2.35
i1409	14.00	9.00	120.00	2.43		2.46
i1409.67	14.00	9.67	129.38			2.53
i1410	14.00	10.00	134.00	2.53		
i1603	16.00	3.00	39.00	2.37	2.37	2.37
i1604	16.00	4.00	55.00	2.50		2.50
i1605	16.00	5.00	71.00	2.62		2.64
i1606	16.00	6.00	87.00	2.75		2.77
i1607	16.00	7.00	103.00	2.87		2.91
i1608	16.00	8.00	119.00	3.00		3.04
i1609	16.00	9.00	135.00	3.12		3.19
i1609.50	16.00	9.50	143.00			3.25
i1610	16.00	10.00	151.00	3.25		

MODEL	Span (ft)	Effective Rise (ft)	Waterway Area (sf)	1' Cover Total Precast Weight (Tons/ft)	5' Cover Total Precast Weight (Tons/ft)	10' Cover Total Precast Weight (Tons/ft)
i1803	18.00	3.00	42.00	2.60	2.60	2.60
i1804	18.00	4.00	60.00	2.72		2.72
i1805	18.00	5.00	78.00	2.85		2.87
i1806	18.00	6.00	96.00	2.97		2.99
i1807	18.00	7.00	114.00	3.10		3.14
i1808	18.00	8.00	132.00	3.22		3.27
i1809	18.00	9.00	150.00	3.35		3.41
i1809.50	18.00	9.50	159.00			3.47
i1810	18.00	10.00	168.00	3.47		
i2004	20.00	4.00	65.00	2.83		3.30
i2005	20.00	5.00	85.00	2.94		3.44
i2006	20.00	6.00	105.00	3.07		3.57
i2007	20.00	7.00	125.00	3.20		3.71
i2008	20.00	8.00	145.00	3.33		3.84
i2009	20.00	9.00	165.00	3.45		3.99
i2009.33	20.00	9.33	171.60			4.03
i2010	20.00	10.00	185.00	3.86		
i2204	22.00	4.00	68.00	3.02		3.74
i2205	22.00	5.00	90.00	3.14		3.89
i2206	22.00	6.00	112.00	3.27		4.03
i2207	22.00	7.00	134.00	3.39		4.16
i2208	22.00	8.00	156.00	3.83		4.30
i2209	22.00	9.00	178.00	3.96		4.45
i2210	22.00	10.00	200.00	4.08		
i2404	24.00	4.00	71.00	3.20		3.98
i2405	24.00	5.00	95.00	3.33		4.13
i2406	24.00	6.00	119.00	3.79		4.28
i2407	24.00	7.00	143.00	3.92		4.42
i2408	24.00	8.00	167.00	4.04		4.57
i2408.83	24.00	8.83	186.92			4.69
i2409	24.00	9.00	191.00	4.17		
i2410	24.00	10.00	215.00	4.29		

Precast Waterway Charts

CONTECH ENGINEERED SOLUTIONS

CON/SPAN® O-SERIES

O-100 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O113	13' - 0"	3'-2 7/8"	33	0.86
O114	14' - 0"	4'-1 1/4"	45	0.96
O115	15' - 0"	4'-11 5/8"	57	1.06
O116	16' - 0"	5'-10"	71	1.17
O117	17' - 0"	6'-8 3/8"	85	1.28
O118	18' - 0"	7'-6 3/4"	100	1.40
O119	19' - 0"	8'-5 1/8"	116	1.52
O120	20' - 0"	9'-3 5/8"	133	1.63
O121	21' - 0"	10'-2"	151	1.76
O122	22' - 0"	11'-0 3/8"	170	1.88
O123	23' - 0"	11'-10 3/4"	189	2.01
O124	24' - 0"	12'-9 1/8"	209	2.14

O-200 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O215	15' - 0"	3'-2 3/4"	40	0.96
O216	16' - 0"	4'-1 1/8"	53	1.06
O217	17' - 0"	4'-11 5/8"	67	1.16
O218	18' - 0"	5'-10"	83	1.27
O219	19' - 0"	6'-8 3/8"	99	1.38
O220	20' - 0"	7'-6 3/4"	115	1.50
O221	21' - 0"	8'-5 1/8"	133	1.62
O222	22' - 0"	9'-3 1/2"	152	1.75
O223	23' - 0"	10'-1 7/8"	171	1.86
O224	24' - 0"	11'-0 3/8"	192	1.98
O225	25' - 0"	11'-10 3/4"	213	2.11
O226	26' - 0"	12'-9 1/8"	235	2.24

O-300 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O321	21' - 0"	4'-2 3/8"	69	1.58
O322	22' - 0"	5'-0 3/4"	88	1.70
O323	23' - 0"	5'-11 1/8"	107	1.83
O324	24' - 0"	6'-9 5/8"	128	1.97
O325	25' - 0"	7'-8"	149	2.11
O326	26' - 0"	8'-6 3/8"	171	2.26
O327	27' - 0"	9'-4 3/4"	194	2.41
O328	28' - 0"	10'-3 1/8"	218	2.56
O329	29' - 0"	11'-1 1/2"	242	2.72
O330	30' - 0"	11'-11 7/8"	268	2.89
O331	31' - 0"	12'-10 3/8"	294	3.06

O-400 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O425	25' - 0"	5'-0"	95	1.86
O426	26' - 0"	5'-10 3/8"	112	1.99
O427	27' - 0"	6'-8 3/4"	140	2.12
O428	28' - 0"	7'-7 1/8"	164	2.26
O429	29' - 0"	8'-5 1/2"	189	2.40
O430	30' - 0"	9'-3 7/8"	214	2.54
O431	31' - 0"	10'-2 1/4"	241	2.70
O432	32' - 0"	11'-0 3/4"	268	2.85
O433	33' - 0"	11'-11 1/8"	296	3.01
O434	34' - 0"	12'-9 1/2"	325	3.18

O-500 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O529	29' - 0"	5'-7"	128	2.39
O530	30' - 0"	6'-5 2/8"	154	2.56
O531	31' - 0"	7'-3 3/4"	180	2.74
O532	32' - 0"	8'-2 1/8"	207	2.92
O533	33' - 0"	9'-0 1/2"	235	3.12
O534	34' - 0"	9'-10 7/8"	264	3.32
O535	35' - 0"	10'-9 1/4"	294	3.54
O536	36' - 0"	11'-7 3/4"	325	3.76
O537	37' - 0"	12'-6 1/8"	357	4.00

O-600 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O633	33' - 0"	6'-4 1/8"	163	3.05
O634	34' - 0"	7'-2 1/2"	192	3.22
O635	35' - 0"	8'-1"	222	3.39
O636	36' - 0"	8'-11 3/8"	253	3.58
O637	37' - 0"	9'-9 3/4"	285	3.78
O638	38' - 0"	10'-8 1/8"	317	3.99
O639	39' - 0"	11'-6 1/2"	350	4.21
O640	40' - 0"	12'-4 7/8"	385	4.43
O641	41' - 0"	13'-3 1/4"	420	4.67

O-700 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O737	37' - 0"	7'-2 1/4"	204	3.49
O738	38' - 0"	8'-0 5/8"	236	3.68
O739	39' - 0"	8'-11 1/8"	270	3.88
O740	40' - 0"	9'-9 1/2"	304	4.09
O741	41' - 0"	10'-7 7/8"	339	4.31
O742	42' - 0"	11'-6 1/4"	375	4.54
O743	43' - 0"	12'-4 5/8"	412	4.78
O744	44' - 0"	13'-3"	449	5.03

O-800 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O843	43' - 0"	8'-9 3/8"	283	4.10
O844	44' - 0"	9'-7 3/4"	321	4.29
O845	45' - 0"	10'-6 1/8"	359	4.50
O846	46' - 0"	11'-4 1/2"	399	4.72
O847	47' - 0"	12'-2 7/8"	439	4.94
O848	48' - 0"	13'-1 3/8"	480	5.18

O-900 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O949	49' - 0"	8'-7"	320	4.56
O950	50' - 0"	9'-5 3/8"	363	4.78
O951	51' - 0"	10'-3 3/4"	406	5.00
O952	52' - 0"	11'-2 1/8"	451	5.23
O953	53' - 0"	12'-0 1/2"	496	5.45
O954	54' - 0"	12'-10 7/8"	543	5.72
O955	55' - 0"	13'-9 1/4"	590	5.98

O-1000 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O1055	55' - 0"	8'-11 1/8"	380	5.69
O1056	56' - 0"	9'-9 1/2"	428	5.91
O1057	57' - 0"	10'-7 7/8"	477	6.14
O1058	58' - 0"	11'-6 3/8"	527	6.38
O1059	59' - 0"	12'-4 3/4"	577	6.63
O1060	60' - 0"	13'-3 1/8"	629	6.89

O-1100 Series

SHAPE	SPAN (FEET)	RISE (FEET)	WATERWAY AREA (SF)	WEIGHT PER FOOT (TONS)
O1161	61' - 0"	10'-0 7/8"	465	6.36
O1162	62' - 0"	10'-11 1/4"	519	6.60
O1163	63' - 0"	11'-9 3/4"	573	6.84
O1164	64' - 0"	12'-8 1/8"	628	7.10
O1165	65' - 0"	13'-6 1/2"	684	7.37

ARCH LAY LENGTHS

O-100 to O-400	8'-0" LAY LENGTH
O-500 to O-800	9'-11 3/4" LAY LENGTH
O-900 to O-1100	11'-11 3/4" LAY LENGTH

* 1/4" Joints between Precast Concrete Units

DESIGN SPECIFICATIONS
AASHTO Standard Specifications for Highway Bridges - Section 16.8 & AASHTO LRFD Bridge Design - Section 12.14

MANUFACTURING SPECIFICATIONS
ASTM C1504

CON/SPAN® O-SERIES · CON/SPAN® BRIDGE SYSTEMS · BEBO® Arch Systems

CONISPAN®
BRIDGE SYSTEMS

STANDARD CONISPAN© BRIDGE UNITS																								
	WATERWAY AREA (FT.²)												WEIGHT (TONS/FT.)											
RISE	SPAN (FEET)												SPAN (FEET)											
(FT.)	12	14	16	20	24	28	32	36	42	48	54	60	12	14	16	20	24	28	32	36	42	48	54	60
3	30	*	*	*	*	*	*	*	*	*	*	*	.94	*	*	*	*	*	*	*	*	*	*	*
4	42	50	55	65	*	*	*	*	*	*	*	*	1.04	1.14	1.59	1.73	*	*	*	*	*	*	*	*
5	54	64	71	85	95	*	*	*	*	*	*	*	1.14	1.24	1.71	1.88	2.05	*	*	*	*	*	*	*
6	66	78	87	105	119	139	*	*	*	*	*	*	1.24	1.34	1.83	1.99	2.18	2.64	*	*	*	*	*	*
7	78	92	103	125	143	167	184	*	*	*	*	*	1.34	1.44	1.96	2.12	2.31	2.99	3.56	*	*	*	*	*
8	90	106	119	145	167	195	216	232	*	*	*	*	1.44	1.54	2.09	2.24	2.44	3.14	3.71	4.09	*	*	*	*
9	102	120	135	165	191	223	248	268	*	*	*	*	1.54	1.64	2.21	2.38	2.57	3.29	3.86	4.23	*	*	*	*
10	114	134	151	185	215	251	280	304	334	387	435	*	1.64	1.74	2.33	2.49	2.69	3.44	4.01	4.40	4.87	5.27	6.52	*
11	*	*	*	*	239	279	312	340	378	435	489	*	*	*	*	*	2.81	3.59	4.16	4.59	5.04	5.48	6.72	*
12	*	*	*	*	*	*	344	376	418	483	543	578	*	*	*	*	*	*	4.31	4.76	5.21	5.67	6.92	7.76
13	*	*	*	*	*	*	*	412	460	531	599	638	*	*	*	*	*	*	*	4.93	5.38	5.68	7.12	7.98
14	*	*	*	*	*	*	*	448	501	579	652	698	*	*	*	*	*	*	*	5.11	5.59	6.08	7.32	8.21

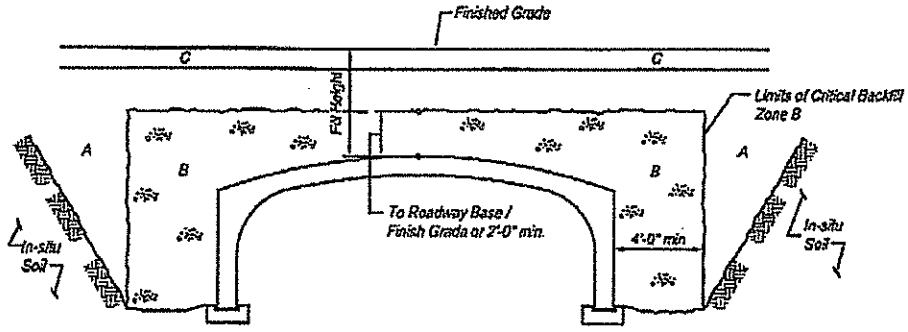
ARCH LAY LENGTHS (Nominal)

12'-24' SPAN	8' LAY LENGTH
28'-42' SPAN	6' LAY LENGTH
48'-60' SPAN	4' LAY LENGTH

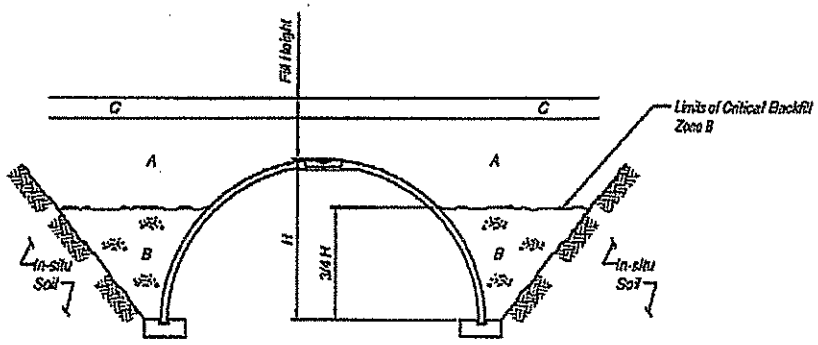
*1/4" joints between Precast Concrete Units

Backfill Requirements

Backfill is a key component of any buried structure.
Please refer to the precast element specifications for detailed requirements.



