

**DRAINAGE STUDY FOR**  
**FAMILY DOLLAR STORE**

**Highway 6 & 50  
Fruita, Colorado**

**GS&P PROJECT # 23556.31**

**October 5, 2005**



**G R E S H A M  
S M I T H   A N D  
P A R T N E R S**

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Family Dollar Store  
Drainage Study  
Continued.....

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FAMILY DOLLAR SITE  
Drainage Study  
continued.....

**I. Location and Description of Property**

**A. Property Location:**

The Family Dollar Store project is located in the City of Fruita, County of Mesa, State of Colorado, more particularly being in the NE 1/4 of Section 18, T.1 N., R.2 W., of the Ute Prime Meridian.

Existing Streets within the area of the project include Wallace Street to the north which terminates at the project's north boundary line U S Highway 6 & 50 running southeast to northwest defines the south boundary line of the project site. U S Highway 6 & 50 will provide the primary access to the project. (Exhibit 1.0)

The subject property historically has been used as grazing and pasture land. The property is bounded to the east by a single family residence which borders the west bank of the Little Salt Wash. The property is bounded to the south by US Highway 6 & 50 with the Railroad ROW beyond. West of and adjacent to the site is property owned and occupied by the Fruita Consumers Coop. To the north lies the Rosenauer property zoned community residential, the Ricks property zoned community residential and Filing No. 3 of Downer Subdivision a single family residential development. Land use in the vicinity of the project is best described as low to moderate density residential, commercial and undeveloped drainage way.

**B. Description of Property:**

The Family Dollar Store site is 1.25 acres and is planned for the development of a 9,180 square foot retail store and 1500 s.f. retail shop with associated paved parking area.

Topography of the site is considered historically flat draining from the northeast to the southwest in an overland sheet-flow fashion at an average slope of 0.60% grade to an existing irrigation tailwater ditch along the South boundary of the site. The existing tailwater ditch conveys runoff from the site and the Fruita Coop property southeasterly adjacent to and parallel with the highway to an existing 24-inch diameter CMP under US Hwy. 6 & 50. The existing 24-inch CMP conveys the runoff to the south under the highway ultimately discharging into the Colorado River.

The site soils are classified as (Rc) Fruita Sandy Clay Loam, 0 to 2 percent slopes, hydrological soils group "B" and (Bc) Sagers Silty Clay Loam, 0 to 2 percent slopes, hydrological soils group "B", (Exhibit 2.0, Reference 3).

FAMILY DOLLAR SITE  
Drainage Sturdy  
Continued.....

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

### **A. Major Basin Description:**

The stormwater runoff from the Fruita Coop property to the west, the project site and a portion of the single family residence drain via overland flow to the existing 24-inch diameter culvert under Hwy. 6 & 50 and is subsequently conveyed towards the Colorado River. Land to the north of the site, Downer Subdivision Filing No. 3 drains via lot grading away from the site into Wallace Street and then north. The Little Salt Wash is located adjacent to our neighbors to the east of our site.

The site is defined as being Zone X as shown on the "Flood Insurance Rate Map, Mesa County Colorado" (Exhibit 3.0, Reference2). The Base Flow Elevation (B.F.E.) adjacent to the Little Salt Wash is defined as 4,486.00. The proposed building finish floor elevation is to be 4,490.50 which provides for 4.5 feet above to the Base Flow Elevation.

### **B. Sub-Basin Description:**

Topography of the site is considered flat draining from the northeast to the southwest in a overland sheet-flow fashion at an average slope of 0.60% grade to an existing irrigation tailwater ditch along the south boundary of the site. The existing tailwater ditch conveys runoff from the site, single family residence to Fruita Coop property to the west and then southeasterly adjacent to and parallel with the highway to an existing 24-inch diameter CMP under US hwy. 6 & 50. The existing 24-inch CMP conveys the runoff south under the highway ultimately discharging into the Colorado River.

The only Offsite Basins that contribute flow directly to the project site is a portion of the single family residence to our East as shown on the Final Drainage Plan contained herein.

All storm water runoff generated by the project shall be collected by a new onsite storm sewer system within the parking lot areas. The stormwater shall be collected by area inlets at low points within the parking areas and routed southeast onsite discharging directly to the Little Salt Wash. Due to the project's close proximity to the Little Salt Wash and the Colorado River, detention of stormwater runoff is not warranted.

FAMILY DOLLAR SITE  
Drainage Sturdy  
Continued.....

### **III. Drainage Facility Design**

#### **A. General Concept:**

The "Mesa County, City of Grand Junction, Stormwater Management Manual" (SWMM), (Reference 1) was used as the basis for analysis and facility design.

As the project is commercial development containing approximately 1.25 acres the "Rational Method" was used to calculate developed flowrates. The major storm is the 100- Year frequency rainfall event. Developed flowrates for the project are calculated and presented as Exhibit 7.0.

The new storm sewer pipe system shall convey un-attenuated 100 -Year flows from the project site to the Little Salt Wash. The storm water system has been designed to accommodate the development of the property between our site and the Little Salt Wash.

Runoff Coefficients used in the final computations are a composite (C) for the 100-Year Storm Event. These values are based on the existing soils conditions and proposed roadway, lot improvements, building and landscape areas. These values were compared to the most recent Mesa County, City of Grand Junction criteria as defined in Reference 1 and shown on Exhibit 5.0, and were found to be acceptable. A developed condition (C) Runoff Coefficient of 0.74 was used in the calculations of the 100 Year Storm runoff rates. A developed (C) of 0.8 was used for the 1.3 acre offsite drainage basin to Inlet #4.

The Intensity Duration Frequency data (IDE) presented in the (SWMM), Reference 1, Exhibit 4.0 was used for final design and analysis.

Times of Concentration were calculated based on the Average Velocities For Overland Flow and the Overland Flow Curves as provided in Reference 1 and shown on Exhibit 6.1. The calculated Times of Concentration are presented on Exhibit 6.0.

#### **B. Detailed Design**

The proposed Final Drainage Plan divides the site into 4 drainage sub-basins with a combined area of 2.50 acres as follows:

##### Sub-Basin A1 (0.75 Acres)

Runoff from this sub-basin is generated entirely by the roof top drainage and landscape area on the northwest side of the site. This runoff is conveyed via the lot grading to a area inlet #1 in sump condition. The total routed flow at design inlet #1 is calculated to be 1.7 C.F.S. This runoff is to be conveyed via an 12-inch diameter A.D.S. pipe southeast to inlet #2.

*\* Historic "C" values not included in this report.*

Family Dollar Store  
Drainage Study  
Continued.....

Sub-Basin A2 (0.30 Acres)

Runoff from this sub-basin includes a portion of the parking lot. The runoff is conveyed via parking lot grading to a C.D.O.T Type 'C' inlet in a sump condition. The 100 year runoff to inlet #2 is calculated to be 1.25 C.F.S. This runoff is conveyed to inlet #3 via 18" ADS drainage pipe.

Sub-Basin A3 (0.15 Acres)

Runoff from this sub-basin is a portion of the parking lot. This runoff is conveyed via parking lot grading to an C.D.O.T. Type 'C' inlet in sump condition. The total routed flow at design inlet #3 is calculated to be 0.65 C.F.S. This runoff is to be conveyed via an 18-inch diameter RCP pipe southeast to inlet #4.

Sub-Basin A4 (1.30 Acres)

Runoff from this sub-basin is a portion of our driveway and the 1.3 acre offsite drainage from the east. The total routed flow at inlet #4 is 4.6 C.F.S. The storm water piping has been sized to accommodate the runoff from sub-basins A1, A2 and A3 and is calculated to be 8.2 C.F.S. for the 2.5 acre drainage basin. This runoff is to be conveyed via a 24-inch diameter ADS/RCP pipe southeast discharging directly into the Little Salt Wash.

**V. Storm Sewer System Hydraulic Design**

The proposed storm sewer system for this project was analyzed for adequate capacity to convey the developed un-detained 100-Year Storm Event. Hydraulic Grade Lines were calculated at each inlet based on 100-Year flow rates, pipe size and material type. A calculation showing grate elevations versus water surface elevations is presented on Exhibits 8.0 – 12.0. Hydraulic Grade Lines were calculated using a starting water surface elevation of 4,486.00 at the outlet end in Little Salt Wash. The calculated H.G.L. at each design point was found to occur below inlet grates.

