Drainage Letter

For:

Reigning Hope Indoor Arena

May 9, 2019

Prepared for

Reigning Horse Indoor Arena

14489 Holmes Rd

Black Forest, CO 80905

Prepared By:

Wallace Engineering, Structural Consultants, Inc.

Structural and Civil Consultants

Scott Rodehaver, P.E.

9800 Pyramid Court, Suite 350

Englewood, Colorado 80112

303.350.1690

srodehaver@wallacesc.com

Wallace Project #1975017

Purpose:

The purpose of this report is to explore the existing and proposed drainage conditions on the Reigning Hope Project site at 15589 Holmes Rd, Black Forest, Colorado 80908

Add PCD File No. PPR1935

wallace

Wallace Engineering
Structural Consultants, Inc.
9800 Pyramid Court, Suite 350
Englewood, Colorado 80112
303.350.1690, 800.364.5858
www.wallacesc.com

Engineer's Statement

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

_____

Name: Scott Rodehaver, P.E.

COLORADO LICENSED
SCOTT M. RODEHAVER
0049845
PROFESSIONAL ENGINEER

Seal

Developer's Statement

05/16/2019

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

_____

Business Name

By:_____

Title:_____

Address:_____

Please revise to state the following:
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.

El Paso County Only:

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

_____ _____

Director of Public Works Date

Conditions:

Please revise to the following:
Jennifer Irvine, P.E.
County Engineer/ECM Administrator

TABLE OF CONTENTS

The lot size is 4.15 acres.

Please provide a floodplain statement indicating whether or not any portion of the development is in a designated FEMA floodplain.

General Description

Reigning Hope Project is a 1.6 acre lot in Black Forest, Colorado. The lot is located at the north end of Holmes Rd as shown in Appendix A. The site has three buildings currently, and is covered by gravel roads, some scattered trees, and grass area. A new indoor horse area is proposed on the north side of the property.

Please indicate what drainage basins the site is located in (i.e. Black Squirrel Creek and East Cherry Creek)

Existing Drainage

The drainage from the site flows in two directions. The south half flows to the south and the north half flows north off the site. The south end of the site drains from the east to west, toward the center of the site, and then to the south and off the site. There is a drainage ditch along Holmes Rd where the drainage from the south end of the property flows. The north half of the site flows to the north, towards an existing gravel road. It then flows off the property and into a channel to the north. See existing drainage plan in Appendix B.

What is the ultimate outfall of this runoff? Discuss the impacts to the adjacent properties.

Proposed Drainage

The proposed site will have a new indoor horse-riding arena on the north end of the site. The flow from the north of the property will be directed around the new arena towards the north. The drainage to the south of the proposed arena will be collected in a swale and directed around the existing building, and towards the existing drainage swale along Holmes Road. There is a proposed 18" culvert under the existing driveway for the drainage of subbasin B. The calculations for the culvert design are included in appendix F. The drainage pattern will be similar to the existing drainage pattern, with the addition of the new arena, and the associated swales and channels. See the proposed drainage plan in Appendix D.

Hydrologic Calculations:

Please state whether the increase in flow is negligible or not.

This site was analyzed using the rational method, and a full spreadsheet of calculations is included in appendix C and E for the existing and proposed peak flowrate on the site. The peak flowrate for the 100 year storm on the existing site is 2.31 cfs for the north subbasin (A), and 1.58 cfs for the south subbasin (B). The proposed site also has a peak runoff for the 100 year storm of 1.93 for north subbasin (A) in the north and 2.01 for the south subbasin (B).

see comment above

Conclusion

The Reigning Hope Indoor Arena project is a 1.6-acre site in Black Forest, Colorado. It will consist of a new arena addition, and the corresponding drainage and swales for the new arena. The drainage patterns and volumes will be very similar to the existing site at Reigning Hope.

