MASTER DEVELOPMENT DRAINAGE PLAN
FOR
THE VILLAGES AT SAND CREEK

(TEXAS INSTRUMENTS SUBDIVISION)

JR Engineering, Ltd.

JR Engineering, Ltd.
4935 North 30th Street
Colorado Springs, Colorado 80919
(719) 593-2593 • FAX (719) 528-6613

6110 Greenwood Plaza Blvd.
Englewood, Colorado 80111
(303) 740-9393 • FAX (303) 721-9019

4812 South College Avenue
Fort Collins, Colorado 80525
(303) 282-4335 • FAX (303) 282-4340

MASTER DEVELOPMENT DRAINAGE PLAN
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April 1994

Prepared For:

SAND CREEK DEVELOPMENT, L.L.C.
1401 North Potter, Suite 201
Colorado Springs, CO 80909
(719) 598-2374

Prepared By:

JR ENGINEERING, LTD.
4935 North 30th Street
Colorado Springs, CO 80919
(719) 593-2593

Job No. 8631.00

MASTER DEVELOPMENT DRAINAGE PLAN
FOR THE VILLAGES AT SAND CREEK

DRAINAGE REPORT STATEMENT

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 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.

COLORADO REGISTERED JOSEPH W. DESJARDIN 24207 PROFESSIONAL ENGINEER

9.24.94

Joseph W. DesJardin, Colorado P.E. #24207 Date
For and On Behalf of JR Engineering, LLC

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: Sand Creek Development, L.L.C.

By: _____
Linda Clifford

Title: MANAGER

Address: 1401 North Potter, Suite 201

Colorado Springs, CO 80909

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

_____ 11/9/94
City Engineer Date

Conditions:

MASTER DEVELOPMENT DRAINAGE PLAN FOR THE VILLAGES AT SAND CREEK

TABLE OF CONTENTS

APPENDICES

MASTER DEVELOPMENT DRAINAGE PLAN FOR THE VILLAGES AT SAND CREEK

PURPOSE

This document is the Master Development Drainage Plan for the Villages at Sand Creek Subdivision. The purpose of this report is to identify major drainageways, culvert and inlet locations, and areas tributary to this site. This report will analyze routing for developed flows and the ability of existing facilities to handle these flows.

GENERAL DESCRIPTION

The Villages At Sand Creek Subdivision is located in Section 23 and 24, Township 14 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso. The site is bounded to the north by Airport Road, to the west by Sand Creek, to the south by the "East Fork" of Sand Creek, and to the east by the "Center Tributary" of Sand Creek.

Existing zoning of this property is PIP-2 and a zone change request to R1-6000 is currently being processed. Proposed use of this 140.899 acre site is a single-family residential development with a portion of the site being reserved for a school site and community center. (see Drainage Map for locations)

The site gradually slopes from the northeast to southwest at an approximately 2% grade. The average soil condition reflects Hydrologic Group "B" (Sampson Bresser, Ellicott and Truckton soils) as determined by the "Soil Survey of El Paso County Area", prepared by S.C.S. (see Appendix). An existing 12 inch sanitary sewer and abandoned 15 inch high pressure gas line are currently present on-site.

EXISTING DRAINAGE CONDITIONS

The Villages At Sand Creek Subdivision is located within the Sand Creek Drainage Basin. This basin has been studied numerous times (United Planning and Engineering Company, October, 1977 and Simons, Li & Associates, Inc, July, 1985) and is currently being updated by the Kiowa Engineering Corporation for the City of Colorado Springs. The southerly boundary of the Texas Instruments Subdivision is the "East Fork" of Sand Creek. This tributary was analyzed in the "East Fork Sand Creek Drainage Basin Planning Study" by Kiowa Engineering Corporation, January, 1989. The on-site drainage characteristics were analyzed by Leigh Whitehead and Associates in the "Drainage Report and Plan Texas Instruments Subdivision" December, 1981. These previously mentioned studies were consulted for the preparation of this report.

An advanced copy of the Sand Creek Drainage Basin Planning Study (DBPS) currently being updated by Kiowa Engineering was obtained to ensure conformance with any recommendations suggested. In 1980, the Schuck Corporation improved the east, south and west drainage channels per the approved construction drawings prepared by Weiss Consulting Engineers. These improvements included repairing portions of the existing rip-rap channel sections and constructing the center tributary channel. These improvements were completed and accepted by the City of Colorado Springs. Per the unapproved Kiowa DBPS and conversations with Kiowa Engineering, the central tributary (Sta 0+00 to 9+00) is fully improved and the existing rip-rap banks do not require any additional improvements.

The existing improvements along the westerly portion of this project (Sand Creek) consist of rip-rap lined banks with a natural bottom. Per the unapproved DBPS, the channel should be widened and new bank stabilization (rip-rap) is recommended along with check structures along the channel bottom. Visual inspections confirm the need for new bank stabilization on both sides of the channel as well as extensive maintenance to remove vegetation and debris from the channel bottom and banks. The existing improvements have failed or are in need of repair. The widening of the channel will facilitate the city obtaining additional drainage right-of-way. This additional area is not procurable from the west due to the

existence of platted rear lot lines and homes. The area to the east has also been platted, but with the replatting of the future Villages at Sand Creek Filings, the additional right-of-way will be dedicated to the City of Colorado Springs. The East Fork of Sand Creek also has previously installed bank lining (rip-rap), drop and check structures. These facilities are also in disrepair. Similar to Sand Creek, extensive maintenance is need to remove and clear overgrown vegetation and debris from the channel bottom and side slopes. The DBPS recommends the installation of rip-rap lining on the north and south side of the East Fork along with check and drop structures. With the replatting of the future Villages at Sand Creek Filings along the northerly side of the East Fork, additional right-of-way will be dedicated to the City of Colorado Springs for purposes of channel construction and maintenance.

As stated previously, the central tributary south of Airport Road and north of the East Fork has existing bank improvements that the Kiowa DBPS has evaluated and found them to be acceptable.