Family Dollar Store  
Drainage Study  
Continued.....

**V. Rip-Rap Outlet Protection**

The outfall end of the new storm sewer where it discharges to the Little Salt Wash is to be 24-inch diameter RCP and shall have a flared end section. Rip-Rap shall be installed as outlet protection and shall be of the following specification.

d50 = 9-inches  
Length = 15-feet  
Width = 7.5-feet  
Depth = 1.5-feet

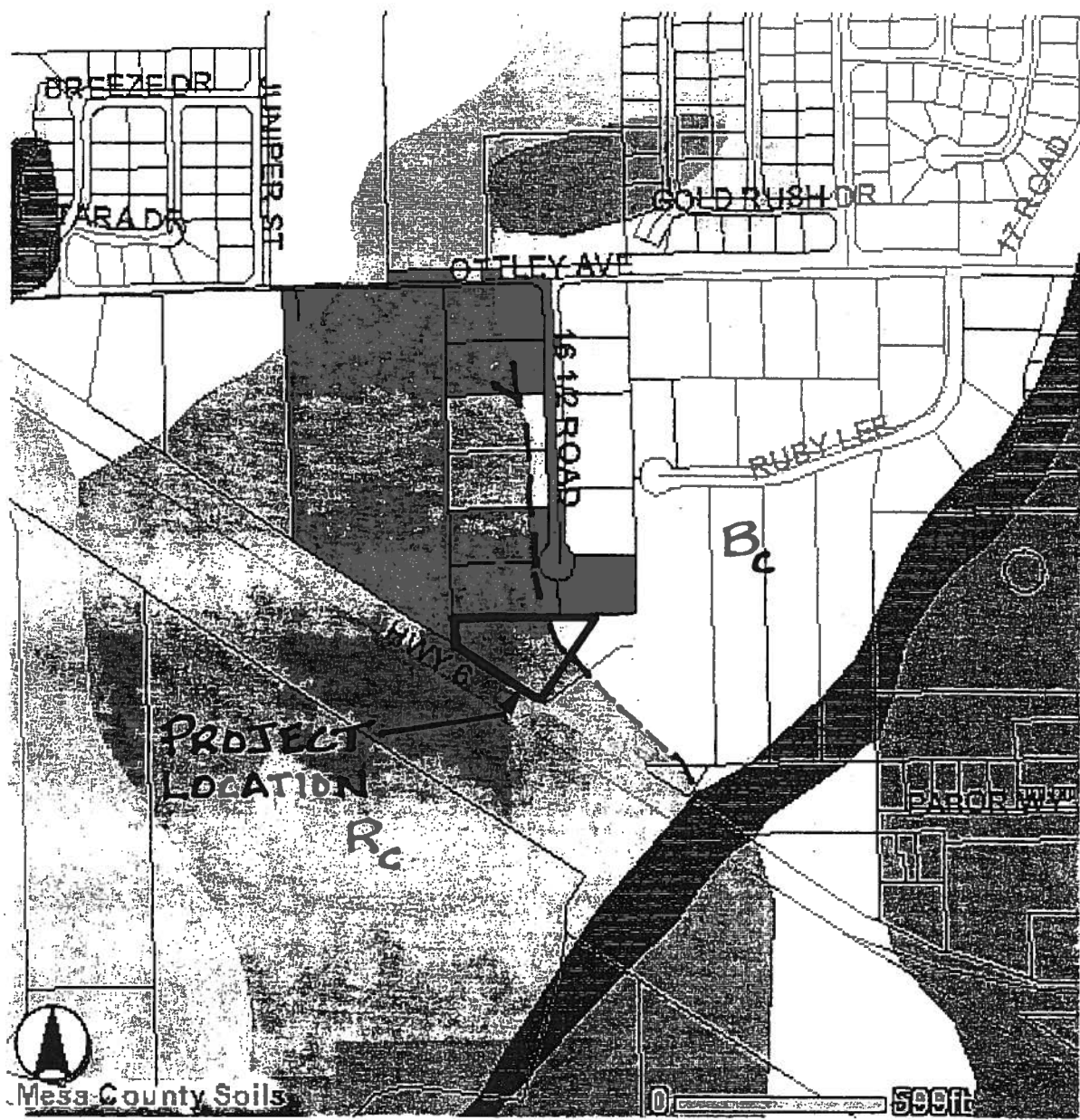
**VI. Conclusion**

This Drainage Study has been prepared to address site-specific drainage concerns in accordance with the requirements of the City of Fruita, Mesa County, Colorado. The Appendix of this report includes criteria, exhibits, tables and design nomographs used in the final design of this project.

## **V. References**

1. Stormwater Management Manual (SWMM), City of Grand Junction, Mesa County, Colorado, January, 1996.
2. Flood Insurance Rate Map, Mesa County, Colorado, (Unincorporated Areas), Community Panel Number 08011 5-0265-B, Federal Emergency Management Agency, Map Revised July 15th, 1992.
3. Soil Survey Mesa County Area1 Colorado1 USDA Natural Resources Conservation Service, January 14, 2002.
4. Hydrology, Storm Sewers, Copyright 1990, by Engineering Data Systems, Inc.





Map Unit Name

Rec	Map Unit Symbol	Map Unit Name	Percent Slope	FARMLAND
1	Rc	Fruitland Sandy Clay Loam	0-2	Prime if Irrigated
2	Bc	Sagers Silty Clay Loam	0-2	Prime if Irrigated

