JDS-HYDRO CONSULTANTS, INC.

January 31, 2018

Raimere Fitzpatrick
El Paso County Planning and Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910

RE: Grant Subdivision Drainage Letter

The purpose of this drainage letter is to satisfy requirements of the El Paso County Planning and Community Development division pertaining to the proposed minor subdivision of the Grant Property. This letter was prepared in accordance with Section 8.4.5 Drainage Considerations and Standards for Subdivision Design, Improvements, and Dedications of the 2016 Land Development Code.

Property Description:

The Grant Property (Site) is located at 1315 Walsen Rd, Colorado Springs, El Paso County, Colorado. The Site is located in the southwest one-quarter (SW1/4) of the northeast one-quarter (NE1/4) of Section 22, Township 12 South (T12S), Range 66 West (R66W), El Paso County Assessor's schedule number 6205000029. The existing property is 41 acres. The proposed minor subdivision will divide the property from north to south into one 11-acre parcel on the west and one 30-acre parcel on the east. The proposed access to each parcel will be from Walsen Rd. on a shared driveway in the northwest corner of the site as shown on the Grant Subdivision plat provided separate from this letter. Smith Creek travels through the northern portion of the property and the shared driveway splits after the Smith Creek crossing. The 11-acre parcel contains an existing single-family residence, barn, gravel driveway, water well, and septic system. The 30-acre parcel of land is bare land with no proposed improvements at this time. In order to estimate future impacts to stormwater runoff on the Site, a single-family residence and driveway were assumed for future development.

Existing Drainage Characteristics:

The drainage characteristics for the Site were determined from the 2002 Smith Creek Drainage Basin Planning Study (2002 Drainage Report) by JR Engineering which was adopted by El Paso County in 2003. The Grant Property is located outside the 100-year flood plain as shown on the map included with this letter. According to the 2002 Drainage Report, the 100-yr floodplain is narrow and mostly contained within the stream channel for this section of Smith Creek. The Smith Creek drainage area is shown in the preliminary design drawings prepared by JR Engineering for the 2002 Drainage Report. Sheet 4 of the preliminary design drawings shows the drainage area for Smith Creek and the Grant property. The Grant property, which was previously delineated on Sheet 4, has been highlighted to facilitate identification. The preliminary design drawings are attached for reference. The existing drainage channel size varies on the Grant property. The channel width is at its greatest at the northern boundary at approximately 70 ft and narrows to an average width of 55 ft throughout the Grant property. An 80-ft easement, as shown on the Grant Subdivision plat, is proposed to meet the requirements of the ECM 3.3.3.K.1.

The major drainage characteristics include the conveyance of water (via sheet-flow) northwest across the site into the stream channel of Smith Creek which then flows into one (1) existing 36-inch CMP culvert. A small portion of the Site is located north of Smith Creek and drains southwest into Smith Creek.

MS 17-005

545 EAST PIKES PEAK AVENUE SUITE 300, COLORADO SPRINGS, CO 80903
(719) 227-0072 FAX (719) 471-3401

According to the NRCS Soil Resource Report, the on-site soils are classified as a combination of Tomah-Crowfoot complex and Pring coarse sandy loam, both of which are in hydrologic soil group "B". Both are well-drained soils with medium to low surface runoff. A copy of the NRCS Soil Resource Report will be submitted separate of this Drainage Letter.

The table below shows the runoff coefficients for the existing site which were taken from Table 5-1 of the El Paso County Drainage Criteria Manual (DCM) and Table 6-6 of the City of Colorado Springs DCM.

Site Composition (SF)		C_5	C_{10}	C_{100}
Roof (House-11-acre parcel)	2,639	0.73	0.9	0.95
Roof (Barn-11-acre parcel)	500	0.73	0.9	0.95
Paved Driveway (11-acre parcel)	17,400	0.9	0.9	0.95
Native	1,721,861	0.08	0.2	0.25
Total	**1,742,400**	**.09**	**0.21**	**0.26**

The following table displays the peak runoff flow rate for the existing site and the corresponding rainfall intensity used to calculate it. The rainfall intensity was found using Figure 5-1 of the El Paso County DCM. The runoff was calculated using the Rational Method and the time of concentration was calculated to be approximately 28.8 minutes.

