REQUEST FOR
CONDITIONAL LETTER OF MAP REVISION

UNNAMED TRIBUTARY TO
BLACK SQUIRREL CREEK,
FALCON MARKETPLACE

Falcon, Colorado
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DBC Project No. 20988-00CSCV

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FALCON MARKET PLACE

1.0 INTRODUCTION

1.1 Background

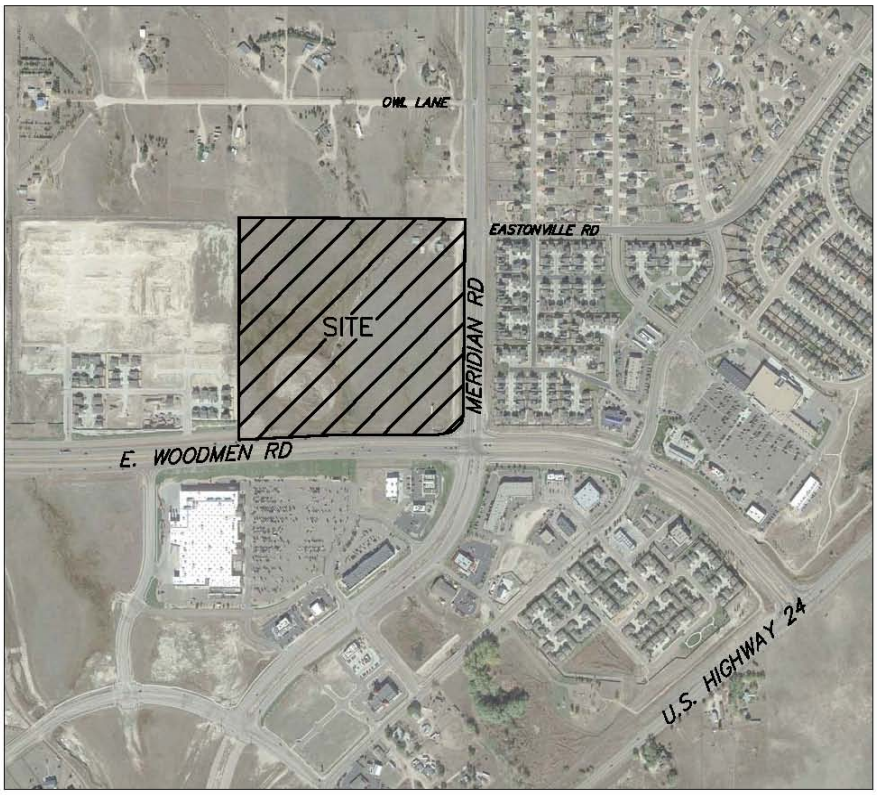
The following report and supporting documentation are being submitted to FEMA for the purpose of requesting a Conditional Letter of Map Revision (CLOMR) for a portion of the Unnamed Tributary to Black Squirrel Creek (UTBSC) within El Paso County, Colorado.

The Falcon Marketplace owner is proceeding with development of their property, which consists of approximately 35 acres at the northwest corner of E. Woodmen Road and Meridian Road. A vicinity map is shown in Figure 1. To best utilize the property with commercial retail uses, the owner proposes to construct improvements to re-route the UTBSC channel across the property. Improvements impacting the UTBSC include the construction of a “sub regional” detention pond and confining the 100-year floodplain to a new 96” piped storm drain system and a grass lined channel across the property.

The drainage improvements associated with the Falcon Marketplace development are in general conformance with the Falcon Basin, Drainage Basin Planning Study (FALCON DBPS), prepared by El Paso County in 2015. Specifically, the Falcon Marketplace development will construct “Sub Regional Detention Pond SR4” identified in the FALCON DBPS. The hydrologic analysis completed for the FALCON DBPS was used as the basis for the current CLOMR. A general site layout of the proposed Falcon marketplace development is shown in the construction drawings included in Appendix 1.

The effective and preliminary Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) shows the UTBSC 100-year Zone A floodplain running from north to south through the middle of the Falcon Marketplace property. Copies of the effective and preliminary FIRM, annotated to show the Falcon Marketplace site, are included in Appendix 2. This report presents hydrologic and hydraulic study results showing the proposed 100-year floodplain, as confined by the proposed improvements, will be significantly different from that shown on the effective/preliminary FIRM. Approval of the CLOMR will result in the revision and conversion of the approximate Zone A floodplain to a Zone AE floodplain with Base Flood Elevations (BFE) in a few designated open flow areas. The majority of the flow will be confined within a piped storm drain system.

It is the Owner/Developer's intent to comply with all floodplain regulations.



Vicinity Map
NTS

	FALCON MARKETPLACE VICINITY MAP	Drexel, Barrell & Co. Engineers • Surveyors DATE: 8/18/16 JOB NO: 20988-00 DWG. NO. VMAP SHEET 1 OF 1

Figure 1 – Vicinity Map

1.2 General Location and Project Description

The limits of this CLOMR are limited to the 35-acre Falcon Marketplace parcel located at the northwest corner of E. Woodmen Road and Meridian Road, SE 1/4 of the SE 1/4 of Section 1, Township 13 S, Range 65 W of the 6th P.M., El Paso County, Colorado, at an approximate latitude/longitude of 38°56’33”N / 104°36’37”W and at an approximate elevation of 6890-ft.

The subject property is currently undeveloped with the exception of a single family residence (11680 E Woodmen Road) at the northeast corner of the property. The property owner seeks to develop the subject property for a multi-pad shopping center/office complex (Falcon Marketplace).

The Falcon Marketplace development proposes filling the site and rerouting the UTBSC across the site. Approximately 1,200-ft of the creek will be impacted by the Falcon Marketplace development, which proposes to intercept the existing creek at the north property line and convey it via a rundown to a detention pond. The detention pond will discharge to a new 96” piped storm drainage system which will flow south and east across the property and discharge to a section of grass lined open channel which will flow from west to east paralleling the south perimeter of the property. The open channel will then discharge to two sets of existing culverts under E. Woodmen Road at the south property line. The detention pond, pipe and channel are designed to convey the full 100-year discharge. Construction drawings for the proposed Falcon Marketplace are included in Appendix 1.

1.3 Regulatory Floodplain

The effective floodplain, Zone A limits for the UTBSC, in the vicinity of Falcon Marketplace project, are defined on the FIRM for El Paso County, Colorado and Unincorporated Areas, Map Number 8041C0575F, Effective Date March 17, 1997. A FIRMette annotated to show the Falcon Marketplace project area is included in Appendix 2. No flow rates, floodway data or flood profiles were defined for this section of UTBSC in the effective FIS, El Paso County, Colorado and Incorporated Areas, Revised August 23, 1999.

The effective floodplain, Zone A limits for the UTBSC, in the vicinity of the Falcon Marketplace development, were modified by a LOMR, Case No. 12-08-0579P, Woodmen Road Widening Project - Powers Boulevard to US-24, Effective Date February 28, 2013. Applicable portions of the LOMR Determination Document are included in Appendix 2. No flow rates, floodway data or flood profiles were defined for this section of UTBSC in this LOMR.

FEMA issued Preliminary FIS and FIRM documents for El Paso County, Colorado and Incorporated Areas dated July 29, 2015. The Preliminary FIRM, Map Number 08041C0553G, incorporates the LOMR revised Zone A floodplain identified above. A

copy of the preliminary FIRM, annotated to show the Falcon Marketplace development, is included in Appendix 2. No flow rates, floodway data or flood profiles were defined for this section of the UTBSC in the preliminary FIS.

2.0 PREVIOUS STUDIES

El Paso County completed hydrologic and hydraulic analysis summarized in a report titled: Falcon Basin, Drainage Basin Planning Study, Selected Plan Report, Final, September 2015 (Falcon DBPS). The Falcon DBPS encompasses three unnamed tributaries to Black Squirrel Creek, including the "Middle Tributary" which flows across the subject property. Select output from the Falcon DBPS is included in Appendix 3. A complete copy of the Falcon DBPS is included as a PDF file on the CD in Appendix 12.

3.0 HYDROLOGIC ANALYSIS

3.1 Falcon DBPS

The Falcon DBPS completed hydrologic analysis for the Falcon Basin Watershed, using HEC-HMS v3.5 software, for historical, existing, and future land use conditions by applying a 24-hour storm event with 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals and current drainage conveyance infrastructure. Reference Chapter 3 and Appendix 1 of the Falcon DBPS for a detailed discussion of the hydrologic analysis. The Falcon DBPS is included as a PDF file on the CD in Appendix 3. Electronic copies of the HEC-HMS models (File: Aug15_Working_Falcon_DBPS_S.hms & Aug15_Working_Falcon_DBPS_S.dss) are included on the CD in Appendix 12. Peak discharges under future land use conditions with existing drainage infrastructure, in the immediate vicinity of the Falcon Marketplace, are summarized in Table 3-1.

The Falcon DBPS identified recommended future drainage infrastructure improvements within the Falcon Basin, including Sub Regional Pond SR4 (Pond SR4) which was identified to be installed on the Falcon Marketplace property. Pond SR4 was conceptually sized with the parameters shown in Table 3-2 and is shown schematically on Sheet 6-23 included in Appendix 3.

Table 3-2 – Falcon DBPS, Pond SR4, Sizing Parameters

Parameter	Value
100-year Storage Volume	19 af
Q_{2in}	130 cfs
Q_{2out}	27 cfs
Q_{100in}	1,000 cfs
Q_{100out}	730 cfs

Table 3-1. Peak Discharges at Points of Interest in Vicinity of Falcon Marketplace: Falcon Basin, Drainageway Basin Planning Study, Middle Tributary

Location	Future Conditions, with existing drainage infrastructure (Source: Falcon Basin, Drainage Basin Planning Study, HEC-HMS model)								Future Conditions, with existing drainage infrastructure with Sub-Regional Pond SR4 (Source: Falcon Basin, Drainage Basin Planning Study, HEC-HMS model)							
	HEC-HMS Element	Area (sq mi)	Peak Flow (cfs)						HEC-HMS Element	Area (sq mi)	Peak Flow (cfs)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West Branch at North Property Line of Falcon Marketplace	RMT062	0.29	1	11	25	62	110	160	RMT062	0.29	5	21	34	64	81	99
East Branch at North Property Line of Falcon Marketplace	RMT064	0.67	120	270	370	590	710	850	RMT064	0.67	121	273	373	591	712	847
Local Basin	MT060	0.19	30	59	83	140	170	200	MT060	0.19	30	59	83	137	167	199
									Sub Regional Pond SR4 Inflow	1.16	133	310	431	697	847	1,016
Downstream of Proposed Falcon Marketplace Pond SR4	JMT060	1.16	130	310	430	690	840	1,000	Sub Regional Pond SR4 Outflow	1.16	27	142	246	467	595	727
Local Basin	MT070	0.20	25	50	69	110	140	170	MT070	0.20	25	50	69	114	139	165
E. Woodman Road, South Property Line of Falcon Marketplace	JMT070	1.36	150	350	490	800	980	1,200	JMT070	1.36	31	162	281	535	685	844

Peak discharges, under future land use conditions, with existing drainage infrastructure, and with the recommended Pond SR4 are also summarized in Table 3-1. As shown in Table 3-1, the 100-year discharge to E. Woodmen Road, at the South property line, with Pond SR4 is 844 cfs. To be in conformance with the Falcon DBPS recommendations, the allowable 100-year discharge from the Falcon Marketplace development was therefore determined to be no greater than 844 cfs.

3.2 Falcon Marketplace

The Falcon DBPS HEC-HMS hydrologic analysis for future land use conditions, with existing drainage infrastructure and with Pond SR4 was used as the basis for the Falcon Marketplace hydrologic analysis. The Falcon DBPS HEC-HMS hydrologic model was updated to reflect the proposed Falcon Marketplace site design as shown on the construction drawings in Appendix 1. Specifically, Pond SR4's stage/storage/discharge characteristics were updated and local basin MT070 characteristics were updated to reflect the proposed Falcon Marketplace development. Initial sizing, analysis and determination of Pond SR4's stage/storage/discharge relationships were completed using UD-Detention v2.35 software. UD-Detention software, which is a Microsoft Excel based spreadsheet published by the Urban Drainage & Flood Control District, in Denver, Colorado, is used for the design of full-spectrum release detention ponds. The stage/storage/discharge relationships quantified by UD-Detention where then input into the proposed conditions HEC-HMS hydrologic model.

Select output from the UD-Detention model is included in Appendix 7 and an electronic copy of the model file is included on the CD in Appendix 12 (UD-Detention File: FM pond#1.xls). Select output from the HEC-HMS model is included in Appendix 4 and electronic copies of the model files are included on the CD in Appendix 12 (HEC-HMS file: Proposed_Falcon_DPMS.hms & Proposed_Falcon_DPMS.dss).

Pond SR4 to be constructed as part of the Falcon Marketplace development is sized with the parameters shown in Table 3-3.

Table 3-3 – Pond SR4, Inflow/Outflow/Stage/Storage Parameter

Recurrence Interval	Pond Inflow (cfs)	Pond Outflow (cfs)	Water Surface Elevation, (NGVD29) (ft)	Storage Volume (ac-ft)
100-year	1,016	644	6897.0	26.6
50-year	847	481	6896.4	24.5
25-year	697	338	6895.8	22.5
10-year	431	106	6894.6	18.3
5-year	310	52	6894.2	17.0
2-year	133	12	6891.8	10.0

Peak discharges resulting from the proposed Falcon Marketplace development, in the immediate vicinity of the development, are summarized in Table 3-4.

The Falcon Marketplace development will discharge to six (6) existing 48-inch diameter RCP culverts under E. Woodmen Road. No changes to the existing culverts are proposed as part of the Falcon Marketplace project. HY-8 software was used to quantify a 765-cfs total capacity of the existing culverts with the culvert headwater at the elevation of the north edge of roadway pavement. The HY-8 culvert capacity calculations are included in Appendix 7.

As shown in Table 3-4 the 100-year discharge to E. Woodmen Road, at the South Property line, with the proposed Pond SR4 is 757 cfs. The 100-year discharge (757 cfs) is less than the capacity of the existing culverts (765-cfs) and is less than the maximum allowable 100-year discharge (844-cfs) identified in the Falcon DBPS.

4.0 HYDRAULIC ANALYSIS

4.1 General

The effective and preliminary FIRM/FIS identifies an approximate Zone A floodplain across the Falcon Marketplace property with no flood profiles or BFE's defined.

The Falcon Marketplace development proposes filling and regrading the site and rerouting the existing UTBSC channel across the site. Approximately 1,200-ft of the existing UTBSC channel will be impacted. The existing UTBSC will be intercepted at the north property line and be conveyed via a rundown to Pond SR4. Pond SR4 will discharge to a new 96” RCP piped storm drainage system which will flow south and east across the property. The 96” RCP pipe will discharge to a section of grass lined open channel which will flow from west to east paralleling the south property line of the property. The open channel then discharges to two sets of existing 3-48” RCP culverts under E. Woodmen Road at the south property line. The detention pond, pipe and channel have been designed to convey the full 100-year discharge. Construction drawings for the proposed Falcon Marketplace development are included in Appendix 1.

For purposes of modeling the floodplain across the Falcon Marketplace property, the hydraulic analysis was divided into multiple reaches. Table 4.1 identifies these reaches, and the software used for the hydraulic analysis in each reach.

4.2 Vertical Datum

The effective FIRM is on the National Geodetic Vertical Datum of 1929 (NGVD29).

The Preliminary FIRM is on the North American Vertical Datum of 1988 (NAVD88).

Table 3-4. Peak Discharges at Points of Interest in Vicinity of Falcon Marketplace Development

Location	Future Conditions, with existing drainage infrastructure + Falcon Marketplace Development (Source: Falcon Marketplace , HEC-HMS model)							
	HEC-HMS Element	Area (sq mi)	Peak Flow (cfs)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West Branch at North Property Line of Falcon Marketplace	RMT062	0.29	5	21	34	64	81	99
East Branch at North Property Line of Falcon Marketplace	RMT064	0.67	121	273	373	591	712	847
Local Basin	MT060	0.19	30	59	83	137	167	199
Sub Regional Pond SR4 Inflow	-	1.16	133	310	431	697	847	1,016
Sub Regional Pond SR4 Outflow	JMT060	1.16	12	52	106	338	481	644
Local Basin	MT070	0.20	30	57	79	129	157	186
E. Woodman Road, South Property Line of Falcon Marketplace	JMT070	1.36	32	62	119	398	562	757

Table 4-1 – Floodplain Hydraulic Reaches

Reach		Hydraulic Model	Comment
1	Two sets of 3-48" RCP Culverts under E. Woodmen Road	HY-8	Calculated headwater elevation used as starting WSEL for Reach 2 analysis
2	Grass Lined Channel	HEC-RAS v4.10	Calculate WSEL's, XS-61 to XS-866
3	96" Pipe	StormCAD v4.1.1	Calculate hydraulic gradeline through pipe system
4	Pond SR4	UD-Detention v 2.35 & HEC-HMS v3.5	Programs used to model pond stage/storage/discharge curves
5	Pond SR4 to North Property Line	HEC-RAS v4.10	Calculate WSEL's, XS-2842 to XS-2926

Topographic data received from El Paso County, field surveys, design and construction drawings completed for the Falcon Marketplace project are on the NGVD29 datum. The Falcon DBPS does not indicate the vertical datum on which it is based; however a spot comparison of topographic mapping at known locations indicates it was completed on the NGVD29 datum. Floodplain modeling was completed on the NGVD29 datum.

For purposes of preparing the annotated FIRM and Flood Profile the hydraulic modeling results were converted from the NGVD29 datum to the NAVD88 datum using the following conversion:

NGVD29 + 3.78-ft = NAVD88

4.3 Horizontal Datum

Field surveys, design, construction drawings and floodplain modeling for the Falcon Marketplace project were completed on an assumed horizontal datum. For purposes of preparing the geospatially referenced floodplain line work submitted as part of this CLOMR, the floodplain line work was translated to the North American Datum 1983 (NAD83), Colorado State Plane Coordinates, Central Zone.

4.4 Hydraulic Analysis – Reach 1, 48" Culverts under E. Woodmen Road

Under pre- and post-project conditions, UTBSC flows leaving the Falcon Marketplace site will discharge to two sets of existing 3-48" RCP culverts under E. Woodmen Road (six culverts total). HY-8 software was used to analyze the hydraulic performance of the existing culverts. HY-8 File: Woodmen Culvert.hy8. Table 4-2 lists the discharge/headwater relationship for the two sets of culverts. HY-8 calculations are included in Appendix 7 and electronic model file is included on the CD in Appendix 12.

Table 4-2 identifies the assumed maximum allowable discharge through each of the two sets of culverts assuming the maximum allowable headwater elevation is equal to the elevation of the edge of roadway asphalt along the north side of E. Woodmen Road.

Table 4-2 – E. Woodmen Road Culverts, Headwater/Discharge Data

West Set of 3-48" RCP Culverts		East Set of 3-48" RCP Culverts	
Headwater Elevation (ft)	Total Discharge (cfs)	Headwater Elevation (ft)	Total Discharge (cfs)
6871.20	0	6867.80	0
6873.04	50	6869.44	50
6873.88	100	6870.26	100
6874.60	150	6870.95	150
6875.27	200	6871.58	200
6875.96	250	6872.41	250
6876.84	300	6873.01	300
6877.87	350	6873.88	350
6877.99	355	6875.00	400
6878.0*	355.5*	6875.12	405
6878.59	450	6875.2*	408.4*
6878.80	500	6875.78	500

* maximum allowable discharge through each of the two sets of culverts assuming the maximum allowable headwater elevation is equal to the elevation of the edge of roadway asphalt along the north side of E. Woodmen Road.

4.5 Hydraulic Analysis – Reach 2, Grass Lined Channel

The grass lined channel, which parallels the south property line of the Falcon Marketplace property was analyzed using HEC-RAS software.

- The channel is approximately 900-feet in length and has a trapezoid cross section with an 8-ft bottom width and 4:1 side slopes.
- HEC-RAS File: FALCON_FP.prj HEC-RAS Plan: FALCON_DS

- Seven cross sections were generated using field survey information completed for the project. Cross section locations are identified on the Floodplain Work Map in Appendix 10.
- Roughness values of 0.04 were utilized for the cross sections based on data published by the Urban Drainage and Flood Control District, Denver, Colorado for grass lined channels.
- Contraction and expansion factors of 0.1 and 0.3 respectively where utilized.
- A 100-year discharge of 757 cfs was input at XS1000 based on HEC-HMS modeling results (at JMT070) discussed above.
- The grass lined open channel contains a check dam, located immediately downstream (east) of the westerly set of 3-48” culverts under E. Woodmen Road. The check dam will help to more evenly divide flows between the westerly and easterly sets of 3-48” culverts under E. Woodmen Road. The check dam will be constructed of earthen material armored with riprap. The check dam was modeled as an obstruction at XS535 with a crest elevation of 6875.9 which was chosen to maximize flow to the westerly set of culverts without out exceeding the allowable headwater elevation.
- To model main channel flows that are diverted to the existing westerly set of 3-48" culverts under E. Woodmen Road, a lateral structure (538), located on the right overbank, was used in the model. The lateral structure utilizes a diversion rating curve, based on the HY-8 discharge/headwater analysis for the westerly set of 3-48" culverts under E. Woodmen Road, discussed in Section 4.4. The HEC-RAS model results indicate that of the total 100-year discharge = 757 cfs in the main channel, 351 cfs is diverted to the westerly set of culverts and 406 cfs remains in the main channel.
- The starting water surface elevation at XS61 is dependent on the discharge remaining in the main channel, downstream of the Lateral Structure 538. With a known discharge = 406 cfs, the starting water surface elevation was quantified based on the HY-8 discharge/headwater analysis for the easterly set of 3-48" culverts under E. Woodmen Road, discussed in Section 4.4.

HEC-RAS model results for the 100-yr event are summarized in Table 4-3. Selected model output is included in Appendix 5 and electronic model files are included on the CD in Appendix 12. The floodplain delineation is shown on the Floodplain Work Map in Appendix 10.

4.6 Hydraulic Analysis – Reach 3, 96” RCP Pipe

StormCAD v4.1.1 software was used to model the hydraulics of the 96” piped storm drainage system. StormCAD’s steady state backwater analysis routines were used to compute the hydraulic profile in the piped storm sewer system.

- The approximately 1,060-ft long, 96” piped storm drainage system generally runs north to south across the property, conveying Pond SR4 discharges to the grass lined channel. The StormCAD software was used in lieu of the culvert routines in HEC-RAS due to the length and alignment of the pipe system and multiple manholes along the culvert. The StormCAD software allowed for more detailed hydraulic analysis of the culvert, including head losses at the manholes along the culvert.

Table 4-3 – HEC-RAS Result Summary Table, Grass Lined Channel (Reach 2)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
FACLON_DS	1000	100-YR	757	6873.28	6877.67	6877.67	6879.83	0.025447	11.78	64.27	15.07	1.01
FACLON_DS	866	100-YR	757	6873.12	6878.43		6878.76	0.003684	4.61	164.2	54.88	0.47
FACLON_DS	729	100-YR	757	6872.36	6878.07		6878.36	0.002239	4.43	181.63	58.61	0.39
FACLON_DS	594	100-YR	757	6871.61	6877.87		6878.09	0.001565	3.81	204.13	64.17	0.32
FACLON_DS	538		Lat Struct									
FACLON_DS	535	100-YR	405.98	6875.9	6877.25	6877.25	6877.88	0.022194	6.39	63.62	51.93	1.01
FACLON_DS	309	100-YR	405.98	6870.05	6875.27		6875.39	0.001048	2.78	149.69	50.01	0.26
FACLON_DS	61	100-YR	405.98	6868.44	6875.19	6871.23	6875.24	0.000291	1.86	238.95	67.57	0.14

Table 4-4 – StormCAD Result Summary Table, 96" RCP Pipe (Reach 3)

Pipe Label	Node U/S	Node D/S	Length (ft)	Section Size	Total System Flow (cfs)	Average Velocity (ft/s)	Invert Elevation U/S (ft)	Invert Elevation D/S (ft)	Slope (ft/ft)	Upstream Ground Elevation (ft)	Hydraulic Grade U/S (ft)	Hydraulic Grade D/S (ft)
P-1	O-1	J-5	16	96	644	15.19	6873.41	6873.29	0.0075	6883.50	6879.85	6879.43
P-2	J-5	J-4	18	96	644	12.81	6873.54	6873.41	0.0072	6883.70	6881.54	6881.45
P-3	J-4	J-3	334.1	96	644	12.81	6876.15	6873.64	0.0075	6887.14	6884.56	6882.90
P-4	J-3	J-2	276.3	96	644	12.81	6878.32	6876.25	0.0075	6889.48	6887.38	6886.00
P-5	J-2	J-1	336.8	96	644	12.81	6880.85	6878.32	0.0075	6891.15	6890.57	6888.89
P-6	J-1	I-6	83.5	96	644	12.81	6881.87	6880.95	0.0110	6894.00	6891.57	6891.15

Table 4-5 – HEC-RAS Result Summary Table, Detention Pond SR4 to North Property Line (Reach 5)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
FALCON_US	2926	100-YR	1016	6895.98	6898.75	6898.75	6899.12	0.025538	6.71	306.22	403.31	0.91
FALCON_US	2842	100-YR	1016	6888.58	6897	6889.37	6897	0.000001	0.15	6775.42	897.89	0.01

- StormCAD File: 96-RCP.stm
- A roughness value of 0.013 was utilized in accordance with El Paso County's Drainage Criteria Manual.
- A 100-year discharge of 644 cfs was utilized, based on HEC-HMS modeling results (at JMT060) discussed above.
- Hydraulic losses at manholes were quantified by the StormCAD software based on alignment geometry and methodologies adapted from FHWA HEC No. 22.
- The starting water surface elevation at the downstream end of the 96" pipe was entered as 6877.67, which is the 100-year water surface elevation calculated by HEC-RAS at the upstream end of the grass lined channel. The StormCAD analysis defaulted to a starting water surface elevation equal to critical depth = 6879.43, which is slightly higher than the HEC-RAS value and more conservative.

StormCAD model results for the 100-yr event are summarized in Table 4-4. Selected model output is included in Appendix 6 and electronic model files are included on the CD in Appendix 12.

4.7 Hydraulic Analysis – Reach 4, Detention Pond SR4

As discussed in section 3.2, UD-Detention and HEC-HMS software was used to model the hydraulics of the proposed Detention Pond SR4.

- The detention pond will intercept UTBSC drainage entering the Falcon Marketplace property at the north property and release it at a reduced flow rate into the 96" pipe. Pond SR4 inflow, outflow, stage and storage parameters for various flood recurrence intervals are shown in Table 3-3.
- The Pond SR4 peak 100-year discharge = 644 cfs was used as the design discharge for the 96" RCP pipe.
- The Pond SR4 peak 100-year water surface elevation = 6897.0 was used as the starting water surface elevation for Reach 5.
- In accordance with El Paso County criteria, the emergency spillway crest elevation was set at 6898.0, 1-ft higher than the 100-year water surface. The emergency spillway was sized for the 100-year discharge into the pond = 1016 cfs.

Select output from the UD-Detention model is included in Appendix 7 and an electronic copy of the model file is included on the CD in Appendix 12 (UD-Detention File: FM Pond #1rev (w6897.5).xls). Select output from the HEC-HMS model is included in Appendix 4 and electronic copies of the model files are included on the CD in Appendix 12 (HEC-HMS file: Proposed_Falcon_DPMS.hms & Proposed_Falcon_DPMS.dss).

4.8 Hydraulic Analysis – Reach 5, Detention Pond SR4 to North Property Line

The short reach between Pond SR4 and the north property line of the Falcon Marketplace development was analyzed using HEC-RAS software.

- UTBSC flows reaching the north property line of the will be conveyed into Pond SR4.

- HEC-RAS File: FALCON_FP.prj HEC-RAS Plan: FALCON_US
- Two cross sections were generated using 2-ft topographic mapping provided by El Paso County. Cross section locations are identified on the Floodplain Work Map in Appendix 10.
- Roughness values of 0.04 were utilized for the cross section (XS2842) through Pond SR4 based on data published by the Urban Drainage and Flood Control District, Denver, Colorado for grass lined channels. Roughness values of 0.05 and .08 were utilized for the main channel and overbank areas respectively, for the cross section (XS2926) across the north property line based on guidance data published in the HEC-RAS manual and is consistent with roughness values identified in the Falcon DBPS.
- Contraction and expansion factors of 0.1 and 0.3 respectively where utilized.
- A 100-year discharge of 1016 cfs was used based on HEC-HMS modeling results for the inflow to Pond SR4.
- The starting water surface elevation at XS2842 was set equal to the 100-year water surface elevation in Pond SR4 = 6897.0.

HEC-RAS model results for the 100-yr event are summarized in Table 4-4. Selected model output is included in Appendix 5 and electronic model files are included on the CD in Appendix 12. The floodplain delineation is shown on the Floodplain Work Map in Appendix 10.

5.0 NFIP REGULATION COMPLIANCE

5.1 FEMA Forms

The appropriate FEMA forms and supporting information are located in Appendix 8.

5.2 Floodplain Tie-ins

There is no tie to an existing UTBSC floodplain at the downstream end of the study area. The effective/preliminary Zone A 100-yr floodplain delineation truncates or terminates at approximately the north ROW line of East Woodmen Road. The revised Zone AE, 100-yr floodplain delineation also truncates or terminates at approximately the north row line of East Woodmen Road. Under pre- and post-project conditions, 100-year discharges downstream of this point are conveyed under E. Woodmen Road in two sets of existing 3-48” RCP culverts.

At the upstream limits of the study area, the revised Zone AE floodplain, located at the north property line of the Falcon Marketplace, graphically ties to the effective/preliminary Zone A immediately north of the north property line.

5.3 Floodplain Work Maps

The effective/preliminary and post-project 100-yr UTBSC floodplains are delineated on the Floodplain Work Maps, located in Appendix 10.

5.4 Annotated FIRM and Flood Profile

An annotated preliminary FIRM panel is included in Appendix 11.

The Preliminary FIS does not contain Flood Profiles for the study area reach of UTBSC. Appendix 11 includes a post project Flood Profile for the study area reach of UTBSC.

A floodway analysis was not completed for this project. As a result this CLOMR submittal does not include Annotated Floodway Data Tables. In our opinion the urban nature of the Falcon Marketplace development and the confined nature of the drainage improvements used to convey the relocated UTBSC across the site, encroachments to define a floodway are not applicable. If FEMA wishes to define a floodway, our recommendation would be for the floodway delineation to be coincident with the 100-year floodplain delineation.

5.5 Notifications

Modifications to 100-year floodplain elevations and delineations are limited the Falcon Marketplace development. No public notifications have been made as part of this CLOMR submittal.

5.6 Pond SR4 Operation and Maintenance Manual

An Operation and Maintenance Manual for Detention Pond SR4 in included in appendix 13.

6.0 CONCLUSIONS

The proposed Falcon Marketplace development, located at the northwest corner of E Woodmen Road and Meridian Road in El Paso County, Colorado will relocate a portion of an Unnamed Tributary of Black Squirrel Creek. This report and supporting documentation are being submitted to FEMA for the purpose of requesting a CLOMR to officially change the floodplain in accordance with NFIP regulations.

7.0 REFERENCES

City of Colorado Springs/El Paso County, *Drainage Criteria Manual*, September 30, 1990 with revisions October 12, 1994.

FEMA, *FIRM, El Paso County, Colorado and Incorporated Areas, Panel 575 of 1300, Map Number 08041C0575F, Effective Date March 17, 1997.*

FEMA, *FIS, El Paso County, Colorado and Incorporated* Areas, Revised August 23, 1999.

FEMA, *LOMR Determination Document, Case No. 12-08-0579P, Woodmen Road Widening Project - Powers Boulevard to US-24, Effective Date February 28, 2013.*

FEMA, *FIRM, El Paso County, Colorado and Incorporated Areas, Panel 553 of 1300, Map Number 08041C0553G, Preliminary, July 29, 2015.*

FEMA, *FIS, El Paso County, Colorado and Incorporated Areas, Preliminary, July 29, 2015.*

Haestad Methods, *StormCAD v4.1.1, December 10, 2001*.

USDOT, FHWA, *Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22, Third Edition, revised 2013*

Matrix Design Group, *Falcon Drainage Basin Planning Study, Selected Plan Report, Final, September 2015.*

USACE, *River Analysis System (HEC-RAS), Version 4.1.0., January 2010*

USACE, *Hydraulic Modeling System (HEC-HMS), Version 3.5, Build 1417, August 10, 2010.*

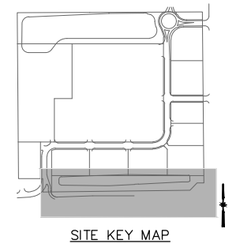
UDFCD, *Detention Basin Volume Estimating Workbook (UD-Detention), Version 2.35, January 2015, Urban Drainage and Flood Control District, Denver, Colorado.*

UDFCD, *Urban Storm Drainage Criteria Manual, Volume 1-3, 2015-16, 2015, Urban Drainage and Flood Control District, Denver, Colorado.*

APPENDICES

APPENDIX 1

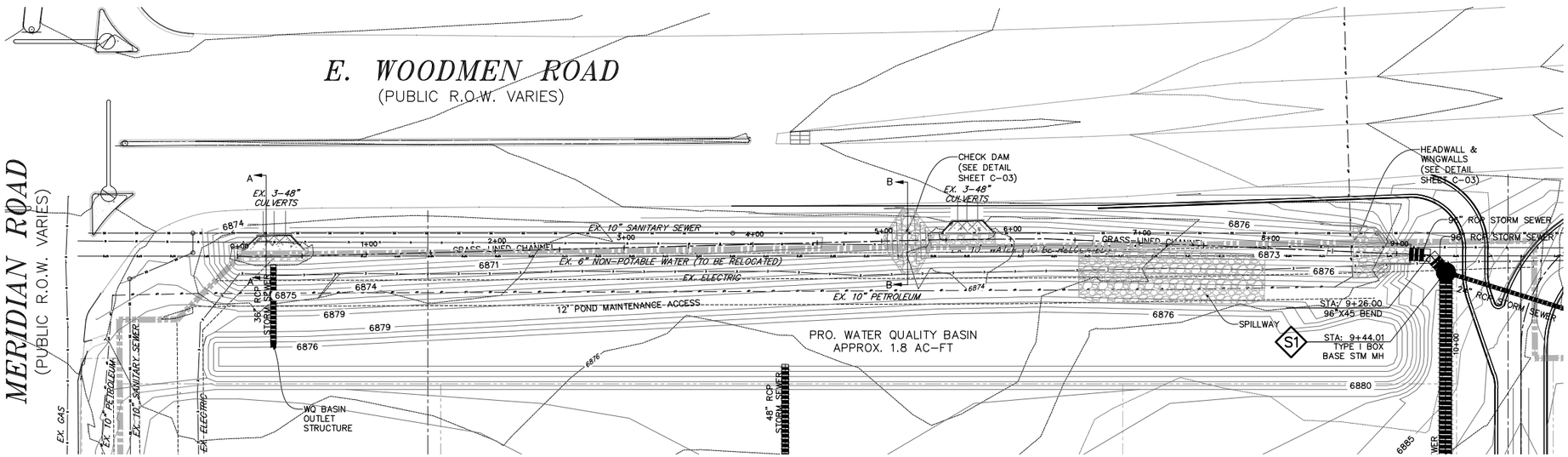
CONSTRUCTION DRAWINGS

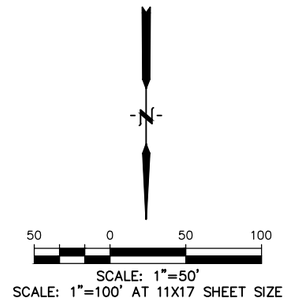


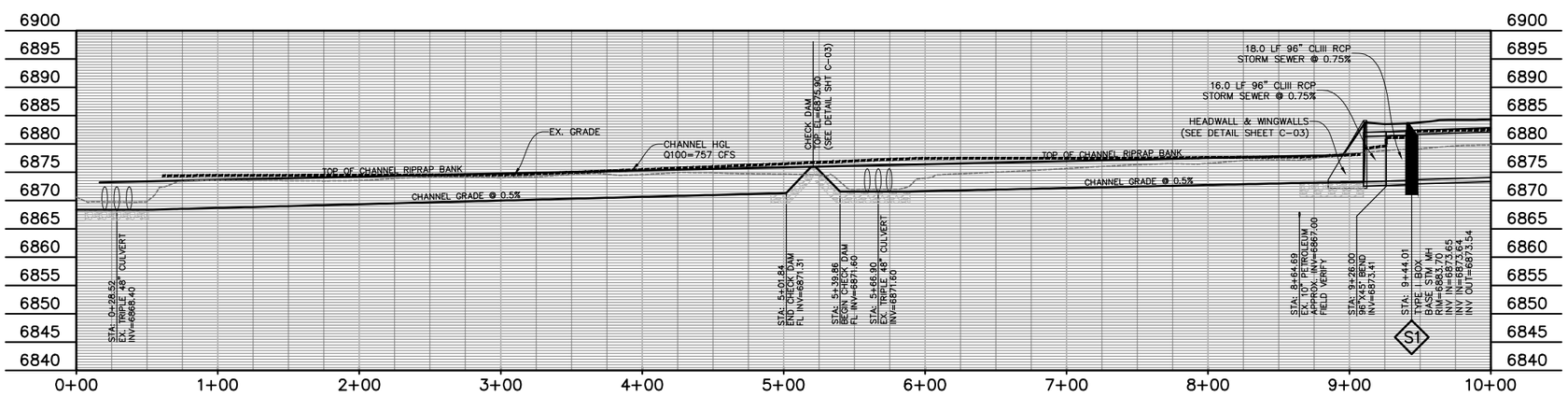
SITE KEY MAP
NTS

LEGEND

- PROPERTY LINE
- FEMA FLOODPLAIN
- LOT LINE
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR — 6245
- EX. INTERMEDIATE CONTOUR
- EX. INDEX CONTOUR — 6245
- PROPOSED STORM SEWER







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CLIENT:

CONSTRUCTION PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-29-16
REVISED	10-17-16

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

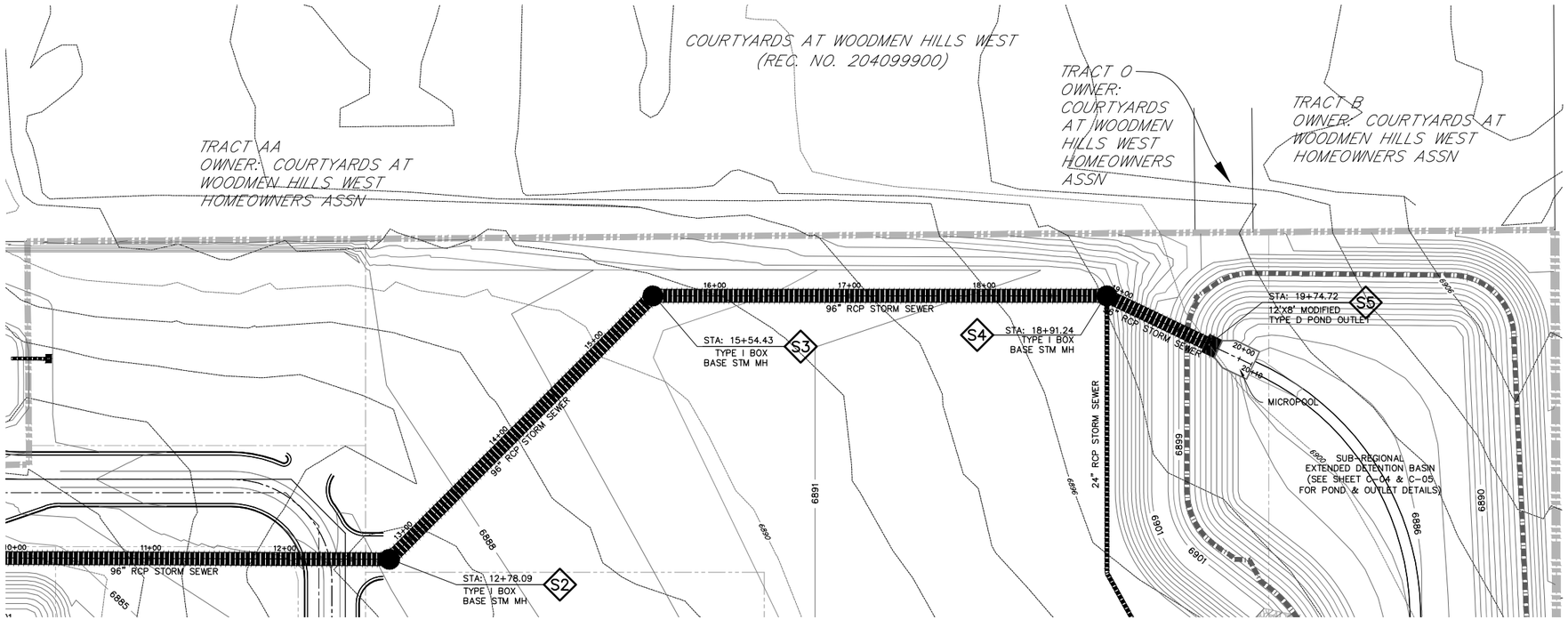
DRAWING SCALE:
HORIZONTAL: 1"=50'
VERTICAL: 1"=5'

PRELIMINARY STORM PROFILES

PROJECT NO. 20988-00CSCV
DRAWING NO.

C-01

SHEET: 1 OF 5

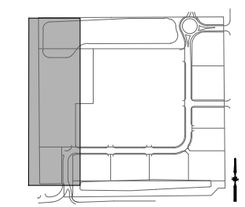


LEGEND

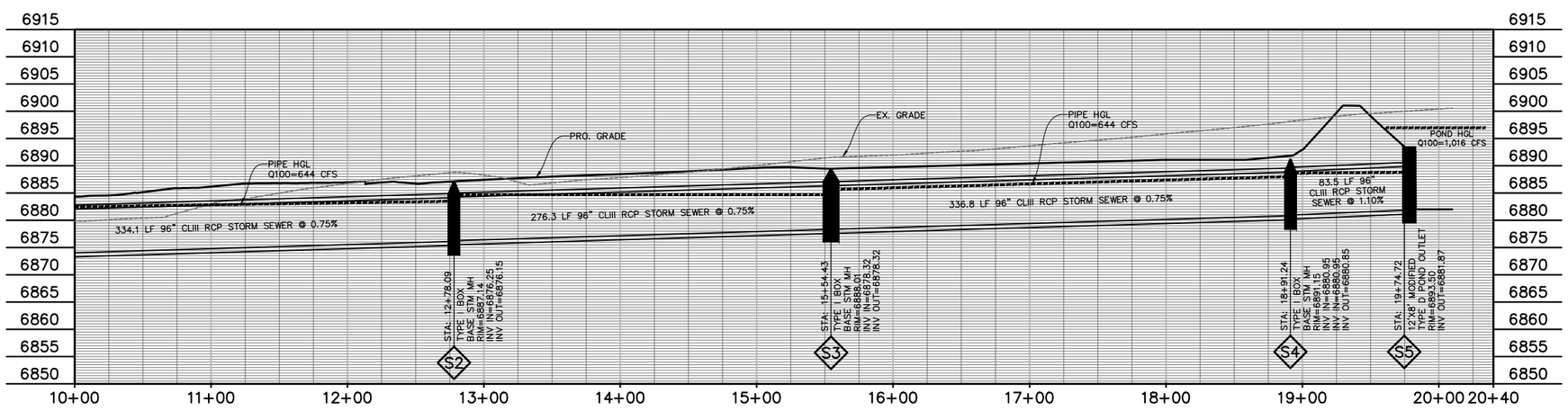
- PROPERTY LINE
- FEMA FLOODPLAIN
- LOT LINE
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR — 6245
- *EX. INTERMEDIATE CONTOUR*
- *EX. INDEX CONTOUR* — 6245
- PROPOSED STORM SEWER

50 0 50 100

SCALE: 1"=50'
SCALE: 1"=100' AT 11X17 SHEET SIZE



SITE KEY MAP
NTS



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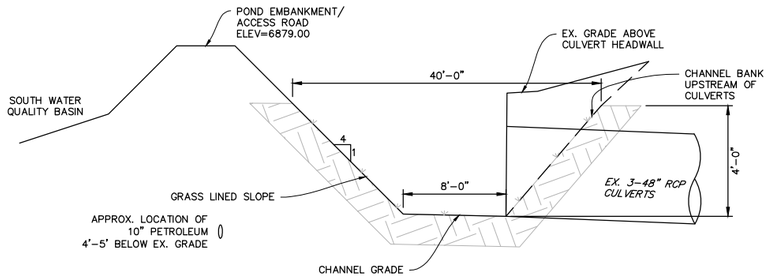
DRAWING SCALE:
HORIZONTAL: 1"=50'
VERTICAL: 1"=5'

PRELIMINARY STORM PROFILES

PROJECT NO. 20988-00CSCV
DRAWING NO.