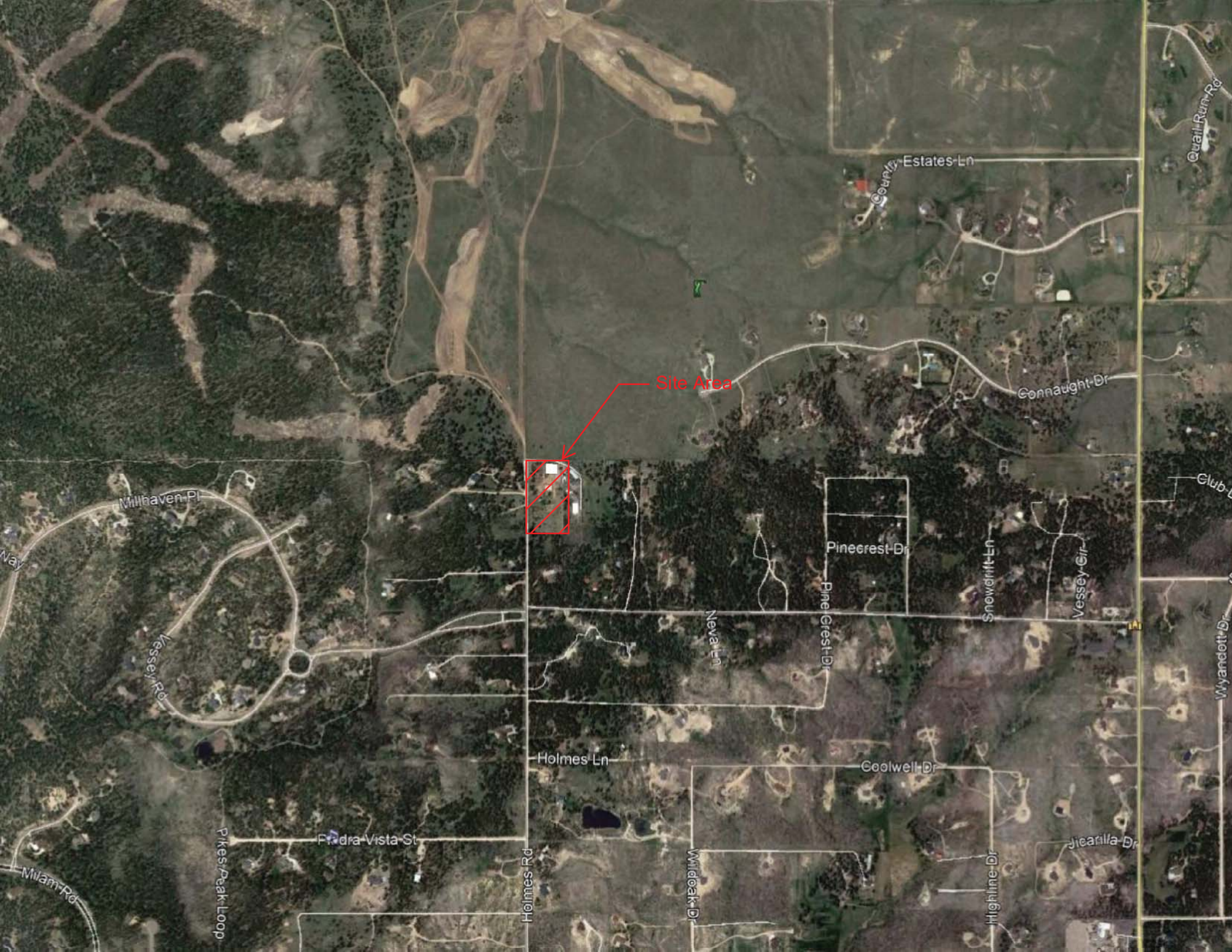
please see comments in the proposed conditions calculations.

Please indicate in the report whether or not there will be any adverse affects to the surrounding or downstream properties due to this development.

Please include the evaluation of the 4-step process per ECM Section I.7.2.