Component: FRUITLAND

% of Mapunit 90

Hydrologic Group B Frost Action: Low

Corrosivity to Concrete: Low

Corrosivity to Steel: Moderate

Component: SAGERS

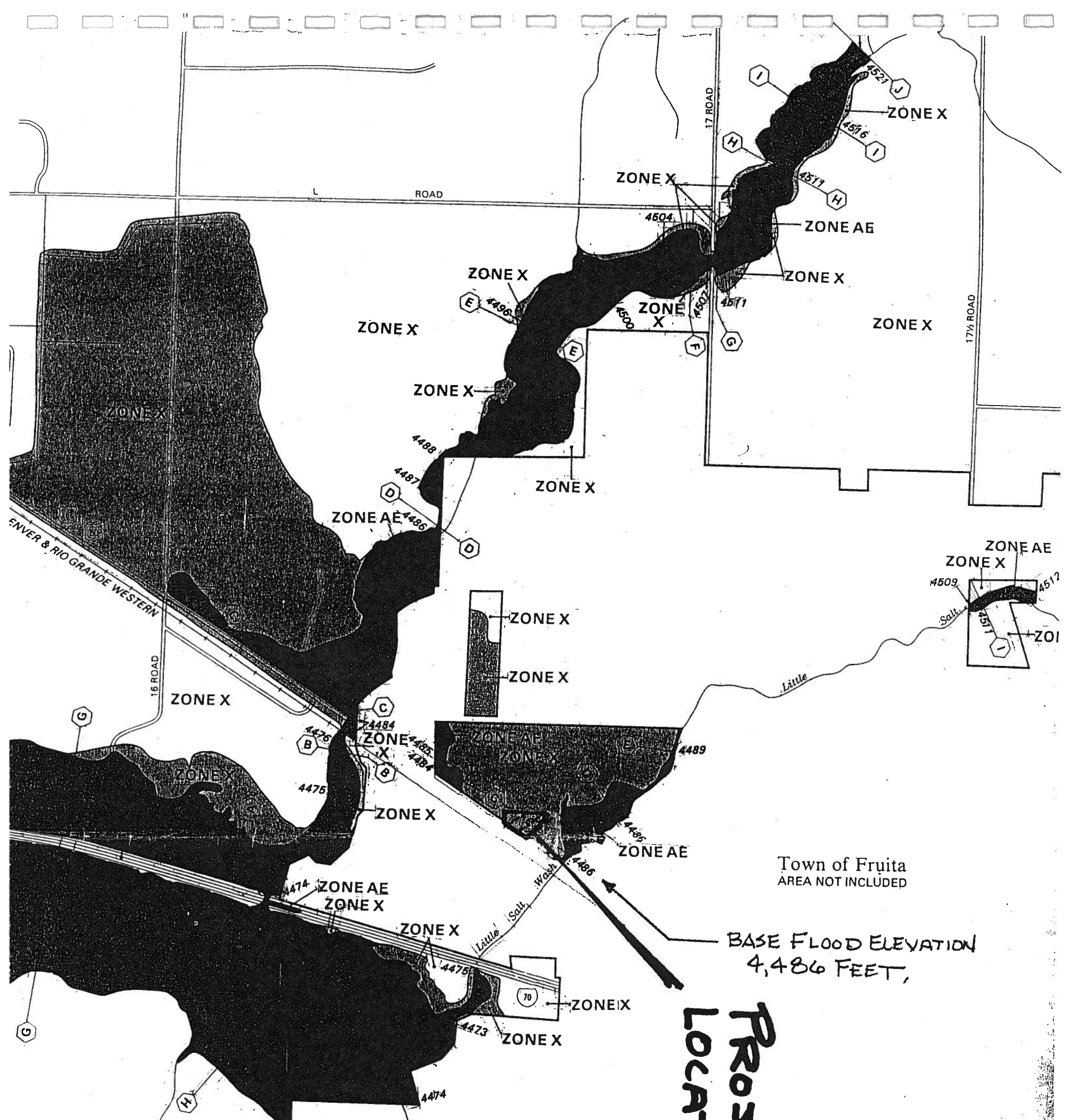
% of Mapunit 90

Hydrologic Group B Frost Action: Low

Corrosivity to Concrete: Moderate Corrosivity to Steel: High

# SITE SOILS MAP

## EXHIBIT 2.0



**LEGEND**

**SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD**

**ZONE A**  
No base flood elevations determined.  
Base flood elevations determined.

**ZONE AE**  
Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

**ZONE AH**  
Flood depths of 1 to 3 feet (usually areas of ponding); average depths determined; base flood elevations determined; no base flood elevations determined.

**ZONE AD**  
Flood depths of 1 to 3 feet (usually areas of ponding); average depths determined; no base flood elevations determined; no base flood elevations determined.

**ZONE A99**  
To be protected from 100-year flood by construction of a protection system under construction; no base flood elevations determined.

**ZONE V**  
Coastal flood with velocity hazard (see notes); base flood elevations determined.

**ZONE VE**  
Coastal flood with velocity hazard (see notes); base flood elevations determined.

**FLOODWAY AREAS IN ZONE AE**

**OTHER FLOOD AREAS**

**ZONE X**  
Areas of 100-year flood; areas of 100-year flood with average depth 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.**

**Base Flood Elevation Line: Elevation in Feet\***

**Contour Section Line**

**Base Flood Elevation in Feet Where Uniform Within Zone**

**Elevation Reference Mark**

**RM7 X**

**IEL 9871**

**513**

**D**

**D**

\*Referenced to the National Geodetic Vertical Datum of 1929

**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM**

**FLOOD INSURANCE RATE MAP**

**MESA COUNTY, COLORADO (UNINCORPORATED AREAS)**

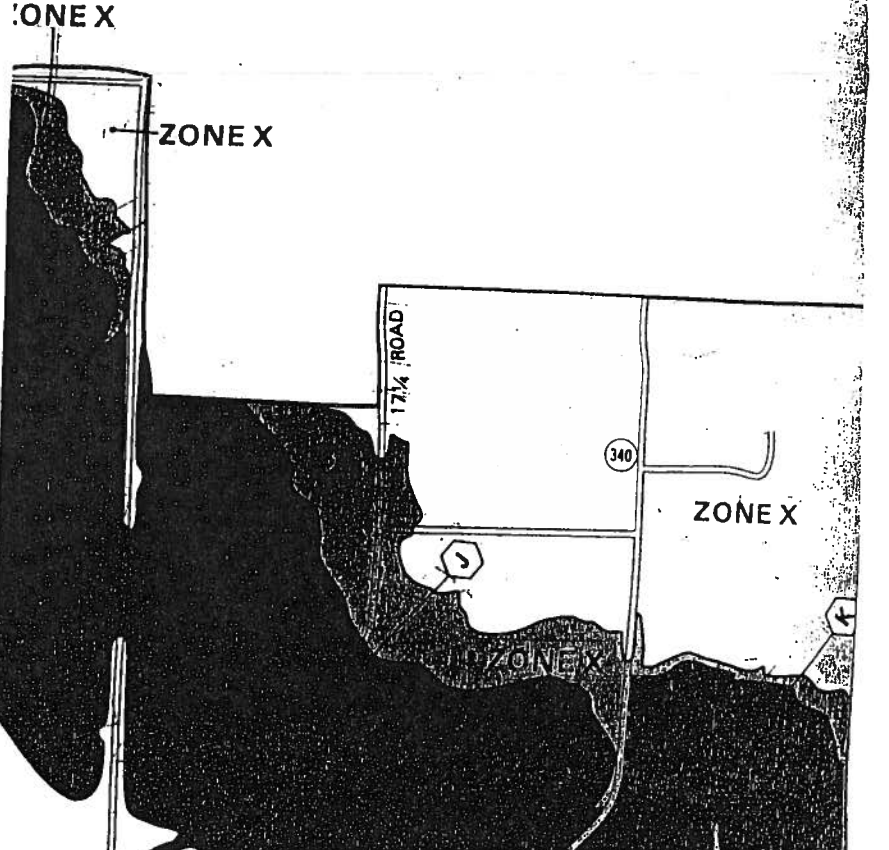
**PANEL 265 OF 1000**

SEE MAP INDEX FOR PANELS NOT PRINTED

**COMMUNITY PANEL NUMBER 080115 0265 B**

**MAP REVISED: JULY 15, 1992**

**Federal Emergency Management Agency**



**EXHIBIT B.C**

**TABLE "A-1a"**  
**IDF DATA FOR USE IN THE GRAND VALLEY**

Time (min)	2-Year Intensity (in/hr)	100-Year Intensity (in/hr)	Time (min)	2-Year Intensity (in/hr)	100-Year Intensity (in/hr)
5	1.11	4.41	33	0.51	2.03
6	1.07	4.23	34	0.50	1.99
7	1.03	4.07	35	0.49	1.95
8	0.99	3.92	36	0.49	1.91
9	0.95	3.78	37	0.48	1.88
10	0.92	3.64	38	0.47	1.85
11	0.89	3.52	39	0.46	1.82
12	0.86	3.41	40	0.45	1.79
13	0.83	3.30	41	0.45	1.76
14	0.81	3.20	42	0.44	1.73
15	0.79	3.11	43	0.43	1.70
16	0.76	3.02	44	0.42	1.67
17	0.74	2.93	45	0.42	1.64
18	0.72	2.85	46	0.41	1.61
19	0.70	2.77	47	0.40	1.59
20	0.68	2.70	48	0.40	1.57
21	0.67	2.63	49	0.39	1.55
22	0.65	2.57	50	0.39	1.53
23	0.64	2.51	51	0.38	1.50
24	0.62	2.45	52	0.38	1.48
25	0.61	2.39	53	0.37	1.46
26	0.59	2.34	54	0.37	1.44
27	0.58	2.29	55	0.36	1.42
28	0.57	2.24	56	0.36	1.40
29	0.56	2.19	57	0.35	1.38
30	0.54	2.15	58	0.35	1.37
31	0.53	2.11	59	0.34	1.35
32	0.52	2.07	60	0.34	1.33