CONISPAN© Arch

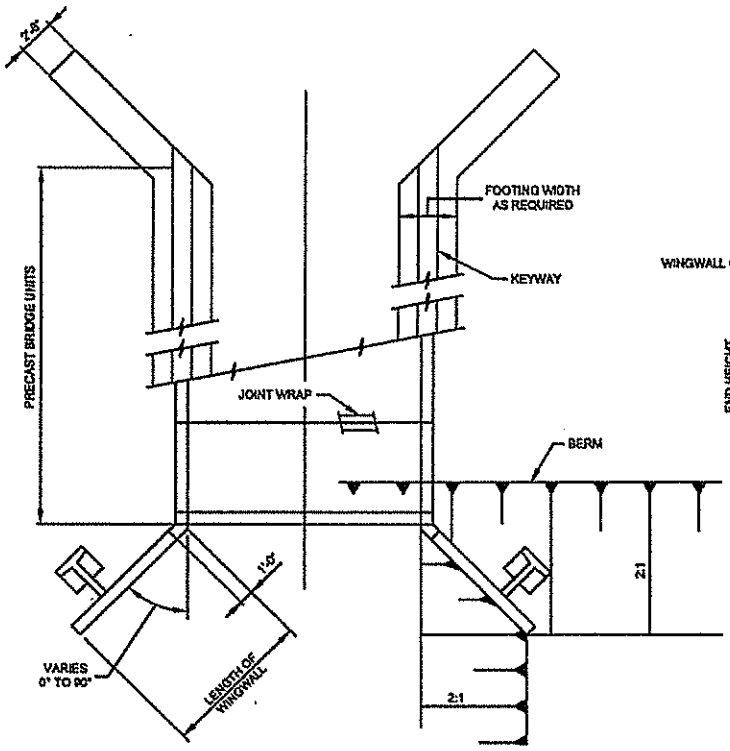


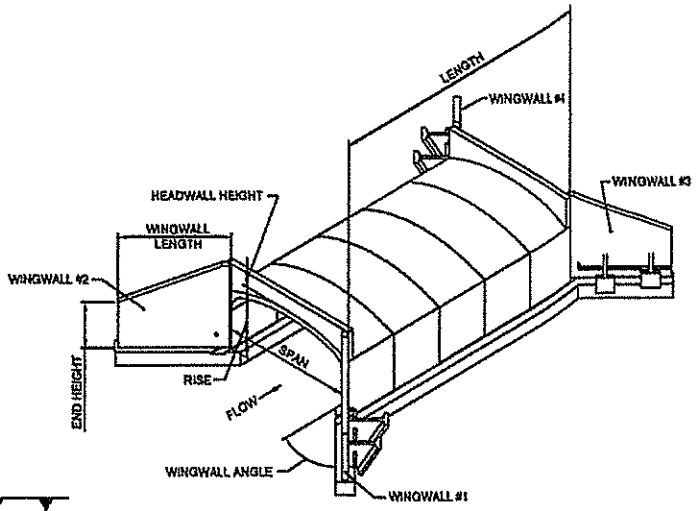
BEBO© Arch

1. *In-situ material must be sufficiently stable to allow support of the precast units.*
2. *Zone A: Embankment or overfill material shall be properly graded and compacted, per project specifications.*
3. *Zone B: Structural backfill material per CONISPAN© or BEBO© specifications. (Generally, a well-graded angular sand or gravel placed in 8" lifts and compacted to 95% of the maximum dry density, per AASHTO T-99 specification.)*
4. *Zone C: Roadway base and surface materials, per project specifications.*

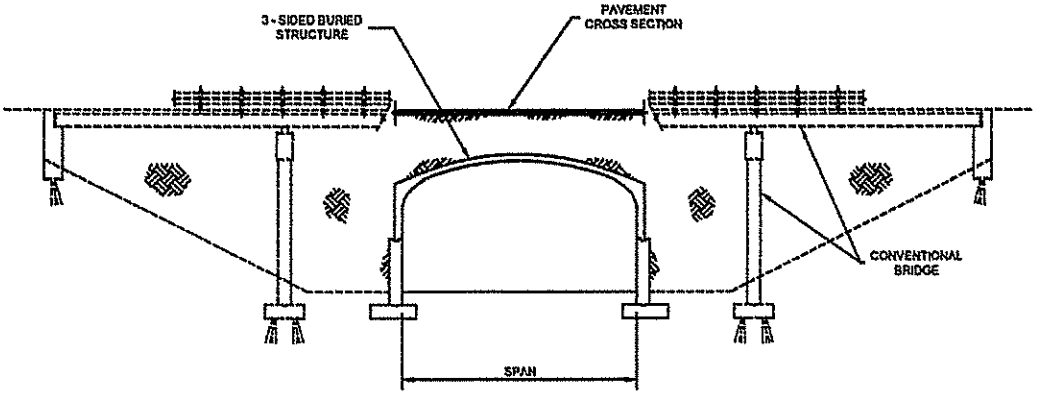
CONTECH®
ENGINEERED SOLUTIONS

Precast Details





Buried Structure vs. Bridge-at-Grade



DESIGN SPECIFICATIONS

AASHTO:
Standard Specifications for Highway Bridges - Section 16.8
LRFD Bridge Design Specifications - Section 12.14

MANUFACTURING SPECIFICATIONS

ASTM C1504

CONSPAN® BRIDGE SYSTEMS

BEBO® Arch Systems

CONSTRUCTION PLANS
FOR

EAST TRIBUTARY OF JIMMY CAMP CREEK

PORTION OF THE S 1/2 OF SECTION 14 AND N 1/2 OF SECTION 23,
TOWNSHIP 15 SOUTH, RANGE 65 WEST OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

JUNE, 2015

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

GENERAL NOTES

1. THE PHYSICAL FEATURES WITHIN THE LIMITS OF THE PROJECT HAVE BEEN SHOWN BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME OF DESIGN. THE CONTRACTOR SHALL VERIFY AND BE RESPONSIBLE FOR ALL FEATURES PRIOR TO BEGINNING ANY WORK.

2. THE CONTRACTOR ASSUMES RESPONSIBILITY FOR PROTECTION OF ALL UTILITIES DURING THE WORK. PRIOR TO ANY EXCAVATION, CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO AT 1-800-922-1987 AT LEAST TWO WORKING DAYS PRIOR TO DIGGING.

3. THE PHYSICAL FEATURES REQUIRING REMOVAL OR OBLITERATION WITHIN THE PROJECT SHALL BE REMOVED BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER OR OWNER. THOSE ITEMS REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR, REMOVED FROM THE PROJECT LIMITS AND SUITABLY DISPOSED OF EXCEPT AS SPECIFICALLY NOTED OTHERWISE.

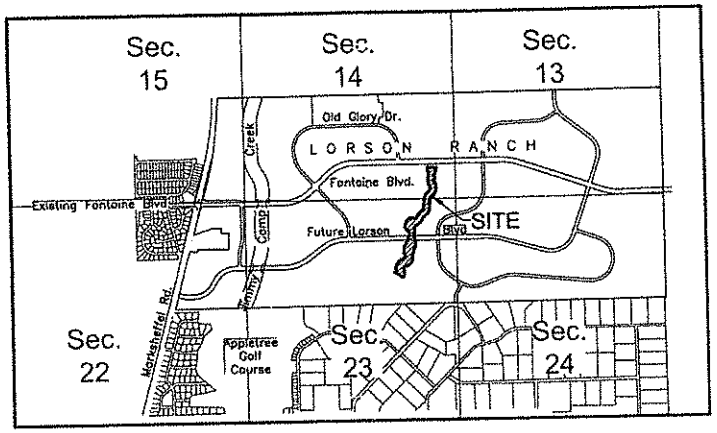
4. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS FOR WORK WITHIN PUBLIC RIGHTS OF WAY INCLUDING PERMIT FEES AND BONDS. THE CONTRACTOR WILL BE FULLY RESPONSIBLE FOR COMPLIANCE WITH ALL CONDITIONS OF THESE PERMITS. PAYMENT FOR COMPLYING WITH PERMITS WILL NOT BE MADE SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.

5. THE CONTRACTOR SHALL COORDINATE ALL CONSTRUCTION ACTIVITIES WITH ALL WORK BY FRANCHISE UTILITY COMPANIES WITHIN THE PROJECT LIMITS INCLUDING BUT NOT LIMITED TO RELOCATION OF EXISTING UTILITIES AND THE CONSTRUCTION OF NEW UTILITIES.

6. THE CONTRACTOR SHALL COORDINATE A PRE-CONSTRUCTION CONFERENCE WITH THE OWNER OR HIS REPRESENTATIVE, EL PASO COUNTY, WIDEFIELD WATER AND SANITATION DISTRICT (390-7111), AND ALL APPLICABLE UTILITY COMPANIES.

7. NO RUBBLE, DEBRIS OR DELETERIOUS MATERIALS SHALL BE PLACED IN THE BACKFILL UNDER ANY OF THE ROADWAYS, CURB AND GUTTER AND DRAINAGE STRUCTURES.

8. a) ALL STORM SEWER PIPES SHALL BE REINFORCED CONCRETE PIPE, CLASS III, UNLESS PRIOR APPROVAL IS OBTAINED FROM THE ENGINEER AND EL PASO COUNTY DEVELOPMENT SERVICES - ENGINEERING DIVISION
   b) ALL STORM SEWER BENDS SHALL BE PRE-MANUFACTURED.



VICINITY MAP
NO SCALE

SHEET INDEX

SHEET NO.	SHEET DESCRIPTION
C0.1	COVER SHEET
C0.1	HORIZONTAL CONTROL
C4.1-C4.5	GRADING PLAN, DETAILS, AND POND CONSTRUCTION
C6.1-6.4	EAST TRIB PLAN AND PROFILE
C10.1-C10.3	EAST TRIB DETAILS
C13.1-C13.3	EAST TRIB CROSS SECTION

DEVELOPER'S STATEMENT

THE UNDERSIGNED OWNER/DEVELOPER HAS READ AND WILL COMPLY WITH ALL THE REQUIREMENTS SPECIFIED IN THESE CONSTRUCTION PLANS AND THE ACCOMPANYING DRAINAGE REPORT.

BUSINESS NAME LRMD NO. 1, LORSON NORTH DEV. CORP, LORSON LLC
BY _____ DATE 7/15/15
TITLE President
ADDRESS 212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, CO 80903

CONSTRUCTION APPROVAL

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

9-1-15
ANDRE BRACKIN, COUNTY ENGINEER/ECM ADMINISTRATOR — DATE
CONDITIONS:

ENGINEER'S APPROVAL

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED ROADWAY, DRAINAGE, GRADING AND EROSION CONTROL PLANS AND SPECIFICATIONS, AND SAID PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH APPLICABLE MASTER DRAINAGE PLANS AND MASTER TRANSPORTATION PLANS. SAID PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR ROADWAY AND DRAINAGE FACILITIES ARE DESIGNED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS.

