

**AMENDMENT TO**  
**MASTER DEVELOPMENT DRAINAGE REPORT (M.D.D.P.)**  
**AND**  
**PRELIMINARY/FINAL DRAINAGE REPORT FOR THE**  
**FALCON SCHOOL DISTRICT ANNEXATION**  
Colorado Springs, Colorado

**APRIL 18, 2011**

PREPARED FOR:  
**Arrow J Landscape & Design, Inc.**  
909 E 68<sup>th</sup> Ave.  
Denver, Colorado 80229  
(303) 289-4388  
Contact: Chet Jones

PREPARED BY:  
**Drexel, Barrell & Co.**  
2955 Village Drive, Suite 14  
Steamboat Springs, Colorado 80488-2225  
(970) 879-1523  
Contact: Anne Pagano, P.E.

*Project Number 20252-00CSCV*

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**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 City/County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

*[Handwritten signature of Anne M. Pagano]*

\_\_\_\_\_  
Anne M. Pagano, P.E. #36763  
For and on Behalf of Drexel, Barrell & Co.

Seal



**DEVELOPER'S STATEMENT:**

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

Business Name: Falcon School District, No. 49

By: *Becky Carter*

Title: *Chief Education Officer*

Address: 10850 E. Woodmen Road

Falcon, CO 80831

**CITY OF COLORADO SPRINGS ONLY:**

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 1980, as amended.

*EM*  
For the City Engineer

5/16/11  
Date

Conditions: *see note/change p.5 (EM).*

## **I. Purpose**

The purpose of this report is to amend the current drainage report for the Vista Ridge High School located within the Falcon School District. This report will discuss the proposed improvements which include a baseball field and a soccer field. The original report, *Master Development Drainage Report (MDDP) and Preliminary/Final Drainage Report for the Falcon School District Annexation in Colorado Springs, Colorado* was prepared by Terra Nova Engineering, Inc. revised in August of 2007.

## **II. General Location and Description**

The Master Development Drainage Plan (MDDP) was developed to study the effects of storm water on downstream facilities when Vista Ridge High School was fully developed. The entire site of the High School is 55.56 acres and a portion of the North half of the Southeast Quarter of Section 7, Township 13 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in unincorporated El Paso County.

The High School property currently consists of the building, track and football fields, parking lots, and a baseball diamond. The School is now proposing to add a new soccer and baseball field to the grounds in an undeveloped part of the property. The development of the baseball and soccer fields will impact 11.5 acres of the property.

The entire site is bounded to the north by the Horseshoe Rancheros residential subdivision, to the west by a land trust, to the south by Greenhaven Filing No. 1, and to the east by Black Forest Road.

This site is entirely in the Sand Creek Basin. Any flows from the site are tributary to Sand Creek.

According to the NRCS Web Soils Survey (Map Unit Symbol 8 see Appendix B), the soils on the site are a Blakeland loamy sand and are primarily of Hydrologic Group A. The area of development slopes from northwest to southeast with an average slope of 6%.

## **III. Drainage Basins and Sub-Basins**

### **Major Basin Description**

As shown on the USGS map included in Appendix D, the project site lies within the Sand Creek Basin. Sand Creek runs from the northeast to the southwest and is located southeast of the project site.

which shows the location of all design points and the basin boundaries. Appendix G also includes the Erosion Control Plan from the Construction set to show the detail of the proposed improvements. Additionally, see Appendix H for the drainage map from the MDDP which includes the delineation of offsite basins.

**Table 1: Developed Conditions Design Point Flows**

DESIGN POINT	Q <sub>10</sub> (CFS)	Q <sub>100</sub> (CFS)
1	6.98	13.53
2	38.91	74.85
3	6.44	12.73
4	51.73	99.86
5	16.61	32.40
6	1.19	2.50
7	96.83	179.75

Design Point 1: Design point 1 (Q<sub>10</sub> = 6.98 cfs, Q<sub>100</sub> = 13.53 cfs) was examined to size Swale A-A which will carry offsite flows from the north, as well as onsite flow from Basin 1. Additionally, the proposed 18” storm culvert was sized from design point 1 to carry the 10-year storm.

Design Point 2: The flow at design point 2 (Q<sub>10</sub> = 38.91 cfs, Q<sub>100</sub> = 74.85 cfs) was utilized to size Swale B-B which will carry the flow from below the culvert in Swale A-A as well as offsite basins from the west.

Design Point 3: Design point 3 (Q<sub>10</sub> = 6.44 cfs, Q<sub>100</sub> = 12.73 cfs) was used to size the proposed Swale C-C which will carry flows from Basin 3 around the ballfield and over to the bottom of Swale B-B.

Design Point 4: The flow at design point 4 (Q<sub>10</sub> = 51.73 cfs, Q<sub>100</sub> = 99.86 cfs) was used to check the design for Swale D-D, which was designed with the approved *Final Drainage Report for Greenhaven Filing No. 1 and No. 2*, March 2004. We confirmed that the original design section for Swale D-D will handle the developed flow at Design Point 4, at a depth of 0.61 feet and over a foot of freeboard. The original Swale D-D was designed for a larger drainage basin, Basin OS 145-3 (67.60 acres) including a portion of the developed school site, as detailed in the Greenhaven Drainage Report. The flow calculated for this larger basin was Q<sub>100</sub> = 258 cfs.

Design Point 5: The flow at design point 5 (Q<sub>10</sub> = 16.61 cfs, Q<sub>100</sub> = 32.40 cfs) will flow through the site to the south via overland flow as currently exists. This basin will not be affected by the development of the ballfields.

Design Point 6: The flow at design point 6 (Q<sub>10</sub> = 1.19 cfs, Q<sub>100</sub> = 2.50 cfs) was used to size Swale E-E which will carry flow from Basin 6 around the ballfield to the south and into Swale D-D.

Design Point 7: The flows to Design Point 7 were calculated to confirm that the proposed development does not increase the ultimate discharge at the southeast corner of the site to the existing 66" pipe. Our analysis resulted in a 100-year flow of 179.75 cfs to Design Point 7. This compares within 2% of the previously calculated  $Q_{100}$  of 182 cfs per the approved MDDP. In summary, the ultimate discharge from the property is not significantly different in our analysis compared to the approved MDDP.

#### **Water Quality**

The development of this project does not include installation of any paved areas and therefore will not increase the imperviousness of the school property. Since the imperviousness of the site is not increased with this development, water quality treatment has not been included. However, the existing natural swale that the storm water passes through before entering the storm culvert at the southeast corner of the property will provide some sediment removal and water quality.

#### **Drainage Fees**

~~Per the MDDP (page 15), Drainage Fees were paid at the time of Final Plat for the Annexation of the school property. Fees were paid for the entire school site at that time and therefore no additional fees are due at this time.~~

*Fees due if/when  
platted.*

### **VI. Floodplain Statement**

No portion of this project site is within a designated floodplain as shown on the FEMA Flood Insurance Rate Map (FIRM) Number 08041C0537F, Effective Date March 17, 1997. Please see Appendix C for a copy of the FIRM for this area.

### **VII. Summary**

The proposed improvements to the Vista Ridge High School, including a baseball field and soccer field, will have no significant impact to the approved MDDP or downstream drainage structures and facilities. Since the improvements do not include impervious areas, the overall release of flow from the property will not increase with this development. Drainage swales and culverts within the affected area have been sized according to the Colorado Springs Criteria and will be installed with the construction of the ballfields to convey flow in accordance with historic patterns and the approved MDDP.

## VIII. References

1. *Master Development Drainage Report (MDDP) and Preliminary/Final Drainage Report for the Falcon School District Annexation*, Colorado Springs, Colorado, Terra Nova Engineering, Inc., Revised August 2007.
2. *Master Development Drainage Plan Amendment No. II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly Portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements*, JR Engineering, revised September 2004.
3. *Final Drainage Report Greenhaven Filing No. 1 and No. 2, Colorado Springs, Colorado*, Terra Nova Engineering, Inc., Revised March 2004.
4. *City of Colorado Springs and El Paso County Drainage Criteria Manual, Volume I*, October 1994.
5. *City of Colorado Springs Drainage Criteria Manual, Volume 2*, November 2002.
6. NRCS Web Soil Survey, <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>
7. United States Geological Survey, Falcon NW Quadrangle, Revised 1994.