Source: Mesa County 1992 (Modified)

$$I_2 = \frac{26.71}{T_c + 19.01}$$

$$I_{100} = \frac{104.94}{T_c + 18.80}$$

**EXHIBIT 4.0**

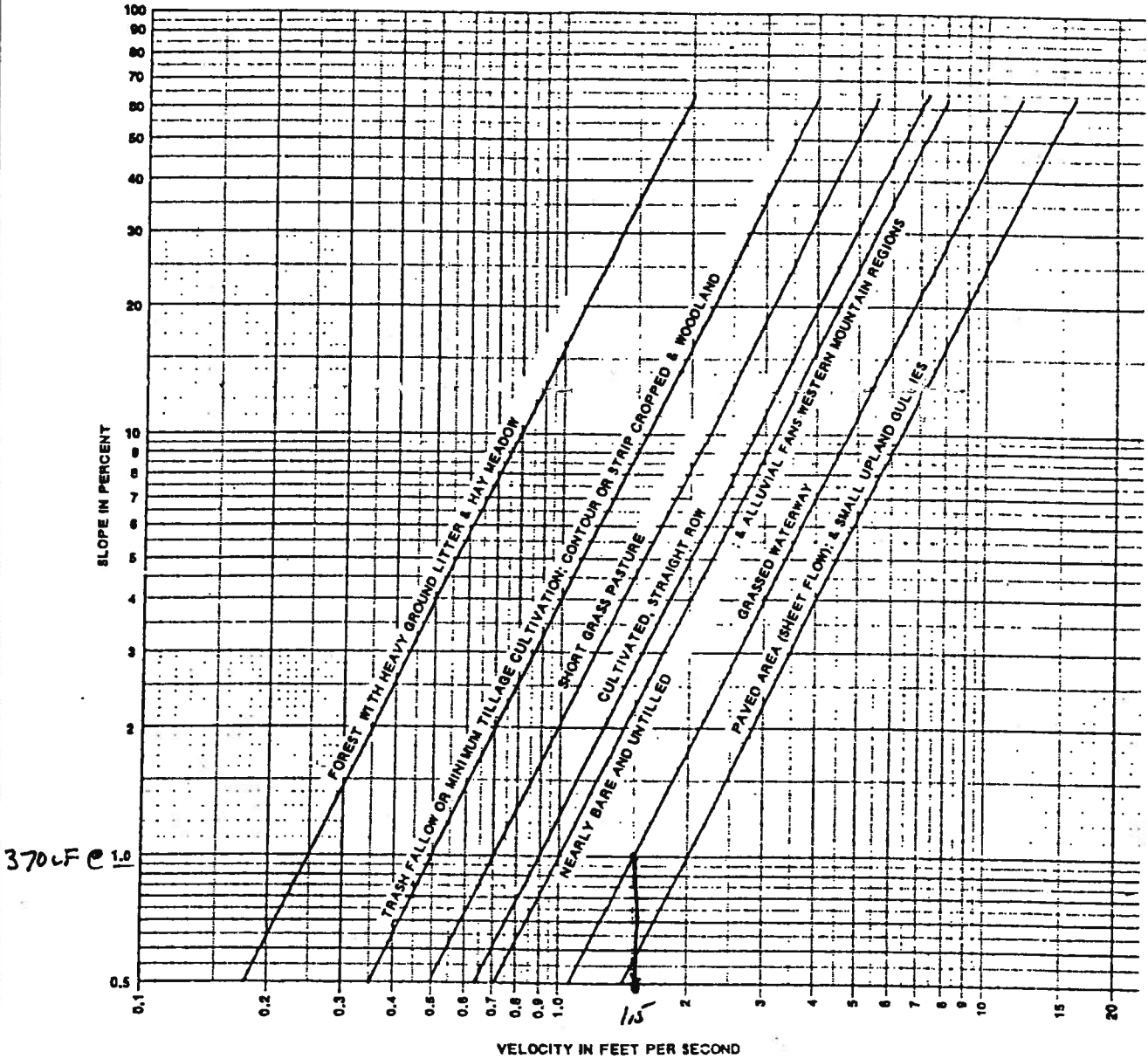
DEC 1994

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	16-26	25-35	14-22	22-30	30-38	20-28	28-36	36-44	24-32	30-38	40-48
	14-24	22-32	30-40	20-28	28-36	37-45	26-34	33-43	40-48	30-38	40-48	50-58
Cultivated/Agricultural	08-18	13-23	16-26	11-19	15-23	21-29	14-22	19-27	26-34	18-26	23-31	31-39
	14-24	18-28	22-32	16-24	21-29	28-36	20-28	25-33	34-42	24-32	29-37	41-49
Pasture	12-22	20-30	30-40	18-26	28-36	37-45	24-32	34-42	44-52	30-38	40-48	50-58
	15-25	25-35	37-47	23-31	34-42	45-53	30-38	42-50	52-60	37-45	50-58	62-70
Meadow	10-20	16-26	25-35	14-22	22-30	30-38	20-28	28-36	36-44	24-32	30-38	40-48
	14-24	22-32	30-40	20-28	28-36	37-45	26-34	33-43	44-52	30-38	40-48	50-58
Forest	05-15	08-18	11-21	08-16	11-19	14-22	10-18	13-21	16-24	12-20	16-24	20-28
	08-18	11-21	14-24	10-18	14-22	18-26	12-20	16-24	20-28	15-23	20-28	25-33
RESIDENTIAL AREAS 1/8 acre per unit	40-50	43-53	46-56	42-50	45-53	50-58	45-53	48-56	53-61	48-56	51-59	57-65
	48-58	52-62	55-65	50-58	54-62	59-67	53-61	57-65	64-72	56-64	60-68	69-77
1/4 acre per unit	27-37	31-41	34-44	29-37	34-42	38-46	32-40	36-44	41-49	35-43	39-47	45-53
	35-45	39-49	42-52	38-46	42-50	47-55	41-49	45-53	52-60	43-51	47-55	57-65
1/3 acre per unit	22-32	26-36	29-39	25-33	29-37	33-41	28-36	32-40	37-45	31-39	35-43	42-50
	31-41	35-45	38-48	31-41	38-46	42-50	36-44	41-49	48-56	39-47	43-51	53-61
1/2 acre per unit	16-26	20-30	24-34	19-27	23-31	28-36	22-30	27-35	32-40	26-34	30-38	37-45
	25-35	29-39	32-42	28-36	32-40	36-44	31-39	35-43	42-50	34-42	38-46	48-56
1 acre per unit	14-24	19-29	22-32	17-25	21-29	26-34	20-28	25-33	31-39	24-32	29-37	35-43
	22-32	26-36	29-39	24-32	28-36	34-42	28-36	32-40	40-48	31-39	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
	95-97	96-98	97-99	95-97	96-98	97-99	94-96	95-97	96-98	94-96	95-97	96-98
Traffic areas (soil and gravel)	55-65	60-70	64-74	60-68	64-72	67-75	64-72	67-75	69-77	72-80	75-83	77-85
	65-70	70-75	74-79	68-78	72-80	75-83	72-80	75-83	77-85	79-87	82-90	84-92
Green landscaping (lawns, parks)	10-20	16-26	25-35	14-22	22-30	30-38	20-28	28-36	36-44	24-32	30-38	40-48
	14-24	22-32	30-40	20-28	28-36	37-45	26-34	33-43	42-52	30-38	40-48	50-58
Non-green and gravel landscaping	30-40	36-46	45-55	45-53	42-50	50-58	40-48	48-56	56-64	44-52	50-58	60-68
	34-44	42-52	50-60	50-60	48-56	57-65	46-54	55-63	64-72	50-58	60-68	70-78
Cemeteries, playgrounds	20-30	26-36	35-45	26-36	32-40	40-48	30-38	38-44	46-54	34-42	40-48	50-58
	24-34	32-42	40-50	40-50	38-46	47-55	36-44	43-53	54-62	40-48	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)

