MASTER DEVELOPMENT DRAINAGE PLAN PATRIOT PARK

for

PATRIOT PARK, LLC

Contact: George Swintz
COPT
101 N. Cascade Ave. Suite 200
Colorado Springs, CO 80903
(719) 228-3611

by

Reese M. Lundgren, P.E. No. 35730

Nolte Associates, Inc.
5225 North Academy Blvd., Suite 304
Colorado Springs, Colorado 80918
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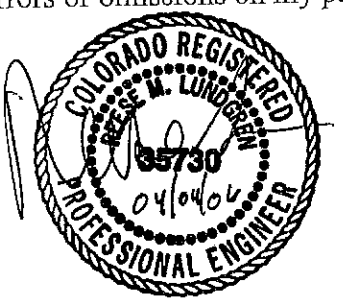
May 2005
Revised *March* 2006

Drainage Plan Statements

Engineers 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.

Reese M. Lundgren, P.E. Colorado
Nolte Associates, Inc.



04/04/06
Date

Developers Statement

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

Business Name: Patriot Park, LLC

George Swintz

4/4/06
Date

City of Colorado Springs

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

City Engineer

Date 4/4/06

TABLE OF CONTENTS

GENERAL LOCATION AND DESCRIPTION

Location

Patriot Park is located in a portion of Section 12, Township 14 South, Range 66 West of the Sixth Principal Meridian, El Paso County, Colorado. The major streets leading to the proposed development are Galley Road to the north, Powers Boulevard to the East and Platte Avenue to the south. (see vicinity map, page 2).

Description of Property

Patriot Park is approximately 64.87 acres in size and is adjacent to Science Park Subdivision No. 1 to the north, Powers Boulevard to east, Platte Avenue to the south, and approximately 300-400 feet of undeveloped property and the main stem of Sand Creek to the west. The entire site lies within the Sand Creek Basin. Historically, stormwater flows from the northeast to the southwest and eventually into Sand Creek at the southwest corner of the property. Patriot Park will be developed into ±8 "Defense" oriented office buildings with associated parking and "force protection" buffers. This land use is consistent with those used in the Sand Creek Drainage Basin Planning Study.

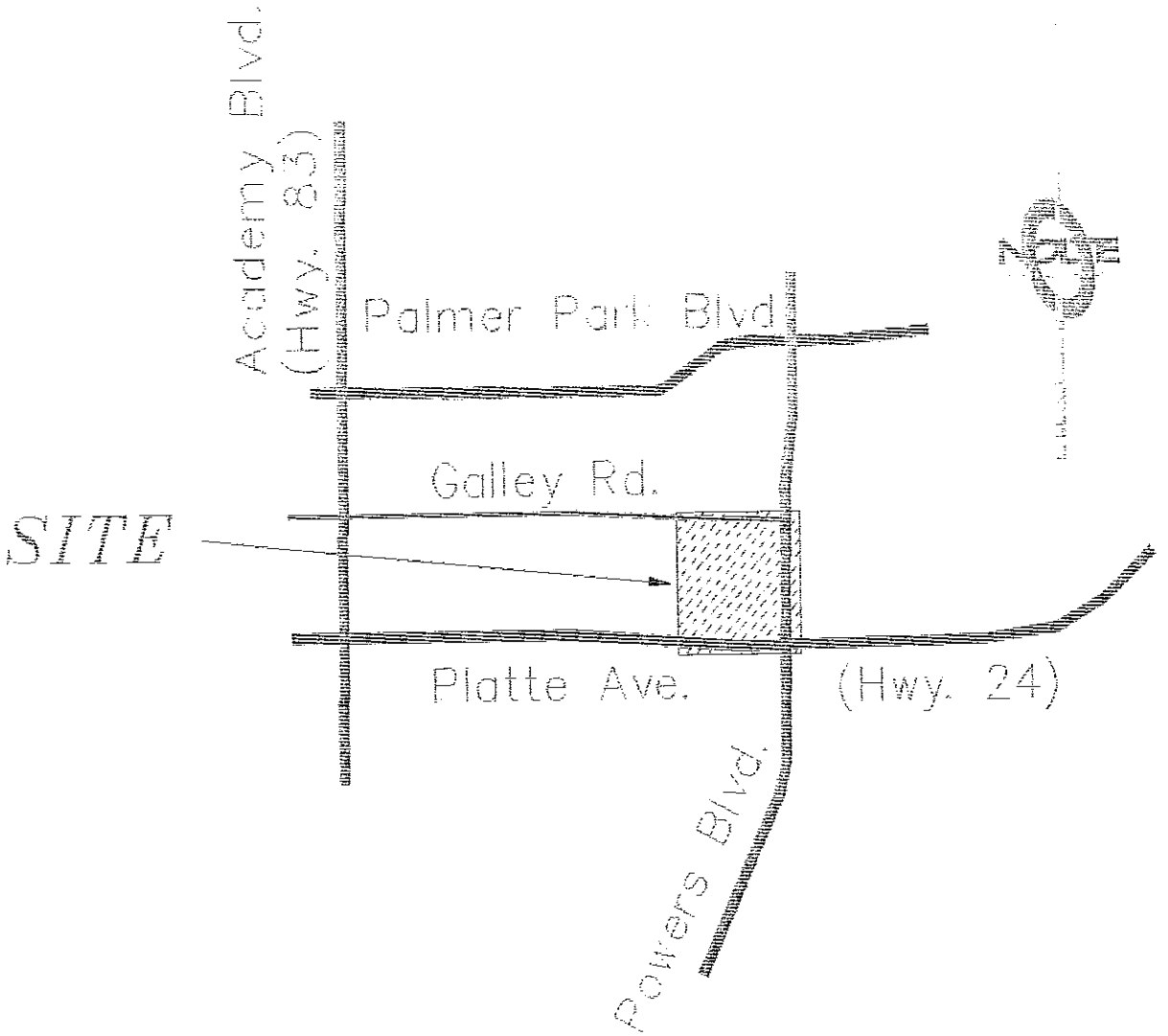
Soil type within the site was taken from the *Soil Survey of El Paso County Area, Colorado*). The average soil condition reflects Hydrologic Group "B" (Truckton 96, Blendon 10, and Bresser 11) with slow surface runoff (see Appendix).

DRAINAGE CONDITIONS

Existing Conditions

Currently, the site predominantly drains from the northeast to the southwest and south towards Sand Creek or into the roadside ditch along the west side of Powers Boulevard and north side of Platte Avenue, which ultimately outfalls to the west into Sand Creek at the southwest corner of the property. Slopes on the site range from 1- 5%.