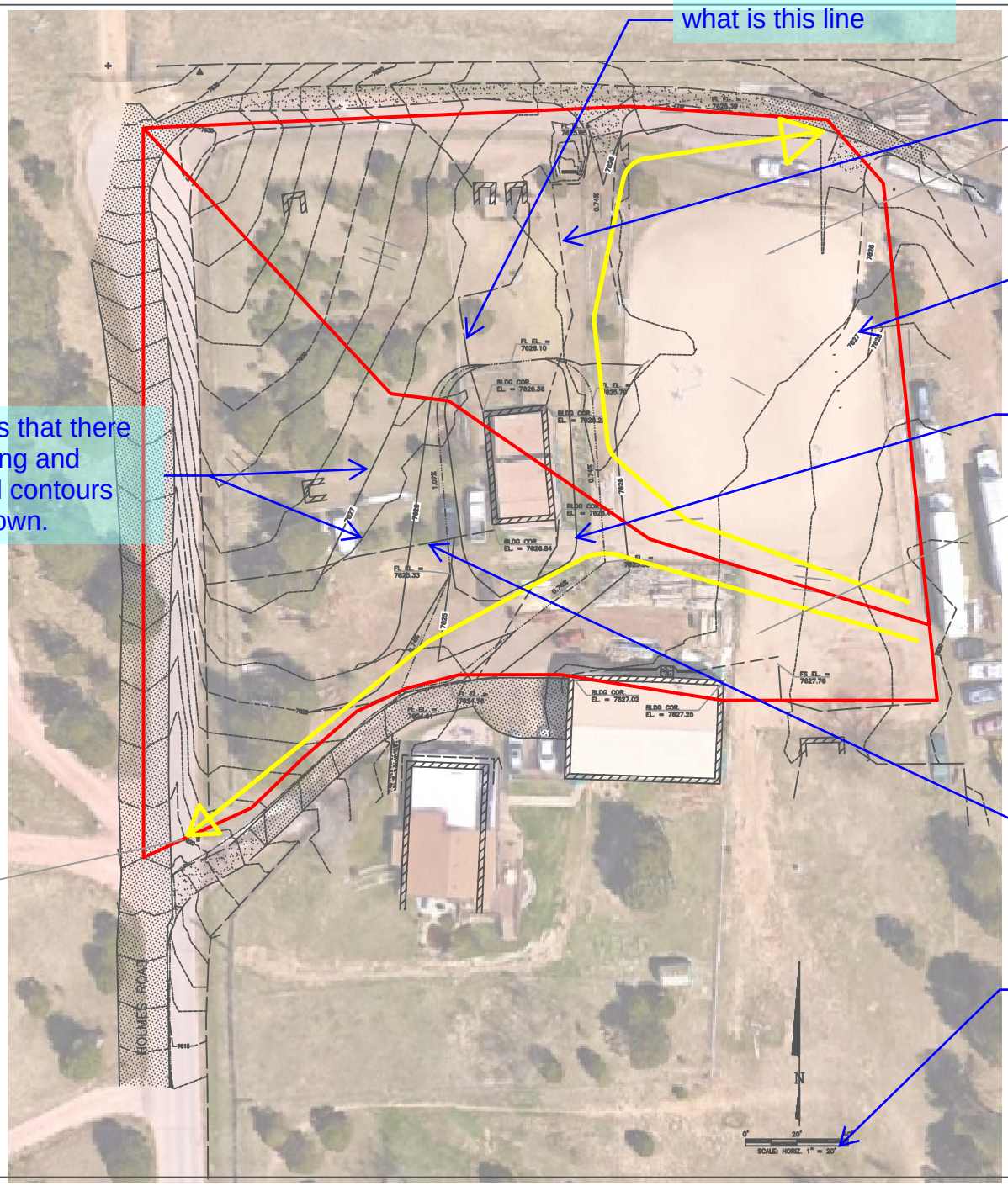
Appendix A

Vicinity Map


Site Area
Estates Ln
Quail Run Rd
Connaught Dr
Club
Milhaven Pl
Pinecrest Dr
Snowdrift Ln
Vessey Cir
Pine Crest Dr
Nevada Ln
Vessey Rd
Holmes Ln
Coolwell Dr
Pedra Vista St
Jicarilla Dr
Pikes Peak Loop
Holmes Rd
Widdoak Dr
Highline Dr
Milam Rd
Wyandott Dr

Appendix B

Existing Drainage Plan



what is this line

It appears as there are layers from the proposed plan being shown on the existing plan. Please update drawing accordingly.

Please fix the floating contour labels accordingly.

assuming this is a contour line, please add a contour label.

It appears that there are existing and proposed contours being shown.

Please provide a legend for the various line types and hatches shown.

what is this line?