	5-year	10-year	100-year
Intensity (in/hr)	2.49	3.00	4.50
Q (CFS)	8.90	24.99	46.49

Proposed Drainage Characteristics:

The proposed drainage from this site will generally remain the same as the existing drainage. The 30-acre parcel will likely be developed in the future. These developments may include a single-family residence and driveway in accordance with the local zoning. The table below contains the runoff coefficients from the proposed site improvements which were also taken from Table 5-1 of the El Paso County DCM and Table 6-6 of the City of Colorado Springs DCM.

Site Composition (SF)		C_5	C_{10}	C_{100}
Roof (House-11-acre parcel)	2,639	0.73	0.9	0.95
Roof (Barn-11-acre parcel)	500	0.73	0.9	0.95
Roof (Proposed House-30-acre parcel)	3,000	0.73	0.9	0.95
Paved Driveway (11-acre parcel)	17,400	0.9	0.9	0.95
Paved Driveway (Proposed-30-acre parcel)	17,500	0.9	0.9	0.95
Native	1,701,461	0.08	0.2	0.25
Total	**1,742,400**	**0.10**	**0.22**	**0.27**

The following table displays the peak runoff flow rate for the proposed site and the corresponding rainfall intensity used to calculate it. The rainfall intensity was also found using Figure 5-1 of the El Paso County DCM. The runoff was calculated using the Rational Method and the time of concentration was calculated to be approximately 28.6 minutes. The time of concentration reduced due to the increased runoff coefficient for the proposed site development.

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	5-year	10-year	100-year
Intensity (in/hr)	2.51	3.00	4.50
Q (CFS)	9.91	25.98	47.97
Difference (CFS)	1.01	0.99	1.48

These calculations project a slight increase of 1.01, 0.99 and 1.48 cfs in the 5-, 10- and 100-year peak flows, respectively. This is primarily due to the increased impervious area for the proposed development.

Existing Culvert Evaluation:

The existing driveway crossing over Smith Creek has one (1) 36-inch corrugated metal pipe (CMP) culvert. The culvert is 24-feet in length with a slope of 2.24%. The entire Smith Creek drainage basin is 5.48 square miles. The culvert has a drainage area of approximately 4.02 square miles. The culvert is located at Station 156+00 on Reach 5 of Smith Creek as shown in the 2002 Drainage Report. The hydrologic analysis data from the 2002 Drainage Report was used to evaluate the existing culvert. Below is a table summarizing the 2-, 5-, 10-, 50-, and 100-year storm event peak runoff flow rates. The future flows are based on the proposed future development in the Smith Creek Drainage Basin.

Storm Event	Existing Flows, cfs	Future Flows, cfs
2-year	66	65
5-year	268	270
10-year	464	504
50-year	1219	1240
100-yr	1770	2019

The existing culvert was evaluated using Manning's Equation and found to be capable of passing 53 cubic feet per second (cfs) at a velocity of 7.5 feet per second (fps). The calculations are included as an attachment. Based on these calculations and the peak runoff flowrates calculated in the 2002 Drainage Report, the existing culvert is unable to pass a 2-year or greater storm event without increasing the headwater depth above the allowable height. The existing culvert does not appear to be designed to pass any minor storm events, and inundation of the driveway may occur during a minor and major storm event.

The El Paso County DCM culvert criteria for streets permits an allowable culvert headwater depth (AHW) ratio (Hw/D) for design flows with clear opening 50 square feet or less of no greater than 1.5 without County approval. The existing driveway crossing was evaluated for the 5-yr and 10-yr storm events. The culvert size necessary for each storm event was selected using the discharge capacity curves on Figure 9-14 in the DCM for a standard circular corrugated metal pipe with headwall entrance. Below is a summary of the culvert sizing results. The calculations are included as an attachment.