Drainage flows from Science Park Filing No.1, Phase 1 (labeled OS-3 on drainage map) generally flow to the south and west into Technology Court, which is north of the Patriot Park, then west in the existing street and into Sand Creek via a existing swale. This area produces a Q_5 / Q_{100} of 10.6 / 22.4 cubic feet per second (cfs) (DP 18) which will continue to follow its current flow path with the construction of Patriot Park.


Academy Blvd.
(Hwy. 83)
Palmer Park Blvd.
Galley Rd.
SITE
Platte Ave.
(Hwy. 24)
Powers Blvd.

Drainage from Science Park Filing No.1, Phase 2 (labeled OS-1 on drainage map) flows to the south and west and outfalls directly into the proposed road at the north end of Patriot Park. The existing Q_5 / Q_{100} of 13.5 / 27.2 cfs (DP 1) will be accounted for in the public storm system to be constructed with Patriot Park and passed through the site.

The offsite area that borders Patriot Park on the east and south (the area between Patriot Park and Powers Boulevard/Platte Avenue) currently drains to the south into a roadside ditch along Platte Avenue, then west into Sand Creek. There is an existing 4' X 8' concrete box culvert oriented north to south under Platte Avenue just west of Powers; however, this culvert is partially plugged, allowing minimal flows through. This area produces a Q_5 / Q_{100} of 3.9 / 9.7 cfs (DP 16) which will continue to follow its existing flow path and drain un-detained into Sand Creek via the proposed 36" culvert under Space Center Drive.

Proposed Conditions

Per the approved Concept Plan, the development of Patriot Park will result in ±8 lots containing defense related office buildings. The public road to be constructed through the site (Space Center Drive) will contain the public storm drain system sized to accommodate the 100-year rainfall event. As development continues, each lot will be graded to allow drainage to flow towards the public street and be collected in a series of inlets, then piped to the south. The proposed public storm drain system on Space Center Drive has the capacity to accept all of the developed flows from each lot; however, each lot has the option of creating an on-site storm drainage system and connecting that system to the proposed storm drain system on Space Center Drive. There will be no developed runoff flowing from lot to lot. Flows will outlet into the proposed water quality pond before being released into Sand Creek.

As previously stated, offsite flows from Science Park Filing 1 Phase 1 will continue to drain to Technology Court and discharge to Sand Creek north of Patriot Park. Drainage from Science Park Filing 1 Phase 2 will outfall onto the north end of Space Center Drive, be collected in the public storm drain system, and passed through the site. The drainage generated along the east and south boundary of Patriot Park will flow to the south and west in roadside ditch along Powers and Platte, and outfall to Sand Creek via the proposed 36" culvert under Space Center Drive.

Sand Creek Improvements

Concurrent with this MDDP for Patriot Park, Matrix Design Group, Inc. is preparing a Final Drainage Report for Sand Creek Channel Improvements at Platte Avenue. Matrix's report will analyze the stretch of Sand Creek between Galley Road and Platte Avenue and recommend channel improvements for that stretch. Preliminary design data from Matrix indicates that 6 drop structures with bank stabilization will be ultimately required for the Stretch of Sand Creek from Galley Road to Platte Avenue. With the construction of Patriot Park, the two drop structures north of Platte Avenue and the associated bank stabilization will be built. Matrix's findings are consistent with the recommendations outlined in the Sand Creek Basin Planning Study Preliminary Design Report.

DRAINAGE DESIGN CRITERIA

Hydrologic Criteria

Hydrologic calculations have been performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. The Modified Rational Method was used to estimate the peak stormwater runoff from each assumed basin. Composite Impervious and "C" factors were determined based on the land use areas shown in the approved concept plan. The onsite C_{100}/C_5 were calculated to be 0.67/0.55 with an average Impervious Percentage of 0.74. As the individual lots are developed, the land use will be evaluated in the lot specific Preliminary/Final Drainage Report for the lot and any deviation will have to be accounted for.

Hydraulic Conditions

The public storm drain system was designed and analyzed using Stormcad based upon the hydrologic conditions calculated above. A copy of the Stormcad Schematic and a summary of the calculations are included in the appendix.

DRAINAGE FACILITY DESIGN

Stormwater Quality

A centrally located private stormwater quality pond has been designed for this site to adhere to the City of Colorado Springs Stormwater Quality requirements. The size of the

pond was based upon the assumptions made in the Hydrologic Criteria of this report. The required volume was calculated to be 1.9 ac-ft. A pond has been designed to accommodate this volume and is located as shown on the drainage plan included in the appendix. The pond was designed as an extended detention basin with an orifice plate release designed to drain the pond in 40hrs. During the 100 year event, the peak flow into the pond is approximately 303.8 cfs, with the 40 hr release rate of the pond being 0.57 cfs. The 1.9 acre-ft volume is achieved at a pond depth of 4.0 ft. The pond overflows through the grate of the modified type "D" inlet at a pond depth of 4.5 ft, and the emergency overflow through hardened weir into Sand Creek occurs at a pond depth of 5 ft. The 100 yr outflow rate is 303.8 cfs when the pond reaches capacity and overflows. The outfall facility is a modified type "D" inlet that was designed to incorporate a water quality control orifice plate. The Matrix drop structure was designed to handle the required developed flows from the 54" outfall pipe from the Patriot Park Development. Erosion protection for the 54" outfall pipe was considered when the Matrix drop structure was designed. (See report by Matrix) The Matrix drop structure will be constructed prior to or concurrent with the Patriot Park water quality pond. Details for the construction of the pond and outlet structure are found in the construction plans for Patriot Park. As the Preliminary/Final Drainage reports for the individual lots are developed, deviations from the assumptions made in this MDDP will have to be accounted for on a per lot basis.

Maintenance

The proposed public storm sewer pipes within the public R.O.W. or public improvement easement of Space Center Drive will be owned and maintained by the City of Colorado Springs, while the water quality pond will be owned and maintained by Patriot Park, LLC.

Floodplain Statement

A small portion of this site is located within the floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C 0751F, 290F with effective dates March 17, 1997. With Matrix Design Group Inc's Final Drainage Report for Sand Creek Channel Improvements, the floodplain limits will change. The public channel improvements will be dedicated to the city and then no portion of this site will be within the floodplain. (See report by Matrix)

Drainage and Bridge Fees

Per the approved DBPS for the Sand Creek Drainage Basin, only major systems included in the DBPS are reimbursable thru the drainage basin funds. The fees are as follows:

Drainage Fees:		
$8,133/acre x 64.87 acres		$527,588.00
Pond Fees:		
Land		
$734/acre x 64.87 acres		$ 47,615.00
Facilities		
$1,788/acre x 64.87 acres		$115,988.00
Bridge:		
$511/acre x 64.87 acres		$ 33,149.00
	TOTAL	**$724,340.00**

Construction Cost Opinion

Quantities and costs were evaluated for the major systems that will be required for the proposed Master Plan for Patriot Park.