RICHARD L. SCHINDLER, P.E. # 33997
FOR AND ON BEHALF OF CORE ENGINEERING GROUP

WATER / SANITARY
WIDEFIELD WATER AND SANITATION DISTRICT
37 WIDEFIELD BLVD.
SECURITY, CO 80911
719-390-7111

CABLE
COMCAST
P.O. BOX 173838
DENVER, CO 80217
970-641-4774

ELECTRIC
MOUNTAIN VIEW ELECTRIC
11140 E. WOODMEN RD.
COLORADO SPRINGS, CO 80831
719-485-2283

SECURITY FIRE PROTECTION DISTRICT
400 SECURITY BOULEVARD
SECURITY, CO 80911
719-392-7121

TELEPHONE
CENTURYLINK
7925 INDUSTRY ROAD
COLORADO SPRINGS, CO 80939
719-278-4651

GAS
BLACK HILLS ENERGY
7060 ALLEGRE ST.
FOUNTAIN, CO 80817
719-393-6639

EL PASO COUNTY
DEVELOPMENT SERVICES
2880 INTERNATIONAL CIRCLE
COLORADO SPRINGS, CO 80910
719-520-6300

PREPARED FOR
LORSON NORTH DEV. CORP
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, CO 80903
719-635-3200
CONTACT: JEFF MARK

PREPARED BY
CORE ENGINEERING GROUP
2618 N. MEADE AVENUE
COLORADO SPRINGS, CO 80907
719-570-1100
CONTACT: RICHARD L. SCHINDLER P.E.

Note: Channel Designed for 100-year Storm Event with 5500cfs Flow (Developed).

BASIS OF BEARING

BEARINGS ARE BASED ON THE SOUTH LINE OF THE SOUTHWEST 1/4 OF SECTION 14 AS BEARING N89°43'17"E (ASSUMED MERIDIAN).

BENCHMARK

FWS MONUMENT F204 LOCATED AT THE NORTHWEST CORNER OF FONTAINE BLVD AND COTTONWOOD GROVE DR.
ELEVATION 5724.072 (N.G.V.D. 29)

CORE ENGINEERING GROUP
2618 N. MEADE AVE.
COLORADO SPRINGS, CO 80907
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: RSchindler@CORE-EG.COM

NO.	DESCRIPTION	DATE

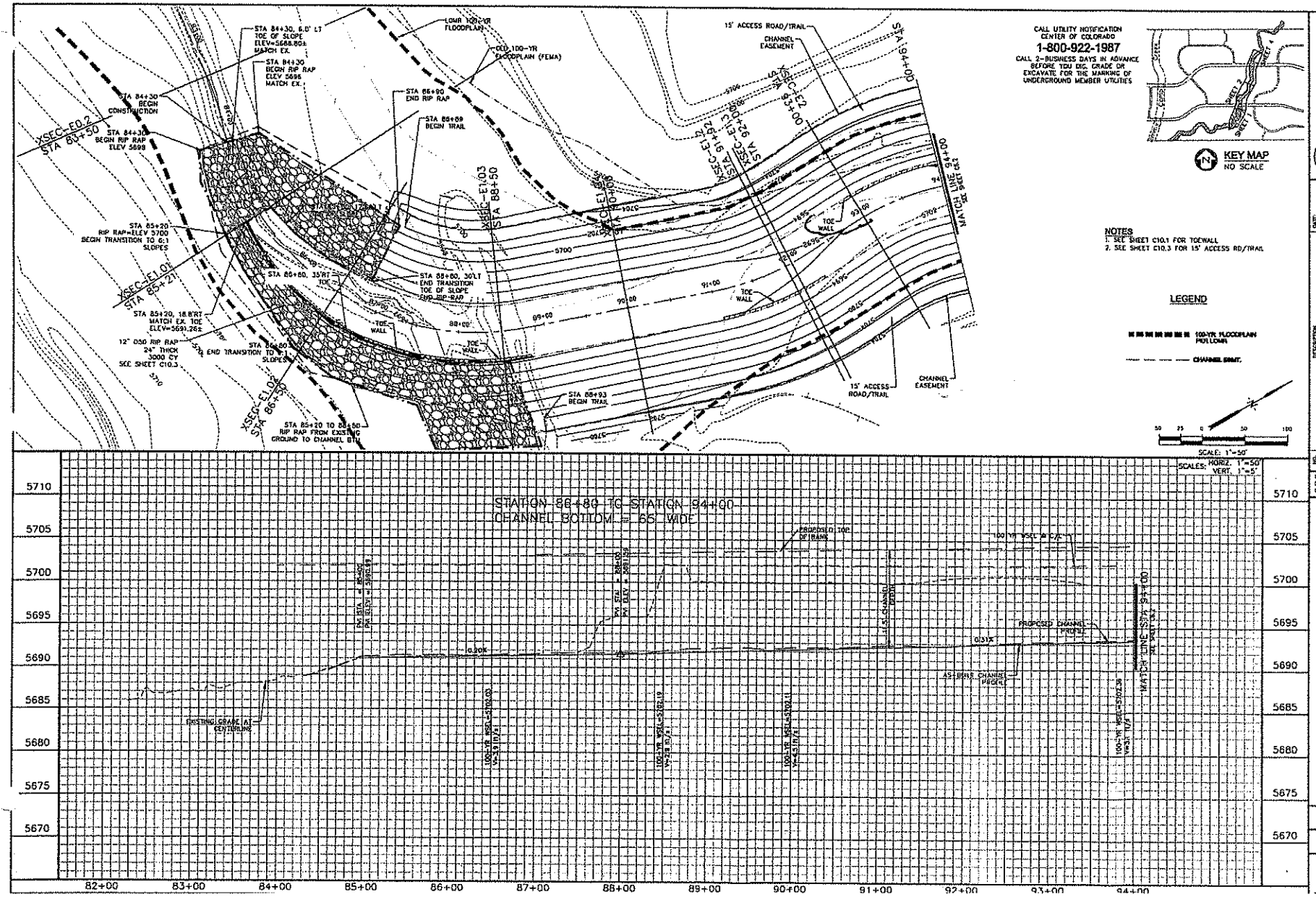
PREPARED FOR:
LORSON NORTH DEV. CORP
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, CO 80903
719-635-3200
CONTACT: JEFF MARK

PROJECT: EAST TRIBUTARY JCC
OLD GLORY DRIVE
EL PASO COUNTY, COLORADO

DRAWN: AZM
DESIGNED: LAB
CHECKED: LAB

COVER SHEET
EAST TRIBUTARY

DATE: JULY, 2015
PROJECT NO. 100.011
SHEET NUMBER C0.1
TOTAL SHEETS: 21



CORE ENGINEERING GROUP
ESMA LTD. LIABILITY CO.
PO BOX 1123, BUENA VISTA, CO 81211
PHONE: 719-395-8259
CONTACT: RICHARD L. SCHOKLER, P.E.
EMAIL: RICHMCEE1@AOL.COM

PREPARED FOR: LORSON LLC
212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
PHONE: 719-635-3200
CONTACT: DAVE GOODLIN

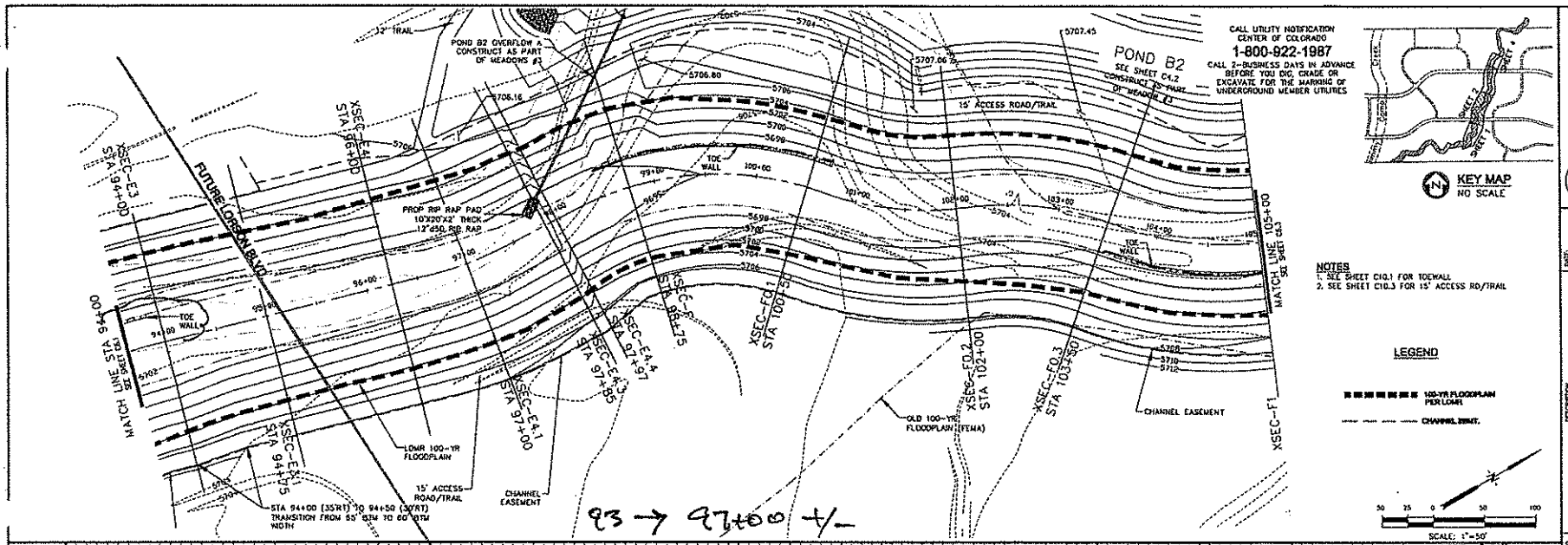
PROJECT: EAST TRIBUTARY JCC
OLD GLORY DRIVE
EL PASO COUNTY, COLORADO

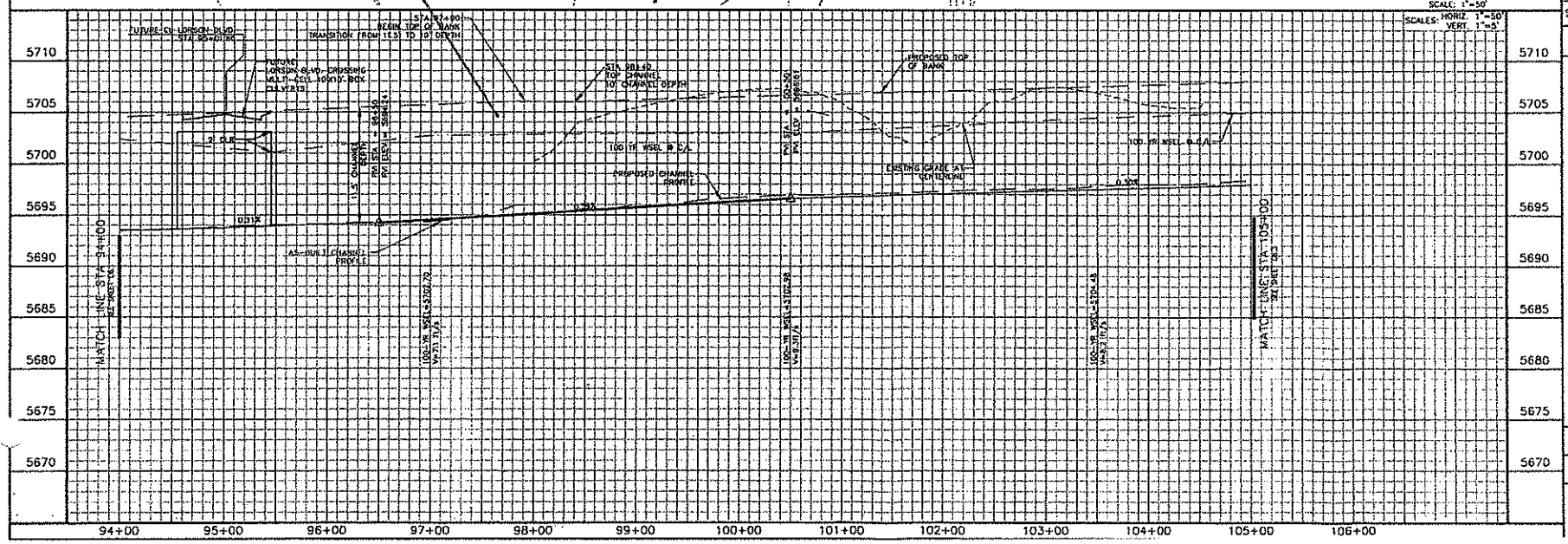
NO.	DESCRIPTION	DATE

DRAWN: ESM
DESIGNED: LAB
CHECKED: LAB

EAST TRIBUTARY
PLAN AND PROFILE
STA 82+00 TO 94+00

DATE: JULY, 2015
PROJECT NO. 100.011
SHEET NUMBER C6.1





CORE ENGINEERING GROUP
1000 S. 8TH AVENUE, S.
BRIGHTON, CO 80601
PH: 719.659.1160
CONTACT: LEE SPONSLER, P.E.
EMAIL: RICHARD@CEG.COM

PREPARED FOR: LORSON, LLC
118 N. MAIN ST., STE. 301
COLORADO SPRINGS, COLORADO 80903
CONTACT: DAVE CROCKIN
719-634-3000

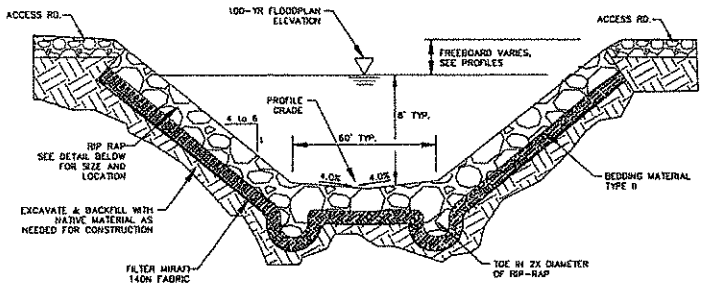
PROJECT: EAST TRIBUTARY JCC
OLD GLORY DRIVE
EL PASO COUNTY, COLORADO

DATE | DESCRIPTION | NO.