C-02

SHEET: 2 OF 5



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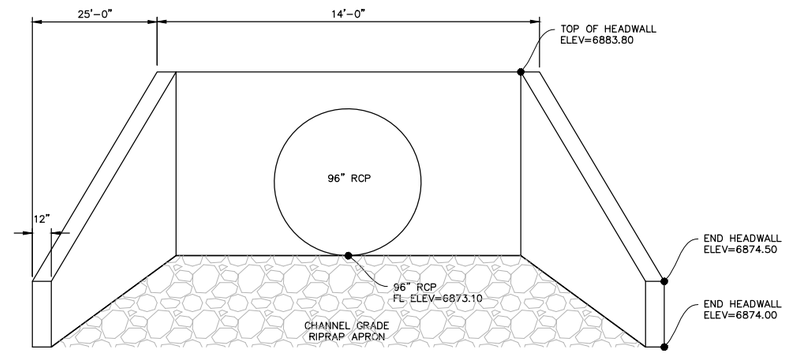

HEADWALL & WINGWALL DETAIL

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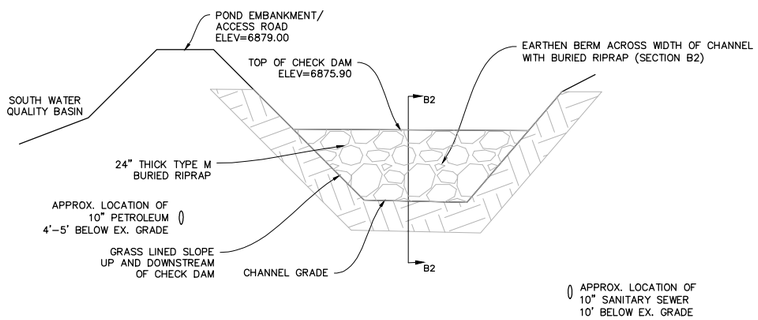

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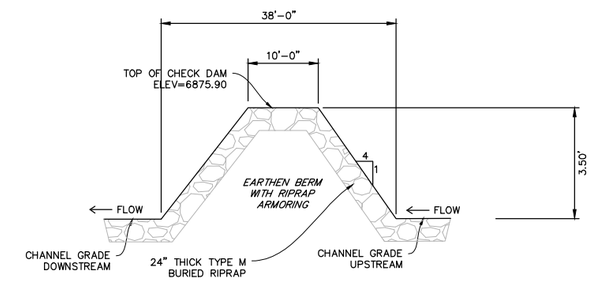

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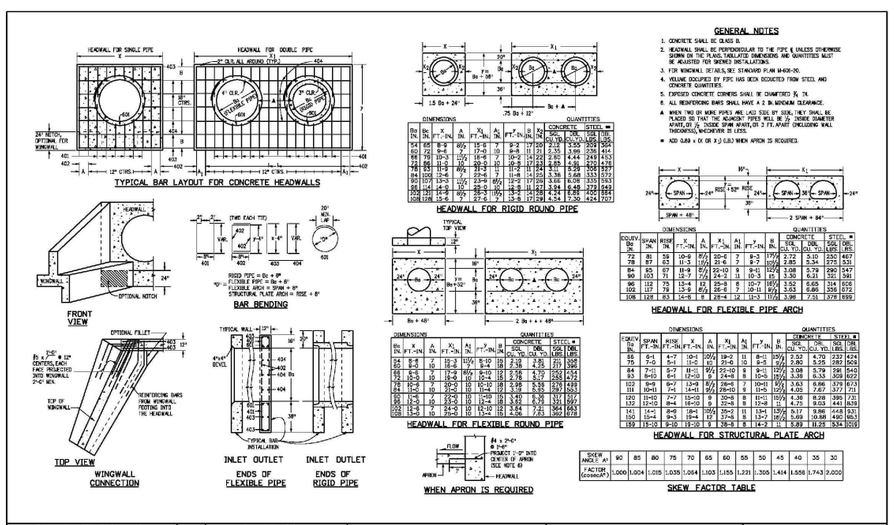

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Drawing File Name: 60160001D.dgn	(EX)			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(EX)			

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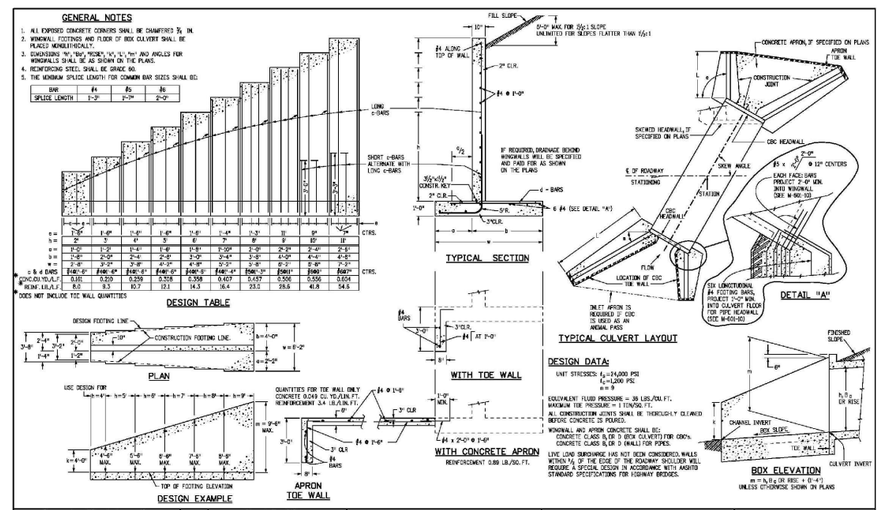
HEADWALL FOR PIPES

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-601-10
Sheet No. 1 of 1



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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(EX)			

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WINGWALLS FOR PIPE OR BOX CULVERTS

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M-601-20
Sheet No. 1 of 1

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CONSTRUCTION PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	9–29–16
REVISED	10–17–16

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
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VERTICAL: N/A

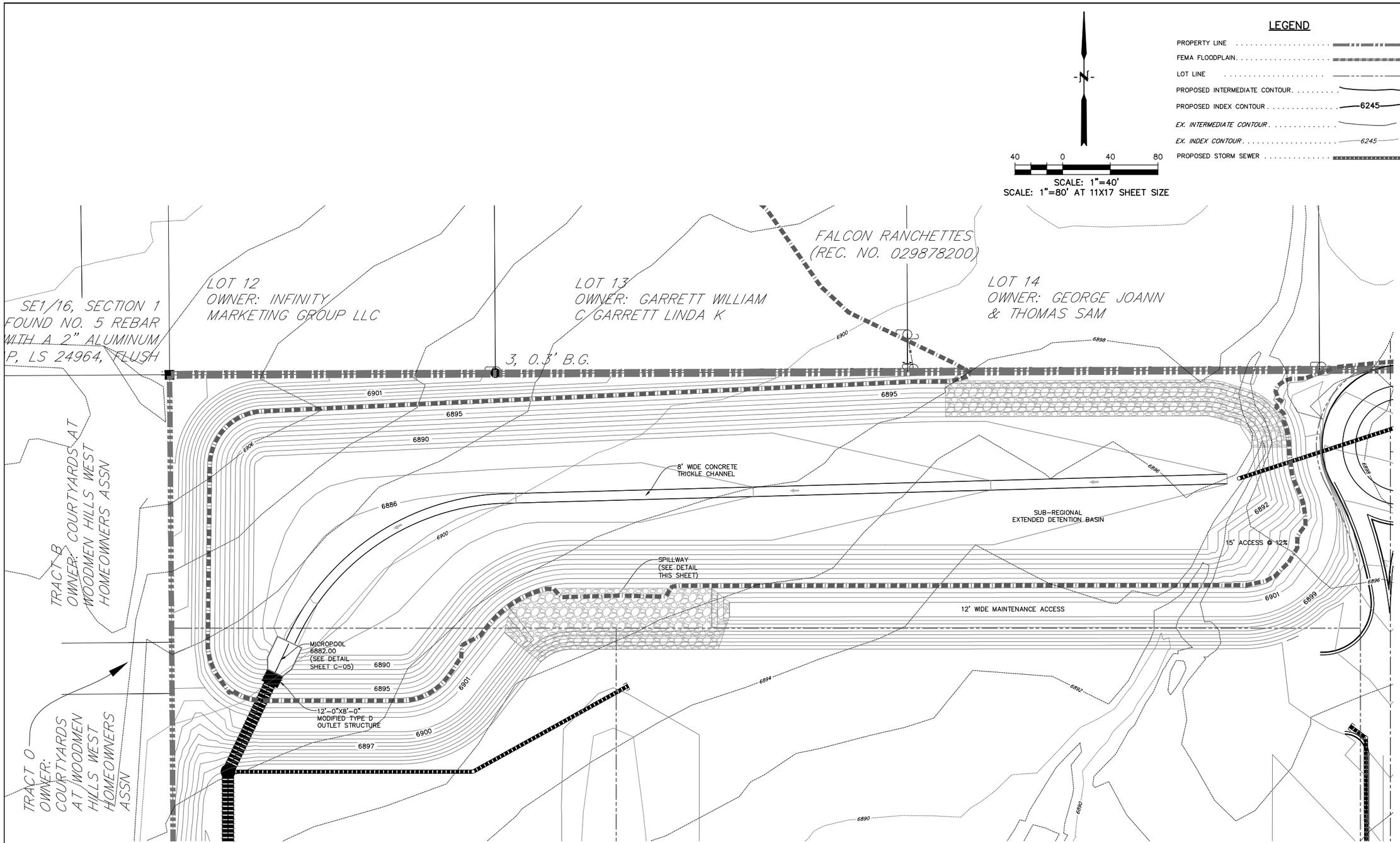
PRELIMINARY STORM DETAILS

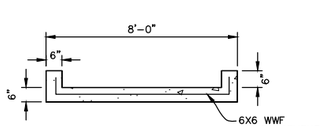
PROJECT NO. 20988–00CSCV

DRAWING NO.

C-03

SHEET: 3 OF 5





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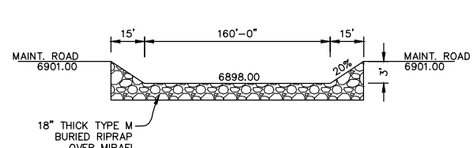

SPILLWAY SECTION

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CONSTRUCTION PLAN FOR

FALCON MARKETPLACE

FALCON, COLORADO

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REVISED	10-17-16

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DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

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DRAWING SCALE:
HORIZONTAL: 1"=40'
VERTICAL: N/A

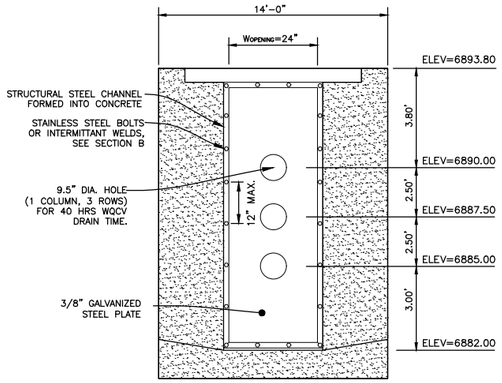
EXTENDED DETENTION BASIN PLAN

PROJECT NO. 20988-00CSCV

DRAWING NO.

C-04

SHEET: 4 OF 5



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PERFORATED PLATE DETAIL
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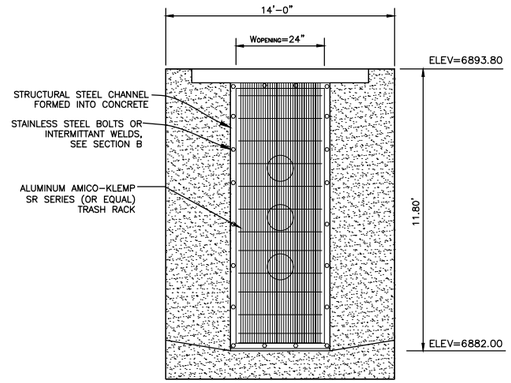

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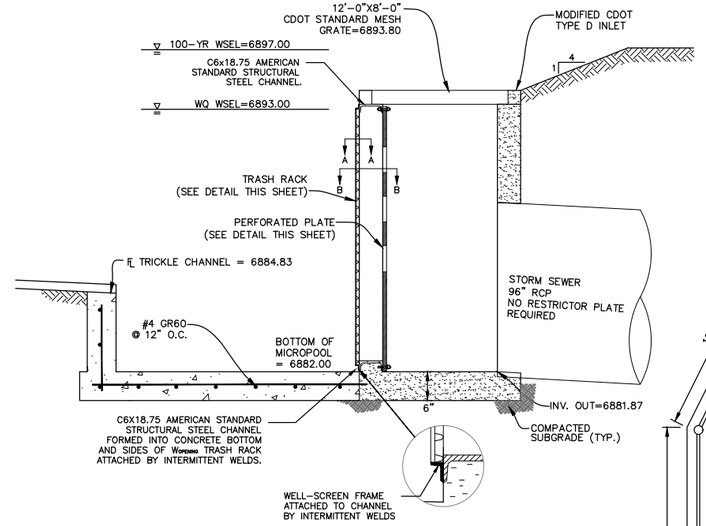

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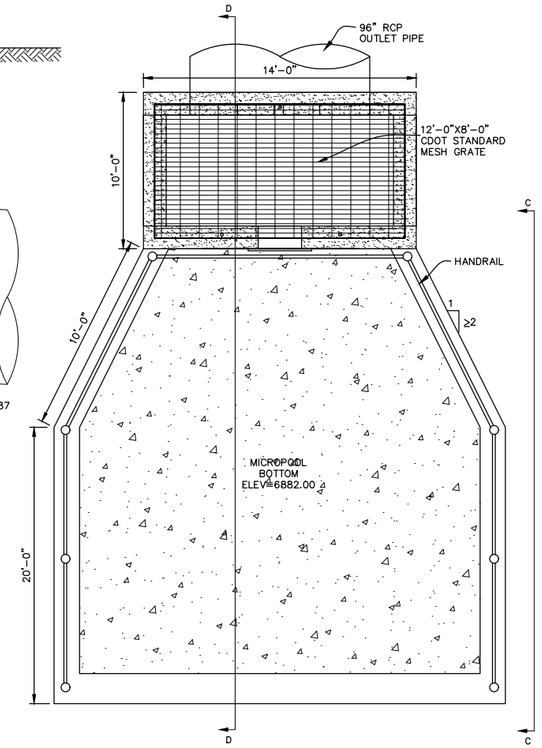


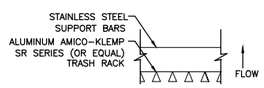
POND OUTLET
NO SCALE

PERFORATED PLATE NOTES:

1. PROVIDE GASKET MATERIAL OR GROUT BETWEEN THE ORIFICE PLATE AND CONCRETE.
2. BOLT PLATE TO CONCRETE @ 12" MAX. ON CENTER. ORIFICE PLATE IS TO BE REMOVABLE.
3. ALL METAL SURFACES ARE TO BE COATED WITH ZRC COLD GALVANIZING COMPOUND.

GENERAL NOTES:

1. ALL EXTERIOR STEEL SHALL BE EITHER STAINLESS OR HOT DIPPED GALVANIZED



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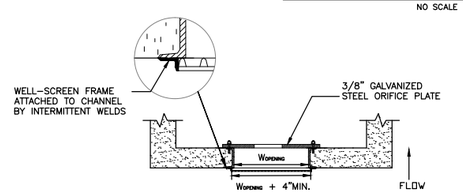

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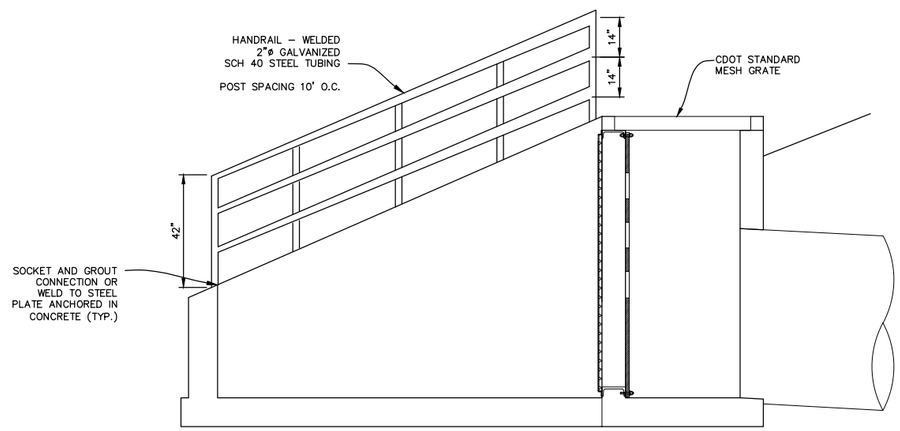

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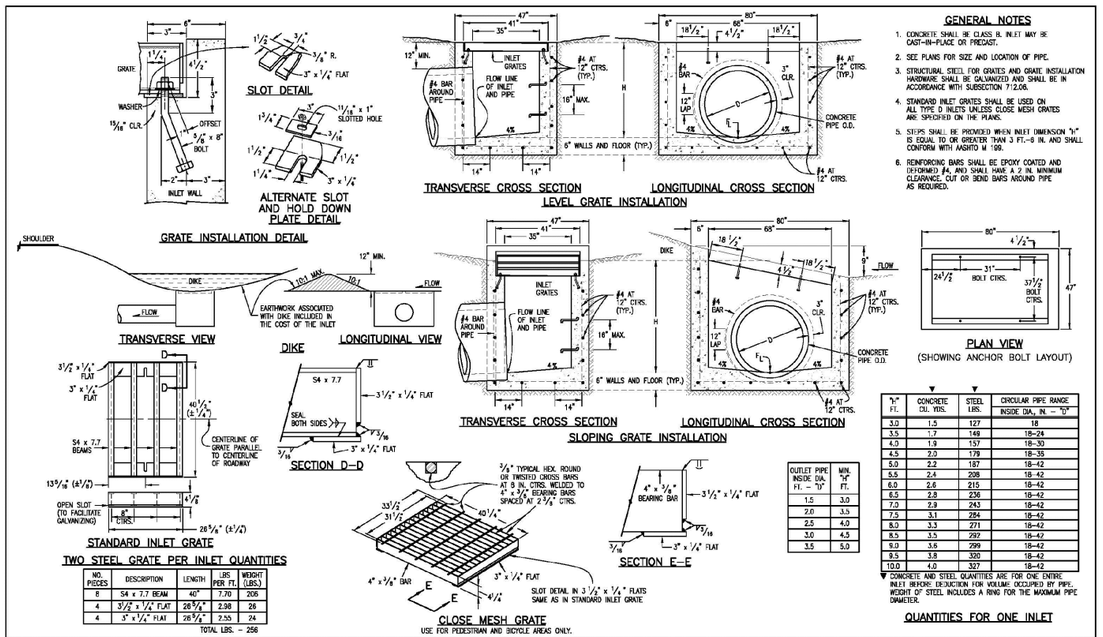

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
2. SEE PLANS FOR SIZE AND LOCATION OF PIPE.
3. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
4. STANDARD INLET GRATES SHALL BE USED ON ALL TYPE D INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT.-6 IN. AND SHALL CONFORM WITH AASHTO M 199.
6. REINFORCING BARS SHALL BE EPOXY COATED AND DEFORMED #4, AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. CUT OR BEND BARS AROUND PIPE AS REQUIRED.

TWO STEEL GRATE PER INLET QUANTITIES

NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
8	S4 x 7.7 BEAM	40"	7.70	206
4	3 1/2" x 1/4" FLAT	26 5/8"	2.98	26
4	3" x 1/4" FLAT	26 5/8"	2.55	24
TOTAL LBS. - 256				

OUTLET PIPE INSIDE DIA. FT. - "D"	MIN. "H" FT.
1.5	3.0
2.0	3.5
2.5	4.0
3.0	4.5
3.5	5.0

"H" FT.	CONCRETE CU. YDS.	STEEL LBS.	CIRCULAR PIPE RANGE INSIDE DIA. IN. - "D"
3.0	1.5	127	18
3.5	1.7	149	18-24
4.0	1.9	157	18-30
4.5	2.0	179	18-35
5.0	2.2	187	18-42
5.5	2.4	208	18-42
6.0	2.6	215	18-42
6.5	2.8	236	18-42
7.0	2.9	243	18-42
7.5	3.1	264	18-42
8.0	3.3	271	18-42
8.5	3.5	292	18-42
9.0	3.6	299	18-42
9.5	3.8	320	18-42
10.0	4.0	327	18-42

▼ CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

QUANTITIES FOR ONE INLET

Computer File Information	
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Last Modification Date: 07/04/06	Initials: LTA
Full Path: www.cot.state.co.us/DesignSupport/	
Drawing File Name: 6040110101.dwg	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	

Sheet Revisions	
Date:	Comments

Colorado Department of Transportation
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Denver, Colorado 80222
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Project Development Branch SRJ/LTA

INLET, TYPE D

STANDARD PLAN NO.
M-604-11
Sheet No. 1 of 1
Issued By: Project Development Branch on July 04, 2006

PREPARED BY:

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BOULDER • COLORADO SPRINGS

CLIENT:

CONSTRUCTION PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-29-16
REVISED	10-17-16

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: N/A
VERTICAL: N/A

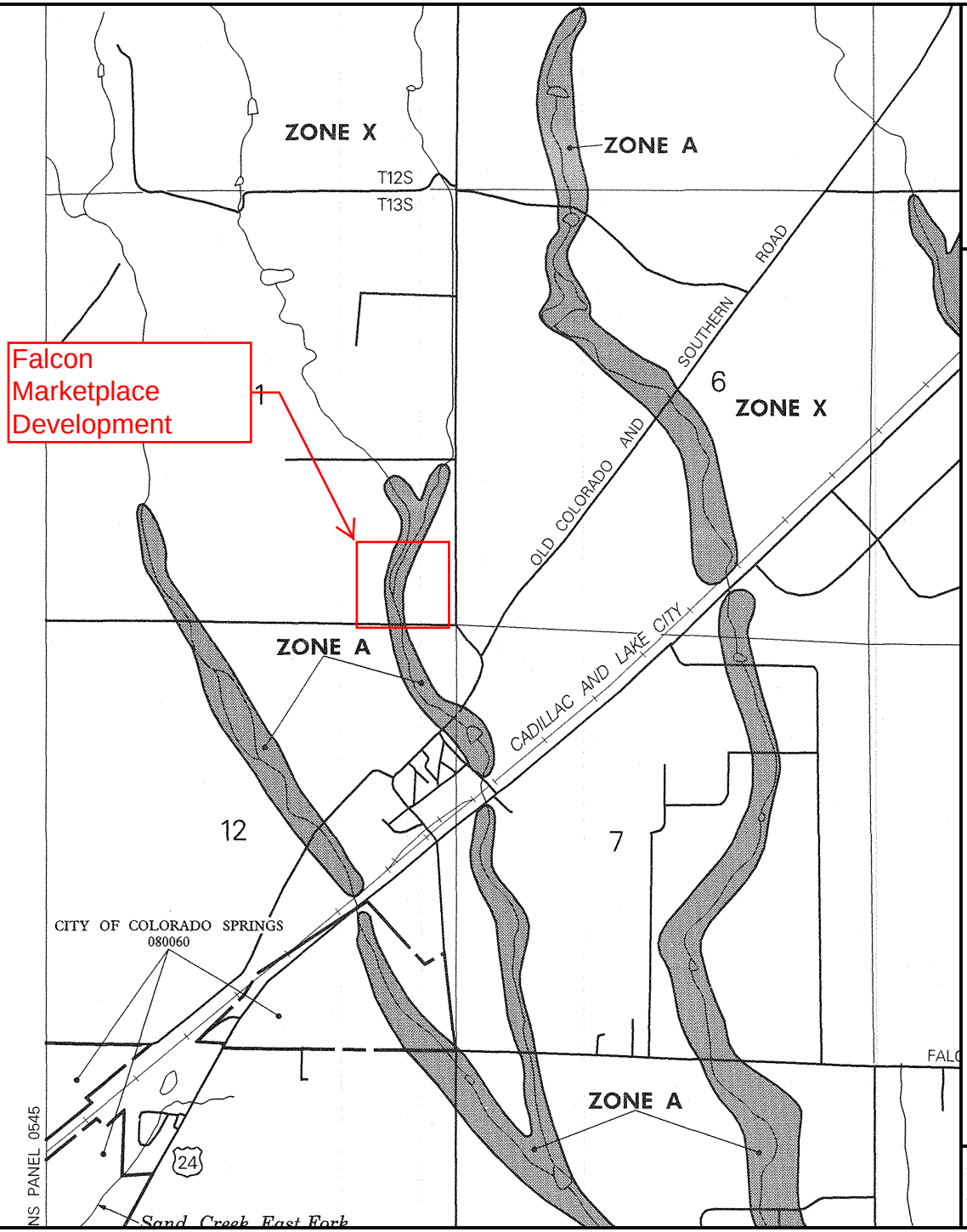
DETENTION BASIN DETAILS

PROJECT NO. 20988-00CSCV
DRAWING NO.
C-05

SHEET: 5 OF 5

APPENDIX 2

FEMA INFORMATION



APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 575 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0575	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0575	F

MAP NUMBER 08041C0575 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

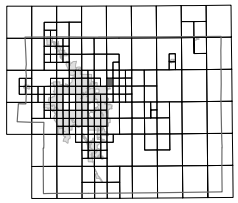
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

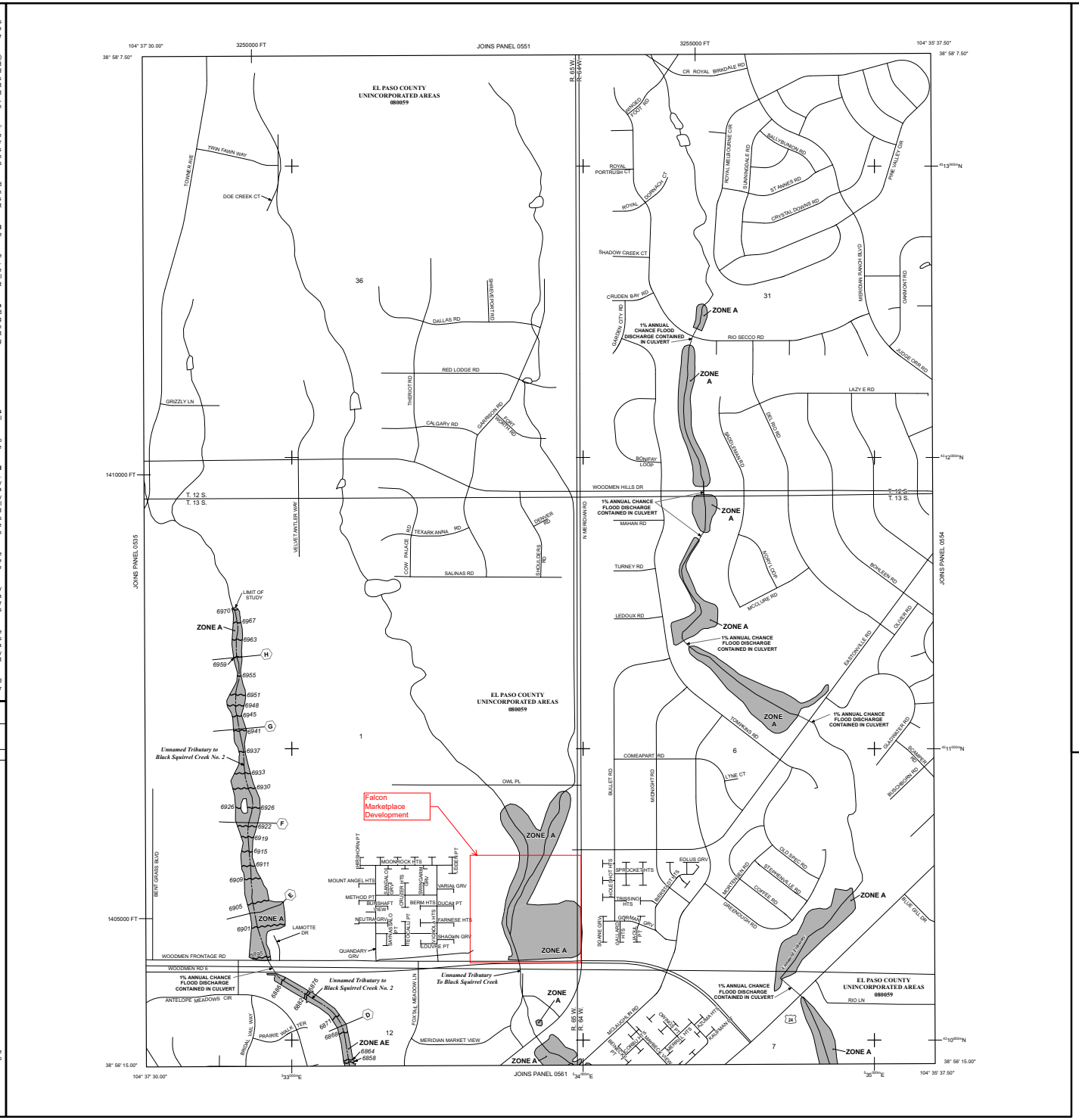
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A Cross section line
23 - - - 23 Transect line
97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4172000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
[MAP REVISED DATE] - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

PANEL 0553G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 553 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0553	G

PRELIMINARY
JULY 29, 2015

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0553G

MAP REVISED

Federal Emergency Management Agency

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	BRIDGE CHANNELIZATION CULVERT	FLOODWAY HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	Woodmen Road Widening Project -- Powers Boulevard to US-24	APPROXIMATE LATITUDE & LONGITUDE: 38.941, -104.693 SOURCE: Other DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 08041C0535F DATE: March 17, 1997 TYPE: FIRM* NO.: 08041C0575F DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILE(S): 204, 343, and 343(A) FLOODWAY DATA TABLE: TABLE 5

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES) See Page 2 for Additional Flooding Sources

Sand Creek - From approximately 615 feet downstream of East Woodmen Road to approximately 980 feet upstream of East Woodmen Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sand Creek	Zone AE	Zone AE	YES	YES
	Zone X (shaded)	Zone X (shaded)	YES	YES
	BFEs	BFEs	YES	YES
	Floodway	Floodway	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information Exchange (FMIXESC) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the Engineering Library, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

Sand Creek - From approximately 615 feet downstream of East Woodmen Road to approximately 980 feet upstream of East Woodmen Road

East Fork Sand Creek - From approximately 1,260 feet downstream of East Woodmen Road to approximately 590 feet upstream of East Woodmen Road

Unnamed Tributary to Black Squirrel Creek No. 2 - From approximately 330 feet downstream of Woodmen Road to approximately 760 feet upstream of Woodmen Road

Falcon Basin Middle Tributary - From Woodmen Road to approximately 780 feet upstream of Woodmen Road

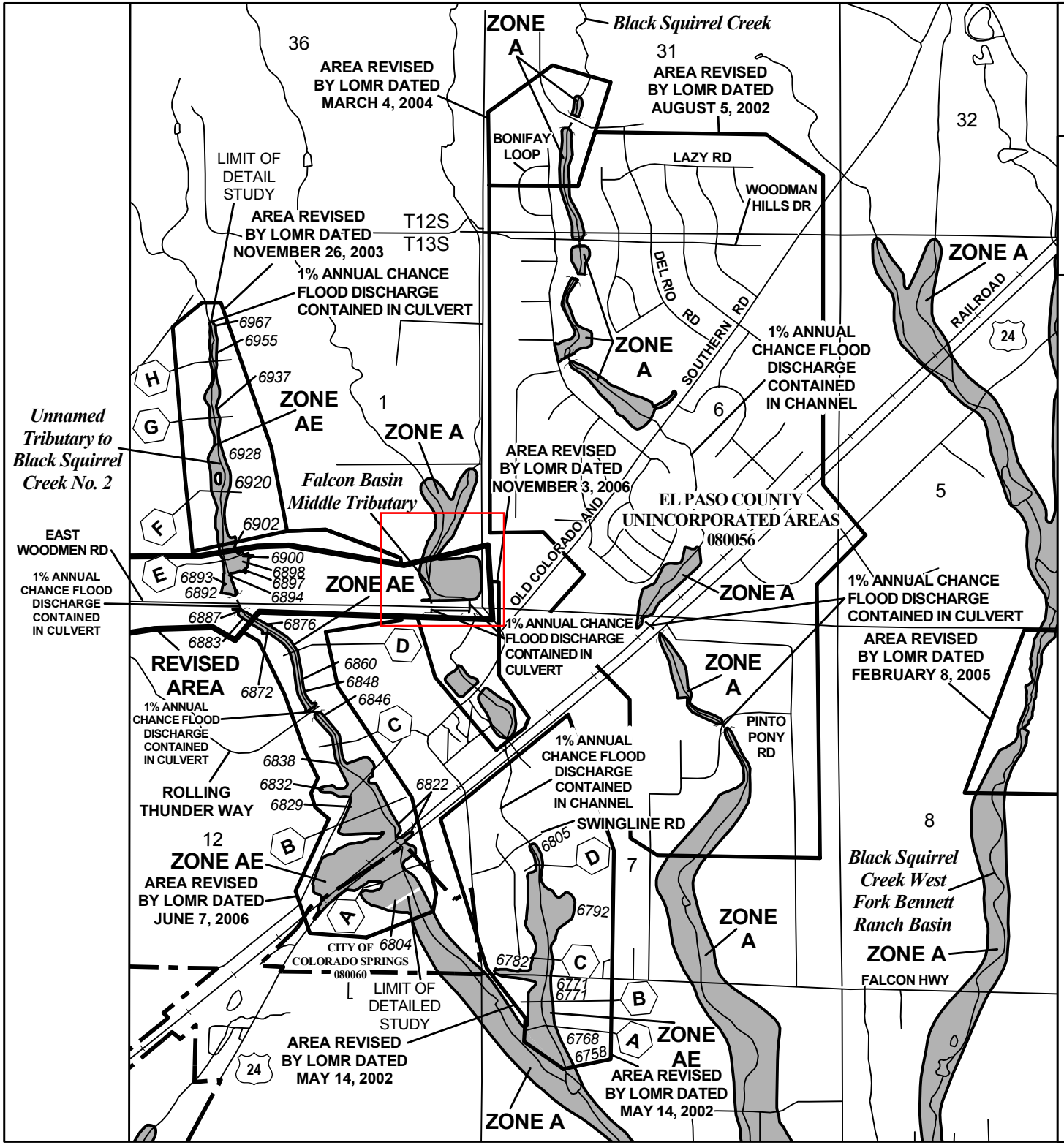
SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sand Creek	Zone X (unshaded)	Zone X (unshaded)	YES	YES
East Fork Sand Creek	Zone A	Zone A	YES	YES
	Zone X (unshaded)	Zone X (unshaded)	YES	YES
Unnamed Tributary to Black Squirrel Creek No. 2	Zone AE	Zone AE	YES	YES
	BFEs	BFEs	YES	YES
	Zone X (unshaded)	Zone X (unshaded)	YES	YES
Falcon Basin Middle Tributary	Zone A	Zone A	YES	YES
	Zone X (unshaded)	Zone X (unshaded)	YES	YES

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information Exchange (FMIXESC) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the Engineering Library, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

David N. Bascom, CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Legend

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

MAP SCALE 1" = 2000'

1000 0 2000 FEET

600 0 600 METERS

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 575 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0575	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0575	F

REVISION TO REFLECT LOMR EFFECTIVE: February 28, 2013

MAP NUMBER 08041C0575 F

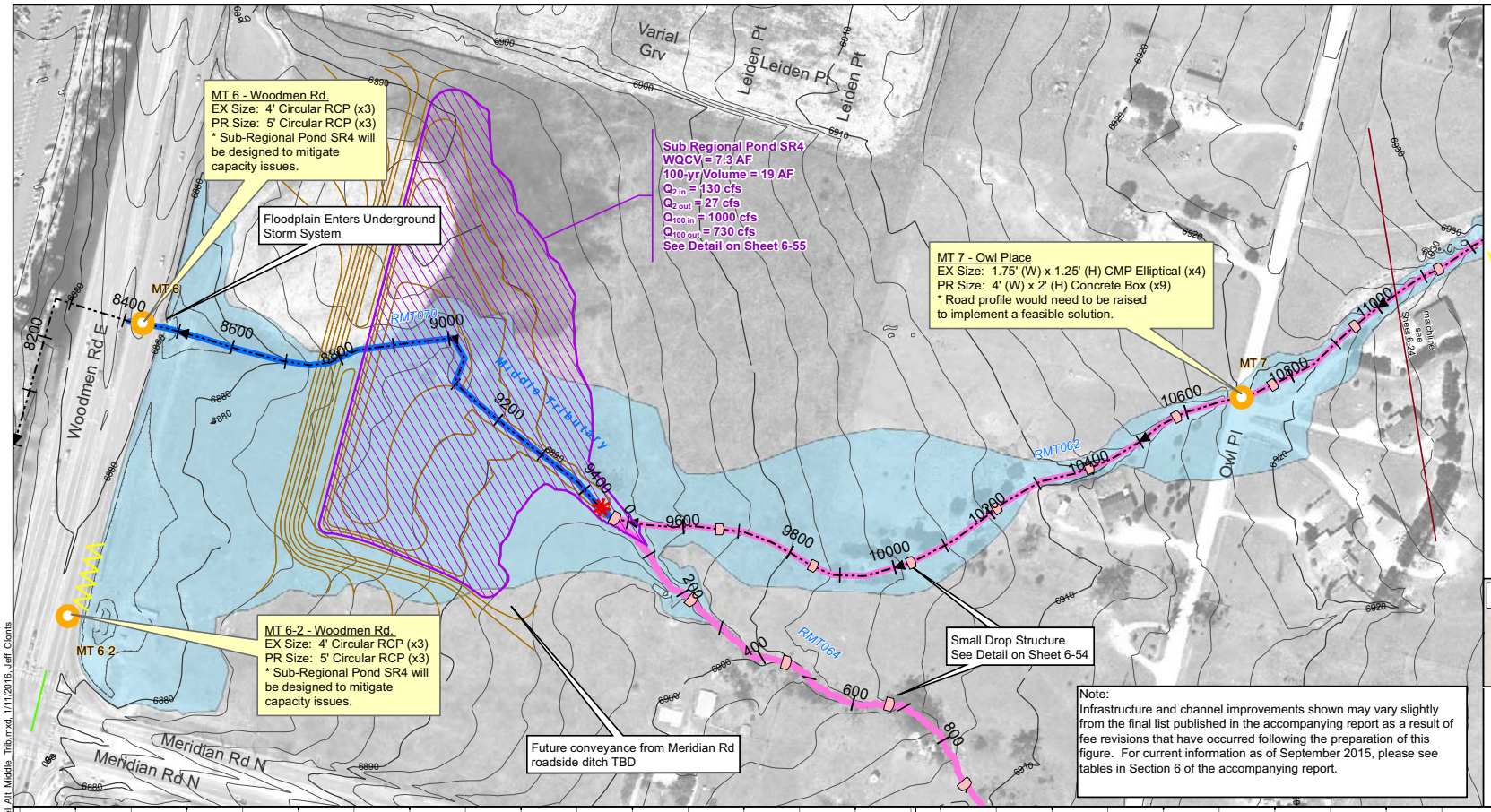
EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

APPENDIX 3

FALCON DBPS

Sheet 6-23
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO



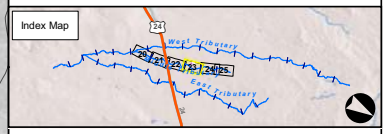
Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

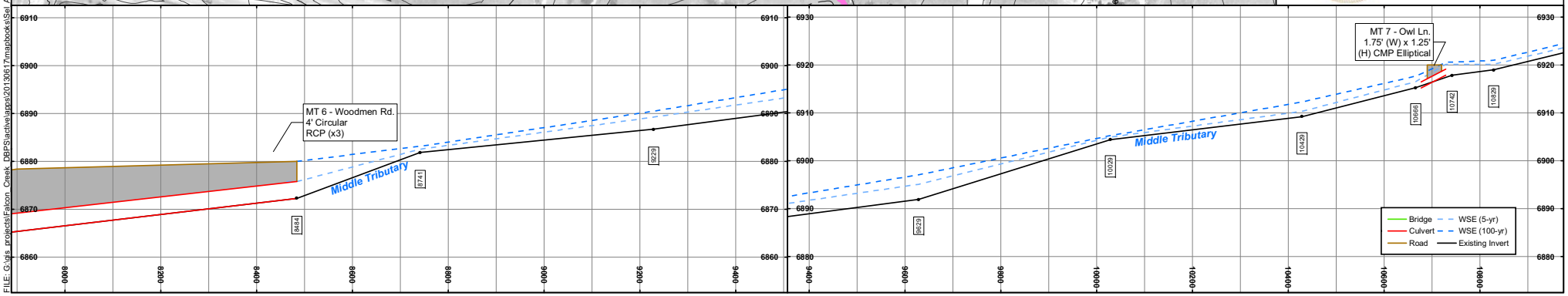
Storm Sewer
Inlet
Manhole
Pipe

Reach Improvements
Natural Channel Design
Protect In Place
Roadside Ditch Improvement
Small Drop Structures w/ Toe Protection
Existing Detention
Proposed Detention
Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

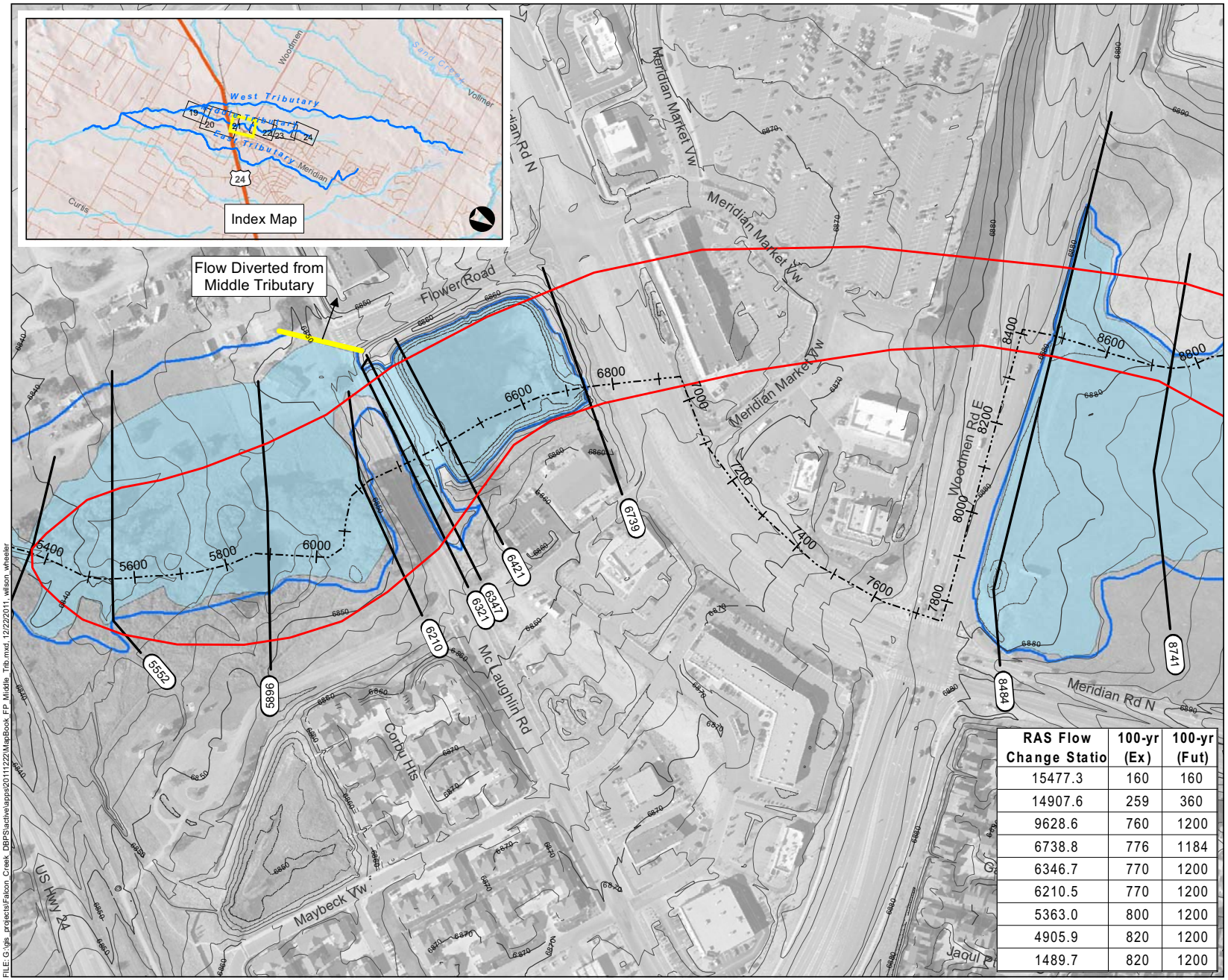
0 100 200 Feet

* These approximate 100-yr floodplain boundaries are for planning purposes only. This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area.
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.





FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20130617\mapbooks\Sel Alt Middle Trib.mxd, 1/11/2016, Jeff Clonts



RAS Flow Change Statio	100-yr (Ex)	100-yr (Fut)
15477.3	160	160
14907.6	259	360
9628.6	760	1200
6738.8	776	1184
6346.7	770	1200
6210.5	770	1200
5363.0	800	1200
4905.9	820	1200
1489.7	820	1200

Sheet 4-21

Middle Tributary Floodplain
Falcon DBPS
El Paso County, CO

Legend

- Approximate 100-yr Floodplain Existing
- Approximate 100-yr Floodplain Existing (Based on Assumed Split Flow Condition)
- Approximate 100-yr Floodplain Future
- Approximate 100-yr Floodplain Future (Based on Assumed Split Flow Condition)
- Shallow Flooding
- HEC-RAS Centerline
- XSCutLines (Middle Trib)
- FEMA Regulatory Floodplain (Effective as of of 1999)*
- Study Limit

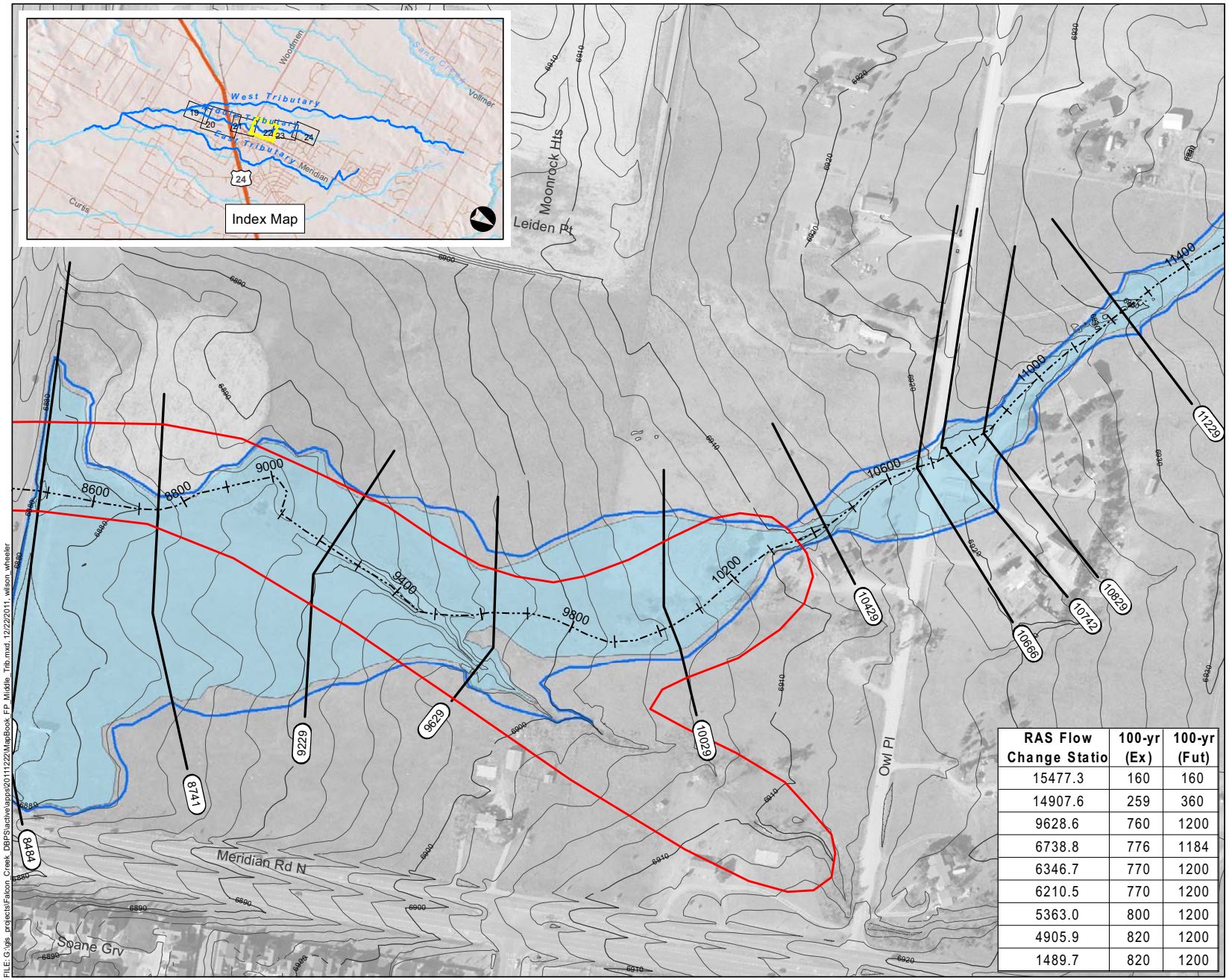
*Letters of Map Change completed after 1999 are not shown

N

0 100 200 400
Feet

Matrix DESIGN GROUP

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20111222\MapBook_FP_Middle_Trib.mxd, 12/22/2011, wilson_wheeler



RAS Flow Change Statio	100-yr (Ex)	100-yr (Fut)
15477.3	160	160
14907.6	259	360
9628.6	760	1200
6738.8	776	1184
6346.7	770	1200
6210.5	770	1200
5363.0	800	1200
4905.9	820	1200
1489.7	820	1200

Sheet 4-22

Middle Tributary Floodplain
Falcon DBPS
El Paso County, CO

Legend

- Approximate 100-yr Floodplain Existing
- Approximate 100-yr Floodplain Existing (Based on Assumed Split Flow Condition)
- Approximate 100-yr Floodplain Future
- Approximate 100-yr Floodplain Future (Based on Assumed Split Flow Condition)
- Shallow Flooding
- HEC-RAS Centerline
- XSCutLines (Middle Trib)
- FEMA Regulatory Floodplain (Effective as of 1999)*
- Study Limit

*Letters of Map Change completed after 1999 are not shown

N

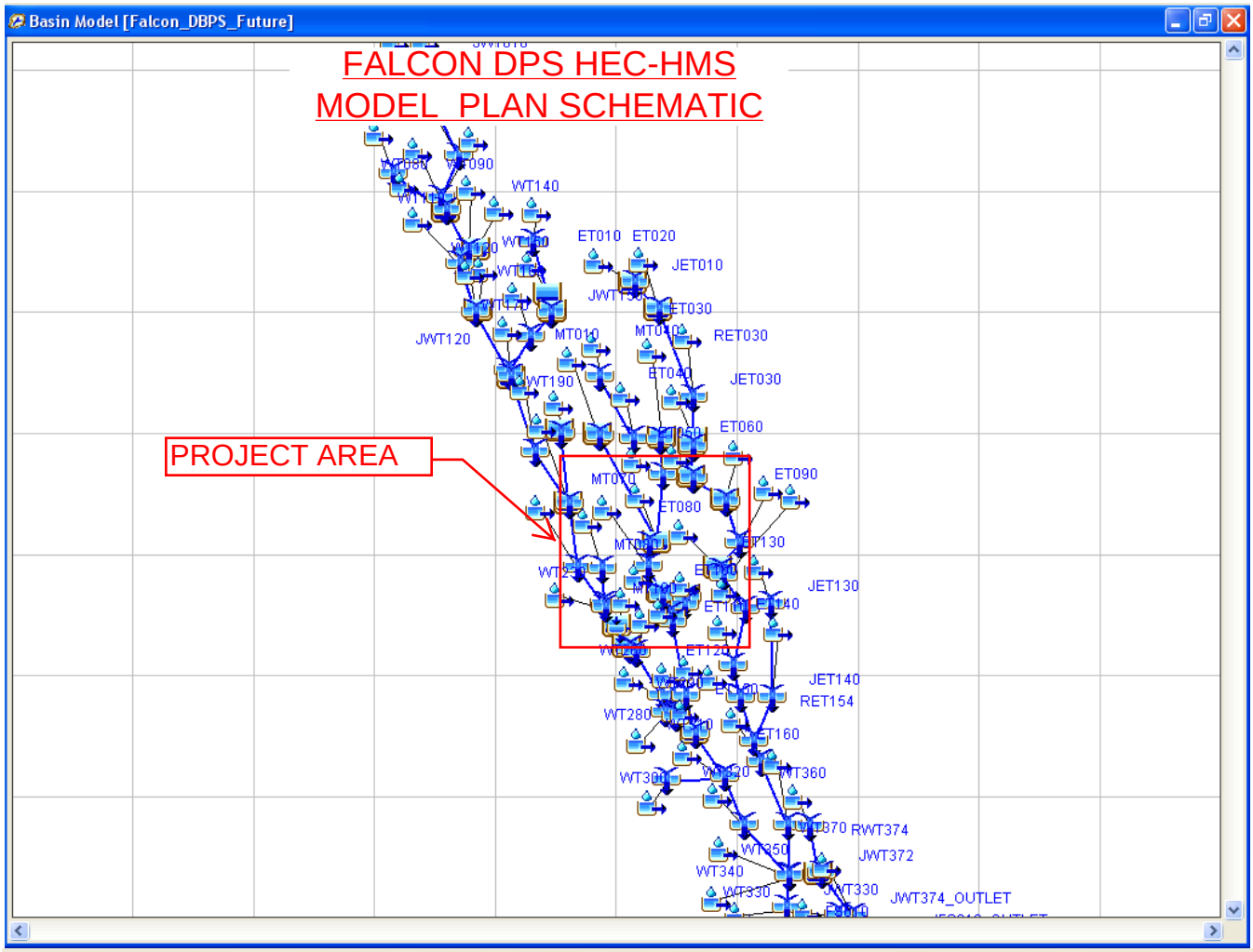
0 100 200 400
Feet

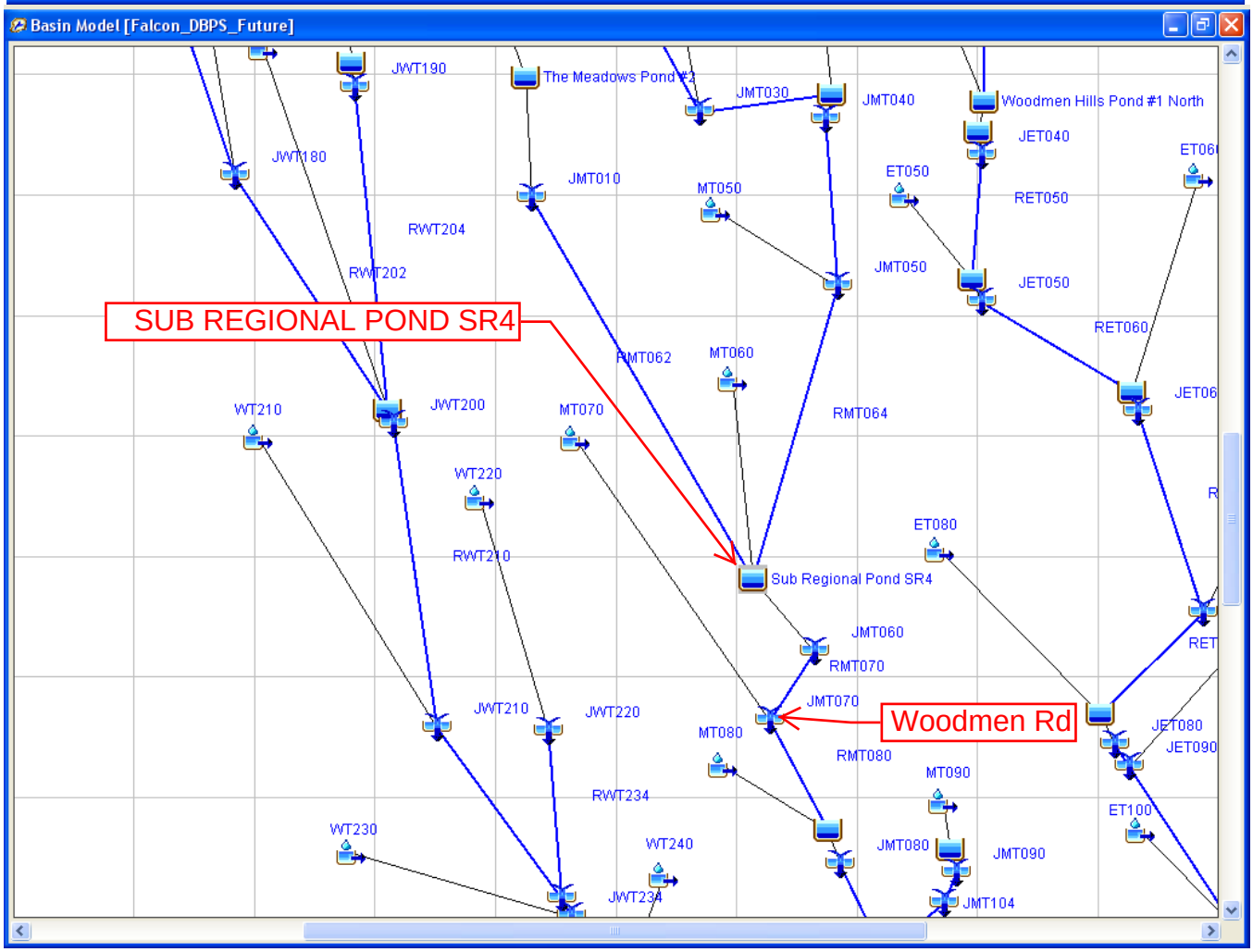
Matrix DESIGN GROUP

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20111222\MapBook_FP_Middle_Trib.mxd, 12/22/2011, wilson_wheeler

APPENDIX 4

HEC-HMS MODELING


Basin Model [Falcon_DBPS_Future]
FALCON DPS HEC-HMS
MODEL PLAN SCHEMATIC
PROJECT AREA
WT140
ET010
ET020
JET010
JWT120
RET030
JET030
ET060
ET090
ET080
JET130
JET140
RET154
WT280
WT360
RWT374
JWT372
WT340
JWT374_OUTLET


Basin Model [Falcon_DBPS_Future]
JWT190
The Meadows Pond #2
JMT030
JMT040
Woodmen Hills Pond #1 North
JET040
JWT180
JMT010
MT050
ET050
RET050
RWT204
RWT202
JMT050
JET050
SUB REGIONAL POND SR4
RET060
RMT062
MT060
WT210
JWT200
MT070
RMT064
WT220
ET080
RWT210
Sub Regional Pond SR4
JMT060
RMT070
JMT070
Woodmen Rd
JWT210
JWT220
MT080
RMT080
JET080
JET090
MT090
RWT234
ET100
WT230
WT240
JMT080
JMT090
JWT234
JMT104

Summary Results for Reservoir "Sub Regional Pond SR4"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 100-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	100-yr
Compute Time:	14Oct2016, 16:56:14	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	1016.1 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:21
Peak Outflow :	643.9 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 06:38
Total Inflow :	1.85 (IN)	Peak Storage :	26.6 (AC-FT)
Total Outflow :	1.62 (IN)	Peak Elevation :	6897.0 (FT)

Summary Results for Reservoir "Sub Regional Pond SR4"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 50-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	50-yr
Compute Time:	17Oct2016, 10:18:20	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	846.6 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:22
Peak Outflow :	480.5 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 06:41
Total Inflow :	1.58 (IN)	Peak Storage :	24.5 (AC-FT)
Total Outflow :	1.35 (IN)	Peak Elevation :	6896.4 (FT)

Summary Results for Reservoir "Sub Regional Pond SR4"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 25-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	25-yr
Compute Time:	17Oct2016, 10:22:41	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	697.0 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:23
Peak Outflow :	338.4 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 06:46
Total Inflow :	1.31 (IN)	Peak Storage :	22.5 (AC-FT)
Total Outflow :	1.10 (IN)	Peak Elevation :	6895.8 (FT)

Summary Results for Reservoir "Sub Regional Pond SR4"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 10-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	10-yr
Compute Time:	17Oct2016, 10:26:50	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	430.8 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:26
Peak Outflow :	105.8 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 07:29
Total Inflow :	0.84 (IN)	Peak Storage :	18.3 (AC-FT)
Total Outflow :	0.64 (IN)	Peak Elevation :	6894.6 (FT)

Summary Results for Reservoir "Sub Regional Pond SR4"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 5-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	5-yr
Compute Time:	17Oct2016, 10:33:06	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	310.4 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:28
Peak Outflow :	51.7 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 08:13
Total Inflow :	0.62 (IN)	Peak Storage :	17.0 (AC-FT)
Total Outflow :	0.45 (IN)	Peak Elevation :	6894.2 (FT)

Summary Results for Reservoir "Sub Regional Pond SR4"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 2-yr Reservoir: Sub Regional Pond SR4

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	2-yr
Compute Time:	17Oct2016, 10:44:25	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow :	133.4 (CFS)	Date/Time of Peak Inflow :	01Jan2011, 06:40
Peak Outflow :	11.8 (CFS)	Date/Time of Peak Outflow :	01Jan2011, 10:43
Total Inflow :	0.35 (IN)	Peak Storage :	10.0 (AC-FT)
Total Outflow :	0.25 (IN)	Peak Elevation :	6891.8 (FT)

Summary Results for Junction "JMT070"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 100-yr Junction: JMT070

Start o...	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Fu
End o...	02Jan2011, 00:00	Meteorologic Model:	100-yr
Comput...	DATA CHANGED, RECOMPUTE	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Outflow : 756.8 (CFS) Date/Time of Peak Outflow : 01Jan2011, 06:42
Total Outflow : 1.67 (IN)

Summary Results for Junction "JMT070"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 50-yr Junction: JMT070

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	50-yr
Compute Time:	17Oct2016, 10:18:20	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Outflow : 562.2 (CFS) Date/Time of Peak Outflow : 01Jan2011, 06:46
Total Outflow : 1.40 (IN)

Summary Results for Junction "JMT070"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 25-yr Junction: JMT070

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	25-yr
Compute Time:	17Oct2016, 10:22:41	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Outflow : 397.5 (CFS) Date/Time of Peak Outflow : 01Jan2011, 06:49
Total Outflow : 1.14 (IN)

Summary Results for Junction "JMT070"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 10-yr Junction: JMT070

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	10-yr
Compute Time:	17Oct2016, 10:26:50	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Outflow : 119.0 (CFS) Date/Time of Peak Outflow : 01Jan2011, 07:31
Total Outflow : 0.68 (IN)

Summary Results for Junction "JMT070"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 5-yr Junction: JMT070

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	5-yr
Compute Time:	17Oct2016, 10:33:06	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Outflow : 61.5 (CFS) Date/Time of Peak Outflow : 01Jan2011, 06:25
Total Outflow : 0.49 (IN)

Summary Results for Junction "JMT070"

Project: Proposed_Falcon_DPMS
Simulation Run: FU 2-yr Junction: JMT070

Start of Run:	01Jan2011, 00:00	Basin Model:	Falcon_DBPS_Future
End of Run:	02Jan2011, 00:00	Meteorologic Model:	2-yr
Compute Time:	17Oct2016, 10:44:25	Control Specifications:	24-hr Storm

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Outflow : 32.1 (CFS) Date/Time of Peak Outflow : 01Jan2011, 06:26
Total Outflow : 0.27 (IN)

Project: Falcon Marketplace
Project No.: 20988-00

HEC-HMS Data Output
Proposed Conditions Model (Drexel Barrell Model)
File: H:\20988-00CSCV-BOULDER\Proposed_Falcon_DPMS\Proposed_Falcon_DPMS.hms
HMS Project: Proposed_Falcon_DPMS
Run Date: 10/17/2016
Simulation Run: FU 100-yr
Basin Model: 100-yr
Control Specifications: 24-hr Storm

Hydraulic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
ET010	0.15	198.3	01Jan2011, 06:11	16.4
ET020	0.21	360.5	01Jan2011, 06:06	24.8
ET030	0.20	242	01Jan2011, 06:15	23
ET040	0.15	165.7	01Jan2011, 06:14	15.3
ET050	0.12	197.1	01Jan2011, 06:03	11.6
ET060	0.29	529.3	01Jan2011, 06:01	29.3
ET070	0.25	461	01Jan2011, 06:02	27.3
ET080	0.29	517.9	01Jan2011, 06:07	37.1
ET090	0.12	133	01Jan2011, 06:22	14.9
ET100	0.05	72	01Jan2011, 06:02	4
ET110	0.23	198.8	01Jan2011, 06:12	17.5
ET120	0.11	89.4	01Jan2011, 06:14	8.5
ET130	0.13	85.4	01Jan2011, 06:27	11.2
ET140	0.27	122.8	01Jan2011, 06:46	22.2
ET150	0.18	136.2	01Jan2011, 06:18	14.3
ET160	0.19	137.2	01Jan2011, 06:23	16.3
FS010	0.12	74.9	01Jan2011, 06:16	7.7
JET010	0.15	150.9	01Jan2011, 06:20	16.3
JET020	0.36	195.4	01Jan2011, 06:41	37.9
JET030	0.56	266	01Jan2011, 06:43	60.5
JET040	0.71	261.1	01Jan2011, 07:18	69.5
JET050	0.83	250.3	01Jan2011, 07:46	79.3
JET060	1.11	360.9	01Jan2011, 06:06	105.9
JET070	1.36	636.4	01Jan2011, 06:04	132.9
JET080	1.66	288	01Jan2011, 07:00	139.2
JET090	1.78	330.8	01Jan2011, 06:59	153.9
JET100	1.83	335.4	01Jan2011, 07:01	157.8
JET110	2.05	362.1	01Jan2011, 07:03	175.1
JET120	2.16	403.2	01Jan2011, 06:17	183.2
JET130	0.13	85.4	01Jan2011, 06:27	11.2
JET140	0.40	204.8	01Jan2011, 06:51	33.3
JET152	2.57	572.3	01Jan2011, 07:10	216.1
JET154	2.74	595.8	01Jan2011, 07:12	230.1
JET160	2.93	633.6	01Jan2011, 06:38	245.2
JFS010_OUTLET	0.12	74.9	01Jan2011, 06:16	7.7
JMT010	0.29	99.3	01Jan2011, 06:53	23.4
JMT020	0.09	143.1	01Jan2011, 06:04	9
JMT030	0.25	294.4	01Jan2011, 06:07	24
JMT040	0.56	751.7	01Jan2011, 06:11	61.7
JMT050	0.67	851.9	01Jan2011, 06:14	73.1
JMT060	1.16	643.9	01Jan2011, 06:38	99.8
JMT070	1.36	756.8	01Jan2011, 06:42	120.8
JMT080	1.42	728.6	01Jan2011, 06:49	129.2
JMT090	0.04	18.6	01Jan2011, 06:07	5.9
JMT102	1.46	741.6	01Jan2011, 06:55	134.8
JMT104	0.04	18.6	01Jan2011, 06:08	5.9
JMT106	1.52	741.6	01Jan2011, 06:57	140.6
JMT110	1.64	757.1	01Jan2011, 07:09	151.5
JWT010	0.14	88.9	01Jan2011, 06:17	9.3
JWT020	0.07	41.9	01Jan2011, 06:21	4.8
JWT030	0.14	85.4	01Jan2011, 06:09	10.3
JWT042	0.28	167	01Jan2011, 06:21	19.6
JWT044	0.46	259.4	01Jan2011, 06:28	32.4

Hydraulic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
JWT050	0.85	475.4	01Jan2011, 06:31	62.7
JWT070	0.17	133.9	01Jan2011, 06:12	11.8
JWT080	1.09	513.2	01Jan2011, 06:40	78.4
JWT090	1.43	617.4	01Jan2011, 06:42	108.4
JWT110	1.63	676.9	01Jan2011, 06:41	124.6
JWT120	1.77	710.8	01Jan2011, 06:43	139
JWT140	0.13	178.7	01Jan2011, 06:09	13.6
JWT150	0.36	182.2	01Jan2011, 07:11	38
JWT160	0.47	190.5	01Jan2011, 07:17	48.8
JWT172	2.36	842	01Jan2011, 07:02	197.8
JWT174	2.36	839.1	01Jan2011, 07:05	195.6
JWT180	2.46	852.4	01Jan2011, 07:15	202.7
JWT190	0.06	2.1	01Jan2011, 08:29	2.8
JWT200	2.82	907.4	01Jan2011, 07:26	229.7
JWT210	3.09	1024.4	01Jan2011, 06:55	257.3
JWT220	0.19	250.4	01Jan2011, 06:12	21.3
JWT232	3.28	1079.9	01Jan2011, 06:59	278.2
JWT234	3.47	1107.8	01Jan2011, 06:49	301.3
JWT240	3.55	970.8	01Jan2011, 07:47	293.6
JWT250	3.70	982.8	01Jan2011, 07:48	310.6
JWT260	3.84	996.6	01Jan2011, 07:58	321
JWT270	0.03	57.1	01Jan2011, 06:04	3.6
JWT280	0.27	251.8	01Jan2011, 06:12	22.3
JWT292	3.87	999.1	01Jan2011, 08:00	324.4
JWT294	4.13	1016.8	01Jan2011, 08:01	346.5
JWT296	5.88	1463.7	01Jan2011, 07:41	498
JWT300	0.10	91.6	01Jan2011, 06:12	8.1
JWT310	6.25	1489.7	01Jan2011, 07:47	527.6
JWT320	6.46	1501.6	01Jan2011, 07:54	543.8
JWT330	0.33	249.3	01Jan2011, 06:19	27.2
JWT352	9.69	2029.7	01Jan2011, 07:54	813.5
JWT354	10.30	2089.4	01Jan2011, 07:53	863.7
JWT360	0.07	54.8	01Jan2011, 06:15	5.3
JWT372	10.36	2091.6	01Jan2011, 08:02	864.5
JWT374_OUTLET	10.58	2098.8	01Jan2011, 08:12	873.7
MT010	0.29	206.3	01Jan2011, 06:24	25
MT020	0.09	143.1	01Jan2011, 06:04	9
MT030	0.16	228.6	01Jan2011, 06:05	15.1
MT040	0.31	455.2	01Jan2011, 06:11	38.1
MT050	0.12	109.7	01Jan2011, 06:18	11.4
MT060	0.19	199.3	01Jan2011, 06:13	18
MT070	0.20	185.5	01Jan2011, 06:22	21.1
MT080	0.06	191.9	01Jan2011, 06:00	11
MT090	0.04	127.4	01Jan2011, 06:00	7.1
MT100	0.06	88.2	01Jan2011, 06:05	5.9
MT110	0.12	117.4	01Jan2011, 06:16	11.5
Paint Brush Hills Pond #4	0.15	150.9	01Jan2011, 06:20	16.3
Paint Brush Hills Pond A	0.10	142	01Jan2011, 06:10	10.5
Paint Brush Hills Pond B1	0.36	266.5	01Jan2011, 06:36	41.2
Paint Brush Hills Pond B2	0.36	182.2	01Jan2011, 07:11	38
Paint Brush Hills Pond C	0.19	143.8	01Jan2011, 06:15	17.3
Regional Pond MN	1.42	728.6	01Jan2011, 06:49	129.2
Regional Pond R1	5.88	1463.7	01Jan2011, 07:41	498
Regional Pond R2	10.36	2091.6	01Jan2011, 08:02	864.5
Regional Pond WU Diversion	3.55	1072.1	01Jan2011, 07:03	264.2
Regional Pond WU North	3.55	1110.8	01Jan2011, 07:03	307.5
Regional Pond WU South	3.55	932.3	01Jan2011, 07:47	250.5
RET020	0.15	150	01Jan2011, 06:37	16.3
RET030	0.36	194.9	01Jan2011, 07:02	37.5
RET040	0.56	265.2	01Jan2011, 06:50	60.3
RET050	0.71	261.1	01Jan2011, 07:23	69.4
RET060	0.83	250.3	01Jan2011, 07:53	79.1
RET070	1.11	356.7	01Jan2011, 06:16	105.6
RET080	1.36	517.5	01Jan2011, 06:23	131.3
RET090	1.66	287.3	01Jan2011, 07:03	139

Hydraulic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
RET100	1.78	330.7	01Jan2011, 07:01	153.8
RET110	1.83	335.2	01Jan2011, 07:05	157.6
RET120	2.05	361.3	01Jan2011, 07:09	174.7
RET140	0.13	84.7	01Jan2011, 06:54	11.1
RET152	2.16	402.2	01Jan2011, 06:24	182.9
RET154	0.40	204.4	01Jan2011, 07:05	33.2
RET156	2.57	572	01Jan2011, 07:14	215.8
RET162	2.74	595.1	01Jan2011, 07:25	228.9
RET164	2.93	629	01Jan2011, 06:47	244.7
RMT030	0.09	141.8	01Jan2011, 06:17	8.9
RMT040	0.25	293	01Jan2011, 06:11	24
RMT050	0.56	745.8	01Jan2011, 06:14	61.7
RMT062	0.29	99.2	01Jan2011, 07:18	23.2
RMT064	0.67	847	01Jan2011, 06:21	73
RMT070	1.16	641.1	01Jan2011, 06:43	99.7
RMT080	1.36	755.8	01Jan2011, 06:43	120.7
RMT090	0.04	18.6	01Jan2011, 06:08	5.9
RMT102	1.42	726.5	01Jan2011, 06:55	128.9
RMT104	0.04	18.6	01Jan2011, 06:12	5.9
RMT106	1.46	734.8	01Jan2011, 06:57	134.7
RMT112	1.52	737.6	01Jan2011, 07:09	140
RMT114	1.64	756	01Jan2011, 07:14	151.2
RWT030	0.07	41.9	01Jan2011, 06:29	4.8
RWT042	0.14	85.3	01Jan2011, 06:15	10.3
RWT044	0.14	88.8	01Jan2011, 06:24	9.3
RWT046	0.28	166.7	01Jan2011, 06:28	19.6
RWT054	0.46	258.8	01Jan2011, 06:35	32.3
RWT080	0.17	133.4	01Jan2011, 06:22	11.8
RWT092	0.85	475.2	01Jan2011, 06:32	62.7
RWT094	1.09	512.4	01Jan2011, 06:45	78.3
RWT122	1.43	617.2	01Jan2011, 06:44	108.4
RWT124	1.63	676.7	01Jan2011, 06:45	124.4
RWT150	0.13	177.4	01Jan2011, 06:18	13.6
RWT160	0.36	182.2	01Jan2011, 07:18	37.9
RWT172	1.77	709.9	01Jan2011, 06:55	138.6
RWT174	0.47	190.4	01Jan2011, 07:25	48.6
RWT176	2.36	841.9	01Jan2011, 07:03	197.7
RWT180	2.36	838.2	01Jan2011, 07:15	195.1
RWT202	2.46	851.6	01Jan2011, 07:26	202
RWT204	0.06	2.1	01Jan2011, 08:55	2.7
RWT210	2.82	906.9	01Jan2011, 07:31	229.3
RWT232	3.09	1023.5	01Jan2011, 07:00	256.9
RWT234	0.19	249.6	01Jan2011, 06:20	21.3
RWT236	3.28	1079.8	01Jan2011, 06:59	278.2
RWT240	3.47	1104	01Jan2011, 06:52	301.1
RWT240_Diversion Reach	0.00	38.7	01Jan2011, 07:08	43.1
RWT250	3.55	970.5	01Jan2011, 07:48	293.5
RWT260	3.70	982.3	01Jan2011, 07:58	309.5
RWT291	3.84	996.5	01Jan2011, 08:00	320.8
RWT292	0.03	56.9	01Jan2011, 06:08	3.5
RWT294	0.27	251.2	01Jan2011, 06:15	22.2
RWT295	3.87	999	01Jan2011, 08:01	324.2
RWT296	4.13	1016.3	01Jan2011, 08:07	345.7
RWT312	0.10	91.1	01Jan2011, 06:29	8.1
RWT314	5.88	1463.2	01Jan2011, 07:47	497.2
RWT320	6.25	1487.8	01Jan2011, 07:54	526.6
RWT344	0.33	248.4	01Jan2011, 06:25	27.2
RWT352	6.46	1500.1	01Jan2011, 08:04	542.5
RWT354	9.69	2029.7	01Jan2011, 07:54	813.5
RWT372	10.30	2088.2	01Jan2011, 08:00	862.6
RWT374	0.07	54.6	01Jan2011, 06:24	5.3
RWT376	10.36	2089.3	01Jan2011, 08:12	862.2
Sub Regional Pond SR1	1.09	513.2	01Jan2011, 06:40	78.4
Sub Regional Pond SR2	2.36	839.1	01Jan2011, 07:05	195.6
Sub Regional Pond SR3	2.82	907.4	01Jan2011, 07:26	229.7

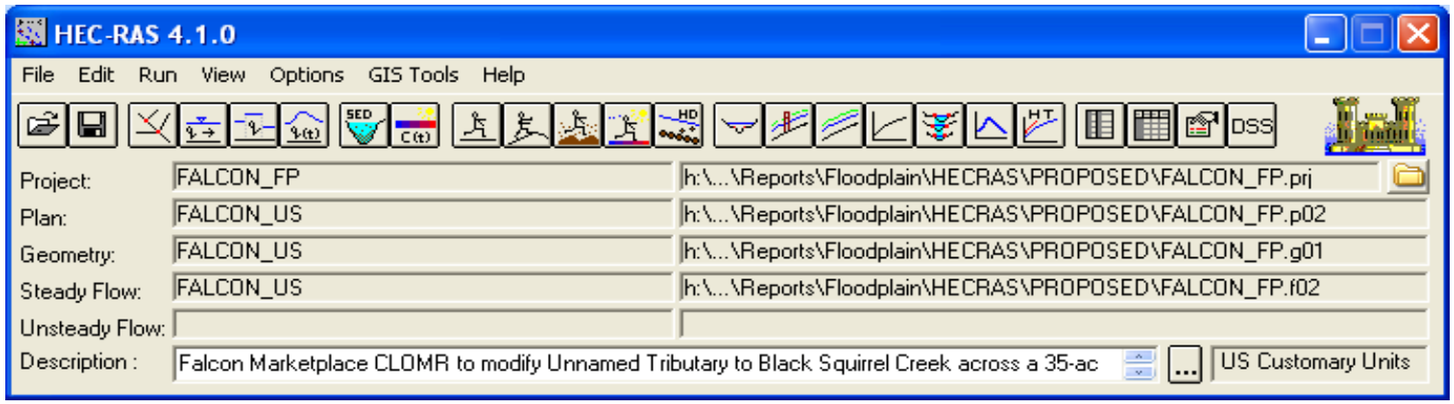
Hydraulic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Sub Regional Pond SR4	1.16	643.9	01Jan2011, 06:38	99.8
Sub Regional Pond SR6	0.36	195.4	01Jan2011, 06:41	37.9
The Meadows Pond #1	0.06	2.1	01Jan2011, 08:29	2.8
The Meadows Pond #2	0.29	99.3	01Jan2011, 06:53	23.4
Woodmen Hills Pond #1 North	0.71	263.5	01Jan2011, 07:09	75.5
Woodmen Hills Pond #1 South	0.71	261.1	01Jan2011, 07:18	69.5
Woodmen Hills Pond #2	0.83	250.3	01Jan2011, 07:46	79.3
Woodmen Hills Pond #3	1.11	360.9	01Jan2011, 06:06	105.9
Woodmen Hills Pond #4	1.66	288	01Jan2011, 07:00	139.2
Woodmen Hills Pond #5	0.04	18.6	01Jan2011, 06:07	5.9
Woodmen Hills Pond H	0.56	751.7	01Jan2011, 06:11	61.7
WT010	0.14	88.9	01Jan2011, 06:17	9.3
WT020	0.07	41.9	01Jan2011, 06:21	4.8
WT030	0.08	75.3	01Jan2011, 06:07	5.5
WT040	0.19	92.7	01Jan2011, 06:28	12.8
WT050	0.19	139.4	01Jan2011, 06:19	15.3
WT060	0.20	116.8	01Jan2011, 06:26	15.1
WT070	0.17	133.9	01Jan2011, 06:12	11.8
WT080	0.07	67.3	01Jan2011, 06:10	5.6
WT090	0.15	162.4	01Jan2011, 06:09	12.8
WT100	0.19	302.8	01Jan2011, 06:04	19.3
WT110	0.19	169.9	01Jan2011, 06:14	16.2
WT120	0.05	54.5	01Jan2011, 06:08	4.1
WT130	0.10	173.1	01Jan2011, 06:05	11.4
WT140	0.13	178.7	01Jan2011, 06:09	13.6
WT150	0.23	248.4	01Jan2011, 06:22	27.7
WT160	0.11	184.5	01Jan2011, 06:02	10.8
WT170	0.12	144.7	01Jan2011, 06:07	10.5
WT180	0.10	65.6	01Jan2011, 06:21	7.6
WT190	0.06	74.7	01Jan2011, 06:05	5
WT200	0.30	186.8	01Jan2011, 06:30	26
WT210	0.27	187.9	01Jan2011, 06:35	28
WT220	0.19	250.4	01Jan2011, 06:12	21.3
WT230	0.20	346.7	01Jan2011, 06:05	23.1
WT240	0.08	160.3	01Jan2011, 06:01	9.1
WT250	0.15	291.4	01Jan2011, 06:02	17.1
WT260	0.14	77.5	01Jan2011, 06:34	11.5
WT270	0.03	57.1	01Jan2011, 06:04	3.6
WT280	0.27	251.8	01Jan2011, 06:12	22.3
WT290	0.10	110.3	01Jan2011, 06:09	8.7
WT300	0.10	91.6	01Jan2011, 06:12	8.1
WT310	0.28	246.7	01Jan2011, 06:13	22.3
WT320	0.21	200.6	01Jan2011, 06:11	17.2
WT330	0.33	249.3	01Jan2011, 06:19	27.2
WT340	0.28	147.3	01Jan2011, 06:37	23.1
WT350	0.30	276.7	01Jan2011, 06:14	26.3
WT360	0.07	54.8	01Jan2011, 06:15	5.3
WT370	0.21	123.3	01Jan2011, 06:12	11.5

APPENDIX 5

HEC-RAS MODELING

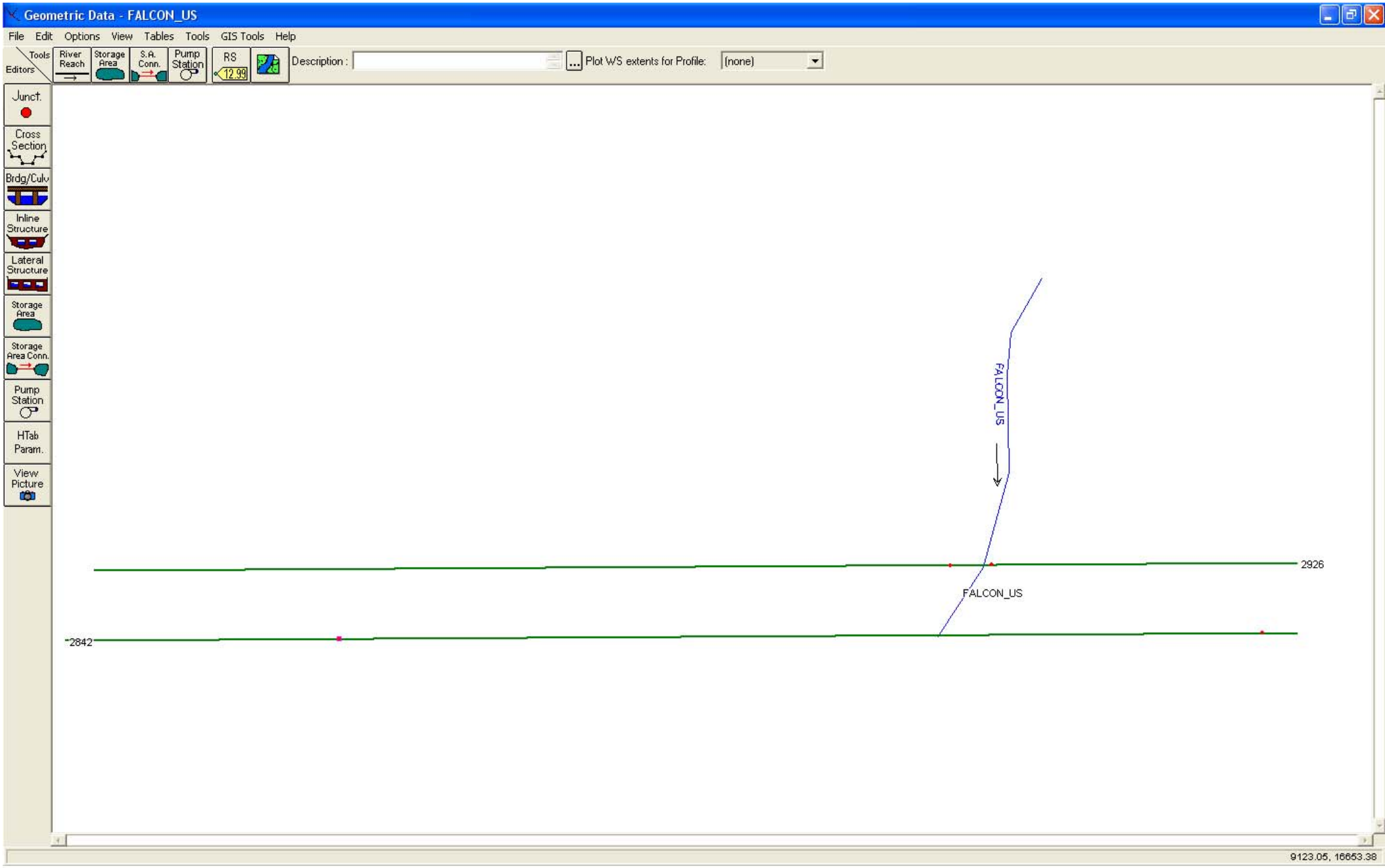
Project: Falcon Marketplace
Project No.: 20988-00

HEC-RAS Data Output
Proposed Conditions Model, North (Drexel Barrell Model)
File: H:\20988-00CSCV\Reports\Floodplain\HECRAS\PROPOSED\FALCON_FP.prj
Plan: FALCON_US