Public Storm Drain System

DESCRIPTION	QUANTITY	UNIT COST	COST
60" RCP	175 LF	$125.00	$21,875.00
54" RCP	250 LF	$110.00	$27,500.00
48" RCP	1085 LF	$90.00	$97,650.00
36" RCP	285 LF	$70.00	$19,950.00
30" RCP	220 LF	$50.00	$11,000.00
24" RCP	155 LF	$45.00	$ 6,975.00
18" RCP	120 LF	$40.00	$ 4,800.00
10' TYPE 'R' INLET	12	$5,000.00	$60,000.00
MANHOLES	14	$2,500.00	$35,000.00
		TOTAL	**$284,750.00**

Water Quality Facility

DESCRIPTION	QUANTITY	UNIT COST	COST
Type 'D' Inlet Modified	1	$8,000.00	$8,000.00
54" RCP	65 LF	$110.00	$7,150.00
54" FES	1 EA	$2,000.00	$2,000.00
		TOTAL	**$17,150.00**

Nolte Associates cannot and does not guarantee that the construction costs will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

SUMMARY

Upon development of the individual lots within this development, a Preliminary/Final Drainage report will require using the Rational Method per the City/County Drainage Criteria Manual. Differences between the assumptions made in this MDDP and the individual reports will be accounted for on a per lot basis. Development of this site will not have any detrimental impacts on adjacent properties. Stormwater flows from this site are collected in a public storm system, and safely conveyed to the proposed water quality pond before release to Sand Creek.

REFERENCES

1. City of Colorado Springs & El Paso County Storm Drainage Criteria Manual, revised October 1994.

2. City of Colorado Springs & El Paso County Storm Drainage Criteria Manual, Volume II, November 2002.

3. Sand Creek Drainage Basin Planning Study, Colorado Springs, Kiowa Engineering Corporation, July 1996.

4. Science Park Subdivision No. 1 Master Drainage Plan and Report, R. Kieth Hook & Associates, May 1984

5. Soil Survey of El Paso County Area, Colorado. United States Department of Agriculture Soil Conservation Service, June 1981

6. Final Drainage Report for Sand Creek Channel Improvements at Platte Avenue, Matrix Design Group, INC, May 2005

APPENDIX

SOILS MAP
(S.C.S. SURVEY)

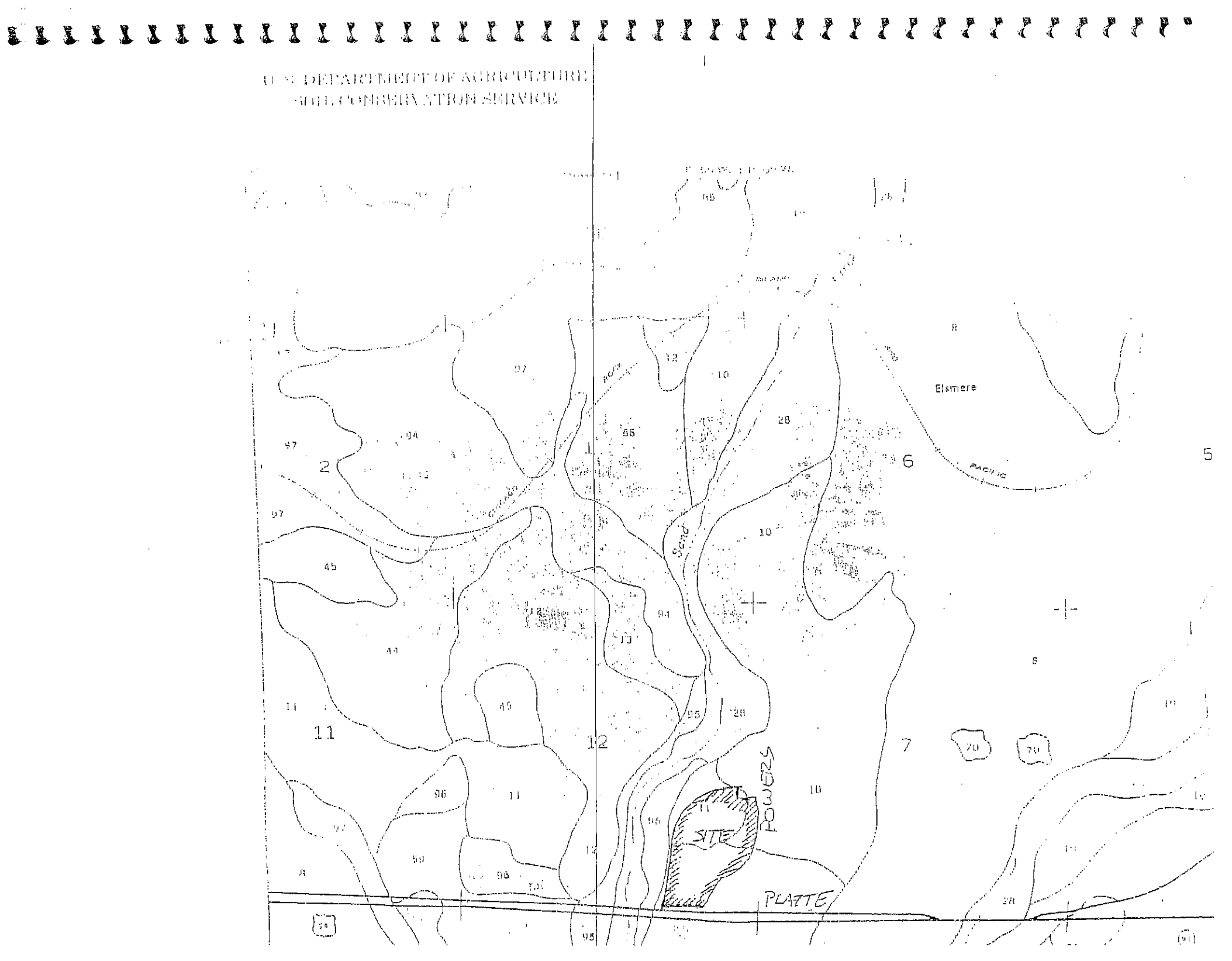

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Elsmere
Sand
POWERS
SITE
PLATTE