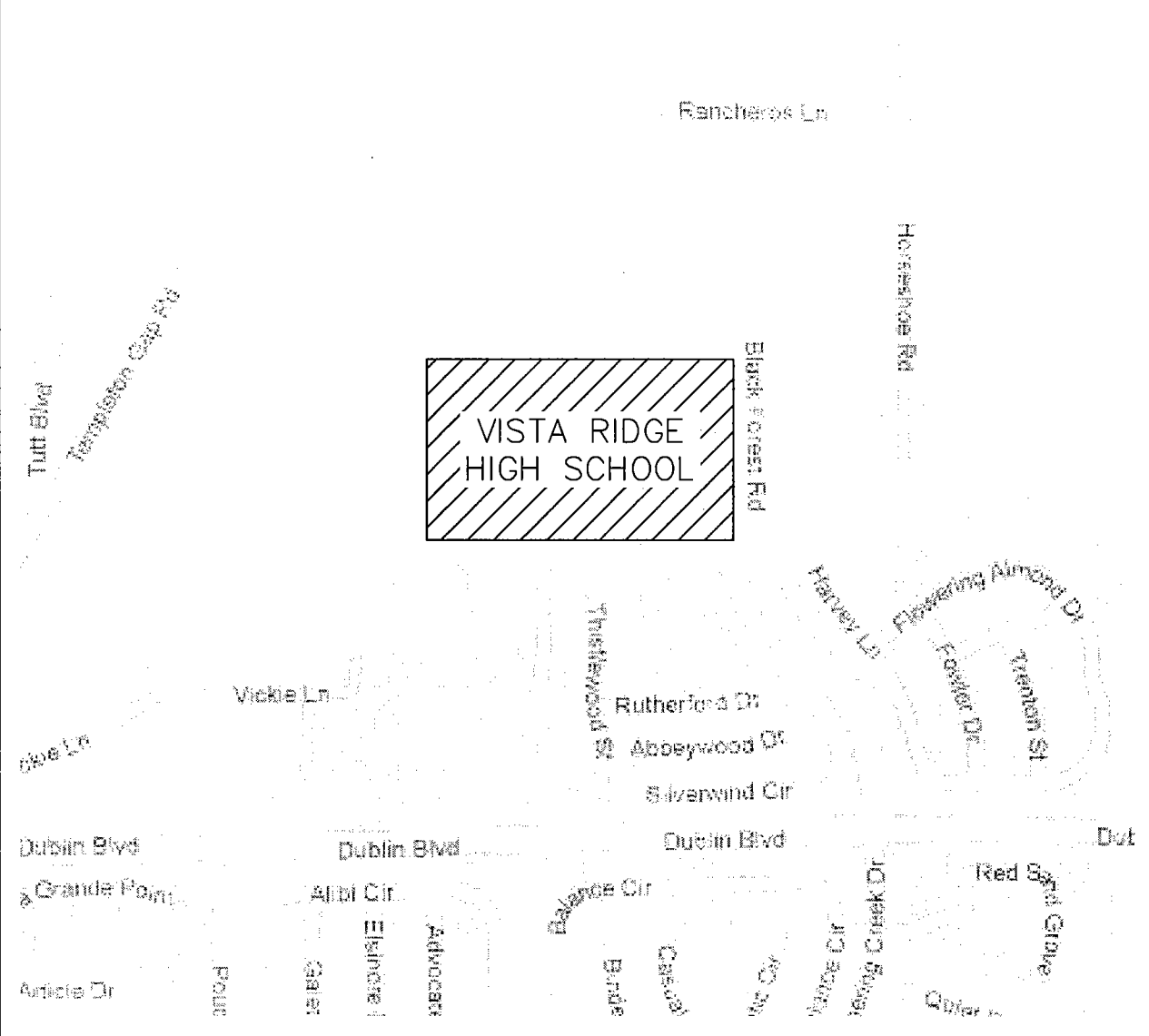
**APPENDIX A**

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**VICINITY MAP**



# VISTA RIDGE HIGH SCHOOL BASEBALL FIELD



## VICINITY MAP

NOT TO SCALE



### VISTA RIDGE HIGH SCHOOL BASEBALL FIELD VICINITY MAP

**Drexel, Barrell & Co.**  
Engineers • Surveyors

DATE:  
02/14/2011

DWG. NO.

1

JOB NO:  
20525

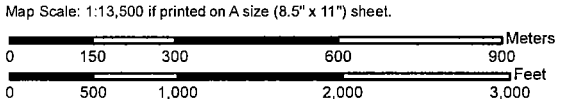
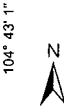
SHEET 1 OF 1

**APPENDIX B**

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**NRCS SOILS MAP**

Soil Map—El Paso County Area, Colorado  
(Vista Ridge High School Baseball Field)



Soil Map—El Paso County Area, Colorado  
(Vista Ridge High School Baseball Field)

**MAP LEGEND**

	Area of Interest (AOI)		Very Stony Spot
	Area of Interest (AOI)		Wet Spot
	Soils		Other
	Soil Map Units	<b>Special Line Features</b>	
<b>Special Point Features</b>			Gully
	Blowout		Short Steep Slope
	Borrow Pit		Other
	Clay Spot	<b>Political Features</b>	
	Closed Depression		Cities
	Gravel Pit	<b>Water Features</b>	
	Gravelly Spot		Oceans
	Landfill		Streams and Canals
	Lava Flow	<b>Transportation</b>	
	Marsh or swamp		Rails
	Mine or Quarry		Interstate Highways
	Miscellaneous Water		US Routes
	Perennial Water		Major Roads
	Rock Outcrop		Local Roads
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		
	Spoil Area		
	Stony Spot		

**MAP INFORMATION**

Map Scale: 1:13,500 if printed on A size (8.5" × 11") sheet.  
 The soil surveys that comprise your AOI were mapped at 1:24,000.  
 Please rely on the bar scale on each map sheet for accurate map measurements.  
 Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: UTM Zone 13N NAD83  
 This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.  
 Soil Survey Area: El Paso County Area, Colorado  
 Survey Area Data: Version 7, May 4, 2009  
 Date(s) aerial images were photographed: 7/30/2005