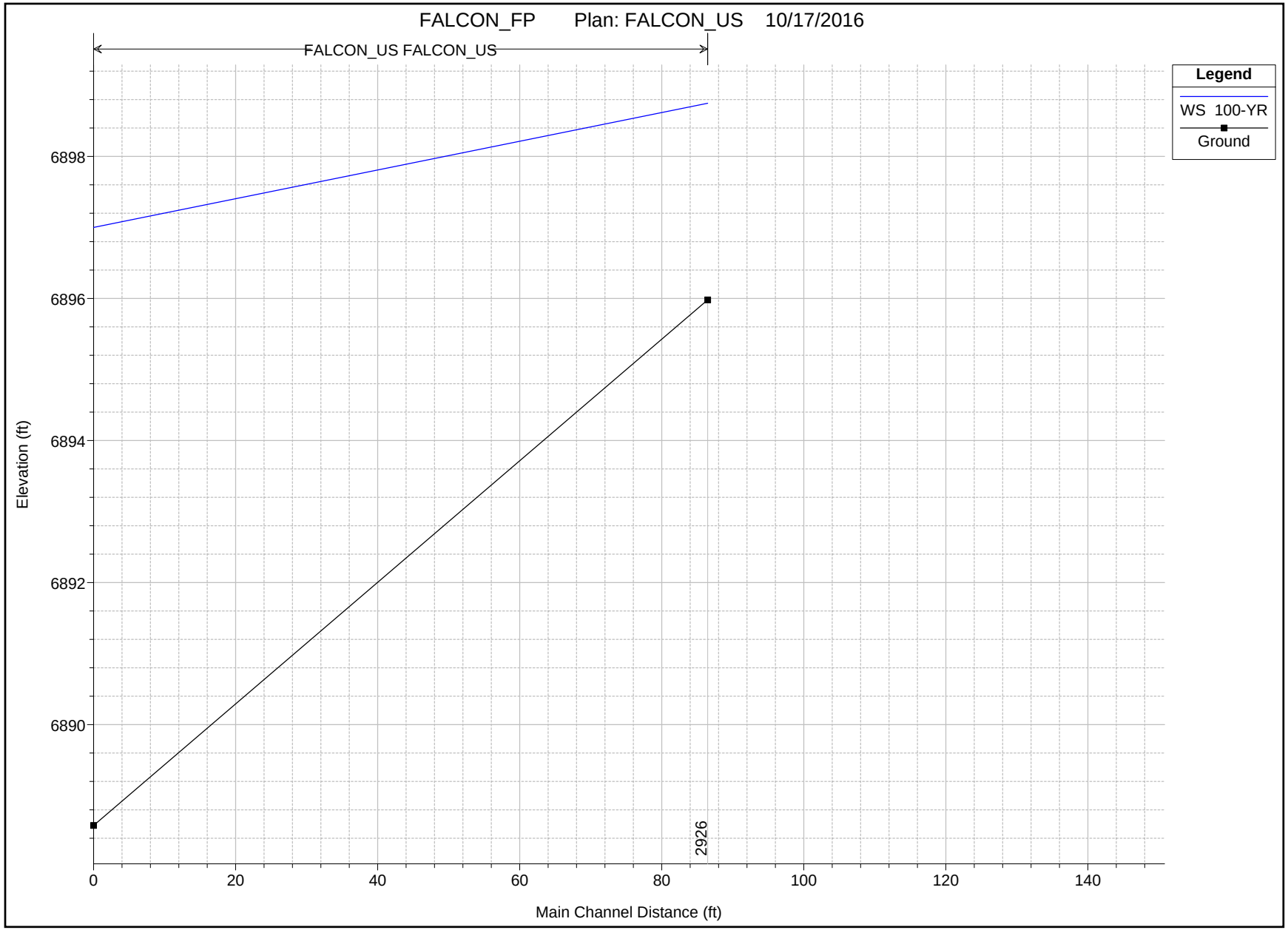


Date: 10/17/16
100-year Output, Standard Tabel 1
Cross Sections: 2926-2842

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
FALCON_US	2926	100-YR	1016	6895.98	6898.75	6898.75	6899.12	0.025538	6.71	306.22	403.31	0.91
FALCON_US	2842	100-YR	1016	6888.58	6897	6889.37	6897	0.000001	0.15	6775.42	897.89	0.01



ras
10/6/2016 , 9:34:18 AM
Geometric Data - FALCON_US



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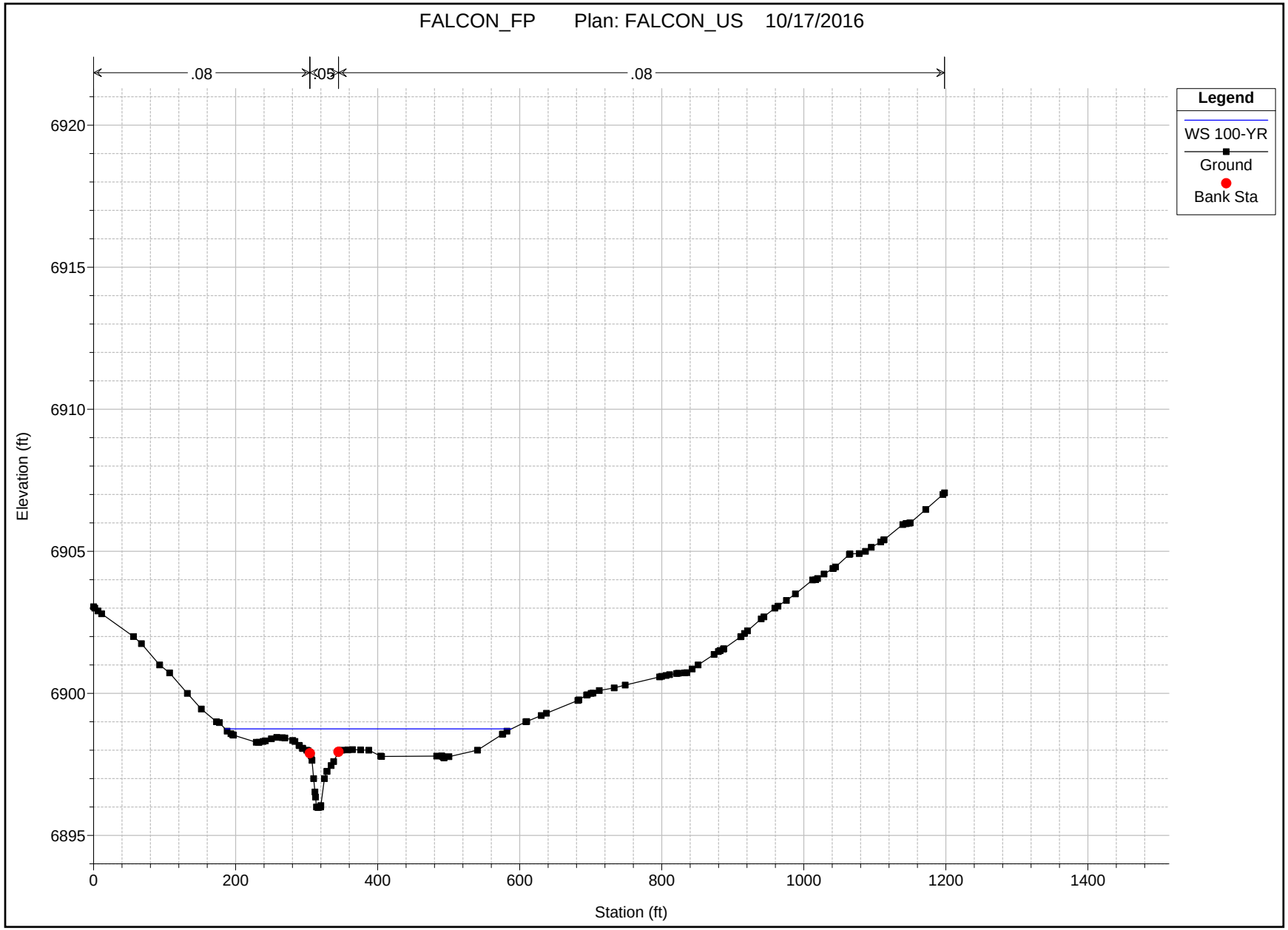
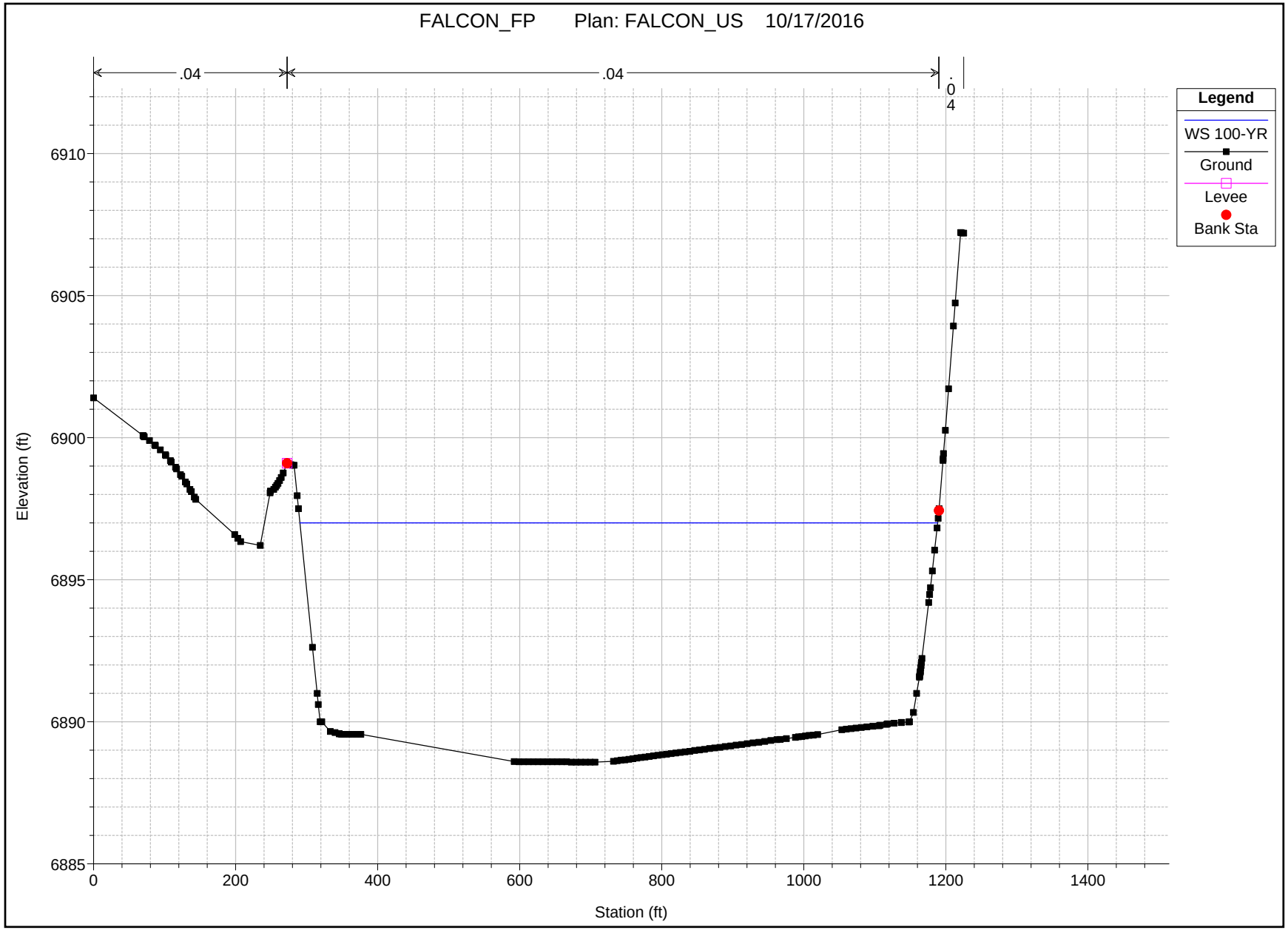


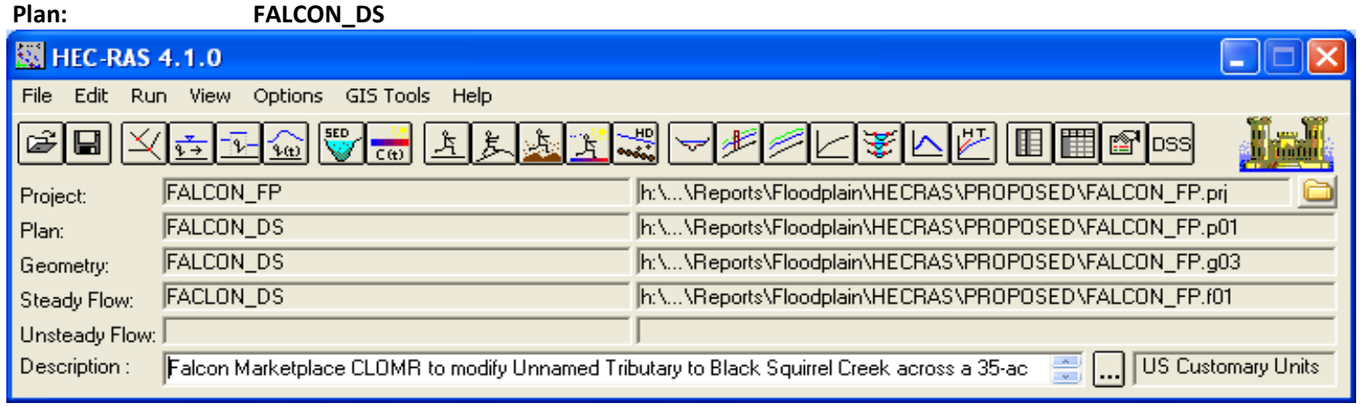
1 in Horiz. = 200 ft 1 in Vert. = 5 ft



1 in Horiz. = 200 ft 1 in Vert. = 5 ft

Project: Falcon Marketplace
Project No.: 20988-00

HEC-RAS Data Output
Proposed Conditions Model, South (Drexel Barrell Model)
File: H:\20988-00CSCV\Reports\Floodplain\HECRAS\PROPOSED\FALCON_FP.prj
Plan: FALCON_DS

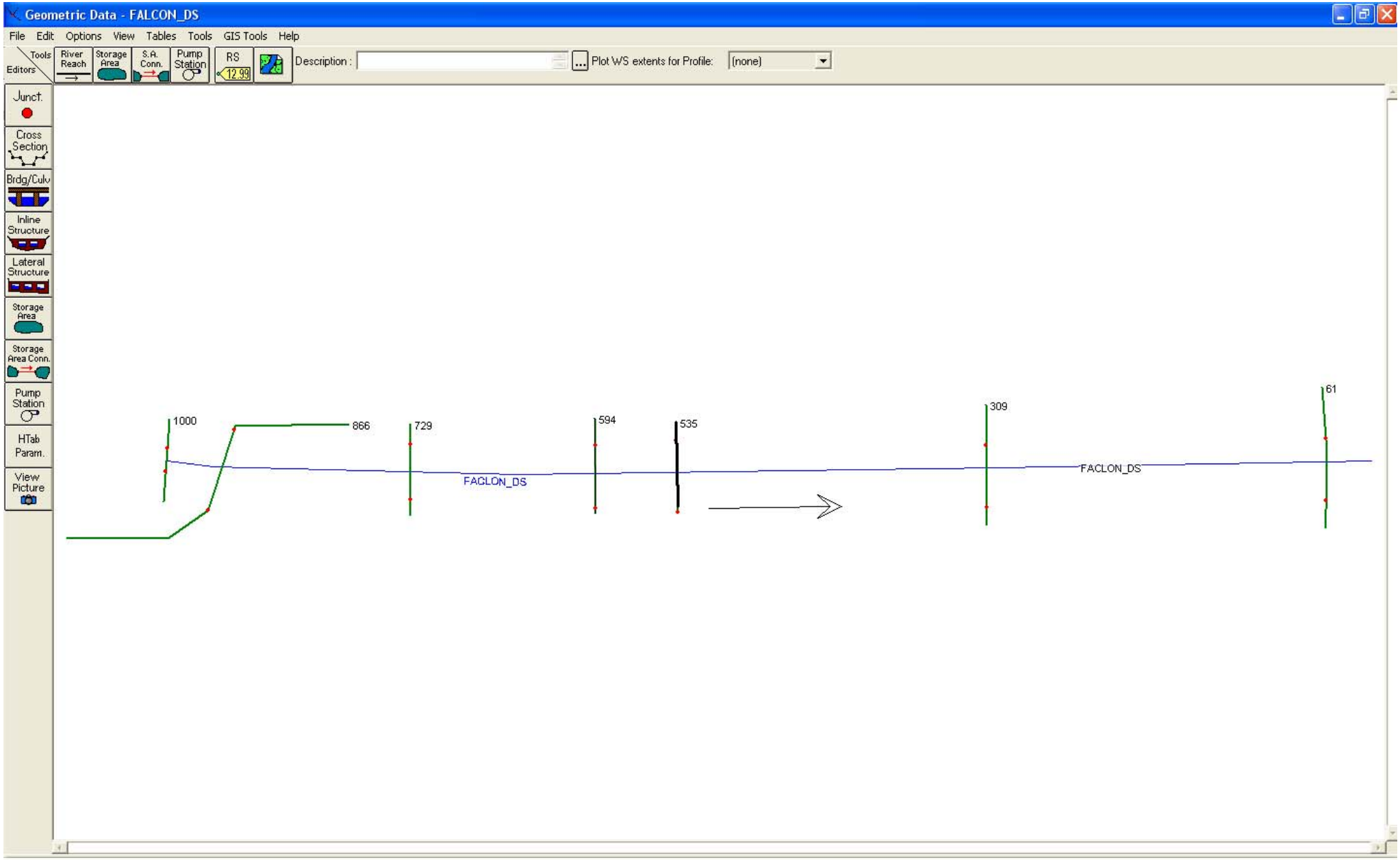


Date: 10/17/16
100-year Output, Standard Tabel 1
Cross Sections: 1000-61

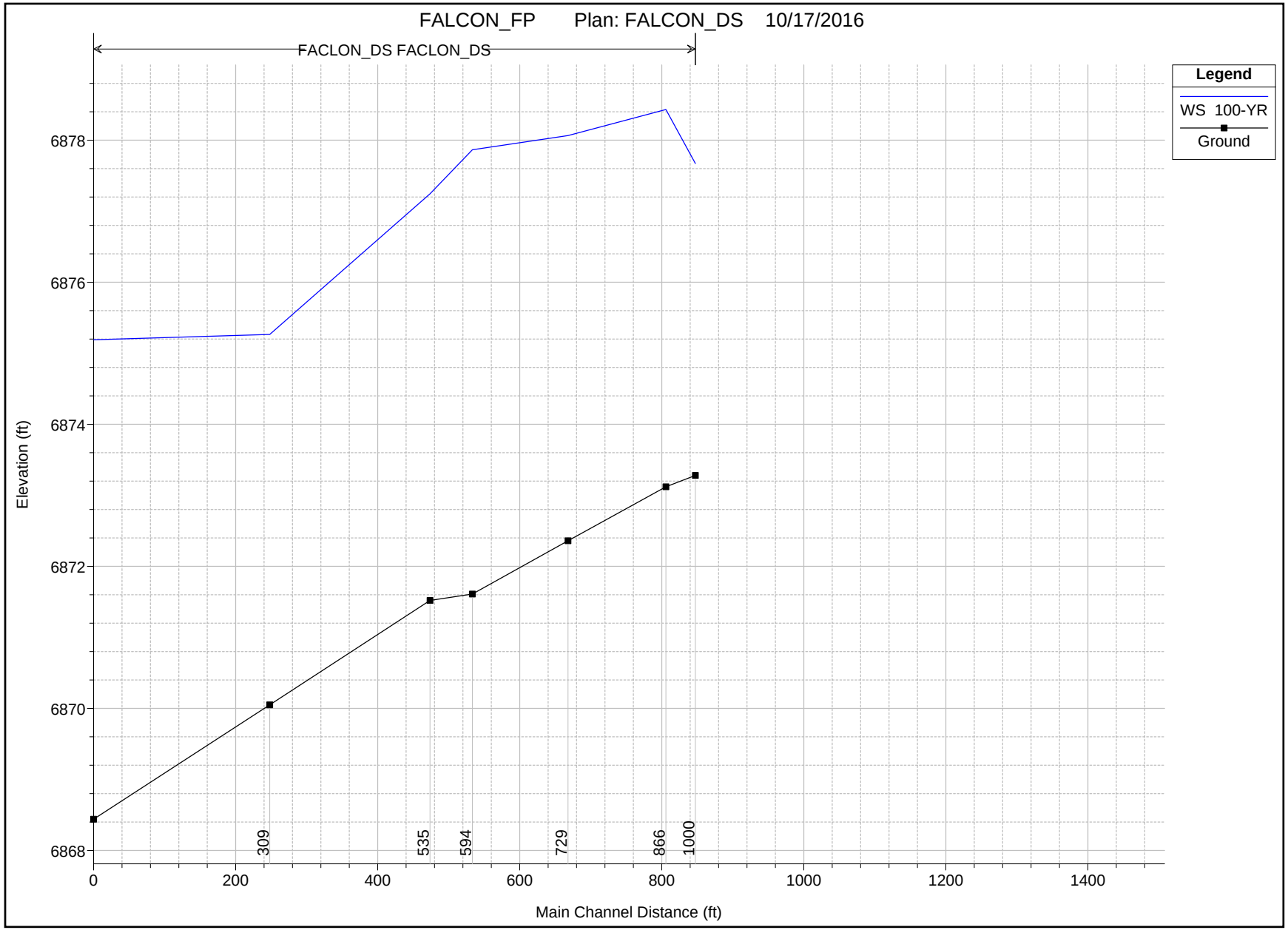
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
FACLON_DS	1000	100-YR	757	6873.28	6877.67	6877.67	6879.83	0.025447	11.78	64.27	15.07	1.01
FACLON_DS	866	100-YR	757	6873.12	6878.43		6878.76	0.003684	4.61	164.2	54.88	0.47
FACLON_DS	729	100-YR	757	6872.36	6878.07		6878.36	0.002239	4.43	181.63	58.61	0.39
FACLON_DS	594	100-YR	757	6871.61	6877.87		6878.09	0.001565	3.81	204.13	64.17	0.32
FACLON_DS	538		Lat Struct									
FACLON_DS	535	100-YR	405.98	6875.9	6877.25	6877.25	6877.88	0.022194	6.39	63.62	51.93	1.01
FACLON_DS	309	100-YR	405.98	6870.05	6875.27		6875.39	0.001048	2.78	149.69	50.01	0.26
FACLON_DS	61	100-YR	405.98	6868.44	6875.19	6871.23	6875.24	0.000291	1.86	238.95	67.57	0.14

100-year Output, Standard Table: Lateral Structures
Reaches: FALCON_DS
Structures: West Culvert

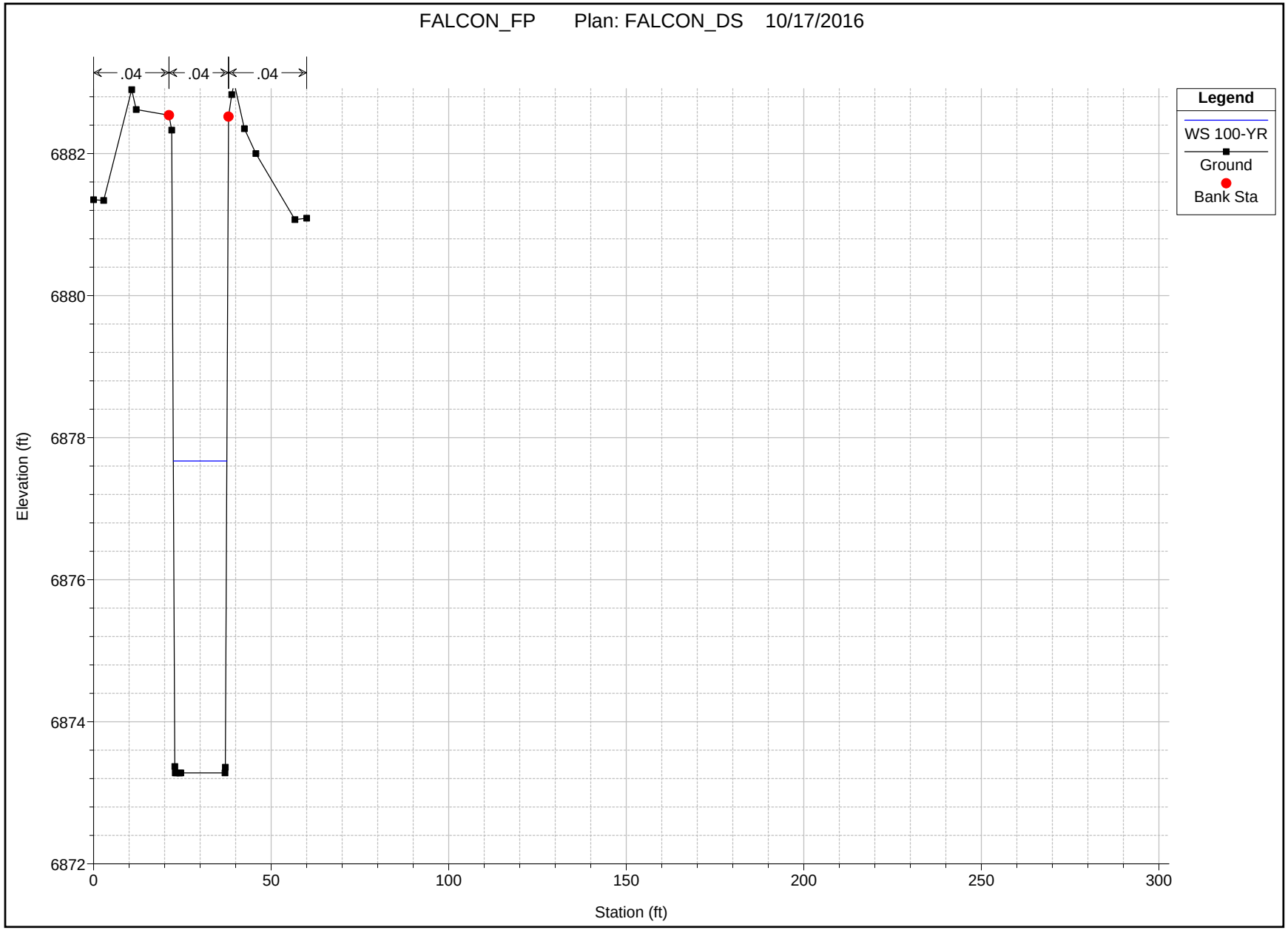
Reach	River Sta	Profile	Q US (cfs)	Q Leaving (cfs)	Q DS (cfs)	Q Weir (cfs)	Q Gates (cfs)	Wr Top (ft)	Weir Max (ft)	Weir Avg (ft)	Min El (ft)	E.G. US. (ft)	W.S. US. (ft)	E.G. DS (ft)	W.S. DS (ft)
FACLON_DS	538	100-YR	757	349.74	405.98	0	0	0	0	0	0	6878.09	6877.87	6877.88	6877.25



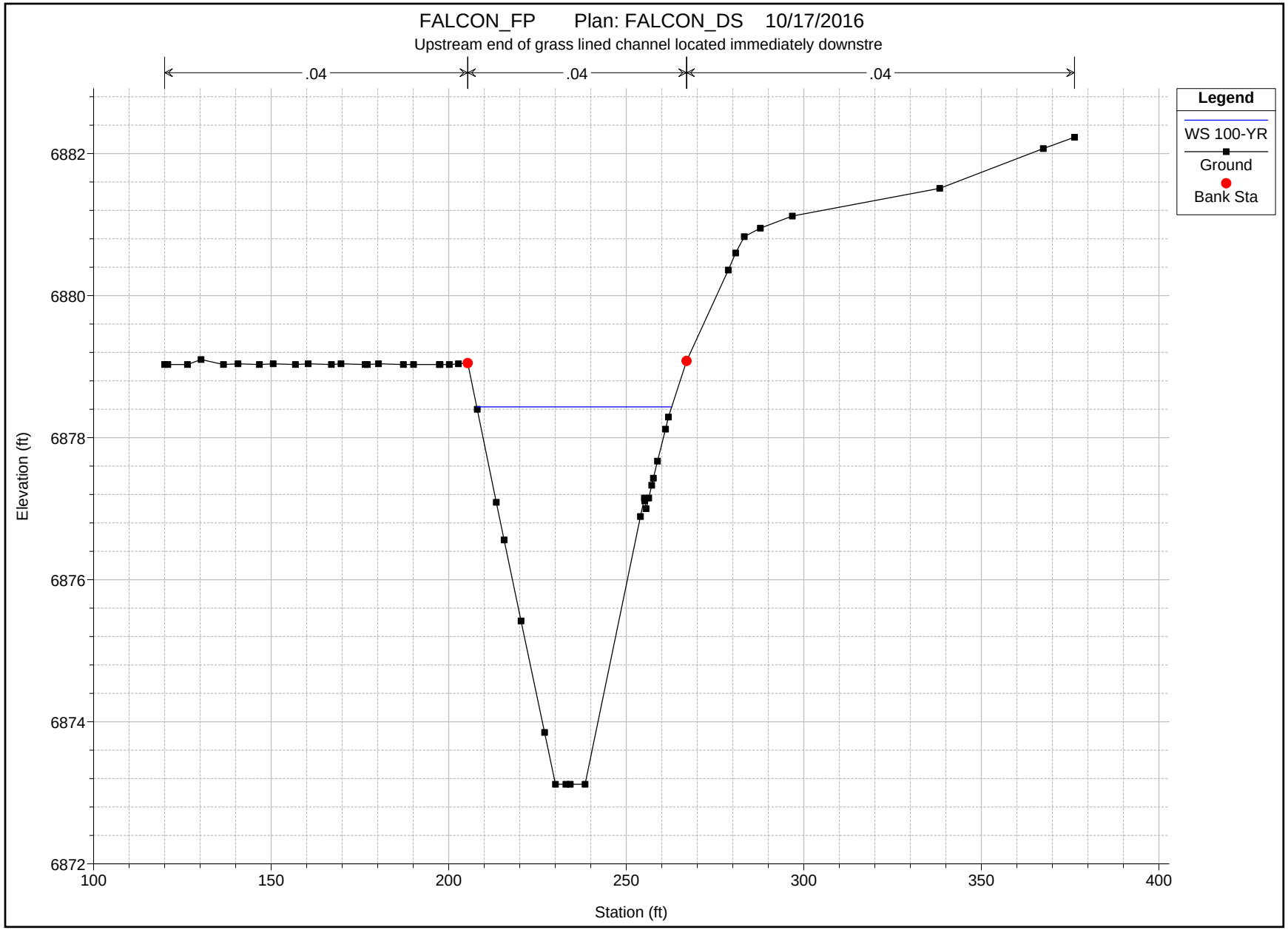
ras
10/13/2016 , 8:55:37 AM
Geometric Data - FALCON_DS