Storm Event	AHW, ft	Culvert Dia., inches	Hw/D	Design Discharge (per culvert), cfs	L/100So	Resulting Headwater Depth, ft
5-yr	6.75	54	1.5	140	14	6.0
10-yr	7.50	60	1.5	172	16	6.3

The existing driveway crossing would require two (2) 54-inch CMP culverts at a 1.70% slope to pass a 5-yr storm event (estimated future flow of 270 cfs) and maintain a velocity less than 10 fps. In order to pass

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a 10-yr storm event (estimated future flow of 504 cfs) and maintain a velocity less than 10 fps, the existing driveway crossing would require three (3) 60-inch CMP culverts at a 1.48% slope. Additional configurations (culvert size, number, slope, outlet energy dissipaters) could be evaluated in the event the culvert was to be replaced. The existing culvert is not proposed to be replaced at this time unless required by the County.

Habitat Conservation:

Field observations confirmed the downstream invert of the existing culvert is near the natural channel bottom which allows upstream migration of fish and other animal species, including the Preble's Meadow Jumping Mouse. Native vegetation, including willows, shrubs, grasses, and trees are abundant surrounding this area of Smith Creek which provides a natural habitat for the Preble's Meadow Jumping Mouse and other "listed" species. The proposed access to the 30-acre parcel will be from a shared driveway over Smith Creek. The portion of the shared driveway over Smith Creek is existing. Based on these observations, the minor subdivision will have negligible adverse impact to the "listed" species and their habitat.

Drainage Fees:

The Site is in the Smith Creek Drainage Basin of Monument Creek (Basin Number FOMO4000). The Smith Creek Basin 2017 fees are $6,633.00 per impervious acre for drainage fees and $890.00 per impervious acre for bridge fees. The proposed minor subdivision has 41 acres of land (an 11-acre and 30-acre parcel). Per the El Paso County Resolution 99-383, a fee reduction of 25% for lots 2.5 acre and larger may be applied for drainage fees. The 11-acre parcel is approximately 4.3% impervious resulting in a drainage fee of $2,353.00 and bridge fee of $421.00. The impervious acreage for the 11-acre parcel is based on the existing structures and driveway. The 30-acre parcel is approximately 1.6% impervious resulting in a drainage fee of $2,388.00 and bridge fee of $427.00. The estimated impervious acreage for the 30-acre parcel is based on a 3,000 sf single-family residence and 17,500 sf driveway. The total drainage fees for the Site are $4,741.00 and bridge fees are $848.00 for 41-acres of land.

Respectfully,
JDS-Hydro Consultants, Inc.

COLORADO LICENSED
RYAN M. MANGINO
43304
1/31/18
PROFESSIONAL ENGINEER

Ryan M. Mangino, P.E.

Enclosures

Attachment A - Floodplain Map (FIRM)
Attachment B - Culvert Calculations
Attachment C - Preliminary Design Drawings (2002 Drainage Report)
Attachment D - El Paso County Drainage Report Signature Block

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ATTACHMENT A –
Floodplain Map (FIRM)

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 295 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0295	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0295	F

MAP NUMBER
08041C0295 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

JDS-HYDRO CONSULTANTS, INC.
545 East Pikes Peak Avenue, Suite 300
Colorado Springs, Colorado 80903
(719) 227-0072

GRANT SUBDIVISION
MINOR SUBDIVISION
FLOODPLAIN MAP

Project No.:	279.01
Scale:	AS NOTED
Date:	08-03-17
Design:	EMS
Drawn:	EMS
Check:	RMM
Revised:	

F1

1

J:\JDS-Hydro\Project Files\279 Grant Property\279.01 Grant Property\Drawings\279.01 Grant Property.dwg
2017/08/03 8:31 AM By: dallaqato-A2K1

ATTACHMENT B –
Culvert Calculations

Culvert Evaluation: Existing 36-inch CMP (Flowing Full)

Manning's Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

$V=(1.486/n)R_h^{2/3}S^{1/2}$

$Q=V*A$

R=A/P

A=cross sectional area

P=wetter perimeter

S=slope of channel

n=Manning's roughness coefficient

Diameter=	36	inches
n (CMP)=	0.025	Mannings coeff
Length=	24	feet
Invert (Upstream)=	15.58	feet
Invert (Downstream)=	16.14	feet
Slope=	0.023	in/in
L/100S=	10	