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See "flooding" in Glossary for definition of terms as "rare," "brief," and "very brief." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Alamosa: 1	C	Frequent	Brief	May-Jun	>60	---	High.
Ascalon: 2, 3	B	None	---	---	>60	---	Moderate.
Badland: 4	D	---	---	---	---	---	---
Bijou: 5, 6, 7	B	None	---	---	>60	---	Low.
Blakeland: 8	A	None	---	---	>60	---	Low.
9: Blakeland part	A	None	---	---	>60	---	Low.
Fluvaquentic Haplaquolls part	D	Common	Very brief	Mar-Aug	>60	---	High.
Blendon: 10	B	None	---	---	>60	---	Moderate.
Bresser: 11, 12, 13	B	None	---	---	>60	---	Low.
Brussett: 14, 15	B	None	---	---	>60	---	Moderate.
Chaseville: 16, 17	A	None	---	---	>60	---	Low.
18: Chaseville part	A	None	---	---	>60	---	Low.
Midway part	D	None	---	---	10-20	Rippable	Moderate.
Columbine: 19	A	None to rare	---	---	>60	---	Low.
Connerton: 20: Connerton part	B	None	---	---	>60	---	High.
Rock outcrop part	D	---	---	---	---	---	---
Cruckton: 21	B	None	---	---	>60	---	Moderate.
Cushman: 22, 23	C	None	---	---	20-40	Rippable	Moderate.
120: Cushman part	C	None	---	---	20-40	Rippable	Moderate.
Kutch part	C	None	---	---	20-40	Rippable	Moderate.
Elbeth: 25, 26	B	None	---	---	>60	---	Moderate.
127: Elbeth part	B	None	---	---	>60	---	Moderate.

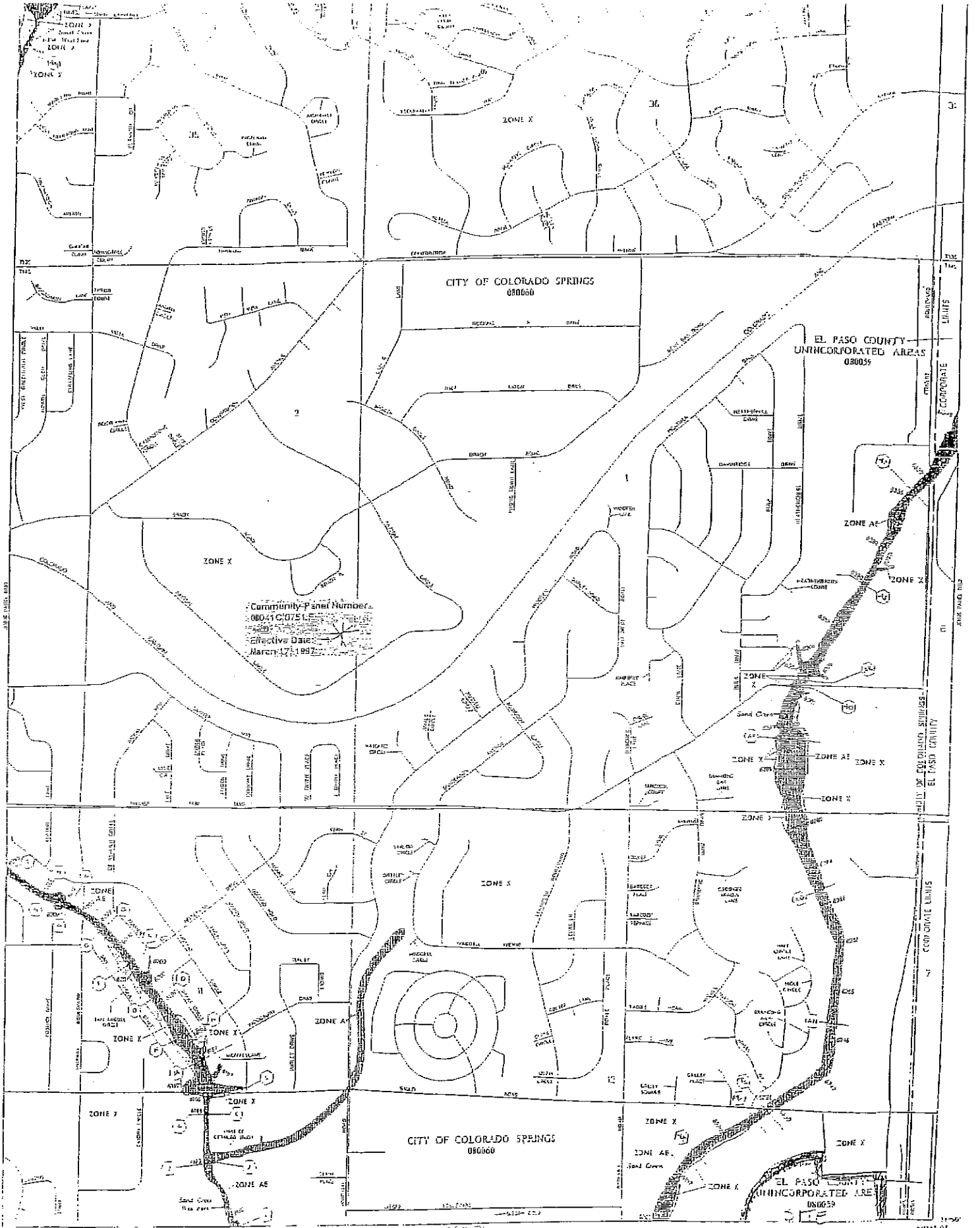
See footnote at end of table.