DRAWN: ABK
DESIGNED: LM
CHECKED: LS

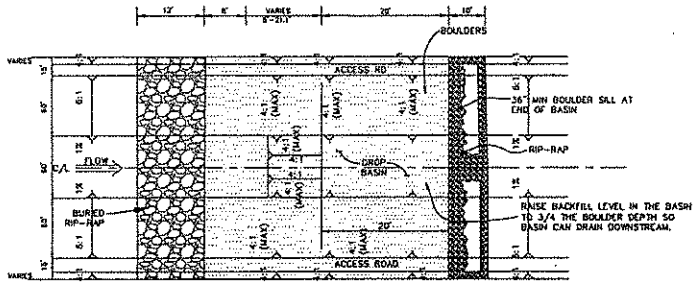
EAST TRIBUTARY
PLAN AND PROFILE
STA 94+00 TO 105+00

DATE: JULY, 2015
PROJECT NO. 100.011
SHEET NUMBER C6.2
TOTAL SHEETS: 21



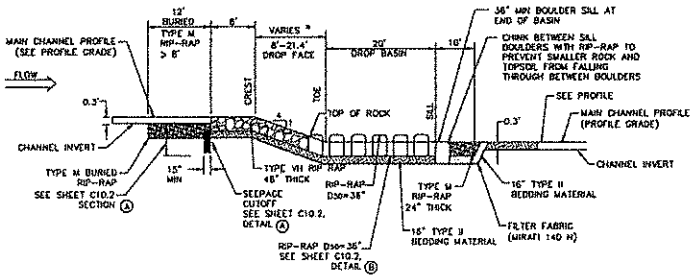
1. FUTURE DROP STRUCTURE DETAIL

NO SCALE



2A. FUTURE DROP STRUCTURE PLAN

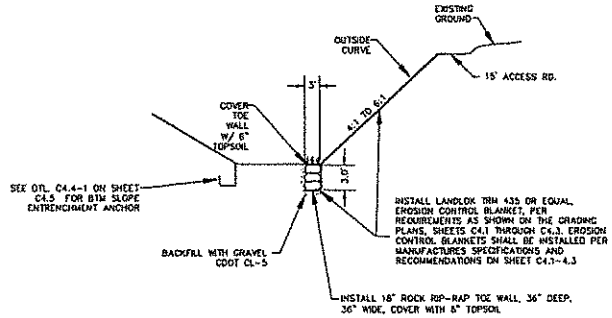
NO SCALE



2. FUTURE DROP STRUCTURE PROFILE

NO SCALE

SLOPE	DROP	*LENGTH
4:1	2'	8'
4:1	3'	12'
4:1	4'	16'



3. STONE TOE WALL PROTECTION DETAIL

GRANULAR BEDDING THICKNESS REQUIREMENTS

MINIMUM BEDDING THICKNESS (INCHES)

RIPRAP DESIGNATION	FINE GRAINED SOILS: TYPE II (INCHES)	COARSE GRAINED SOILS**: TYPE II (INCHES)
L, G, SM	12	6
M	12	6
H	12	8
VH	12	8

SUBSTITUTION OF ONE LAYER OF TYPE II BEDDING SHALL NOT BE PERMITTED AT DROP STRUCTURES. USE OF A COMBINATION OF FILTER FABRIC AND TYPE II BEDDING AT DROP STRUCTURES IS ACCEPTABLE.

** FIFTY PERCENT OR MORE BY WEIGHT RETAINED ON THE #40 SIEVE

GRADATION FOR GRANULAR BEDDING

U.S. STANDARD SIEVE SIZE	SQUARE MESH SIEVES TYPE II
3"	90-100
1-1/2"	–
3/4"	20-90
3/8"	–
#4	0-20
#16	–
#50	–
#100	–
#200	0-3

CLASSIFICATION AND GRADATION OF ORDINARY RIPRAP

RIPRAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)
TYPE VL *d50=6"	70-100	12
	50-70	9
	35-50	6
	2-10	2
TYPE L *d50=9"	70-100	15
	50-70	12
	35-50	9
	2-10	3
TYPE M *d50=12"	70-100	21
	50-70	18
	35-50	12
	2-10	4
TYPE H *d50=18"	100	30
	50-70	24
	35-50	18
	2-10	6
TYPE VH *d50=24"	100	42
	50-70	33
	35-50	24
	2-10	9

*d50 = MEAN PARTICLE SIZE IN INCHES

REF: THE COLORADO SPRINGS DRAINAGE CRITERIA MANUAL (PAGES 10-65 AND 10-66)

CORE ENGINEERING GROUP
15004 1st AVENUE S.W.
NORTH LAKE, CO 80026
PH: 719.635.3200
CONTACT: RICHARD L. SCHNEIDER, P.E.
EMAIL: Richard@1.com

NO.	DESCRIPTION	DATE

PREPARED FOR: LORSON NORTH DEV. CORP
7250 N. NEVADA AVENUE
COLORADO SPRINGS, COLORADO 80915
719-635-3200
CONTACT: SCOTT MANN

PROJECT: EAST TRIBUTARY JOC
DRAINAGE BASIN
EL PASO COUNTY, COLORADO

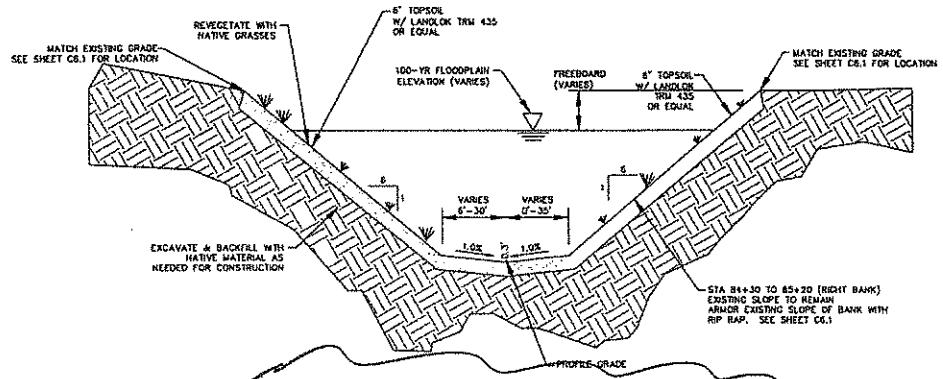
DRAWN: ABE
DESIGNED: LAB
CHECKED: LAB

EAST TRIBUTARY
TOE WALL AND FUTURE DROP STRUCTURE DETAIL SHEET

DATE: JULY, 2015

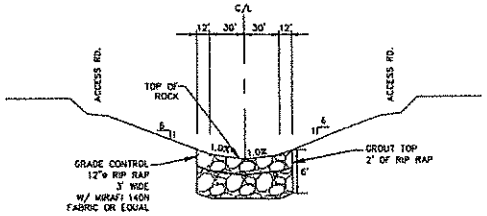
PROJECT NO. 100.013

SHEET NUMBER C10.1



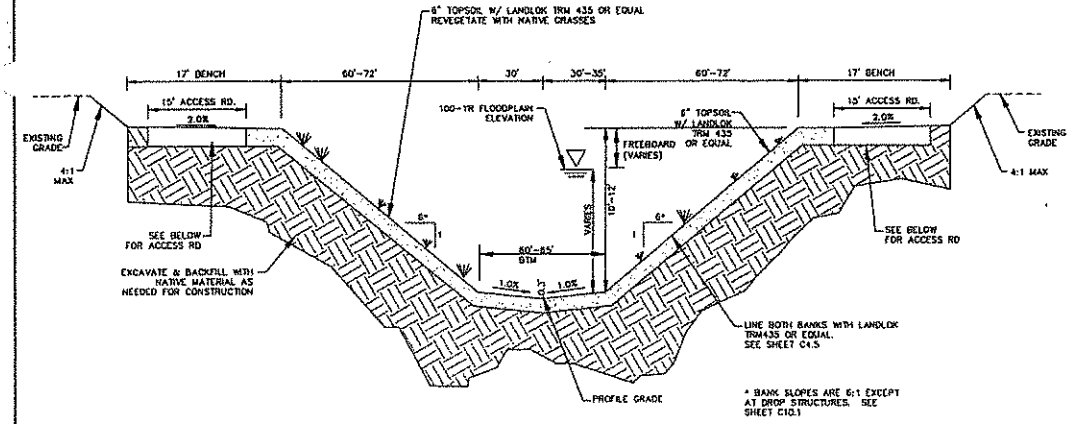
1. TYPICAL CONSTRUCTED CHANNEL SECTION (STA 84+30 TO 86+60)

NO SCALE



GRADE CONTROL STRUCTURE (STATION 105+90)

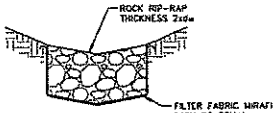
NO SCALE



2. TYPICAL CONSTRUCTED CHANNEL SECTION (STA 86+60 TO 119+78)**

**** ONLY GRADING TO OCCUR BETWEEN STA 113+60 AND 119+78**

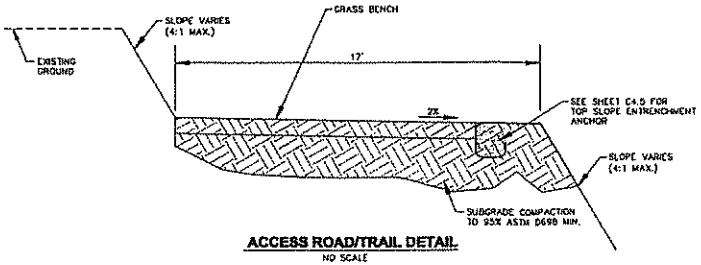
NO SCALE



TYPICAL RIP-RAP INSTALLATION

NOT TO SCALE

NOTE:
1. DO NOT USE THIS DETAIL FOR RIP RAP INSTALLATION WITHIN DROP STRUCTURES.