			Solution to Manning's Equation	
Area, ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, ft/s	Flow, cfs
7.07	9.42	0.75	7.49	53.0

Culvert Evaluation: 5-yr Storm Event, Two 54-inch CMPs (Flowing Full)

Manning's Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

$V=(1.486/n)R_h^{2/3}S^{1/2}$

$Q=V*A$

R=A/P

A=cross sectional area

P=wetter perimeter

S=slope of channel

n=Manning's roughness coefficient

Diameter=	54	inches
n (CMP)=	0.024	Mannings coeff
Length=	24	feet
Slope=	0.017	in/in
L/100S=	14	

			Solution to Manning's Equation	
Area, ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, ft/s	Flow, cfs
15.90	14.14	1.13	8.73	138.9
				277.8 2 - 54" CMPs

Culvert Evaluation: 10-yr Storm Event, Three 60-inch CMPs (Flowing Full)

Manning's Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

$V=(1.486/n)R_h^{2/3}S^{1/2}$

$Q=V*A$

R=A/P

A=cross sectional area

P=wetter perimeter

S=slope of channel

n=Manning's roughness coefficient

Diameter=	60	inches
n (CMP)=	0.024	Mannings coeff
Length=	24	feet
Slope=	0.0148	in/in
L/100S=	16	

			Solution to Manning's Equation	
Area, ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, ft/s	Flow, cfs
19.63	15.71	1.25	8.74	171.6
				514.9 3 - 60" CMPs

ATTACHMENT C –
2002 Drainage Report Preliminary Design Drawings

SMITH CREEK DRAINAGE BASIN PLANNING STUDY

CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

PRELIMINARY PLAN

AUGUST 2002

LEGEND FOR PLAN AND PROFILE SHEETS

PLAN

- 50+00 — STATION LINE
- 100-YEAR FUTURE FLOODPLAIN — ALSO, FLOODPLAIN FOR EXISTING PHYSICAL CONDITION CLOSELY MATCHING FLOODPLAIN ASSOCIATED WITH THE FUTURE IMPROVEMENTS AS PROPOSED PER THIS PRELIMINARY PLAN EXCEPT WHERE OTHERWISE SHOWN
- 100-YEAR EXISTING FLOODPLAIN — WHERE NONCOINCIDENT WITH FUTURE CONDITIONS
- ZONE OF SHALLOW FLOOD LIMITS
- EXISTING THALWEG (FROM FIMS MAPPING)
- PRUDENT LINE
- CHECK STRUCTURE
- CUT BACK BANK AND PROTECT WITH VEGETATION
- RIPRAP CHANNEL PROTECTION
- RIPRAP TOE PROTECTION
- CUT BACK BANK AND PROTECT TOE WITH RIPRAP
- SC01 — MULLER REACH IDENTIFIERS
- (SC01) — JR ENGINEERING REACH IDENTIFIERS USED IN BASIN MODELING

PROFILE

- FUTURE STREAM BED
- EXISTING STREAM BED — WHERE THE EXISTING BED DOES NOT CHANGE IN FUTURE CONDITIONS THE EXISTING STREAM BED IS SHOWN.
- PROPOSED ROAD EMBANKMENT
- EXISTING ROAD EMBANKMENT
- 100-YEAR FUTURE WATER SURFACE PROFILE — FUTURE AND EXISTING CONDITION WATER SURFACE PROFILES MAY COINCIDE IN WHICH FUTURE IS DELINEATED.
- 100-YEAR EXISTING WATER SURFACE PROFILE
- CHECK STRUCTURES
- 705 — ROUTING ELEMENTS USED IN MODELING
- 705 — DESIGN POINTS USED IN MODELING
- 612 — DETENTION PONDS USED IN MODELING

PLAN SHEET LAYOUT

SCALE: N.T.S.