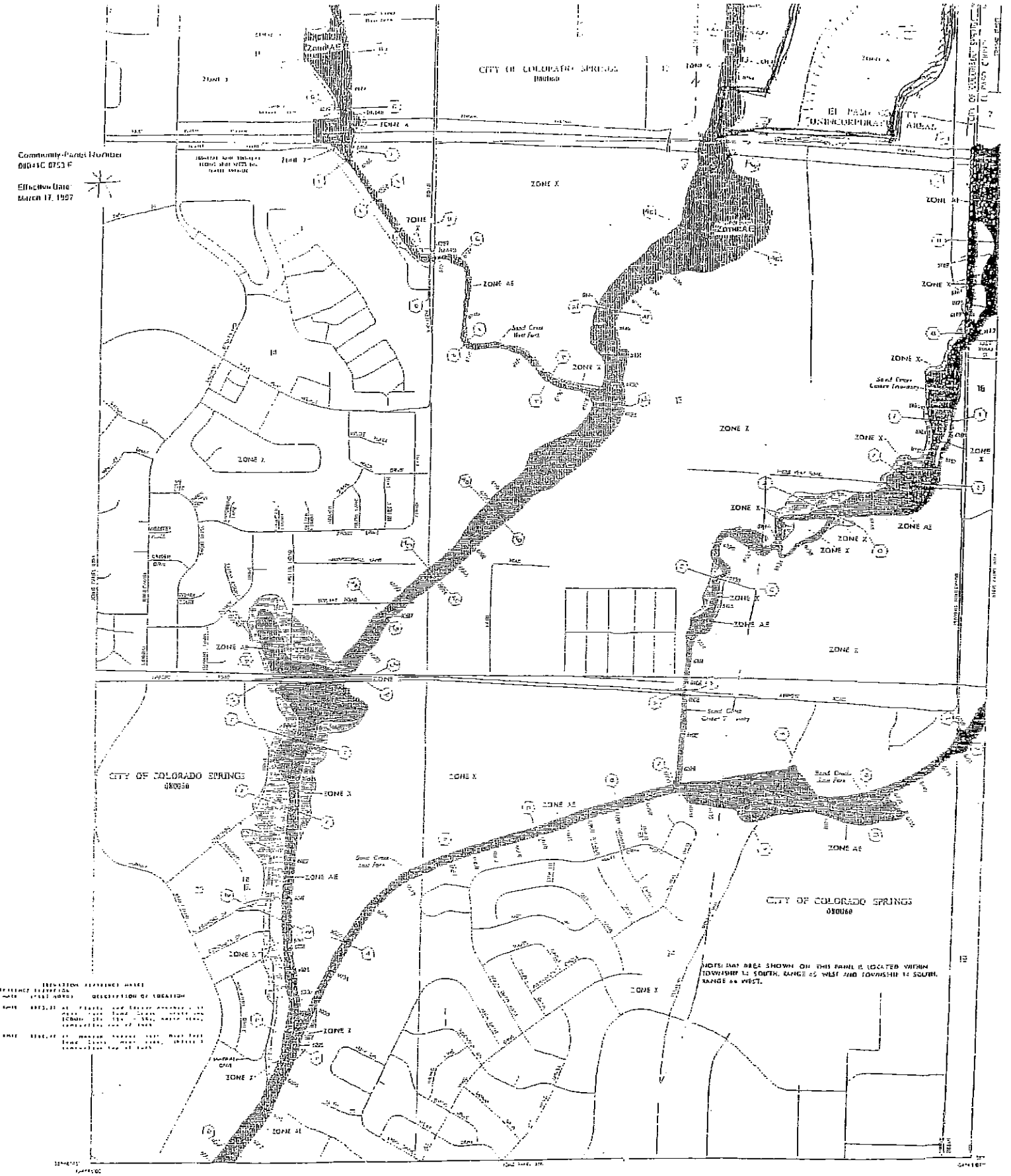
TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					in		
Tomah:							
192, 193:							
Tomah part-----	B	None----------	---	---	>60	---	Moderate.
Crowfoot part--	B	None----------	---	---	>60	---	Moderate.
Travessilla:							
194:							
Travessilla part----------	D	None----------	---	---	6-20	Hard	Low.
Rock outcrop part----------	D	---	---	---	---	---	---
Truckton:							
95, 96, 97-------	B	None----------	---	---	>60	---	Moderate.
198:							
Truckton part--	B	None----------	---	---	>60	---	Moderate.
Blakeland part-	A	None----------	---	---	>60	---	Low.
199, 1100:							
Truckton part--	B	None----------	---	---	>60	---	Moderate.
Bresser part---	B	None----------	---	---	>60	---	Low.
Ustic Torrifluvents:							
101----------	B	Occasional----	Very brief----	Mar-Aug	>60	---	Moderate.
Valent:							
102, 103---------	A	None----------	---	---	>60	---	Low.
Vona:							
104, 105---------	B	None----------	---	---	>60	---	Moderate.
Wiggon:							
106----------	A	None----------	---	---	>60	---	Low.
Wiley:							
107, 108---------	B	None----------	---	---	>60	---	Low.
Yoder:							
109, 110---------	B	None----------	---	---	>60	---	Low.

1This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

FEMA MAP


CITY OF COLORADO SPRINGS
080060
EL PASO COUNTY
UNINCORPORATED AREAS
080059
Community-Panel Number
080041C0751E
Effective Date:
March 17, 1997
ZONE X
ZONE AE
ZONE A
ZONE X
CITY OF COLORADO SPRINGS
080060
EL PASO COUNTY
UNINCORPORATED AREAS
080059


Community-Panel Number
080116 0753 F
Effective Date
March 17, 1997
CITY OF COLORADO SPRINGS
080060
EL PASO COUNTY
UNINCORPORATED AREAS
080059
ZONE X
ZONE AE
ZONE A
Sand Creek
Sand Creek Tributary
Sand Creek East Fork
NOTE: THIS AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST AND TOWNSHIP 14 SOUTH, RANGE 66 WEST.

HYDROLOGIC CALCULATIONS

COMPOSITE IMPERVIOUS AND "C" FACTORS

LOCATION: Patriot Park

DATE: 10/3/2005

BASIN DESIGNATION	AREAS (ACRES) GREEN BELTS	ROOFS	SCHOOLS	ROADS	POND	TOTAL
A	1.31	0.58	0.00	3.35	0.00	5.24
B	1.41	0.70	0.00	4.50	0.00	6.61
C	1.50	0.66	0.00	3.85	0.00	6.01
D	1.51	0.70	0.00	4.00	0.00	6.21
E	1.99	0.90	0.00	5.26	0.00	8.15
F	1.44	0.65	0.00	3.79	0.00	5.88
G	1.32	0.62	0.00	3.58	0.00	5.52
H	1.42	0.55	0.00	3.17	0.00	5.14
I	0.57	0.30	0.00	1.73	0.00	2.60
J	0.50	0.29	0.00	1.50	0.00	2.29
K	1.50	0.87	0.00	4.90	0.00	7.27
L	0.92	0.65	0.00	0.28	0.00	1.85
M	1.61	0.00	0.00	0.00	0.72	2.33
[illegible]	0.49	0.66	0.00	3.08	0.00	4.23
[illegible]	1.78	0.46	0.00	1.98	0.00	4.22
[illegible]	0.85	0.76	0.00	2.77	0.00	4.38