ACCESS ROAD/TRAIL DETAIL

NO SCALE

CORE ENGINEERING GROUP
5265 LEGACY DRIVE, SUITE 1-300
EDGEWATER, CO 80020
PH: 720.772.5605 FAX: 720.772.5606
CONTACT: JAMES L. SCHMUCK, P.E.
EMAIL: jschmuck@core-eng.com

NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON NORTH DEV. CORP
A WHOLLY OWNED SUBSIDIARY OF
COLORADO SPRINGS, COLORADO 80903
719-635-3200
CONTACT: JOE PARK

PROJECT:
EAST TRIBUTARY JCC
JOINT COMMUNITY
EL PASO COUNTY, COLORADO

DRAWN: ADM
DESIGNED: SAB
CHECKED: SAB

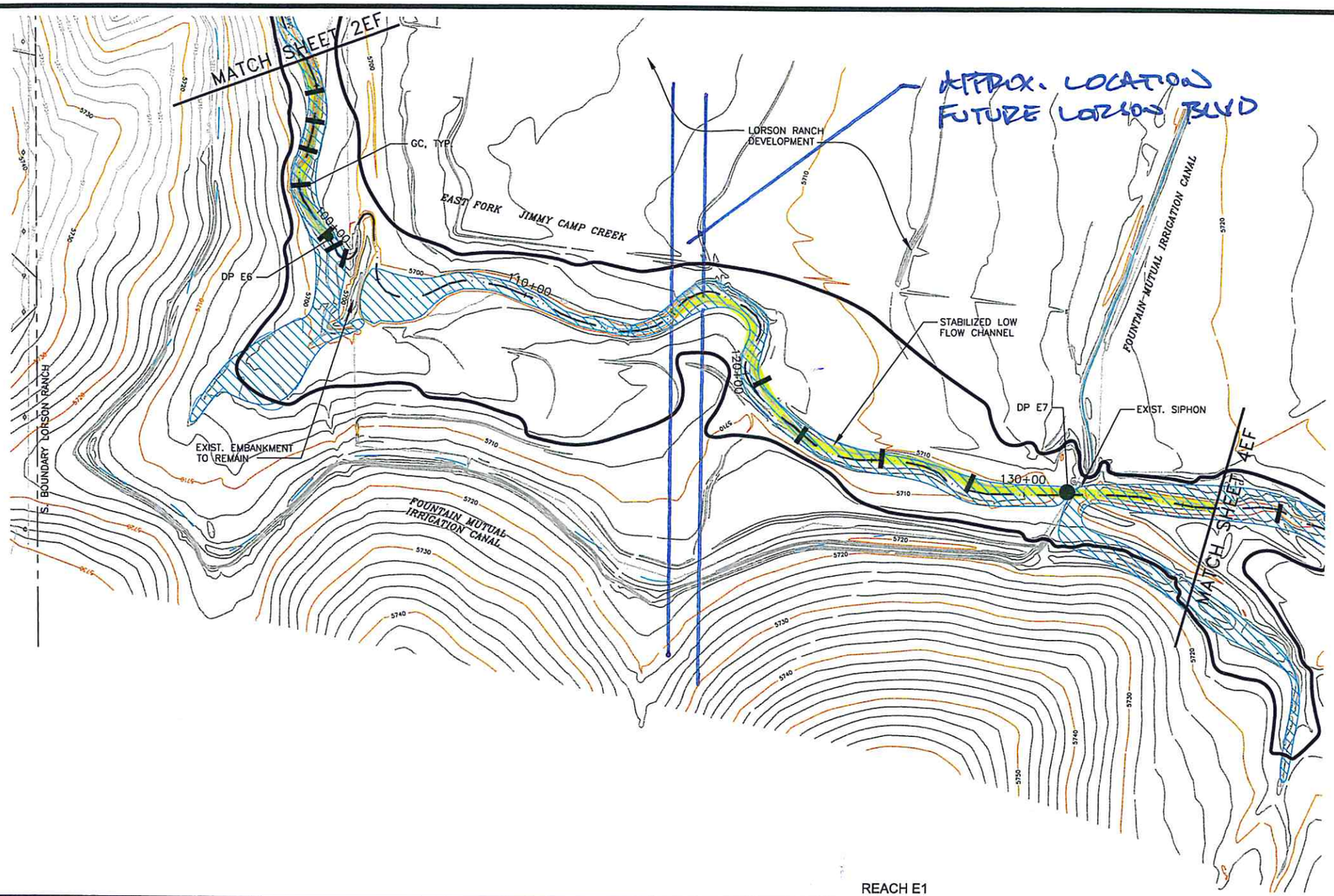
EAST TRIBUTARY
TYPICAL SECTIONS AND DETAILS

DATE: JULY, 2015

PROJECT NO. 100.011

SHEET NUMBER C10.3

TOTAL SHEETS: 21



REACH E1

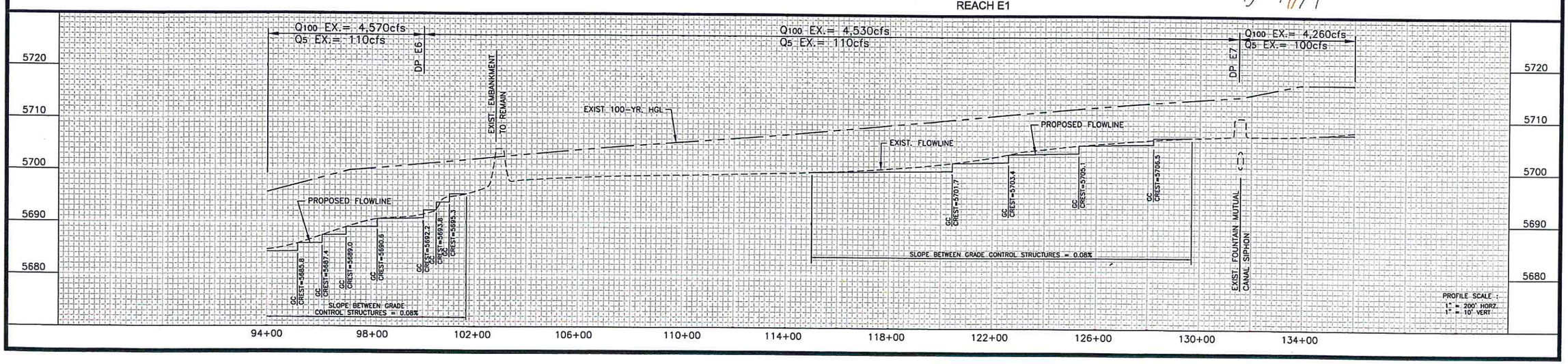
LEGEND

- 100-YR FLOODPLAIN
- STREAM FLOWLINE
- CORPORATE LIMITS
- STABILIZED LOW FLOW CHANNEL
- STABILIZED BANK
- PROPOSED FILL
- POTENTIAL JURISDICTIONAL WETLANDS
- OPEN WATER
- RIPARIAN TREES AND SHRUBS MAY INCLUDE SMALL AREAS OF WETLANDS
- POTENTIAL JURISDICTIONAL WATERS OF THE U.S. MAY INCLUDE SMALL AREAS OF WETLANDS AND/OR RIPARIAN SPECIES

FLOODPLAIN BOUNDARIES ARE FOR PLANNING INFORMATION ONLY AND ARE NOT INTENDED TO BE USED FOR FLOODPLAIN REGULATION OR MANAGEMENT.

THIS DRAWING IS A PLANNING EXHIBIT REPRESENTING CONCEPTUAL ENGINEERING AND IS SUBJECT TO REFINEMENT. THIS DRAWING SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

DISCHARGES UPSTREAM OF DP E1 HAD NO AREA ADJUSTMENT APPLIED



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

JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
EAST FORK JIMMY CAMP CREEK

CONCEPTUAL DESIGN PLAN & PROFILE

CITY OF COLORADO SPRINGS, COLORADO

Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

3EF

14008-3EF-25lcdbo.dwg/Aug 15, 2014

Appendix B

Conditional Letter of Map Revision Case No. 17-08-1043R
Proposed Condition Work Maps

TOPOGRAPHIC MAPPING IS BASED UPON AERIAL TOPOGRAPHIC MAPPING PROVIDED BY CORE ENGINEERING INC., COLORADO STATE PLANE COORDINATES 1983, AND NATIONAL GEODETIC VERTICAL DATUM OF 1929.

THE TOPOGRAPHY WAS COMPILED IN ACCORDANCE WITH NATIONAL MAPPING STANDARDS FOR 1"=200' & 2' CONTOUR INTERVAL DETAIL.

SITE BENCHMARK: FIMS MONUMENT NO. F204

RICHARD N. WRAY DATED
COLORADO LIC. 19310

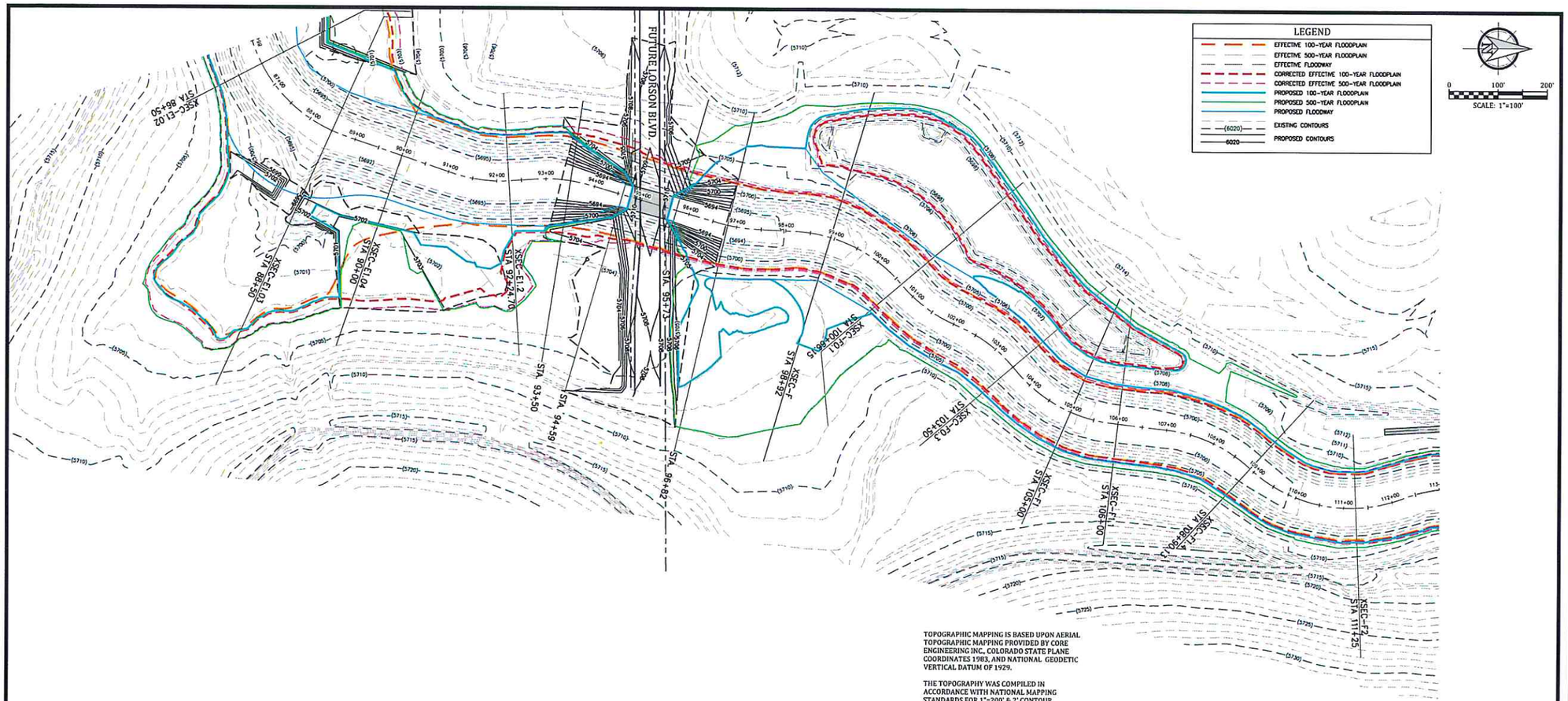
Kiowa Engineering Corporation
Celebrating 30 years
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

EAST TRIBUTARY JIMMY CAMP CREEK CLOMR
LORSON RANCH
PROPOSED CONDITIONS FLOODPLAIN MAP
EL PASO COUNTY, COLORADO

Project No.:	16031
Date:	June 21, 2017
Design:	RNW
Drawn:	ELS
Check:	RNW
Revisions:	

SHEET 1 OF 4 SHEETS

17001 Base.dwg/Oct 24, 2017



TOPOGRAPHIC MAPPING IS BASED UPON AERIAL TOPOGRAPHIC MAPPING PROVIDED BY CORE ENGINEERING INC., COLORADO STATE PLANE COORDINATES 1983, AND NATIONAL GEODETIC VERTICAL DATUM OF 1929.