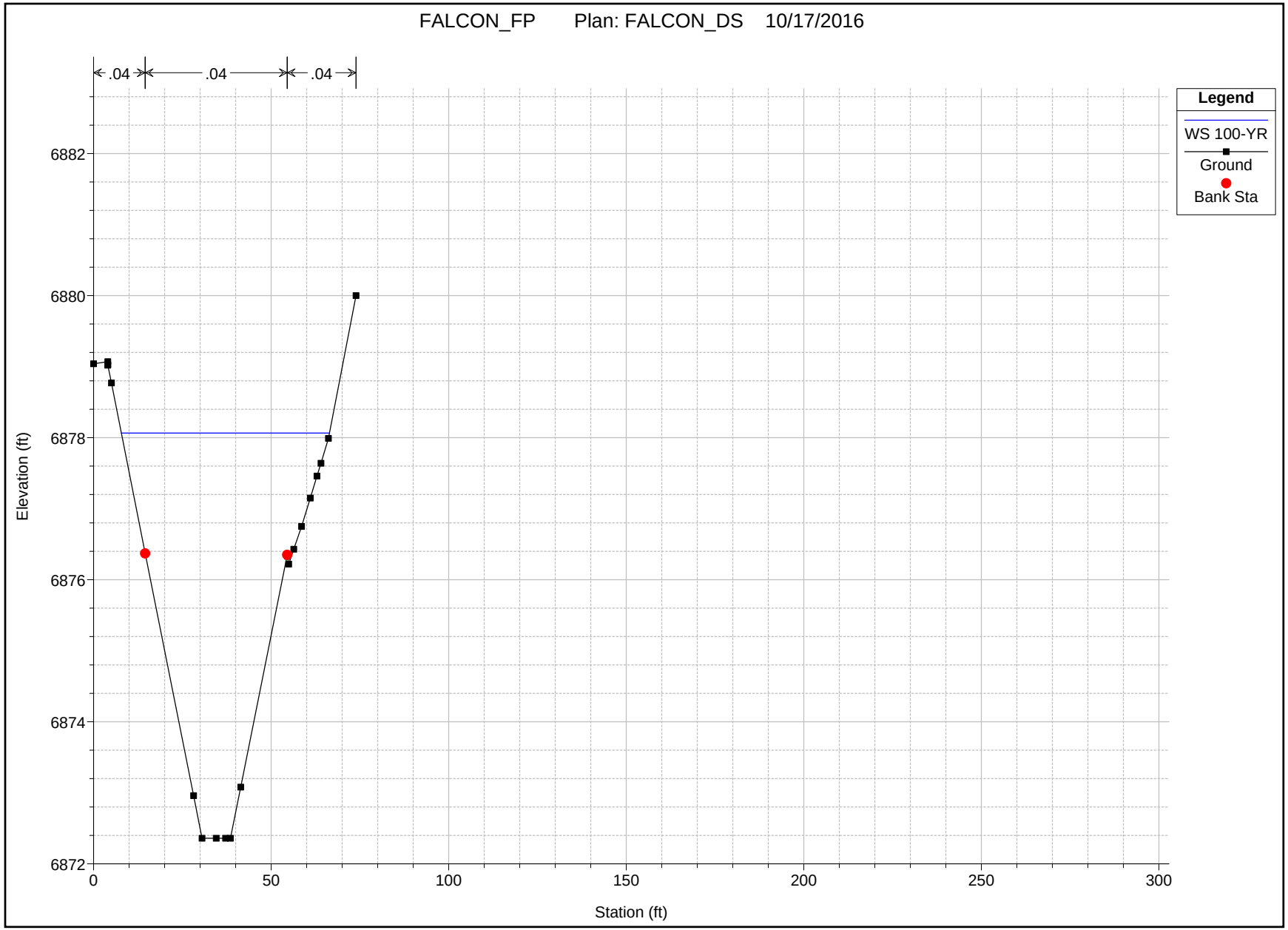
1 in Horiz. = 200 ft 1 in Vert. = 2 ft



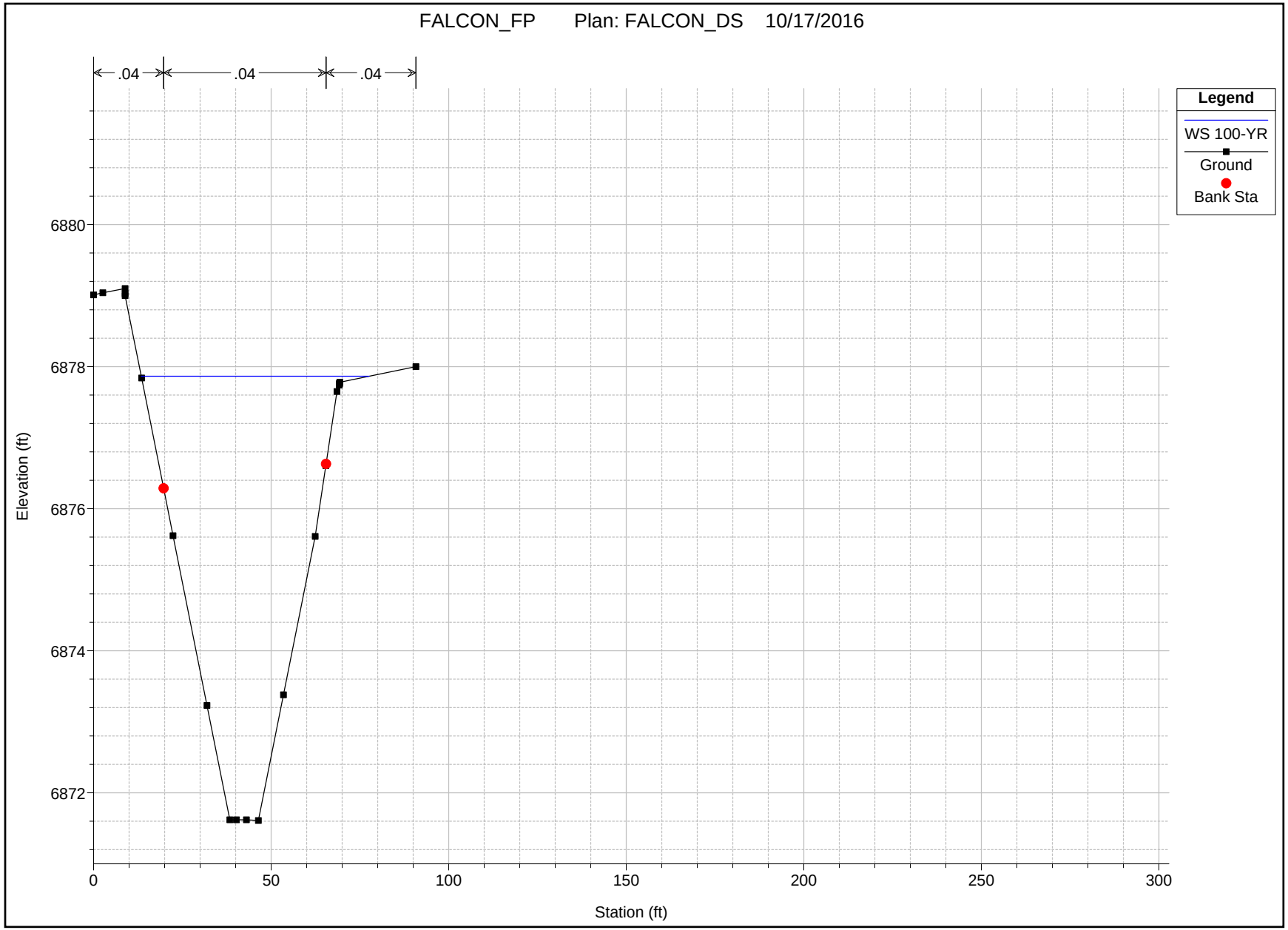
1 in Horiz. = 40 ft 1 in Vert. = 2 ft



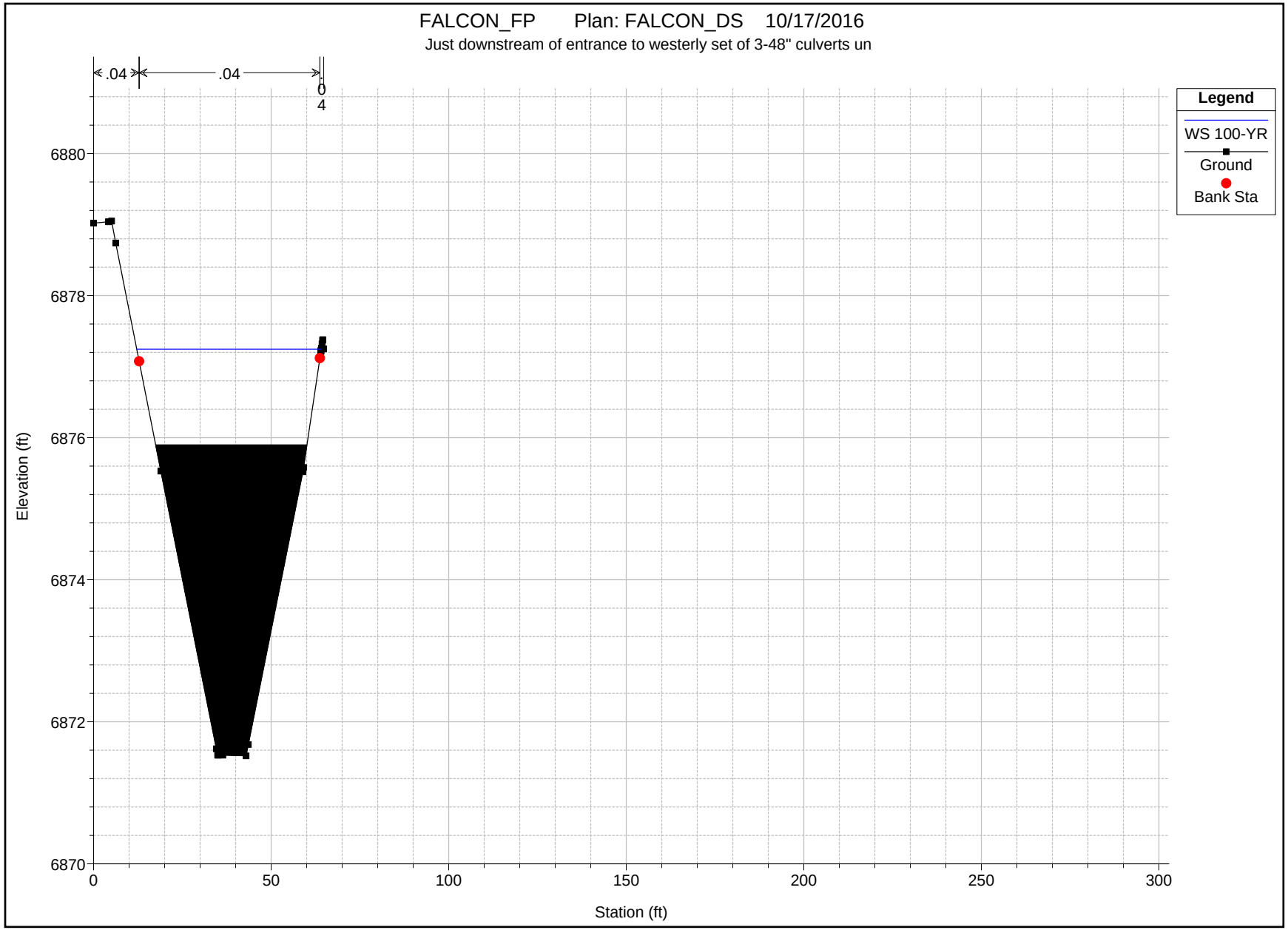
1 in Horiz. = 40 ft 1 in Vert. = 2 ft



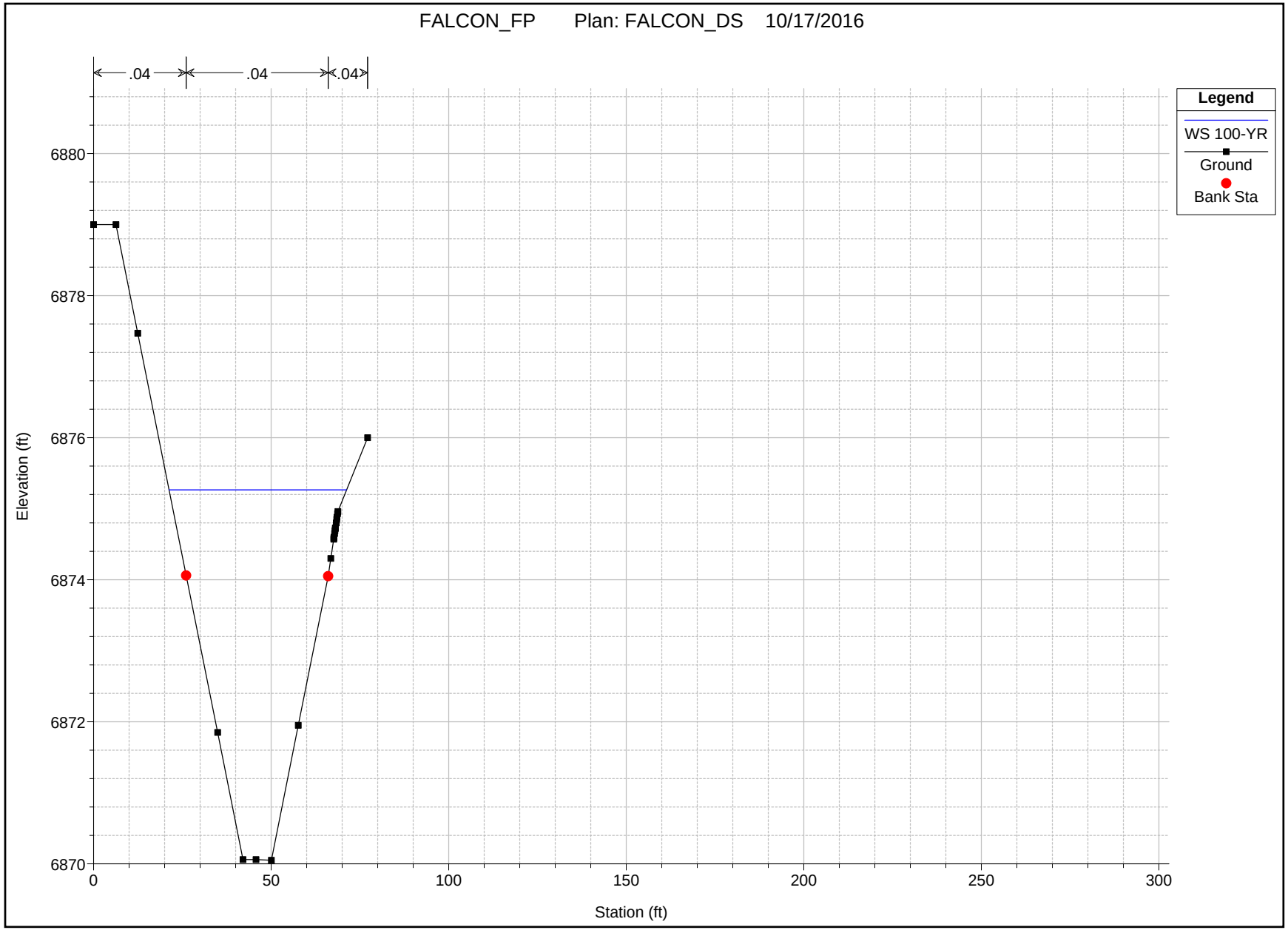
1 in Horiz. = 40 ft 1 in Vert. = 2 ft



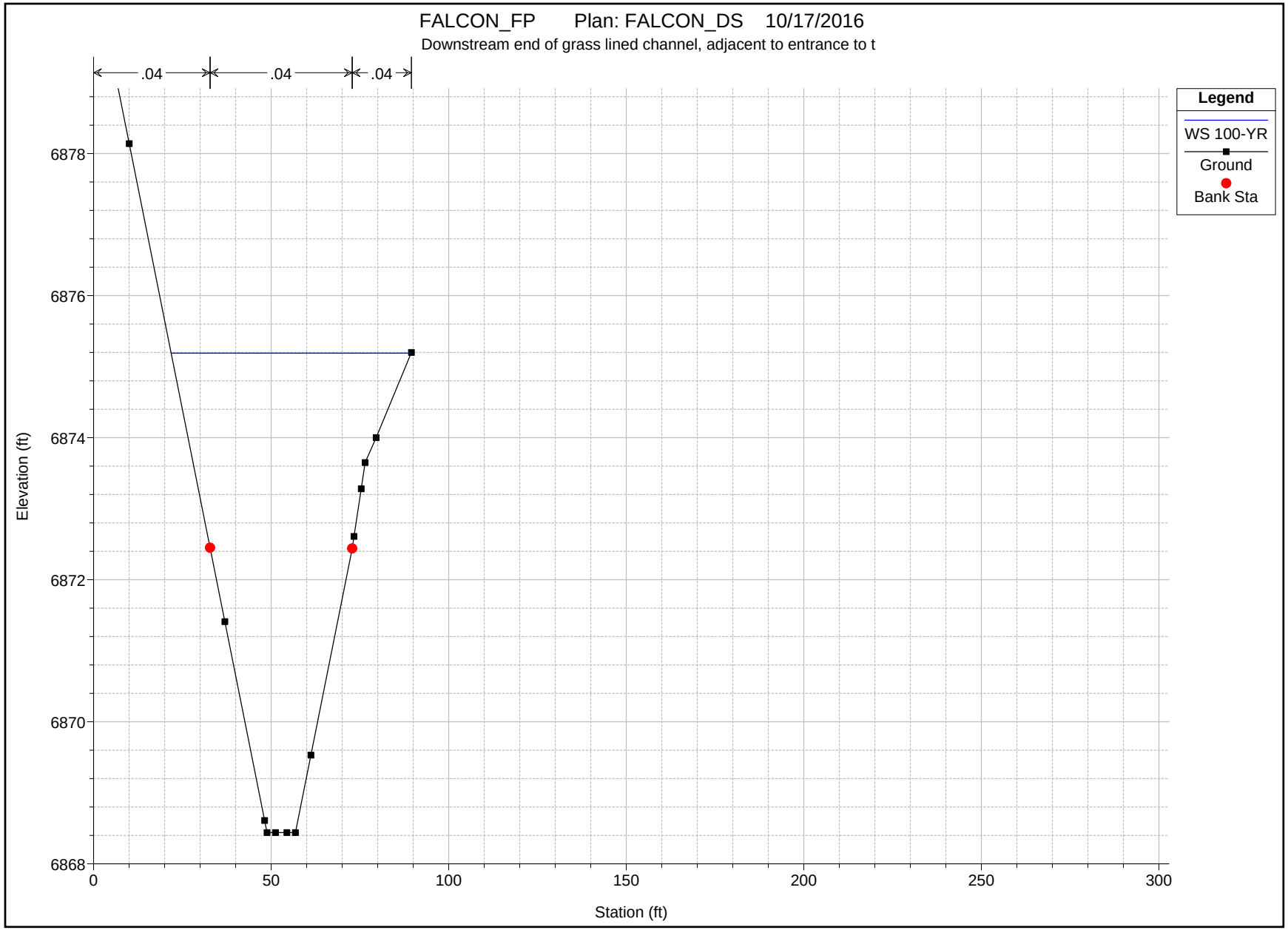
1 in Horiz. = 40 ft 1 in Vert. = 2 ft



1 in Horiz. = 40 ft 1 in Vert. = 2 ft



1 in Horiz. = 40 ft 1 in Vert. = 2 ft

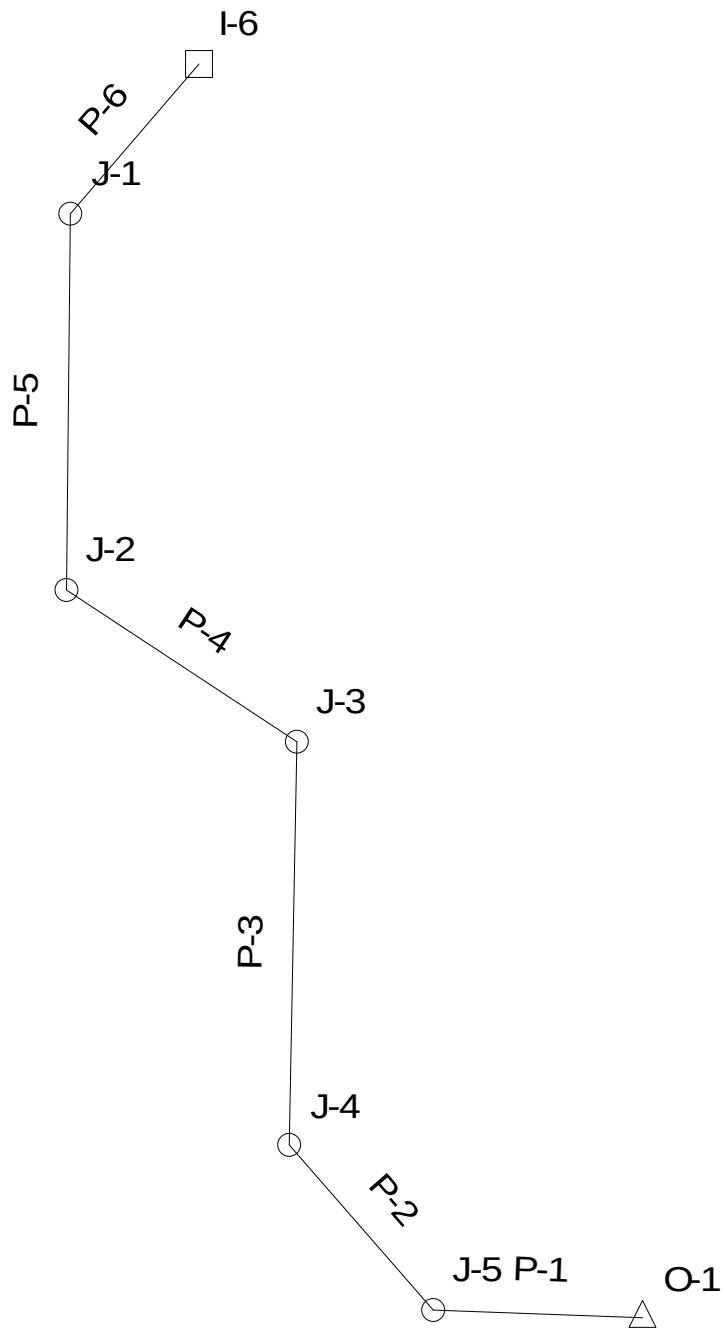


1 in Horiz. = 40 ft 1 in Vert. = 2 ft

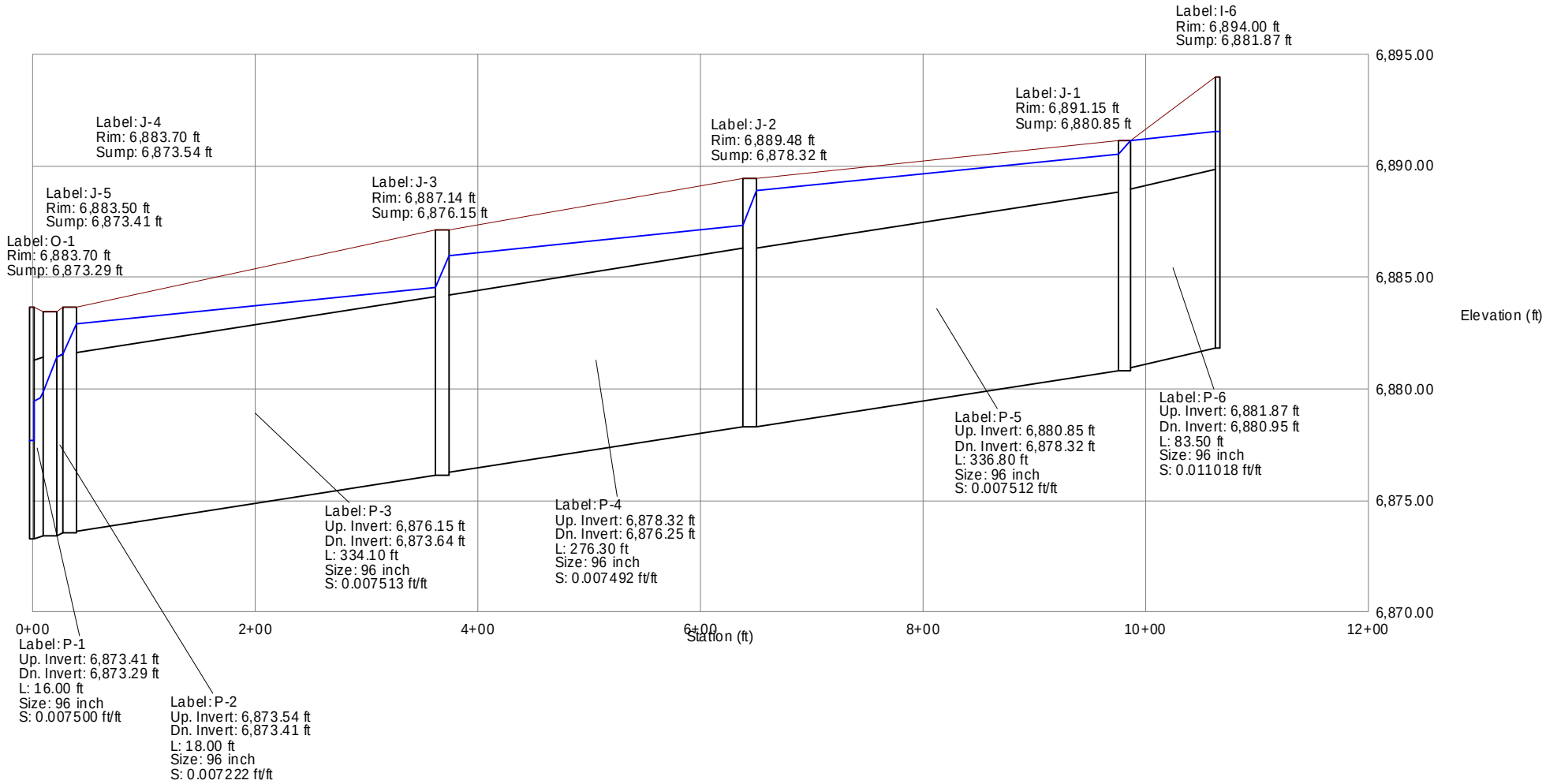
APPENDIX 6

STORMCAD MODELING

Scenario: 597cfs HEC22



Profile
Scenario: 644cfs HEC22



Scenario: 644cfs HEC22

Combined Pipe\Node Report

Label	Downstream Node	Upstream Node	Length (ft)	Section Size	Total System Flow (cfs)	Full Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Upstream Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)
P-1	O-1	J-5	16.00	96 inch	644.00	789.84	15.19	6,873.41	6,873.29	0.007500	6,883.50	6,879.85	6,879.43	6,883.28	6,883.19
P-2	J-5	J-4	18.00	96 inch	644.00	775.07	12.81	6,873.54	6,873.41	0.007222	6,883.70	6,881.54	6,881.45	6,884.09	6,884.00
P-3	J-4	J-3	334.10	96 inch	644.00	790.51	12.81	6,876.15	6,873.64	0.007513	6,887.14	6,884.56	6,882.90	6,887.11	6,885.45
P-4	J-3	J-2	276.30	96 inch	644.00	789.41	12.81	6,878.32	6,876.25	0.007492	6,889.48	6,887.38	6,886.00	6,889.93	6,888.55
P-5	J-2	J-1	336.80	96 inch	644.00	790.46	12.81	6,880.85	6,878.32	0.007512	6,891.15	6,890.57	6,888.89	6,893.12	6,891.44
P-6	J-1	I-6	83.50	96 inch	644.00	957.32	12.81	6,881.87	6,880.95	0.011018	6,894.00	6,891.57	6,891.15	6,894.12	6,893.70

APPENDIX 7

MISCELLANEOUS CALCULATIONS

DETENTION BASIN VOLUME ESTIMATING WORKBOOK

Version 2.35, Released January 2015

Urban Drainage and Flood Control District
Denver, Colorado

Purpose: **This workbook aids in the estimation of stormwater detention storage volume for urban watersheds that are smaller than 160 acres.**

Function:

1. **To apply the Rational Method (sometimes called the Modified FAA Method) and Hydrograph Method to estimate stormwater detention volume.**
2. **To approximate the storage volume of a detention basin given the basin geometry.**
3. **To estimate a stage-storage-discharge relationship for a detention basin**

Content: **This workbook consists of the following sheets:**

Detention Volume Estimating Calculations:

Modified FAA	Estimates detention storage volume using the Rational-Modified FAA method.
Hydrograph	Estimates detention storage volume using the Hydrograph Method.
Full-Spectrum	Estimates detention storage volume using the Full Spectrum Control Method.

Stage-Storage Tables for Detention Basins:

Basin	Tabulates stage-storage relationship estimates for various detention basin shapes.

Stage-discharge Tables Using Outlets with Inlet & Outlet Control:

WQCV	Tabulates a stage-discharge relationship for the water quality capture volume outlet structure (inlet contr
Restrictor Plate	Sizes a choking plate over a circular vertical orifice and dimensions an equivalent rectangular orifice.
Outlet	Tabulates a stage-discharge relationship for the final outlet structure (inlet control).
Culvert	Tabulates a stage-discharge relationship for the outlet culvert, comparing inlet vs. outlet control.
Spillway	Tabulates a stage-discharge relationship for a spillway.

Reservoir Routing Estimation:

Routing	Uses modified Puls method to perform reservoir routing of storm hydrographs through a detention basin.
Design Info	Provides runoff coefficient vs. watershed imperviousness relationships.

Acknowledgements: ***Spreadsheet Development Team:***
Dr. James C.Y. Guo, P.E.
Professor, Department of Civil Engineering
University of Colorado at Denver
Ken MacKenzie, P.E.
Urban Drainage and Flood Control District

Comments? Direct all comments regarding this spreadsheet workbook to: **UDFCD email**
Revisions? Check for revised versions of this or any other workbook at: **Downloads**

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project:
Basin ID:

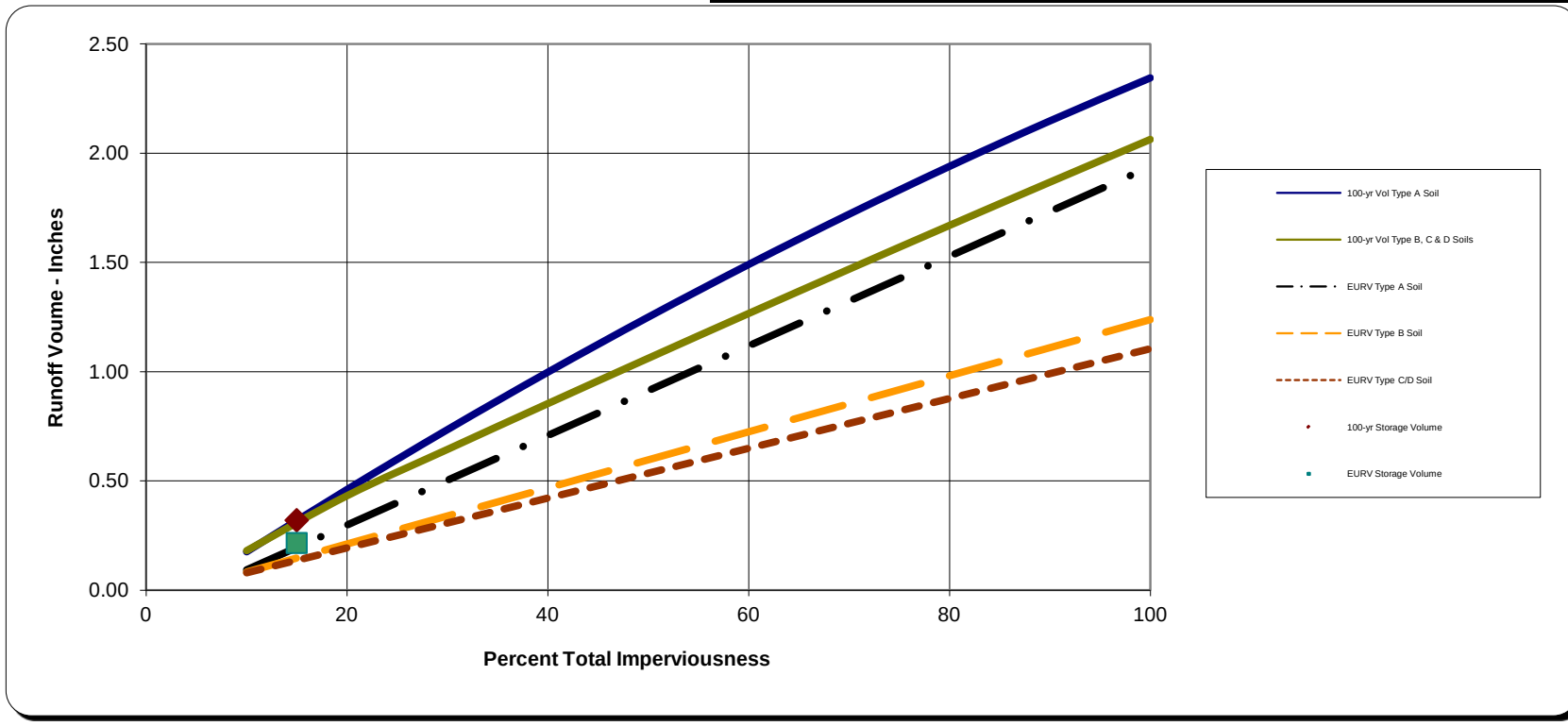
* User input data shown in blue.

Area of Watershed (acres)	740.00	
Subwatershed Imperviousness	15.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	15.0%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A	100.0%	740.0
Type B		0.0
Type C or D		0.0

	Recommended Horton's Equation Parameters for CUHP		
	Infiltration (inches per hour)		**Decay Coefficient--*a***
	Initial--f_i	**Final--*fo***	
	5	1.0	0.0007

	Detention Volumes [2,5]		**Maximum Allowable Release Rate, cfs[3]**
	(watershed inches)	**(acre-feet)**	
Excess Urban Runoff Volume[4]	0.22	13.30	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.32	19.72	370.00



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

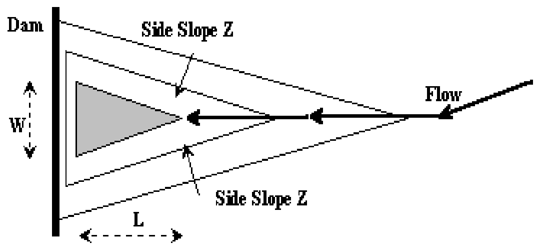
3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

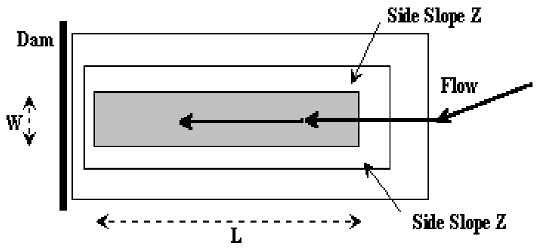
4) EURV approximates the difference between developed and pre-developed runoff volume.

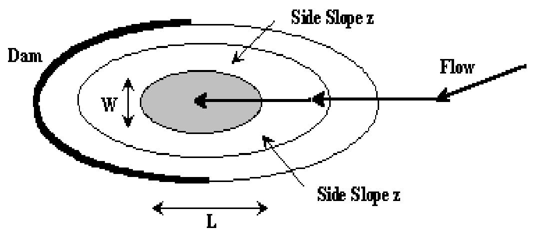
5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1







Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	13.30	19.72	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	6882.00					531		0.012	0.000	
	6883.00		0.00	0.00		531	531	0.012	0.012	
	6884.00		0.00	0.00		531	1,062	0.012	0.024	
	6885.00		0.00	0.00		886	1,771	0.020	0.041	
	6886.00		0.00	0.00		9,189	6,808	0.211	0.156	
	6887.00		0.00	0.00		27,880	25,343	0.640	0.582	
	6888.00		0.00	0.00		60,263	69,414	1.383	1.594	
	6889.00		0.00	0.00		85,329	142,210	1.959	3.265	
	6890.00		0.00	0.00		103,874	236,812	2.385	5.436	
	6891.00		0.00	0.00		111,922	344,710	2.569	7.913	
	6892.00		0.00	0.00		116,616	458,979	2.677	10.537	
	6893.00		0.00	0.00		128,472	581,523	2.949	13.350	
	6894.00		0.00	0.00		136,926	714,222	3.143	16.396	
	6895.00		0.00	0.00		145,498	855,434	3.340	19.638	
	6896.00		0.00	0.00		154,188	1,005,277	3.540	23.078	
	6896.50		0.00	0.00		158,590	1,083,471	3.641	24.873	
	6897.00		0.00	0.00		162,992	1,163,867	3.742	26.719	
	6897.50		0.00	0.00		167,639	1,246,524	3.848	28.616	
	6898.00		0.00	0.00		172,286	1,331,506	3.955	30.567	
	6899.00		0.00	0.00		181,155	1,508,226	4.159	34.624	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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							#N/A		#N/A	
							#N/A		#N/A	
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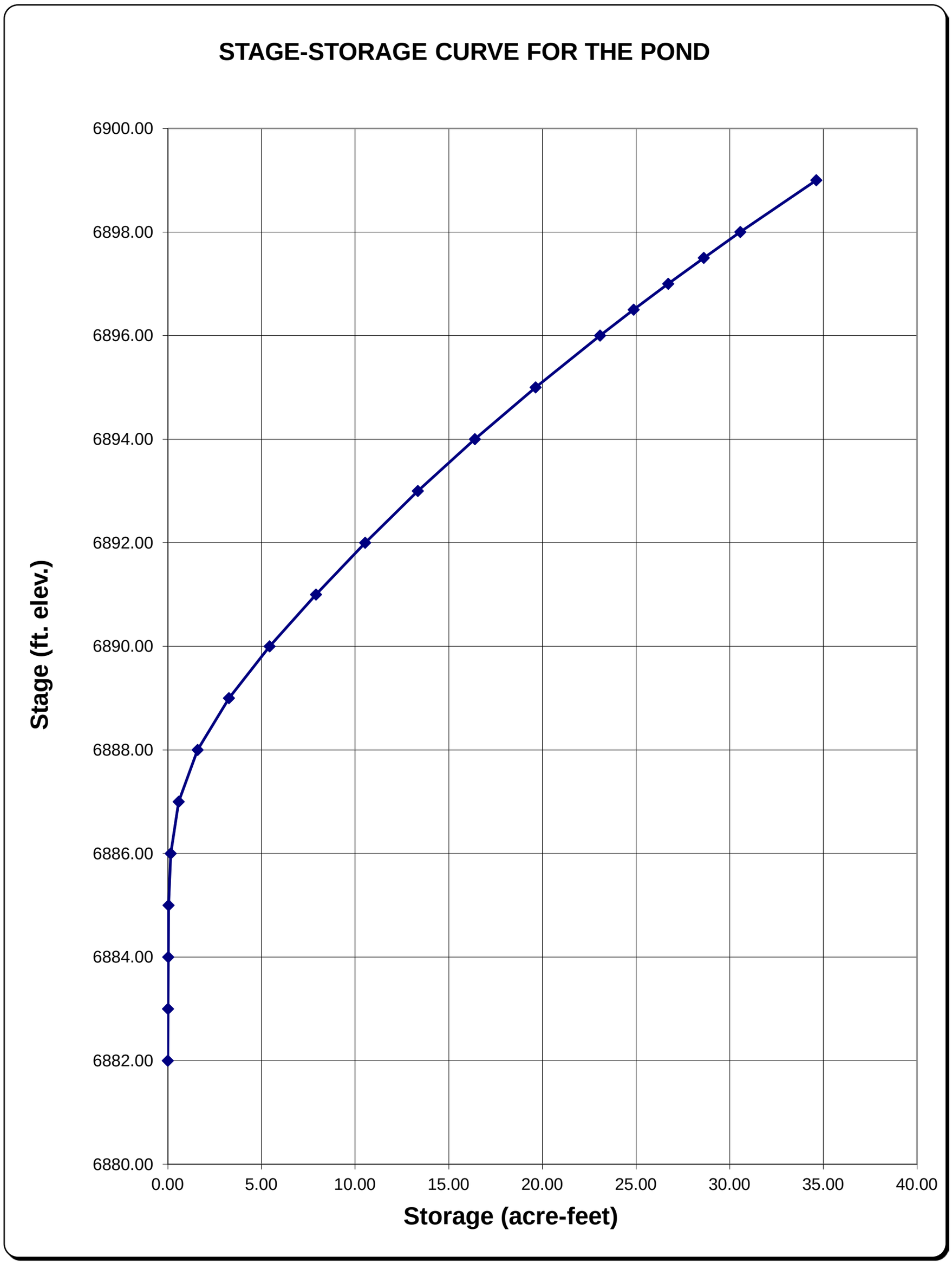
							#N/A		#N/A	

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____

Basin ID: _____



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

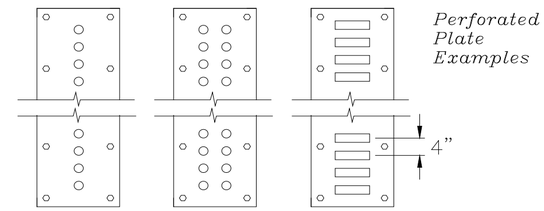
WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 15.0 percent
Catchment Area, A = 740.00 acres
Depth at WQCV outlet above lowest perforation, H = 8 feet
Vertical distance between rows, h = 30.00 inches
Number of rows, NL = 3.00
Orifice discharge coefficient, C_o = 0.50
Slope of Basin Trickle Channel, S = 0.005 ft / ft
Time to Drain the Pond = 40 hours

Diameter of holes, D = 9.500 inches
Number of holes per row, N = 1
OR
Height of slot, H = inches
Width of slot, W = inches

Watershed Design Information (Input):

Percent Soil Type A = 100 %
Percent Soil Type B = %
Percent Soil Type C/D = %



Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 0.216 watershed inches
N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 13.300 acre-feet
Outlet area per row, Ao = 69.21 square inches
Total opening area at each row based on user-input above, Ao = 70.88 square inches
Total opening area at each row based on user-input above, Ao = 0.492 square feet

3

	Central Elevations of Rows of Holes in feet																								Σ
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	**Flow**
	6885.00	6887.50	6890.00																						
	Collection Capacity for Each Row of Holes in cfs																								
6882.00	0.0000	0.0000	0.0000																						**0.00**
6883.00	0.0000	0.0000	0.0000																						**0.00**
6884.00	0.0000	0.0000	0.0000																						**0.00**
6885.00	0.0000	0.0000	0.0000																						**0.00**
6886.00	1.9751	0.0000	0.0000																						**1.98**
6887.00	2.7932	0.0000	0.0000																						**2.79**
6888.00	3.4210	1.3966	0.0000																						**4.82**
6889.00	3.9502	2.4190	0.0000																						**6.37**
6890.00	4.4164	3.1229	0.0000																						**7.54**
6891.00	4.8380	3.6951	1.9751																						**10.51**
6892.00	5.2256	4.1898	2.7932																						**12.21**
6893.00	5.5864	4.6320	3.4210																						**13.64**
6894.00	5.9253	5.0355	3.9502																						**14.91**
6895.00	6.2458	5.4090	4.4164																						**16.07**
6896.00	6.5506	5.7583	4.8380																						**17.15**
6896.50	6.6979	5.9253	5.0355																						**17.66**
6897.00	6.8419	6.0876	5.2256																						**18.16**
6897.50	6.9830	6.2458	5.4090																						**18.64**
6998.00	20.9955	20.7620	20.5258																						**62.28**
6899.00	7.3901	6.6979	5.9253																						**20.01**
	#N/A	#N/A	#N/A																						**#N/A**
	#N/A	#N/A	#N/A																						**#N/A**
	#N/A	#N/A	#N/A																						**#N/A**
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	#N/A	#N/A	#N/A																						**#N/A**
	#N/A	#N/A	#N/A																						**#N/A**
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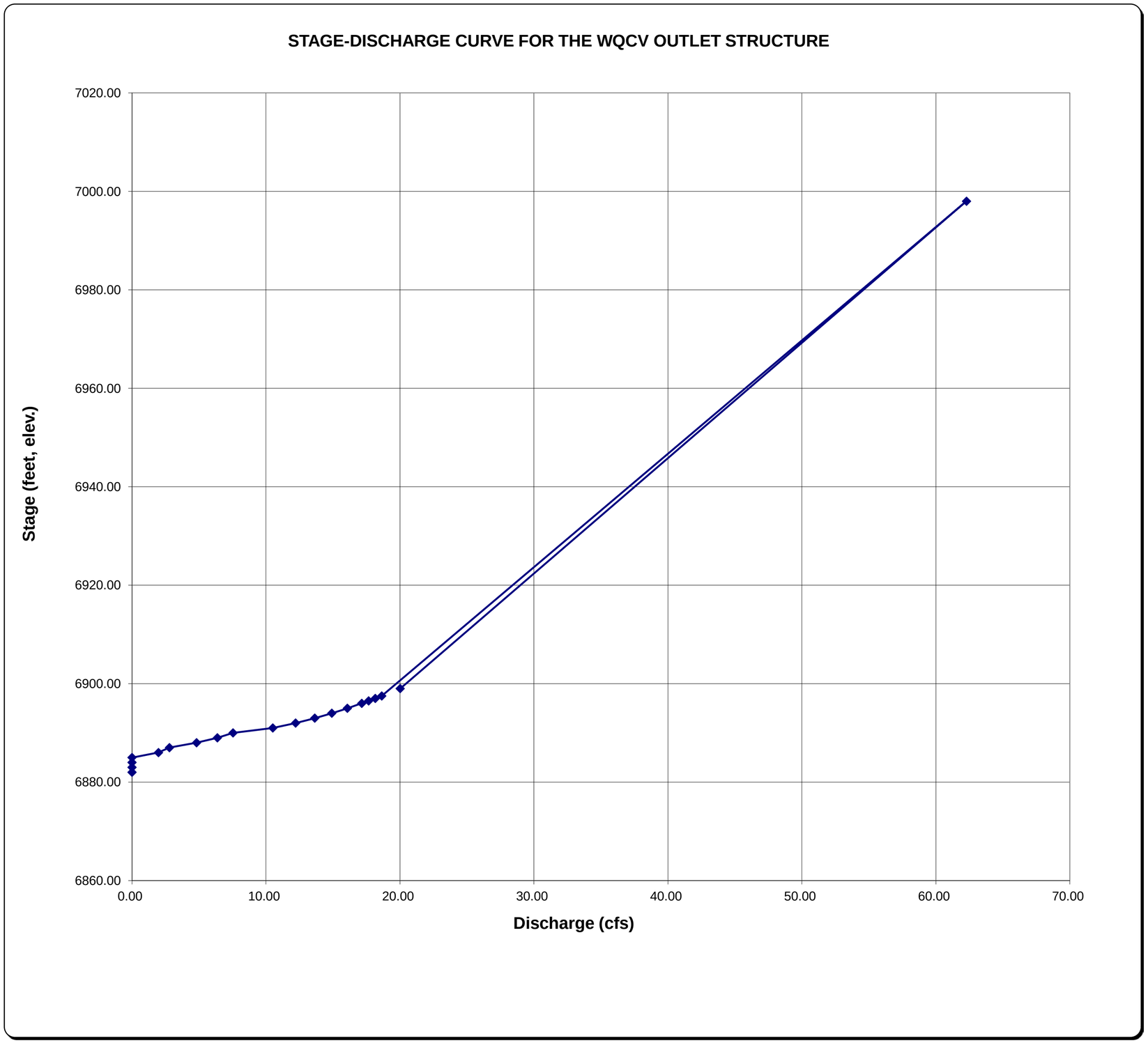
	#N/A	#N/A	#N/A																						**#N/A**
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

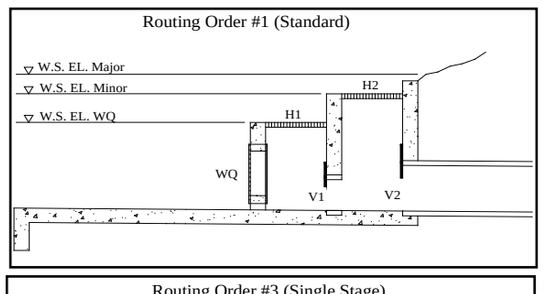
Worksheet Protected

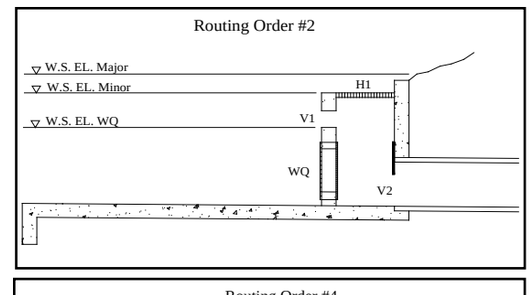
Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

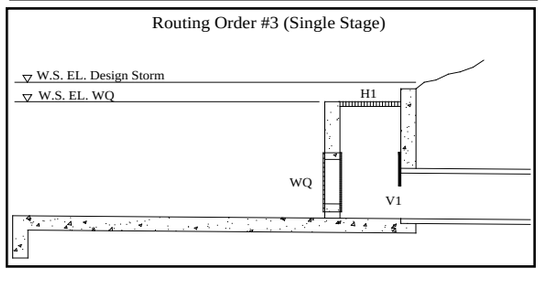


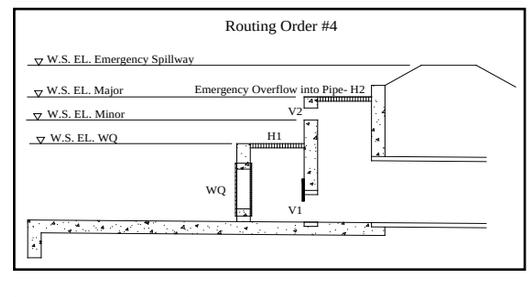
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: **Falcon Marketplace #1**
Basin ID: **NORTH POND #1**









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			96.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	8.00				ft.
	Length (Height for Vertical)	L or H =	12.00				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	80		100		%
	Orifice Coefficient	C_o =	0.75		0.75		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	6893.80		6,881.97		ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =	76.80		50.27		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	36.80	ft.			
OPTIONAL: User-Overide Weir Length	L_w =		ft.			
Top Elevation of Vertical Orifice Opening, Top =				6889.97		ft.
Center Elevation of Vertical Orifice Opening, Cen =				6885.97		ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6882.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	**0.00**	
	6883.00	0.00	0.00	0.00	0.00	0.00	27.95	0.00	**0.00**	
	6884.00	0.00	0.00	0.00	0.00	0.00	77.34	0.00	**0.00**	
	6885.00	0.00	0.00	0.00	0.00	0.00	141.04	0.00	**0.00**	
	6886.00	1.98	0.00	0.00	0.00	0.00	216.33	0.00	**1.98**	
	6887.00	2.79	0.00	0.00	0.00	0.00	301.66	0.00	**2.79**	
	6888.00	4.82	0.00	0.00	0.00	0.00	395.95	0.00	**4.82**	
	6889.00	6.37	0.00	0.00	0.00	0.00	498.43	0.00	**6.37**	
	6890.00	7.54	0.00	0.00	0.00	0.00	607.33	0.00	**7.54**	
	6891.00	10.51	0.00	0.00	0.00	0.00	678.51	0.00	**10.51**	
	6892.00	12.21	0.00	0.00	0.00	0.00	742.90	0.00	**12.21**	
	6893.00	13.64	0.00	0.00	0.00	0.00	802.14	0.00	**13.64**	
	6894.00	14.91	9.87	206.72	0.00	0.00	857.30	0.00	**24.79**	
	6895.00	16.07	145.12	506.36	0.00	0.00	909.11	0.00	**161.20**	
	6896.00	17.15	360.25	685.61	0.00	0.00	958.13	0.00	**377.40**	
	6896.50	17.66	489.80	759.53	0.00	0.00	981.72	0.00	**507.45**	
	6897.00	18.16	631.97	826.88	0.00	0.00	1004.76	0.00	**650.12**	
	6897.50	18.64	785.73	889.13	0.00	0.00	1027.28	0.00	**804.36**	
	6898.00	62.28	950.26	947.31	0.00	0.00	1049.32	0.00	**1009.59**	
	6899.00	20.01	1309.10	1054.06	0.00	0.00	1092.06	0.00	**1074.08**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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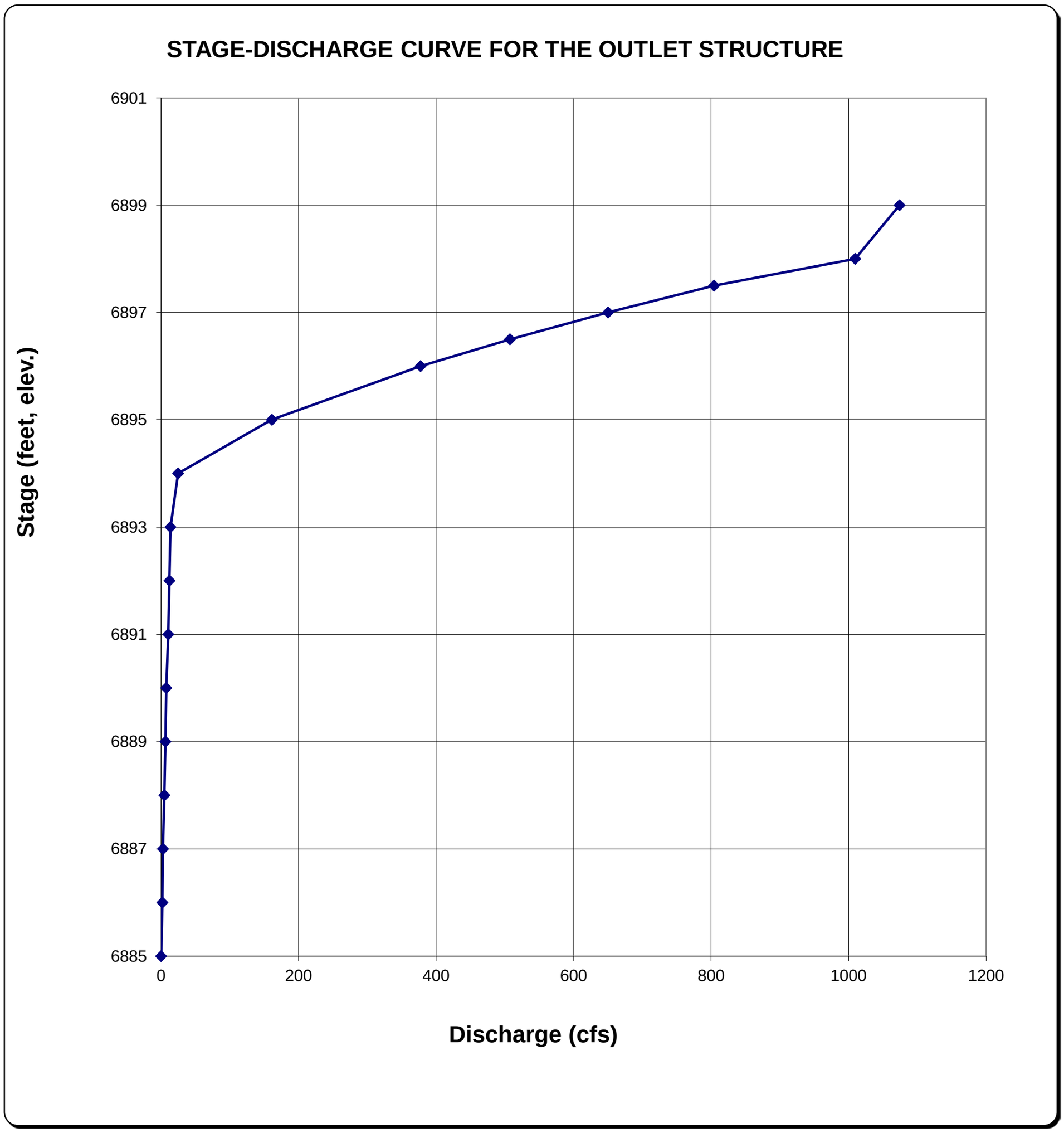
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Marketplace #1
Basin ID: NORTH POND #1



RESERVOIR ROUTING THROUGH THE DETENTION POND

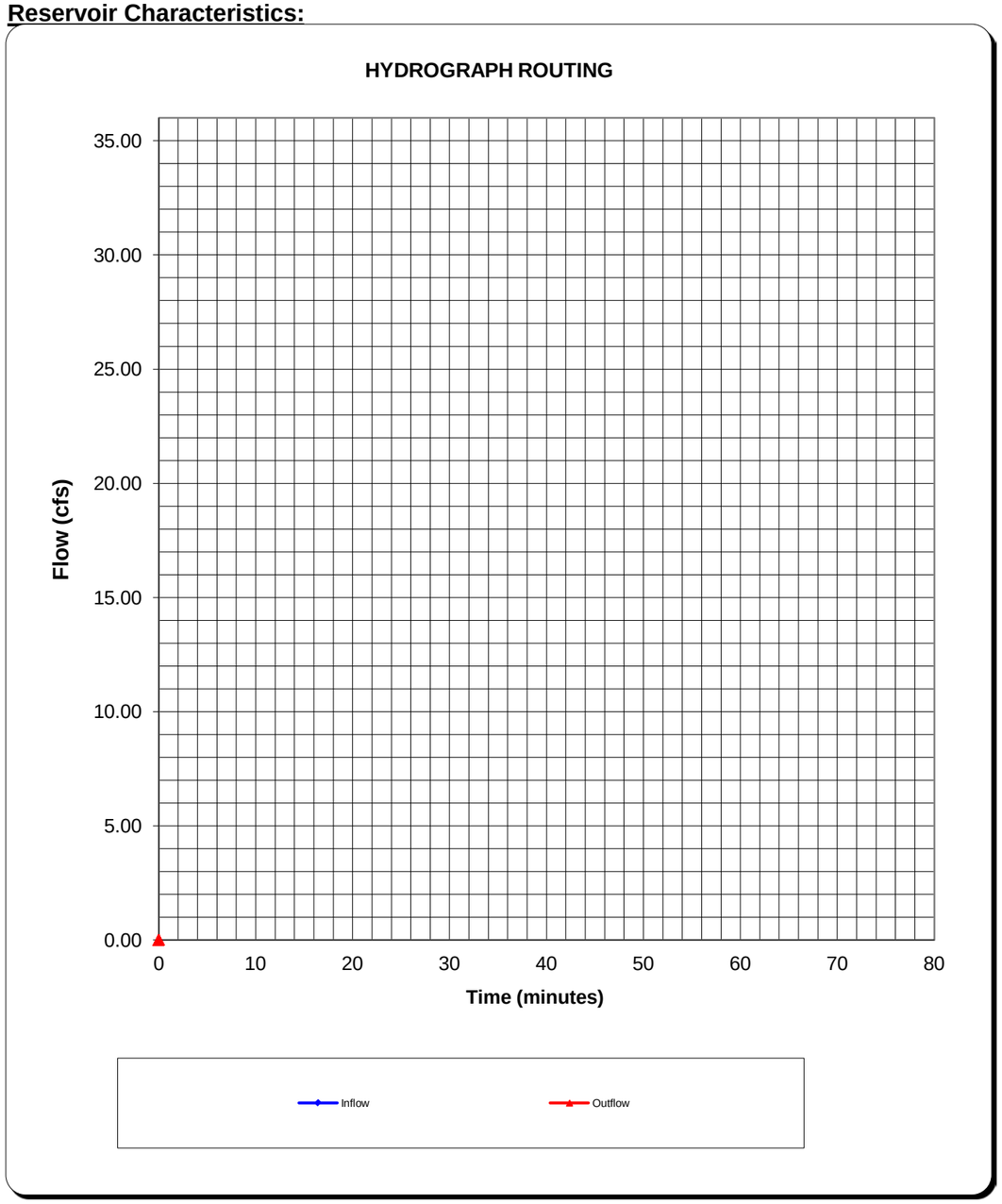
Project:

Basin ID:

Sheet Status:

Source Sheet: Culvert

Reservoir Characteristics:



Stage St., Feet	Outflow O, cfs	Storage S, cu.ft.	2S cu.ft.	O*dt+2S R, cu.ft.	dQ/dV (1/s)	dSt/dV (1/sq.ft)
6,882.00	0.00	0	0	0	0.0000E+00	0.0000E+00
6,883.00	0.00	531	1,062	1,062	0.0000E+00	9.4162E-04
6,884.00	0.00	1,062	2,124	2,124	0.0000E+00	9.4162E-04
6,885.00	0.00	1,771	3,541	3,541	0.0000E+00	7.0572E-04
6,886.00	1.98	6,808	13,616	13,616	1.9653E-04	9.9256E-05
6,887.00	2.79	25,343	50,685	50,685	2.1851E-05	2.6977E-05
6,888.00	4.82	69,414	138,828	138,828	2.3031E-05	1.1345E-05
6,889.00	6.37	142,210	284,420	284,420	1.0646E-05	6.8685E-06
6,890.00	7.54	236,812	473,623	473,623	6.1838E-06	5.2853E-06
6,891.00	10.51	344,710	689,419	689,419	1.3763E-05	4.6340E-06
6,892.00	12.21	458,979	917,957	917,957	7.4386E-06	4.3756E-06
6,893.00	13.64	581,523	1,163,045	1,163,045	5.8346E-06	4.0802E-06
6,894.00	24.79	714,222	1,428,443	1,428,443	4.2012E-05	3.7679E-06
6,895.00	161.20	855,434	1,710,867	1,710,867	4.8300E-04	3.5408E-06
6,896.00	377.40	1,005,277	2,010,553	2,010,553	7.2142E-04	3.3368E-06
6,896.50	507.45	1,083,471	2,166,942	2,166,942	8.3158E-04	3.1972E-06
6,897.00	650.12	1,163,867	2,327,733	2,327,733	8.8730E-04	3.1096E-06
6,897.50	0.00	1,246,524	2,493,049	2,493,049	-3.9326E-03	3.0245E-06
6,898.00	0.00	1,331,506	2,663,011	2,663,011	0.0000E+00	2.9418E-06
6,899.00	0.00	1,508,226	3,016,452	3,016,452	0.0000E+00	2.8293E-06
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
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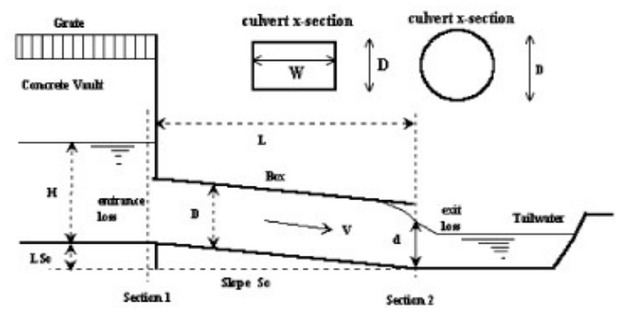
0.00	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

Status: Culvert Data is valid!