BASIN DESIGNATION	IMPERVIOUS PERCENTAGE GREEN-BELTS	ROOFS	SCHOOLS	ROADS	POND	COMPOSITE IMPERVIOUS FACTOR	C FACTOR (Table RO-5) 5 YR C&D	5 YR A	5 YR B	100 YR C&D	100 YR A	100 YR B
A	0.02	0.90	0.50	1.00	1.00	0.74	0.57	0.50	0.53	0.70	0.60	0.65
B	0.02	0.90	0.50	1.00	1.00	0.78	0.61	0.54	0.57	0.73	0.64	0.69
C	0.02	0.90	0.50	1.00	1.00	0.74	0.57	0.50	0.53	0.70	0.60	0.65
D	0.02	0.90	0.50	1.00	1.00	0.76	0.59	0.52	0.55	0.72	0.62	0.67
E	0.02	0.90	0.50	1.00	1.00	0.75	0.58	0.50	0.54	0.71	0.61	0.66
F	0.02	0.90	0.50	1.00	1.00	0.75	0.57	0.50	0.54	0.71	0.61	0.66
G	0.02	0.90	0.50	1.00	1.00	0.75	0.58	0.51	0.54	0.71	0.61	0.66
H	0.02	0.90	0.50	1.00	1.00	0.72	0.55	0.47	0.51	0.69	0.58	0.63
I	0.02	0.90	0.50	1.00	1.00	0.77	0.60	0.53	0.56	0.72	0.63	0.68
J	0.02	0.90	0.50	1.00	1.00	0.85	0.68	0.63	0.66	0.79	0.72	0.75
K	0.02	0.90	0.50	1.00	1.00	0.79	0.61	0.55	0.58	0.73	0.64	0.69
L	0.02	0.90	0.50	1.00	1.00	0.93	0.79	0.76	0.77	0.87	0.83	0.85
M	0.02	0.90	0.50	1.00	1.00	0.32	0.31	0.20	0.26	0.57	0.38	0.49
[illegible]	0.02	0.90	0.50	1.00	1.00	0.87	0.71	0.65	0.68	0.80	0.74	0.77
[illegible]	0.02	0.90	0.50	1.00	1.00	0.58	0.44	0.35	0.40	0.62	0.48	0.55
[illegible]	0.02	0.90	0.50	1.00	1.00	0.79	0.62	0.55	0.59	0.74	0.65	0.69

TIME OF CONCENTRATION

LOCATION: Patriot Park — Preliminary/Final — BY: RML — DATE: 10/3/2005

SUB-BASIN DATA			INIT./OVERLAND TIME (Ti)			TRAVEL TIME (Tt)										TOTAL	Tc Check (Urbanized Basins		FINAL Tc	REMARKS
DESIGNATION	C5	AREA (AC)	LENGTH (FT)	SLOPE %	Ti (Min.)*	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	Ti+Tt(Min.)	LGTH. (FT)	Tc = (L/180) + 10	(minutes)	FORMULAS: * Ti = 1.8 (1.1-C5)L^0.5/S^1/3 ** V=10^(.5 log(S/100)+k where k=1.18 for grassed waterways and 1.3 for gutter flow
A	0.53	5.23	50	2.00	5.72	PAVED	900	2.00	2.02	5.32						11.0	950.00	15.3	11	
B	0.57	6.61	50	2.00	5.33	PAVED	1000	2.00	2.02	5.81						11.2	1050.00	15.8	11	
C	0.53	6.01	50	2.00	5.72	PAVED	900	2.00	2.02	5.61						11.3	1000.00	15.6	11	
D	0.55	6.21	50	2.00	5.52	PAVED	900	2.00	2.02	5.32						10.8	950.00	15.3	11	
E	0.54	8.13	50	2.00	5.66	PAVED	1200	2.00	2.02	7.09						12.7	1250.00	16.9	13	
F	0.54	5.88	50	2.00	5.67	PAVED	600	2.00	2.02	4.73						10.4	850.00	14.7	10	
G	0.54	5.52	50	2.00	5.61	PAVED	500	3.00	2.02	2.95						8.6	550.00	13.1	9	
H	0.51	5.14	50	2.00	5.97	PAVED	750	2.00	2.02	4.43						10.4	800.00	14.4	10	
I	0.56	2.60	50	2.00	5.41	PAVED	550	2.00	2.02	3.25						8.7	600.00	13.3	9	
J	0.66	2.29	50	2.00	4.48	PAVED	580	2.00	2.02	3.48						8.0	640.00	13.6	8	
K	0.58	7.27	50	2.00	5.27	PAVED	1100	2.00	2.02	6.50						11.8	1150.00	16.4	12	
L	0.77	0.35	15	2.00	1.81	PAVED	510	1.00	2.00	4.30						6.1	525.00	12.9	5	
M	0.26	2.33	50	2.00	8.48	PAVED	500	2.00	2.02	3.01						11.5	610.00	13.4	12	
OS-1	0.68	4.23	50	2.00	4.20	PAVED	434	2.00	2.02	2.56						6.8	484.00	12.7	7	
OS 2	0.40	4.22	50	2.00	7.12	GRASS	3072	2.00	2.14	28.09						35.7	3722.00	30.7	31	
OS 3	0.59	4.38	50	2.00	5.20	PAVED	720	2.00	2.02	4.25						9.4	770.00	14.3	9	

HYDRAULIC CALCULATIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

DESIGN STORM: 5-YEAR DEVELOPED

Calc. by: RML
Chk'd by: JDR
Date: 3/31/2006

LOCATION: Patriot Park — Preliminary/Final — City of Colorado Springs

STATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
		BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./ hr.)	Q (cfs)	Sum AREA	Sum Tc (min.)	I (in./hr.)	Sum CA	Total Q (cfs)	
	2	A	5.23	0.53	11	2.79	3.90	10.9						10' TYPE "R" INLET ON GRADE
	3	B	6.61	0.57	11	3.78	3.87	14.6	10.84	11	3.87	8.53	33.03	10' TYPE "R" INLET ON GRADE & SUM OF DP 1 & DP3
	4	C	6.01	0.53	11	3.21	3.86	12.4						10' TYPE "R" INLET ON GRADE
	5	D	6.21	0.55	11	3.43	3.93	13.5						10' TYPE "R" INLET ON GRADE
	6	E	8.13	0.54	13	4.39	3.67	16.1						10' TYPE "R" INLET ON GRADE
	7	F	5.88	0.54	10	3.17	4.00	12.7						10' TYPE "R" INLET ON GRADE
	9	G	5.52	0.54	9	3.00	4.30	12.9						10' TYPE "R" INLET ON GRADE
	8	H	5.14	0.51	10	2.62	4.00	10.4						10' TYPE "R" INLET ON GRADE
	13	I	2.60	0.56	9	1.46	4.29	6.3						10' TYPE "R" INLET IN SAG
	11	J	2.29	0.66	8	1.50	4.42	6.6						10' TYPE "R" INLET ON GRADE
	10	K	7.27	0.58	12	4.20	3.80	16.0						10' TYPE "R" INLET ON GRADE
	12	L	0.35	0.77	6	0.27	4.82	1.3						10' TYPE "R" INLET IN SAG
	15	M	2.87	0.23	12	0.66	3.75	2.5	68.33	12	3.75	57.25	214.95	10' TYPE "R" INLET ON GRADE & SUM OF DP 1 - DP14
	14								2.95	9	4.23	1.73	7.33	SUM OF DP12 & DP13
	17								62.51	13	3.64	34.98	127.20	SUM DP1 - DP11
	19												0.57	POND OUTFLOW (40 HR RELEASE)
	1	OS-1	4.23	0.68	7	2.90	4.66	13.5						
	16	OS-2	4.22	0.40	31	1.67	2.32	3.9						ONTO SITE FROM SCIENCE PARK
	18	OS-3	4.38	0.59	9	2.56	4.15	10.6						OFFSITE TO SAND CREEK VIA 30"
														SCIENCE PARK OFFSITE TO SAND CR