PROPOSED DRAINAGE CHARACTERISTICS

After construction of this project, drainage from on-site will be split into several areas (see Drainage Map). The first phase of this development includes 145 single-family lots. An existing high point in Airport Road at the Sand Creek Drive intersection results in flows being diverted into three basins (B, H, and M). Basin M flows (Q_{10} = 8 cfs and Q_{100} = 14 cfs) consist of flows generated by the southerly half of Airport Road and the backyards of Lots 11 through 21. These flows travel in the existing Airport Road southerly Type 1 curb and gutter to Design Point 7 where the flows turn the corner and head southerly down the easterly half of Sand Creek Drive. The capacity of Sand Creek Drive at 1% is Q_{10} = 10 cfs (crownline of street) and Q_{100} = 139 cfs (total street capacity to right-of-way assuming 2% from top of curb to right-of-way).

Basin D-2 flows (Q_{10} = 6 cfs and Q_{100} = 11 cfs) travel westerly in the northerly Type II curb and gutter of Brush Creek Road to Design Point 9. The street capacity of Brush Creek Road at 2.5% is Q_{10} = 14 cfs and Q_{100} = 108 cfs. An 8 foot D-10-R curb inlet at Design Point 9 intercepts Q_{10} = 3 cfs and Q_{100} = 4 cfs and produces a flowby of Q_{10} = 3 cfs and Q_{100} = 7 cfs. The intercepted flow travels to Design Point 8 in 18 inch RCP. The flowby combines with Basin D-1 flows (Q_{10} = 5 cfs and Q_{100} = 8 cfs) for a resultant flow of Q_{10} = 6 cfs and Q_{100} = 13 cfs. These flows travel across Vernal Drive on a 6 foot cross-pan with a 100-year depth of 3 inches.

At Design Point 8 the flows from Basins M, D-1, A (Q_{10} = 8 cfs and Q_{100} = 13 cfs) and the Basin D-2 flowby converge for a resultant flow of Q_{10} = 18 cfs and Q_{100} = 35 cfs. The Basin E flows (Q_{10} = 4 cfs and Q_{100} = 8 cfs) travel to Design Point 10 for a total flow accumulation at Design Points 8 and 10 of Q_{10} = 22 cfs and Q_{100} = 40 cfs. 10-year flows are not allowed to cross the crown (Q_{10} (Design Point 8) = 18 cfs and Q_{10} (Design Point 10) = 4 cfs) and the 100-year flows are assumed to split evenly (Q_{100} (Design Point 8 and 10) = 20 cfs). This results in a 16 foot D-10-R at Design Point 8 and a 6 foot D-10-R at Design Point 10. Maximum ponding depths of the crownline (0.44') for 10-year events and the right-of-way (0.81') for the 100-year event were used for inlet sizing. A clogging factor of 1.25 was also used. The totally intercepted flows are carried southerly in a 30 inch RCP in Sand Creek Drive to Design Point 12.

Basin F flows (Q_{10} = 5 cfs and Q_{100} = 10 cfs) travel westerly in the northerly half of Coolwater Drive. The capacity of Coolwater drive at 1.2% is Q_{10} = 10 cfs and Q_{100} = 75 cfs. These flows travel across a 6 foot cross-pan at Design Point 14 with a 100-year flow depth of 2.5 inches.

Basin K flows (Q_{10} = 2 cfs and Q_{100} = 3 cfs) travel in the southerly half of Coolwater Drive to Design Point 11. These flows travel across a 6 foot cross-pan with a 100-year flow depth of 1.5 inches. These flows continue to travel westerly in Coolwater Drive to Sand Creek

Drive where they turn and head southerly to Design Point 12. The Basin F and Basin N-1 (Q_{10} = 7 cfs and Q_{100} = 11 cfs) flows combine with the Basin K flows for a resultant flow of Q_{10} = 11 cfs and Q_{100} = 20 cfs. The capacity of Sand Creek Drive at 1.6% is Q_{10} = 12 cfs and Q_{100} = 176 cfs. Basin N-2 flows (Q_{10} = 6 cfs and Q_{100} = 11 cfs) travel westerly in the northerly half of Sand Creek Drive to Design Point 12. The capacity is also Q_{10} = 11 cfs and Q_{100} = 20 cfs. Total flows tributary to Design Point 12 (Basins F, K, N-1, N-2) are Q_{10} = 18 cfs and Q_{100} = 31 cfs.

Basin L flows (Q_{10} = 7 cfs and Q_{100} = 12 cfs) include front yard flows from the future filing to the south. These areas were included to insure proper sizing of the Design Point 12 and 13 sump inlets. The total flow at Design Points 12 and 13 is Q_{10} = 22 cfs and Q_{100} = 39 cfs. 10-year flows are not allowed to cross the crown (Q_{10} (Design Point 12) = 18 cfs and Q_{10} (Design Point 13) =7 cfs) and the 100-year flows are assumed to split evenly (Q_{100} (Design Point 12 and 13) = 20 cfs). This results in a 16 foot D-10-R at Design Point 12 and a 4 foot D-10-R at Design Point 13. All 10 and 100-year flows will be intercepted by the two inlets. The total flow discharging at Design Point 15 (Q_{10} = 43 cfs and Q_{100} =75 cfs) is carried to Design Point 16 in a temporary outfall channel located within a 40 foot public drainage easement. The outfall channels will be grass-lined to mitigate any erosion potential and a private maintenance agreement will be submitted to the city. Assurances will also be posted for the pipe system that will convey the Filing No. 1 flows to Sand Creek and East Fork Sand Creek. The pipe discharge from Design Point 13 can easily be carried by the temporary channel section at non-erosive velocities (V = 3.93 fps). Due to the unknown configuration of the future filing lots and streets, the temporary drainage channel will transfer developed flows from Filing No. 1 to Sand Creek. The ultimate storm sewer configuration will include replacing the temporary outfall channel with a pipe system to transfer flows directly to Sand Creek. Temporary rip-rap outfall protection will be installed at the Design Point 15 pipe outfall and at the channel discharge point (Design Point 16) at Sand Creek. Basin Q flows (Q_{10} = 5 cfs and Q_{100} = 10 cfs) are unconcentrated sheet flow that are collected by the temporary drainage channel for a resultant channel flow of Q_{10} = 46 and Q_{100} = 82 cfs.