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

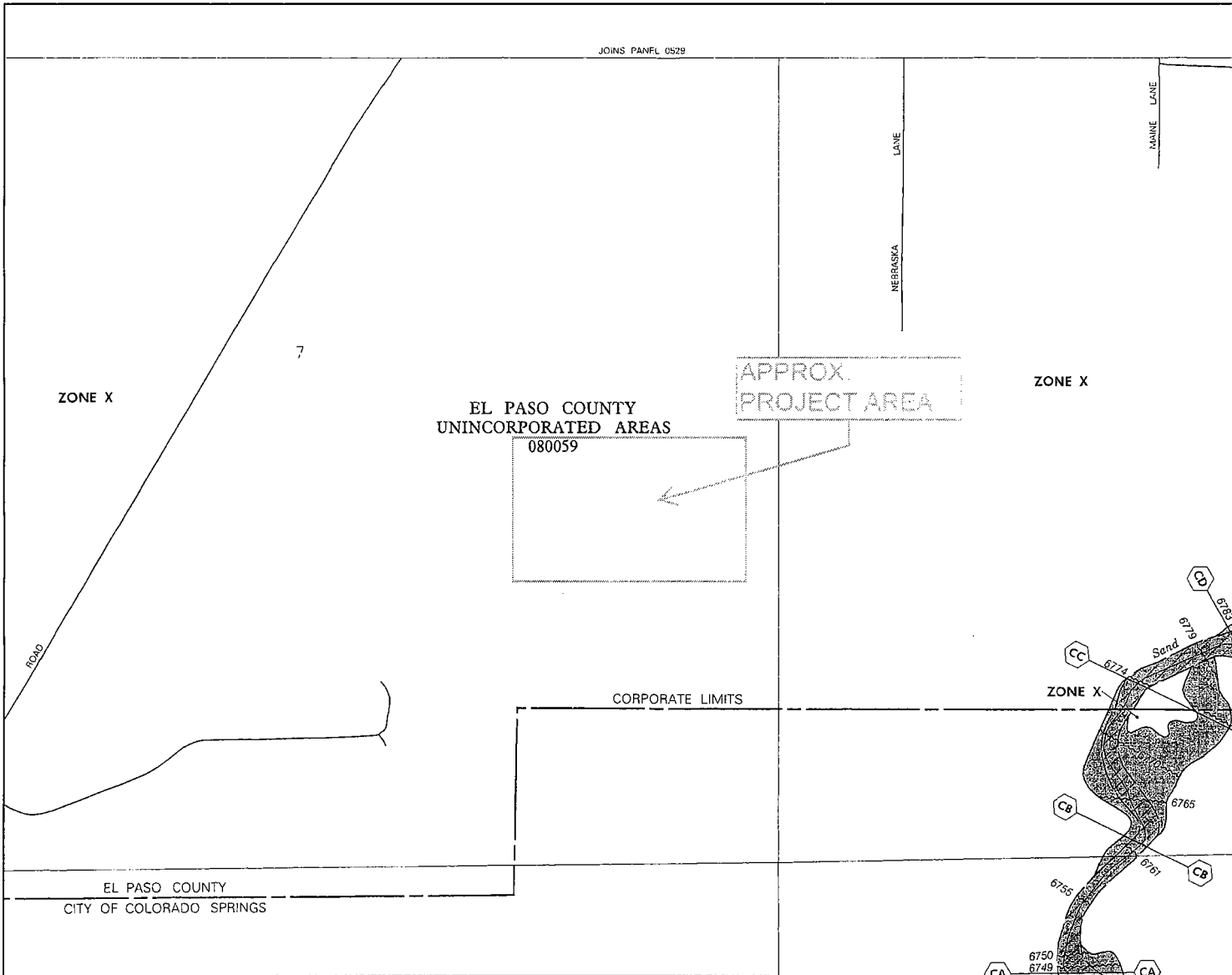
## Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	510.4	73.1%
9	Blakeland-Fluvaquentic Haplaquolls	53.3	7.6%
10	Blendon sandy loam, 0 to 3 percent slopes	78.2	11.2%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	17.7	2.5%
97	Truckton sandy loam, 3 to 9 percent slopes	39.1	5.6%
<b>Totals for Area of Interest</b>		<b>698.7</b>	<b>100.0%</b>

**APPENDIX C**

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**FEMA FLOODPLAIN MAP**



APPROXIMATE SCALE IN FEET  
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**  
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,  
COLORADO AND  
INCORPORATED AREAS

PANEL 537 OF 1300  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS CITY OF	082000	0537	F
EL PASO COUNTY UNINCORPORATED AREAS	082509	0537	F

MAP NUMBER  
08041C0537 F

EFFECTIVE DATE:  
MARCH 17, 1997



Federal Emergency Management Agency

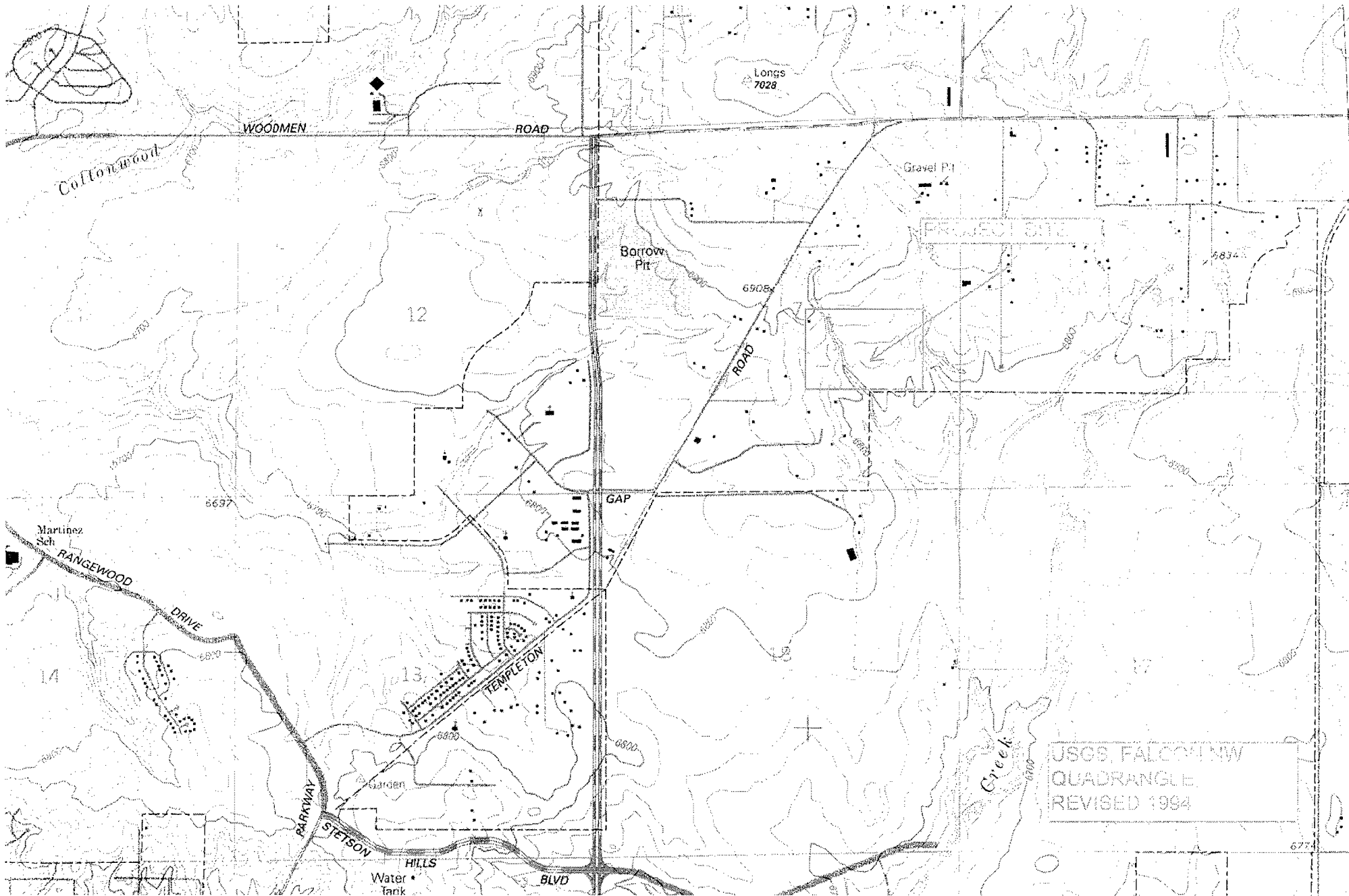
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program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

**APPENDIX D**

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**USGS MAP**





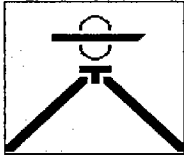
USGS FALCON NW  
QUADRANGLE,  
REVISED 1994

677

**APPENDIX E**

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**HYDROLOGIC CALCULATIONS**



**DREXEL, BARRELL & Co.**  
Engineers - Surveyors  
970-879-1523 PH  
970-879-1619 FAX

PROJECT: A.W.S. Vista Ridge High School Ballfields      DATE: 4/13/2011  
PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

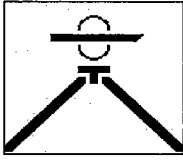
### DESIGN POINT 1

#### WEIGHTED COEFFICIENTS

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>	CA <sub>10</sub>	CA <sub>100</sub>
BASIN 1	1.35	0.25	0.35	0.34	0.47
BASIN OS-5*	3.71	0.25	0.35	0.93	1.30
BASIN B*	0.68	0.82	0.88	0.56	0.60
<b>TOTAL</b>	<b>5.74</b>			<b>1.82</b>	<b>2.37</b>

Weighted Coefficients	
C <sub>10</sub> =	0.32
C <sub>100</sub> =	0.41

*\*Master Development Drainage Report and Preliminary/Final Drainage Report for the Falcon School District Annexation, August 2007, Terra Nova Engineering*



**DREXEL, BARRELL & Co.**  
Engineers - Surveyors  
970-879-1523 PH  
970-879-1619 FAX

PROJECT NAME: Vista Ridge High School Ballfields      DATE: 4/13/2011  
PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

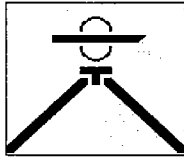
## DESIGN POINT 2

### WEIGHTED COEFFICIENTS

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>	CA <sub>10</sub>	CA <sub>100</sub>
BASIN 1	1.35	0.25	0.35	0.34	0.47
BASIN 2	2.50	0.25	0.35	0.63	0.88
BASIN OS-5*	3.71	0.25	0.35	0.93	1.30
BASIN B*	0.68	0.90	0.95	0.61	0.65
BASIN OS-4*	18.62	0.35	0.45	6.52	8.38
BASIN OS-3*	4.07	0.35	0.45	1.42	1.83
<b>TOTAL</b>	<b>30.93</b>			<b>10.44</b>	<b>13.50</b>

Weighted Coefficients	
C <sub>10</sub> =	0.34
C <sub>100</sub> =	0.44

*\*Master Development Drainage Report and Preliminary/Final Drainage Report for the Falcon School District Annexation, August 2007, Terra Nova Engineering*



**DREXEL, BARRELL & Co.**  
Engineers - Surveyors  
970-879-1523 PH  
970-879-1619 FAX

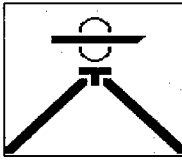
PROJECT NAME: Vista Ridge High School Ball Fields      DATE: 4/13/2011  
PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

### DESIGN POINT 3

#### WEIGHTED COEFFICIENTS

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>
BASIN 3	7.58	0.25	0.35
TOTAL AREA	7.58		

Weighted Coefficients	
C <sub>10</sub> =	0.25
C <sub>100</sub> =	0.35



**DREXEL, BARRELL & Co.**  
Engineers - Surveyors  
970-879-1523 PH  
970-879-1619 FAX

PROJECT NAME: Vista Ridge High School Expansion      DATE: 4/13/2011  
PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

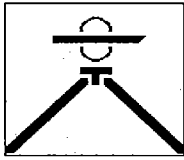
### DESIGN POINT 4

#### WEIGHTED COEFFICIENTS

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>	CA <sub>10</sub>	CA <sub>100</sub>
BASIN 1	1.95	0.25	0.35	0.34	0.47
BASIN 2	2.50	0.25	0.35	0.63	0.88
BASIN 3	7.58	0.25	0.35	1.90	2.65
BASIN 4	4.38	0.25	0.35	1.10	1.53
BASIN OS-5*	3.71	0.25	0.35	0.93	1.30
BASIN B*	0.68	0.90	0.95	0.61	0.65
BASIN OS-4*	16.62	0.35	0.45	6.52	8.38
BASIN OS-3*	4.07	0.35	0.45	1.42	1.83
1/3 BASIN OS-2*	4.66	0.35	0.45	1.63	2.10
<b>TOTAL</b>	<b>47.55</b>			<b>15.06</b>	<b>19.79</b>

Weighted Coefficients	
C <sub>10</sub> =	0.32
C <sub>100</sub> =	0.42

*\*Master Development Drainage Report and Preliminary/Final Drainage Report for the Falcon School District Annexation, August 2007, Terra Nova Engineering*



**DREXEL, BARRELL & Co.**  
Engineers - Surveyors  
970-879-1523 PH  
970-879-1619 FAX

PROJECT NAME: Vista Ridge High School Barfields      DATE: 4/13/2011  
PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

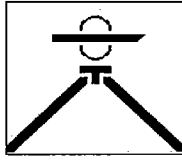
### DESIGN POINT 5

#### WEIGHTED COEFFICIENTS

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>	CA <sub>10</sub>	CA <sub>100</sub>
BASIN 5	2.02	0.25	0.35	0.51	0.71
2/3 BASIN OS-2*	9.31	0.35	0.45	3.26	4.19
OS-1*	2.83	0.35	0.45	0.99	1.27
<b>TOTAL</b>	<b>14.16</b>			<b>4.75</b>	<b>6.17</b>

Weighted Coefficients	
C <sub>10</sub> =	0.34
C <sub>100</sub> =	0.44

*\*Master Development Drainage Report and Preliminary/Final Drainage Report for the Falcon School District Annexation, August 2007, Terra Nova Engineering*



**DREXEL, BARRELL & Co.**  
Engineers - Surveyors  
970-879-1523 PH  
970-879-1619 FAX

PROJECT NAME: Vista Ridge High School Ballfields      DATE: 4/13/2011  
PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

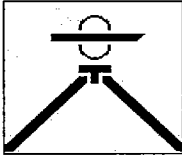
### DESIGN POINT 6

#### WEIGHTED COEFFICIENTS

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>
BASIN 6	1.06	0.25	0.35
TOTAL AREA	1.06		

Weighted Coefficients		
C <sub>10</sub>	=	0.25
C <sub>100</sub>	=	0.35





**DREXEL, BARRELL & Co.**  
 Engineers - Surveyors  
 970-879-1523 PH  
 970-879-1619 FAX

PROJECT NAME: View Ridge High School Ballfields      DATE: 4/13/2011  
 PROJECT NUMBER: 20252-00CSCV      CALCULATED BY: AMP

**DESIGN POINT 7**

**WEIGHTED COEFFICIENTS**

BASIN	ACREAGE	C <sub>10</sub>	C <sub>100</sub>	CA <sub>10</sub>	CA <sub>100</sub>
BASIN 1	1.35	0.25	0.35	0.34	0.47
BASIN 2	2.60	0.25	0.35	0.63	0.88
BASIN 3	7.68	0.25	0.35	1.90	2.65
BASIN 4	4.38	0.25	0.35	1.10	1.53
BASIN 6	1.06	0.25	0.35	0.27	0.37
BASIN 7	33.73	0.75	0.85	25.30	28.67
BASIN OS-5*	3.71	0.25	0.35	0.93	1.30
BASIN B*	0.68	0.90	0.95	0.61	0.65
BASIN OS-4*	18.62	0.35	0.45	6.52	8.38
BASIN OS-3*	1.07	0.35	0.45	1.42	1.83
1/3 BASIN OS-2*	4.66	0.35	0.45	1.63	2.10
<b>TOTAL</b>	<b>82.34</b>			<b>40.63</b>	<b>48.83</b>

Weighted Coefficients	
C <sub>10</sub> =	0.49
C <sub>100</sub> =	0.59

*\*Master Development Drainage Report and Preliminary/Final Drainage Report for the Falcon School District Annexation, August 2007, Terra Nova Engineering*

DREXEL, BARRELL & CO.  
 CIVIL ENGINEERS/LAND SURVEYORS

**TIME OF CONCENTRATION  
 RATIONAL METHOD  
 PROJECT: Vista Ridge High School Baseball Field  
 CALC. BY: AMP DATE: 04-12-11**

SUB-BASIN DATA			INITIAL / OVERLAND TIME (Ti)				TRAVEL TIME (Tt)						FINAL Tc	REMARKS
DESIGN PT.	COEFF. C <sub>10</sub>	AREA (Ac)	LENGTH (Ft)	Δ ELEV. (ft)	SLOPE %	Ti (Min.)	LENGTH (Ft)	Δ ELEV. (ft)	SLOPE (ft/ft)	Grass or Pavement	VELOCITY* (Fps)	Tt (Min.)	(Min.)	
1	0.32	5.74				13.8	570	35	0.061	Grass	3.80	2.5	16.3	Initial Time of Concentration from MDDP, DP 9
2	0.34	30.93				16.3	250	18	0.072	Grass	4.20	1.0	17.3	Initial Time of Concentration from Design Point 1
3	0.25	7.58	300	10	3.33	18.5	780	44	0.056	Grass	3.50	3.7	22.2	
4	0.32	47.55				17.3	665	22	0.033	Grass	2.80	4.0	21.2	Initial Time of Concentration from Design Point 2
5	0.34	14.16				16.1	650	35	0.054	Grass	3.40	3.2	19.3	Initial Time of Concentration from MDDP, DP 4
6	0.25	1.06	170	24	14.12	8.7	300	5	0.017	Grass	2.00	2.5	11.2	
7	0.49	82.34				17.3	1810	41	0.023	Grass	1.60	18.9	36.2	Initial Time of Concentration from Design Point 2

\*Urban Drainage and Flood Control District Figure RO-1

# DREXEL BARRELL & CO.

## STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

PROJECT Vista Ridge High School Baseball Field  
 JOB # 20252-00  
 DATE: 12-Apr-11

CALC. BY: AMP  
 DESIGN STORM 10-YR and 100-YR PROPOSED

DESIGN POINT	10-YEAR RUNOFF							100-YEAR RUNOFF					
	AREA DESIGN	AREA (ac.)	C <sub>10</sub>	t <sub>c</sub> (min.)	C <sub>10</sub> A (ac.)	I INHR	Q <sub>10</sub> (cfs)	AREA (ac.)	C <sub>100</sub>	t <sub>c</sub> (min.)	C <sub>100</sub> A (ac.)	I INHR	Q <sub>100</sub> (cfs)
1	Swale AA	5.74	0.32	16.3	1.837	3.80	<b>6.98</b>	5.74	0.41	16.3	2.35	5.75	<b>13.53</b>
2	Swale BB	30.93	0.34	17.3	10.516	3.70	<b>38.91</b>	30.93	0.44	17.3	13.61	5.50	<b>74.85</b>
3	Swale CC	7.58	0.25	22.2	1.895	3.40	<b>6.44</b>	7.58	0.35	22.2	2.65	4.80	<b>12.73</b>
4	Swale DD	47.55	0.32	21.2	15.216	3.40	<b>51.73</b>	47.55	0.42	21.2	19.97	5.00	<b>99.86</b>
5		14.16	0.34	19.3	4.814	3.45	<b>16.61</b>	14.16	0.44	19.3	6.23	5.20	<b>32.40</b>
6	Swale EE	1.06	0.25	11.2	0.265	4.50	<b>1.19</b>	1.06	0.35	11.2	0.37	6.75	<b>2.50</b>
7	66" Outfall Pipe	82.34	0.49	36.2	40.347	2.40	<b>96.83</b>	82.34	0.59	36.2	48.58	3.70	<b>179.75</b>

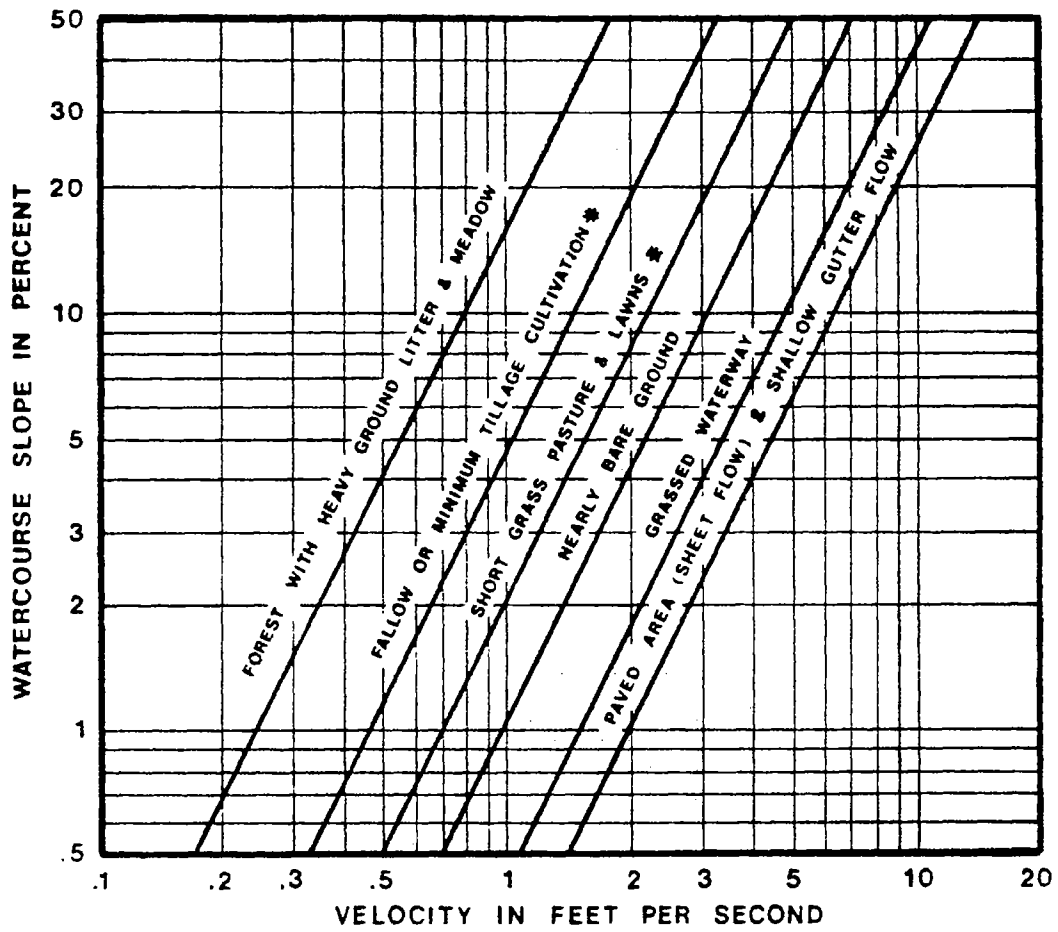


Figure RO-1—Estimate of Average Overland Flow Velocity for Use With the Rational Formula

**APPENDIX F**

---

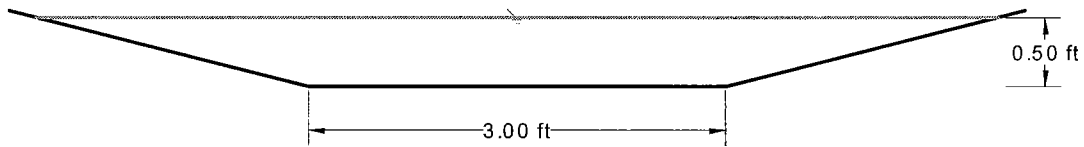
**HYDRAULIC CALCULATIONS**

# SWALE A-A

## Cross Section for Trapezoidal Channel

Project Description	
Worksheet	SWALE A-A
Flow Element	Trapezoidal Char
Method	Manning's Formu
Solve For	Channel Depth

Section Data	
Mannings Coeffici	0.035
Slope	.067000 ft/ft
Depth	0.50 ft
Left Side Slope	4.00 H : V
Right Side Slope	4.00 H : V
Bottom Width	3.00 ft
Discharge	13.53 cfs



Freeboard:  
 $H = 1.0 + 0.25VD^{0.33}$   
 $V = 5.45 \text{ fps}$   
 $D = 0.50 \text{ ft}$   
 $H = 1.1 \text{ FT}$   
 MINIMUM CHANNEL DEPTH = 0.50 + 1.1 = 1.6 FT

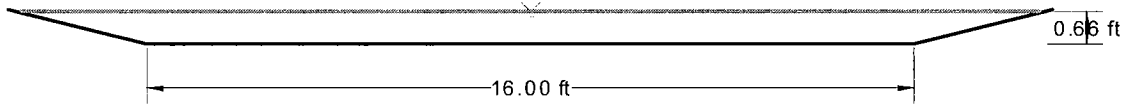
V:1  
 H:1  
 NTS

# SWALE B-B

## Cross Section for Trapezoidal Channel

Project Description	
Worksheet	SWALE B-B
Flow Element	Trapezoidal Char
Method	Manning's Formu
Solve For	Channel Depth

Section Data	
Mannings Coeffici	0.050
Slope	.089000 ft/ft
Depth	0.66 ft
Left Side Slope	4.00 H : V
Right Side Slope	4.00 H : V
Bottom Width	16.00 ft
Discharge	74.85 cfs



Freeboard:  
 $H = 1.0 + 0.025VD^{0.33}$   
 $V = 6.11 \text{ fps}$   
 $D = 0.66 \text{ ft}$   
 $H = 1.1 \text{ FT}$

MINIMUM CHANNEL DEPTH =  $0.66 + 1.1 = 1.76 \text{ FT}$

Riprap Sizing:  
 Table MD-16 UDFCD  
 $(V/1.486)^2 / (1.49 / (4.75 - 1) * (0.66)^{1.49}) = 0.1$   
 Use type M-1 riprap, d50 = 1.5"

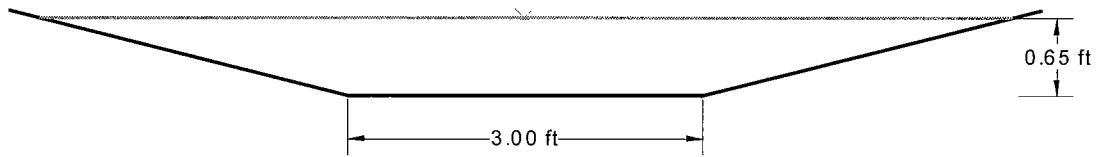
V:1  
 H:1  
 NTS

# SWALE C-C

## Cross Section for Trapezoidal Channel

Project Description	
Worksheet	SWALE C-C
Flow Element	Trapezoidal Char
Method	Manning's Formu
Solve For	Channel Depth

Section Data	
Mannings Coeffici	0.030
Slope	.015000 ft/ft
Depth	0.65 ft
Left Side Slope	4.00 H : V
Right Side Slope	4.00 H : V
Bottom Width	3.00 ft
Discharge	12.73 cfs



V:1  
H:1  
NTS

```

Freeboard:
H = 1.2 - 0.25 * 0.030
V = 3.00 ft
D = 0.65 ft
H = 1.2 - 0.25 * 0.030
MINIMUM CHANNEL DEPTH = 0.65 + 1.1 = 1.8 FT
    
```

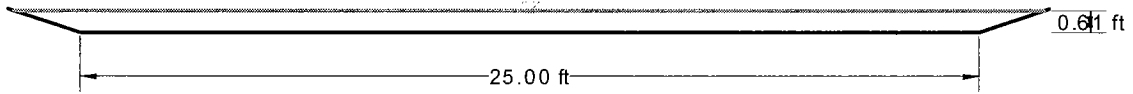


# SWALE D-D

## Cross Section for Trapezoidal Channel

Project Description	
Worksheet	SWALE D-D
Flow Element	Trapezoidal Char
Method	Manning's Formu
Solve For	Channel Depth

Section Data	
Mannings Coeffici	0.030
Slope	.033000 ft/ft
Depth	0.61 ft
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Bottom Width	25.00 ft
Discharge	99.86 cfs



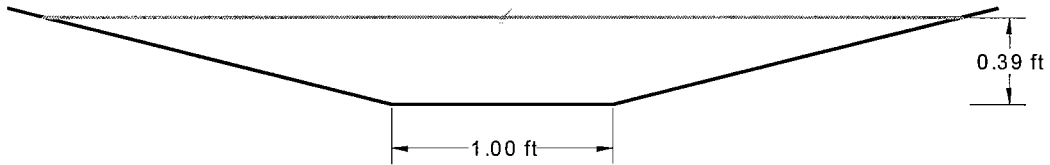
V:1  
H:1  
NTS

# SWALE E-E

## Cross Section for Trapezoidal Channel

Project Description	
Worksheet	SWALE E-E
Flow Element	Trapezoidal Char
Method	Manning's Formu
Solve For	Channel Depth

Section Data	
Mannings Coeffici	0.030
Slope	.017000 ft/ft
Depth	0.39 ft
Left Side Slope	4.00 H : V
Right Side Slope	4.00 H : V
Bottom Width	1.00 ft
Discharge	2.50 cfs



V:1  
H:1  
NTS

Freeboard:  
 $H = 1.0 + .025VD^{0.33}$   
 $V = 2.48 \text{ fps}$   
 $D = 0.39 \text{ ft}$   
 $H = 1.05 \text{ FT}$   
 MINIMUM CHANNEL DEPTH =  $0.39 + 1.05 = 1.4 \text{ FT}$

# Culvert Calculator Report

## Culvert at Design Point 1

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	39.50 ft	Headwater Depth/Height	2.00
Computed Headwater Elev:	39.50 ft	Discharge	12.60 cfs
Inlet Control HW Elev.	38.95 ft	Tailwater Elevation	33.70 ft
Outlet Control HW Elev.	39.50 ft	Control Type	Outlet Control

12.60 cfs

Grades			
Upstream Invert	36.50 ft	Downstream Invert	33.34 ft
Length	78.83 ft	Constructed Slope	0.040086 ft/ft

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.34 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.34 ft
Velocity Downstream	7.58 ft/s	Critical Slope	0.043552 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	39.50 ft	Upstream Velocity Head	0.79 ft
Ke	0.20	Entrance Loss	0.16 ft

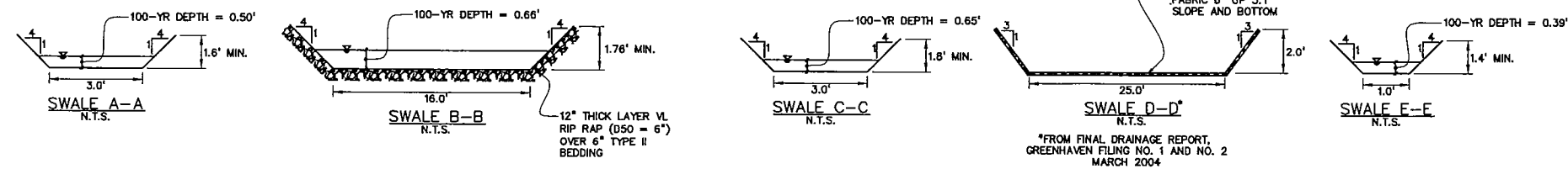
Inlet Control Properties			
Inlet Control HW Elev.	38.95 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	1.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Inlet Protection Riprap Sizing  
 Use MD-21 UDFCD  
 $(C=1.5) = 3.9$   
 $(K/D) = 0.2$   
 Use Type M Riprap, d50=9"  
 $(1/2) \tan(\text{expansion angle}) = 1.2$   
 $(1/2) \tan(33.7) = 0.74$   
 Use 1.5 ft for length of protection

**APPENDIX G**

---

**PROPOSED DRAINAGE PLAN  
EROSION CONTROL AND STORM WATER QUALITY PLAN**



**LEGEND**

DRAINAGE BASIN BOUNDARY ..... [Symbol]

DRAINAGE BASIN DESIGN POINT ..... [Symbol]

BASIN I.D. ..... [Symbol]

BASIN AREA (Acres) ..... [Symbol]

10 YEAR RUNOFF COEFFICIENT ..... [Symbol]

100 YEAR RUNOFF COEFFICIENT ..... [Symbol]

PROPOSED INTERMEDIATE CONTOUR ..... [Symbol]

PROPOSED INDEX CONTOUR ..... [Symbol]

EX. INTERMEDIATE CONTOUR ..... [Symbol]

EX. INDEX CONTOUR ..... [Symbol]

EX. SPOT ELEVATIONS ..... [Symbol]

DIRECTION OF FLOW ..... [Symbol]

PREPARED BY:

**DREXEL, BARRELL & CO.**  
 Engineers-Surveyors  
 3 S. 7TH STREET  
 COLORADO SPRINGS, CO 80905  
 CONTACT: TIM MCCONNELL, P.E.  
 (719) 260-0887  
 BOULDER • COLORADO SPRINGS • DENVER  
 GRAND JUNCTION • GREELEY  
 STEAMBOAT SPRINGS

OWNER/DEVELOPER:

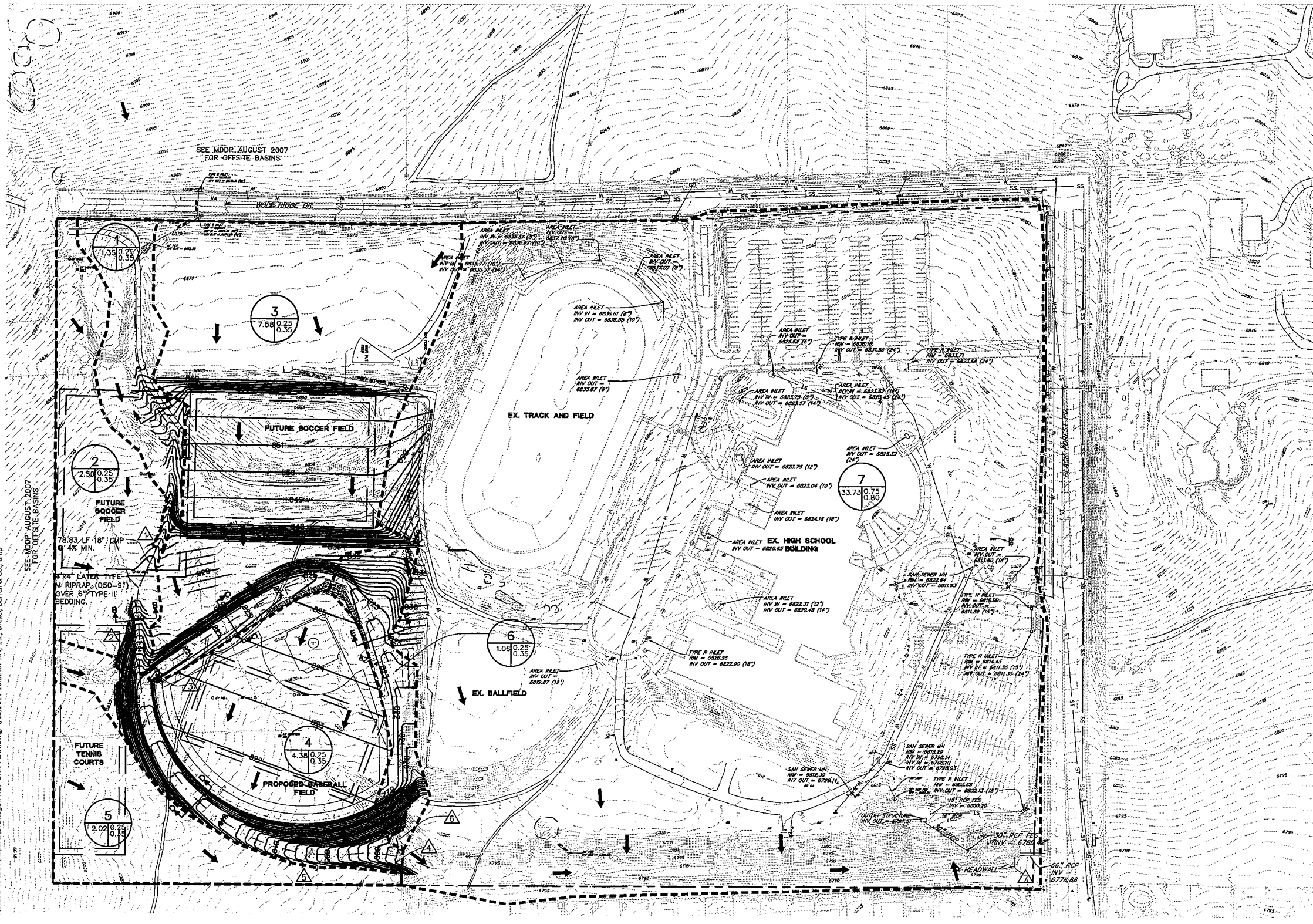
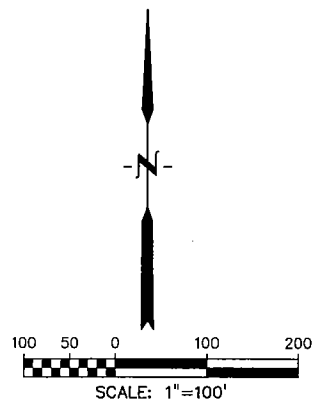
**FALCON SCHOOL DISTRICT 49**

**ARROW J**  
 909 E. 68TH AVE.  
 DENVER, CO 80229  
 (303) 289-4388  
 CONTACT: CHET JONES

CONSTRUCTION DOCUMENTS FOR:

**VISTA RIDGE BASEBALL FIELD**  
**VISTA RIDGE HIGH SCHOOL BASEBALL FIELD**  
 6888 BLACK FOREST ROAD  
 COLORADO SPRINGS, COLORADO

ISSUE	DATE
CITY COMMENTS	4/18/11
DESIGNED BY:	MTM
DRAWN BY:	MTM
CHECKED BY:	AMP
FILE NAME:	PROP DRN PLAN



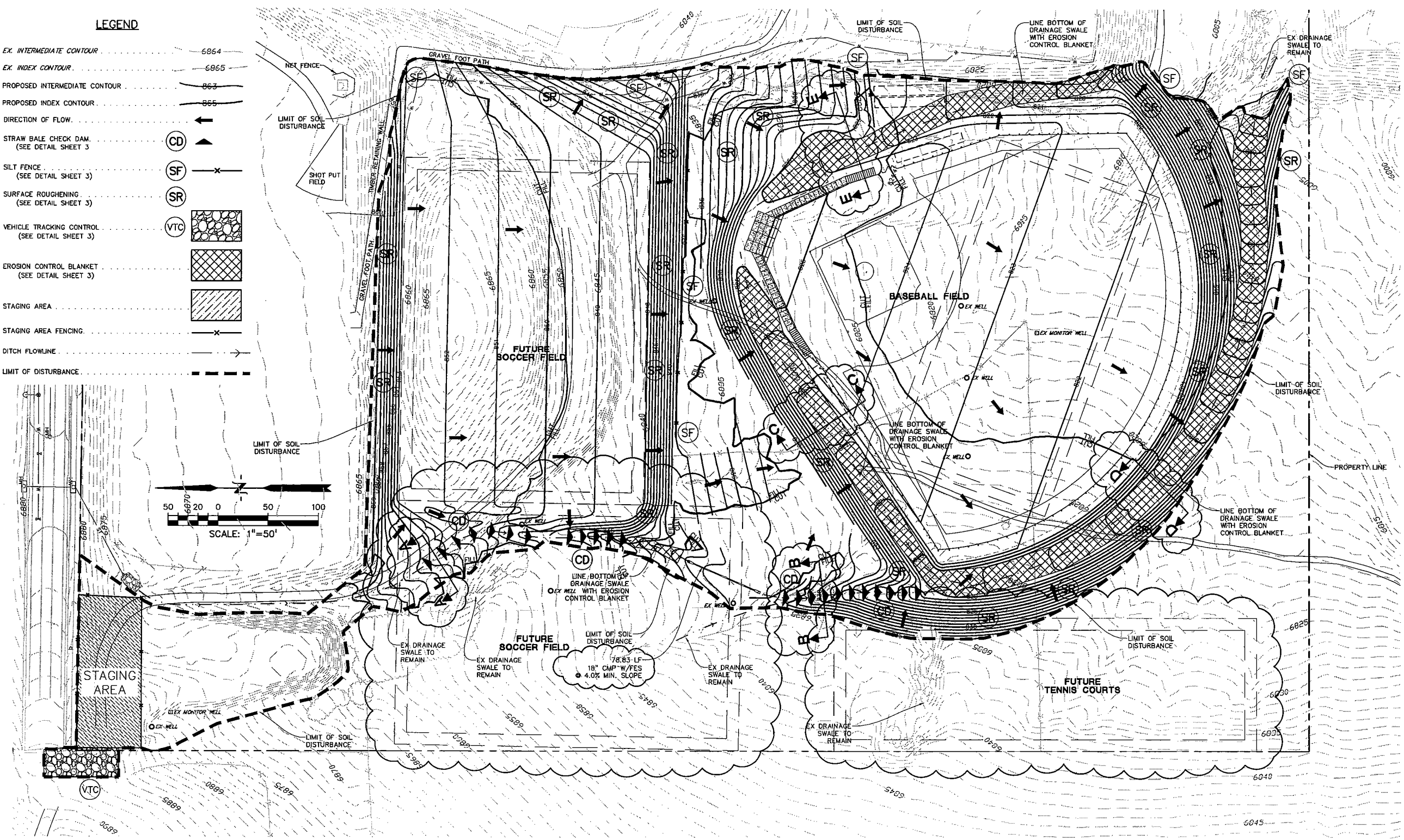
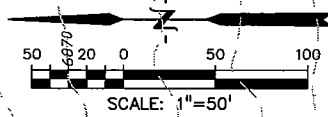
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**DRNG**

