DRAINAGE AND FLOOD PLAIN REPORT

RED CLIFFS MOBILE HOME VILLAGE NO. 2

FRUITA, COLORADO

NOVEMBER, 2000

Prepared for:

RED CLIFFS LLC
2210 I ROAD
Grand Junction, Colorado 81505

Prepared by:

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NAI Job No. 3860

Red Cliffs Mobile Home Village No. 2
Drainage and Flood Plain Report

Contents

Appendices

CERTIFICATION

I, John E Vasey, hereby certify that this drainage and flood report and the work that it represents for the Red Cliffs Mobile Home Village No. 2 development was prepared by myself or under my direct supervision and has been prepared in accordance with diligent and prudent civil engineering practices acceptable at the time of this report.

_____

John E. Vasey P.E. 33557 Date

I. GENERAL LOCATION AND DESCRIPTION

A. Site Location

The Red Cliffs Mobile Home Village No. 2 development is the completion of the Red Cliffs Mobile Home Village as Platted in 1981. This development is located in the W1/2 NW1/4 of Section 20, Township 1 North, Range 2 West, of the Ute Principal Meridian. Access to this site will be through the existing park on Red Cliffs Drive and Applewood Way via Highway 340, and also by a new road, Hollyberry Way, which will intersect with 17 1/4 Road. This site is in close proximity to the Colorado River, with the southwest portion falling within the 100 year flood hazard area as delineated by the FEMA Flood Insurance Rate Map for this area. A site location map and copy of the FEMA flood plain map are included in Appendix A.

The proximity of this site to the Colorado River makes it suitable for payment of a drainage fee rather than providing on site detention. This drainage study was completed with the intent of providing a drainage fee.

B. Site Description

This site has an area of 11.74 acres and generally slopes southwesterly. Construction for this portion of Red Cliffs Mobile Home Village was started in the early 1980's. The previous construction operations ended after the site was cleared and the roads were cut to subgrade elevations. Cover on the site currently consists of weeds, native grasses, and trees that have voluntarily grown since the previous work. The most recent use of this site was for pasturing horses. The soils at the site are classified by the Natural Resources Conservation Service as Rc: Fruitland, Ra: Turley, and Be: Unnamed. These soil classifications are characterized as Hydrologic Group B. The NRCS soils information concerning hydrology is included in Appendix B.

II. EXISTING DRAINAGE CONDITIONS

A. Off-Site Drainage

The existing portion of Red Cliffs Mobile Home Village is graded to drain into the proposed development. The flow is concentrated in the existing curb and gutter system until it reaches the undeveloped portion. Earthen ditches provide flow across the undeveloped site. The land adjoining the northwest portion of this development (Lot B) slopes southwesterly to the Highway 340 borrow ditch and will not affect this project. The land south of this project flows away from the site to the Colorado River.

Runoff calculations completed for the proposed development accounted for the existing development. The information necessary for calculating runoff from the existing development was obtained from As-Built drawings and the original plat.

B. Site Drainage

The site has had some preliminary grading completed several years ago. The runoff from the site currently concentrates into the road cuts and flows into an earthen ditch located at the boundary between Lots B and C. This ditch flows to the southwest corner of the site where the runoff enters the Highway 340 borrow ditch and flows to the Colorado River. A Rational Runoff Coefficient of 0.28 was estimated for the existing conditions.

III. PROPOSED DRAINAGE CONDITIONS

A. Changes in Drainage

The development of this site will increase the storm water runoff quantities during storm events. The construction of roads and driveways combined with the mobile homes will create a significant amount of impervious area. Weighted average values of the Rational Runoff Coefficient for the developed conditions were estimated as 0.75 and 0.80 for the 2 year event and 100 year event respectively.

A piping system is proposed to collect the runoff at two low points in the road system. These proposed facilities can be seen on the post development drainage map included in Appendix A. This system will be installed below grade and will daylight at the southwest corner of the proposed park.

B. Maintenance Issues

The maintenance of the storm water system and associated piping will be the responsibility of the Town of Fruita upon approval of the constructed project.

IV. Flood Hazards

The FEMA Flood Insurance Rate Map (FIRM) for the Town of Fruita, Community-Panel Number 080194 0003 B, pertains to the project site. This map and the adjacent county FIRM maps were studied for this project. The 100 year flood hazard area shows a base flood elevation of 4481 based on the North American Vertical Datum (NAVD) of 1929 for the southwest portion of this project. This elevation was adjusted to 4484.3 for conversion to NAVD88, the vertical datum on which the site contours were generated. The site grading plan was completed in an effort to keep the majority of the lot grades above the base flood.

The modern construction of modular homes off site and then setting them in place on the lots helps when considering base flood elevations. The floor elevation of buildings must be 1 foot above the base flood elevations. All residences within this development will be required to install the building at an elevation of 4484.3. The development of this project will ensure that Chapter 17.70.140 of the Fruita Land Use Code is met. This chapter pertains specifically to manufactured homes and flood ways.

V. Hydrology and Hydraulics

The calculations for hydrologic and hydraulic conditions created by this project were modeled according the Stormwater Management Manual (SWMM) as adopted by Mesa County and dated May 1996. A computer spreadsheet was developed to complete the necessary calculations for the storm drainage system design. A copy of this spreadsheet is included in Appendix C.

The SWMM requires design storm frequencies of 2-years and 100-years for the analysis of drainage conditions. The Rational Method for determining runoff volumes was selected due to the small size of the drainage basins. This method is based on the equation:

$$Q = CIA$$

Where:

Q	=	Runoff in Inches/acre/hour which is considered equivalent to cubic foot per second (cfs)
C	=	Runoff Coefficient
I	=	Storm Intensity
A	=	Area in Acres

The runoff coefficients (C) were obtained by determining a weighted average of values taken from Table B-1 in the SWMM. The area of the roads, driveways and roof areas for each lot, and grassed lawn areas were determined for the proposed development by placing an average sized modular home on each lot. These areas were utilized to determine the weighted average for the development.

The development was divided into subbasins to allow the analysis of curb flows. These subbasins are shown in Appendix A. The area of each subbasin was determined for the runoff calculations. Each section of curb was analyzed by determining the total area of the proposed development plus the area of the existing development that contributes to each particular reach.

The storm intensities were determined from Table "A-1a" in Appendix A of the SWMM. Table "A-1a" provides storm intensity values based on the Time of Concentration (T_C). The Time of Concentration calculation was simplified by assuming all flows approximate shallow concentrated flow. The values for T_S were determined by the equation:

$$T_S = L/(60*V)$$

Where:

T_S	=	Shallow Concentrated Flow travel time (minutes)
L	=	Length of shallow concentrated flow
V	=	Velocity in feet/second (obtained from Figure "E-3" SWMM)

The intensity for each particular reach of curb flow was calculated for the longest flow length contributing to the reach being investigated. The flow lengths of the existing development were included in these calculations to allow for the inflow onto this project from previous development.