Basin C flows (Q_{10} = 3 cfs and Q_{100} = 5 cfs) travel to Design Point 1 where they cross a 6 foot cross-pan with a 100-year flow depth of 2.3 inches. These flows are joined with the Basin B flows (Q_{10} = 5 cfs and Q_{100} = 9 cfs) for a resultant flow at Design Point 2 of Q_{10} = 7 cfs and Q_{100} = 12 cfs. The flows then head southerly down Sand Creek Drive across a 6 foot cross-pan with a 100-year flow depth of 2.3 inches. Basin G-2 flows (Q_{10} = 4 cfs and Q_{100} = 7 cfs) are then added for a total flow at Design Point 3 of Q_{10} = 8 cfs and Q_{100} = 14 cfs. Sand Creek Drive has a street capacity at 1.8% of Q_{10} = 13 cfs and Q_{100} = 185 cfs. A four foot D-10-R at-grade inlet accepts Q_{10} = 2 cfs and Q_{100} = 3 cfs and produces a flowby of Q_{10} = 6 cfs and Q_{100} = 11 cfs. The inlet flows travel to Design Point 4 in an 18 inch RCP.

Basin G-1 flows (Q_{10} = 4 cfs and Q_{100} = 7 cfs) are then added to the Basins B, C, and G-2 flowby for a resultant flow at Design Point 3 of Q_{10} = 10 cfs and Q_{100} = 18 cfs. These flows head westerly across a 6 foot cross-pan with a 100-year depth of 3 inches to Design Point 4 where Basin I-1 (Q_{10} = 3 cfs and Q_{100} = 5 cfs) is added for a resultant flow of Q_{10} = 13 cfs and Q_{100} = 23 cfs which is still within the street capacity of Q_{10} = 13 cfs and Q_{100} = 185 cfs. Basin I-2 flows (Q_{10} = 2 cfs and Q_{100} = 3 cfs) also travel to Design Point 4. The total flows reaching Design Point 4 are Q_{10} = 14 cfs and Q_{100} = 26 cfs.

Basin H flows (Q_{10} = 3 cfs and Q_{100} = 5 cfs) travel southerly down the easterly side of Sand Creek Drive to Design Point 5.

Basin J flows (Q_{10} = 4 cfs and Q_{100} = 7 cfs) also include front yard flows from the future southerly filing to insure proper inlet sizing at Design Points 4 and 6. The Basin H flows are added for a resultant flow in the southerly half of Sand Creek Drive at Design Point 6 of Q_{10} = 6 cfs and Q_{100} = 10 cfs. The total flow at design Points 4 and 6 is Q_{10} = 18 cfs and Q_{100} = 32 cfs. 10-year flows are not allowed to cross the crown (Q_{10} (Design Point 4) = 14 cfs and Q_{10} (Design Point 6) = 6 cfs and the 100-year flows are assumed to split evenly (Q_{100} (Design Point 4 and 6) = 16 cfs). A ten foot D-10-R inlet at Design Point 4 and a four foot D-10-R inlet at Design Point 6 will intercept all 10 and 100-year flows. The total discharge at Design

Point 17 is Q_{10} = 20 cfs and Q_{100} = 35 cfs. These flows will travel to "East Fork" Sand Creek in a temporary drainage channel located within a 40 foot public drainage easement. The street and lot configuration for the area to the south is still unknown at this time. Ultimately, the intercepted flow from Filing No. 1 will be discharged directly into East Fork Sand Creek in a piped system. The outfall channels will be grass-lined to mitigate any erosion potential and a private maintenance agreement will be submitted to the city. Assurances will also be posted for the pipe system that will convey the Filing No. 1 flows to Sand Creek and East Fork Sand Creek. Basin P flows (Q_{10} = 1 cfs and Q_{100} = 3 cfs) travel as unconcentrated sheet flow directly into the temporary outfall channel for a resultant channel flow of Q_{10} = 21 cfs and Q_{100} = 37 cfs. The channel flows produce a non-erosive velocity of 3.29 fps. Rip-rap protection will be provided at the Design Point 17 pipe outfall and Design Point 18 channel outfall.

Basin O flows (Q_{10} = 30 cfs and Q_{100} = 52 cfs) are generated by the school and community center site. These flows currently travel as unconcentrated sheet flow directly into Sand Creek. At this time, no detailed information for the school/community center site is available. When a detailed school site is available these flows will be reanalyzed to ensure they do not negatively impact the future residential areas to the south.

The future residential phases (Basins R-1, R-2, S, T, U, V-1, V-2, W-1, W-2, X-1, and X-2) also generate flows that are directed towards several sump inlets. These flows will join Phase 1 flows in a continuation of the Phase 1 storm drain facilities. The future complete system will discharge developed flows into Sand Creek and its tributaries at several locations as concentrated pipe flow. Appropriate rip-rap at the discharge locations will mitigate any erosion problems.

Basin S and T flows will travel as unconcentrated sheet flow directly into Sand Creek. The Phase 4 residential area contains an existing 20 foot drainage easement. Per the drainage report for the Texas Instruments Subdivision, a 36 inch RCP storm drain was to be installed

connecting the existing 36" x 48" C.M.P.E. in Airport Road to an "East Fork" Sand Creek outfall location. Also recommended was the installation of an inlet in Airport Road to collect street flows before they entered the site. These facilities were never installed although they appear to be needed to convey off-site generated flows to Sand Creek, the development of the Basin X-1 and X-2 residential site will require additional examination of this system.

The Kiowa D.B.P.S. recommends improvements to Sand Creek and the"East Fork" channel sections. These improvements include rip-rap armoring and check structures. As stated earlier, at this time the Kiowa DBPS is being reevaluated to determine what facilities currently exist and where new facilities are required. At the time of platting areas adjacent to the Creek and its tributaries, additional drainage right-of-way will be granted. Airport Road will be widened and improved as a part of this project. Currently, at Design Point 20, an existing curb cut allows that flows from Basin Z (Q_{10} = 9 cfs and Q_{100} = 14 cfs) to enter the site and travel to East Fork Sand Creek as overland flow. In addition to these flows, an existing 36" x 48" C.M.P.E. collects flows from the mobile home park and discharges them into an existing 20 foot drainage easement that was platted with the Texas Instruments Subdivision. These flows currently travel overland to East Fork Sand Creek. Sump inlets (6 foot D-10-R) will be installed at Design Points 19 and 20 with the Airport Road construction to intercept both 10 and 100-year flows. The facilities that currently exist to intercept flows from the trailer park will be relocated out of the public right-of-way where they currently exist. The intercepted flows will continue along their existing path until the area east of Filing No. 1 is platted and the storm sewer extended to East Fork Sand Creek. Assurances were previously posted for the storm sewer extension to East Fork Sand Creek with the platting of the Texas Instruments Subdivision.