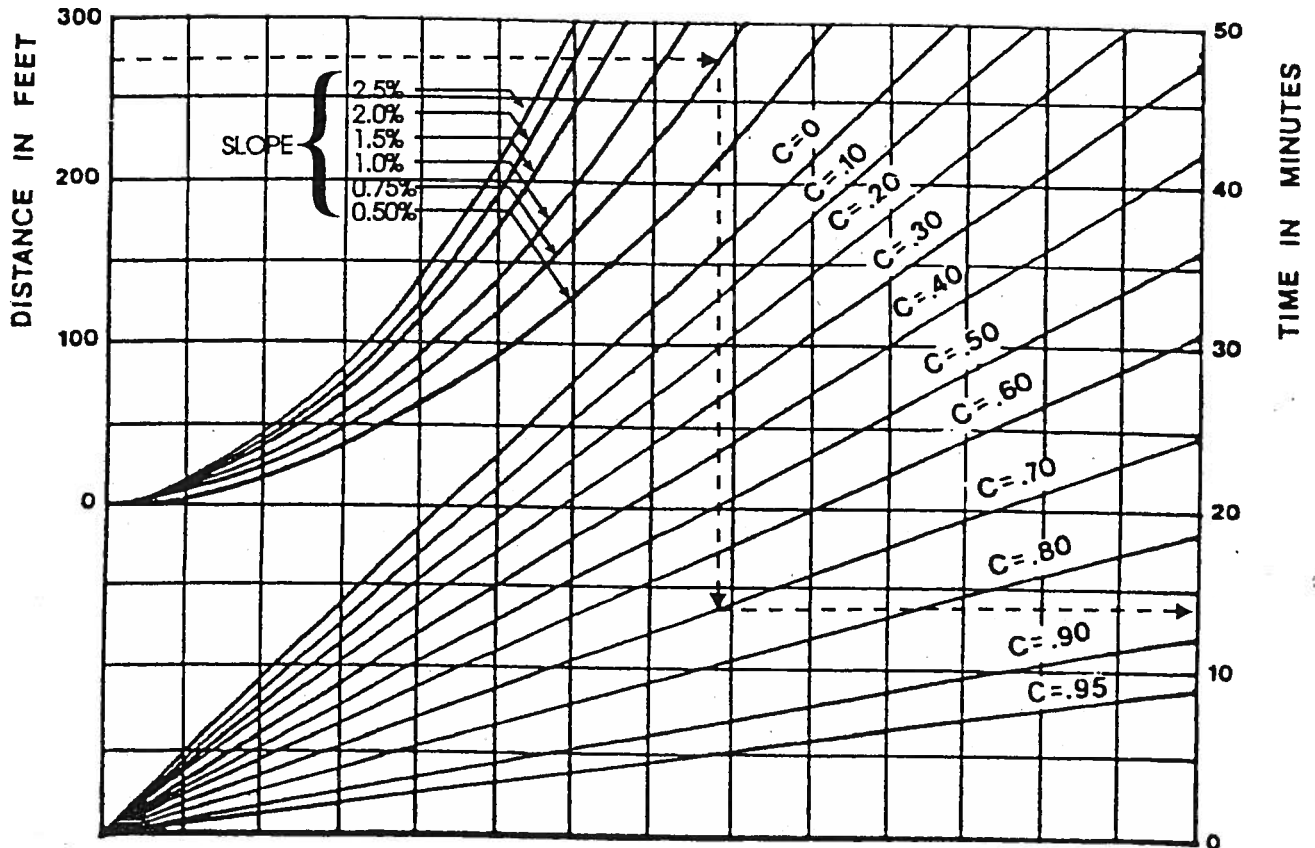
REPRODUCED FROM FIGURE 15.2, SCS 1972



370cF @ 1.5 ft/s =  $T_c = 4.1 \text{ min}$   
 USE 5.0 MIN

**EXHIBIT 6.0**

MODIFIED FROM FIGURE 403, MESA COUNTY



THE ABOVE CURVES ARE A SOLUTION OF THE FOLLOWING EQUATION:

$$T_o = \frac{1.8 (1.1 - C) \sqrt{L}}{\sqrt[3]{S}}$$

- WHERE:  $T_o$  = OVERLAND FLOW TIME (MIN.) •  
 $S$  = SLOPE OF BASIN (%)  
 $C$  = RUNOFF COEFFICIENT (SEE TABLE "B-1" IN APPENDIX "B")  
 $L$  = LENGTH OF BASIN (ft)

# EXHIBIT 6.1

NO.	TYPE	T.C.	I.E. (IN)	I.E. (OUT)	TYPE PIPE	PIPE DIA.(IN.)	L.F.	SLOPE	Q (CFS) CAP / ACTUAL	VEL (FPS)	AREA INLET / TOTAL	"C"
1	AREA DRAIN	4487.0		4484.8								
	DTL 10/C4.2				ADS	12"	40	0.5%	1.7/2.2	2.9	0.75/0.75	0.52
2	TYPE 'C'	4488.4	4484.6	4484.55								
	DTL 7/C4.2				ADS	18"	172	0.4%	2.95/6.65	3.7	0.3/1.05	0.64
3	TYPE 'C'	4488.3	4483.85	4483.80								
	DTL 7/C4.2				RCP	18"	32	0.5%	3.6/7.4	4.2	0.15/1.2	0.68
4	TYPE 'C'	4488.3	4483.65	4483.60								
	DTL 7/C4.2				ADS	24"	367	0.4%	8.2/14.3	4.5	1.3/2.5	0.74
5	HEADWALL			4482.15								

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EXHIBIT 7.0

# Storm Sewer Profile

Elev. (ft)

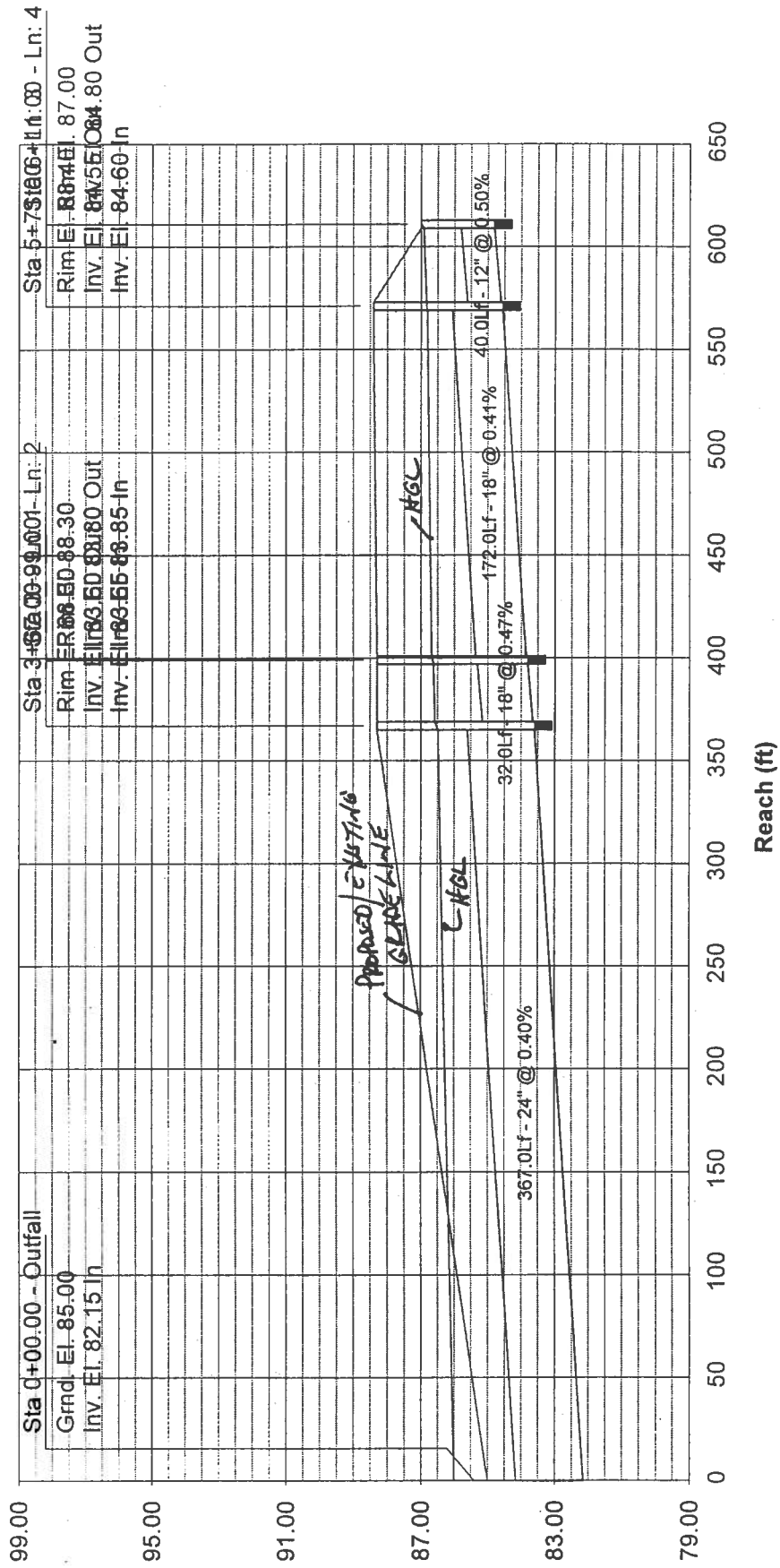


EXHIBIT 8.0



# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		8.20	24 c	367.0	82.15	83.60	0.395	86.00*	86.48*	0.05	86.54	End
2		3.60	18 c	32.0	83.65	83.80	0.469	86.58*	86.61*	0.03	86.65	1
3		2.95	18 c	172.0	83.85	84.55	0.407	86.67*	86.80*	0.02	86.83	2
4		1.70	12 c	40.0	84.60	84.80	0.500	86.83*	86.92*	0.07	86.99	3

Project File: hgl.stm

Number of lines: 4

Run Date: 09-30-2005

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; \*Surcharged (HGL above crown).

# Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	367.0	0.00	0.00	0.00	0.00	0.00	0.0	2.3	0.0	8.20	14.22	2.61	24	0.40	83.60	82.15	86.48	86.00	88.30	85.00	
2	1	32.0	0.00	0.00	0.00	0.00	0.0	0.0	2.0	0.0	3.60	7.19	2.04	18	0.47	83.80	83.65	86.61	86.58	88.30	88.30	
3	2	172.0	0.00	0.00	0.00	0.00	0.0	0.0	0.3	0.0	2.95	6.70	1.67	18	0.41	84.55	83.85	86.80	86.67	88.40	88.30	
4	3	40.0	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	1.70	2.52	2.16	12	0.50	84.80	84.60	86.92	86.83	87.00	88.40	

Project File: hgl.stm

Number of lines: 4

Run Date: 09-30-2005

NOTES: Intensity = 170.80 / (Inlet time + 18.20) ^ 0.91; Return period = 100 Yrs. ; Total flows limited to inlet captured flows.

# Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet		Byp line No										
							Ht (In)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depth (ft)	Spread (ft)	Depr (in)							
1	2	4.60*	0.00	4.60	0.00	Genr	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off
2	3	0.65*	0.00	0.65	0.00	Genr	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off
3	4	1.25*	0.00	1.25	0.00	Genr	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off
4	5	1.70*	0.00	1.70	0.00	Genr	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off

Project File: hgl.stm

Number of lines: 4

Run Date: 09-30-2005

NOTES: Inlet N-Values = 0.016 ; Intensity = 170.80 / (Inlet time + 18.20) ^ 0.91; Return period = 100 Yrs. ; \* Indicates Known Q added

# Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream							Len (ft)	Upstream							Check		JL coeff (K)	Minor loss (ft)		
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)		Sf (%)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)			Ave Sf (%)	Enrgy loss (ft)
1	24	8.20	82.15	86.00	2.00	3.14	2.61	0.11	86.11	0.131	367	83.60	86.48	2.00	3.14	2.61	0.11	86.59	0.131	0.131	0.483	0.50	0.05
2	18	3.60	83.65	86.58	1.50	1.77	2.04	0.06	86.64	0.118	32.0	83.80	86.61	1.50	1.77	2.04	0.06	86.68	0.118	0.118	0.038	0.50	0.03
3	18	2.95	83.85	86.67	1.50	1.77	1.67	0.04	86.71	0.079	172	84.55	86.80	1.50	1.77	1.67	0.04	86.85	0.079	0.079	0.136	0.50	0.02
4	12	1.70	84.60	86.83	1.00	0.79	2.16	0.07	86.90	0.228	40.0	84.80	86.92	1.00	0.79	2.16	0.07	86.99	0.228	0.228	0.091	1.00	0.07

Project File: hgl.stm

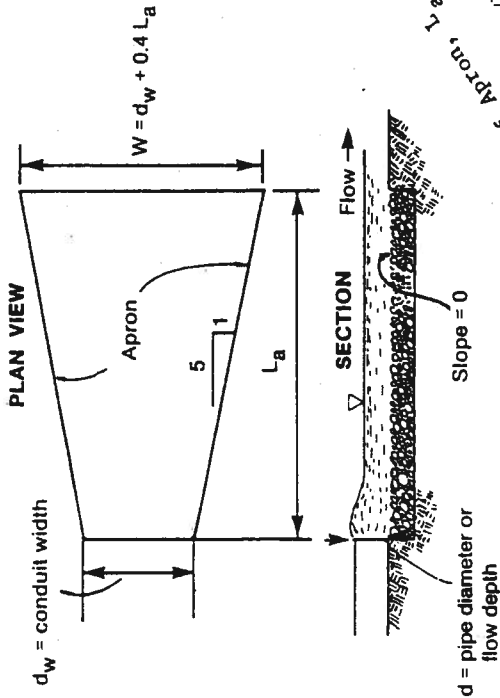
Number of lines: 4

Run Date: 09-30-2005

VOLUME 2—PROCEDURES

NOTES:

1. Tailwater  $\geq 0.5d_0$  = maximum tailwater condition
2.  $d_w$  = pipe diameter or box culvert width
3. For rectangular sections or partially full pipes, use depth of flow and velocity
4. Velocities shown are for pipes flowing full



Box Culvert Example

Given:

- $Q = 230$  cfs
- $B = 10'$   $D = 5.5'$
- $d = 5.0'$   $D = 60"$
- $TW = 5.0'$
- $V = 12$  fps

Find:

- $d_{50} = 0.4'$
- $L_a = 40'$
- $W = 26'$

MIN.  $L = 2'-3"$   
 $L = 8'$   
 $W = 10'$   
 Proposed  $L = 9'$   
 $L = 15'$   
 $W = 7.5'$   
 Depth = 1.5'

C.D.P.T. F.E.S. CONTRACT

143 cfs  
 PIPE CAPACITY  
 Pipe 24" RCP  
 $V = 4.5$  FPS

Reference: Goldman et al. (1966).