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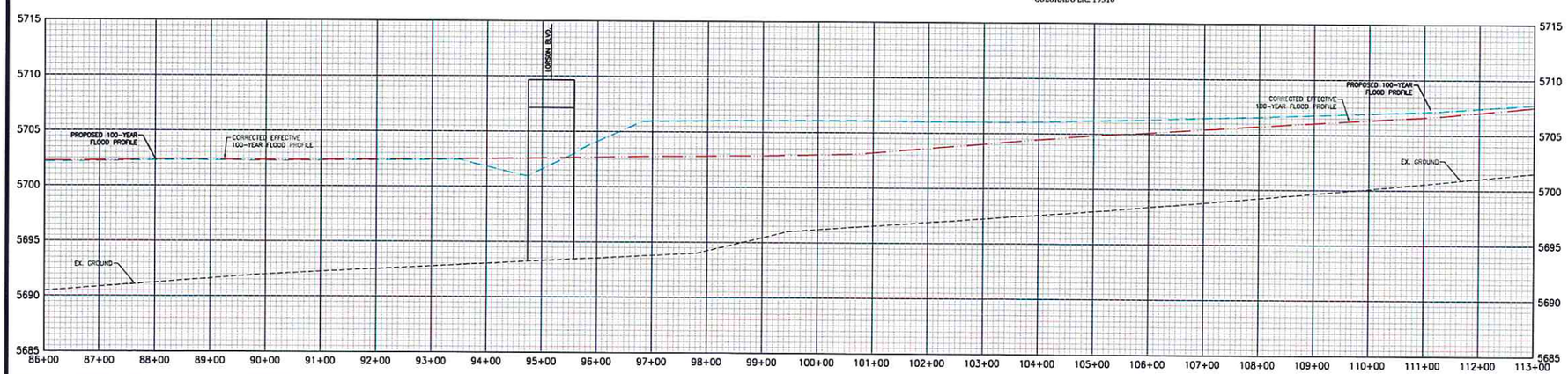
SITE BENCHMARK: FIMS MONUMENT NO. F204

RICHARD N. WRAY DATED
COLORADO LIC. 19310



Kiowa Engineering Corporation
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EAST TRIBUTARY JIMMY CAMP CREEK CLOMR
LORSON RANCH
PROPOSED CONDITIONS FLOODPLAIN MAP
EL PASO COUNTY, COLORADO

Project No.:	16031
Date:	June 21, 2017
Design:	RNW
Drawn:	ELS
Check:	RNW
Revisions:	

SHEET 2 OF 4 SHEETS

17001 Base.dwg/Oct 24, 2017

Appendix C

Lorson Ranch 404 Permit

REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
SOUTHERN COLORADO REGULATORY OFFICE
200 S. SANTA FE AVENUE, SUITE 301
PUEBLO, COLORADO 81003

September 7, 2017

Regulatory Division

SUBJECT: Action No. SPA-2005-00757; Modification to the Lorson Ranch Permit in El Paso County, Colorado

Elizabeth Klein
Kiowa Engineering
1604 South 21st Street
Colorado Springs, CO 80904

Ms. Klein:

The U.S. Army Corps of Engineers (Corps) is in receipt of your letter dated August 3, 2017, requesting a modification to the Department of the Army permit for the discharge of dredged and fill material into waters of the United States associated with Lorson Ranch. This includes the bridge construction and stream configurations and updating delineation for upland swale in the Lorson ranch development, Fountain, El Paso County, Colorado.

We have reviewed and hereby approve your request. Action Number SPA-2005-00757 is modified as follows: This includes approval of the Special Condition 1 - Lorson Blvd. & Fontaine Blvd. bridge design and stream configuration, Special Condition 2 – no action required; and Upper Reach Item #2 Stabilization – No permit required.

Replace the project description on page one of your permit with: Insert the approved designs into the Permit as an attachment to the Special Condition 1.

The expiration date of your is still September 30, 2021.

This modification is effective immediately. All other terms and conditions of the original permit remain in full force and effect.

If you have any questions concerning this letter, please contact me at (719) 543-6915 or by e-mail at Van.A.Truan@usace.army.mil.

Sincerely,

TRUAN.VAN.ALLAN.1231422150

Digitally signed by TRUAN.VAN.ALLAN.1231422150
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=TRUAN.VAN.ALLAN.1231422150
Date: 2017.09.07 09:15:45 -06'00'

Van Truan
Chief, Southern Colorado
Regulatory Branch

16031 File

Kiowa
Engineering Corporation

August 3, 2017

Mr. Van Truan
U. S. Army Corps of Engineers
200 South Santa Fe Avenue Suite 301
Pueblo, Colorado 81003

Re: SPA Action No. 2005 00757
Lorson Ranch East Fork Jimmy Camp Creek Permit Modification Amendment No.1
El Paso County, Colorado
(Kiowa Project No. 16031)

Dear Van:

Following our telephone conversation of last January, we are submitting a Permit Modification Amendment No. 1 for the above-mentioned project on behalf of Lorson Development and requesting your concurrence.

Action Number 2005 00757 Modification Amendment Request No. 1

Project impacts for the East Fork Jimmy Camp Creek on the Lorson Ranch were originally authorized under the above-mentioned Action Number by the Pueblo Regulatory Office on September 22, 2006 with an expiration date of December 31, 2009. The permit authorized channel bank linings, grade control structures and two roadway crossings for three segments for the entire length of the East Fork Jimmy Camp Creek on the Lorson Ranch. See Exhibit 1, Permit Modification Amendment 1 Map (attached) for location of existing, proposed, and future activities discussed here.

The central stream segment, designed as a reconfigured reach (Item#1 on Exhibit 1) was completed in about 2007 or 8. Subsequently, a construction standstill in 2009 occurred with no further activity. It appears that the permit has been extended twice, first to September 2001 and then to September 2021.

At that time, about 3,600 linear feet of reconfigured trapezoidal channel consisting of 100-Year riprap bank linings and grouted grade control structures were completed (*Photograph #1*). The bottom width was designed at about 60-feet wide and the top width was about 180-feet wide. Currently, the reconfigured channel is vegetated with upland vegetation with areas of exposed rock on the bank linings and grouted drops structures.

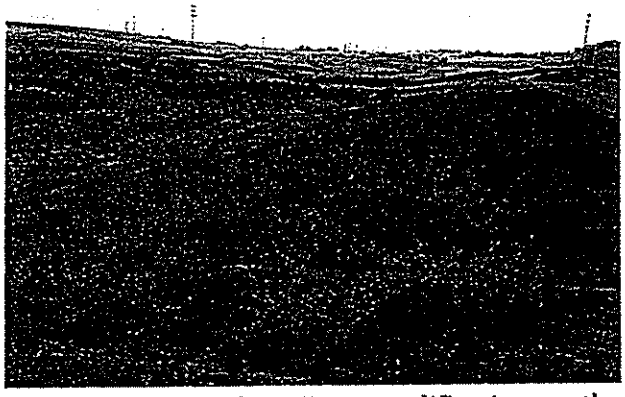
The purpose of this Modification Amendment is to address and clarify Special Conditions in the permit and summarize all future activities that were originally authorized in this permit. An

1604 South 21st Street, Colorado Springs, Colorado 80904-4208

additional Modification Amendment Request will be submitted in the future to address remaining authorized activities.

Special Condition 1

Per Special Condition 1, final design drawings for Fontaine Boulevard and Lorson Boulevard Bridges need to be submitted for review and approval 60 days prior to construction. At this time, we are transmitting final design drawings for the proposed Fontaine Boulevard and Lorson Bridges (see attachments.)



The proposed Fontaine Boulevard Bridge (Item #3) will be a 48-foot span, 130-foot long by 14-foot high arched Contech pre-cast bridge and pre-cast headwalls with an ungrouted rock invert. This bridge will be constructed over the north termination of the existing reconfigured trapezoidal channel reach (*Photograph #2*). Minor modifications to the reconfigured channel in the vicinity of the bridge will be necessary to link the existing improvements to the proposed bridge.

The proposed Lorson Boulevard Bridge (Item #4) is currently in final design and is expected to be constructed in the early spring of 2018. The location of Lorson Boulevard Bridge will be over the reconfigured channel at about the location of Photograph #1. The Lorson Boulevard Bridge will be a 48-foot span, 84-foot long by 13-foot high arched Contech pre-cast bridge and pre-cast headwalls with an ungrouted rock invert. Similar to Fontaine Boulevard Bridge, minor modifications to the reconfigured channel under the bridge will be required to match the existing condition.

Special Condition 2

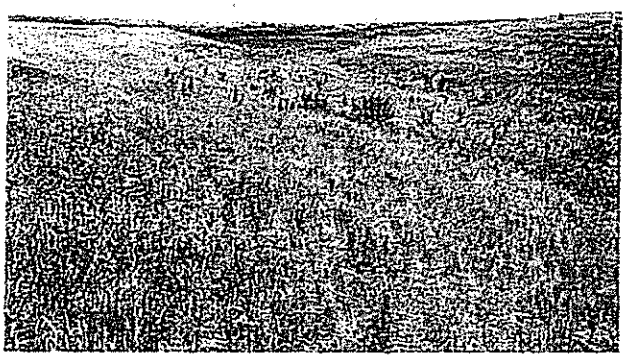
This Special Condition refers to the lower stream preservation reach (Item #5 on Exhibit 1) that has not yet been designed. This reach will be about 3,900 linear feet of three-to-one riprap bank linings in select locations with possibly one to several grade control structures. We anticipate the bottom width of the channel will be less than 20-feet. The design concept for this reach is to retain the stream alignment, to avoid future channel incision and to lay back nearly vertical banks to three-to-one. Modifications to this channel segment are anticipated to be minimal.

The Lorson Ranch has been delineated twice during the permitting process. The original delineation by Savage and Savage in 2002 for the overall project delineated both the Mainstem Jimmy Camp Creek and the East Fork Jimmy Camp Creek. Subsequently, the Mainstem Jimmy Camp Creek was permitted and completed under Action No. 2002 00701. The East Fork Jimmy Camp Creek in the Lorson Ranch was again delineated in March 7, 2006 by AG Environmental Services, Inc. under Action No. 2005 00757. The existing delineations for this reach will be reviewed and verified for current conditions. The existing delineations for this reach will be reviewed and verified

for current conditions. Improvements for this segment will be addressed in a future permit modification amendment.

Upper Reach Item#2 Stabilized Channel

The upper reach (Item#2 *Photograph# 3*) was originally a portion of the stream reconfiguration reach. This upper segment was not and currently is not wetland or a water of the U.S. This reach is a vegetated swale with upland vegetation and lacks a bed and bank configuration. The permit requests the channel design for this reach for clarity.



Prior to design, this reach was re-evaluated by Kiowa according to current criteria with the result being that channel reconfiguration is no longer required. A stabilized floodplain section can appropriately be applied here with three small sloping grouted boulder drop structures 6-foot long, 2,900 linear feet of low flow soil/rock and TRM lined channel and 1,020 linear feet buried rock/soil bank linings in select locations on outside bends. The bottom width of the low flow channel will be 25-feet and the top-width will be 43-feet. The stabilized floodplain section allows for the preservation of the stream alignment and prevents future channel incision. The overall design will provide an alternative with significantly less environmental impact than a reconfigured channel This portion of the work will be constructed in an upland swale and therefore is non-jurisdictional, but design plans are being submitted per permit request for review and approval by the COE 60 days prior to construction.

Please let us know if you need more information.

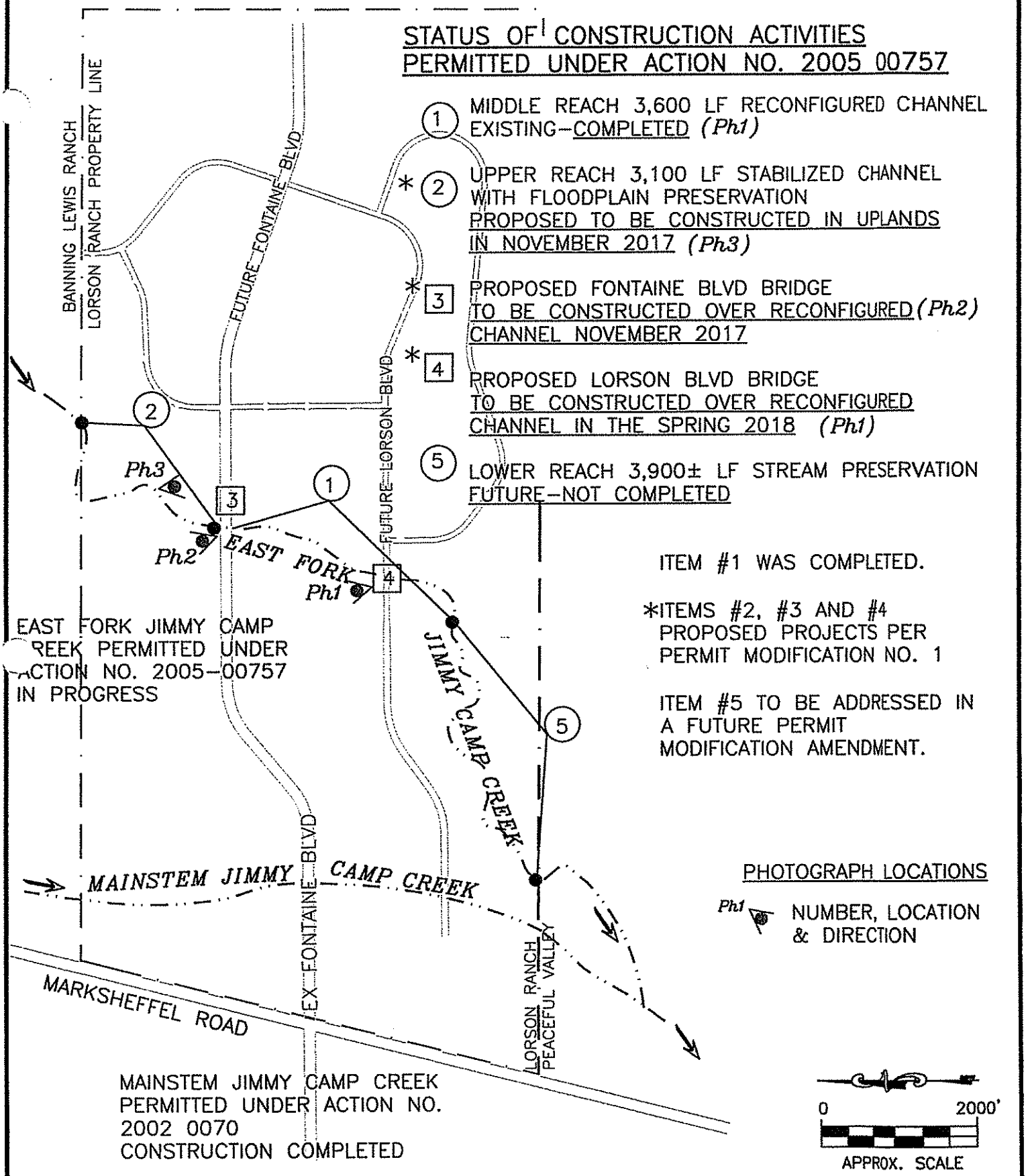
Sincerely,
KIOWA ENGINEERING CORPORATION