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

DESIGN STORM: 100-YEAR DEVELOPED

Calc. by: RML
Chk'd by: JDR
Date: 3/31/2006

LOCATION: Patriot Park — Preliminary/Final — City of Colorado Springs

STATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
		BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./ hr.)	Q (cfs)	Sum AREA	Sum Tc (min.)	I (in./hr.)	Sum CA	Total Q (cfs)	
	2	A	5.23	0.65	11	3.41	6.94	23.7						10' TYPE "R" INLET ON GRADE
	3	B	6.61	0.68	11	4.51	6.89	31.1	10.84	11	6.95	7.79	54.1	10' TYPE "R" INLET ON GRADE & SUM OF DP 1 & DP3
	4	C	6.01	0.65	11	3.92	6.87	26.9						10' TYPE "R" INLET ON GRADE
	5	D	6.21	0.67	11	4.14	6.99	29.0						10' TYPE "R" INLET ON GRADE
	6	E	8.13	0.66	13	5.34	6.53	34.9						10' TYPE "R" INLET ON GRADE
	7	F	5.88	0.66	10	3.86	7.11	27.4						10' TYPE "R" INLET ON GRADE
	9	G	5.52	0.66	9	3.65	7.66	27.9						10' TYPE "R" INLET ON GRADE
	8	H	5.14	0.63	10	3.26	7.11	23.2						10' TYPE "R" INLET ON GRADE
	13	I	2.60	0.68	9	1.76	7.63	13.4						10' TYPE "R" INLET IN SAG
	11	J	2.29	0.75	8	1.72	7.86	13.5						10' TYPE "R" INLET ON GRADE
	10	K	7.27	0.69	12	5.00	6.76	33.8						10' TYPE "R" INLET ON GRADE
	12	L	0.35	0.85	6	0.30	8.58	2.6						10' TYPE "R" INLET IN SAG
	15	M	2.87	0.46	12	1.32	6.68	8.8	7.10	12	6.68	45.46	303.8	10' TYPE "R" INLET ON GRADE & SUM OF DP 1 - DP14
	14								2.95	9	7.52	2.05	15.44	SUM OF DP12 & DP13
	17								62.51	13	6.47	42.08	272.4	SUM DP1 - DP11
	19												0.57	POND OUTFLOW (40 HR RELEASE)
	1	OS-1	4.23	0.77	7	3.28	8.30	27.2						ONTO SITE FROM SCIENCE PARK
	16	OS-2	4.22	0.55	31	2.33	4.13	9.7						OFFSITE TO SAND CREEK VIA 30"
	18	OS-3	4.38	0.69	9	3.04	7.38	22.4						SCIENCE PARK OFFSITE TO SAND CR

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: RML
Company: Nolte Associates, Inc.
Date: April 25, 2005
Project: Patriot Park
Location: Colorado Springs, CO

1. Basin Storage Volume	
A) Tributary Area's Imperviousness Ratio (i = I_a / 100)	I_a = 75.00 % i = 0.75
B) Contributing Watershed Area (Area)	Area = 64.15 acres
C) Water Quality Capture Volume (WQCV) (WQCV =1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I))	WQCV = 0.30 watershed inches
D) Design Volume: Vol = (WQCV / 12) * Area * 1.2	Vol = 1.921 acre-feet
2. Outlet Works	
A) Outlet Type (Check One)	X Orifice Plate Perforated Riser Pipe Other:
B) Depth at Outlet Above Lowest Perforation (H)	H = 6.10 feet
C) Required Maximum Outlet Area per Row, (A_o)	A_o = 0.93 square inches
D) Perforation Dimensions **(enter one only)**: i) Circular Perforation Diameter **OR** ii) 2" Height Rectangular Perforation Width	D = 1.1000 inches, **OR** W = inches
E) Number of Columns (nc, See Table 6a-1 For Maximum)	nc = 1 number
F) Actual Design Outlet Area per Row (A_o)	A_o = 0.95 square inches
G) Number of Rows (nr)	nr = 18 number
H) Total Outlet Area (A_{ot})	A_{ot} = 17.39 square inches
3. Trash Rack	
A) Needed Open Area: A_t = 0.5 * (Figure 7 Value) * A_{ot}	A_t = 584 square inches
B) Type of Outlet Opening (Check One)	X ≤ 2" Diameter **Round** 2" High **Rectangular** Other:
C) For 2", or Smaller, **Round Opening** (Ref.: Figure 6a):	
i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1	W_{conc} = 12 inches
ii) Height of Trash Rack Screen (H_{TR})	H_{TR} = 97 inches

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Designer: RML
Company: Nolte Associates, Inc.
Date: April 25, 2005
Project: Patriot Park
Location: Colorado Springs, CO

iii) Type of Screen (Based on Depth H), Describe if "Other"	X S.S. #93 VEE Wire (US Filter) Other:
iv) Screen Opening Slot Dimension, Describe if "Other"	X 0.139" (US Filter) Other:
v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)	1.00 inches TE 0.074 in. x 0.50 in.
vi) Type and Size of Holding Frame (Ref.: Table 6a-2)	0.75 in. x 1.00 in. angle
D) For 2" High **Rectangular Opening** (Refer to Figure 6b):	
I) Width of Rectangular Opening (W)	W = ____ inches
ii) Width of Perforated Plate Opening (W_{conc} = W + 12")	W_{conc} = ____ inches
iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1	$W_{opening}$ = ____ inches
iv) Height of Trash Rack Screen (H_{TR})	H_{TR} = ____ inches
v) Type of Screen (based on depth H) (Describe if "Other")	Klemp™ KPP Series Aluminum Other:
vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"	inches Other:
vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)	