SHEET: 1 OF 1

**LEGEND**

- EX. INTERMEDIATE CONTOUR ..... 6864
- EX. INDEX CONTOUR ..... 6865
- PROPOSED INTERMEDIATE CONTOUR ..... 863
- PROPOSED INDEX CONTOUR ..... 865
- DIRECTION OF FLOW ..... ←
- STRAW BALE CHECK DAM (SEE DETAIL SHEET 3) ..... (CD) ▲
- SILT FENCE (SEE DETAIL SHEET 3) ..... (SF) — x —
- SURFACE ROUGHENING (SEE DETAIL SHEET 3) ..... (SR) [Cross-hatch pattern]
- VEHICLE TRACKING CONTROL (SEE DETAIL SHEET 3) ..... (VTC) [Stippled pattern]
- EROSION CONTROL BLANKET (SEE DETAIL SHEET 3) ..... [Grid pattern]
- STAGING AREA ..... [Diagonal line pattern]
- STAGING AREA FENCING ..... — x —
- DITCH FLOWLINE ..... —>—
- LIMIT OF DISTURBANCE ..... - - - - -



NOTE:  
 1. SEE LANDSCAPE ARCHITECT PLAN FOR ALL EXISTING VEGETATED AREAS TO REMAIN UNDISTURBED. SEE PLAN FOR SEEDING OF AREAS TO BE REVEGETATED.  
 2. DISTURBED AREA DOES NOT FALL IN A 100-YR FLOOD PLAIN  
 3. SOIL TYPES IN THE CONSTRUCTION AREA ARE PRIMARILY OF THE HYDROLOGIC GROUP A AS SHOWN IN THE S.C.S. MAPPING OF "SOILS SURVEY OF EL PASO COUNTY AREA."  
 4. STAGING AREA TO CONTAIN PETROLEUM STORAGE, SPILL CLEAN UP KITS, TRASH DUMPSTERS, SANITARY FACILITIES, FIELD OFFICE, CONCRETE WASHOUT, AND MATERIAL STORAGE.  
 5. CONTRACTOR TO DETERMINE LOCATION OF SOIL STOCKPILES, EQUIPMENT STORAGE, MATERIALS AND TEMPORARY DISPOSAL AREAS.  
 6. ESTIMATED COST OF TEMPORARY AND PERMANENT BMP'S INCLUDING INSTALLATION AND MAINTENANCE UNTIL FINAL STABILIZATION IS \$6,083.

PREPARED BY:

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 Engineers - Surveyors  
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 COLORADO SPRINGS, CO 80905  
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 STEAMBOAT SPRINGS

OWNER/DEVELOPER:

**FALCON SCHOOL DISTRICT 49**

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 909 E. 68TH AVE.  
 DENVER, CO 80229  
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CONSTRUCTION DOCUMENTS FOR:  
**VISTA RIDGE BASEBALL FIELD**  
 VISTA RIDGE HIGH SCHOOL BASEBALL FIELD  
 6888 BLACK FOREST ROAD  
 COLORADO SPRINGS, COLORADO

ISSUE	DATE
50% DD SET	2/14/2011
95% CD SET	3/2/2011
PLAN REVISION	3/14/2011
SWALE DETAILS	3/22/2011
PLAN REVISION	3/29/2011
CITY COMMENTS	4/18/2011

DESIGNED BY: MTM  
 DRAWN BY: MTM  
 CHECKED BY: AMP  
 FILE NAME: EC02

DRAWING SCALE:  
 HORIZONTAL: 1" = 50"  
 VERTICAL: N/A

**EROSION CONTROL AND STORM WATER QUALITY PLAN**

PROJ NO. 20252-00  
 DRAWING NO.

**C2**

SHEET: 2 OF 3



NOT VALID WITHOUT ORIGINAL SIGNATURE AND DATE



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

H:\20252-00\SCV\Plans\Sheets\EC02.dwg, 4/18/2011 4:18:48 PM, 1:2, Drexel, Barrell & Co., .mp

# D-49 HIGH SCHOOL NO. 3 COLORADO SPRINGS, COLORADO DRAINAGE MAP-FINAL BUILD-OUT JUNE 2007

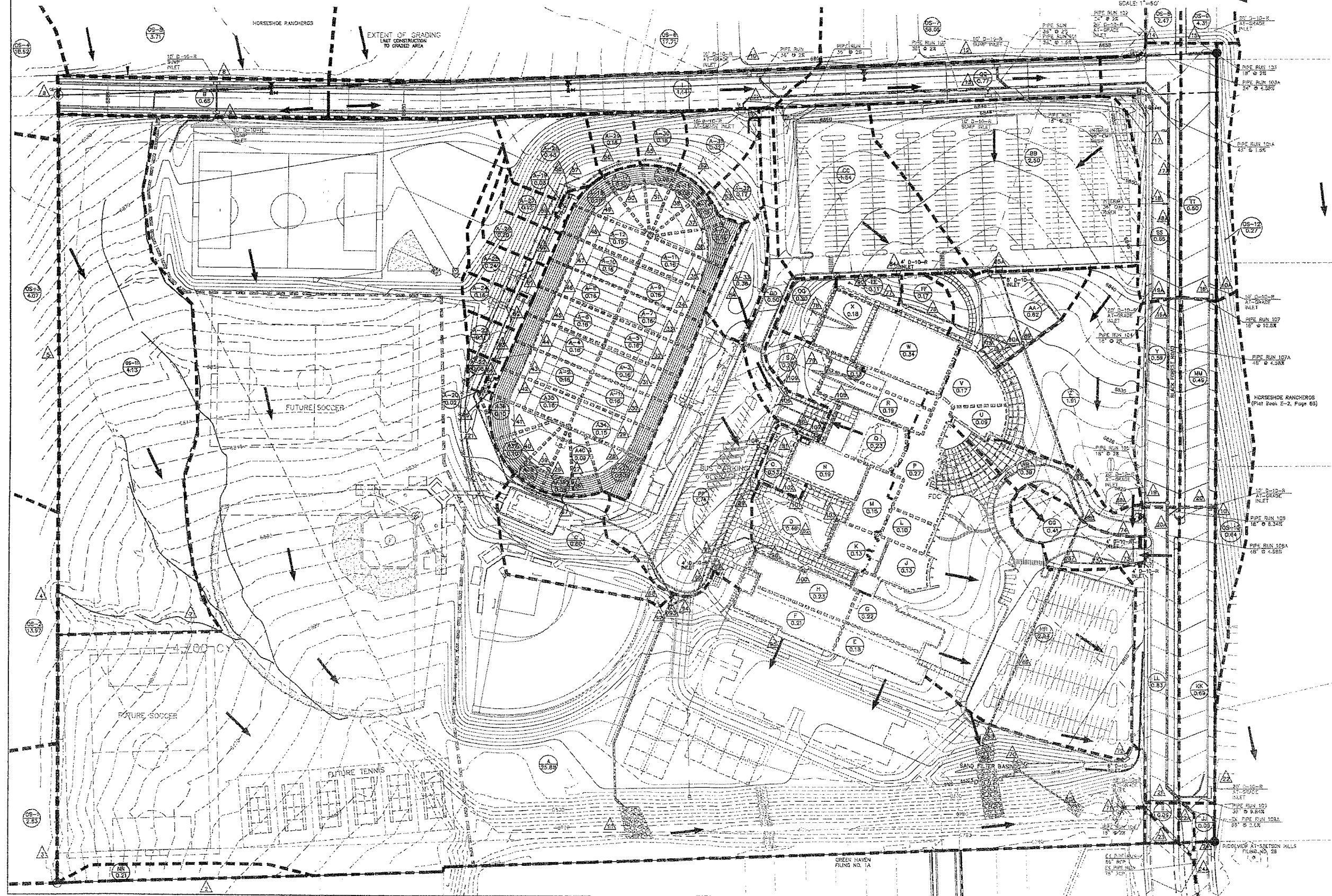
SCALE: 1"=50'

N

60' 0" 60' 0" 120' 0"

LEGEND

- BENCH MARK (AS SHOWN IN BASH 140)
- DESIGN POST
- BASH BOUNDARY
- PROPOSED WASH LINE (MIN)
- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- DIRECTION OF FLOW



UNLESS OTHERWISE SPECIFIED, ALL INFORMATION ON THIS DRAWING IS THE PROPERTY OF THE ENGINEER AND SHALL BE KEPT CONFIDENTIAL AND NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER.

PREPARED FOR:  
**FALCON SCHOOL DISTRICT 49**  
ATTN: HENRY REITWESNER  
10850 E. WOODMEN ROAD  
FALCON, CO. 80831  
719-485-1004

DESIGNED BY: [Name]  
CHECKED BY: [Name]  
DATE: [Date]

D-49 HIGH SCHOOL NO. 3