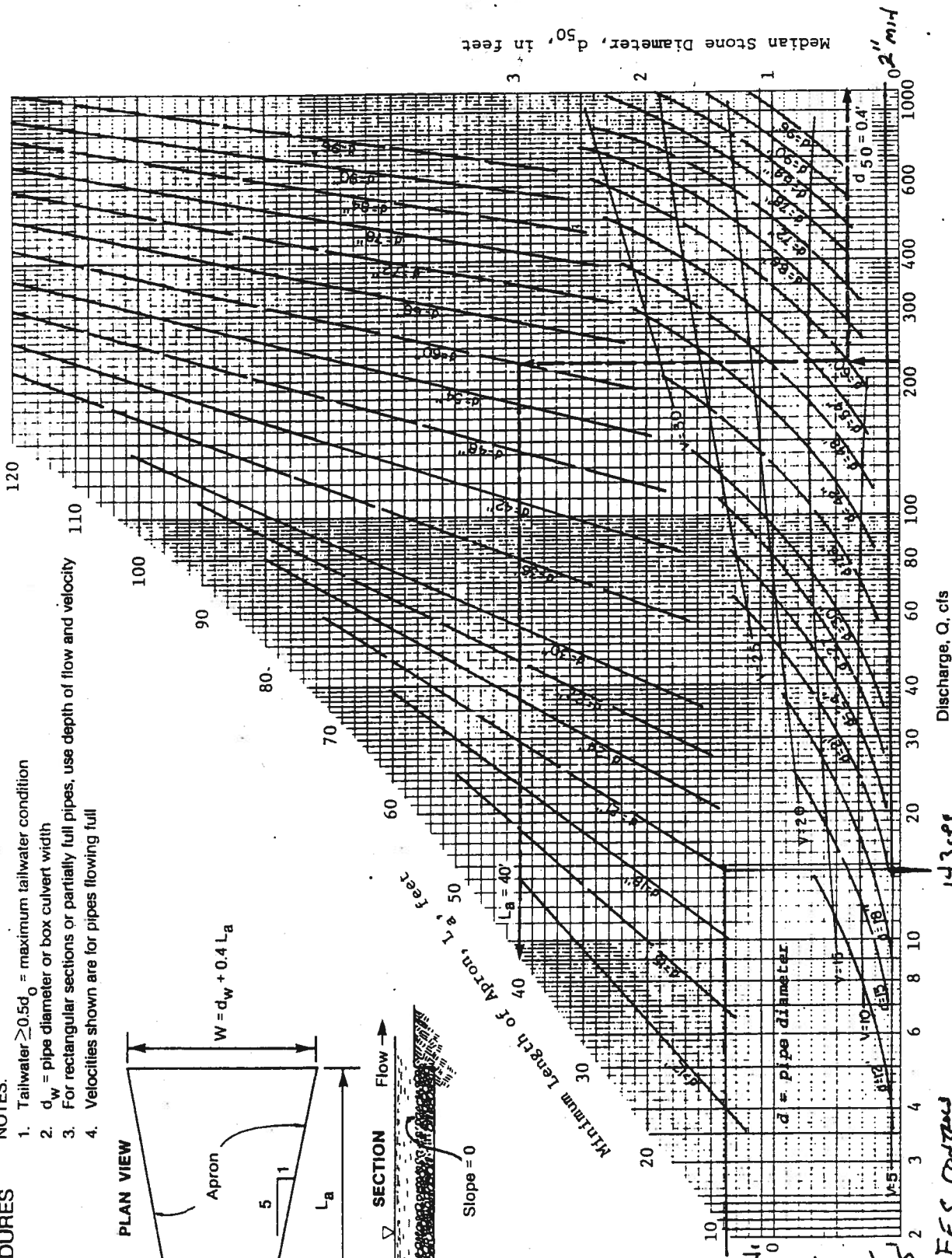
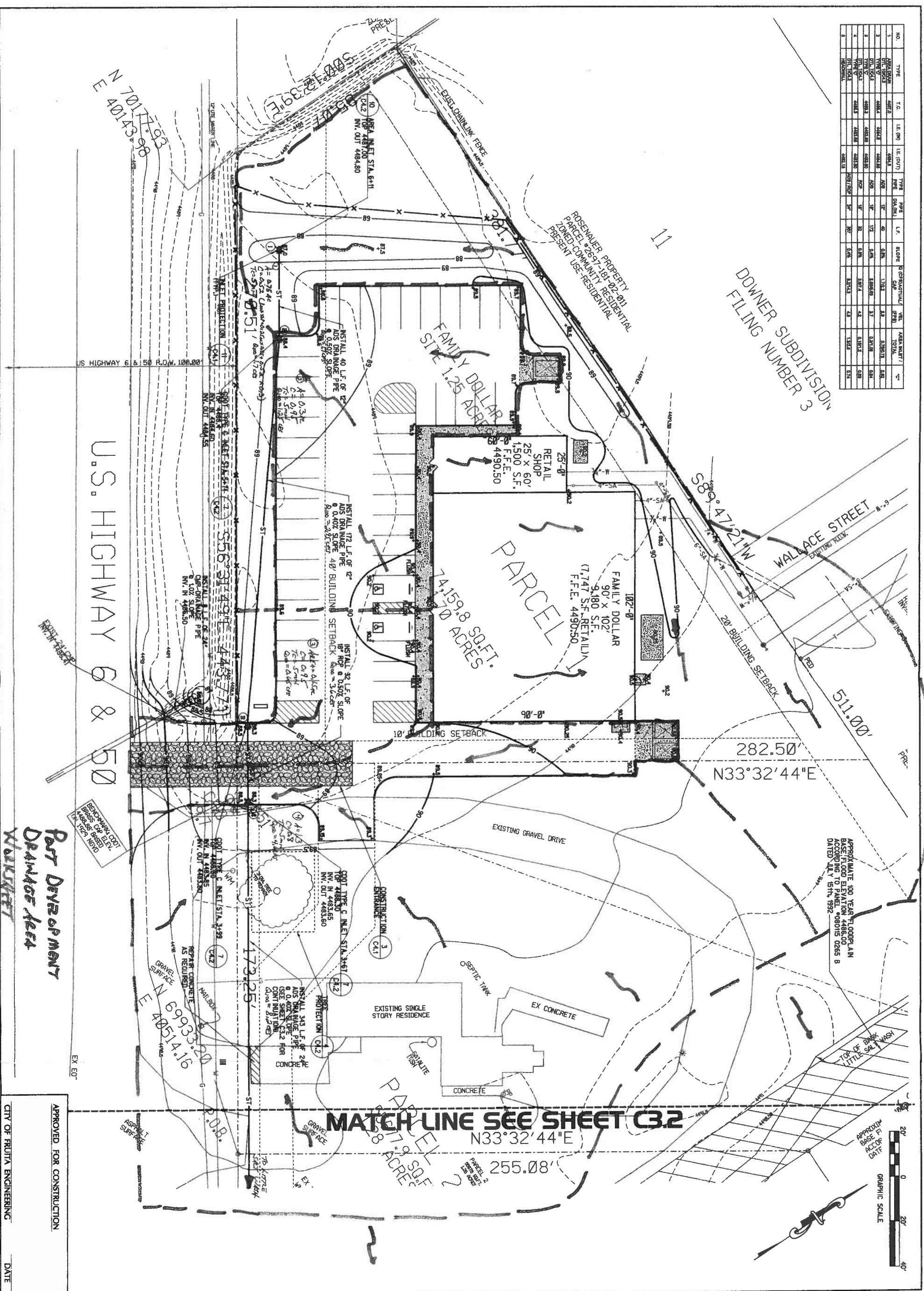


FIGURE 10-2 Design of Riprap Apron under Maximum Tailwater Conditions

EXHIBIT 9.2



NO.	TYPE	T.O.	LE (IN)	LE (OUT)	TYPE	PIPE DIA. (IN)	L.F.	GRADE	CONSTRUCTION	VAL.	AREA (S.F.)
1	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
2	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
3	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
4	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
5	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
6	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
7	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
8	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
9	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000
10	4" DIA. RCP	4487.0	4487.0	4487.0	RCP	48"	40'	0.0%	1.783	0.0	0.000



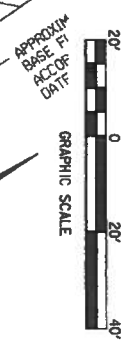
DOWNER SUBDIVISION  
FILING NUMBER 3

U.S. HIGHWAY 6 & 50

WALLACE STREET

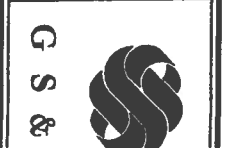
Part Development  
Drainage Area

APPROXIMATE 100 YEAR FLOODPLAIN  
ACCORDING TO PANEL #080115 0255 B  
DATED JULY 15th 1992



APPROVED FOR CONSTRUCTION  
CITY OF FRUITA ENGINEERING  
DATE

MATCH LINE SEE SHEET C3.2  
N33°32'44"E



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- Charlotte
- Columbu
- Dallas
- Fort Lauderdale
- Indianapolis
- Jacksonvil
- Louisvill
- Nashville
- Memphis
- Raleigh
- Richmon
- Tampa



**FAMI  
DOLL**  
9,180(B) S.F.

Fruta,  
U.S. Highway

REVISIC  
NUMBER

GRADING, DR.  
AND EROSION  
CONTROL PL  
**C3.**

FAMILY DOLLAR STORE

HWY 6 & 50

FRUITA, COLORADO

DETERMINE HISTORIC AND POST DEVELOPMENT RUNOFF COEFFICIENTS

HISTORIC RUNOFF COEFFICIENT FOR THE EXISTING SITE

SITE AREA = 2.98 ACRES

EXISTING BUILDINGS = 5,136 SF = 0.112 AC

EXISTING ASPHALT AND CONCRETE = 3625 SF = 0.08 AC

EXISTING GRAVEL DRIVES = 19,475 SF = 0.45 AC

EXISTING GRASS AREAS = 101,495 SF = 2.33 AC  
2.98 AC

EXIST. BLDG.:  $0.112 \text{ AC} \times 0.95 = 0.114$

EXIST. ASP/CONC.:  $0.08 \text{ AC} \times 0.95 = 0.076$

EXIST. GRAVEL:  $0.45 \text{ AC} \times 0.70 = 0.315$

EXIST. GRASS:  $2.33 \text{ AC} \times 0.25 = \underline{0.5825}$

$1.0875 \div 2.98 = 0.365$

HISTORIC "C" = 0.365

Calculations OK -

Impact Fee = \$ 4,665<sup>50</sup>

SES 1/10/06



## POST DEVELOPMENT RUNOFF COEFFICIENT

FAMILY DOLLAR STORE	=	9,180 SF	=	0.21 ac
PROP. ASPHALT / CONCRETE	=	19,086 SF	=	0.44 ac
EXIST. BUILDINGS	=	5,136 SF	=	0.12 ac
EXIST. ASP. / CONCRETE	=	3,625 SF	=	0.08 ac
EXIST. GRAVEL DRIVE	=	19,475 SF	=	0.45 ac
GRASSED AREAS	=	73,180 SF	=	1.68 ac
				<u>2.98 ac</u> Total parcel size