Please verify the scale as it does not appear to be correct

EXISTING DRAINAGE PLAN

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SITE OVERVIEW
HOFFMAN RANCH GRADING PLAN
CRAIG HOFFMAN

DRAWN: TJN
DESIGNED: JCK
CHECKED: JCK
DATE: 2019
PROJECT NO: 19000.000
GMS FILE NO: 3608

GMS, INC.
CONSULTING ENGINEERS
611 N. WEBBER, SUITE 300
COLORADO SPRINGS, COLORADO 80903

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Appendix C

Existing Hydrology Results

EXISTING CONDITIONS

Date	4/29/2019	**Sheet No.**	1	of	3
Job#	1975017 Reigning Hope Indoor Arena				
Subject	Existing Drainage Calculations				

Composite Runoff Coefficients

		Runoff Coefficients (HSG A&B)**			
Land Use Or Surface Characteristics	**% Imp.**	**C_2**	**C_5**	**C_{10}**	**C_{100}**
Hardscape (Asph & Conc)	100.0%	0.89	0.90	0.92	0.96
Roofs	90.0%	0.71	0.73	0.75	0.81
Gravel	80.0%	0.57	0.59	0.63	0.70
Lawns (A & B Soils, 2-7%)	0.0%	0.02	0.08	0.15	0.35
Lawns (C & D Soils, 2-7%)	0.0%	0.04	0.15	0.25	0.50

Design Layout

Subbasin	Total Area (acres)	Total Area (sf)	Land Use Area per Subbasin											Weighted Imperviousness	Total Weighted Runoff Coefficients			
			Hardscaping		Roofs		Gravel		Lawns (A&B Soils)		Lawns (C&D Soils)		% Check					
			Area (sf)	%	Area (sf)	%	Area (sf)	%	Area (sf)	%	Area (sf)	%			2-year	5-year	10-year	100-year
A	0.83	36,344	0	0.0%	283	0.8%	13,773	37.9%	22571	62.1%	0	0.0%	100.8%	31.02%	0.23	0.28	0.34	0.49
B	0.77	33,680	0	0.0%	791	2.3%	1,179	3.5%	31710	94.2%	0	0.0%	100.0%	4.91%	0.06	0.11	0.18	0.37
Total	**1.61**	**70,024**	**0**	**0.0%**	**1,074**	**1.5%**	**14,952**	**21.4%**	**54281**	**77.5%**	**0**	**0.0%**	**100.4%**	**18.5%**	**0.15**	**0.20**	**0.26**	**0.43**

** Colorado Springs Drainage Manual, Chapter 6, Table 6-6.

XB = Existing Basin

XOS = Existing Off-Site Basin

EXISTING CONDITIONS

Date	4/29/2019	**Sheet No.**	2	of	3
Job#	1975017 Reigning Hope Indoor Arena				
Subject	Existing Drainage Calculations				

Time of Concentration

Rational Method

Subbasin Data			Initial / Overland, t_i Time (Ti) = $0.395(1.1-C_5)L^{1/2}/(S^{1/3})$*				Travel Time, t_t (Tt) = (L)/(V*60) where (V = $C_v S w^{1/2}$) **						Urban Basins Tc Check			Final	Remarks
Design Point	Coeff. C_5	Area (Ac)	Length (ft)	Δ Elev. (ft)	Slope (ft/ft)	Ti (min.)	Length (ft)	Δ Elev. (ft)	Slope (ft/ft)	Conveyance Coefficient (C_v)***	Velocity (fps)	Tt (min.)	Computed Tc (min.)	Total Length (ft)	Tc=(L/180)+10 (min.)	Tc (min.)	Contributing Basins
POA-1	0.28	0.83	130.00	2.7	0.021	13.45	192	2.1	0.011	10	1.05	3.06	16.51	322.00	11.79	16.51	XA
POA-2	0.11	0.77	122.00	2.5	0.020	15.73	222	6.5	0.029	10	1.71	2.16	17.90	344.00	11.91	17.90	XB
-																	-
-																	-
-																	-

* Colorado Springs Drainage Manual, Chapter 6, Eq. 6-8

** Colorado Springs Drainage Manual, Chapter 6, Eq. 6-9 and table 6-7 for Cv Coefficients

*** Colorado Springs Drainage Manual, Chapter 6, Table 6-7

EXISTING CONDITIONS

Date	4/29/2019	**Sheet No.**	3	of	3
Job#	1975017 Reigning Hope Indoor Arena				
Subject	Existing Drainage Calculations				