Elizabeth Klein

Elizabeth A. Klein
Certified Wetland Scientist

Encs. Exhibit 1
Fontaine Boulevard Bridge and East Fork Jimmy Camp Creek Channel Design Drawings
Lorson Boulevard Bridge

cc: Jeff Mark, Lorson Development
Richard Schindler, Core Engineering



LORSON RANCH
PERMIT MODIFICATION AMENDMENT NO. 1 MAP

ACTION NO. 2005 00757

EL PASO COUNTY, COLORADO

EXHIBIT 1

DATE: 08/03/17
PROJECT NO. 16031

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

DEPARTMENT OF THE ARMY PERMIT

Permittee Lorson LLC nominee for Lorson Conservation Investment 1, LLLP

Permit No. 2005 00757

Issuing Office Albuquerque District Corps of Engineers

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: The work includes modifying the lower 3,110 linear feet of stream with bank protection while preserving the stream alignment (stream preservation reach), and reconfiguring the upper 5,825 linear feet of the stream (reconfiguration reach). Specifically:

In the lower stream preservation reach, about 3,110 linear feet will be treated on one or both banks by regrading the overbank to 3H:1V and treating with concrete or synthetic matting with seeded topsoil beneath the mat. About 350 linear feet will be treated with stone toe protection with soil coir lifts. One or two grade control structures may be built to provide protection from future channel incision.

In the upper reconfiguration reach, a breached stock pond dam will be removed. About 4,025 linear feet of the upper channel will be reconstructed with a bottom width of about 40 feet, side slopes no steeper than 6H:1V, and a natural channel bottom. The new channel side slopes will be protected with a mat material that will provide stability while allowing establishment of vegetation. Eleven boulder grade control structures will be built.

The upper 1,800 linear feet of the channel is actually an upland swale and is not a water of the U.S. However, it's channel design is included in the permit for clarity.

Two road crossings will be built in the upper reach for Lorson Boulevard and Fontaine Boulevard. These structures will be two or three concrete arch, natural bottom spans. A temporary construction crossing may be built in the upper stream portion.

The project will be constructed in accordance with the attached drawings, entitled, "Lorson Ranch channel modification in East Tributary of Jimmy Camp Creek near Fountain, El Paso County, Colorado, Application by: Lorson LLC, Application No. 2005 00757," sheets 1 through 16, dated May 17, 2006.

Project Location: In the East Tributary of Jimmy Camp Creek and adjacent wetlands in the east portion of the Lorson Ranch development located east of the intersection of Fountaine Boulevard and Marksheffel Road near Fountain, El Paso County, Colorado, Sections 13, 14 and 23, Township 15S, Range 65W (38° 44.1′ N Latitude, 104° 37.9′ W Longitude).

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on December 31, 2009. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

After a detailed and careful review of all of the conditions contained in this permit, the permittee acknowledges that, although said conditions were required by the Corps of Engineers, nonetheless the permittee agreed to those conditions voluntarily to facilitate issuance of the permit; the permittee will comply fully with all the terms of all the permit conditions.

1. Final bridge designs for Fontaine Boulevard and Lorson Boulevard will be submitted to the Corps of Engineers for review and approval 60 days prior to start of each bridge construction. Project construction of each structure may begin upon the Corps of Engineers' issuance of a start-of-work authorization.

2. The bank armoring for the stream preservation (lower) reach will be ungrouted stone toe with coir fabric lifts or similar materials. A final design for the stream preservation reach, including vegetation species list, will be submitted to the Corps of Engineers for review and

approval 60 days prior to start of bank armoring construction. Project construction may begin upon the Corps of Engineers' issuance of a start-of-work authorization.

3. The bank armoring for the reconfiguration (upper) reach will be armorflex, geogrid, or similar materials. The bank armoring will be covered with at least 6 inches of topsoil and seeded with grasses. The boulder grade control structures will be ungrouted. A final design for the reconfigured channel reach, including vegetation species list, will be submitted to the Corps of Engineers for review and approval 60 days prior to start of channel construction. Project construction may begin upon the Corps of Engineers' issuance of a start-of-work authorization.

4. Sloping boulder grade control structures will be ungrouted and designed to allow passage of small fish. For the stream preservation (lower) reach, the location of grade control structures and their design will be submitted to the Corps of Engineers for review and approval 60 days prior to the start of grade control structure construction.

5. Erosion control measures will be implemented to prevent upland erosion into the East Tributary of Jimmy Camp Creek. All upland areas disturbed by the permittee or their (sub)contractors located within 200 feet of the stream will be treated with erosion control measures including placing topsoil, seeding, and mulching within 21 calendar days after final grading or final earth disturbance or in accordance with the erosion control plan required by El Paso County. An erosion control plan or a summary of the County's approved plan will be provided to the Corps of Engineers within 60 days of permit issuance.

6. Noxious weeds will be controlled in all project-disturbed areas within 200 feet of the stream during the 5-year maintenance period. A plan for such control will be provided to the Corps of Engineers within 60 days of permit issuance, for review and approval.

7. A detailed mitigation plan will be provided to the Corps of Engineers within 60 days of permit issuance, for review and approval prior to start of project construction. Project construction may begin upon the Corps of Engineers' issuance of a start-of-work authorization. The plan will provide for the mitigation of the loss of 4.56 acres of wetland shrubs and the loss of riparian trees. The mitigation work will begin in the spring following winter construction (or in the fall following summer construction) and be completed within 6 months of project construction. The plan will include, but is not limited to, the following items:

- A typical cross section showing the area to be planted with shrubs and trees,
- Planting densities and number and species of trees,
- Methods and times of year for planting. (If willow stakes are used, they must be planted with no more than 6 inches of the stake exposed above the ground.) And,
- A plan for short and long term management and maintenance of the mitigation sites, including supplemental tree watering if needed,

replacement of failed plantings before the end of the 5-year monitoring period, and other contingency needs.

8. The mitigation efforts must be maintained for at least 5 years including 5 growing seasons or until the Corps of Engineers has determined that the mitigation efforts have been successful. Tree plantings will be deemed successful when 80% of the planted trees are alive at the end of the 5-year period. Willow shrub plantings will be deemed successful when 50% of the planted shrubs are alive at the end of the 5-year period.

9. An annual monitoring report of mitigation activities is required and will be sent to the Corps of Engineers by October 31 of each year. The monitoring report will include as a minimum:

- A drawing or sketch showing photographic monitoring points,
- Before and after photographs from fixed photographic location(s),
- A brief discussion of the overall success, any bare or problem areas, and a plan to remedy any problem areas.

10. A letter of intent from the local governing authority will be provided as financial assurances for construction, and for contingency and monitoring of the mitigation for the 5-year monitoring period. The assurances of the mitigation effort will be provided sufficient to hire an independent contractor to complete the proposed mitigation should the permittee default. The financial assurance for construction of the mitigation project will in an amount equal to 115 percent of the estimated cost of construction. The financial assurance for contingency and monitoring of the mitigation for the 5-year monitoring period will be in an amount equal to 25% of the construction costs and will be to assure the success of the mitigation. The letter of intent will be submitted to the Corps of Engineers, for approval, within 90 days of permit issuance.

11. Any changes to the project must be approved by the Corps of Engineers through a permit modification prior to the changes being implemented.

Further information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(XX) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE)

(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Van A. Truan
Chief, Southern Colorado Regulatory Office
(for the DISTRICT ENGINEER)

22 September 2006
(DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFERREE)

(DATE)

Appendix D

Lorson Boulevard Bridge Geotechnical Soils Borings

NCRS Soil Survey Lorson Ranch

TEST BORING: 3
DATE DRILLED:
6/2/16
REMARKS:
GROUNDWATER @ 12.5 '
6/7/16 5204.5 TOP EL.

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, tan, medium dense, moist				
5			35	8.9
10			10	5.2
CLAY, SANDY, brown, stiff, moist to wet				
15			16	21.5
SAND, CLAYEY, tan, loose, moist to wet				
20			8	23.1
25				28.0
30				
35				
40				
45				
CLAYSTONE, SANDY, gray, moist to wet				
				22.7

5160.5

TEST BORING: 4
DATE DRILLED:
6/1/16
REMARKS:
GROUNDWATER @ 12.5 '
6/2/16 TOP 5204.5

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, gray to brown, medium stiff to very stiff, moist to wet				
5			50	9.3
10			25	19.6
15			5	22.8
SAND, SILTY, tan, loose, moist to wet				
20			14	20.9
				19.9

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS
RMG
ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

TEST BORING LOGS

JOB No. 152808

FIGURE No. 3

DATE 9/15/16

SOILS DESCRIPTION

CLAYEY SAND

CLAYSTONE

SANDY CLAY

SILTY SAND

SILTY TO CLAYEY SAND

SYMBOLS AND NOTES

XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

FREE WATER TABLE

DEPTH AT WHICH BORING CAVED

BULK — DISTURBED BULK SAMPLE

AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS
RMG
ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 152808

FIGURE No. 1

DATE 9/15/16

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	% Swell/ Collapse	FHA Expansion Pressure (psf)
1	4.0	9.6							
1	9.0	7.8							
1	14.0	8.6							
1	19.0	13.3							
1	24.0	15.1							
2	4.0	6.6							
2	9.0	11.6							
2	14.0	16.8	107.6	39	26		91.0	- 0.1	
2	19.0	17.9							
2	24.0	14.5							
3	4.0	8.9							
3	9.0	5.2		NP	NP		27.8		
3	14.0	21.5							
3	19.0	23.1							
3	24.0	28.0							
3	48.0	22.7							
4	4.0	9.3							
4	9.0	19.6							
4	14.0	22.8							
4	19.0	20.9	102.2	NP	NP	0.0	17.9	- 0.4	
4	23.0	19.9							