SHEET INDEX

SHEET NO.	TITLE
1	TITLE SHEET
2-11	PLAN AND PROFILE SHEETS
12	PLAN VIEW- CITY IMPROVEMENTS
13	DETAIL SHEET

GENERAL NOTES:

1.) THESE DRAWINGS ARE FOR MASTER PLANNING PURPOSES AND REPRESENT PRELIMINARY ENGINEERING. ALTERNATIVES TO THIS OUTFALL SYSTEM MAY BE CONSIDERED BY EL PASO COUNTY PROVIDED THE ALTERNATIVE OFFERS EQUAL HYDROLOGIC RESPONSE AND HYDRAULIC CAPACITY AND STREAM STABILITY. THE ALTERNATIVE MUST COMPLY WITH ALL REQUIREMENTS OF EL PASO COUNTY OR OTHER LOCAL, STATE AND FEDERAL AGENCIES HAVING JURISDICTION OVER THE AREA BEING DEVELOPED. THESE DRAWINGS SHALL NOT BE USED FOR CONSTRUCTION

2.) UTILITIES SHOWN ARE BASED ON INFORMATION SUPPLIED BY LOCAL UTILITY DISTRICTS AND UTILITY COMPANIES. ALL LOCATIONS ARE APPROXIMATE. VERIFY ALL LOCATIONS AND DEPTHS DURING FINAL DESIGN.

3.) DRAINAGE FACILITIES ARE PROPOSED ON THE PLANS AND ARE BASED ON FUTURE HYDROLOGIC CALCULATIONS FOR THIS MASTER PLAN.

4.) EXISTING DRAINAGE SYSTEM LOCATIONS ARE SCHEMATICALLY DEPICTED ON THE DRAWINGS.

5.) REGIONAL DETENTION POND SIZES SHOWN ARE APPROXIMATE AND SHOULD BE VERIFIED DURING FINAL DESIGN. THE FINAL DESIGN OF ALL DETENTION FACILITIES SHOULD CONSIDER WATER QUALITY MEASURES AND EMERGENCY OVERFLOWS, INCLUDING EMERGENCY OVERFLOW REQUIREMENTS, EROSION PROTECTION, AND SURFACE RELIEF ROUTES.

6.) RIPRAP EROSION PROTECTION SHOULD BE PLACED AT ALL CULVERTS, BRIDGES, STORM SEWER OUTLETS AND CERTAIN INLETS, AND ALL OTHER LOCATIONS WHERE CONDITIONS DICTATE THIS

7.) HEADWALLS AND WINGWALLS SHOULD BE INCLUDED FOR ALL CHANNEL CROSSINGS IN ACCORDANCE WITH COLORADO DEPARTMENT OF TRANSPORTATION STANDARDS.

8.) THIS PLAN DOES NOT INDICATE LIMITS OF EXISTING WETLANDS OR EXISTING PREBLES MEADOW JUMPING MOUSE HABITAT. BOTH WILL NEED TO BE ESTABLISHED AND PERMITS OBTAINED FROM THE US ARMY CORPS OF ENGINEERS AND USFW PRIOR TO CONSTRUCTION. THESE PLANS ARE A PLANNING TOOL AND NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DOCUMENTS.

PREPARED BY:

J·R ENGINEERING
A Subsidiary of Westrian

4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613
www.jrengineering.com

PREPARED FOR
PICOLAN, INC.
ATTN: STEVE SHARKEY
90 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

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

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A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • fax 719-528-6613
www.jrengineering.com

No.		BY	DATE
1	REVISED PER AGENCY COMMENTS	ACS	03/20/02
2	REVISED PER COUNTY COMMENTS	MFS	07/16/02

H-SCALE	NTS
V-SCALE	NTS
DATE	6/29/01
DESIGNED BY	
DRAWN BY	MSD
CHECKED BY	

SMITH CREEK DRAINAGE BASIN PLANNING STUDY

COVER SHEET

SHEET 1 OF 13

JOB NO. 8898.90

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NOTE:

CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBEY, COLORADO P.E. # 32339 DATE

UNTIL SUCH TIME AS RESTRICTIVE WAIVERS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING AND PICOLAN, INC. ARE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
PICOLAN, INC.
ATTN: STEVE SHARKEY
90 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