Hydrologic Analysis

				Runoff Coefficients				Rainfall Intensity*				Peak Discharge			
Basin	**Design Point**	**Area (ac)**	**Time of Concentration Tc (min)**	C_2	C_5	C_{10}	C_{100}	I 2-yr (in/hr)	I 5-yr (in/hr)	I 10-yr (in/hr)	I 100-yr (in/hr)	Q 2-yr (cfs)	Q 5-yr (cfs)	Q 10-yr (cfs)	Q 100-yr (cfs)
A	POA-1	0.83	16.51	0.23	0.28	0.34	0.49	2.70	3.38	3.94	5.67	0.53	0.79	1.11	2.31
B	POA-2	0.77	17.90	0.06	0.11	0.18	0.37	2.60	3.26	3.80	5.47	0.11	0.28	0.53	1.58

* IDF Equations From Colorado Springs Drainage Manual, Chapter 6, Figure 6-5

I100 = -2.52 ln(tc) + 12.735

I50 = -2.25 ln(tc) + 11.375

I25 = -2.00 ln(tc) + 10.111

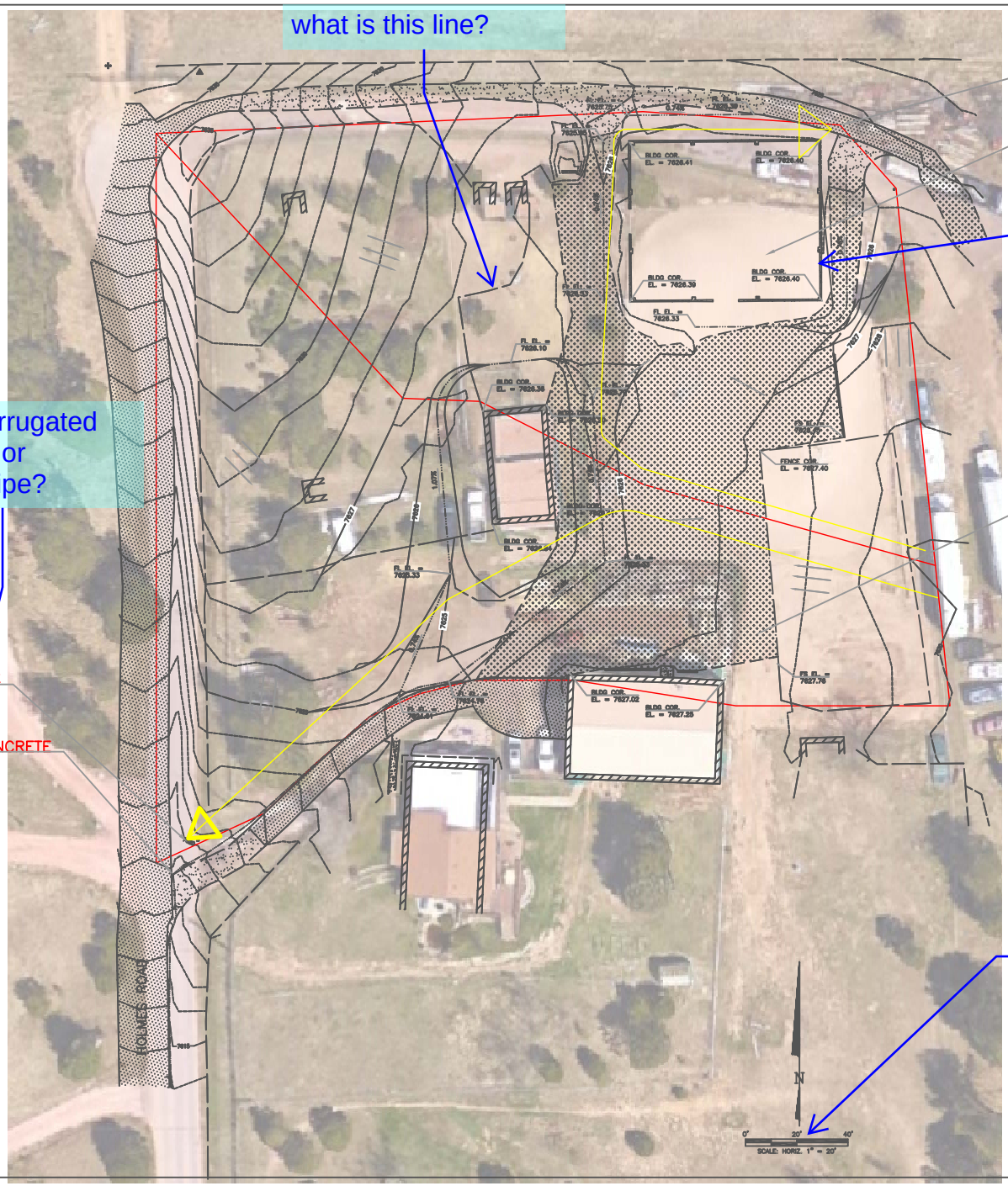
I10 = -1.75 ln(tc) + 8.847

I5 = -1.50 ln(tc) + 7.583

I2 = -1.19 ln(tc) + 6.035

Appendix D

Proposed Drainage Plan



Please verify that the location of the new building matches what is shown on the site plan. The site plan shows a 25' setback on the north. Update the drainage plan as necessary.