FLOODPLAIN STATEMENT

A portion of this site is located within the floodplain as determined by the Flood Insurance Rate Map (F.I.R.M.) Community Panel Number 080060-283B, dated December 18, 1986. Elevations were calculated for the Sand Creek Floodplain that encroaches onto the westerly portion of this site. No grading or construction will take place in these areas until a floodplain development permit is obtained. The existing floodplain encroachment into the school site and areas south will be revised by filling the areas along the easterly bank of Sand Creek and processing a L.O.M.R. This will ensure that the school site has no floodplain encroachments.

DRAINAGE DESIGN CRITERIA

This report has been prepared in accordance with the 1991 City/County Drainage Criteria Manual. The rational method was used to calculate basin flows.

SUMMARY

Development of the Villages at Sand Creek will reduce the overall developed flows to Sand Creek through a reduction of the runoff coefficients necessitated by the rezone from industrial use to residential. This site has previously been platted and channel improvements were constructed and repaired. Additional drainage right-of-way will be granted along Sand Creek and the northerly side of the east fork of Sand Creek from the subdivision boundary inward to provide the area for the future channel improvements widening. This area will be detailed with the future filings.

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated October, 1991.

2. Sand Creek Drainage Basin Planning Study, Simons, Li & Associates, Inc., July, 1985.

3. Sand Creek Drainage Basin Study, United Planning and Engineering Company, October, 1977.

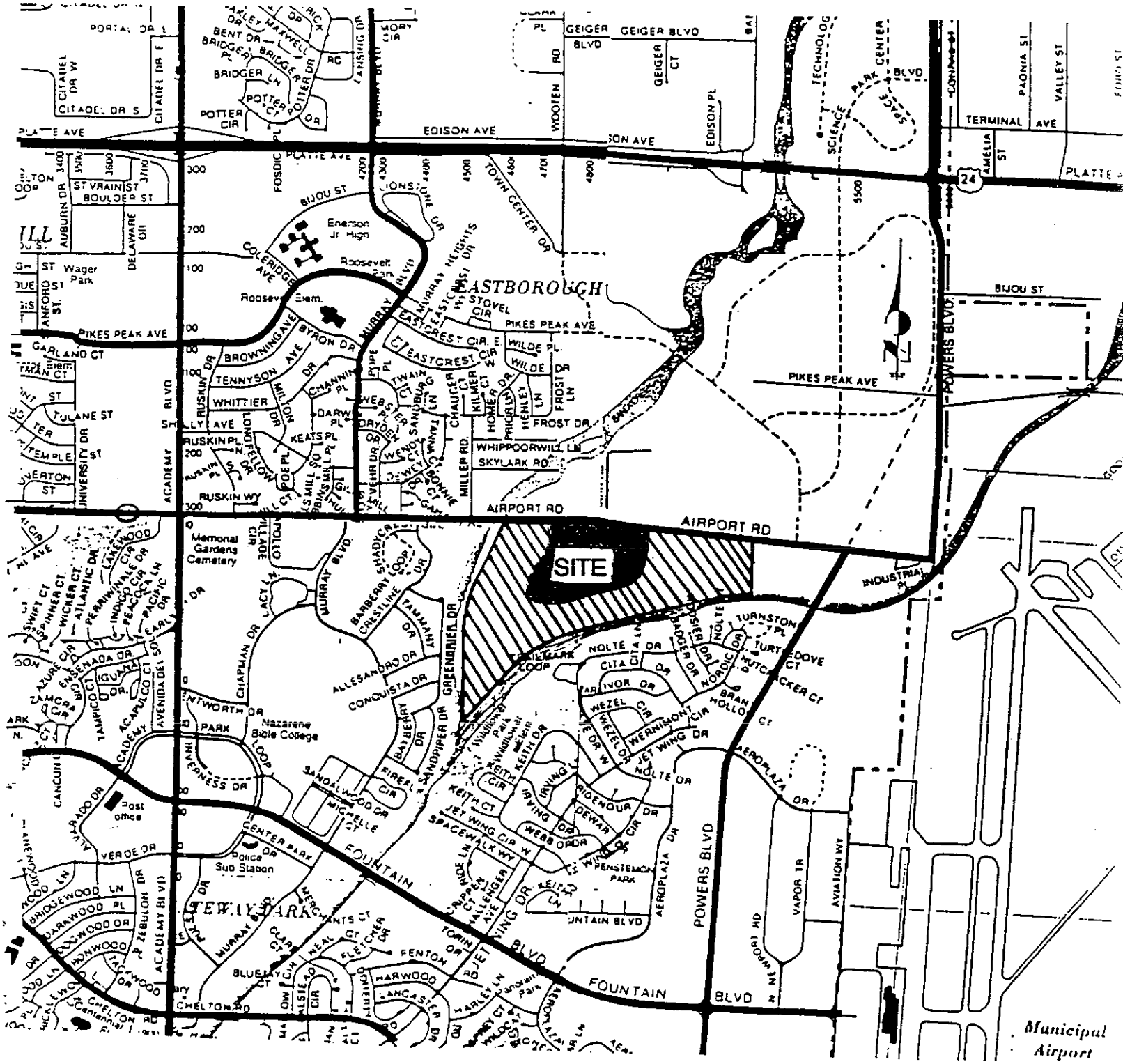
4. Sand Creek Drainage Basin Planning Study Preliminary Design Report, Kiowa Engineering Corporation, Revised April, 1993.