Scenario: Base

Report Output

Label	Upstream Node	Downstream Node	Length (ft)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (%)	Section Size	Material	Total Flow (cfs)	Full Capacity (cfs)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Average Velocity (ft/s)
P-1	SDMH-120	O-2	90.40	6,180.90	6,180.00	1.00	66 inch	Concrete	243.07	335.05	6,187.51	6,186.85	6,185.25	6,183.73	15.37
P-2	Bend-1	SDMH-120	82.60	6,181.31	6,180.90	0.50	66 inch	Concrete	235.43	236.58	6,189.22	6,188.81	6,187.69	6,187.29	9.91
P-3	SDMH-130	Bend-1	92.10	6,181.78	6,181.31	0.51	66 inch	Concrete	236.43	239.68	6,190.30	6,189.84	6,188.76	6,188.30	9.95
P-4	Bend-2	SDMH-130	82.60	6,183.11	6,182.28	1.00	60 inch	Concrete	237.17	261.06	6,192.63	6,191.95	6,190.37	6,189.68	12.08
P-5	SDMH-150	Bend-2	122.00	6,184.33	6,183.11	1.00	60 inch	Concrete	238.26	260.43	6,194.58	6,193.56	6,192.30	6,191.27	12.13
P-6	Bend-3	SDMH-150	97.00	6,186.77	6,184.83	2.00	54 inch	Concrete	189.32	278.09	6,197.23	6,196.33	6,195.03	6,194.13	11.90
P-7	SDMH-160	Bend-3	121.40	6,189.20	6,186.77	2.00	54 inch	Concrete	190.19	278.20	6,199.26	6,198.13	6,197.04	6,195.91	11.96
P-8	Bend-4	SDMH-160	100.50	6,191.21	6,189.20	2.00	54 inch	Concrete	190.91	278.09	6,202.01	6,201.06	6,199.77	6,198.82	12.00
P-9	SDMH-180	Bend-4	77.60	6,192.76	6,191.21	2.00	54 inch	Concrete	191.46	277.91	6,203.65	6,202.91	6,201.40	6,200.66	12.04
P-10	Bend-5	SDMH-180	73.30	6,193.87	6,192.77	1.50	54 inch	Concrete	171.89	240.89	6,205.58	6,205.02	6,203.76	6,203.20	10.81
P-11	SDMH-190	Bend-5	68.40	6,194.90	6,193.87	1.51	54 inch	Concrete	172.38	241.30	6,206.84	6,206.31	6,205.01	6,204.49	10.84
P-12	SDMH-200	SDMH-190	92.80	6,196.29	6,194.90	1.50	54 inch	Concrete	173.03	240.66	6,209.03	6,208.31	6,207.19	6,206.47	10.88
P-13	SDMH-210	SDMH-200	228.00	6,199.70	6,196.29	1.50	54 inch	Concrete	119.47	240.48	6,210.57	6,209.72	6,209.69	6,208.85	7.51
P-14	Bend-6	SDMH-210	85.10	6,201.48	6,200.20	1.50	48 inch	Concrete	119.94	176.16	6,212.14	6,211.54	6,210.72	6,210.13	9.54
P-15	SDMH-230	Bend-6	103.20	6,203.02	6,201.48	1.49	48 inch	Concrete	120.50	175.46	6,213.44	6,212.72	6,212.01	6,211.29	9.59
P-16	SDMH-240	SDMH-230	187.70	6,207.78	6,204.02	2.00	36 inch	Concrete	71.89	94.40	6,217.09	6,214.91	6,215.48	6,213.30	10.17
P-17	SDMH-250	SDMH-240	188.20	6,215.81	6,208.28	4.00	30 inch	Concrete	72.28	82.04	6,225.66	6,219.81	6,222.29	6,216.44	14.73
P-18	SDIN-11	SDMH-120	37.90	6,184.79	6,184.03	2.01	18 inch	Concrete	11.47	14.67	6,188.39	6,187.94	6,187.74	6,187.29	6.49
P-19	SDIN-9	SDMH-150	11.80	6,187.57	6,187.33	2.03	24 inch	Concrete	26.37	32.26	6,195.38	6,195.22	6,194.29	6,194.13	8.39
P-20	SDIN-10	SDMH-150	37.50	6,188.27	6,187.33	2.51	24 inch	Concrete	32.76	35.81	6,196.60	6,195.82	6,194.91	6,194.13	10.43
P-21	SDIN-8	SDMH-160	34.10	6,195.45	6,194.77	1.99	30 inch	Concrete	23.37	57.92	6,203.66	6,203.55	6,203.31	6,203.20	4.76
P-22	SDIN-6	SDMH-200	10.30	6,198.49	6,198.28	2.04	30 inch	Concrete	33.97	58.56	6,209.66	6,209.59	6,208.92	6,208.85	6.92
P-23	SDIN-7	SDMH-200	38.70	6,199.05	6,198.28	1.99	30 inch	Concrete	27.13	57.85	6,209.49	6,209.32	6,209.02	6,208.85	5.53
P-24	SDIN-4	SDMH-230	10.50	6,205.23	6,205.02	2.00	24 inch	Concrete	26.01	31.99	6,214.50	6,214.36	6,213.44	6,213.30	8.28
P-25	SDIN-5	SDMH-230	38.80	6,205.80	6,205.02	2.01	24 inch	Concrete	28.52	32.07	6,215.20	6,214.58	6,213.92	6,213.30	9.08
P-26	SDIN-2	SDMH-250	10.30	6,216.52	6,216.31	2.04	24 inch	Concrete	21.07	32.30	6,225.77	6,225.68	6,225.07	6,224.98	6.71
P-27	SDIN-3	SDMH-250	38.50	6,216.58	6,215.81	2.00	30 inch	Concrete	55.06	58.00	6,227.63	6,226.94	6,225.68	6,224.98	11.22
P-28	SDIN-12	O-1	32.80	6,181.88	6,180.00	5.73	18 inch	Concrete	14.95	25.15	6,185.78	6,185.11	6,184.66	6,184.00	8.46
P-29	SDMH-110	SDIN-12	10.20	6,182.04	6,181.88	1.57	18 inch	Concrete	12.86	13.16	6,186.64	6,186.49	6,185.82	6,185.66	7.28
P-30	SDIN-13	SDMH-110	38.50	6,182.69	6,182.04	1.69	18 inch	Concrete	12.90	13.65	6,187.35	6,186.77	6,186.52	6,185.94	7.30
P-35	I-13	O-3	186.60	6,184.00	6,176.00	4.29	30 inch	Concrete	12.28	84.92	6,185.63	6,179.00	6,185.18	6,176.64	12.31