FAMILY DOLLAR STORE	=	0.21 ac	$\times$	0.95	=	0.1995
PROP. ASPH / CONCRETE	=	0.44 ac	$\times$	0.95	=	0.418
EXIST. BLDG'S	=	0.12 ac	$\times$	0.95	=	0.114
EXIST. ASP / CONC.	=	0.08 ac	$\times$	0.95	=	0.076
EXIST. GRAVEL	=	0.45 ac	$\times$	0.70	=	0.315
GRASSED AREA	=	1.68 ac	$\times$	0.25	=	0.42

$$1.5425 \div 2.98 \text{ ac}$$

$$\underline{\underline{C' = 0.5176}}$$

$$\underline{\text{POST DEV } C'' = 0.52}$$

$$\underline{* \text{ HISTORIC } C'' = 0.365}$$

~~\* Calculations not included.   
 \* Calculations not included.   
 \* Calculations not included.   
 \* Calculations not included.   
 \* Calculations not included.~~

## DRAINAGE IMPACT FEE:

$$\begin{aligned} & \$14,000 \times (\text{Post } C'' - \text{Historic } C'') \times (\text{ACRES})^{0.7} \\ & \$14,000 \times (0.52 - 0.365) \times (2.98)^{0.7} \\ & \$14,000 \times 0.155 \times 2.15 = \$4,665.50 \end{aligned}$$

$$\underline{\underline{\$4,665.50}} \quad \text{OK } 11/10/06 \text{ KCS}$$



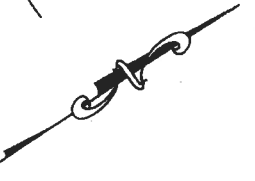
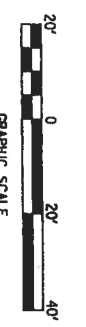
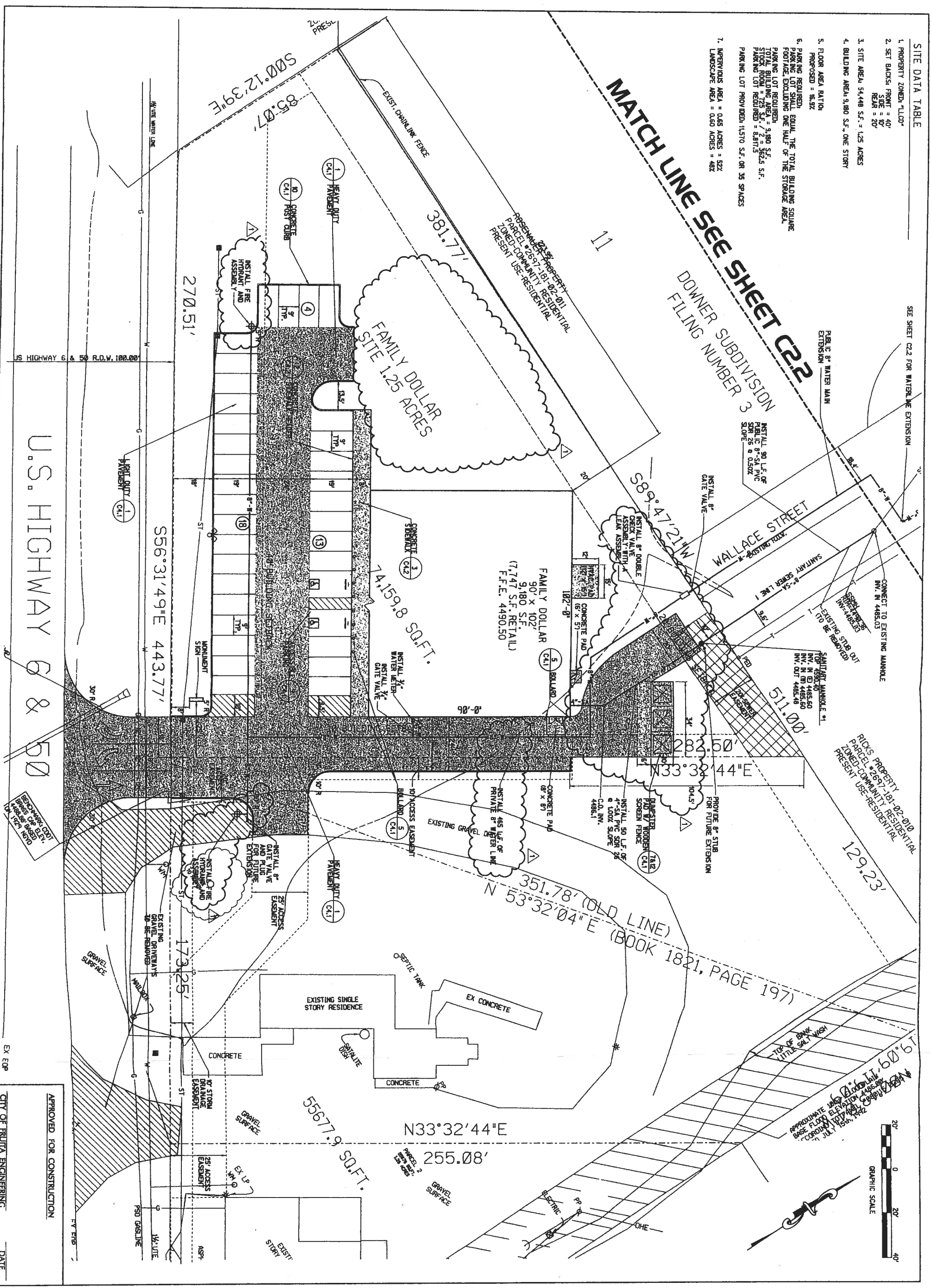
**SITE DATA TABLE**

1. PROPERTY ZONED: T-100\*
2. SET BACKS: FRONT = 40'  
SIDE = 10'  
REAR = 20'
3. SITE AREA 54,448 S.F. = 1.25 ACRES
4. BUILDING AREA 9,180 S.F. ONE STORY
5. FLOOR AREA RATIO:  
PROPOSED = 16.9%
6. PARKING LOT SHALL BE EQUAL TO THE TOTAL BUILDING SQUARE FOOTAGE EXCLUDING ONE HALF OF THE STORAGE AREA.  
PARKING LOT REQUIRED:  
TOTAL BUILDING AREA = 9,180 S.F.  
STOCK ROOM = 725 S.F. / 2 = 362.5 S.F.  
PARKING LOT REQUIRED = 8,817.5 S.F.
7. IMPERVIOUS AREA = 0.65 ACRES = 32%  
LANDSCAPE AREA = 0.60 ACRES = 46%

**MATCH LINE SEE SHEET C2.2**

DOWNER SUBDIVISION  
FILING NUMBER 3

SEE SHEET C2.2 FOR WATER LINE EXTENSION



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Nashville, Tennessee 37218  
615.776.8100  
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**FAMILY DOLLAR**  
9,180 (R) S.F. Facility  
Fruita, CO  
U.S. Highway 8 & 50

REVISION

NUMBER	DATE	REVISION
1	12.21.05	Comments

APPROVED FOR CONSTRUCTION

CITY OF FRUITA ENGINEERING

DATE

**C2.1**

SITE LAYOUT AND UTILITY PLAN

FILE: 22481.21  
PROJECT: 10/04/2004