5. East Fork Sank Creek Drainage Basin Planning Study, Kiowa Engineering Corporation, January, 1989.

6. Drainage Report and Plan Texas Instruments Subdivision, Leigh Whitehead and Associates, December, 1981.

APPENDICES

VICINITY MAP



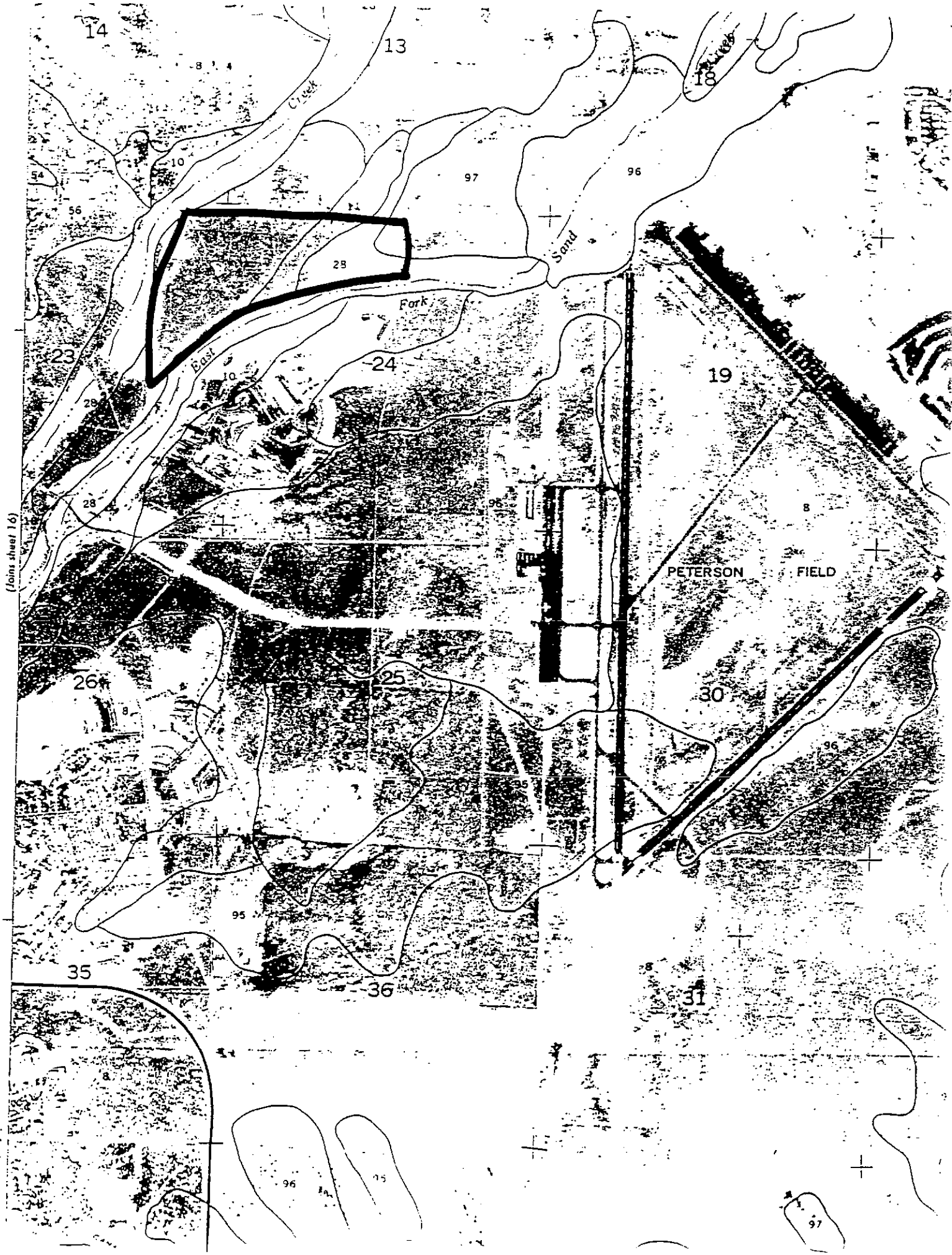
VICINITY MAP

NOT TO SCALE

EXHIBIT A

SOIL MAP (S.C.S. SURVEY)

(SHEET NO. 17)


14
13
18
Creek
10
54
56
97
96
28
Sand
Fork
East
23
24
19
28
28
96
8
PETERSON
FIELD
(Joins sheet 16)
26
25
30
8
96
95
95
35
36
31
8
96
95
97
14 S.
15 S.

SOIL TYPE SUMMARY

CLASSIFICATION	TYPE/CHARACTERISTICS	
78	SAMPSON	"B"
	- Deep, well drained	
11	BRESSER	"B"
	- Deep, well drained	
28	ELLICOTT	"A"
	- Deep, somewhat excessively well drained	
97	TRUCKTON	"B"
	- Deep, well drained	

F.E.M.A. MAP

A B C D

MILLER STREET

MURRAY BLVD

VENR DRIVE

GAHART DR

BONNIE COURT

14

AIRPORT ROAD

KARR ROAD

13

JOINS P

ZONE X

ZONE AE

6080

6083

6114

6111

6108

6106

6102

6098

6095

6090

6085

6080

6075

6070

6065

6061

6057

6055

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6049

6045

6044

6041

6039

6038

6035

6030

6025

6020

6015

6010

6006

6058

6062

6066

6054

Sand Creek East Fork

Sand Creek Center Tributary

6100

6105

6110

6124

6128

6132

6136

6140

6145

6148

CRESTLINE DRIVE

TAMMANY DRIVE

GREENBRIAR DR

Sand Creek

MURRAY BLVD

ALLESSANDRO DR

CONQUISTA DR

BAYBERRY DRIVE

SANDPIPER DRIVE

23

24

ZC

CITA LN

BADGER

HOOSIER DRIVE

NOLTE CT

NOLTE DRIVE NORTH

NORDIC DRIVE

IVOR DR

CITA DRIVE

WEZEL CIRCLE

WERNIMONT CIRCLE

NOLTE DRIVE WEST

KEITH DRIVE

KEITH CIR

KEITH CT

RIDENOUR DR

IRVING LANE

IRVING DRIVE

DEWAR DRIVE

WEBB DRIVE

KEITH

WING CIRCLE

NORDIC BOULEVARD

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CITY OF
COLORADO SPRINGS,
COLORADO
EL PASO COUNTY

PANEL 283 OF 625
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
080060 0283 B

EFFECTIVE DATE:
DECEMBER 18, 1986

HYDROLOGIC CALCULATIONS

VILLAGES AT SAND CREEK

(AREA RUNOFF COEFFICIENT SUMMARY)