ROCKY MOUNTAIN GROUP

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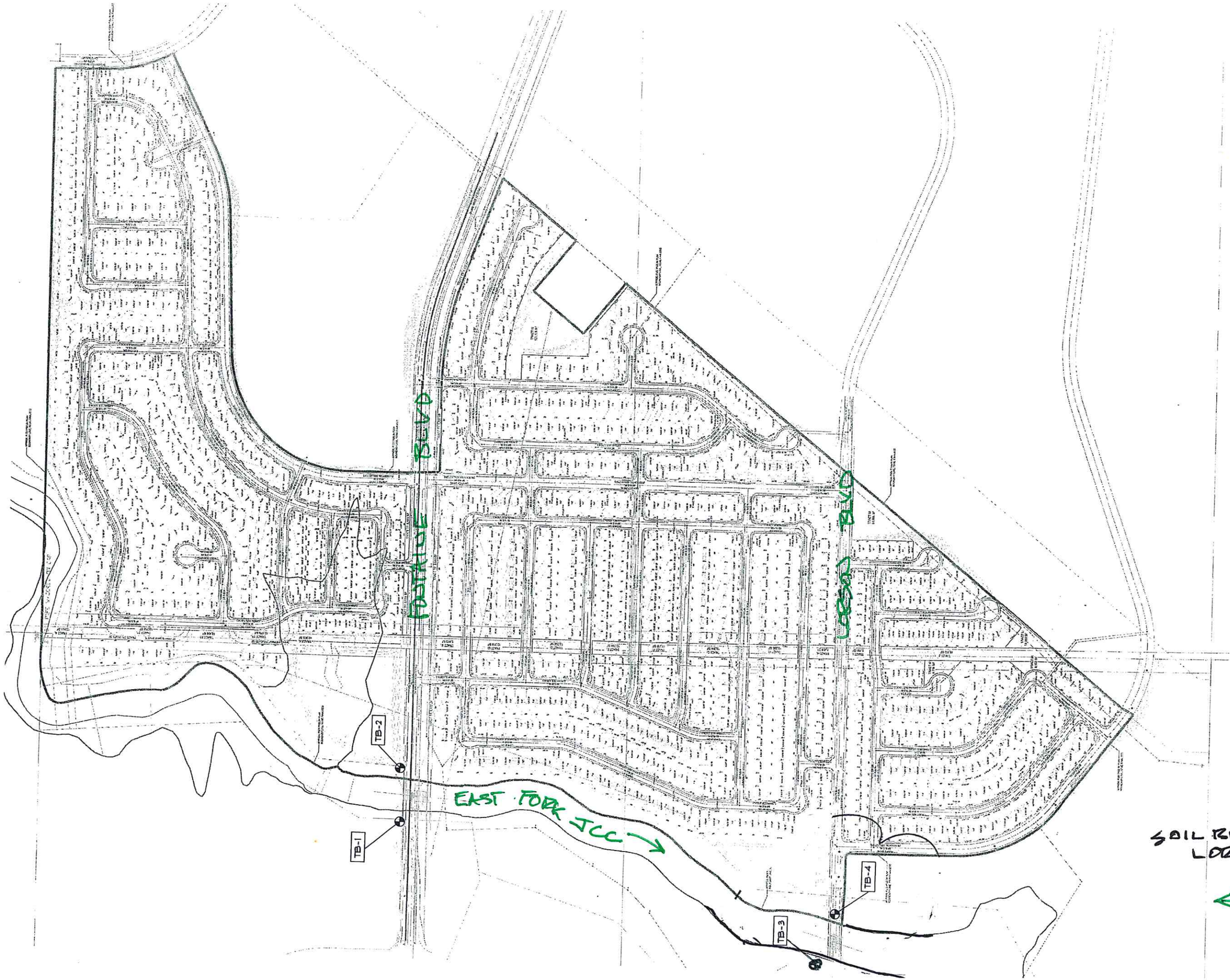
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 152808
FIGURE No. 4
PAGE 1 OF 1
DATE 9/15/16



SOIL BORING LOCATIONS
LORDON BLVD.

N

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

Lorson Ranch

April 26, 2017

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://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

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 Web Soil Survey, the site for official soil survey information.

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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.

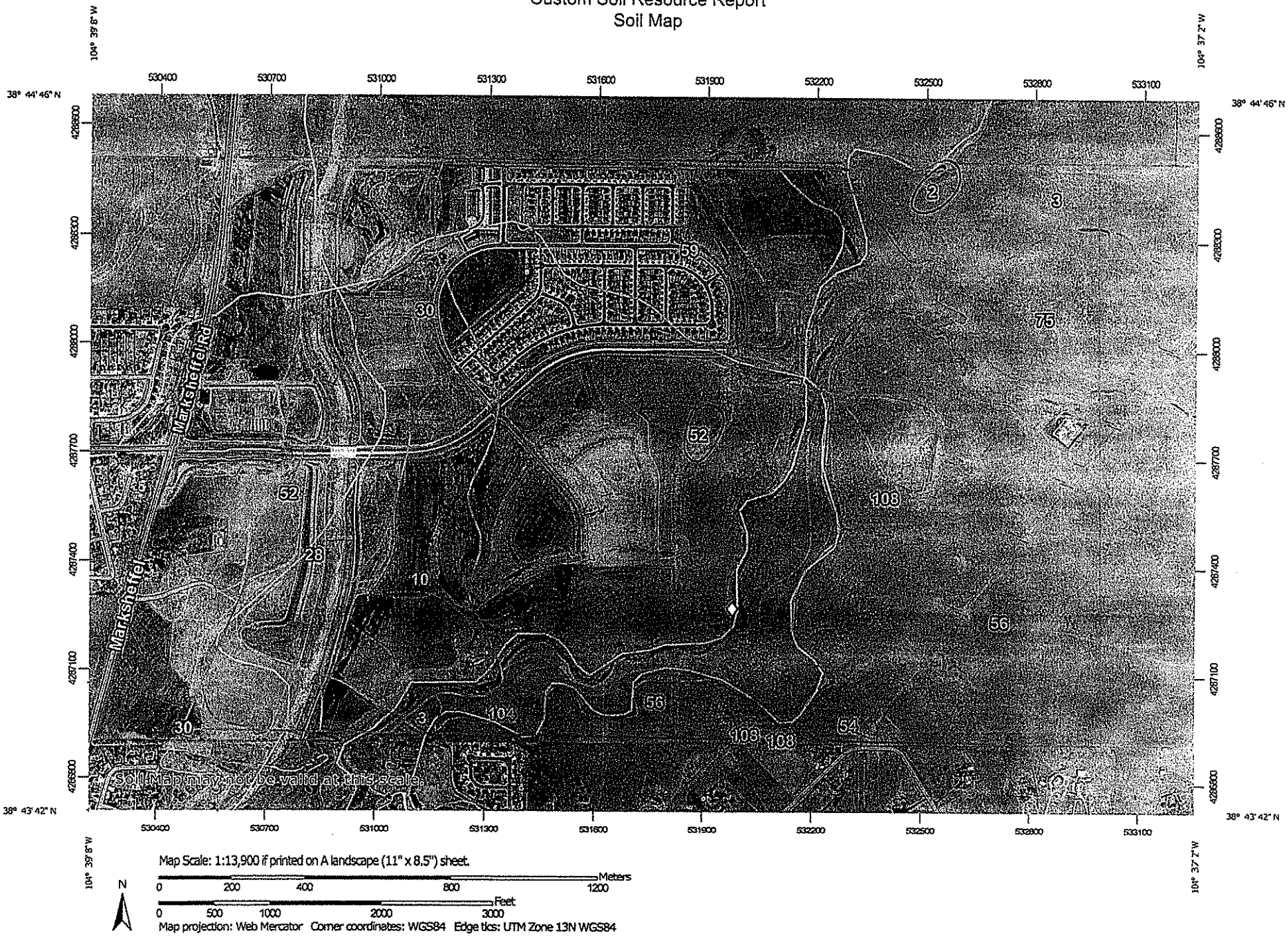
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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 Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

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

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.

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	12.5	1.5%
3	Ascalon sandy loam, 3 to 9 percent slopes	11.0	1.3%
10	Blendon sandy loam, 0 to 3 percent slopes	70.2	8.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	75.7	8.9%
30	Fort Collins loam, 0 to 3 percent slopes	24.8	2.9%
52	Manzanst clay loam, 0 to 3 percent slopes	315.6	37.0%
54	Midway clay loam, 3 to 25 percent slopes	3.7	0.4%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	129.4	15.2%
59	Nunn clay loam, 0 to 3 percent slopes	85.4	10.0%
75	Razor-Midway complex	25.8	3.0%
104	Vona sandy loam, warm, 0 to 3 percent slopes	9.7	1.1%
108	Wiley silt loam, 3 to 9 percent slopes	89.2	10.5%
Totals for Area of Interest		**852.7**	**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

2—Ascalon sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367q
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
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

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

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 21 inches: sandy clay loam
BC - 21 to 27 inches: sandy loam
Ck1 - 27 to 48 inches: sandy loam
Ck2 - 48 to 60 inches: loamy sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
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 in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Plains LRU's A & B (R069XY026CO)
Other vegetative classification: SANDY PLAINS (069BY026CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

3—Ascalon sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlny
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 13 to 18 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 95 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk1 - 19 to 35 inches: fine sandy loam
Bk2 - 35 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline (0.1 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 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
Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Alluvial fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
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 in profile: 2 percent
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F

Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition
Ellicott and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting
Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: Sandy Bottomland LRU's A & B (R069XY031CO)
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll
Percent of map unit:
Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit:
Hydric soil rating: No

Pleasant
Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

30—Fort Collins loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3683
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Fort collins and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fort Collins

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 9 inches: loam
Bt - 9 to 16 inches: clay loam
Bk - 16 to 21 inches: clay loam
Ck - 21 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R067BY002CO)
Other vegetative classification: LOAMY PLAINS (069AY006CO)

Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

52—Manzanst clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2w4nr
Elevation: 4,060 to 6,660 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manzanst and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanst

Setting

Landform: Terraces, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Clayey alluvium derived from shale

Typical profile

A - 0 to 3 inches: clay loam
Bt - 3 to 12 inches: clay
Btk - 12 to 37 inches: clay
Bk1 - 37 to 52 inches: clay
Bk2 - 52 to 79 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural 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
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 3 percent
Salinity, maximum in profile: Slightly saline (4.0 to 7.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: Saline Overflow (R067BY037CO)
Hydric soil rating: No

Minor Components

Ritoazul

Percent of map unit: 7 percent
Landform: Drainageways, interfluves
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Plains (R067BY042CO)
Hydric soil rating: No

Arvada

Percent of map unit: 6 percent
Landform: Drainageways, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Salt Flat (R067XY033CO)
Hydric soil rating: No

Wiley

Percent of map unit: 2 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Plains (R067BY002CO)
Hydric soil rating: No

54—Midway clay loam, 3 to 25 percent slopes

Map Unit Setting

National map unit symbol: 368y
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: clay loam

C - 4 to 13 inches: clay

Cr - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 3 to 25 percent

Depth to restrictive feature: 6 to 20 inches to paralithic bedrock

Natural drainage class: Well drained

Runoff class: Medium

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

Calcium carbonate, maximum in profile: 15 percent

Gypsum, maximum in profile: 15 percent

Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 15.0

Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D

Ecological site: Shaly Plains LRU's A & B (R069XY046CO)

Other vegetative classification: SHALY PLAINS (069AY046CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 45 percent
Tassel and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Shaly Plains (R067BY045CO)

Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Description of Tassel

Setting

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

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
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
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shaly Plains (R067BY045CO)
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

59—Nunn clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3693
Elevation: 5,400 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Nunn and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunn

Setting

Landform: Terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

A - 0 to 12 inches: clay loam
Bt - 12 to 26 inches: clay loam
BC - 26 to 30 inches: clay loam
Bk - 30 to 58 inches: sandy clay loam
C - 58 to 72 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
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
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C

Ecological site: Clayey Plains LRU's A & B (R069XY042CO)
Other vegetative classification: CLAYEY PLAINS (069AY042CO)
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit:
Hydric soil rating: No

Pleasant
Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

75—Razor-Midway complex

Map Unit Setting
National map unit symbol: 369p
Elevation: 5,300 to 6,100 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition
Razor and similar soils: 50 percent
Midway and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Razor

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile
A - 0 to 4 inches: stony clay loam
Bw - 4 to 22 inches: cobbly clay loam
Bk - 22 to 29 inches: cobbly clay
Cr - 29 to 33 inches: weathered bedrock

Properties and qualities
Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium

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
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Alkaline Plains LRU's A & B (R069XY047CO)
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
Hydric soil rating: No

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: clay loam
C - 4 to 13 inches: clay
Cr - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 3 to 25 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
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
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 15 percent
Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shaly Plains LRU's A & B (R069XY046CO)
Other vegetative classification: SHALY PLAINS (069AY045CO)

Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

104—Vona sandy loam, warm, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t516
Elevation: 3,590 to 6,000 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Vona, warm, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vona, Warm

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 5 inches: sandy loam
Bt1 - 5 to 12 inches: sandy loam
Bt2 - 12 to 17 inches: sandy loam
Bk - 17 to 41 inches: sandy loam
BCk - 41 to 79 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively 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
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.5 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: Loamy, Dry (G067BW019CO), Sandy Plains #24 (067XY024CO_2)
Hydric soil rating: No

Minor Components

Valent, warm

Percent of map unit: 5 percent
Landform: Sand sheets
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Deep Sand (R067BY015CO)
Other vegetative classification: Sandy, Dry (G067BW026CO), Deep Sands #15 (067XY015CO_3)
Hydric soil rating: No

Olnest, warm

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: Loamy, Dry (G067BW019CO)
Hydric soil rating: No

Otero

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: Loamy, Dry (G067BW019CO), SANDY PLAINS (067XY024CO_1)
Hydric soil rating: No

108—Wiley silt loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 367b
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Wiley and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wiley

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty eolian deposits

Typical profile

A - 0 to 4 inches: silt loam
Bt - 4 to 16 inches: silt loam
Bk - 16 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
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 in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R067BY002CO)
Other vegetative classification: LOAMY PLAINS (069AY006CO)
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

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