J-R ENGINEERING
A Subsidiary of Wenck Inc.
4700 Annapolis Drive • Colorado Springs, CO 80920
719-531-5599 • Fax 719-531-5810
www.jrengineering.com

No.	REVISION	BY	DATE
1	REVISED PER AGENCY COMMENTS	ACS	03/20/02
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DRAWN BY	MSD		
CHECKED BY			

SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE

STA 00+00 TO STA 60+00

SHEET 2 OF 13

JOB NO. 8896.90

NOTE:

CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBEY, COLORADO P.E. # 32339 DATE

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

PREPARED FOR
PICOLAN, INC.
ATTN: STEVE SHARKEY
30 S. CASCADE AVE., STE. #1301
COLORADO SPRINGS, CO 80903
(719) 381-8441

J-R ENGINEERING
A Subsidiary of Wantman
4700 Annapolis Drive • Colorado Springs, CO 80920
719-593-2593 • Fax 719-528-6333
www.jrengineering.com

Rev.	REVISION	BY	DATE
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CHECKED BY	

SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE

STA 60+00 TO STA 120+00

SHEET 3 OF 13

JOB NO. 88996.90

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NOTE: TWO PRIVATE PROPERTY ACCESS ROADS CROSS SMITH CREEK AT STA. 129+50 AND STA. 156+00. THE EXISTING CULVERTS BENEATH THESE ROADS ARE GROSSLY UNDERSIZED PER COUNTY CRITERIA. SINCE THE ROADS ARE FOR PRIVATE USE, AND THERE IS NO APPARENT PROPERTY DAMAGE THAT WOULD RESULT FROM THE BACKWATER EFFECTS, IT WAS CONCLUDED TO NOT INCLUDE ANY REHABILITATING WORK TO THESE CULVERTS IN THIS PRELIMINARY PLAN. HOWEVER, IT IS RECOMMENDED THAT THE CULVERTS EITHER BE ELIMINATED OR REPLACED WITH ADEQUATELY SIZED CULVERTS. IN THE EVENT THE CULVERTS ARE IN THE NEED TO BE REPLACED, OR REMOVED, THE PRIVATE PROPERTY OWNER SHALL BE RESPONSIBLE FOR THE COST AND THE WORK SHALL BE PERFORMED IN ACCORDANCE WITH COUNTY REQUIREMENTS.

NOTE:
CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBLY, COLORADO P.E. # 32339 DATE

PREPARED FOR
PICCOLAN, INC.
ATTN: STEVE SHARKEY
90 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

J-R ENGINEERING
A Subsidiary of Westrian
4250 Arrowhead Drive • Colorado Springs, CO 80907
719-593-2593 • fax 719-593-2601
www.jrengineering.com

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

No.	REVISION	BY	DATE
1	REVISED PER AGENCY COMMENTS	ACS	03/29/02
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H-SCALE	NTS		
V-SCALE	NTS		
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		DRAWN BY	MSD
		CHECKED BY	

SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE
STA 120+00 TO STA 180+00

SHEET 4 OF 13
JOB NO. 8896.90

X:\2880000.all\2889690\Drawings\prelim plan\071602 11x17\Sm-04.dwg Wed Jul 17 08:22:05 2002

NOTE:
A PRIVATE PROPERTY ACCESS ROAD CROSSES SMITH CREEK AT STA. 188+00. THE EXISTING CULVERT BENEATH THIS ROAD IS GROSSLY UNDERSIZED PER COUNTY CRITERIA. IT IS RECOMMENDED THAT THIS DRIVEWAY EMBANKMENT BE REBUILT AND THE PROPOSED REGIONAL DETENTION FACILITY BE CONSTRUCTED AT THIS LOCATION. THIS LOCATION WAS CHOSEN FOR A REGIONAL POND DUE TO THE FACT THAT THE EXISTING DRIVEWAY EMBANKMENT IS CURRENTLY ACTING LIKE A DETENTION POND RESTRICTION.