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches — D = 96 in.
Circular Culvert: Inlet Edge Type (choose from pull-down list) — Grooved End with Headwall
OR:
Box Culvert: Barrel Height (Rise) in Feet — Height (Rise) = ft.
Box Culvert: Barrel Width (Span) in Feet — Width (Span) = ft.
Box Culvert: Inlet Edge Type (choose from pull-down list) — Square Edge w/ 90-15 deg. Flared Wingwall

Number of Barrels — No = 1
Inlet Elevation at Culvert Invert — I_{elev} = 6881.97 ft. elev.
Outlet Elevation at Culvert Invert — O_{elev} = 6880.85 ft. elev.
Culvert Length in Feet — L = 78.0 ft.
Manning's Roughness — n = 0.0120
Bend Loss Coefficient — K_b = 0.00
Exit Loss Coefficient — K_x = 1.00

Design Information (calculated):

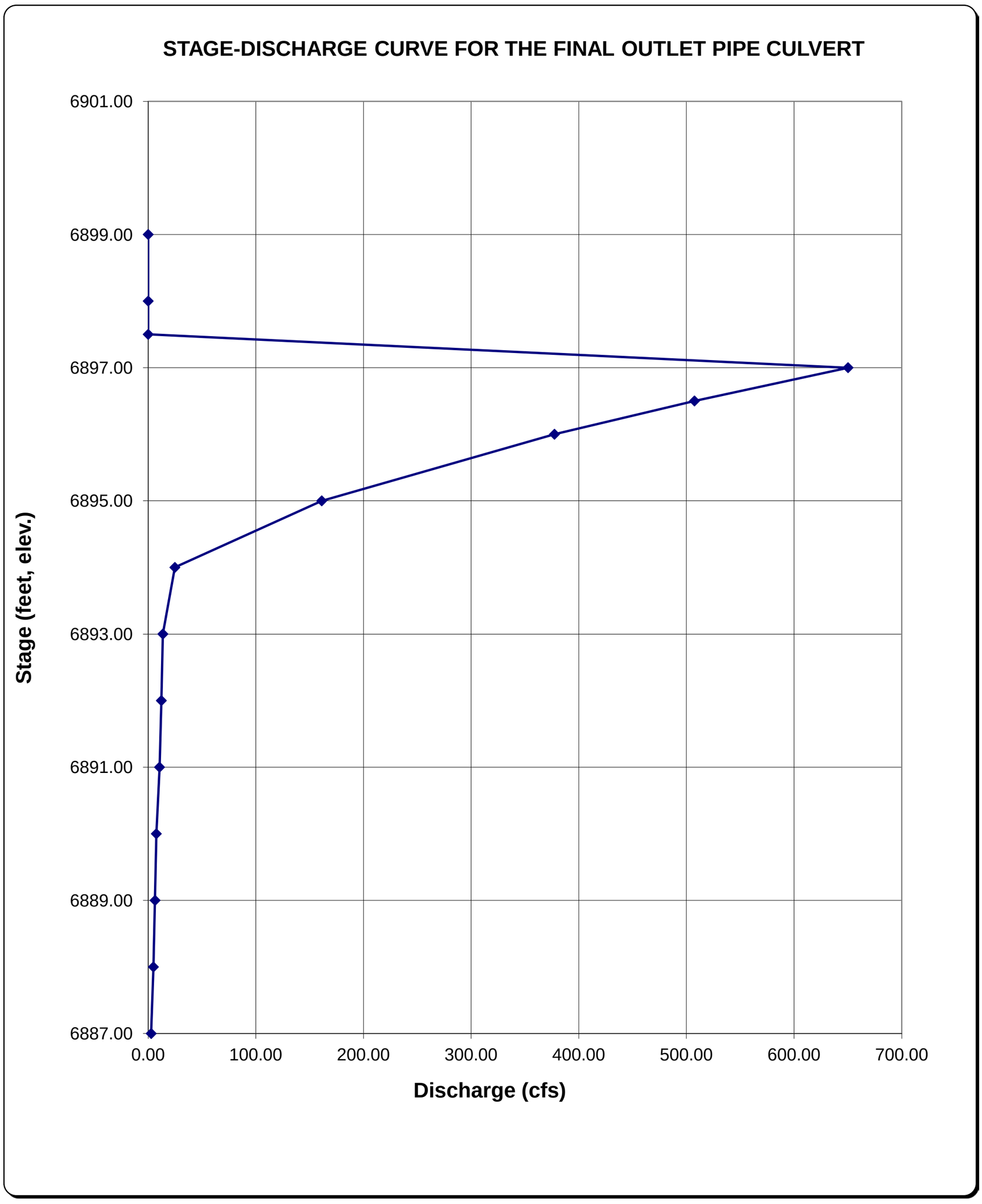
Entrance Loss Coefficient — K_e = 0.20
Friction Loss Coefficient — K_f = 0.13
Sum of All Loss Coefficients — K_s = 1.33
Orifice Inlet Condition Coefficient — C_d = 0.99
Minimum Energy Condition Coefficient — KE_{low} = -0.04

Calculations of Culvert Capacity (output):

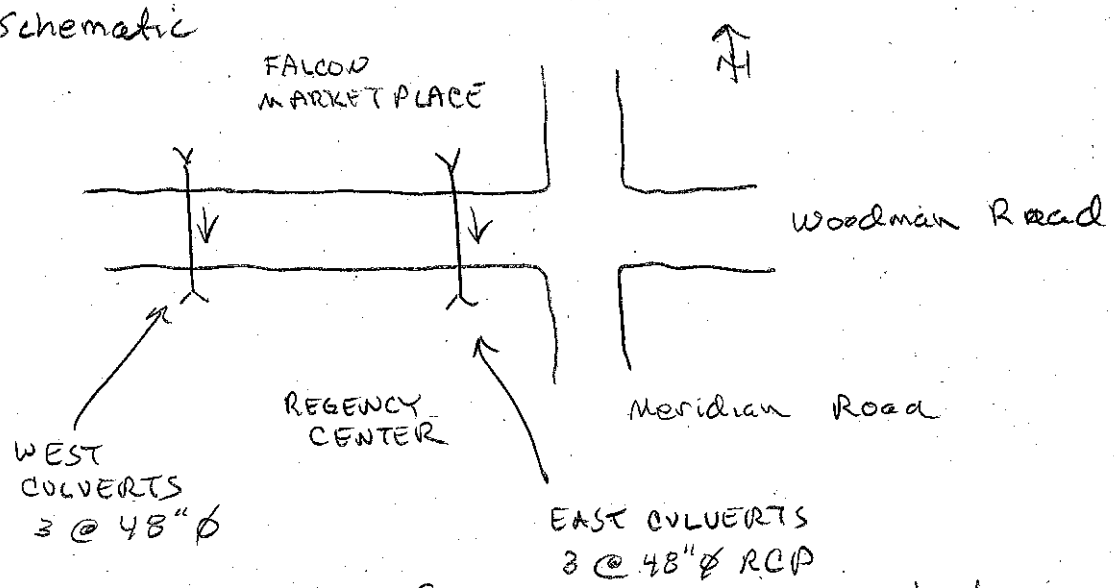
Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6882.00	0.00	0.10	73.88	**0.00**	**0.00**	Min. Energy. Eqn.
6883.00	0.00	8.20	127.58	**0.00**	**0.00**	Min. Energy. Eqn.
6884.00	0.00	38.80	179.44	**0.00**	**0.00**	Min. Energy. Eqn.
6885.00	0.00	83.70	227.39	**0.00**	**0.00**	Min. Energy. Eqn.
6886.00	0.00	142.70	253.50	**1.98**	**1.98**	Regression Eqn.
6887.00	0.00	207.40	260.30	**2.79**	**2.79**	Regression Eqn.
6888.00	0.00	284.50	274.34	**4.82**	**4.82**	Regression Eqn.
6889.00	0.00	370.40	296.59	**6.37**	**6.37**	Regression Eqn.
6890.00	0.00	456.70	327.85	**7.54**	**7.54**	Regression Eqn.
6891.00	0.00	537.00	401.74	**10.51**	**10.51**	Regression Eqn.
6892.00	0.00	609.70	475.03	**12.21**	**12.21**	Regression Eqn.
6893.00	0.00	675.30	541.57	**13.64**	**13.64**	Regression Eqn.
6894.00	0.00	735.40	601.48	**24.79**	**24.79**	Regression Eqn.
6895.00	0.00	790.90	656.53	**161.20**	**161.20**	Regression Eqn.
6896.00	0.00	843.00	707.57	**377.40**	**377.40**	Regression Eqn.
6896.50	0.00	892.20	755.10	**507.45**	**507.45**	Regression Eqn.
6897.00	0.00	915.90	777.72	**650.12**	**650.12**	Regression Eqn.
6897.50	0.00	0.00	0.00	**804.36**	**0.00**	No Flow (WS < inlet)
6898.00	0.00	0.00	0.00	**1009.59**	**0.00**	No Flow (WS < inlet)
6899.00	0.00	0.00	0.00	**1074.08**	**0.00**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



① Schematic



② Use FHWA HY-8 software to check culvert capacity

③ Model input based on 3 sources of information

a) project surveys by DBC for Falcon Marketplace
email 9/26/16

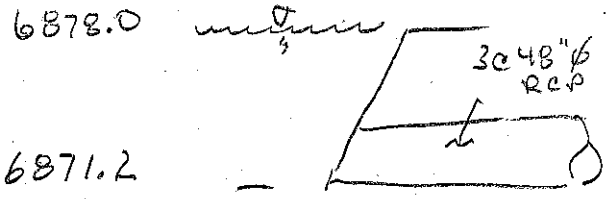
b) Design drawing from Regency Center
URS 8/24/04

c) Design drawing for culvert extension on north side of woodman
DMJM Harris/AECOM 9/11/2007

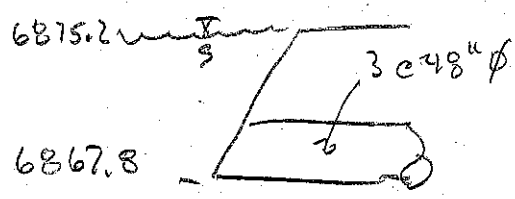
d) See HY8 model output files
file: HY-8-Woodman Culverts.hy8

e) Design flow rate varied until allowable headwater elevation reached. Allowable headwater elevation = to north edge of Woodman Road Asphalt.

f) west culvert:



EAST CULVERT:



g) The woodman Road culverts discharge to large 84" culvert & 8'x8' culvert on the Regency center property that are @ a significantly lower elevation.

than the invert of the 48"Ø pipes; therefore inlet control conditions are anticipate w/ no backwater from downstream

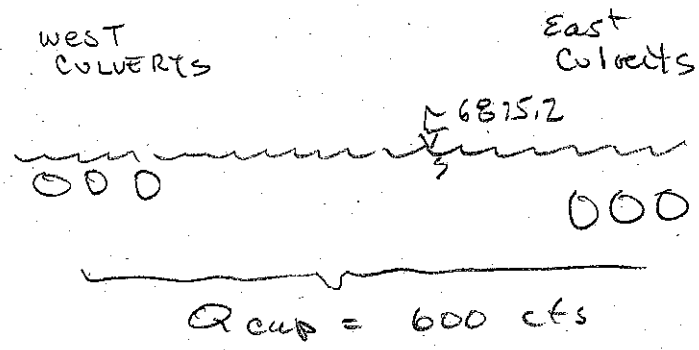
(4) See HY-8 output

a) West Culvert: Q_{cap} = 355 cfs w/ HW @ 6877.99 ≈ 6878

b) East Culvert: Q_{cap} = 405 cfs w/ HW @ 6875.12 ≈ 6875.2

c) Total Capacity 760 cfs

d) Also looked @ capacity of both culverts with the lower allowable headwater elevation



HY-8 Culvert Analysis Report

Project Notes

Project Title:

Designer:

Project Date: Wednesday, September 28, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

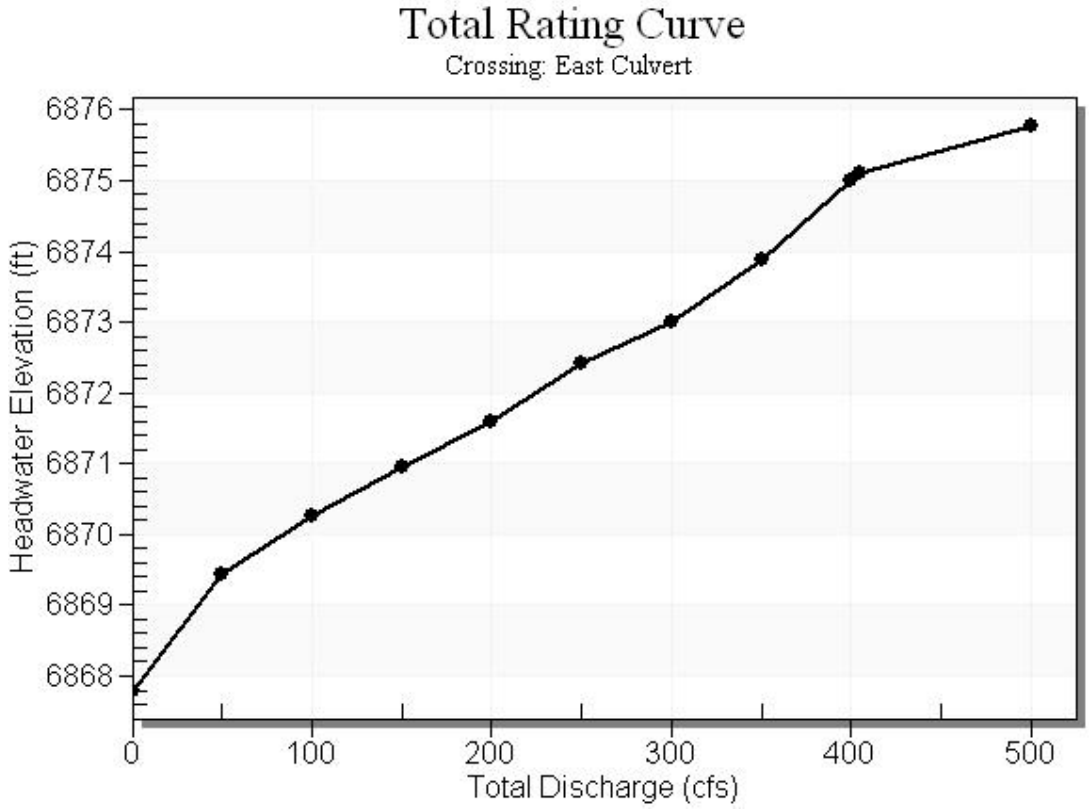
Exit Loss Option: Standard Method

Crossing Notes: East Culvert

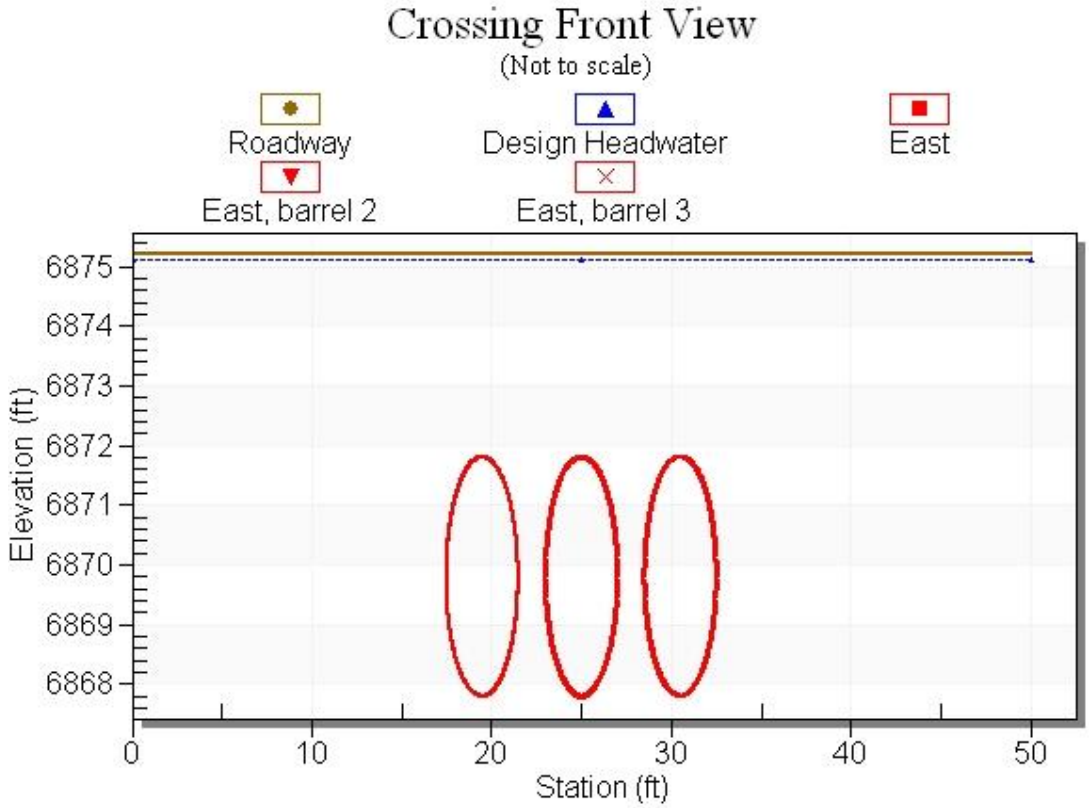
Table 1 - Summary of Culvert Flows at Crossing: East Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	East Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6867.80	0.00	0.00	0.00	1
6869.44	50.00	50.00	0.00	1
6870.26	100.00	100.00	0.00	1
6870.95	150.00	150.00	0.00	1
6871.58	200.00	200.00	0.00	1
6872.41	250.00	250.00	0.00	1
6873.01	300.00	300.00	0.00	1
6873.88	350.00	350.00	0.00	1
6875.00	400.00	400.00	0.00	1
6875.12	405.00	405.00	0.00	1
6875.78	500.00	432.38	67.60	5
6875.20	408.39	408.39	0.00	Overtopping

Rating Curve Plot for Crossing: East Culvert



Crossing Front View (Roadway Profile): East Culvert



Culvert Notes: East

Table 2 - Culvert Summary Table: East

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6867.80	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
50.00	50.00	6869.44	1.645	0.0*	1-S2n	1.114	1.197	1.117	0.745	5.778	8.385
100.00	100.00	6870.26	2.457	0.0*	1-S2n	1.620	1.708	1.622	1.169	6.978	10.692
150.00	150.00	6870.95	3.153	0.0*	1-S2n	2.042	2.114	2.043	1.532	7.747	12.238
200.00	200.00	6871.58	3.785	0.0*	1-S2n	2.445	2.461	2.445	1.864	8.280	13.414
250.00	250.00	6872.41	4.445	4.610	2-M2c	2.874	2.763	2.766	2.175	8.989	14.366
300.00	300.00	6873.01	5.196	5.208	2-M2c	3.464	3.018	3.030	2.473	9.792	15.165
350.00	350.00	6873.88	6.077	6.001	2-M2c	4.000	3.246	3.258	2.760	10.663	15.852
400.00	400.00	6875.00	7.109	7.200	7-M2c	4.000	3.420	3.447	3.039	11.579	16.454
405.00	405.00	6875.12	7.221	7.318	7-M2c	4.000	3.437	3.464	3.066	11.676	16.509
500.00	432.38	6875.78	7.861	7.984	7-M2c	4.000	3.533	3.544	3.578	12.241	17.466

* theoretical depth is impractical. Depth reported is corrected.

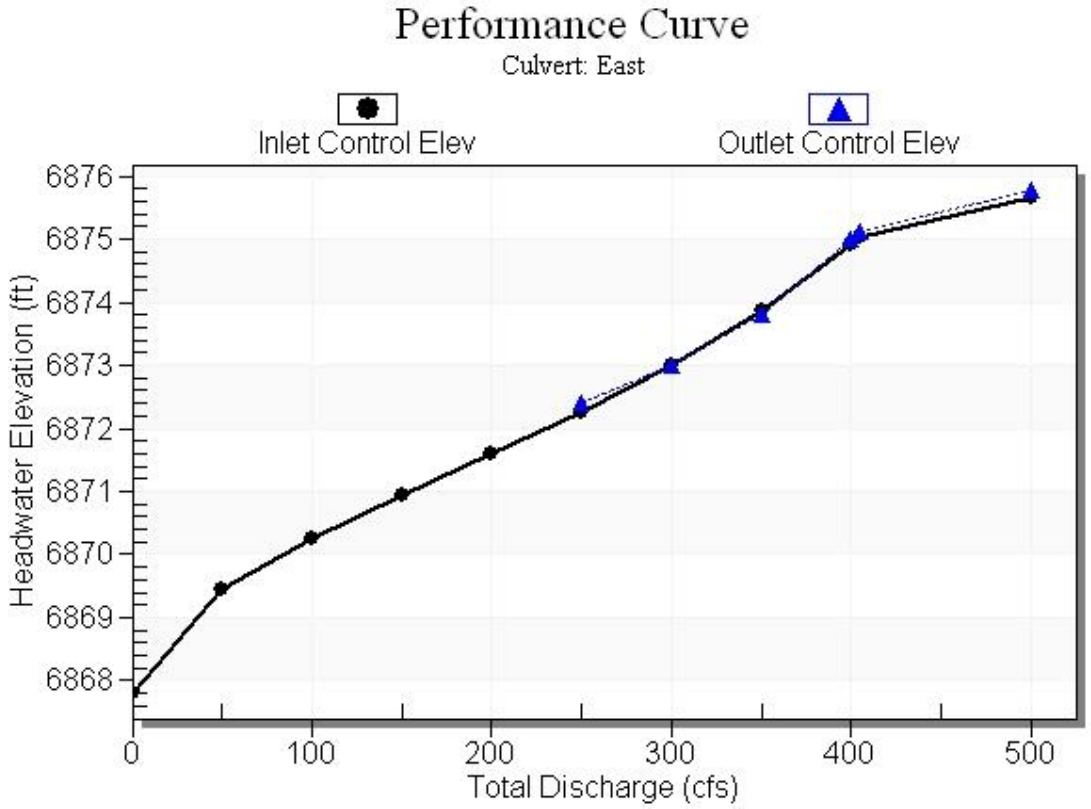
****

Inlet Elevation (invert): 6867.80 ft, Outlet Elevation (invert): 6866.90 ft

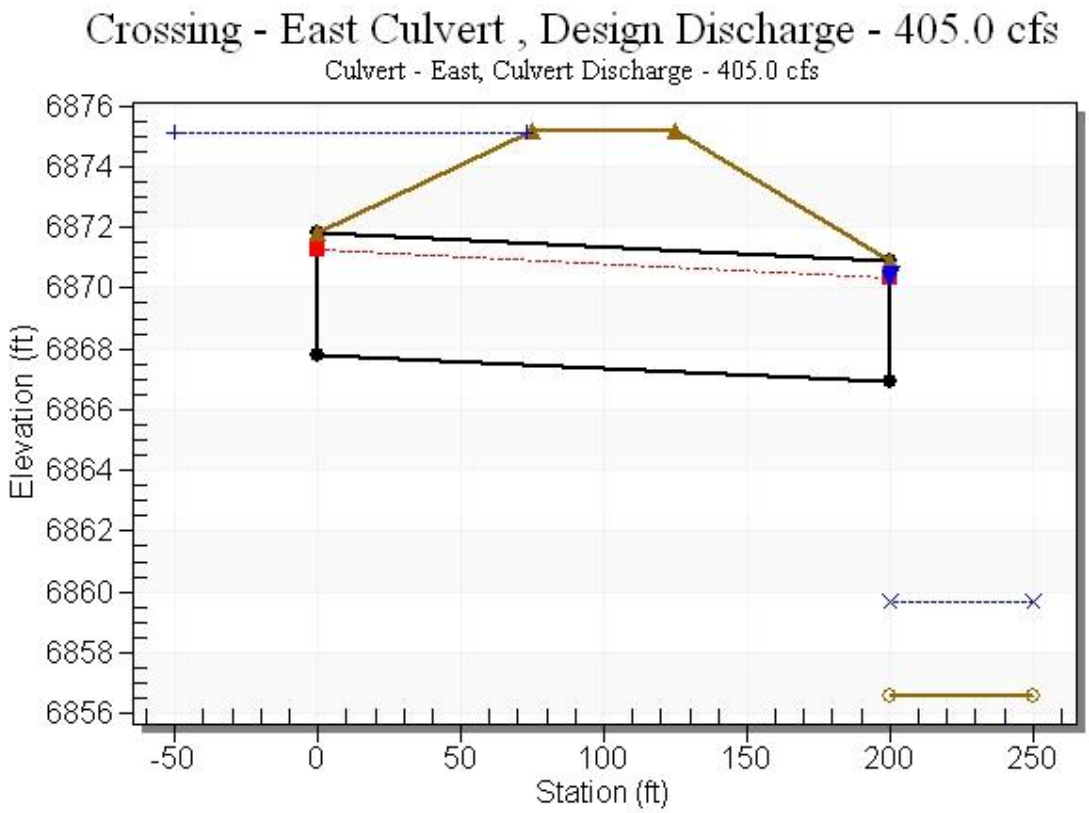
Culvert Length: 200.00 ft, Culvert Slope: 0.0045

****

Culvert Performance Curve Plot: East



Water Surface Profile Plot for Culvert: East



Site Data - East

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6867.80 ft

Outlet Station: 200.00 ft

Outlet Elevation: 6866.90 ft

Number of Barrels: 3

Culvert Data Summary - East

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: East Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6856.60	0.00	0.00	0.00	0.00
50.00	6857.35	0.75	8.39	0.47	1.71
100.00	6857.77	1.17	10.69	0.73	1.74
150.00	6858.13	1.53	12.24	0.96	1.74
200.00	6858.46	1.86	13.41	1.16	1.73
250.00	6858.78	2.18	14.37	1.36	1.72
300.00	6859.07	2.47	15.17	1.54	1.70
350.00	6859.36	2.76	15.85	1.72	1.68
400.00	6859.64	3.04	16.45	1.90	1.66
405.00	6859.67	3.07	16.51	1.91	1.66
500.00	6860.18	3.58	17.47	2.23	1.63

Tailwater Channel Data - East Culvert

Tailwater Channel Option: Rectangular Channel

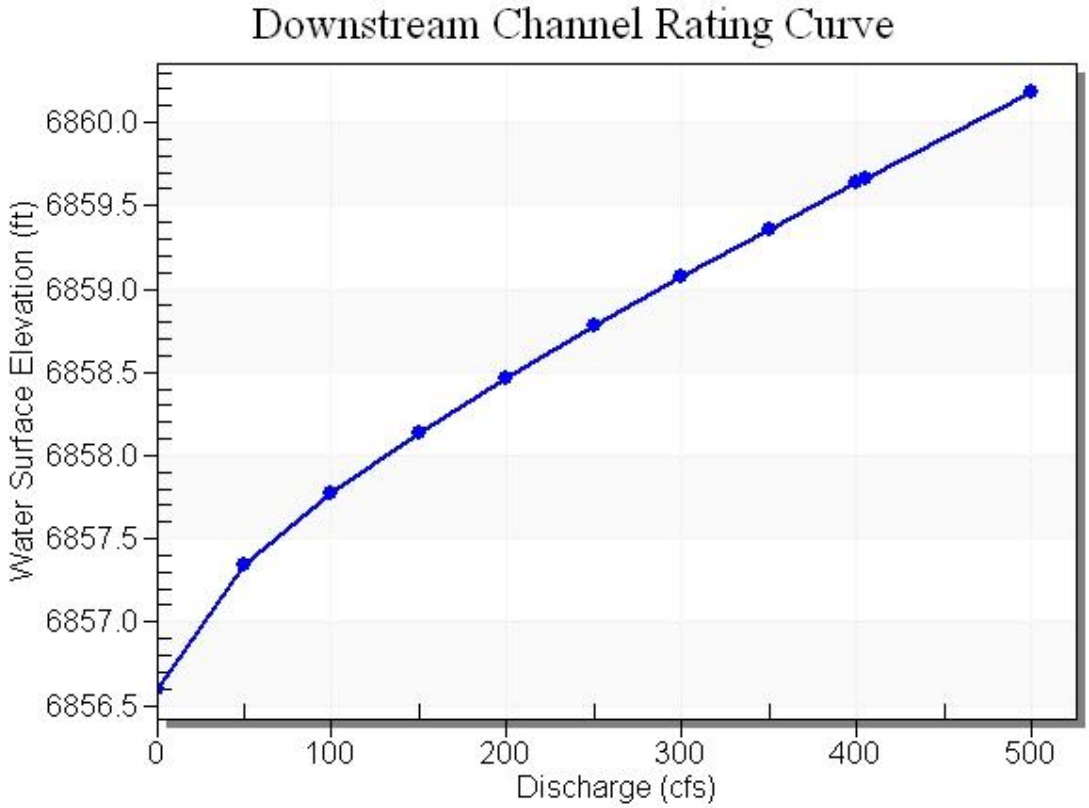
Bottom Width: 8.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0130

Channel Invert Elevation: 6856.60 ft

Tailwater Rating Curve Plot for Crossing: East Culvert



Roadway Data for Crossing: East Culvert

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	6875.20
1	25.00	6875.20
2	50.00	6875.20

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

HY-8 Culvert Analysis Report

Project Notes

Project Title:

Designer:

Project Date: Wednesday, September 28, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

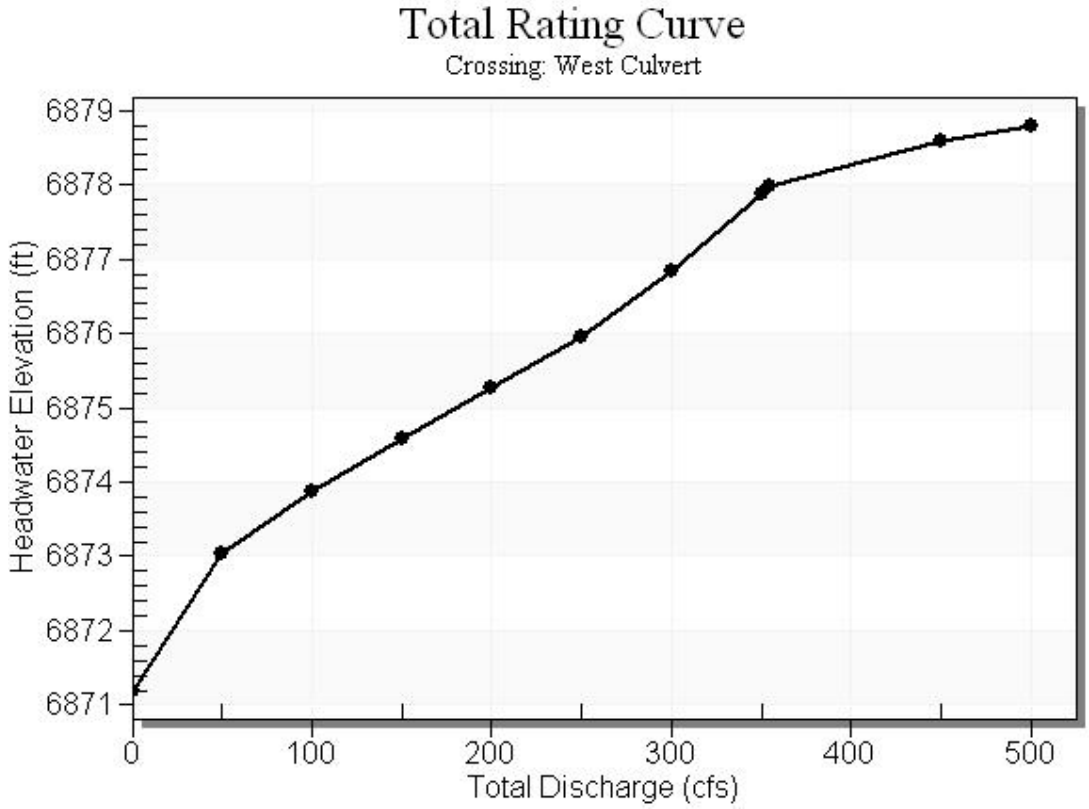
Exit Loss Option: Standard Method

Crossing Notes: West Culvert

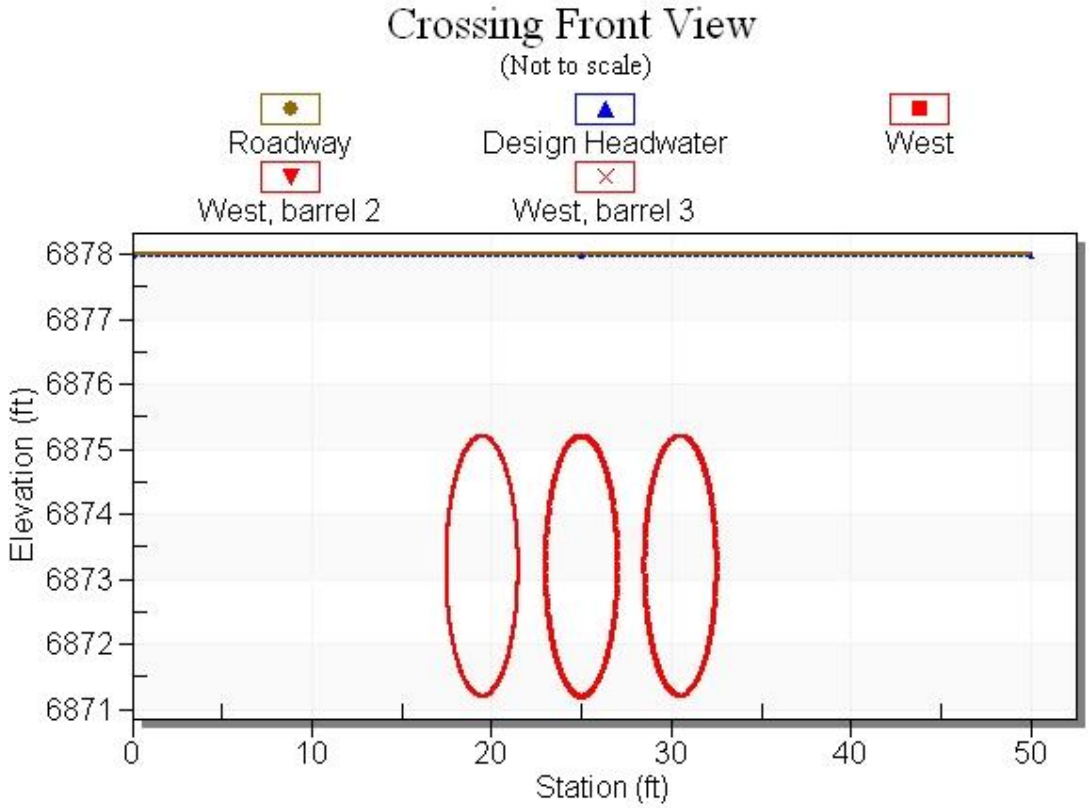
Table 1 - Summary of Culvert Flows at Crossing: West Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	West Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6871.20	0.00	0.00	0.00	1
6873.04	50.00	50.00	0.00	1
6873.88	100.00	100.00	0.00	1
6874.60	150.00	150.00	0.00	1
6875.27	200.00	200.00	0.00	1
6875.96	250.00	250.00	0.00	1
6876.84	300.00	300.00	0.00	1
6877.87	350.00	350.00	0.00	1
6877.99	355.00	355.00	0.00	1
6878.59	450.00	381.65	68.32	5
6878.80	500.00	390.91	108.90	4
6878.00	355.54	355.54	0.00	Overtopping

Rating Curve Plot for Crossing: West Culvert



Crossing Front View (Roadway Profile): West Culvert



Culvert Notes: West

Table 2 - Culvert Summary Table: West

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6871.20	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
50.00	50.00	6873.04	1.649	1.836	2-M2c	1.492	1.197	1.197	0.821	5.273	8.705
100.00	100.00	6873.88	2.463	2.685	2-M2c	2.228	1.708	1.716	1.297	6.473	11.017
150.00	150.00	6874.60	3.159	3.396	2-M2c	2.970	2.114	2.121	1.709	7.390	12.536
200.00	200.00	6875.27	3.791	4.071	2-M2c	4.000	2.461	2.465	2.090	8.203	13.674
250.00	250.00	6875.96	4.451	4.755	2-M2c	4.000	2.763	2.766	2.449	8.989	14.582
300.00	300.00	6876.84	5.202	5.642	7-M2c	4.000	3.018	3.030	2.795	9.792	15.335
350.00	350.00	6877.87	6.083	6.665	7-M2c	4.000	3.246	3.258	3.130	10.646	15.976
355.00	355.00	6877.99	6.179	6.787	7-M2c	4.000	3.264	3.278	3.163	10.735	16.035
450.00	381.65	6878.59	6.718	7.388	7-M2c	4.000	3.356	3.380	3.777	11.230	17.019
500.00	390.91	6878.80	6.916	7.602	7-M2c	4.000	3.388	3.413	4.093	11.410	17.453

* theoretical depth is impractical. Depth reported is corrected.

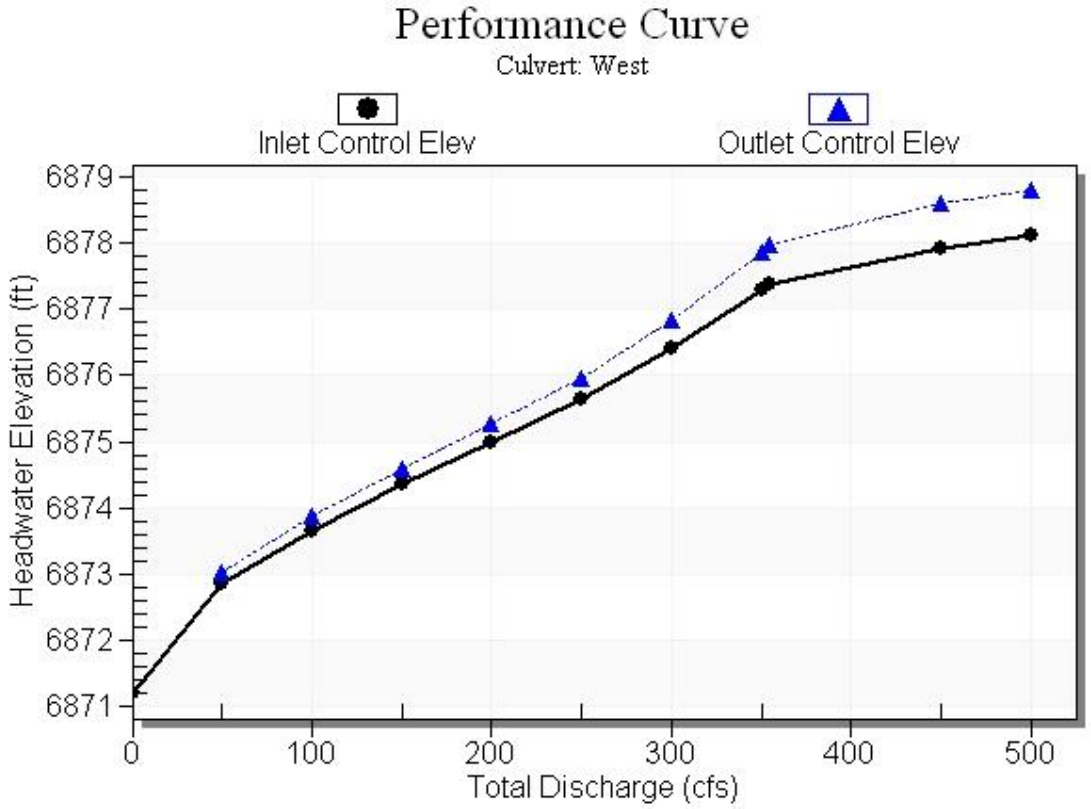
****

Inlet Elevation (invert): 6871.20 ft, Outlet Elevation (invert): 6870.90 ft

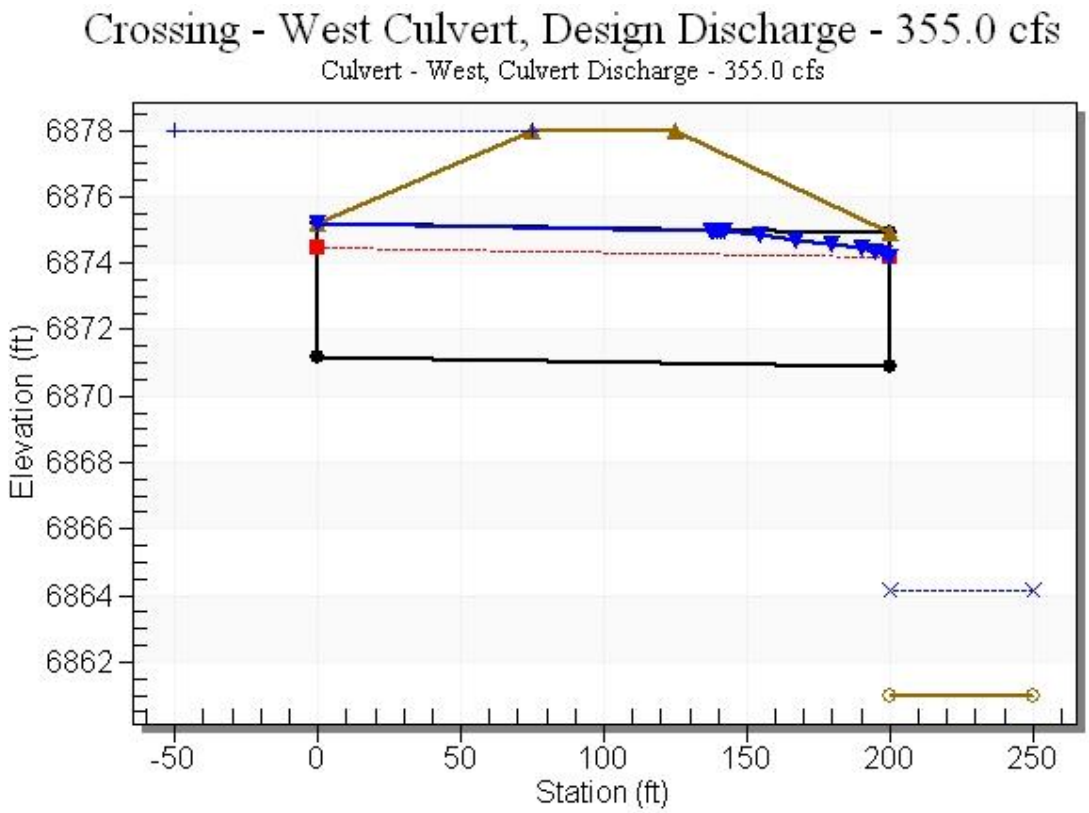
Culvert Length: 200.00 ft, Culvert Slope: 0.0015

****

Culvert Performance Curve Plot: West



Water Surface Profile Plot for Culvert: West



Site Data - West

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6871.20 ft

Outlet Station: 200.00 ft

Outlet Elevation: 6870.90 ft

Number of Barrels: 3

Culvert Data Summary - West

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: West Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6861.00	0.00	0.00	0.00	0.00
50.00	6861.82	0.82	8.71	0.51	1.69
100.00	6862.30	1.30	11.02	0.81	1.71
150.00	6862.71	1.71	12.54	1.07	1.69
200.00	6863.09	2.09	13.67	1.30	1.67
250.00	6863.45	2.45	14.58	1.53	1.64
300.00	6863.79	2.79	15.34	1.74	1.62
350.00	6864.13	3.13	15.98	1.95	1.59
355.00	6864.16	3.16	16.03	1.97	1.59
450.00	6864.78	3.78	17.02	2.36	1.54
500.00	6865.09	4.09	17.45	2.55	1.52

Tailwater Channel Data - West Culvert

Tailwater Channel Option: Rectangular Channel

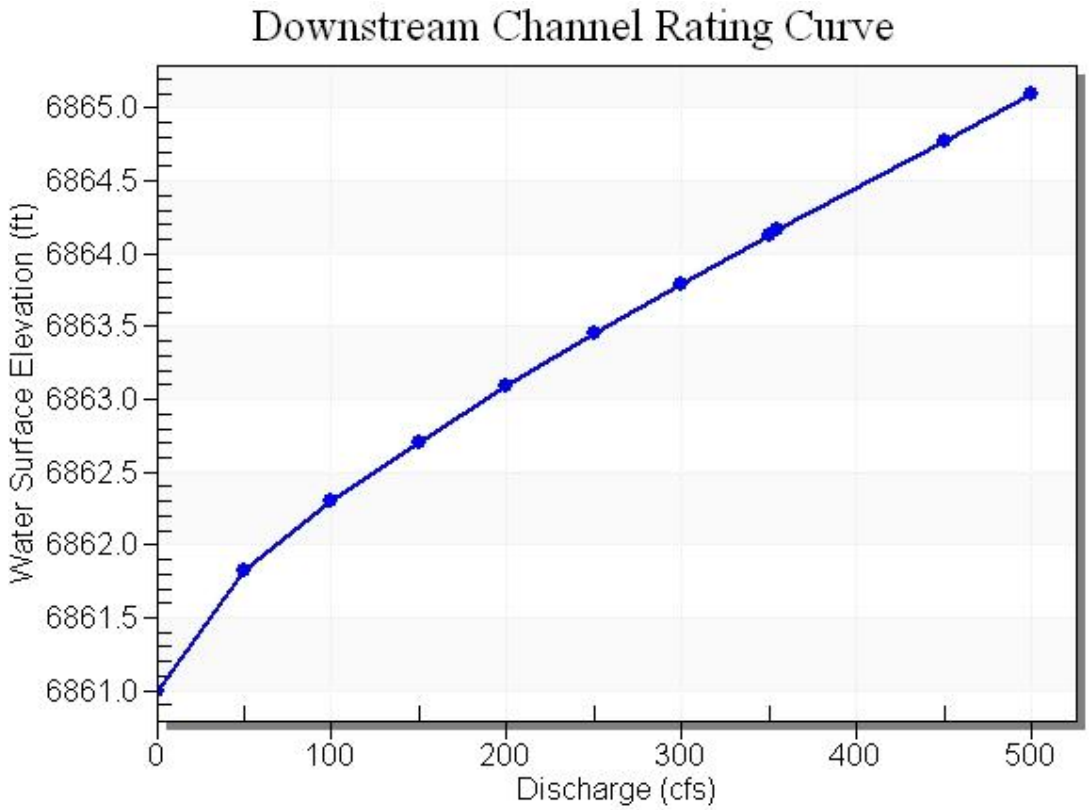
Bottom Width: 7.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0130

Channel Invert Elevation: 6861.00 ft

Tailwater Rating Curve Plot for Crossing: West Culvert



Roadway Data for Crossing: West Culvert

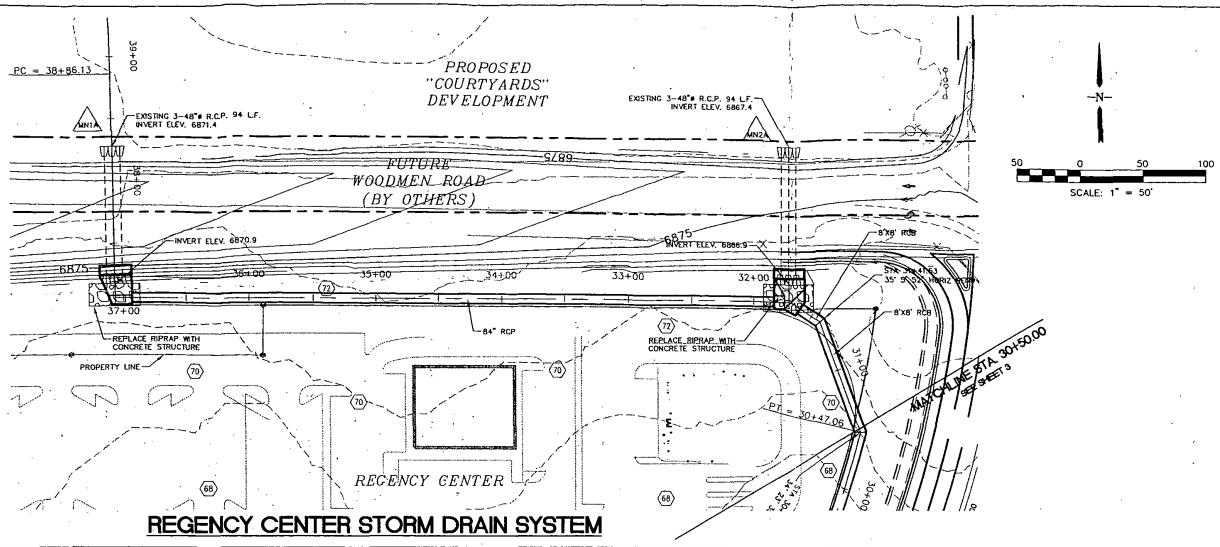
Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