BASIN	AREA TOTAL (Ac)	STREETS (Ac)	C(10) STREETS	C(100)	LOTS (Ac)	C(10) LOTS	C(100)	C(10) WEIGHTED	C(100)
A	3.60	0.71	0.90	0.95	2.89	0.52	0.62	0.59	0.69
B	2.60	0.46	0.90	0.95	2.14	0.52	0.62	0.59	0.68
C	1.00	0.22	0.90	0.95	0.78	0.52	0.62	0.60	0.69
D-1	1.90	0.40	0.90	0.95	1.50	0.52	0.62	0.60	0.69
D-2	3.50	0.30	0.90	0.95	3.20	0.52	0.62	0.55	0.65
E	1.80	0.39	0.90	0.95	1.41	0.52	0.62	0.60	0.69
F	3.70	0.42	0.90	0.95	3.28	0.52	0.62	0.56	0.66
G-1	2.90	0.27	0.90	0.95	2.63	0.52	0.62	0.56	0.65
G-2	1.80	0.35	0.90	0.95	1.45	0.52	0.62	0.59	0.68
H	0.65	0.34	0.90	0.95	0.31	0.52	0.62	0.72	0.79
I-1	1.78	0.27	0.90	0.95	1.51	0.52	0.62	0.58	0.67
I-2	1.32	0.17	0.90	0.95	1.15	0.52	0.62	0.57	0.66
J	1.50	0.32	0.90	0.95	1.18	0.52	0.62	0.60	0.69
K	0.71	0.18	0.90	0.95	0.53	0.52	0.62	0.62	0.70
L	2.90	0.79	0.90	0.95	2.11	0.52	0.62	0.62	0.71
M	3.00	1.2	0.90	0.95	1.80	0.52	0.62	0.67	0.75
N-1	3.30	0.6	0.90	0.95	2.70	0.52	0.62	0.59	0.68
N-2	4.50	0.5	0.90	0.95	4.00	0.52	0.62	0.56	0.66
O	13.00	-	0.90	0.95	13.00	0.70	0.80	0.70	0.80
P	2.70	-	0.90	0.95	2.70	0.15	0.20	0.15	0.20
Q	9.30	-	0.90	0.95	9.30	0.15	0.20	0.15	0.20

(AREA RUNOFF COEFFICIENT SUMMARY)

BASIN	AREA TOTAL (Ac)	C(10) LOTS	C(100)	DESCRIPTION
R-1	7.50	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
R-2	5.20	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
S	5.90	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
T	8.30	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
U	7.90	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
V-1	10.00	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
V-2	3.60	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
W-1	4.20	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
W-2	3.60	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
X-1	12.70	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
X-2	13.20	0.52	0.62	FUTURE PHASE - ZONE R-1 (6000 SF)
Y	1.60	0.90	0.95	AIRPORT ROAD
Z	1.60	0.90	0.95	AIRPORT ROAD

VILLAGES AT SAND CREEK
(AREA DRAINAGE SUMMARY)

BASIN	AREA (Ac)	C(10) OVERLAND	C(100) OVERLAND	C(10) "WEIGHTED"	C(100) "WEIGHTED"	OVER LAND (ft.)	(ft.)	(min.)	STREET FLOW (ft/ft.)	(ft.)	(min.)	TOTAL (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
A	3.60	0.25	0.35	0.59	0.69	1.2	120	17.4	0.0190	300	1.0	19.3	3.5	5.3	8	13
		0.25	0.35			-	-	-	0.01	150	0.7					
		0.25	0.35			-	-	-	0.018	50	0.2					
B	2.60	0.25	0.35	0.59	0.68	1.9	175	20.5	0.0060	75	0.5	22.8	3.3	4.9	5	9
		0.25	0.35			-	-	-	0.012	225	1.0					
		0.25	0.35			-	-	-	0.007	160	0.9					
C	1.00	0.25	0.35	0.60	0.69	3.0	75	8.7	0.0120	150	0.7	9.4	4.8	7.2	3	5
D-1	1.90	0.25	0.35	0.60	0.69	0.5	50	11.2	0.019	950	3.3	14.5	4.0	6.1	5	8
D-2	3.50	0.25	0.35	0.55	0.65	1.8	175	20.8	0.018	550	2.0	25.0	3.1	4.7	6	11
		0.25	0.35			4.0	16	2.2								
E	1.80	0.25	0.35	0.60	0.69	0.5	50	11.2	0.0180	930	3.3	14.5	4.0	6.1	4	8
F	3.70	0.25	0.35	0.56	0.66	0.8	40	8.0	0.0120	700	3.0	33.3	2.6	4.0	5	10
		0.25	0.35			0.8	75	13.8	-	-	-					
		0.25	0.35			0.9	45	8.5	-	-	-					
G-1	2.90	0.25	0.35	0.56	0.65	6.0	24	2.7	0.0100	70	0.3	34.5	2.6	3.9	4	7
		0.25	0.35			2.0	30	4.7	0.0180	125	0.4					
		0.25	0.35			2.0	100	12.6	-	-	-					
		0.25	0.35			1.2	90	13.7	-	-	-					
G-2	1.80	0.25	0.35	0.59	0.68	2.0	135	16.2	0.0180	200	0.7	16.9	3.8	5.7	4	7
H	0.65	0.25	0.35	0.72	0.79	-	-	-	0.0180	850	5.0	5.0	5.8	8.8	3	5
I-1	1.78	0.25	0.35	0.58	0.67	4.0	16	2.2	-	-	-	34.8	2.5	3.8	3	5
		0.25	0.35			2.0	40	5.9	-	-	-					
		0.25	0.35			2.0	50	7.1	-	-	-					
		0.25	0.35			2.0	90	11.6	-	-	-					
		0.25	0.35			0.8	40	8.0	-	-	-					
I-2	1.31	0.25	0.35	0.57	0.66	4.0	16	2.2	-	-	-	34.8	2.5	3.8	2	3
		0.25	0.35			2.0	40	5.9	-	-	-					
		0.25	0.35			2.0	50	7.1	-	-	-					
		0.25	0.35			2.0	90	11.6	-	-	-					
		0.25	0.35			0.8	40	8.0	-	-	-					
J	1.50	0.25	0.35	0.60	0.69	0.5	50	11.2	0.0180	550	2.0	13.2	4.2	6.3	4	7
K	0.71	0.25	0.35	0.62	0.70	0.5	50	11.2	0.0120	275	1.2	12.4	4.3	6.5	2	3
L	2.90	0.25	0.35	0.62	0.71	0.5	50	11.2	0.016	165	0.6	14.79	4.0	6.0	7	12
		0.25	0.35			-	-	-	0.01	615	2.9					
M	3.00	0.25	0.35	0.67	0.75	1.2	60	9.8	0.0150	950	3.7	13.5	4.1	6.3	8	14
N-1	3.30	0.25	0.35	0.59	0.68	1.3	125	17.8	0.012	400	1.7	21.4	3.4	5.1	7	11
		0.25	0.35			-	-	-	0.0162	500	1.9					
N-2	4.50	0.25	0.35	0.56	0.66	2.0	35	5.3	0.014	50	0.2	35.1	2.5	3.8	6	11
		0.25	0.35			2.0	110	13.7	0.0150	100	0.4					
		0.25	0.35			1.2	90	13.7	0.02	40	0.1					
		0.25	0.35			-	-	-	0.0100	275	1.3					
		0.25	0.35			-	-	-	0.016	100	0.4					
O	13.00	0.25	0.35	0.70	0.80	6.0	300	21.9	-	-	-	21.9	3.3	5.0	30	52
P	2.70	0.15	0.20	0.15	0.20	6.0	300	24.5	-	-	-	24.5	3.1	4.7	1	3
Q	9.30	0.15	0.20	0.15	0.20	10.0	300	20.7	-	-	-	20.7	3.4	5.2	5	10

(AREA DRAINAGE SUMMARY)

BASIN	AREA (AC)	C(10) OVERLAND	C(100) OVERLAND	C(10) "WEIGHTED"	C(100) "WEIGHTED"	OVER LAND HEIGHT (ft.)	LAND LENGTH (ft.)	Tc (min.)	STREET FLOW SLOPE (ft./ft.)	STREET FLOW LENGTH (ft.)	Tc (min.)	TOTAL Tc (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) c.f.s.	Q(100) c.f.s.
R-1	7.50	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	350	1.2	28.4	2.9	4.4	11	20
		0.25	0.35			1.2	120	17.4								
R-2	5.20	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	350	1.2	28.4	2.9	4.4	8	14
		0.25	0.35			1.2	120	17.4								
S	3.90	0.25	0.35	0.52	0.62	1.0	100	15.9	0.0200	1200	4.0	19.9	3.5	5.3	7	13
T	8.30	0.25	0.35	0.52	0.62	1.2	60	9.8	-	-	-	9.8	4.7	7.1	20	36
U	7.90	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	1100	3.7	30.9	2.7	4.1	11	20
		0.25	0.35			1.2	120	17.4								
V-1	10.00	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	1350	4.5	31.8	2.7	4.1	14	25
		0.25	0.35			1.2	120	17.4								
V-2	3.60	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	1350	4.5	24.1	3.2	4.8	6	11
W-1	4.20	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	700	2.4	29.6	2.8	4.3	6	11
		0.25	0.35			1.2	120	17.4								
W-2	3.60	0.25	0.35	0.52	0.62	1.2	60	9.8	0.0200	750	2.5	28.2	2.9	4.4	5	10
X-1	12.70	0.25	0.35	0.52	0.62	1.0	100	15.9	0.0100	1200	5.7	21.6	3.3	5.1	22	40
X-2	13.20	0.25	0.35	0.52	0.62	1.0	100	15.9	0.0100	1200	5.7	21.6	3.3	5.1	23	41
Y	1.60	0.90	0.95	0.90	0.95	-	-	5.0	-	-	-	5.0	6.0	9.0	9	14
Z	1.60	0.90	0.95	0.90	0.95	-	-	5.0	-	-	-	5.0	6.0	9.0	9	14

VILLAGES AT SAND CREEK (BASIN RUNOFF SUMMARY)

CONTRIBUTTING BASIN	CA(10)	CA(100)	STREET SLOPE (ft./ft.)	FLOW LENGTH (ft.)	TRAVEL Tc (ft.)	BASIN Tc (min.)	TOTAL Tc (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
C	0.60	0.69	-	-	-	9.4	9.4	4.8	7.2	3	5
--- STREET FLOW TO DP #1											
--- STREET FLOW TO 6' CROSS-PAN											
--- STREET CAPACITY Q(10) = 7 CFS, Q(100) = 57 CFS											
B,C	2.13	2.46	0.0070	200	1.1	22.8	22.8	3.3	4.9	7	12
--- STREET FLOW TO DP #2											
--- STREET FLOW TO 6' CROSS-PAN											
--- STREET CAPACITY Q(10) = 13 CFS, Q(100) = 185 CFS											
B,C,G-2	3.19	3.68	0.0180	600	2.1	34.5	34.5	2.6	3.9	8	14
--- STREET FLOW TO DP #3											
--- STREET FLOW TO 6' CROSS-PAN											
--- STREET CAPACITY Q(10) = 13 CFS, Q(100) = 185 CFS											
--- STREET FLOW TO 4' AT-GRADE INLET											
--- FLOWBY(10) = 6 CFS, FLOWBY(100) = 11 CFS											
--- EQUIV. CA(10) = 2.31, EQUIV. CA(100) = 2.82											
--- PIPE FLOW IN 18" RCP											
B,C,G-2(FB), G-1	3.93	4.71	-	-	-	34.5	34.5	2.6	3.9	10	18
--- STREET FLOW AT DP #3											
--- STREET FLOW TO 6' CROSS-PAN											
--- STREET CAPACITY Q(10) = 13 CFS, Q(100) = 185 CFS											
B,C,G-2(FB), G-1,I-1	4.94	5.90	-	-	-	34.5	34.5	2.6	3.9	13	23
--- STREET FLOW TO DP #4											
--- STREET CAPACITY Q(10) = 13 CFS, Q(100) = 185 CFS											
B,C,G-2(FB), G-1,I-1,I-2, J	5.69	6.77	-	-	-	34.8	34.8	2.5	3.8	14	26
--- STREET FLOW AT DP #4											
--- STREET FLOW TO 10' SUMP INLET (NO FLOWBY)											
--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')											
H	0.47	0.51	-	-	-	5.0	5	6.0	9.0	3	5
--- STREET FLOW AT DP #5											
--- STREET CAPACITY Q(10) = 13 CFS, Q(100) = 185 CFS											
J	0.90	1.04	-	-	-	13.2	13.2	4.2	6.3	4	7
--- STREET FLOW TO DP #6											
--- STREET FLOW TO 4' SUMP INLET (NO FLOWBY)											
--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')											
--- STREET CAPACITY Q(10) = 13 CFS, Q(100) = 185 CFS											
B,C,G-2(FB), G-1,I-1,I-2, J,H	7.06	8.32	-	-	-	34.8	34.8	2.5	3.8	18	32
--- TOTAL STREET FLOW AT DP #4 AND #6											
--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')											
--- ASSUME EVEN SPLIT OF 100-YR FLOWS											
--- 10-YEAR FLOWS NOT ALLOWED TO CROSS CROWN											
TOTAL OUTFALL FROM DP #6	7.50	8.67	-	-	-	34.8	34.8	2.5	3.8	20	35
--- OUTFALL TO EAST SAND CREEK IN TEMPORARY TRAPEZOIDAL CHANNEL											
--- RIP-RAP PROTECTION AT PIPE OUTFALL POINT AND CHANNEL DISCHARGE POINT AT CREEK											
TOTAL OUTFALL FROM DP #6 W/ BASIN P	7.91	9.21	-	-	-	34.8	34.8	2.5	3.8	21	37
--- OVERLAND FLOW TO TEMPORARY OUTFALL CHANNEL											
--- OUTFALL TO EAST SAND CREEK IN TEMPORARY TRAPEZOIDAL CHANNEL											
--- RIP-RAP PROTECTION AT PIPE OUTFALL POINT AND CHANNEL DISCHARGE POINT AT CREEK											

M	2.01	2.25	-	-	-	13.5	13.5	4.1	6.3	8	14
	--- STREET FLOW TO DP #7										
	--- STREET FLOW FROM AIRPORT ROAD TO COBBLE CREEK DRIVE										
A	2.12	2.48	-	-	-	19.3	19.3	3.5	5.3	8	13
	--- STREET FLOW TO DP #8										
	--- STREET CAPACITY Q(10) = 12 CFS, Q(100) = 95 CFS										
M,A	4.13	4.73	0.01	530	2.5	13.5	19.3	3.5	5.3	14	25
	--- STREET FLOW TO DP #8										
	--- STREET FLOW TO 16' SUMP INLET (NO FLOWBY)										
	--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')										
D-2	1.93	2.28	-	-	-	25.0	25.0	3.1	4.7	6	11
	--- STREET FLOW TO DP #9										
	--- STREET CAPACITY Q(10) = 14 CFS, Q(100) = 108 CFS-										
	--- STREET FLOW TO 8' AT-GRADE INLET										
	--- FLOWBY(10) = 3 CFS, FLOWBY(100) = 7 CFS										
	--- EQUIV. CA(10) = 0.97, EQUIV. CA(100) = 1.49										
	--- PIPE FLOW IN 18" RCP										
D-1	1.14	1.39	-	-	-	14.5	14.5	4.0	6.1	5	8
	--- STREET FLOW TO DP #9										
	--- STREET CAPACITY Q(10) = 12 CFS, Q(100) = 95 CFS										
D-1,D-2(FB)	2.11	2.88	-	-	-	25.0	25.0	3.1	4.7	6	13
	--- STREET FLOW AT DP #9										
	--- STREET FLOW TO 6' CROSS-PAN										
	--- STREET CAPACITY Q(10) = 14 CFS, Q(100) = 108 CFS										
M,A,D-1,D-2(FB)	6.24	7.61	-	-	-	25.0	25.0	3.1	4.7	18	35
	--- STREET FLOW TO DP #8										
	--- STREET FLOW TO 16' SUMP INLET (NO FLOWBY)										
	--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')										
E	1.08	1.24	-	-	-	14.5	14.5	4.0	6.1	4	8
	--- STREET FLOW TO DP #10										
	--- STREET CAPACITY Q(10) = 12 CFS, Q(100) = 95 CFS										
	--- STREET FLOW TO 6' SUMP INLET (NO FLOWBY)										
	--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')										
M,A,D-1,	7.32	8.85	-	-	-	25.0	25.0	3.1	4.7	22	40
D-2(FB),E	--- TOTAL STREET FLOW AT DP #8 AND #10										
	--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')										
	--- ASSUME EVEN SPLIT OF 100-YR FLOWS										
	--- 10-YEAR FLOWS NOT ALLOWED TO CROSS CROWN										

F	2.07	2.44	-	-	-	33.3	33.3	2.6	3.9	5	10
	--- STREET FLOW TO DP #14										
	--- STREET FLOW TO 6' CROSS-PAN										
	--- STREET CAPACITY Q(10) = 10 CFS, Q(100) = 75 CFS										
K	0.44	0.50	-	-	-	12.4	12.4	4.3	6.5	2	3
	--- STREET FLOW TO DP #11										
	--- STREET FLOW TO 6' CROSS-PAN										
	--- STREET CAPACITY Q(10) = 10 CFS, Q(100) = 75 CFS										
F,N-1,K	4.46	5.18	0.0162	500	1.9	21.4	35.2	2.5	3.8	11	20
	--- STREET FLOW TO DP #12										
	--- STREET CAPACITY Q(10) = 12 CFS, Q(100) = 176 CFS										
N-2	2.52	2.97	-	-	-	35.1	35.1	2.5	3.8	6	11
	--- STREET FLOW TO DP #12										
	--- STREET CAPACITY Q(10) = 10 CFS, Q(100) = 139 CFS										
F,N-1,K,N-2	6.98	8.15	-	-	-	35.1	35.1	2.5	3.8	18	31
	--- TOTAL STREET FLOW TO DP #12										
L	1.80	2.06	-	-	-	14.8	14.8	4.0	6.0	7	12
	--- STREET FLOW TO DP #13										
	--- STREET CAPACITY Q(10) = 10 CFS, Q(100) = 139 CFS										
F,N-1,N-2,	8.78	10.21	-	-	-	35.1	35.1	2.5	3.8	22	39
K,L	--- TOTAL STREET FLOW AT DP #12 AND #13										
	--- MAXIMUM PONDING DEPTH Q(10) = CROWNLINE(0.45'), Q(100) = ROW(ASSUMING 2% TO ROW)(0.91')										
	--- ASSUME EVEN SPLIT OF 100-YR FLOWS										
	--- 10-YEAR FLOWS NOT ALLOWED TO CROSS CROWN										
TOTAL OUTFALL	18.46	21.63	-	-	-	35.1	35.1	2.5	3.8	46	82
FROM DP #1	--- OVERLAND FLOW TO TEMPORARY OUTFALL CHANNEL										
W/ BASIN Q	--- OUTFALL TO SAND CREEK IN TEMPORARY TRAPEZOIDAL CHANNEL										
	--- RIP-RAP PROTECTION AT PIPE OUTFALL POINT AND CHANNEL DISCHARGE POINT AT CREEK										

DRAINAGE MAP