NOTE:
CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBEY, COLORADO PE # 32339 DATE

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

PREPARED FOR
PICCOLAN, INC.
ATTN: STEVE SHARKEY
90 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

JR ENGINEERING
A Subsidiary of Rentech
4700 Annapolis Drive Colorado Springs, CO 80907
719-593-7551 • fax 719-528-6603
www.jrengineering.com

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DRAWN BY MSD
CHECKED BY

SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE
STA. 180+00 TO STA 240+00

SHEET 5 OF 13
JOB NO. 8896.90

X:\2880000.all\2889690\Drawings\prelim plan\071602 11x17\Sm-05.dwg Wed Jul 17 12:29:20 2002

RES 316	
• 2.08 AC-SURFACE AREA	
• 10.3 AC-FT REQ'D. STORAGE	
• WATER QUALITY VOLUME NOT INCLUDED	
INFLOW	OUTFLOW
Q_2 = 55 cfs	Q_2 = 42 cfs
Q_5 = 192 cfs	Q_5 = 163 cfs
Q_{10} = 355 cfs	Q_{10} = 325 cfs
Q_{50} = 811 cfs	Q_{50} = 771 cfs
Q_{100} = 1158 cfs	Q_{100} = 1219 cfs

NOTE:
SOME OF THE CULVERTS WITHIN THE FOX RUN REGIONAL PARK APPEAR TO BE UNDERSIZED. IN ADDITION, REGRADING AT THE EXISTING STORAGE AREA APPEARS TO HAVE BLOCKED OR DIVERTED FLOW FROM ITS ORIGINAL COURSE. WITHOUT NEW TOPOGRAPHIC INFORMATION, IT IS NOT POSSIBLE TO REEVALUATE THIS AREA.
PER SECTION 6.3.1 OF THE DRAINAGE CRITERIA MANUAL, "SOME TYPES OF FACILITIES, SUCH AS PARKS DO NOT REQUIRE HIGH LEVELS OF PROTECTION AND PERIODIC FLOODING IS ACCEPTABLE SUBJECT TO APPROVAL BY THE CITY/COUNTY." AT THIS TIME, NO IMPROVEMENTS ARE PROPOSED WITHIN FOX RUN REGIONAL PARK.

NOTE:
CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBEY, COLORADO P.E. # 32539 DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, THEY ARE ONLY FOR THE PURPOSES AS STATED BY WRITTEN AUTHORIZATION.

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PICOLAN, INC.
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80 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

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V-SCALE	NTS		
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY
PRELIMINARY PLAN AND PROFILE
STA 240+00 TO STA 281+85

SHEET 6 OF 13
JOB NO. 8896.90

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NOTE:

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80 S. CROSS AVE. STE. #130C
COLORADO SPRINGS, CO 80903
(719) 381-8441

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V-SCALE: NTS
DATE: 6/29/01
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DRAWN BY: MSD
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE
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SHEET 7 OF 13
JOB NO. 8896.90

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NOTE:

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LUANNE D. RUBEY, COLORADO P.E # 32339 DATE

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ATTN: STEVE SHARKEY
80 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-6441

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2	REVISED PER COUNTY COMMENTS	MFS	07/16/02

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V-SCALE NTS
DATE 6/29/01
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE
STA 00+00 TO STA 60+00

SHEET 8 OF 13
JOB NO. 8896.90

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NOTE:

CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

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LUANNE D. RUBEY, COLORADO P.E. # 32335 DATE

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ATTN: STEVE SHARKEY
90 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

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2	REVISED PER COUNTY COMMENTS	MTS	07/16/02

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V-SCALE NTS
DATE 6/29/01
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE
STA. 00+00 TO STA. 50+00

SHEET 9 OF 13
JOB NO. 8898.90

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NOTE:
SOME OF THE CULVERTS WITHIN THE FOX RUN REGIONAL PARK APPEAR TO BE UNDERSIZED. IN ADDITION, REGRADING AT THE EXISTING STORAGE AREA APPEARS TO HAVE BLOCKED OR DIVERTED FLOW FROM ITS ORIGINAL COURSE. WITHOUT NEW TOPOGRAPHIC INFORMATION, IT IS NOT POSSIBLE TO REEVALUATE THIS AREA. PER SECTION 6.3.1 OF THE DRAINAGE CRITERIA MANUAL, "SOME TYPES OF FACILITIES, SUCH AS PARKS DO NOT REQUIRE HIGH LEVELS OF PROTECTION AND PERIODIC FLOODING IS ACCEPTABLE SUBJECT TO APPROVAL BY THE CITY/COUNTY." AT THIS TIME, NO IMPROVEMENTS ARE PROPOSED WITHIN FOX RUN REGIONAL PARK.