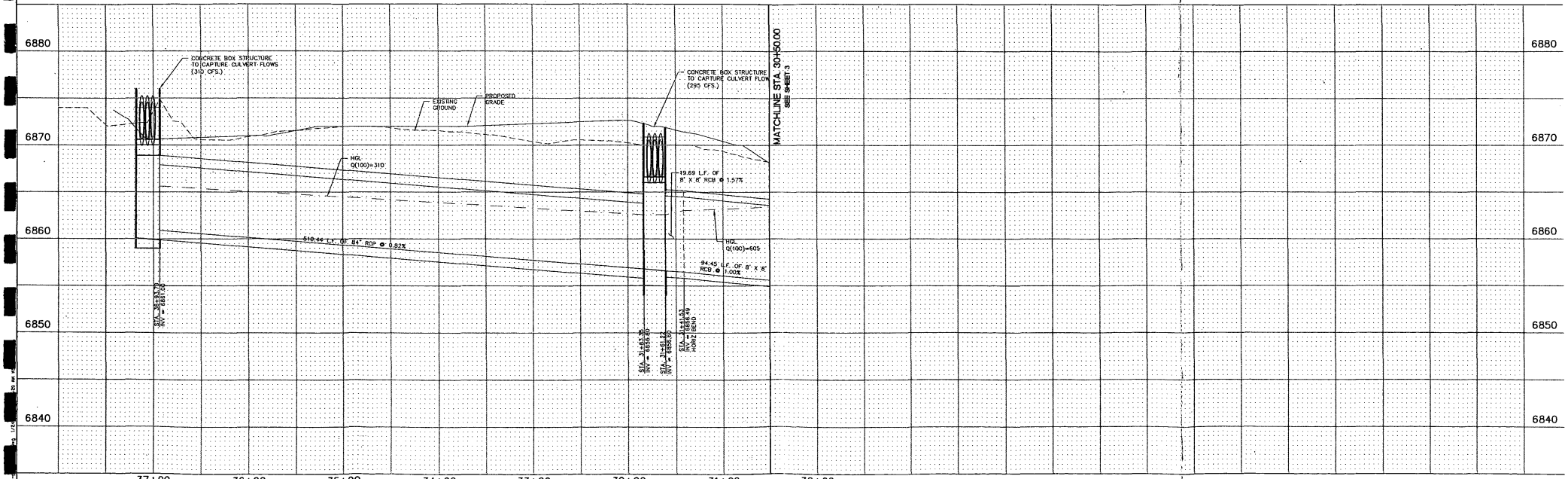
Coord No.	Station (ft)	Elevation (ft)
0	0.00	6878.00
1	25.00	6878.00
2	50.00	6878.00

Roadway Surface: Paved

Roadway Top Width: 50.00 ft



REGENCY CENTER STORM DRAIN SYSTEM



STATEMENT:
EL PASO COUNTY RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN; THE COUNTY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY. RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW:
STREET DESIGN:
CURB & GUTTER REVIEW _____ DATE: _____
FINAL REVIEW _____ DATE: _____
DRAINAGE DESIGN: DRAINAGE BASIN _____

DESIGN DATA:
SIDEWALKS: WIDTH 4'
LOCATION: ATTACHED ☐
DETACHED, 6" FROM P/L ☒
CURB TYPE 1☐ 2☐ 3☒ 4☐ 5☐
CRCD SRCD
R/W WIDTH 80' F/C-F/C 44'
STREET TYPE COLLECTOR
HVEEM _____
ASPHALT THICKNESS:
AC SURFACE _____
AC BASE _____
AGGREGATE BASE THICKNESS:
CLASS 6 _____
CLASS 5 _____
CLASS 2 _____

SCALE: HORIZONTAL 1" = 50' VERTICAL: 1" = 5'
BENCH MARK:
(SEE COVER SHEET)

REVISIONS:

NO.	DESCRIPTION	DATE

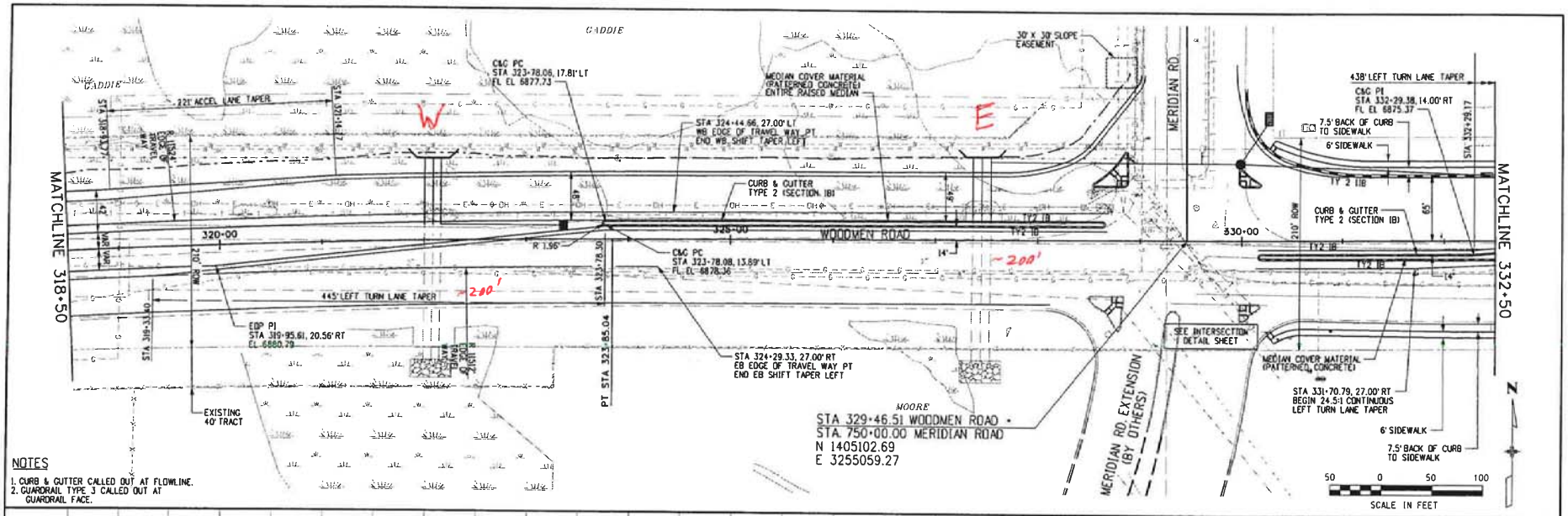
ENGINEER:
DESIGNED BY: JDR DATE: 8/24/04
DRAWN BY: JDR DATE: 8/24/04
CHECKED BY: _____ DATE: _____

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
(SEE COVER FOR LIST OF UTILITY CONTACTS)

URS
9960 FEDERAL DRIVE #300
COLORADO SPRINGS, COLORADO 80921
PHONE: (719) 531-0001
FAX: (719) 531-0007

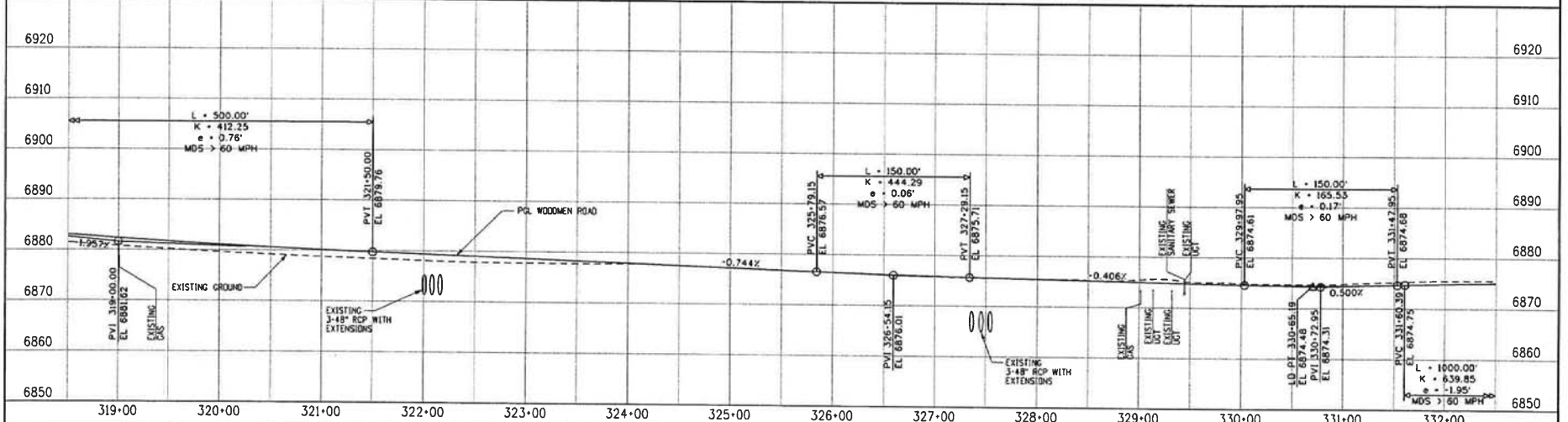
PROJECT REGENCY CENTER
SHEET TITLE PLAN & PROFILE CHANNEL
FROM STA. 30+50 TO STA. 37+00
JOB NO. 21710844 SHEET 2 OF 4

10/10/2007 7:27:19 AM



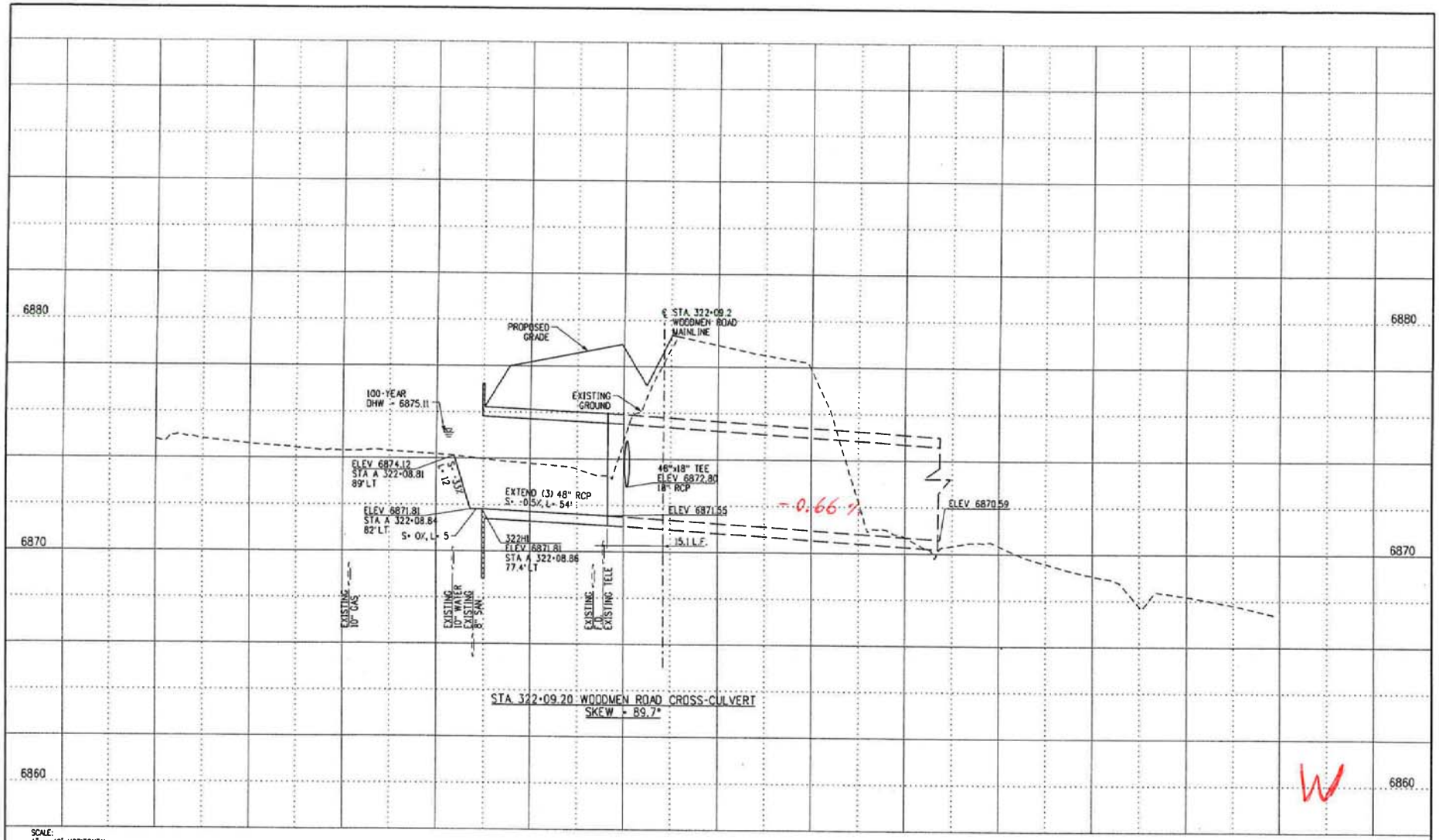
NOTES

1. CURB & GUTTER CALLED OUT AT FLOWLINE.
2. GUARDRAIL TYPE 3 CALLED OUT AT GUARDRAIL FACE.



Computer File Information			Sheet Revisions				As Constructed		WOODMEN ROAD		Project No./Code
Creation Date: 02/07/06	Initials: LPS					DMJM HARRIS | AECOM	No Revisions: –		PLAN & PROFILE-WOODMEN ROAD		STU M240-062
Last Modification Date: 9/11/2007	Initials: LPS					2950 Professional Place Colorado Springs, Colorado 80904 Phone: (719) 386-8300 Fax: (719) 386-8338	Revised: –		Designer: MES	Structure Numbers	13263
Full Path: E:\4954\4954_0604\cadd\roadway\54RDPP24.dgn							Void: –		Detailer: LPS		
Drawing Scale: 1"=50'									Sheet Subset: ROADWAY	Subset Sheets: RDPP23 of 38	Sheet Number 91
V8 Ver. 08.00.01.19	Units: ENGLISH										

10/10/2007 8:00:43 AM



SCALE:
1" = 40' HORIZONTAL
1" = 4' VERTICAL

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Last Modification Date:	9/17/2007	Initials:	LPS
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Drawing Scale:	1=20		
V8 Ver.	08.00.01.19	Units:	ENGLISH

Sheet Revisions		

DMJM HARRIS | AECOM
2950 Professional Place
Colorado Springs, Colorado 80904
Phone: (719) 366-8300 Fax: (719) 366-8338

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

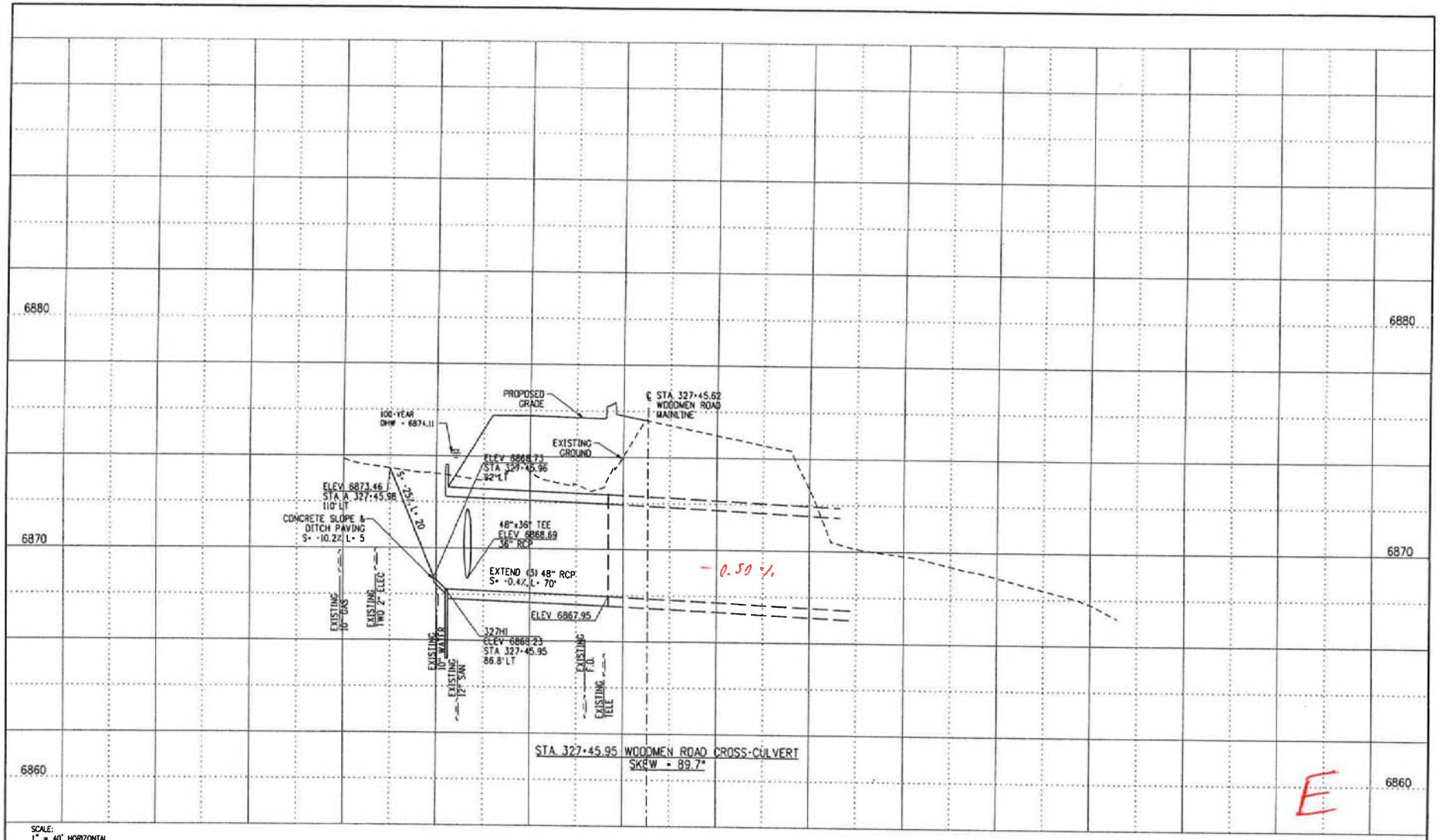
As Constructed	
No Revisions:	-
Revised:	-
Void:	-

WOODMEN ROAD
STORM SEWER PROFILE -
WOODMEN RD. STA. 322+09.20

Designer:	CLK	Structure Numbers	
Detailer:	LPS		
Sheet Subset:	DRAINAGE	Subset Sheets:	DR45 of 50

Project No./Code
STU M240-062
13263
Sheet Number 193

10/10/2007 8:00:56 AM



SCALE:
1" = 40' HORIZONTAL
1" = 4' VERTICAL

Computer File Information		
Creation Date: 02/20/06	Initials: LPS	
Last Modification Date: 10/1/2007	Initials: LPS	
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Drawing Scale: 1=20		
V8 Ver. 08.00.01.19	Units: ENGLISH	

Sheet Revisions

DMJM HARRIS | AECOM
2950 Professional Place
Colorado Springs, Colorado 80904
Phone: (719) 386-8300 Fax: (719) 386-8338

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

As Constructed
No Revisions: –
Revised: –
Void: –

WOODMEN ROAD
STORM SEWER PROFILE – WOODMEN RD. STA. 327+45.95

Designer: CLK
Detailer: LPS
Structure Numbers
Sheet Subset: DRAINAGE
Subset Sheets: DR47 of 50

Project No./Code
STU M240-062
13263
Sheet Number 195

APPENDIX 8

FEMA MT-2 FORMS AND SUPPLEMENTAL INFORMATION

MT-2 REVISION REQUEST SUBMITTAL CHECKLIST

PART A: GENERAL REQUIREMENTS

ELEMENTS	Yes	N/A
NARRATIVE: Please provide a written description about the purpose of the request and the scope of the proposed/as-built project and the methodology used to analyze the project effects.	X	
MT-2 APPLICATION FORMS: Please provide completed forms applicable to your request. Ensure that MT-2 Form 1 was signed by the requester, certifying engineer, and each community affected by the revision.	X	
HYDROLOGIC ANALYSIS: If applicable, please provide a FEMA acceptable hydrologic analysis in digital format, drainage area map and associated backup information (e.g., calculations used to determine lag time, CN and loss values as well as landuse and soil maps). FEMA-acceptable models can be accessed at www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meeting-minimum-requirements.	X	
HYDRAULIC ANALYSIS: Please provide a FEMA acceptable hydraulic analysis in digital format. FEMA-acceptable models can be accessed at www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meeting-minimum-requirements.	X	
CERTIFIED TOPOGRAPHIC WORK MAP: Please provide a certified topographic work map that meets the mapping requirements outlined in MT-2 Form 2. If available, please provide digital Computer-Aided Design (CAD) or Geographic Information System (GIS) data that is spatially referenced.	X	
ANNOTATED FIRM: Please submit a revised FIRM, at the scale of the effective FIRM, which shows the revised boundary delineation of the base floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway and how it ties into the boundary delineation shown on the effective FIRM at the downstream and upstream ends of the revised reach.	X	
REVIEW FEE PAYMENT: Please include the appropriate review fee payment. The current fee schedule is available on the FEMA Web site at www.fema.gov/forms-documents-and-software/flood-map-related-fees.	X	
MEET 65.10 REQUIREMENT: If the request intends to show that a berm/levee/flood wall provides flood protection, please submit all of the data requirements outlined in Section 65.10 of the NFIP regulations.		X
OPERATION AND MAINTENANCE PLAN: If the request involves a berm, levee, flood wall, dam, and/or detention basin project, please submit an officially adopted maintenance and operation plan.	X	
PROPOSED/AS-BUILT PLANS: If applicable, please submit proposed/as-built plans, certified by a registered Professional Engineer, for all the project elements.		X
FLOODWAY NOTICE: If the revision result in changing or establishing floodway boundaries, please provide floodway public notice or a statement by your community that it has notified all affected property owners, in compliance with NFIP regulation Subparagraph 65.7(b)(1).		X
PROPERTY OWNER NOTIFICATION: If the revision result in any widening/shifting/establishing of the base floodplain and/or any BFE increases/establishing BFEs, please provide copy of the individual legal notices sent to all the property owners affected by any increases in the flood hazard information.		X

PART B: CLOMR SPECIFIC REQUIREMENTS

Endangered Species Act COMPLIANCE: Please submit documentation of compliance with the ESA Requirements . To learn more about ESA Compliance, please see the MT-2 Instructions manual.	X	
65.12 REGULATORY REQUIREMENTS: If the Base (1-percent-annual-chance) Flood Elevation (BFE) increases greater than 0.00 foot as a result of encroachment within a floodway or 1.0 foot within Zone AE that has no floodway/Zone A, between the pre-project (existing) conditions and the proposed conditions as a result of the proposed project. Please submit a). Certification that no structures are affected by the increased BFE; b). Documentation of individual legal notice to all affected property owners, explaining the impact of the proposed action on their property; and c). An evaluation of alternatives that would not result in an increase in BFE.		X

Note: Applicants are encouraged to submit their revision request using the Online LOMC tool. To learn more about Online LOMC tool, visit the FEMA website at www.fema.gov/online-lomc.

Falcon Marketplace
Unnamed Tributary to Black Squirrel Creek
CLOMR

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☒ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☐ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Example: 480301 480287	City of Katy Harris County	TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
080059	El Paso County - Unincorporated Areas	CO	08041C	0575F	03/17/97
080059	El Paso County - Unincorporated Areas	CO	08041C	0533G	7/29/15

2. a. Flooding Source: Unnamed Tributary to Black Squirrel Creek

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Falcon Marketplace

4. FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

   a. The basis for this revision request is (check all that apply)

   ☒ Physical Change ☐ Improved Methodology/Data ☐ Regulatory Floodway Revision ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☒ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☒ New Topographic Data ☒ Other (Attach Description)

   Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☒ Channelization ☐ Levee/Floodwall ☒ Bridge/Culvert

☐ Dam ☒ Fill ☒ Other (Attach Description)

6 ☒ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: ~~$6,500~~ $6,750

☐ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Seven Leslie P.E., CFM	Company: Drexel, Barrell & Co.	
Mailing Address: 1800 38th Street Boulder, CO 80301	Daytime Telephone No.: 303-442-4338	Fax No.: 303-442-4373
	E-Mail Address: sleslie@drexelbarrell.com	
Signature of Requester (required): Steven D. Leslie	Date: 10/13/16	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Keith Curtis P.E., CFM - Floodplain Administrator	Community Name: El Paso County	
Mailing Address: 2880 International Circle Colorado Springs, CO 80910	Daytime Telephone No.: 719-327-2898	Fax No.:
	E-Mail Address: keith@pprbd.org	
Community Official's Signature (required):	Date: 10-7-16	

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Seven Leslie P.E., CFM	License No.: 26096	Expiration Date: 10/31/17
Company Name: Drexel, Barrell & Co	Telephone No.: 303-442-4338	Fax No.: 303-442-4373
Signature: Steven D. Leslie	Date: 10/13/16	E-Mail Address: sleslie@drexelbarrell.com

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if …
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☒ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (Optional)

REQUEST FOR CONDITIONAL LETTER OF MAP REVISION
UNNAMED TRIBUTARY TO BLACK SQUIRREL CREEK, FALCON MARKET PLACE

MT-2 FORM 1, SUPPLEMENTAL DATA

Section B.1.

Effective FIRM: 08041C0575F, Effective Date March 17, 1997
Preliminary FIRM: 08041C0553G, Preliminary July 29, 2015

Section B.5.a

A currently undeveloped property at the northwest corner of the E. Woodmen Road and N. Meridian Road, in Falcon, Colorado, will be developed into a multi-pad shopping center/office complex.

The property is located in S1, T13S, R68W at an approximate latitude/longitude of 38°56’33”N / 104°36’37”W.

The Effective FIRM shows a portion of the property inundated by a Special Flood Hazard Area (SFHA), Zone A, of an Unnamed Tributary of Black Squirrel Creek

Section B.5.b

The existing undeveloped property has a natural open channel flowing from north to south across the property, which discharges to existing culverts under E. Woodmen Road.

The proposed development will intercept drainage in the existing open channel at the north property line. Drainage will be conveyed via a rundown into a detention pond. The detention pond will discharge to a new pipe, which will flow south and east across the property. The pipe will discharge into a grass lined open channel paralleling the north side of E. Woodmen Road, which will then discharge to existing culverts under E. Woodmen Road. The detention pond, pipe and open channel are designed to convey the full 100-year discharge.

Section B.6.

A letter documenting ESA compliance is included in the report appendices.

Section C.

Review fee will be submitted separately by the property owner, Hummel Investments, LLC.

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Unnamed Tributary to Black Squirrel Creek

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section B) ☐ No existing analysis ☐ Improved data
☐ Alternative methodology ☒ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)
Pond SR4 Inflow	1.16	NA	1016
Pond SR4 Outflow	1.16	NA	644
E. Woodman Road	1.36	NA	757

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model → Specify Model: HEC-HMS
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit*	E Woodman Road	61	NA	6875.19
Upstream Limit*	Falcon Marketplace, No. Property Line	2962	NA	6898.75

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS, HEC-HMS,, StormCAD

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name: NA	Plan Name: NA	File Name: NA	Plan Name: NA	NA
Corrected Effective Model*	File Name: NA	Plan Name: NA	File Name: NA	Plan Name: NA	NA
Existing or Pre-Project Conditions Model	File Name: NA	Plan Name: NA	File Name: NA	Plan Name: NA	NA
Revised or Post-Project Conditions Model	File Name: See attached	Plan Name: See attached	File Name: NA	Plan Name: NA	NGVD29
Other - (attach description)	File Name: See attached	Plan Name: NA	File Name:	Plan Name:	

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☒ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Floodplain Work Map

Source: Field surveys & El Paso County wide mapping Date: Various

Accuracy: National Mapping Accuracy Standards

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☒ Yes ☐ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:

   - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
   - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☐ Yes ☐ No

   If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill? ☒ Yes ☐ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☐ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

MT-2 FORM 2, SUPPLEMENTAL DATA

Section A.3.

Pre-project hydrologic analysis was completed as part of the Falcon Basin, Drainage Basin Planning Study, 2015 (Falcon DBPS). Selected pages from the Falcon Study are included in Appendix 3. A complete copy of the CLOMR Report plus electronic model files are included on the CD in CLOMR Report Appendices.

A discussion of the proposed conditions, hydraulic analysis completed for the Marketplace Development is discussed in the CLOMR Report and electronic model files are included on the CD in the CLOMR Report Appendices.

Section A.4.

The local community, El Paso County, does not require regional, state or federal agency review.

Section A.5.

Historically and under current conditions, sediment transport in the Unnamed Tributary to Black Squirrel basin has not been a significant problem and has had a negligible impact on basin hydrology.

Section B.1.

Within the CLOMR area the effective Special Flood Hazard Area (SFHA) is Zone A, with no base flood elevations identified.

Section B.1.

The effective and preliminary FIRM contains an approximate Zone A, Special Flood Hazard Area (SFHA) delineation with no BFE's defined. The project limits are the north side of E. Woodmen Road and the north property line of the Falcon Marketplace Development, which is approximately 1,300-ft north of E. Woodmen Road.

There is no tie to an existing UTBSC floodplain at the downstream end of the study area. The effective/preliminary Zone A 100-yr floodplain delineation truncates or terminates at approximately the north ROW line of East Woodmen Road. The revised Zone AE, 100-yr floodplain delineation also truncates or terminates at approximately the north row line of East Woodmen Road. Under pre- and post-project conditions, 100-year discharges downstream of this point are conveyed under E. Woodmen Road in two sets of existing 3-48" RCP culverts.

MT-2 FORM 2, SUPPLEMENTAL DATA

At the upstream limits of the study area, the revised Zone AE floodplain, located at the north property line of the Falcon Marketplace, graphically ties to the effective/preliminary Zone A immediately north of the north property line.

Section B.2.

HY-8 v7.2 was used for analysis of the existing culverts under E. Woodmen road.
HEC-RAS v4.1.0 was used for hydraulic analysis of open channel.
UD-Detention v2.35 and HEC-HMSv3.5 were used for hydraulic analysis of the detention pond SR4.
StormCAD v4.1.1 was used for the hydraulic analysis of the pipe storm drainage system.

Section B.4.

Digital model files are included on CD. Below is a tabulation of the Models used. All models on NGVD29 datum:

Software	File Name	Plan
HEC-RAS	FALCON_FP.prj	FALCON_DS
HEC-RAS	FALCON_FP.prj	FALCON_US
UD-Detention	FM Pond #1rev (w6897.0).xls	NA
HEC-HMS	Proposed_Falcon_DPMS.hms & Proposed_Falcon_DPMS.dss	NA
StormCAD	96-RCP.stm	NA
HY-8	Woodmen Culvert.hy8	NA

Section C

A printed version and digital files of certified Floodplain Workmap are included in the CLOMR Report Appendices. An annotated version of the preliminary FIRM is included in the CLOMR Report Appendices.

Section D.1.a.

The effective/preliminary FIRM contains an approximate, Zone A floodplain delineation and no floodway is defined

The post-project flood elevations, for the most part, are lower than the pre-project flood elevations, due to the nature of the channelization and underground piping. The detention pond has a higher flood elevation than existing, due to the purpose of the pond.

MT-2 FORM 2, SUPPLEMENTAL DATA

Section D.1.b.

Not applicable for CLOMR.

Section D.2

There are no existing structures affected by the pre-project or post-project floodplain. Future structures will be designed to have lowest floor elevations above the floodplain, as required by El Paso County and the Regional Floodplain Administrator.

Section D.3.

Not applicable for CLOMR.

Section D.4

An ESA compliance letter is included in the CLOMR Report Appendices.

The Falcon Marketplace project is not authorized, funded or being carried out by Federal or State Agencies.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

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DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Unnamed Tributary to Black Squirrel Creek

Note**:** Fill out one form for each flooding source studied.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization.....complete Section B
Bridge/Culvert.....complete Section C
Dam.....complete Section D
Levee/Floodwall.....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Modeled Structure

1. Name of Structure: Grass Lined Open Channel

   Type (check one): ☒ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: Paralleling North ROW of E. Woodman Road

   Downstream Limit/Cross Section: 61

   Upstream Limit/Cross Section: 1000

2. Name of Structure: 96" RCP Culvert

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: Between Pond SR4 and Grass Lined Open Channel

   Downstream Limit/Cross Section: 1000

   Upstream Limit/Cross Section: 2482

3. Name of Structure: Detention Pond SR4

   Type (check one) ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☒ Dam

   Location of Structure: Paralleling North Property line of Falcon Marketplace

   Downstream Limit/Cross Section: 2482

   Upstream Limit/Cross Section: 2926

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: Unnamed Tributary to Black Squirrel Creek

Name of Structure: Grass Lined Open Channel

1. Hydraulic Considerations

The channel was designed to carry 757 (cfs) and/or the 100-year flood.

The design elevation in the channel is based on (check one):

☒ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)] ☐ Drop structures ☐ Superelevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/detention basin [Attach Section D (Dam/Basin)] ☐ Energy dissipator

☐ Weir ☒ Other (Describe): check dam, lateral diversion

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: Unnamed Tributary to Black Squirrel Creek

Name of Structure: 96" RCP Culvert

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): StormCAD
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

☒ Dimensions (height, width, span, radius, length)

☒ Shape (culverts only)

☒ Material

☐ Beveling or Rounding

☐ Wing Wall Angle

☐ Skew Angle

☐ Distances Between Cross Sections

☐ Erosion Protection

☐ Low Chord Elevations – Upstream and Downstream

☐ Top of Road Elevations – Upstream and Downstream

☒ Structure Invert Elevations – Upstream and Downstream

☒ Stream Invert Elevations – Upstream and Downstream

☐ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

B. CHANNELIZATION

Flooding Source: Unnamed Tributary to Black Squirrel Creek

Name of Structure: Pond SR4 to North Property Line

1. Hydraulic Considerations

The channel was designed to carry 1116 (cfs) and/or the 100-year flood.
The design elevation in the channel is based on (check one):

☒ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)] ☐ Drop structures ☐ Superelevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/detention basin [Attach Section D (Dam/Basin)] ☐ Energy dissipator

☐ Weir ☐ Other (Describe): slope riprap armoring

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source:

Name of Structure:

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

☐ Dimensions (height, width, span, radius, length)

☐ Shape (culverts only)

☐ Material

☐ Beveling or Rounding

☐ Wing Wall Angle

☐ Skew Angle

☐ Distances Between Cross Sections

☐ Erosion Protection

☐ Low Chord Elevations – Upstream and Downstream

☐ Top of Road Elevations – Upstream and Downstream

☐ Structure Invert Elevations – Upstream and Downstream

☐ Stream Invert Elevations – Upstream and Downstream

☐ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM/BASIN

Flooding Source: Unnamed Tributary to Black Squirrel Creek
Name of Structure: Detention Pond SR4

1. This request is for (check one): ☐ Existing dam/basin ☒ New dam/basin ☐ Modification of existing dam/basin

2. The dam/basin was designed by (check one): ☐ Federal agency ☐ State agency ☒ Private organization ☐ Local government agency

   Name of the agency or organization: Drexel, Barrell & Co.

3. The Dam was permitted as (check one): ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number _____ Permitting Agency or Organization _____

   a. ☒ Local Government Dam ☐ Private Dam

   Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☒ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

   Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

   ☒ Yes, provide supporting documentation with your completed Form 2.

   ☐ No, provide a written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☒ No

   If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☒ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

	Stillwater Elevation Behind the Dam/Basin	
FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	NA	6894.6
50-year (2%)	NA	6896.4
100-year (1%)	NA	6897.0
500-year (0.2%)	NA	NA
Normal Pool Elevation	NA	Empty

7. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one): ☐ upgrading of an existing levee/floodwall system ☐ a newly constructed levee/floodwall system ☐ reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

☐ earthen embankment, dike, berm, etc. Station _____ to _____
☐ structural floodwall Station _____ to _____
☐ Other (describe): Station _____ to _____

c. Structural Type (check one): ☐ monolithic cast-in place reinforced concrete ☐ reinforced concrete masonry block ☐ sheet piling
☐ Other (describe): _____

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☐ No

If Yes, by which agency? _____

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers: _____
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers: _____
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers: _____
4. A layout detail for the embankment protection measures. Sheet Numbers: _____
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, Floodwall structure, closure structures, and pump stations. Sheet Numbers: _____

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout ☐ Yes ☐ No

3.5 feet or more at the upstream end ☐ Yes ☐ No

4.0 feet within 100 feet upstream of all structures and/or constrictions ☐ Yes ☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater). ☐ Yes ☐ No

2.0 feet above the 1%-annual-chance stillwater surge elevation ☐ Yes ☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☐ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Openings through the levee system (check one): ☐ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope land side is: _____

b. The maximum levee slope flood side is: _____

c. The range of velocities along the levee during the base flood is: _____ (min.) to _____ (max.)

d. Embankment material is protected by (describe what kind): _____

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D_{100}	D_{50}	Thickness	
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								

(Extend table on an added sheet as needed and reference each entry)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☐ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:
_____

☐ Overall height: Sta.: _____, height _____ ft.

☐ Limiting foundation soil strength:

Strength ϕ = _____ degrees, c = _____ psf

Slope: SS = _____ (h) to _____ (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):
_____

c. Summary of stability analysis results:

E. LEVEE/FLOODWALL (CONTINUED)

5. Embankment And Foundation Stability (continued)

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed? ☐ Yes ☐ No

If Yes, describe methodology used:

e. Was a seepage analysis for the foundation performed? ☐ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☐ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☐ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is _____ hours.

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) ☐ Other (specify): _____

b. Stability analysis submitted provides for: ☐ Overturning ☐ Sliding If not, explain: _____

c. Loading included in the analyses were: ☐ Lateral earth @ P_A = _____ psf; P_p = _____ psf

☐ Surcharge-Slope @ _____, ☐ surface _____ psf

☐ Wind @ P_w = _____ psf

☐ Seepage (Uplift); _____ ☐ Earthquake @ P_{eq} = _____ %g

☐ 1%-annual-chance significant wave height: _____ ft.

☐ 1%-annual-chance significant wave period: _____ sec.

d. Summary of Stability Analysis Results: Factors of Safety.
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)
Note: (Extend table on an added sheet as needed and reference)

E. LEVEE/FLOODWALL (CONTINUED)

6. Floodwall And Foundation Stability (continued)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☐ Yes ☐ No

b. The computed range of settlement is _____ ft. to _____ ft.

c. Settlement of the levee crest is determined to be primarily from : ☐ Foundation consolidation ☐ Embankment compression ☐ Other (Describe): _____

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: _____ acres
Draining to ponding area: _____ acres

b. Relationships Established

Ponding elevation vs. storage	☐ Yes	☐ No
Ponding elevation vs. gravity flow	☐ Yes	☐ No
Differential head vs. gravity flow	☐ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☐ No

d. Specify the discharge capacity of the head pressure conduit: _____ cfs

e. Which flooding conditions were analyzed?

• Gravity flow (Interior Watershed)	☐ Yes	☐ No
• Common storm (River Watershed)	☐ Yes	☐ No
• Historical ponding probability	☐ Yes	☐ No
• Coastal wave overtopping	☐ Yes	☐ No

If No for any of the above, attach explanation.

e. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☐ Yes ☐ No If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is _____ cfs

h. The length of levee system used to drive this seepage rate in item g: _____ ft.

E. LEVEE/FLOODWALL (CONTINUED)

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage? ☐ Yes ☐ No

If Yes, include the number of pumping plants: _____ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☐ is not a problem
Hydrocompaction ☐ is ☐ is not a problem
Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☐ No Attach supporting documentation

d. Sediment Transport Considerations:

Was sediment transport considered? ☐ Yes ☐ No
If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

10. Operational Plan And Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?
☐ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?
☐ Yes ☐ No If the answer is No to any of the above, please attach supporting documentation.

E. LEVEE/FLOODWALL (CONTINUED)

11. Maintenance Plan

Please attach a copy of the fomal maintenance plan for the levee/floodwall

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

CERTIFICATION OF THE LEVEE DOCUMENTION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: _____ License No.: _____ Expiration Date: _____

Company Name: _____ Telephone No.: _____ Fax No.: _____

Signature: _____ Date: _____ E-Mail Address: _____

F. SEDIMENT TRANSPORT

Flooding Source: _____

Name of Structure: _____

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet

Debris load associated with the base flood discharge: Volume _____ acre-feet

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

MT-2 FORM 3, SUPPLEMENTAL DATA

Section B.2. – Grass Lined Open Channel

Model results indicate subcritical flow conditions at all cross sections with the following exception:

- cross section 1000, which is the upstream limit of the channel at the outlet of the 96" pipe.
- cross section 535, which is a check dam structure designed to equalize flow between the east and west sets of 3-48" RCP culverts under E. Woodmen Road. Critical flow conditions are expected at the check dam structure.

Section B.2. – Grass Lined Open Channel

The CLOMR Report Appendices included construction drawings of the grass lined open channel.

Section B.3. – Grass Lined Open Channel

The grass lined open channel contains a check dam (XS535) located immediately downstream (east) of the westerly set of 3-48" culverts under E. Woodmen Road. The check dam will help to more evenly divide flows between the westerly and easterly sets of 3-48" culverts under E. Woodmen Road. The check dam will be constructed of earthen material armored with riprap.

The grass lined open channel a lateral structure (538) located on the right overbank. The lateral structure uses a diversion rating curve to model flows leaving the main channel in the existing westerly set of 3-48" culverts under E. Woodmen Road. The diversion rating curve is based on headwater conditions to the existing westerly set of 3-48" culverts under E. Woodmen Road.

Section B.4. – Grass Lined Open Channel

Historically and under current conditions, sediment transport in the Unnamed Tributary to Black Squirrel basin has not been a significant problem. It is not anticipated sediment transport will impact the hydraulics of the proposed grass lined channel.

Section B.2. - Pond SR4 to North Property Line

Model results indicate subcritical flow conditions at all cross sections with the following exception:

- cross section 2926, which is a cross section where off site flows enter the Falcon Marketplace site and drop into the Detention Pond SR4. Critical flow conditions are expected at this location.

MT-2 FORM 3, SUPPLEMENTAL DATA

Section B.2. - Pond SR4 to North Property Line

The CLOMR Report Appendices included construction drawings of this section of channel between Pond SR4 to North Property Line.

Section B.3. - Pond SR4 to North Property Line

The portion of the Pond SR4 basin side slope were off site flows enter the pond will be lined with riprap armoring to protect the slope from erosive forces.

Section B.4. - Pond SR4 to North Property Line

Historically and under current conditions, sediment transport in the Unnamed Tributary to Black Squirrel basin has not been a significant problem. It is not anticipated sediment transport will impact the hydraulics of the proposed channel between Pond SR4 to North Property Line.

Section C.2.

StormCAD was used to model the hydraulics of the 96” RCP culvert. The StormCAD software was used in lieu of the culvert routines in HEC-RAS due to the length and alignment of the culvert and multiple structures along the culvert. The StormCAD software allowed for more detailed hydraulic analysis of the culvert, including head losses at the manholes along the culvert.

Section C.3.

The CLOMR Report Appendices included construction drawings of the proposed 96” RCP Culvert.

Section C.4.

Historically and under current conditions, sediment transport in the Unnamed Tributary to Black Squirrel basin has not been a significant problem. It is not anticipated sediment transport will impact the hydraulics of the proposed 96” RCP Culvert.

Section D.3.

The proposed Detention Pond SR4 does not meet Jurisdiction Dam Criteria for the State of Colorado State. Therefore State and Federal review/approval and permitting is not required. However, in accordance with State of Colorado regulations, a notification of intent to construct a non-jurisdictional dam will be made to the State Engineers office.

MT-2 FORM 3, SUPPLEMENTAL DATA

Section D.3.a.

The proposed Detention Pond SR4 will be constructed by the Falcon Marketplace developer and then turned over to El Paso County for ownership, operation and maintenance.

The CLOMR Report Appendices include construction drawings of the proposed detention Pond.

Section D.4.

The proposed Detention Pond SR4 was sized using HEC-HMS software to convey the 100-year flood. The analysis accounted for the full volume of runoff.

The CLOMR Report includes MT-2 Form 2 and supporting documentation.

Section D.5.

Historically and under current conditions, sediment transport in the Unnamed Tributary to Black Squirrel basin has not been a significant problem. A debris/sediment analysis was not completed for this project. In accordance with El Paso County development criteria, the detention pond has been designed to include water quality control features which will facilitate sediment/debris capture and access for periodic sediment/debris removal. The northern slopes of the detention pond will be armored with riprap to protect the slopes from erosion/scour where the Creek enters the pond.

Section D.6.

The effective/preliminary FIRM does not include BFE's at the location of the proposed detention pond. The Falcon Marketplace CLOMR will define BFE's upstream and downstream of the pond. The pond will normally be dry.

Section D.6.

The effective/preliminary FIRM does not include BFE's at the location of the proposed detention pond. The Falcon Marketplace CLOMR will define BFE's upstream and downstream of the pond.

Section D.7.

An Operation and Maintenance Plan for Detention Pond SR4 and is included in Appendix 13.

MT-2 FORM 3, SUPPLEMENTAL DATA

Section E.

No levees or floodwalls are proposed as part of the Falcon Marketplace development.

Section F.

Historically and under current conditions, sediment transport in the Unnamed Tributary to Black Squirrel basin has not been a significant problem. It is not anticipated sediment transport will significantly impact BFE's or structures. A detailed sediment analysis was completed for the Falcon Marketplace development.

APPENDIX 9

ESA COMPLIANCE

DBC
Drexel, Barrell & Co.
Traditional Services, Innovative Solutions
Since 1949

1800 38th St. • Boulder, CO 80301 • 303.442.4338 • 303.442.4373 fax
3 South 7th St. • Colorado Springs, CO 80905 • 719-260-0887 • 719-260-8352 fax
6513 W. 4th Street • Greeley, CO 80634 • 970-351-0645

October 7, 2016

Pikes Peak Regional Building Department
Floodplain Administrator
Attn: Keith Curtis, PE, LEED AP, CFM
2880 International Circle
Colorado Springs, CO 80910
(719) 327-2898

Subject: *Falcon Marketplace CLOMR Submittal Request:*

Endangered Species Act (ESA) Compliance

Mr. Curtis,

On behalf of Hummel Investments, LLC, Drexel, Barrell & Co. is requesting a review of the following supplemental documentation regarding the above site for compliance with the ESA. Based on the below findings, the project will not result in the taking of any threatened or endangered species.

Federal Nexus
The project area is northwest of the intersection of East Woodmen Road and Meridian Road in Falcon, Colorado (Figure 1). Two seasonal drainage ways associated with an unnamed tributary to Black Squirrel Creek join on the site and flow south.

On August 23, 2016, Van Truan, Chief of Southern Colorado Regulatory Branch of the U.S. Army Corps of Engineers, provided an Approved Jurisdictional Ruling determining that "the site contains no jurisdictional waters of the United States that are subject to regulation under Section 404 of the Clean Water Act"; therefore, no known federal nexus is associated with the project.

Project Location
The legal description of the project area is Section 1, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado (Figure 1). The latitude/longitude of the project area is approximately 38.94267°N/104.610104°W. The elevation of the project area is approximately 6,900 feet above sea level.

Project Description
The proposed project consists of constructing a commercial/retail subdivision development, with an associated sub-regional detention pond, roadways, parking areas, landscaping and utility infrastructure.

Endangered Species Act (ESA) Compliance
The project area does not fall within U.S. Fish and Wildlife Service (Service) habitat or survey guidelines for the majority of the species listed by the Service as potentially occurring in El Paso County (Table 1).

Table 1. Federally threatened, endangered, and candidate species potentially found in El Paso County or potentially affected by projects in El Paso County.

Common Name	Scientific Name	Status*	Habitat	Potential Effect on Species
		Mammals		
Black-footed ferret	*Mustela nigripes*	EXPN, XN	Prairie and grassland ranging from midwestern to western U.S.	No effect, habitat not present
North American wolverine	*Gulo gulo luscus*	P	Deep, persistent, and reliable spring snow cover	No effect, habitat not present
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	T	Shrub riparian / wet meadows	No effect, in block clearance area
		Birds		
Interior least tern**	*Sterna antillarum athalassos*	E	Sandy/pebble beaches on lakes, reservoirs, and rivers	No effect, not in Platte River Basin
Mexican spotted owl	*Strix occidentalis*	T	Closed canopy forests in steep canyons	No effect, no habitat present
Piping plover**	*Charadrius melodus*	T	Sandy lakeshore beaches and river sandbars	No effect, not in Platte River Basin
Whooping crane**	*Grus americana*	E	Mudflats around reservoirs and in agricultural areas	No effect, not in Platte River Basin
		Fish		
Arkansas darter	*Etheostoma cragini*	C	Clear waters, low current with sandy bottoms, abundant aquatic vegetation	No, project area lacks flows and there is no continuous surface water connection to the Arkansas River
Greenback cutthroat trout	*Oncorhynchus clarki stomias*	T	Cold, clear, oxygenated streams of moderate gradient	No effect, no habitat present
Pallid sturgeon**	*Scaphirhynchus albus*	E	Large, turbid, free-flowing rivers with a strong current and gravel or sandy substrate	No effect, not in Platte River Basin
		Plants		
Ute ladies' -tresses orchid	*Spiranthes diluvialis*	T	Moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes below 6,500 feet	No habitat present – above species' elevation range
Western prairie fringed orchid**	*Platanthera praeclara*	T	Moist to wet tallgrass prairies and sedge meadows, mostly in relatively undisturbed grasslands	No effect, not in Platte River Basin

*T = Federally Threatened; E = Federally Endangered; C = Federal Candidate; P = Federal Proposed; EXPN, XN = Experimental Non-Essential Population.
**Water depletions in the North Platte, South Platte, and Laramie River basins may affect the species and/or critical habitat in downstream reaches in other counties or states.
Source: Service 2016.

The interior least tern, piping plover, whooping crane, pallid sturgeon, and western prairie fringed orchid are species affected by water depletions from the South Platte River. The project area is not within the Platte River Basin and there would be no depletions of the Platte River. The proposed project would not directly affect the black-footed ferret, North American wolverine, or Mexican spotted owl because of the lack of potentially suitable

habitat in the project area. The project area is within the Preble's meadow jumping mouse (Preble's) Colorado Springs block clearance area, within which Preble's is assumed to be absent. The project area would not likely support the Arkansas darter because the darter is not known to occur in Black Squirrel Creek or its tributaries within the Arkansas River Basin and the project area consists of only small seasonal pooled areas. The greenback cutthroat trout is primarily a high-elevation species, and the project area is outside the range of this species. The project area is not conducive to the establishment of Ute ladies'-tresses orchid (*Spiranthes diluvialis* or ULTO) and differs from the criteria of the Service's November 1992 (Service 1992) *Interim Survey Requirements for Spiranthes diluvialis* because the project area is above the elevation range and occurs outside of the 100-year floodplain of Fountain Creek.

Conclusions

There is no suitable habitat for threatened or endangered species in the project area. Therefore, the proposed development of the property would likely have no effect on species listed by the Service as potentially being present in El Paso County.

Please do not hesitate to contact me at *719-260-0887* if you have any questions or require additional information. We look forward to working with you in processing this CLOMR.

Respectfully,
Drexel, Barrell & Co.

Tim D. McConnell, P.E.
Senior Associate, Regional Manager

Encl: USACE Jurisdictional Ruling 8-23-16

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

REPLY TO ATTENTION OF

August 23, 2016

Regulatory Division

SUBJECT: Approved Jurisdictional Determination – Action No. SPA-2016-00278-SCO, Gaddie Property in Falcon, El Paso County, Colorado

Tim McConnell
Drexel, Barrell & Co.
3 S. 7th Street
Colorado Springs, CO 80905

Mr. McConnell:

I am writing this letter in response to your request for a jurisdictional determination (JD) for the Gaddie Property in Falcon, El Paso County, Colorado. We have assigned Action No. SPA-2016-00278-SCO to your request. Please reference this number in all future correspondence concerning the site.

Based on the information provided, we have determined that the site contains no jurisdictional waters of the United States that are subject to regulation under Section 404 of the Clean Water Act.

The basis for this approved JD (attached) is that the project site contains waters with no nexus to interstate or foreign commerce. This approved JD is valid for five years unless new information warrants revision of the determination before the expiration date.

You may accept or appeal this approved JD or provide new information in accordance with the attached Notification of Administration Appeal Options and Process and Request for Appeal (NAAOP-RFA). If you elect to appeal this approved JD, you must complete Section II of the form and return it to the Army Engineer Division, South Pacific, CESPD-PDS-O, Attn: Tom Cavanaugh, Administrative Appeal Review Officer, 1455 Market Street, Room 1760, San Francisco, CA 94103-1399 within 60 days of the date of this notice. Failure to notify the Corps within 60 days of the date of this notice means that you accept the approved JD in its entirety and waive all rights to appeal the approved JD.

If you have any questions, please contact me at 719-543-6915 or by e-mail at

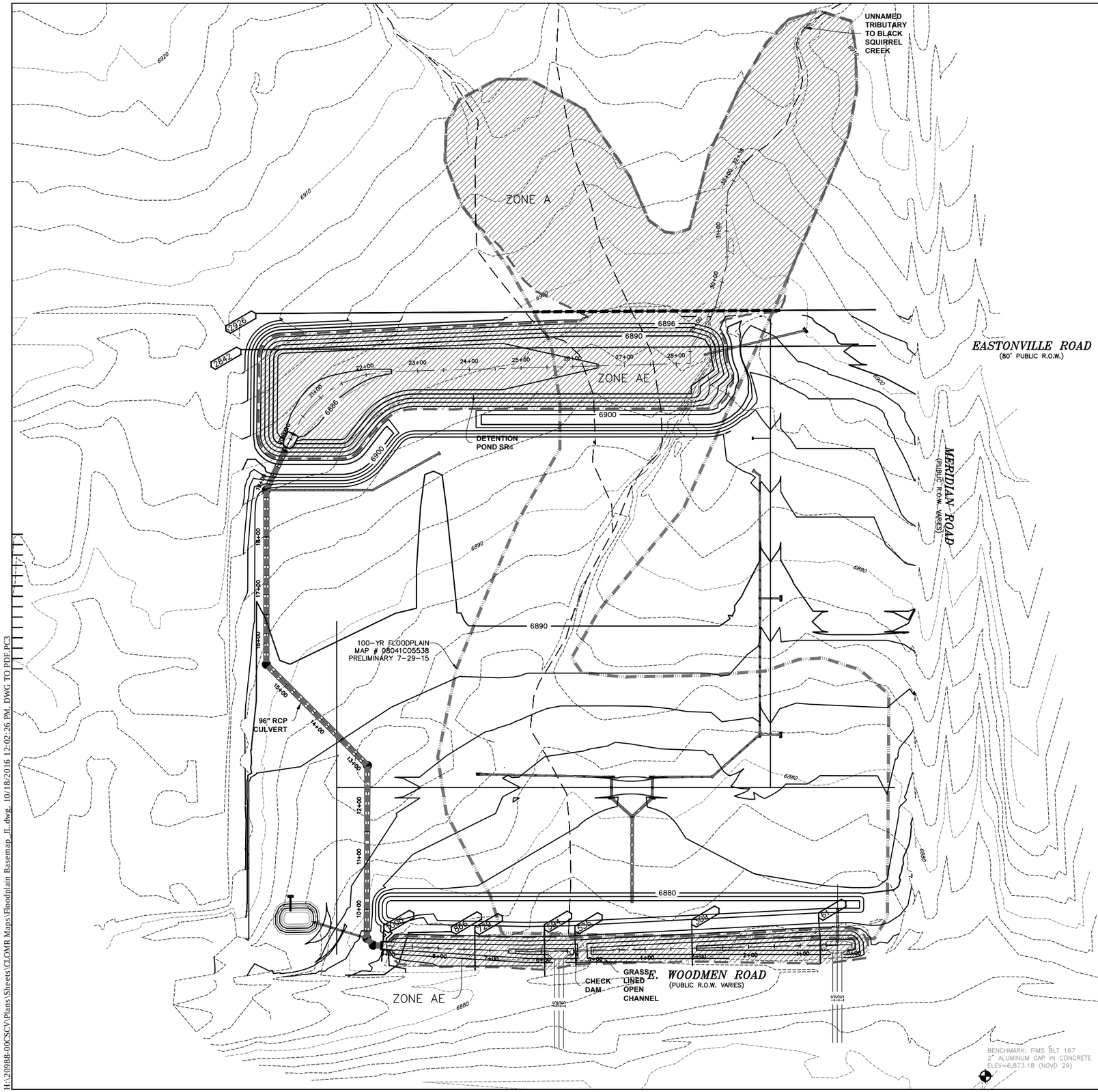
van.a.truan@usace.army.mil. At your convenience, please complete a Customer Service Survey at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Sincerely,

Van Truan
Chief, Southern Colorado
Regulatory Branch

APPENDIX 10

FLOODPLAIN WORK MAPS



LEGEND

- PROPERTY LINE
- LOT LINE
- PROPOSED INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR — 6245
- *EX. INTERMEDIATE CONTOUR*
- *EX. INDEX CONTOUR* — 6245
- PROPOSED STORM SEWER
- HISTORIC DRAINAGE PATH
- HYDRAULIC BASELINE — 10+00
- HECRAS CROSS SECTION — 100
- EFFECTIVE/PRELIMINARY 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- GUTTER LINE
- SURVEY CONTROL POINT

N

100 0 100 200

SCALE IN FEET

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
COLORADO SPGS, COLORADO 80905
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
BOULDER • COLORADO SPRINGS

CLIENT:

FALCON MARKETPLACE

FALCON, COLORADO

ISSUE	DATE
CLOMR	10-13-16

DESIGNED BY:	JL
DRAWN BY:	JL
CHECKED BY:	SDL
FILE NAME:	

COLORADO REGISTERED PROFESSIONAL ENGINEER STEVEN D. LESLIE 26096 10/12/16

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: AS NOTED
VERTICAL: N/A

FLOODPLAIN WORK MAP

PROJECT NO. 20988-00CSCV

DRAWING NO.

SHEET: 1 OF 1

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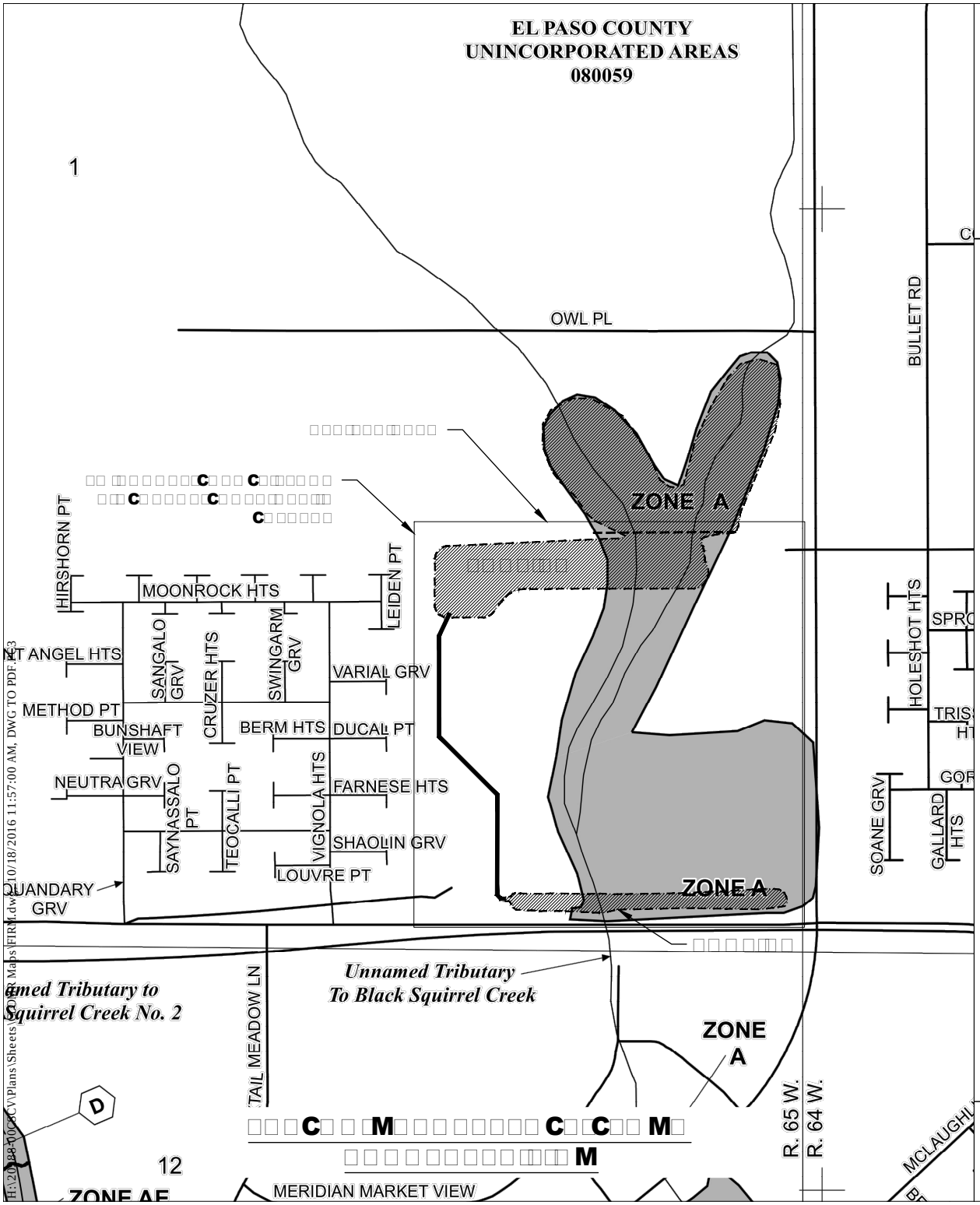
APPENDIX 11

ANNOTATED FIRM AND FLOOD PROFILE



MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

PANEL 0553G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 553 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0553	G

PRELIMINARY
JULY 29, 2015

1% ANNUAL CHANCE FLOODPLAIN

GUTTER LINE

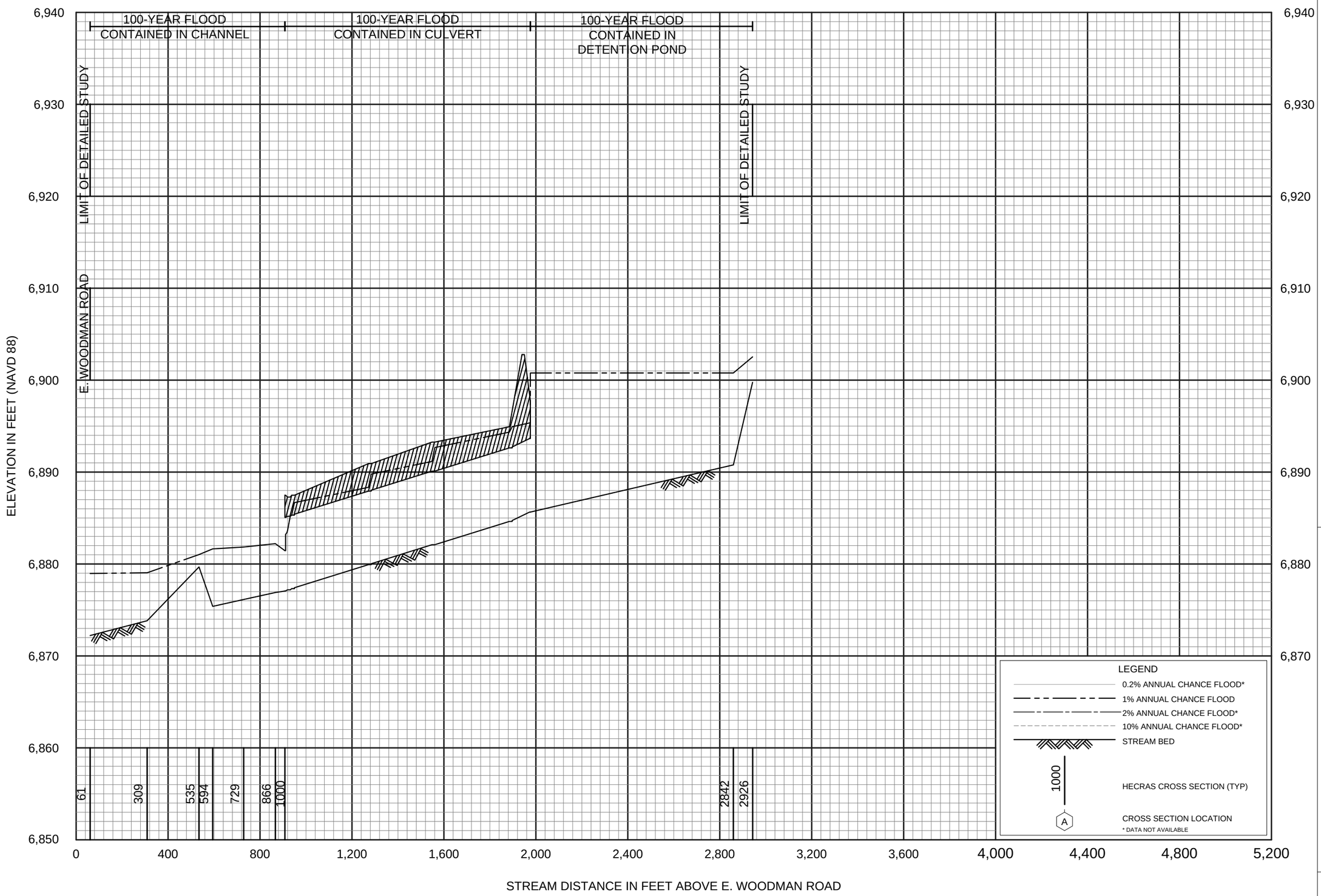
Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0553G

MAP REVISED

Federal Emergency Management Agency

AREA SHOWN LOCATED IN S1, T3S, R65W
VERTICAL DATUM: NAVD 88
COORDINATE SYSTEM: NAD83, COLORADO STATE PLANE, CENTRAL ZONE



FLOOD PROFILES

UNNAMED TRIBUTARY TO BLACK SQUIRREL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
(AND INCORPORATED AREAS)

01P

H:\20988-00CSCV\Reports\Floodplain\HECRAS\Profile10-18.dwg, 10/18/2016 12:10:02 PM, DWG TO PDF.PC3

APPENDIX 12

ELECTRONIC MEDIA CD

APPENDIX 13

POND SR4 OPERATION AND MAINTENANCE MANUAL

OPERATIONS & MAINTENANCE PLAN (O&M)

EXTENDED DETENTION BASIN

for

FALCON MARKETPLACE

11680 E. Woodmen Road
Falcon, Colorado

October 14, 2016

Prepared for:

El Paso County
Planning & Community Development
2880 International Circle
Colorado Springs, CO 80910
(719) 520-6300

El Paso County
Department of Public Works
3275 Akers Drive
Colorado Springs, CO 80922
(719) 520-6460

Prepared by:

Drexel, Barrell & Co.
3 South Seventh Street
Colorado Springs, CO 80905
Contact: Tim McConnell, P.E.
(719) 260-0887

TABLE OF CONTENTS

OPERATIONS & MAINTENANCE PLAN (O&M)

EXTENDED DETENTION BASIN

for

FALCON MARKETPLACE

Falcon, Colorado

1.0 BACKGROUND

This document provides General Guidelines and Standard Operating Procedures for Operation and Maintenance of stormwater facilities.

Extended Detention Basins (EDBs) are one of the most common types of Stormwater BMPs utilized within the Front Range of Colorado. An EDB is a sedimentation basin designed to "extend" the runoff detention time, but to drain completely dry sometime after stormwater runoff ends. The EDB's drain time for the water quality portion of the facility is typically 40 hours. The basins are considered to be "dry" because the majority of the basin is designed not to have a significant permanent pool of water remaining between runoff events.

EDBs are an adaptation of a detention basin used for flood control, with the primary difference is the addition of forebays, micropools and a slow release outlet design. Forebays are shallow concrete "pans" located at the inflow point to the basin and are provided to facilitate sediment removal within a contained area prior to releasing into the pond. These forebays collect and briefly hold stormwater runoff resulting in a process called sedimentation, dropping sediment out of the stormwater. The stormwater is then routed from the forebay into the concrete trickle channel and upper basin, the large grassy portion of the basin. The EDB uses a much smaller outlet that extends the emptying time of the more frequently occurring runoff events to facilitate pollutant removal. An EDB should have a small micropool just upstream of the outlet. This micropool is designed to hold a small amount of water to keep sediment and floatables from blocking the outlet orifices.

2.0 INSPECTING EXTENDED DETENTION BASINS

<u>Access & Easements</u>

Inspection or maintenance personnel may utilize the figures located in Appendix E containing the location(s) of the access points and potential maintenance easements of the EDB(s) within this development.

<u>Features</u>

EDBs have a number of features that are designed to serve a particular function. Many times the proper function of one feature depends on another. For example, if a forebay is not properly maintained, it could negatively affect the performance of a feature downstream (trickle channel, micropool, etc.). Therefore, it is critical that each feature of the EDB is properly inspected and maintained to ensure that the overall facility functions

as it was intended. Below is a list and description of the most common features within an EDB and the corresponding maintenance inspection items that can be anticipated:

Typical Inspection & Maintenance Requirements Matrix

EDB Features	Sediment Removal	Mowing/ Weed control	Trash & Debris Removal	Erosion	Overgrown Vegetation Removal	Standing Water (mosquito/ algae control)	Structure Repair
Inflow Points (outfalls)	X		X	X	X		X
Forebay	X		X			X	X
Low-flow channel	X		X	X	X		X
Bottom Stage	X	X	X	X	X	X	
Micropool	X		X		X	X	X
Outlet Works	X		X			X	X
Emergency Spillway			X	X	X		X
Upper Stage		X	X	X	X		
Embankment		X	X	X	X		

Inflow Points

Inflow Points or Outfalls into EDBs are the point source of the stormwater discharge into the facility. An inflow point is commonly a storm sewer pipe with a flared end section that discharges into the EDB. In some instances, an inflow point could be a drainage channel or ditch that flows into the facility.

An energy dissipater (riprap or hard armor protection) is typically immediately downstream of the discharge point into the EDB to protect from erosion. In some cases, the storm sewer outfall can have a toe-wall or cut-off wall immediately below the structure to prevent undercutting of the outfall from erosion.

The typical maintenance items that are found with inflow points are as follows:

a. *Riprap Displaced* – Many times, because the repeated impact/force of water, the riprap can shift and settle. If any portion of the riprap apron appears to have settled, soil is present between the riprap, or the riprap has shifted, maintenance may be required to ensure future erosion is prevented.

b. *Erosion Present/Outfall Undercut* – In some situations, the energy dissipater may not have been sized, constructed, or maintained appropriately and erosion has occurred. Any erosion within the vicinity of the inflow point will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.

c. *Sediment Accumulation* – Because of the turbulence in the water created by the

energy dissipater, sediment often deposits immediately downstream of the inflow point. To prevent a loss in hydraulic performance of the upstream infrastructure, sediment that accumulates in this area must be removed in a timely manner.

d. *Structural Damage* – Structural damage can occur at anytime during the life of the facility. Typically, for an inflow, the structural damage occurs to the pipe flared end section (concrete or steel). Structural damage can lead to additional operating problems with the facility, including loss of hydraulic performance.

e. *Woody Growth/Weeds Present* – Undesirable vegetation can grow in and around the inflow area to an EDB that can significantly affect the performance of the drainage facilities discharging into the facility. This type of vegetation includes trees (typically cottonwoods) and dense areas of shrubs (willows). If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, resulting in blockage of the discharge. Also, tree roots can cause damage to the structural components of the inflow. Routine maintenance is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree). In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.

<u>Forebay</u>

A forebay is a solid surface (pad), typically constructed of concrete, immediately downstream of the inflow point. The forebay is designed to capture larger particles and trash to prevent them from entering the main portion of the EDB. The solid surface is designed to facilitate mechanical sediment removal (skid steer). The forebay typically includes a small diameter discharge pipe or v-notch weir on the downstream end and designed to drain the forebay in a specified period of time to promote sedimentation. The forebays vary in size and depth depending on the design and site constraints.

The typical maintenance items that are found with forebays are as follows:

a. *Sediment/Debris Accumulation* – Because this feature of the EDB is designed to provide the initial sedimentation, debris and sediment frequently accumulate in this area. If the sediment and debris is not removed from the forebay on a regular basis, it can significantly affect the function of other features within the EDB. Routine sediment removal from the forebay can significantly reduce the need for dredging of the main portion of the EDB using specialized equipment (long reach excavators). Routine removal of sediment from the forebay can substantially decrease the long-term sediment removal costs of an EDB.

b. *Concrete Cracking/Failing* – The forebay is primarily constructed of concrete, which cracks, spalls, and settles. Damage to the forebay can result in deceased performance and impact maintenance efforts.

c. *Drain Pipe/Weir Clogged* – Many times the drainpipe or weir can be clogged with debris, and prevent the forebay from draining properly. If standing water is present in the forebay (and there is not a base flow), the forebay is most likely not draining properly. This can result in a decrease in performance and create potential nuisances with stagnant

water (mosquitoes).

d. *Weir/Drain Pipe Damaged* – Routine maintenance activities, vandalism, or age may cause the weir or drain pipe in the forebay to become damaged. Weirs are typically constructed of concrete, which cracks and spalls. The drainpipe is typically smaller in diameter and constructed with plastic, which can fracture.

Trickle Channel (Low-Flow)

The trickle channel conveys stormwater from the forebay to the micro-pool of the EDB. The trickle channel is typically made of concrete. However, grass lined (riprap sides protected) is also common and can provide for an additional means of water quality within the EDB. The trickle channel is typically 6-9 inches in depth and can vary in width.

The typical maintenance items that are found with trickle channels are as follows:

a. *Sediment/Debris Accumulation* – Trickle channels are typically designed with a relatively flat slope that can promote sedimentation and the collection of debris. Also, if a trickle channel is grass lined it can accumulate sediment and debris at a much quicker rate. Routine removal of accumulated sediment and debris is essential in preventing flows from circumventing the trickle channel and affecting the dry storage portion of the pond.

b. *Concrete/Riprap Damage* – Concrete can crack, spall, and settle and must be repaired to ensure proper function of the trickle channel. Riprap can also shift over time and must be replaced/repaired as necessary.

c. *Woody Growth/Weeds Present* – Because of the constant moisture in the area surrounding the trickle channel, woody growth (cottonwoods/willows) can become a problem. Trees and dense shrub type vegetation can affect the capacity of the trickle channel and can allow flows to circumvent the feature.

d. *Erosion Outside of Channel* – In larger precipitation events, the trickle channel capacity will likely be exceeded. This can result in erosion immediately adjacent to the trickle channel and must be repaired to prevent further damage to the structural components of the EDB.

Bottom Stage

The bottom stage is at least 1.0 to 2.0 feet deeper than the upper stage and is located in front of the outlet works structure. The bottom stage is designed to store the smaller runoff events, assists in keeping the majority of the basin bottom dry resulting in easier maintenance operations, and enhances the facilities pollutant removal capabilities. This area of the EDB may develop wetland vegetation.

The typical maintenance items that are found with the bottom stage are as follows:

a. *Sediment/Debris Accumulation* – The micro-pool can frequently accumulate sediment and debris. This material must be removed to maintain pond volume and proper function

of the outlet structure.

b. *Woody Growth/Weeds Present* - Because of the constant moisture in the soil surrounding the micro-pool, woody growth (cottonwoods/willows) can create operational problems for the EDB. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate outside of the micro-pool, which can cause problems with other EDB features. Also, tree roots can cause damage to the structural components of the outlet works. Routine management is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree).

c. *Bank Erosion* – The micro-pool is usually a couple feet deeper than the other areas of the ponds. Erosion can be caused by water dropping into the micro-pool if adequate protection/armor is not present. Erosion in this area must be mitigated to prevent sediment transport and other EDB feature damage.

d. *Mosquitoes/Algae Treatment* – Nuisance created by stagnant water can result from improper maintenance/treatment of the micro-pool. Mosquito larvae can be laid by adult mosquitoes within the permanent pool. Also, aquatic vegetation that grows in shallow pools of water can decompose causing foul odors. Chemical/mechanical treatment of the micro-pool may be necessary to reduce these impacts to adjacent homeowners.

e. *Petroleum/Chemical Sheen* – Many indicators of illicit discharges into the storm sewer systems will be present in the micro-pool area of the EDB. These indicators can include sheens, odors, discolored soil, and dead vegetation. If it is suspected that an illicit discharge has occurred, contact the supervisor immediately. Proper removal/mitigation of contaminated soils and water in the EDB is necessary to minimize any environmental impacts downstream.

<u>Micro-pool</u>

The micro-pool is a concrete or grouted boulder walled structure directly in front of the outlet works. At a minimum, the micropool is 2.5 feet deep and is designed to hold water. The micro-pool is critical in the proper function of the EDB; it allows suspended sediment to be deposited at the bottom of the micro-pool and prevents these sediments from being deposited in front of the outlet works causing clogging of the outlet structure, which results in marshy areas within the top and bottom stages.

The typical maintenance items that are found with micro-pools are as follows:

a. *Sediment/Debris Accumulation* – The micro-pool can frequently accumulate sediment and debris. This material must be removed to maintain pond volume and proper function of the outlet structure.

b. *Woody Growth/Weeds Present* - Because of the constant moisture in the soil surrounding the micro-pool, woody growth (cottonwoods/willows) can create operational problems for the EDB. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate outside of the micro-pool, which can cause problems with other EDB features. Also, tree roots can cause damage to the

structural components of the outlet works. Routine management is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree).

c. *Mosquitoes/Algae Treatment* – Nuisance created by stagnant water can result from improper maintenance/treatment of the micro-pool. Mosquito larvae can be laid by adult mosquitoes within the permanent pool. Also, aquatic vegetation that grows in shallow pools of water can decompose causing foul odors. Chemical/mechanical treatment of the micro-pool may be necessary to reduce these impacts to adjacent homeowners.

d. *Petroleum/Chemical Sheen* – Many indicators of illicit discharges into the storm sewer systems will be present in the micro-pool area of the EDB. These indicators can include sheens, odors, discolored soil, and dead vegetation. If it is suspected that an illicit discharge has occurred, contact the supervisor immediately. Proper removal/mitigation of contaminated soils and water in the EDB is necessary to minimize any environmental impacts downstream.

<u>Outlet Works</u>

The outlet works is the feature that drains the EDB in specified quantities and periods of time. The outlet works is typically constructed of reinforced concrete into the embankment of the EDB. The concrete structure typically has steel orifice plates anchored/embedded into it to control stormwater release rates. The larger openings (flood control) on the outlet structure typically have trash racks over them to prevent clogging. The water quality orifice plate (smaller diameter holes) will typically have a well screen covering it to prevent smaller materials from clogging it. The outlet structure is the single most important feature in the EDB operation. Proper inspection and maintenance of the outlet works is essential in ensuring the long-term operation of the EDB.

The typical maintenance items that are found with the outlet works are as follows:

a. *Trash Rack/Well Screen Clogged* – Floatable material that enters the EDB will most likely make its way to the outlet structure. This material is trapped against the trash racks and well screens on the outlet structure (which is why they are there). This material must be removed on a routine basis to ensure the outlet structure drains in the specified design period.

b. *Structural Damage* - The outlet structure is primarily constructed of concrete, which can crack, spall, and settle. The steel trash racks and well screens are also susceptible to damage.

c. *Orifice Plate Missing/Not Secure* – Many times residents, property owners, or maintenance personnel will remove or loosen orifice plates if they believe the pond is not draining properly. Any modification to the orifice plate(s) will significantly affect the designed discharge rates for water quality and/or flood control. Modification of the orifice plates is not allowed without approval from El Paso County.

d. *Manhole Access* – Access to the outlet structure is necessary to properly inspect and maintain the facility. If access is difficult or not available to inspect the structure, chances

are it will be difficult to maintain as well.

e. *Woody Growth/Weeds Present* - Because of the constant moisture in the soil surrounding the outlet works, woody growth (cottonwoods/willows) can create operational problems for the EDB. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate around the outlet works, which can cause problems with other EDB features. Also, tree roots can cause damage to the structural components of the outlet works. Routine management is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree).

Emergency Spillway

An emergency spillway is typical of all EDBs and designed to serve as the overflow in the event the volume of the pond is exceeded. The emergency spillway is typically armored with riprap (or other hard armor) and is sometimes buried with soil. The emergency spillway is typically a weir (notch) in the pond embankment. Proper function of the emergency spillway is essential to ensure flooding does not affect adjacent properties.

The typical maintenance items that are found with emergency spillways are as follows:

a. *Riprap Displaced* – As mentioned before, the emergency spillway is typically armored with riprap to provide erosion protection. Over the life of an EDB, the riprap may shift or dislodge due to flow.

b. *Erosion Present* – Although the spillway is typically armored, stormwater flowing through the spillway can cause erosion damage. Erosion must be repaired to ensure the integrity of the basin embankment, and proper function of the spillway.

c. *Woody Growth/Weeds Present* – Management of woody vegetation is essential in the proper long-term function of the spillway. Larger trees or dense shrubs can capture larger debris entering the EDB and reduce the capacity of the spillway.

d. *Obstruction Debris* – The spillway must be cleared of any obstruction (man-made or natural) to ensure the proper design capacity.

Upper Stage (Dry Storage)

The upper stage of the EDB provides the majority of the water quality flood detention volume. This area of the EDB is higher than the micro-pool and typically stays dry, except during storm events. The upper stage is the largest feature/area of the basin. Sometimes, the upper stage can be utilized for park space and other uses in larger EDBs. With proper maintenance of the micro-pool and forebay(s), the upper stage should not experience much sedimentation; however, bottom elevations should be monitored to ensure adequate volume.

The typical maintenance items that are found with upper stages are as follows:

a. *Vegetation Sparse* – The upper basin is the most visible part of the EDB, and therefore aesthetics is important. Adequate and properly maintained vegetation can greatly

increase the overall appearance and acceptance of the EDB by the public. In addition, vegetation can reduce the potential for erosion and subsequent sediment transport to the other areas of the pond.

b. *Woody Growth/Undesirable Vegetation* – Although some trees and woody vegetation may be acceptable in the upper basin, some thinning of cottonwoods and willows may be necessary. Remember, the basin will have to be dredged to ensure volume, and large trees and shrubs will be difficult to protect during that operation.

c. *Standing Water/Boggy Areas* – Standing water or boggy areas in the upper stage is typically a sign that some other feature in the pond is not functioning properly. Routine maintenance (mowing, trash removal, etc) can be extremely difficult for the upper stage if the ground is saturated. If this inspection item is checked, make sure you have identified the root cause of the problem.

d. *Sediment Accumulation* – Although other features within the EDB are designed to capture sediment, the upper storage area will collect sediment over time. Excessive amounts of sedimentation will result in a loss of storage volume. It may be more difficult to determine if this area has accumulated sediment without conducting a field survey.

Below is a list of indicators:

1. Ground adjacent to the trickle channel appears to be several inches higher than concrete/riprap
2. Standing water or boggy areas in upper stage
3. Uneven grades or mounds
4. Micro-pool or Forebay has excessive amounts of sediment

e. *Erosion (banks and bottom)* – The bottom grades of the dry storage are typically flat enough that erosion should not occur. However, inadequate vegetative cover may result in erosion of the upper stage. Erosion that occurs in the upper stage can result in increased dredging/maintenance of the micro-pool.

f. *Trash/Debris* – Trash and debris can accumulate in the upper area after large events, or from illegal dumping. Over time, this material can accumulate and clog the EDB outlet works.

g. *Maintenance Access* – Most EDBs typically have a gravel/concrete maintenance access path to either the upper stage or forebay. This access path should be inspected to ensure the surface is still drivable. Some of the smaller EDBs may not have maintenance access paths; however, the inspector should verify that access is available from adjacent properties.

<u>Miscellaneous</u>

There are a variety of inspection/maintenance issues that may not be attributed to a single feature within the EDB.

a. *Access* – Access needs to be maintained.

b. *Graffiti/Vandalism* – Damage to the EDB infrastructure can be caused by vandals. If criminal mischief is evident, the inspector should forward this information to the local enforcement agency.

c. *Public Hazards* – Public hazards include items such as vertical drops of greater than 4-feet, containers of unknown/suspicious substances, exposed metal/jagged concrete on structures. If any hazard is found within the facility area that poses an immediate threat to public safety, contact the local emergency services at 911 immediately.

d. *Burrowing Animals/Pests* – Prairie dogs and other burrowing rodents may cause damage to the EDB features and negatively affect the vegetation within the EDB.

3.0 MAINTAINING EXTENDED DETENTION BASINS

Maintenance Personnel

Maintenance personnel must be qualified to properly maintain EDBs. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

Equipment

It is imperative that the appropriate equipment and tools are taken to the field with the operations crew. The types of equipment/tools will vary depending on the task at hand. Below is a list of tools, equipment, and material(s) that may be necessary to perform maintenance on an EDB:

1. Loppers/Tree Trimming Tools
2. Mowing Tractors
3. Trimmers (extra string)
4. Shovels
5. Rakes
6. All Surface Vehicle (ASVs)
7. Skid Steer
8. Back Hoe
9. Track Hoe/Long Reach Excavator
10. Dump Truck
11. Jet-Vac Machine
12. Engineers Level (laser)
13. Riprap (Minimum - Type M)
14. Filter Fabric
15. Erosion Control Blanket(s)
16. Seed Mix (Native Mix)
17. Illicit Discharge Cleanup Kits
18. Trash Bags
19. Tools (wrenches, screw drivers, hammers, etc)
20. Chain Saw
21. Confined Space Entry Equipment
22. Approved Inspection and Maintenance Plan

Some of the items identified above may not be needed for every maintenance operation. However, this equipment should be available to the maintenance operations crews should the need arise.

Safety

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. Note If a vertical drop is identified within the EDB that is greater than 48" in height.

Maintenance Categories and Activities

A typical EDB Maintenance Program will consist of three broad categories of work: Routine, Restoration (minor), and Rehabilitation (major). Within each category of work, a variety of maintenance activities can be performed on an EDB. A maintenance activity can be specific to each feature within the EDB, or general to the overall facility. This section of the SOP explains each of the categories and briefly describes the typical maintenance activities for an EDB.

A variety of maintenance activities are typical of EDBs. The maintenance activities range in magnitude from routine trash pickup to the reconstruction of drainage infrastructure. Below is a description of each maintenance activity, the objectives, and frequency of actions:

Routine Maintenance Activities

The majority of this work consists of regularly scheduled mowing and trash and debris pickups for stormwater management facilities during the growing season. This includes items such as the removal of debris/material that may be clogging the outlet structure well screens and trash racks. It also includes activities such as includes weed control, mosquito treatment, and algae treatment. These activities normally will be performed numerous times during the year.

The Maintenance Activities are summarized below, and further described in the following sections.

Summary of Restoration Maintenance Activities

Maintenance Activity	Minimum Frequency	Look for:	Maintenance Action
Mowing	Twice annually	Excessive grass height/aesthetics	Mow grass to a height of 4" to 6"
Trash/Debris Removal	Twice annually	Trash & debris in EDB	Remove and dispose of trash and debris
Outlet Works Cleaning	As needed -after significant rain events – twice annually min.	Clogged outlet structure; ponding water	Remove and dispose of debris/trash/sediment to allow outlet to function properly
Weed control	Minimum twice annually	Noxious weeds; Unwanted vegetation	Treat w/ herbicide or hand pull; Consult the local weed specialist
Mosquito Treatment	As needed	Standing water/mosquito habitat	Treat w/ EPA approved chemicals
Algae Treatment	As needed	Standing water/ Algal growth/green color	Treat w/ EPA approved chemicals

Mowing

Occasional mowing is necessary to limit unwanted vegetation and to improve the overall appearance of the EDB. Native vegetation should be mowed to a height of 4-to-6 inches tall. Grass clippings should be collected and disposed of properly.

Frequency – Routine - Minimum of twice annually or depending on aesthetics.

Trash/Debris Removal

Trash and debris must be removed from the entire EDB area to minimize outlet clogging and to improve aesthetics. This activity must be performed prior to mowing operations.

Frequency – Routine – Prior to mowing operations and minimum of twice annually.

Outlet Works Cleaning

Debris and other materials can clog the outlet work's well screen, orifice plate(s) and trash rack. This activity must be performed anytime other maintenance activities are conducted to ensure proper operation.

Frequency - Routine – After significant rainfall event or concurrently with other maintenance activities.

Weed Control

Noxious weeds and other unwanted vegetation must be treated as needed throughout

the EDB. This activity can be performed either through mechanical means (mowing/pulling) or with herbicide. Consultation with the local Weed Inspector is highly recommended prior to the use of herbicide.

Frequency – Routine – As needed based on inspections.

Mosquito/Algae Treatment

Treatment of permanent pools is necessary to control mosquitoes and undesirable aquatic vegetation that can create nuisances. Only EPA approved chemicals/materials can be used in areas that are warranted.

Frequency – As needed.

Restoration Maintenance Activities

This work consists of a variety of isolated or small-scale maintenance or operational problems. Most of this work can be completed by a small crew, tools, and small equipment.

Maintenance Activity	Minimum Frequency	Look for:	Maintenance Action
Sediment Removal	As needed; typically every 1 –2 years	Sediment build-up; decrease in pond volume	Remove and dispose of sediment
Erosion Repair	As needed, based upon inspection	Rills/gullies forming on side slopes, trickle channel, other areas	Repair eroded areas Revegetate; address source of erosion
Vegetation Removal/Tree Thinning	As needed, based upon inspection	Large trees/wood vegetation in lower chamber of pond	Remove vegetation; restore grade and surface
Drain Cleaning/Jet Vac	As needed, based upon inspection	Sediment build-up /non draining system	Clean drains; Jet Vac if needed

Major Sediment Removal

Major sediment removal consists of removal of large quantities of sediment or removal of sediment from vegetated areas. Care shall be given when removing large quantities of sediment and sediment deposited in vegetated areas. Large quantities of sediment need to be carefully removed, transported and disposed of. Vegetated areas need special care to ensure design volumes and grades are preserved.

Frequency – Nonroutine – Repair as needed based upon inspections.

Major Erosion Repair

Major erosion repair consist of filling and revegetating areas of severe erosion. Determining the cause of the erosion as well as correcting the condition that caused the erosion should also be part of the erosion repair. Care should be given to ensure design grades and volumes are preserved.

Frequency – Nonroutine – Repair as needed based upon inspections.

Structural Repair

An EDB includes a variety of structures that can deteriorate or be damaged during the course of routine maintenance. These structures are constructed of steel and concrete that can degrade or be damaged and may need to be repaired or re-constructed from time to time. These structures include items like outlet works, trickle channels, forebays, inflows and other features. Inhouse operations staff can perform some of the minor structural repairs. Major repairs to structures may require input from a structural engineer and specialized contractors.

Frequency – Nonroutine – Repair as needed based upon inspections.