is this a corrugated metal pipe or concrete pipe?

Please provide a legend for the various line types and hatches shown. It is not clear what some of the line types are and what the hatches represent. Also some of the text is not readable. Revise accordingly.

Please verify the scale as it does not appear to be correct

PROPOSED DRAINAGE PLAN

THIS DRAWING IS THE PROPERTY OF GMS, INC., AND IS NOT TO BE RE-PRODUCED, MODIFIED OR USED FOR ANY OTHER PROJECT OR EXTENSION OF THIS PROJECT EXCEPT BY AGREEMENT WITH THIS COMPANY.

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SITE OVERVIEW
HOFFMAN RANCH GRADING PLAN
CRAIG HOFFMAN

DRAWN: TJN
DESIGNED: XXX
CHECKED: XXX
DATE: 2019
PROJECT NO: 19000.000
GMS FILE NO: 3XXX

GMS, INC.
CONSULTING ENGINEERS
511 N. WEBER, SUITE 300
COLORADO SPRINGS, COLORADO 80903

SHEET X OF X

Appendix E

Proposed Hydrology Results

PROPOSED CONDITIONS

Date	4/29/2019	**Sheet No.**	1	of	3
Job#	1975017 Reigning Hope Indoor Arena				
Subject	Proposed Drainage Calculations				

Composite Runoff Coefficients

		Runoff Coefficients (HSG A&B)**			
Land Use Or Surface Characteristics	**% Imp.**	**C_2**	**C_5**	**C_{10}**	**C_{100}**
Hardscape (Asph & Conc)	100.0%	0.89	0.90	0.92	0.96
Roofs	90.0%	0.71	0.73	0.75	0.81
Gravel	80.0%	0.57	0.59	0.63	0.70
Lawns (A & B Soils, 2-7%)	0.0%	0.02	0.08	0.15	0.35
Lawns (C & D Soils, 2-7%)	0.0%	0.04	0.15	0.25	0.50

The proposed gravel area has been reduced considerably compared to the existing conditions yet more imperviousness will be added with the proposed drive and parking areas. Please revise accordingly.

Design Layout

Subbasin	Total Area (acres)	Total Area (sf)	Land Use Area per Subbasin											Weighted Imperviousness	Total Weighted Runoff Coefficients			
			Hardscaping		Roofs		Gravel		Lawns (A&B Soils)		Lawns (C&D Soils)		% Check					
			Area (sf)	%	Area (sf)	%	Area (sf)	%	Area (sf)	%	Area (sf)	%			2-year	5-year	10-year	100-year
A	0.75	32,671	0	0.0%	4,956	15.2%	2,258	6.9%	25457	77.9%	0	0.0%	100.0%	19.18%	0.16	0.21	0.27	0.44
B	0.86	37,353	0	0.0%	791	2.1%	7,261	19.4%	29301	78.4%	0	0.0%	100.0%	17.46%	0.14	0.19	0.26	0.43
Total	**1.61**	**70,024**	**0**	**0.0%**	**5,747**	**8.2%**	**9,519**	**13.6%**	**54758**	**78.2%**	**0**	**0.0%**	**100.0%**	**18.3%**	**0.15**	**0.20**	**0.26**	**0.44**

** Colorado Springs Drainage Manual, Chapter 6, Table 6-6.

XB = Existing Basin

XOS = Existing Off-Site Basin

The letter of intent indicates a paved driveway. Please account for this in your design. Comments have been made on the site plan to identify the surface material of the drive and parking areas.

PROPOSED CONDITIONS

Date	4/29/2019	**Sheet No.**	2	of	3
Job#	1975017 Reigning Hope Indoor Arena				
Subject	Proposed Drainage Calculations				

Time of Concentration

Rational Method

Subbasin Data			Initial / Overland, t_i Time (Ti) = $0.395(1.1-C_5)L^{1/2}/(S^{1/3})$*				Travel Time, t_t (Tt) = (L)/(V*60) where (V = $C_vSw^{1/2}$) **						Urban Basins Tc Check			Final	Remarks
Design Point	Coeff. C_5	Area (Ac)	Length (ft)	Δ Elev. (ft)	Slope (ft/ft)	Ti (min.)	Length (ft)	Δ Elev. (ft)	Slope (ft/ft)	Conveyance Coefficient (C_v)***	Velocity (fps)	Tt (min.)	Computed Tc (min.)	Total Length (ft)	Tc=(L/180)+10 (min.)	Tc (min.)	Contributing Basins
POA-1	0.21	0.75	29.00	0.217	0.007	9.64	260	1.33	0.005	10	0.72	6.06	15.70	289.00	11.61	15.70	XA
POA-2	0.19	0.86	67.00	0.81	0.012	12.78	392	6.5	0.017	10	1.29	5.07	17.85	459.00	12.55	17.85	XB
-																	-
-																	-
-																	-

* Colorado Springs Drainage Manual, Chapter 6, Eq. 6-8

** Colorado Springs Drainage Manual, Chapter 6, Eq. 6-9 and table 6-7 for Cv Coefficients

*** Colorado Springs Drainage Manual, Chapter 6, Table 6-7

PROPOSED CONDITIONS

Date	4/29/2019	**Sheet No.**	3	of	3
Job#	1975017 Reigning Hope Indoor Arena				
Subject	Proposed Drainage Calculations				

Hydrologic Analysis

				Runoff Coefficients				Rainfall Intensity*				Peak Discharge			
Basin	**Design Point**	**Area (ac)**	**Time of Concentration Tc (min)**	C_2	C_5	C_{10}	C_{100}	I 2-yr (in/hr)	I 5-yr (in/hr)	I 10-yr (in/hr)	I 100-yr (in/hr)	Q 2-yr (cfs)	Q 5-yr (cfs)	Q 10-yr (cfs)	Q 100-yr (cfs)
A	POA-1	0.75	15.70	0.16	0.21	0.27	0.44	2.76	3.45	4.03	5.80	0.34	0.55	0.83	1.93
B	POA-2	0.86	17.85	0.14	0.19	0.26	0.43	2.61	3.26	3.80	5.47	0.32	0.54	0.83	2.01

* IDF Equations From Colorado Springs Drainage Manual, Chapter 6, Figure 6-5

I100 = -2.52 ln(tc) + 12.735

I50 = -2.25 ln(tc) + 11.375

I25 = -2.00 ln(tc) + 10.111

I10 = -1.75 ln(tc) + 8.847

I5 = -1.50 ln(tc) + 7.583

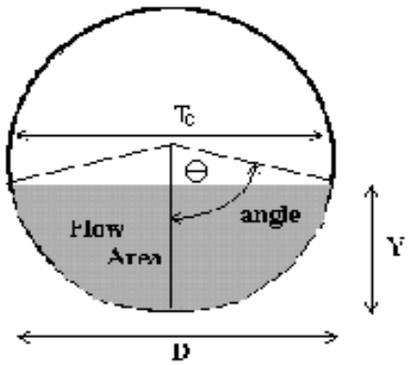
I2 = -1.19 ln(tc) + 6.035

Appendix F

Culvert Calculations

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project: **Blue cells are for user data entry**
Pipe ID: **Green cells are calculated values**



Design Information (Input)			
Pipe Invert Slope	So =	0.0520	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	18.00	inches
Design discharge	**Q =**	**1.84**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	26.02	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	0.88	radians
Flow area	An =	0.22	sq ft
Top width	Tn =	1.15	ft
Wetted perimeter	Pn =	1.31	ft
Flow depth	Yn =	0.27	ft
Flow velocity	Vn =	8.50	fps
Discharge	Qn =	1.84	cfs
Percent Full Flow	Flow =	7.1%	of full flow
Normal Depth Froude Number	Fr_n =	3.46	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.25	radians
Critical flow area	Ac =	0.53	sq ft
Critical top width	Tc =	1.42	ft
Critical flow depth	Yc =	0.51	ft
Critical flow velocity	Vc =	3.47	fps
Critical Depth Froude Number	Fr_c =	1.00	