The Rational formula for runoff quantity was then solved for the 2-year and 100-year events for the developed conditions.

The curb and gutter flows were analyzed using the Manning's modified equation as follows:

$$Q = 0.56(Z/n)S^{0.5}d^{2.67}$$

Where:

Q	=	Flow rate in CFS
Z	=	Inverse pavement cross slope, ft/ft
n	=	Manning's "n" value
S	=	Longitudinal slope of the street gutter, ft/ft
d	=	Depth of gutter flow in feet

The flows determined for each curb reach were used in the equation above to solve for the flow depth. There were no reaches that exceeded the limits of depth as outlined for the 2 year and 100 year events. The 2 year event is constrained to the curb height, in this case 0.375 feet, while the 100 year event is constrained by 1.0 foot above the flowline.

The storm water collection system was sized to handle the 2 year event. During the 100 year event the entire storm water collection system will be inundated by the Base Flood from the Colorado River. The runoff for the storm sewer inlet located on Applewood Way was determined for the entire area of the proposed development draining to that location plus the area of the existing development. The intensity was estimated from the flow length of the longest reach of curb and gutter flowing from the existing development, the time at which all areas are contributing to the runoff. The inlet capacities for handling the design flows were obtained from Table "G-1" in the SWMM, a copy of which is provided in Appendix C.

The pipe specified for carrying the flow away from the site is ADS N-12. This pipe was chosen for its low Manning's "n" value which helps the flow capacity. The piping system was sized using a modified Manning's equation to estimate the capacity of the pipe. The capacity was then checked against flow capacity tables contained in the ADS Specifier Manual. The calculated value was then compared to the 2 year event peak runoff determined when sizing the storm sewer inlets.

VI. Results and Conclusions

The proposed development on this site will cause an increase in the runoff flows during storm events. The increased runoff created by this project is insignificant in comparison to the volume of water that is transported by the Colorado River. The aerial extent of the 100 year flood event on the Colorado River will not be significantly impacted by the development of this project. The aerial extent of the base flood will be modified by fill placed to raise the grade of the lots. The magnitude of the change in the area is again insignificant when compared to the total area encompassed by the Colorado River during such an event.

The calculated drainage fee for this site is $29,158.89. The calculations for determining this fee are included in Appendix C.

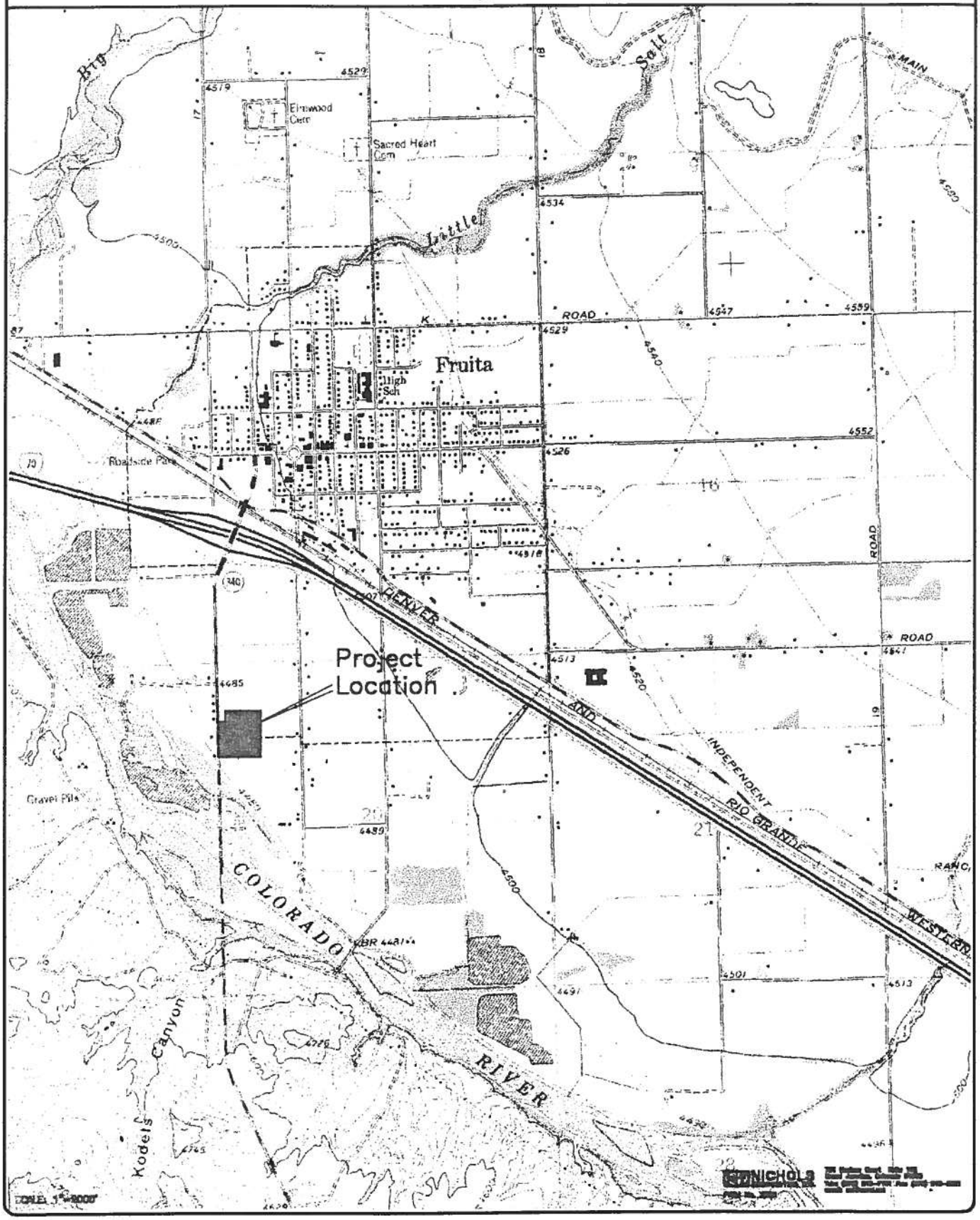
APPENDIX A

PROJECT MAPS

LOCATION MAP

RED CLIFFS MOBILE HOME VILLAGE NO. 2

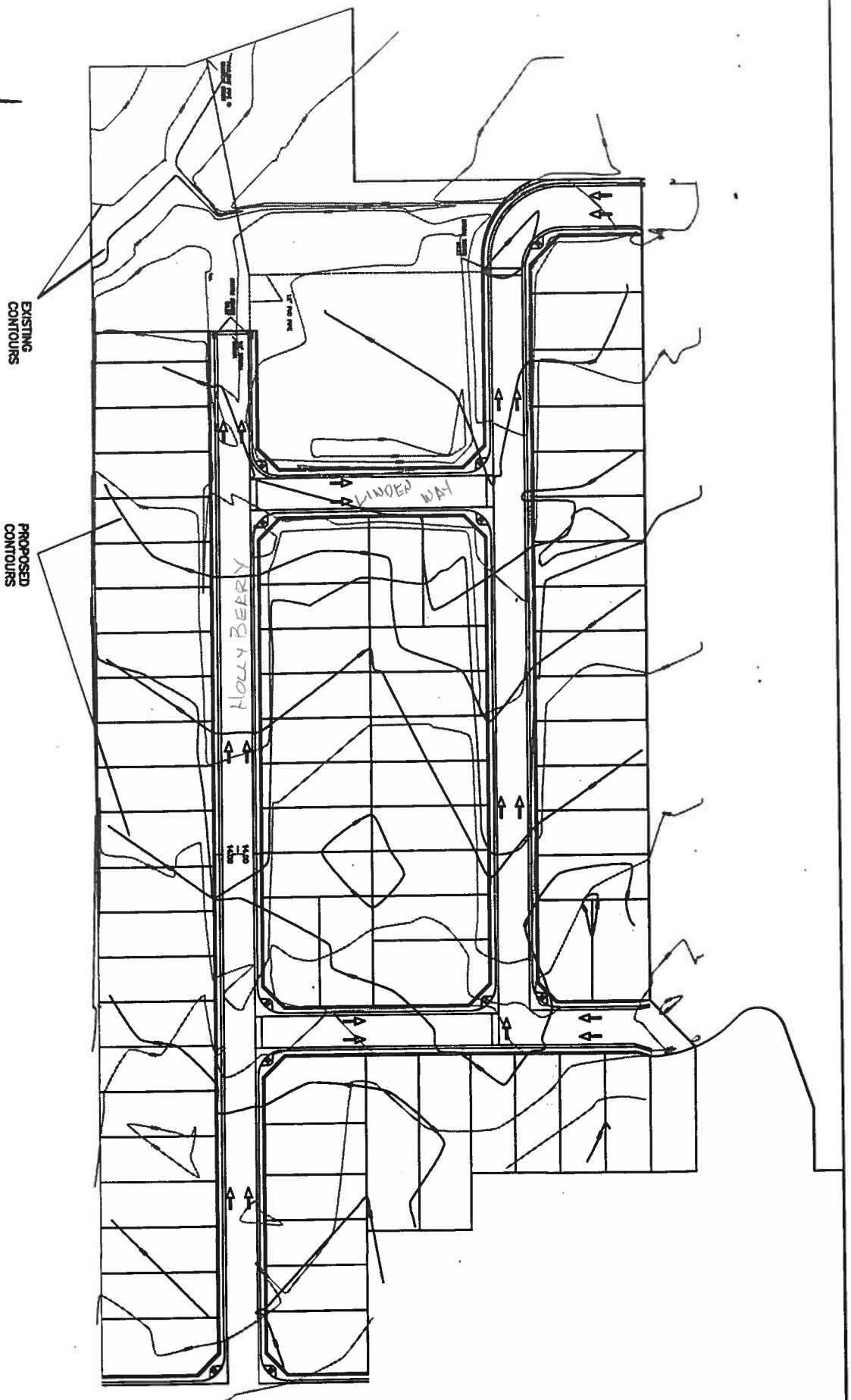
Mesa County, Colorado



NOT TO SCALE

EXISTING CONTOURS

PROPOSED CONTOURS



Red CLiffs Mobile Home Village No. 2
Historic & Developed Drainage Map

NICHOLS ASSOCIATES, INC.

CIVIL ENGINEERING • PHOTOGRAMMETRY • SURVEYING

REVISIONS

NO.	DATE	REMARKS	BY

DESIGNED BY JEV

DRAWN BY

SURVEY DATE AUG. 2000

SHEET NUMBER 1 OF 1

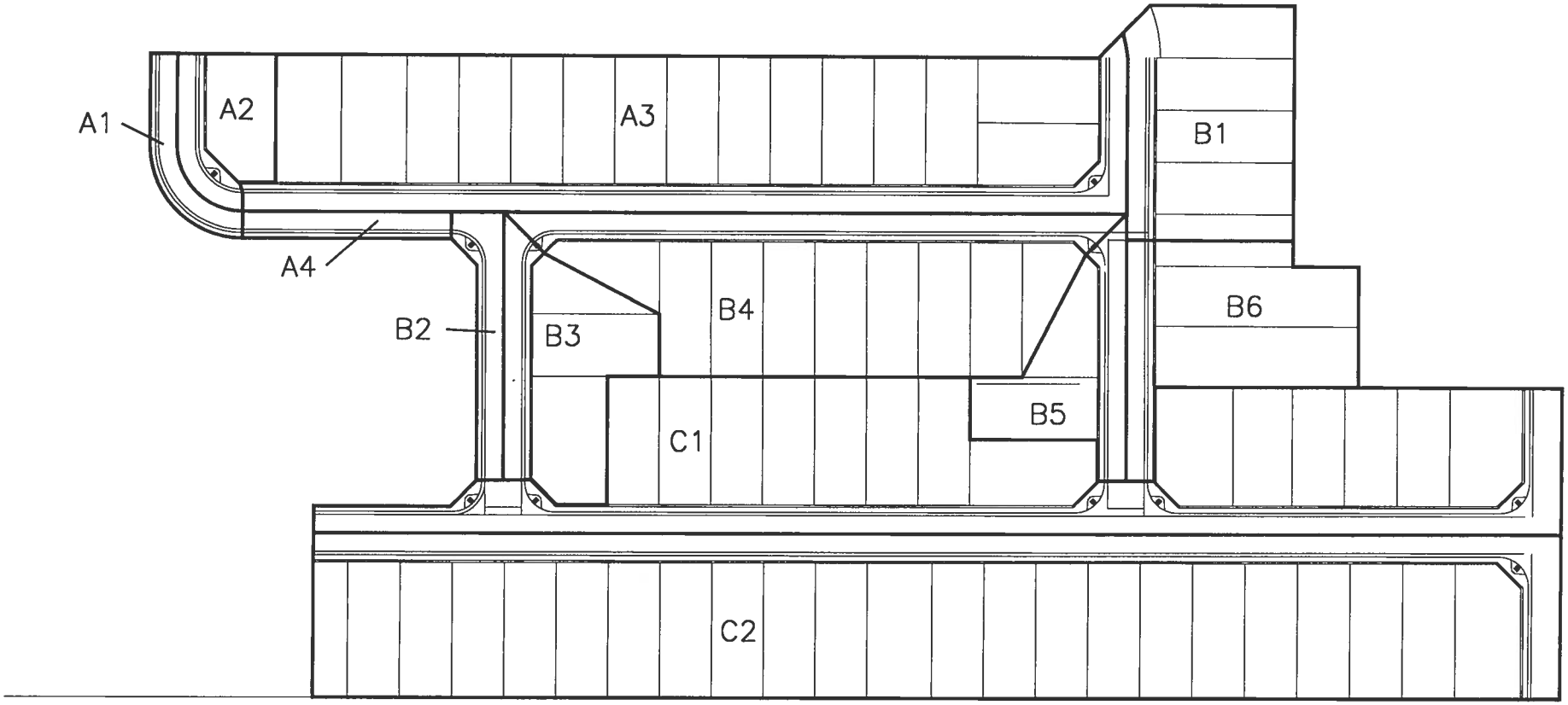
PROJECT NUMBER 2000

SCALE 1 in. = 40 ft.

DATE DRAWN 10/11/00

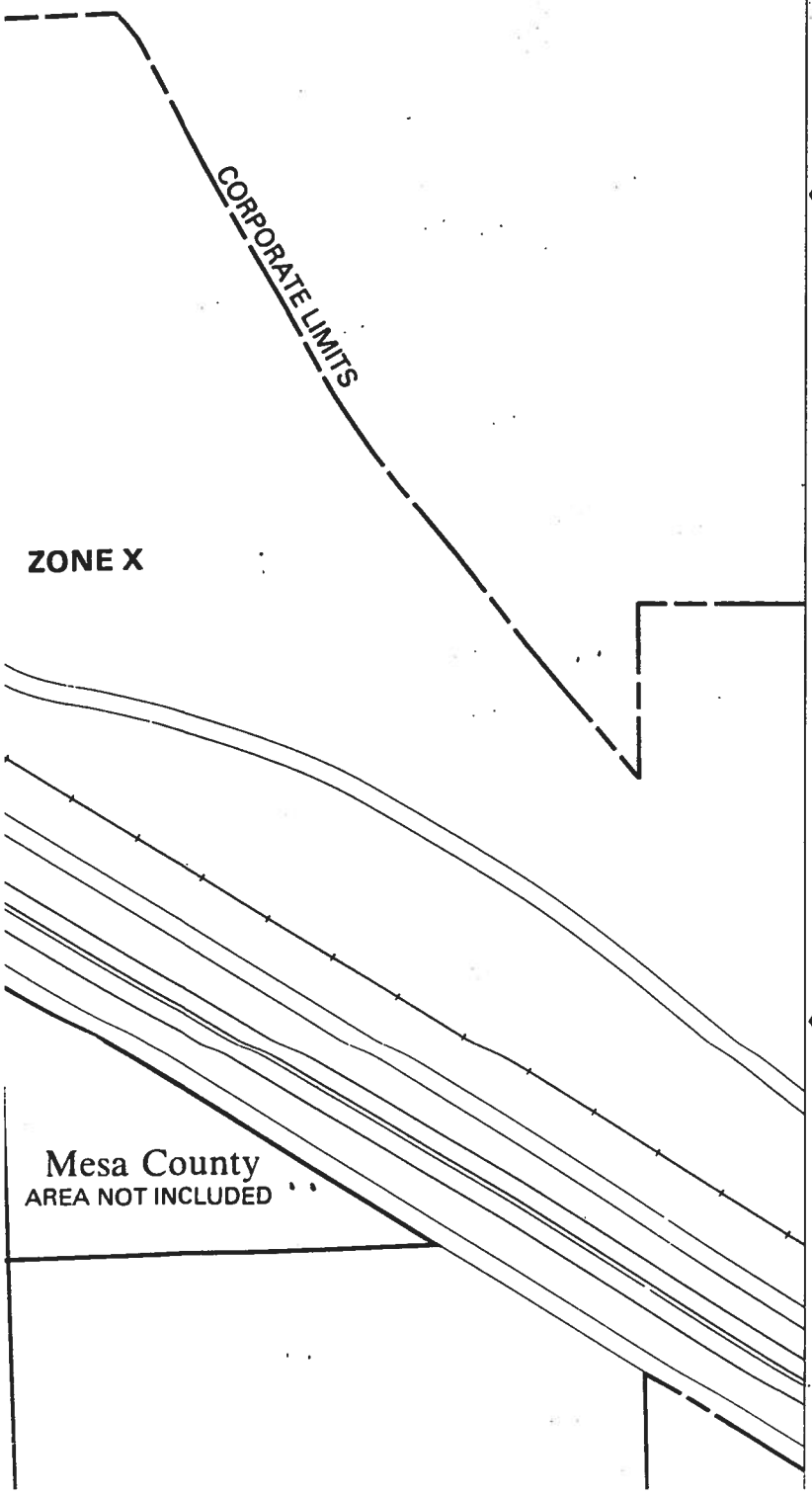
RED CLIFFS MOBILE VILLAGE NO. 2

DRAINAGE ANALYSIS SUBBASINS



Red Cliffs Mobile Home Village No. 2
FEMA Flood Map Legend

Nichols Associates, Inc.



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- D — D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*
- $RM7_X$ — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

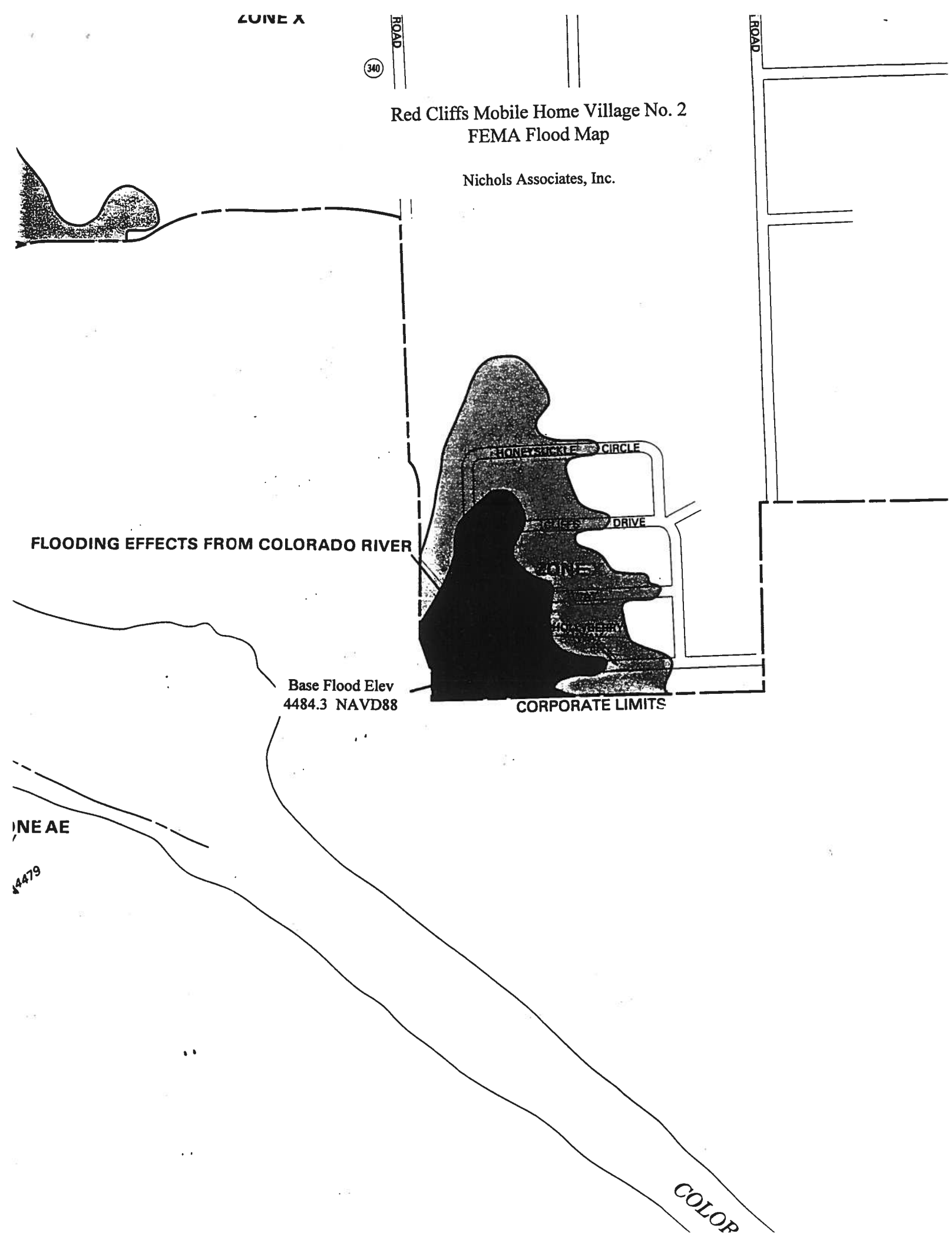
Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 AND VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.


ZONE X
ROAD
340
ROAD
Red Cliffs Mobile Home Village No. 2
FEMA Flood Map
Nichols Associates, Inc.
HONEYSUCKLE
CIRCLE
DRIVE
FLOODING EFFECTS FROM COLORADO RIVER
Base Flood Elev
4484.3 NAVD88
CORPORATE LIMITS
NE AE
4479
COLOR

APPENDIX B

NRCS SOILS CLASSIFICATIONS

Nichols Associates, Inc.
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Grand Junction, Colorado 81506
Phone: 303-245-7101

RED CLIFFS MOBILE HOME VILLAGE NO. 2 - Drainage Study

CALCULATION OF RUNOFF, INLET CAPACITIES, AND PIPE FLOW DUE TO PROPOSED CONSTRUCTION

After Construction {Area - Intensity - Discharge}

EXISTING RED CLIFFS VILLAGE DRAINAGE INFORMATION

BASIN	AREA		RUNOFF	RUNOFF	REACH	LENGTH	SLOPE	V	2-Yr	100-Yr	INTENSITY		DISCHARGE		COMMENTS
	SURFACE TYPE	Ac.	COEF. C2	COEF. C100		FEET	(S) %	Ft./Sec	TIME MIN.	TIME MIN.	Inches/Hour 2-Yr	Inches/Hour 100-Yr	CFS (Q=CiA) 2-Yr	CFS (Q=CiA) 100-Yr	
E1	Lot Flow					140	0.50	1.40	1.7	1.7					
	Curb Flow	0.65	0.75	0.80	ER1	190	0.60	1.55	2.0	2.0					
	Total/average	0.65	0.75	0.80					3.7	3.7	1.11	4.41	0.54	2.29	Curb Analysis
E2	Lot Flow					20	0.50	1.40	0.2	0.2					
	Curb Flow	0.26	0.75	0.80	ER2	120	0.60	1.55	1.3	1.3					
	Total/average	0.26	0.75	0.80					1.5	1.5	1.11	4.41	0.22	0.92	Curb Analysis
E3	Lot Flow					85	0.50	1.40	1.0	1.0					
	Curb Flow	6.74	0.75	0.80	ER3	1,182	0.63	1.55	12.7	12.7					
	Total/average	6.74	0.75	0.80					13.7	13.7	0.83	3.30	4.20	17.79	Curb Analysis
E4	Lot Flow					102	0.50	1.40	1.2	1.2					
	Curb Flow	1.99	0.75	0.80	ER4	1,182	0.51	1.40	14.1	14.1					
	Total/average	1.99	0.75	0.80					15.3	15.3	0.86	3.41	1.28	5.43	Curb Analysis

CURB FLOW ANALYSIS - PROPOSED DEVELOPMENT

BASIN	AREA		RUNOFF	RUNOFF	REACH	LENGTH	SLOPE	V	2-Yr	100-Yr	INTENSITY		DISCHARGE		COMMENTS
	SURFACE TYPE	Ac.	COEF. C2	COEF. C100		FEET	(S) %	Ft./Sec	TIME MIN.	TIME MIN.	Inches/Hour 2-Yr	Inches/Hour 100-Yr	CFS (Q=CiA) 2-Yr	CFS (Q=CiA) 100-Yr	
A1	Lot Flow					50	0.50	1.40	0.6	0.6					
	Curb Flow	0.18	0.75	0.8	AR1	204	0.50	1.40	2.4	2.4					
	Curb Flow	6.74	0.75	0.80	ER3	1,182	0.63	1.55	12.7	12.7					
	Total/average	6.92	0.75	0.80					15.7	15.7	0.76	3.02	3.94	16.72	Curb Analysis
A2	Lot Flow				NA	NA	NA	NA	NA	NA					
	Curb Flow	0.08	0.75	0.80	AR2	173	0.50	1.40	2.1	2.1					
	Curb Flow	1.99	0.75	0.80	ER4	1,182	0.51	1.40	15.3	15.3					
	Total/average	2.07	0.75	0.80					17.3	17.3	0.74	2.93	1.15	4.85	Curb Analysis
A3	Lot Flow					95	0.50	1.40	1.1	1.1					
	Curb Flow	1.82	0.75	0.80	AR3	876	0.72	1.70	8.6	8.6					
	Curb Flow	0.26	0.75	0.80	ER2	120	0.60	1.55	1.3	1.3					
	Total/average	2.08	0.75	0.80					11.0	11.0	0.89	3.52	1.39	5.86	Curb Analysis
A4	Lot Flow				NA	NA	NA	NA	NA	NA					
	Curb Flow	0.08	0.75	0.80	AR4	158	0.50	1.40	1.9	1.9					
	Total/average	0.08	0.75	0.80					1.9	1.9	1.11	4.41	0.07	0.28	Curb Analysis
B1	Lot Flow					102	0.50	1.40	1.2	1.2					
	Curb Flow	0.52	0.75	0.80	BR1	284	0.50	1.40	3.4	3.4					
	Curb Flow	0.65	0.75	0.80	ER1	190	0.60	1.55	2.0	2.0					
	Total/average	1.17	0.75	0.80					6.6	6.6	1.03	4.07	0.90	3.81	Curb Analysis
B2	Lot Flow				NA	NA	NA	NA	NA	NA					
	Curb Flow	0.11	0.75	0.80	BR2	200	0.50	1.40	2.4	2.4					
	Total/average	0.11	0.75	0.80					2.4	2.4	1.11	4.41	0.09	0.39	Curb Analysis
B3	Lot Flow		0.75	0.80		58	0.50	1.40	0.7	0.7					
	Curb Flow	0.39	0.75	0.80	BR3	186	0.67	1.60	1.9	1.9					
	Total/average	0.39	0.75	0.80					2.6	2.6	1.11	4.41	0.32	1.38	Curb Analysis
B4	Lot Flow		0.75	0.80		103	0.50	1.40	1.2	1.2					
	Curb Flow	1.02	0.75	0.80	BR4	462	0.43	1.40	5.5	5.5					
	Curb Flow	0.52	0.75	0.80	BR1	284	0.50	1.40	3.4	3.4					
	Curb Flow	0.28	0.75	0.80	BR5	157	0.43	1.40	NA	NA					
	Curb Flow	0.47	0.75	0.80	BR6	114	0.43	1.40	NA	NA					
	Curb Flow	0.65	0.75	0.80	ER1	190	0.60	1.55	2.0	2.0					
	Total/average	2.94	0.75	0.80					12.2	12.2	0.86	3.41	1.90	8.02	Curb Analysis
B5	Lot Flow					98	0.50	1.40	1.2	1.2					
	Curb Flow	0.28	0.75	0.80	BR5	157	0.43	1.40	1.9	1.9					
	Total/average	0.28	0.75	0.80					3.0	3.0	1.11	4.41	0.23	0.99	Curb Analysis
B6	Lot Flow					152	0.50	1.40	1.8	1.8					
	Curb Flow	0.47	0.75	0.80	BR6	114	0.43	1.40	1.4	1.4					
	Total/average	0.47	0.75	0.80					3.2	3.2	1.11	4.41	0.39	1.66	Curb Analysis

STREET FLOW DEPTH AT THE CURB

Flow Through Street, Curb & Gutter

Discharge quantity is calculated by the following formula:

Q=0.56*(Z/n)*S^.5*d^2.67

Where:

Q = Discharge in CFS (Cubic Feet per Second)

Z = Inverse pavement cross slope

n = Manning roughness coefficient

S = Longitudinal slope of the street or gutter

d = Depth of gutter flow in feet

Solving for maximum depth at gutter

Manning Roughness Coefficient= 0.016

Reach	Inverse Pave. x slope 1/ft/ft	Min. Long. Slope S ft/ft	Required 2 Year Capacity Q CFS	2 year Water Depth d Ft.	Required 100 Yr Capacity Q CFS	100 Yr Water Depth d Ft.
A1	**50**	**0.005**	3.94	0.28	16.72	0.47
A2	**50**	**0.005**	1.15	0.17	4.85	0.30
A3	**50**	**0.007**	1.39	0.17	5.86	0.30
A4	**50**	**0.005**	0.07	0.06	0.28	0.10
B1	**50**	**0.005**	0.90	0.16	3.81	0.27
B2	**50**	**0.005**	0.09	0.07	0.39	0.12
B3	**50**	**0.007**	0.32	0.10	1.38	0.18
B4	**50**	**0.004**	1.90	0.22	8.02	0.37
B5	**50**	**0.004**	0.23	0.10	0.99	0.17
B6	**50**	**0.004**	0.39	0.12	1.66	0.20
C1	**50**	**0.005**	1.27	0.18	5.38	0.31
C2	**50**	**0.005**	1.83	0.21	7.72	0.35

INLET ANALYSIS - PROPOSED DEVELOPMENT

BASIN	AREA		RUNOFF COEF. C2	RUNOFF COEF. C100	REACH	LENGTH FEET	SLOPE (S) %	V Ft./Sec	2-Yr TIME MIN.	100-Yr TIME MIN.	INTENSITY Inches/Hour		DISCHARGE CFS (Q=CiA)		COMMENTS
	SURFACE TYPE	Ac.									2-Yr	100-Yr	2-Yr	100-Yr	
E1		0.65	0.75	0.80	ER1	190	0.60	1.55	NA	NA					Total area Basins A, B +
E2		0.26	0.75	0.80	ER2	120	0.60	1.55	NA	NA			56.7	22.9	Existing Development
E3		6.74	0.75	0.80	ER3	1,182	0.63	1.55	15.3	15.3					
E4		1.99	0.75	0.80	ER4	1,182	0.51	1.40	NA	NA					
A1		0.18	0.75	0.80	AR1	204	0.50	1.40	NA	NA					
A2		0.08	0.75	0.80	AR2	173	0.50	1.40	2.1	2.1					
A3		1.82	0.75	0.80	AR3	876	0.72	1.70	NA	NA					
A4		0.08	0.75	0.80	AR4	158	0.50	1.40	NA	NA					
B1		0.52	0.75	0.80	BR1	284	0.50	1.40	NA	NA					
B2		0.11	0.75	0.80	BR2	200	0.50	1.40	NA	NA					
B3		0.39	0.75	0.80	BR3	186	0.67	1.60	NA	NA					
B4		1.02	0.75	0.80	BR4	462	0.43	1.40	NA	NA					
B5		0.28	0.75	0.80	BR5	157	0.43	1.40	NA	NA					
B6		0.47	0.75	0.80	BR6	114	0.43	1.40	NA	NA					
	Total/average	14.59	0.75	0.80					17.3	17.3	0.74	2.93	8.10	34.20	Inlet Analysis

DRAINAGE ANALYSIS - HOLLYBERRY WAY

BASIN	AREA		RUNOFF COEF. C2	RUNOFF COEF. C100	REACH	LENGTH FEET	SLOPE (S) %	V Ft./Sec	2-Yr TIME MIN.	100-Yr TIME MIN.	INTENSITY Inches/Hour		DISCHARGE CFS (Q=CiA)		COMMENTS
	SURFACE TYPE	Ac.									2-Yr	100-Yr	2-Yr	100-Yr	
C1	Lot Flow					87	0.50	1.40	1.0	1.0					
	Curb Flow				CR1	930	0.58	1.60	9.7	9.7					
	Total/average	1.91	0.75	0.80					10.7	10.7	0.89	3.52	1.27	5.38	Inlet/Curb Analysis
C2	Lot Flow					102	0.50	1.40	1.2	1.2					
	Curb Flow				CR2	930	0.57	1.60	9.7	9.7					
	Total/average	2.74	0.75	0.80					10.9	10.9	0.89	3.52	1.83	7.72	Inlet/Curb Analysis

3.10 13.10

Pipe Capacity For Storm Drainage

$$Q = 0.463 (Dft)^{2.67} * S^{0.5} / n$$

Storm Drain Location	Pipe Diameter Inches	Slope Feet/Feet	Velocity Feet/Sec.	Rough. Coeff. n	Capacity Q CFS	Required Qh2 CFS
Line 1 (Applewood Inlet)	18.00	0.0033	3.70	0.012	6.54	8.10
Line 2 (Hollyberry Inlet)	18.00	0.0120	7.06	0.012	12.48	3.10
Line 3 (Combined Flow)	18.00	0.0033	3.70	0.012	6.54	11.20
Line 1 (Applewood Inlet)	24.00	0.0033	4.49	0.012	14.11	8.10
Line 3 (Combined Flow)	24.00	0.0033	4.49	0.012	14.11	11.20

DEC 1994

Existing

Developed

LAND USE OR SURFACE CHARACTERISTICS	SCS HYDROLOGIC SOIL GROUP (SEE APPENDIX "C" FOR DESCRIPTIONS)											
	A			B			C			D		
	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
UNDEVELOPED AREAS												
Bare ground	.10 - .20 .14 - .24	.16 - .26 .22 - .32	.25 - .35 .30 - .40	.14 - .22 .20 - .28	.22 - .30 .28 - .36	.30 - .38 .37 - .45	.20 - .28 .26 - .34	.28 - .36 .35 - .43	.36 - .44 .40 - .48	.24 - .32 .30 - .38	.30 - .38 .40 - .48	.40 - .48 .50 - .58
Cultivated/Agricultural	.08 - .18 .14 - .24	.13 - .23 .18 - .28	.16 - .26 .22 - .32	.11 - .19 .16 - .24	.15 - .23 .21 - .29	.21 - .29 .28 - .36	.14 - .22 .20 - .28	.19 - .27 .25 - .33	.26 - .34 .34 - .42	.18 - .26 .24 - .32	.23 - .31 .29 - .37	.31 - .39 .41 - .49
Pasture	.12 - .22 .15 - .25	.20 - .30 .25 - .35	.30 - .40 .37 - .47	.18 - .26 .23 - .31	.28 - .36 .34 - .42	.37 - .45 .45 - .53	.24 - .32 .30 - .38	.34 - .42 .42 - .50	.44 - .52 .52 - .60	.30 - .38 .37 - .45	.40 - .48 .50 - .58	.50 - .58 .62 - .70
Meadow	.10 - .20 .14 - .24	.16 - .26 .22 - .32	.25 - .35 .30 - .40	.14 - .22 .20 - .28	.22 - .30 .28 - .36	.30 - .38 .37 - .45	.20 - .28 .26 - .34	.28 - .36 .35 - .43	.36 - .44 .44 - .52	.24 - .32 .30 - .38	.30 - .38 .40 - .48	.40 - .48 .50 - .58
Forest	.05 - .15 .08 - .18	.08 - .18 .11 - .21	.11 - .21 .14 - .24	.08 - .16 .10 - .18	.11 - .19 .14 - .22	.14 - .22 .18 - .26	.10 - .18 .12 - .20	.13 - .21 .16 - .24	.16 - .24 .20 - .28	.12 - .20 .15 - .23	.16 - .24 .20 - .28	.20 - .28 .25 - .33
RESIDENTIAL AREAS												
1/8 acre per unit	.40 - .50 .48 - .58	.43 - .53 .52 - .62	.46 - .56 .55 - .65	.42 - .50 .50 - .58	.45 - .53 .54 - .62	.50 - .58 .59 - .67	.45 - .53 .53 - .61	.48 - .56 .57 - .65	.53 - .61 .64 - .72	.48 - .56 .56 - .64	.51 - .59 .60 - .68	.57 - .65 .69 - .77
1/4 acre per unit	.27 - .37 .35 - .45	.31 - .41 .39 - .49	.34 - .44 .42 - .52	.29 - .37 .38 - .46	.34 - .42 .42 - .50	.38 - .46 .47 - .55	.32 - .40 .41 - .49	.36 - .44 .45 - .53	.41 - .49 .52 - .60	.35 - .43 .43 - .51	.39 - .47 .47 - .55	.45 - .53 .57 - .65
1/3 acre per unit	.22 - .32 .31 - .41	.26 - .36 .35 - .45	.29 - .39 .38 - .48	.25 - .33 .33 - .41	.29 - .37 .38 - .46	.33 - .41 .42 - .50	.28 - .36 .36 - .44	.32 - .40 .41 - .49	.37 - .45 .48 - .56	.31 - .39 .39 - .47	.35 - .43 .43 - .51	.42 - .50 .53 - .61
1/2 acre per unit	.16 - .26 .25 - .35	.20 - .30 .29 - .39	.24 - .34 .32 - .42	.19 - .27 .28 - .36	.23 - .31 .32 - .40	.28 - .36 .36 - .44	.22 - .30 .31 - .39	.27 - .35 .35 - .43	.32 - .40 .42 - .50	.26 - .34 .34 - .42	.30 - .38 .38 - .46	.37 - .45 .48 - .56
1 acre per unit	.14 - .24 .22 - .32	.19 - .29 .26 - .36	.22 - .32 .29 - .39	.17 - .25 .24 - .32	.21 - .29 .28 - .36	.26 - .34 .34 - .42	.20 - .28 .28 - .36	.25 - .33 .32 - .40	.31 - .39 .40 - .48	.24 - .32 .31 - .39	.29 - .37 .35 - .43	.35 - .43 .46 - .54
MISC. SURFACES												
Pavement and roofs	.93 .95	.94 .96	.95 .97	.93 .95	.94 .96	.95 .97	.93 .95	.94 .96	.95 .97	.93 .95	.94 .96	.95 .97
Traffic areas (soil and gravel)	.55 - .65 .65 - .70	.60 - .70 .70 - .75	.64 - .74 .74 - .79	.60 - .68 .68 - .76	.64 - .72 .72 - .80	.67 - .75 .75 - .83	.64 - .72 .72 - .80	.67 - .75 .75 - .83	.69 - .77 .77 - .85	.72 - .80 .79 - .87	.75 - .83 .82 - .90	.77 - .85 .84 - .92
Green landscaping (lawns; parks)	.10 - .20 .14 - .24	.16 - .26 .22 - .32	.25 - .35 .30 - .40	.14 - .22 .20 - .28	.22 - .30 .28 - .36	.30 - .38 .37 - .45	.20 - .28 .26 - .34	.28 - .36 .35 - .43	.36 - .44 .42 - .52	.24 - .32 .30 - .38	.30 - .38 .40 - .48	.40 - .48 .50 - .58
Non-green and gravel landscaping	.30 - .40 .34 - .44	.36 - .46 .42 - .52	.45 - .55 .50 - .60	.35 - .45 .40 - .50	.42 - .50 .48 - .56	.50 - .58 .57 - .65	.40 - .48 .46 - .54	.48 - .56 .55 - .63	.56 - .64 .64 - .72	.44 - .52 .50 - .58	.50 - .58 .60 - .68	.60 - .68 .70 - .78
Cemeteries, playgrounds	.20 - .30 .24 - .34	.26 - .36 .32 - .42	.35 - .45 .40 - .50	.25 - .35 .30 - .40	.32 - .40 .38 - .46	.40 - .48 .47 - .55	.30 - .38 .36 - .44	.38 - .44 .45 - .53	.46 - .54 .54 - .62	.34 - .42 .40 - .48	.40 - .48 .50 - .58	.50 - .58 .60 - .68

NOTES:
1. Values above and below pertain to the 2-year and 100-year storms, respectively.
2. The range of values provided allows for engineering judgement of site conditions such as basic shape, homogeneity of surface type, surface depression storage, and storm duration. In general, during shorter duration storms (Tc ≤ 10 minutes), infiltration capacity is higher, allowing use of a "C" value in the low range. Conversely, for longer duration storms (Tc) 30 minutes), use a ""C value in the higher range.
3. For residential development at less than 1/8 acre per unit or greater than 1 acre per unit, and also for commercial and industrial areas, use values under MISC SURFACES to estimate "C" value ranges for use.

RATIONAL METHOD RUNOFF COEFFICIENTS
(Modified from Table 4, UC-Davis, which appears to be a modification of work done by Rawls)

TABLE "B-1"

9-6-00	Redcl. & FS	Flood Protection

SN02 NAVD 88 + 1.04 m

SN 10 " + 0.96 m

Per Frank Kochevar 9-6-00 11:00

Conversion From NAVD 29 To NAVD 88

Use 1.00 m adjustment

= 3.28 ~~ft~~

From Flood map 100 yr Event

NAVD 29 EL = 4481

+ 3.28

NAVD 88 EL = 4484.28

Development must be protected From Base Flood EL +1

Drainage Fee Calculation

$$\text{Drainage Fee} = 10{,}000 (C_{1000} - C_{100H}) A^{0.7}$$

$$= 10{,}000 (0.80 - 0.28)(11.74)^{0.7}$$

$$\text{Fee} = \$29{,}158.89$$

C_{1000} - Developed Runoff Coeff. 100 yr event

C_{100H} - Historic Runoff Coeff. 100 yr event

A - Developed Area Acres

Taken From Stormwater Management Manual

Dated May 1996

Runoff Coeff. for Developed Lots

	Area	C_2	C_{100}
Grassed	3.32	0.22	0.28
Roof + Drive	3.77	0.93	0.95
Roads	2.38	0.93	0.95
Total/Ave	9.47	0.68	0.71

A Mid sized Building was used to estimate Building & Lawn Areas, If Larger Bldng is used in majority of lots then C will increase

Use $C_2 = 0.75$

$C_{100} = 0.80$

Irrigation Water Rights Required

1.5 shares / acre irrigated required by Fruita

1 share = 4.5 gal/min

Developed Lots Grassed Area = 3.32 acre

shares = 3.32 (1.5) = 4.98

Use 5 shares = 22.5 gpm

5 shares $(4.5\ gpm/share)\left(\frac{1\ m}{60\ s}\right)\left(231\ \frac{in^3}{gal}\right)\left(\frac{ft^3}{1728}\right) = 0.0501\ cfs$

Park Area = 2.27 ac

shares = 2.27 (1.5) = 3.4

Use 4 shares = 18 gpm

Drainage Calculations

Runoff Entering From Existing Park

From original Plat - Areas

Mobile Home Lots = 13.69 ac Total
Public RW = 5.42 ac Total

New Park Areas
Lots = 7.09 ac
ROW 2.38 ac

Old Area Area
Lots = 13.69 - 7.09 = 6.60 Ac
ROW = 5.42 - 2.38 = 3.04 Ac
9.64

4 Locations Flow Enters New Development

		% Area	Area
F1	E Honeysuckle Circle	6.7	0.65 Ac
F2	W Honeysuckle Circle	2.7	0.26 Ac
F3	E Applewood Way	70.0	6.74
F4	W Applewood Way	20.6	1.99

Average Flow slope & Length - Critical Reaches

F1 E Honey S = 0.6 % L = 190'
F2 W Honey S = 0.6 % L = 120'

F3 E Applewood (R. side Honey Suckle) L = 1181.5

	Apple	Honey						
S	0.55	0.45	0.80	.49	.55	.70	1.35	0.58
L	125	240	77	83	400	48.5	117	91
End STA	125	240	317	400	800	848.5	965.5	1056.5

Wtd Ave S = 0.63 %

F4 W Applewood (L side Honey suckle) L = 1181.5

S	0.55	0.48	0.24	0.57	.53	.87	0.44	0.52
L	125	240	77	83	400	48.5	117	91

Wtd Ave S = 0.51 %