NOTE:
CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBEY, COLORADO P.E. # 32339 DATE

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ATTN: STEVE SHARKEY
30 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

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A Subsidiary of Westrian
4700 Janssen Drive • Colorado Springs, CO 80907
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DATE	6/29/01		
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE
STA 00+00 TO STA 20+70

SHEET 10 OF 13
JOB NO. 8896.90

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NOTE: DRAINAGE IS SHALLOW AND SCATTERED THROUGHOUT THE BASIN WITH MANY SMALL AND UNDEFINABLE DRAINAGE PATHS. BECAUSE OF THIS, THERE ARE NO MAJOR DRAINAGEWAY IMPROVEMENTS SUGGESTED ON THE PLAN FOR THIS TRIBUTARY.

NO FLOODPLAIN OR PRUDENT LINE DETERMINATION COULD BE MADE ON THE PLEIER ROAD TRIBUTARY DUE TO THE WIDESPREAD, SHALLOW NATURE OF THE FLOODING IN THIS AREA.

NOTE:

CREEK BOTTOM PROFILE PER MULLER ENGINEERING STUDY.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

LUANNE D. RUBEY, COLORADO P.E. # 32339 DATE

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90 S. CASCADE AVE., STE. #1300
COLORADO SPRINGS, CO 80903
(719) 381-8441

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4700 Annexation Drive • Colorado Springs, CO 80907
719-593-2593 • fax: 719-593-2594
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2	REVISED PER COUNTY COMMENTS	MFS	07/19/02

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V-SCALE	N/S
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY PLAN AND PROFILE

STA 00+00 TO STA 22+00

SHEET 11 OF 13

JOB NO. 8896.90

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LUANNE D. RUBEY, COLORADO P.E. # 32339 DATE

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ATTN: STEVE SHARKEY
90 S. CASCADE AVE., STE. #300
COLORADO SPRINGS, CO 80903
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SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

PLAN VIEW- CITY IMPROVEMENTS

SHEET 12 OF 13

JOB NO. 8896.90

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SUGGESTED CHECK STRUCTURE DESIGN

NOTE:
CHECK STRUCTURE IS TO CONFORM TO SHAPE OF DEFINED LOW FLOW CHANNEL

SUGGESTED CHECK STRUCTURE
TYPICAL SECTION
N.T.S.

SUGGESTED VERTICAL DROP STRUCTURE DESIGN
PROFILE
N.T.S.

* STRUCTURE WIDTH WILL VARY
* SHALL HAVE LOW FLOW TRICKLE CHANNEL

SUGGESTED DITCH CHECK/DROP STRUCTURE
TYPICAL SECTION
N.T.S.

TYPICAL CHANNEL W/VEGETATED BANKS
N.T.S.

ROCK TOE PROTECTION
N.T.S.

TYPICAL CHANNEL W/RIPRAP BANK PROTECTION
N.T.S.

TYPICAL CHANNEL W/RIPRAP BED PROTECTION
N.T.S.

SUGGESTED DITCH CHECK/DROP STRUCTURE
PROFILE
N.T.S.

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No.	BY	DATE

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V-SCALE	N/A
DATE	6/29/01
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CHECKED BY	

SMITH CREEK
DRAINAGE BASIN PLANNING STUDY

DETAIL SHEET

SHEET 13 OF 13
JOB NO. 8696.90

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ATTACHMENT D –
El Paso County Drainage Report Signature Block

Drainage Reports

Design Engineer's Statement:

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

Ryan M. Mangino, PE #43304 — Date: 1/31/18

Owner/Developer's Statement:

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

Clive Grant, Owner — Date: 1/31/2018
1315 Walsen Road, Colorado Springs, CO 80921

El Paso County:

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

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

Conditions: