Camo Doc. Copy

RETURN TO:
Land Development
101 West Costilla, Suite 122
Colorado Springs, CO 80903

ADDENDUM

TO

MASTER DRAINAGE STUDY - STETSON HILLS

CHANNEL NO. 3 IMPROVEMENTS

IN THE CITY OF COLORADO SPRINGS

JOB NUMBER 5156520

July, 1987

Greiner
Engineering

ADDENDUM

TO

MASTER DRAINAGE STUDY - STETSON HILLS

CHANNEL NO. 3 IMPROVEMENTS

IN THE CITY OF COLORADO SPRINGS

JOB NUMBER 5156520

July, 1987

PREPARED FOR:

AMWEST, INC.
5455 NORTH UNION BOULEVARD
COLORADO SPRINGS, COLORADO 80918

PREPARED BY:

GREINER ENGINEERING, INC.
5373 NORTH UNION BOULEVARD
COLORADO SPRINGS, COLORADO 80918

STATEMENTS

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 drainge basin. I accept responsibility for any liability caused by the negligent acts, errors, or omissions on my part in preparing this report.

Barney J. Fix 9/2/87

Barney J. Fix, P.E.
Director of Engineering
GREINER ENGINEERING, INC.

COLORADO REGISTERED BARNEY J. FIX 20730 PROFESSIONAL ENGINEER

The Developer and/or his representative has read and will compy with all the requirements specified in this drainage report and plan.

9/2/87

Authorized Representative
AmWest Development Corporation
5455 N. Union Boulevard
Colorado Springs, Colorado 80918

City of Colorado Springs:

Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980 as amended.

City Engineer

10/15/87
Date

FLOODPLAIN STATEMENT

X REIMBURSEMENT FOR ROCK EXCAVATION NOT TO EXCEED COST ESTIMATE WITHOUT APPROVAL OF THE CITY ENGINEER

Portions of this site are located within the existing floodplain of Sand Creek Main Tributary. With the construction of the channel proposed in this report the future floodplain will be within the channel. The existing FEMA floodplain areas will be protected by the construction of the channel and by overlot grading which will raise the lowest floor elevation of building structures at least one foot above the calculated 100-year water level.

Barney J. Fix 9/7/87

Barney J. Fix, P.E.
Director of Engineering
Greiner Engineering, Inc.

COLORADO REGISTERED BARNEY J. FIX 20730 PROFESSIONAL ENGINEER

TABLE OF CONTENTS

ADDENDUM TO MASTER DRAINAGE STUDY - STETSON HILLS CHANNEL NO. 3 IMPROVEMENTS IN THE CITY OF COLORADO SPRINGS, COLORADO

Purpose of Study

The purpose of this report is to present the results of the final design for the first phase of channel improvements to the eastern tributary that drains into Sand Creek. Design criteria, design assumptions and design calculations are presented. Reference is made to the "Stetson Hills Channel No.3" Construction Drawings, Sheets 1 of 9 through Sheets 9 of 9, for detailed design information. A cost estimate of the proposed channel improvements is also presented in this report. The cost estimated does not include the box culverts and wingwalls at Jedediah Smith Road and Peterson Road.

Location and Description of Study Area

Stetson Hills Channel No. 3 is located within the Stetson Hills Subdivision and is the eastern tributary to Sand Creek Channel. Channel No. 3 is located in Section 20, township 13 South, Range 65 West of the 6th Principle Meridian, City of Colorado Springs, El Paso County, Colorado. The location of the site is shown on Figure 1 of the Appendix. The proposed eastern tributary for this phase of construction will consist of the channelization of approximately 1740 feet of stream from the western outfall point at Sand Creek to Peterson Road. The remaining portion of the eastern tributary will be designed when the adjacent land is platted and developed. It will remain in a natural state until that time.

The existing slope of the tributary varies from approximately 2.5 percent in the lower reach to 1.6 percent in the upper reach with an average slope of 1.7 percent. Under existing conditions, the tributary is intermittent, normally flowing only after times of precipitation. The existing stream is generally meandering with side banks prone to erosion. The channel bottom consist of bare soil with relatively no vegetative cover. During the 100-year storm, the flow in the existing stream is supercritical (Reference 1).

Design Flows and Hydrology

The flows for the eastern tributary were modeled using the SCS TR-20 computer program. The original city criteria called for use of a 100-year, 6-hour storm with a precipitation value of 3.5 inches. However, after discussions with the City of Colorado Springs Engineering Staff, it was agreed that a 100-year, 24-hour storm with a precipitation value of 4.5 inches was to be used. The TR-20 results used in the Master Drainage Study are shown in the Appendix. The eastern tributary is between design points 041 and 042 on the printout. The 100-year design flow used between Sand Creek Channel and Peterson Road was Q100=1455 cubic feet per second.

Design Concepts and Considerations

The concept proposed for this design is to follow the existing stream course as close as possible. Other consideration for Channel No. 3 alignment are

Design Concepts and Considerations (Cont.)

proposed grading, street layouts, and utility crossings. Most of the channel will be concrete lined for erosion protection. A small portion of the channel from the outfall of the baffled chute drop to Sand Creek will be riprap. A temporary channel will be graded from the outfall of Channel No. 3 to the natural Sand Creek stream to insure drainage until the proposed Sand Creek Channelization is constructed. This temporary channel will require riprap (D50=12") were erosive soil conditions are encountered.

The proposed channel slopes range from 0.5 percent to 1.10 percent. Flow in the concrete channel sections will be supercritical with velocities from 13.5 to 18.4 feet per second. The riprap section at the outfall of the channel will be subcritical with a slope of 1.10 percent and a velocity of 7.9 feet per second. See Figure 2, Appendix for complete details of each section used in Channel No. 3. Figure 2 is also found on the "Stetson Hills Channel No. 3" construction plans. Grading will be done outside the concrete channel section to contain the sequent depth in the event that a hydraulic jump would occur in the supercritical channel sections.

Drop structures are proposed along the channel alignment to maintain the design slopes. A U.S. Bureau of Reclamation baffled chute drop is proposed upstream of the Sand Creek outfall point. The baffled chute drop is used to make up 21.1 foot grade change between the proposed outfall point at Sand Creek and the channel invert upstream. The baffled chute was designed per the Bureau of Reclamation, "Design of Small Canal Structures" (Reference 2). The remaining drop structure will be a 3.75 foot vertical drop upstream of the Jedediah Smith Road.

Channel No. 3 crosses Jedediah Smith Road and Peterson Road. Jedediah Smith crossing consist of an existing double 6-foot by 12-foot reinforced box culvert with wingwalls. Peterson Road crossing is a proposed double 8-foot by 10-foot reinforced box culvert with wingwalls. Both crossing are not part of this contract and are included in the "Final Drainage Study for Stetson Hills Filing No. 1 and No. 2" dated April 1985 and revised November 1985 (Reference 3). The box culverts have been reviewed and approved by the City of Colorado Springs. Therefore the box culverts will not be included in the cost comparison outlined later in this report.

A 12-foot wide multi-use trail will be constructed at the time of the channel construction. The trail will consist of 6-inch compaced aggregate base course Class 4 as outlined in Section 304, subsection 703.031 of the "Colorado Department of Highways Specifications" (Reference 4). The multi-use trail will be located along the north side of the channel as shown in Figure 2 of the Appendix. A turn around area will be provided at the top of the baffled chute drop.

Design Criteria and Hydraulic Calculations

Design criteria set forth in the City of Colorado Springs "Subdivision Policy Manual" were used for this design (Reference 5). Where applicable, the recommendation presented in the "Master Drainage Study for Stetson Hills" were followed.

The channel was sized to convey the 100-year developed flow to Sand Creek Channel. The channel side slopes will be 2.5 horizontal to 1.0 vertical in the riprap section and 2.0 horizontal to 1.0 vertical in the concrete sections. There is a concrete transition section upstream of the baffled chute drop. The transition goes from a vertical section to a trapezoidal section. There are also transitions at the box culvert crossings.

Flow depths and velocities were computed using Manning's Equation. Manning's roughness coefficient used in the calculations were 0.045 for riprap and 0.015 for concrete lining. Eighteen inch raprap was used at the channel outfall to be consistent with the proposed Sand Creek Channel Improvements. Twelve inch riprap was used in temporary conditions to reduce erosion. A concrete sill is proposed at the right-of-way line between Sand Creek and Channel No.3. Concrete cutoff walls are spaced no greater than 250 feet apart. See Channel No. 3 construction plans for proposed cutoff wall locations.

Drainage Facilities and Costs

A summary of the drainage facilities are listed below.

Description	Quantity	Unit	Unit Cost	Cost
Baffled Chute Drop	1	Each	LS	$ 60,300.00
Concrete Channel Section w/cutoff walls	1150	C.Y.	150.00	172,500.00
5-Foot Chain Link Fence	230	L.F.	12.00	2,760.00
RipRap D50=12"	460	C.Y.	30.00	13,800.00
RipRap D50=18"	190	C.Y.	30.00	5,700.00
6" Type II Bedding	40	C.Y.	16.00	640.00
Filter Cloth	240	S.Y.	2.00	480.00
Multi-Use 6" Compacted Aggregate	350	C.Y.	14.00	4,900.00
Class I Backfill	110	C.Y.	18.00	1,980.00
Concrete Check Structure for Drop	1	Each	1175.00	1,175.00
Excavation (Rock) Estimated	12217	C.Y.	8.00	97,736.00
Excavation (Soil)	19093	C.Y.	2.00	38,186.00
Subtotal				400,157.00
10% Contingency				40,015.70
				440,172.70
10% Engineering				44,017.27
TOTAL				$484,189.97

NOTE: 1. The cost estimate for the double 8'x10' RCB at Peterson Road is included in the "Final Drainage Study for Stetson Hills Filings No. 1 and 2" (Reference 3).

2. Contract documents for the construction of Stetson Hills Channel #3 will have a section that defines "rock" and also a method for establishing the actual rock excavation in the field. The method for determining the actual rock excavation will be agreed upon by the Owner, Owner's Engineer, City Engineer and contractor prior to any excavation.

The rock excavation cost above is only an estimate and should only be used as such. Upon reaching 75% of the estimated quantity given above, the contractor shall submit a written estimate to complete this item. The Owner, Owner's Engineer, and City Engineer will review the new estimate and come to an agreement of reimbursement for any differences in the new quantity estimate and the above estimate. After this is agreed upon, the contractor shall complete construction and will provide an actual tally of rock excavation to the Owner, Owner's Engineer, and City Engineer for reimbursement.

CONCLUSIONS

The purpose of this report is to analyze and document improvements for the lower 1740 feet of the eastern tributary to Sand Creek in Stetson Hills Subdivision. These improvements will realign the channel, stablize the side slopes and confine the 100-year developed flows within the improved channel section. Detailed design information for the channel improvement are included in "Stetson Hills Channel No.3" Construction Drawings, Sheets 1 of 8 through 8 of 8.

This design report and construction plans are submitted for review and approval.

Prepared by: Larry Roybal
Larry Roybal
Design Engineer

Reviewed by: Barney J. Fix 10/1/87
Barney J. Fix, P.E.
Director of Engineering

REFERENCES

1) Greiner Engineering Sciences, Inc., "Master Drainage Study for Stetson Hills", April 1985.

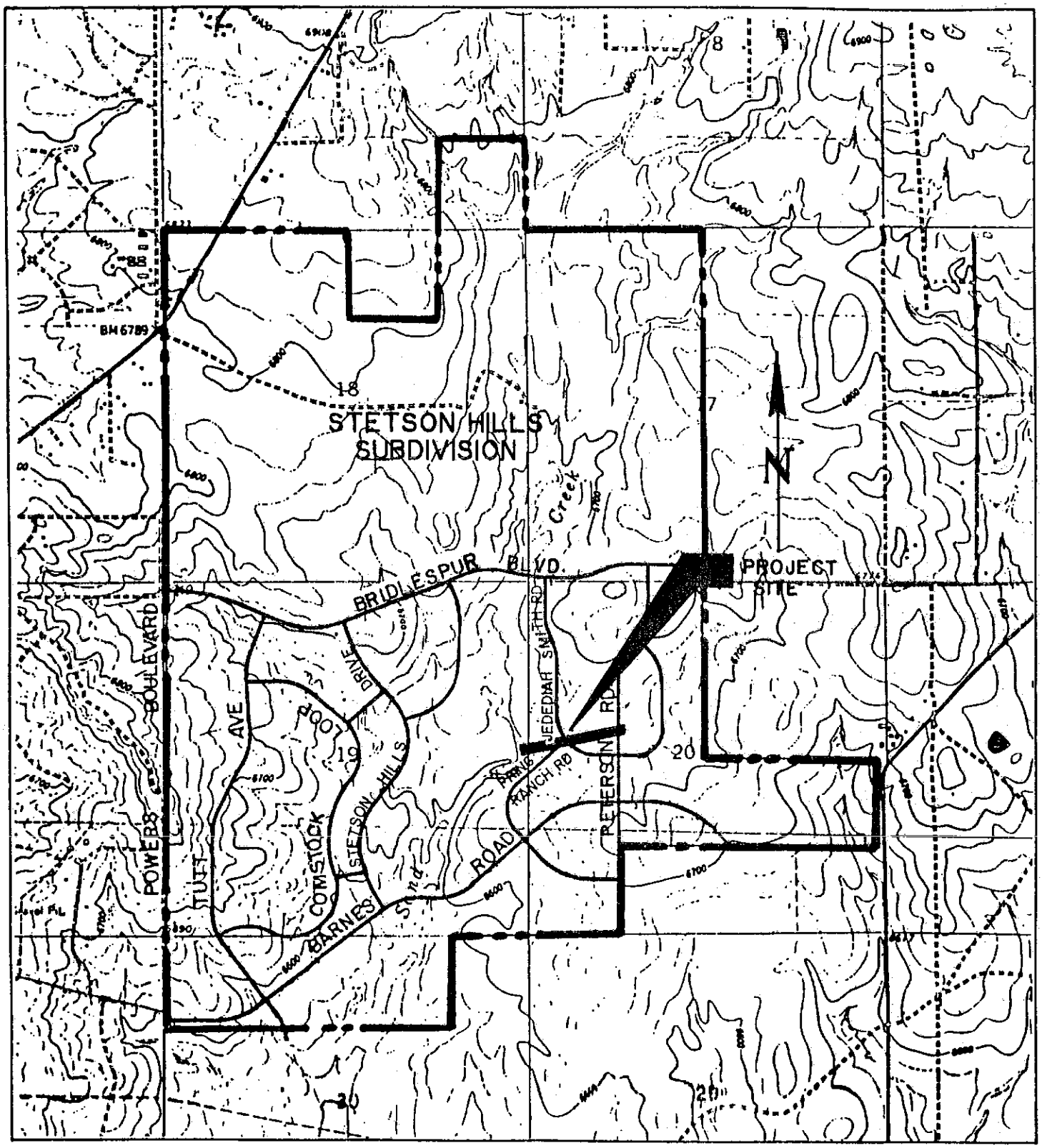
2) U.S. Department of the Interior, Bureau of Reclamation "Design of Small Canal Structures", reprinted 1983.

3) Greiner Engineering Sciences, Inc., "Final Drainage Study for Stetson Hills Filings No. 1 and 2", April 1985, revised November 1985.

4) State Department of Highways, Division of Highways, State of Colorado "Standard Specifications for Road and Bridge Construction", 1986.

5) City of Colorado Springs, "Determination of Storm Runoff Criteria", March 1977.

APPENDIX

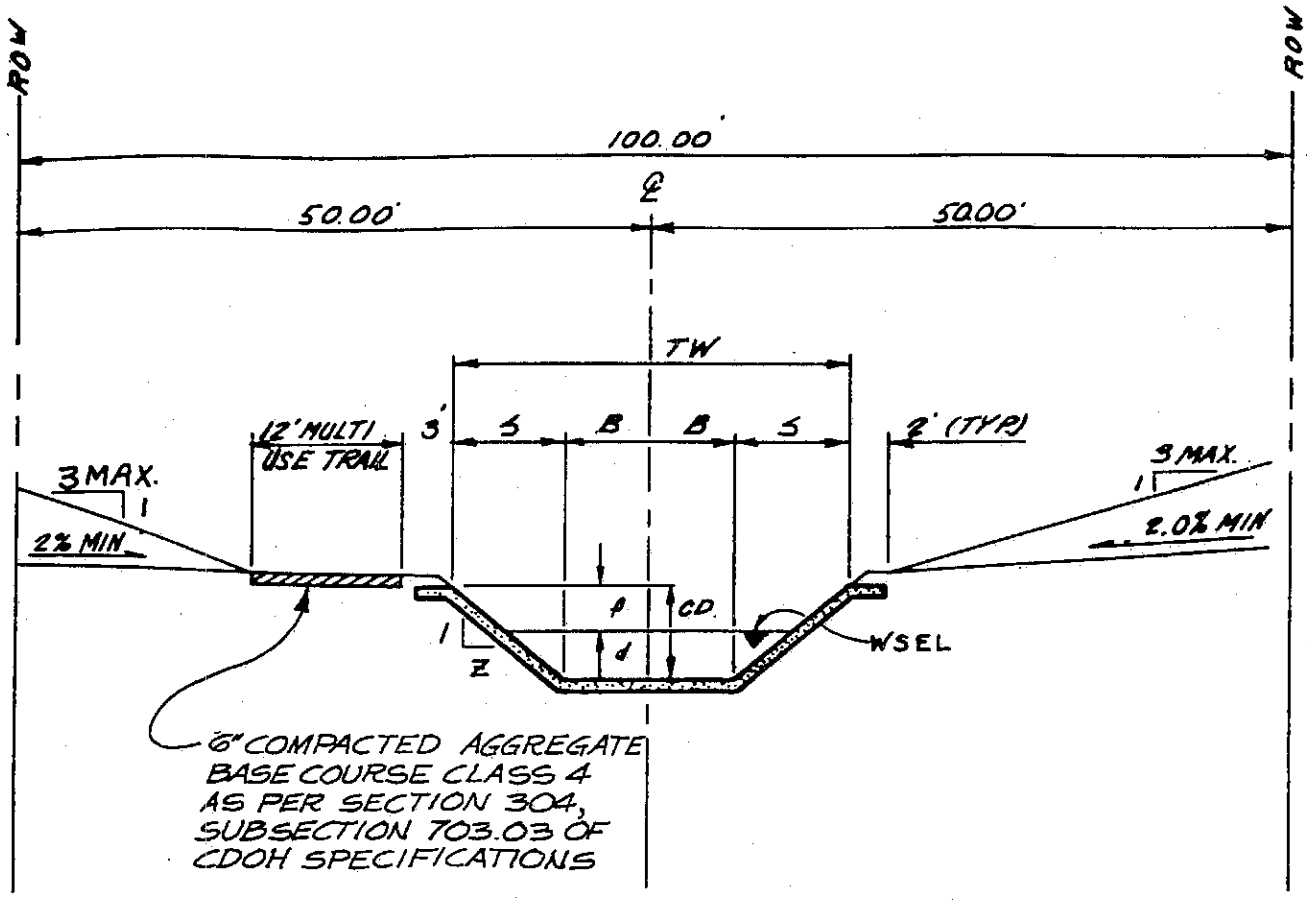


VICINITY MAP

SCALE: 1" 2000'

FALCON NW
QUADRANGLE
T.13S., R.65W.

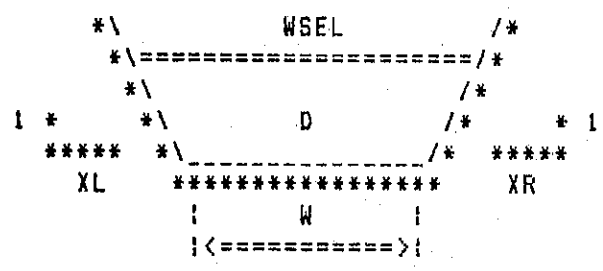
CHANNEL No. 3 DIMENSIONS



Section	Slope Z	Qdesign (cfs)	Velocity (fps)	Froude Number	Alternate Depth(ft)	Sequent Depth(ft)	TW (ft)	S (ft)	B (ft)	d (ft)	f (ft)	CD (ft)	Z	n
A[1]	1.10	1455	7.87	0.74	-	-	57.50	13.75	15.00	4.50	1.10	5.60	2.5	0.045
B	1.10	1455	17.69	2.06	7.18	6.07	43.80	9.40	12.50	2.71	1.99	4.70	2.0	0.015
C	0.50	1455	13.52	1.43	5.22	5.00	43.80	9.40	12.50	3.39	1.31	4.70	2.0	0.015
D	1.13	1455	18.42	2.09	7.80	6.58	41.00	10.00	10.50	2.94	2.06	5.00	2.0	0.015
E	0.50	1455	13.89	1.43	5.29	5.04	41.00	10.00	10.50	3.69	1.31	5.00	2.0	0.015

1. Section "A" is riprap. The remaining sections are concrete.
2. See channel transition on sheet 5 for depth of flow through transition.
3. Underdrain to be determined by the resident soils engineer.
4. Superelevation around the curves is included in the Freeboard.

FIGURE 2



XL	XR	D (FT)	W (FT)	WP (FT)	AREA (FT^2)	Q (CFS)	V (FPS)	n	S	Fr
SECTION A										
2.50	2.50	0.50	30.00	32.69	15.63	33.08	2.12	0.0450	0.011	0.54
2.50	2.50	1.00	30.00	35.39	32.50	106.36	3.27	0.0450	0.011	0.60
2.50	2.50	1.50	30.00	38.08	50.63	212.00	4.19	0.0450	0.011	0.64
2.50	2.50	2.00	30.00	40.77	70.00	347.62	4.97	0.0450	0.011	0.66
2.50	2.50	2.50	30.00	43.46	90.63	512.28	5.65	0.0450	0.011	0.68
2.50	2.50	3.00	30.00	46.16	112.50	705.68	6.27	0.0450	0.011	0.70
2.50	2.50	3.50	30.00	48.85	135.63	927.91	6.84	0.0450	0.011	0.71
2.50	2.50	4.00	30.00	51.54	160.00	1179.24	7.37	0.0450	0.011	0.73
2.50	2.50	4.50	30.00	54.23	185.63	1460.11	7.87	0.0450	0.011	0.74
2.50	2.50	5.00	30.00	56.93	212.50	1771.04	8.33	0.0450	0.011	0.75
2.50	2.50	5.50	30.00	59.62	240.63	2112.60	8.78	0.0450	0.011	0.76
SECTION B										
2.00	2.00	0.50	25.00	27.24	13.00	82.50	6.35	0.0150	0.011	1.61
2.00	2.00	1.00	25.00	29.47	27.00	264.62	9.80	0.0150	0.011	1.79
2.00	2.00	1.50	25.00	31.71	42.00	526.33	12.53	0.0150	0.011	1.90
2.00	2.00	2.00	25.00	33.94	58.00	861.31	14.85	0.0150	0.011	1.97
2.00	2.00	2.50	25.00	36.18	75.00	1266.91	16.89	0.0150	0.011	2.03
2.00	2.00	2.71	25.00	37.12	82.44	1458.04	17.69	0.0150	0.011	2.06
2.00	2.00	3.00	25.00	38.42	93.00	1742.14	18.73	0.0150	0.011	2.08
2.00	2.00	3.50	25.00	40.65	112.00	2286.98	20.42	0.0150	0.011	2.12
2.00	2.00	4.00	25.00	42.89	132.00	2901.93	21.98	0.0150	0.011	2.16
2.00	2.00	4.50	25.00	45.12	153.00	3587.85	23.45	0.0150	0.011	2.19
2.00	2.00	4.70	25.00	46.02	161.68	3882.33	24.01	0.0150	0.011	2.20
SECTION C										
2.00	2.00	0.50	25.00	27.24	13.00	55.62	4.28	0.0150	0.005	1.09
2.00	2.00	1.00	25.00	29.47	27.00	178.41	6.61	0.0150	0.005	1.21
2.00	2.00	1.50	25.00	31.71	42.00	354.85	8.45	0.0150	0.005	1.28
2.00	2.00	2.00	25.00	33.94	58.00	580.70	10.01	0.0150	0.005	1.33
2.00	2.00	2.50	25.00	36.18	75.00	854.15	11.39	0.0150	0.005	1.37
2.00	2.00	3.00	25.00	38.42	93.00	1174.55	12.63	0.0150	0.005	1.40
2.00	2.00	3.39	25.00	40.16	107.73	1457.03	13.52	0.0150	0.005	1.43
2.00	2.00	3.50	25.00	40.65	112.00	1541.88	13.77	0.0150	0.005	1.43
2.00	2.00	4.00	25.00	42.89	132.00	1956.48	14.82	0.0150	0.005	1.46
2.00	2.00	4.50	25.00	45.12	153.00	2418.93	15.81	0.0150	0.005	1.48
2.00	2.00	4.70	25.00	46.02	161.68	2617.47	16.19	0.0150	0.005	1.49
SECTION D										
2.00	2.00	0.50	21.00	23.24	11.00	70.36	6.40	0.0150	0.011	1.63
2.00	2.00	1.00	21.00	25.47	23.00	226.27	9.84	0.0150	0.011	1.81
2.00	2.00	1.50	21.00	27.71	36.00	451.40	12.54	0.0150	0.011	1.91
2.00	2.00	2.00	21.00	29.94	50.00	741.10	14.82	0.0150	0.011	1.99
2.00	2.00	2.50	21.00	32.18	65.00	1093.78	16.83	0.0150	0.011	2.05
2.00	2.00	2.94	21.00	34.15	79.03	1456.07	18.42	0.0150	0.011	2.09
2.00	2.00	3.00	21.00	34.42	81.00	1509.26	18.63	0.0150	0.011	2.10
2.00	2.00	3.50	21.00	36.65	98.00	1988.11	20.29	0.0150	0.011	2.14
2.00	2.00	4.00	21.00	38.89	116.00	2531.33	21.82	0.0150	0.011	2.17
2.00	2.00	4.50	21.00	41.12	135.00	3140.18	23.26	0.0150	0.011	2.20
2.00	2.00	5.00	21.00	43.36	155.00	3816.12	24.62	0.0150	0.011	2.23
SECTION E										
2.00	2.00	0.50	21.00	23.24	11.00	46.80	4.25	0.0150	0.005	1.08
2.00	2.00	1.00	21.00	25.47	23.00	150.52	6.54	0.0150	0.005	1.20
2.00	2.00	1.50	21.00	27.71	36.00	300.27	8.34	0.0150	0.005	1.27
2.00	2.00	2.00	21.00	29.94	50.00	492.97	9.86	0.0150	0.005	1.32
2.00	2.00	2.50	21.00	32.18	65.00	727.57	11.19	0.0150	0.005	1.36
2.00	2.00	3.00	21.00	34.42	81.00	1003.95	12.39	0.0150	0.005	1.39
2.00	2.00	3.50	21.00	36.65	98.00	1322.47	13.49	0.0150	0.005	1.42
2.00	2.00	3.69	21.00	37.50	104.72	1454.70	13.89	0.0150	0.005	1.43
2.00	2.00	4.00	21.00	38.89	116.00	1683.82	14.52	0.0150	0.005	1.45
2.00	2.00	4.50	21.00	41.12	135.00	2088.82	15.47	0.0150	0.005	1.47
2.00	2.00	5.00	21.00	43.36	155.00	2538.45	16.38	0.0150	0.005	1.49

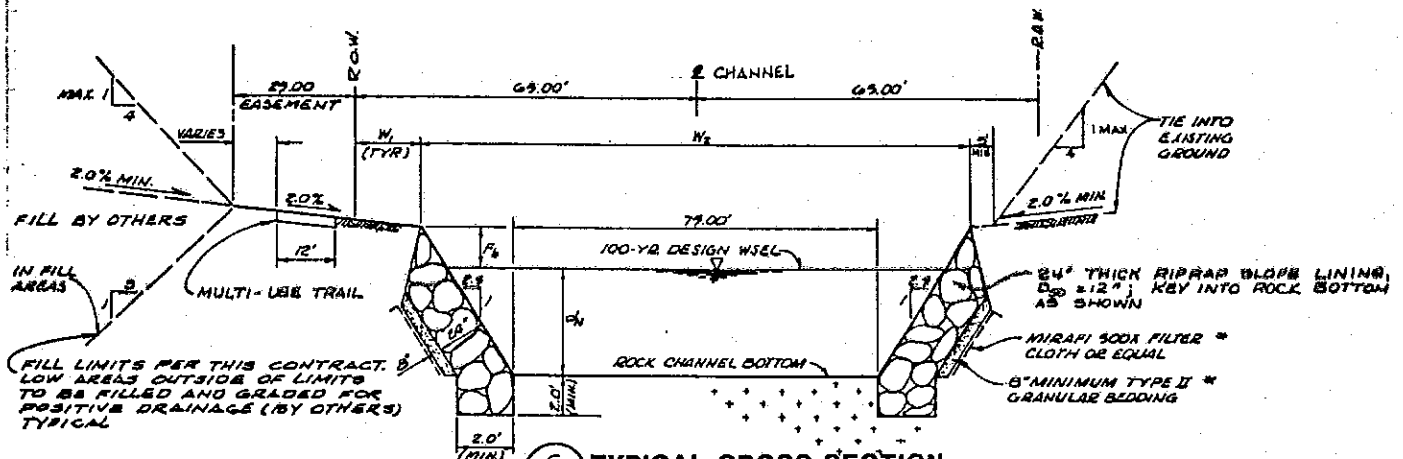
Greiner Engineering

☐ DENVER, COLORADO
☒ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT STETSON HILLS CHANNEL No. 3
JOB NUMBER 5156520 SHEET A4 OF A31
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____

SAND CREEK CHANNEL

THE INTERSECTION OF THE CHANNEL #3 AND THE PROPOSED SAND CREEK CHANNEL IS AT STATION 48+25.00. THE INVERT ELEVATION OF THE PROPOSED SAND CREEK CHANNEL IS 6588.88.



C 12 15 **TYPICAL CROSS SECTION**
STA. 31+79 TO STA. 88+16.66

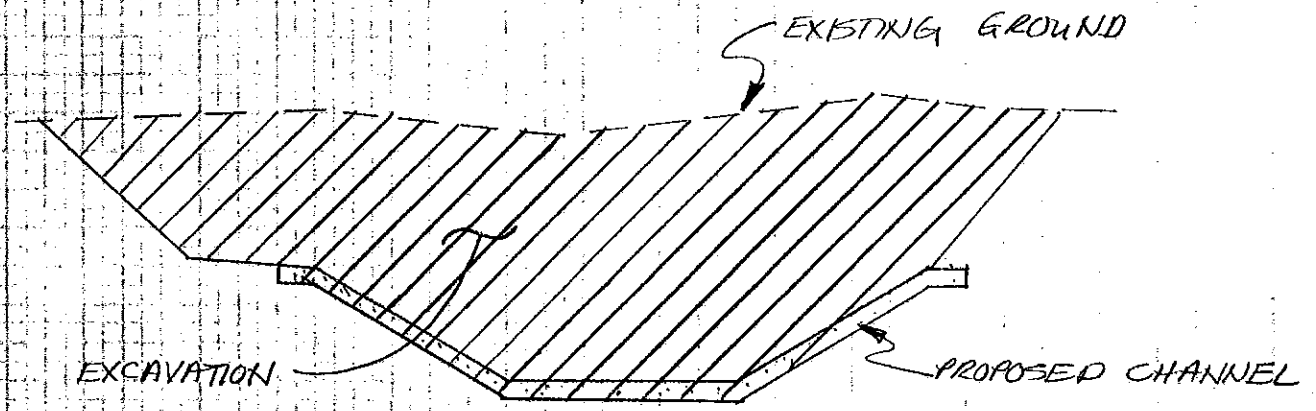
TYPICAL SECTION DATA

STATION	Q_{100}	V_{100}	d_N	F_b	SLOPE	W_1	W_2
32+80 TO 40+79	9900 cfs	10.85 fps	6.06 ft	1.96 ft	0.90%	7.50 ft	115.00 ft
48+79 TO 88+16.66	9600	10.68	5.89	2.16 ft	0.90	7.50 ft	115.00 ft

SEE "PROPOSED 1.47 MILES OF CHANNEL IMPROVEMENTS FOR SAND CREEK" BY GREINER ENGINEERING, ACCEPTED BY THE CITY OF COLORADO SPRINGS ON 7/24/86 FOR COMPLETE DETAILS OF SAND CREEK.

EXCAVATION CALCULATIONS:

THE EXCAVATION QUANTITIES WERE CALCULATED USING THE AVERAGE END AREA. SEE SHEET 9 OF 9 OF THE "STETSON HILLS CHANNEL No. 3" CONSTRUCTION PLANS FOR THE ACTUAL CROSS SECTIONS. AN EXAMPLE OF A SECTION IS SHOWN BELOW.



BAFFLED CHUTE DROP

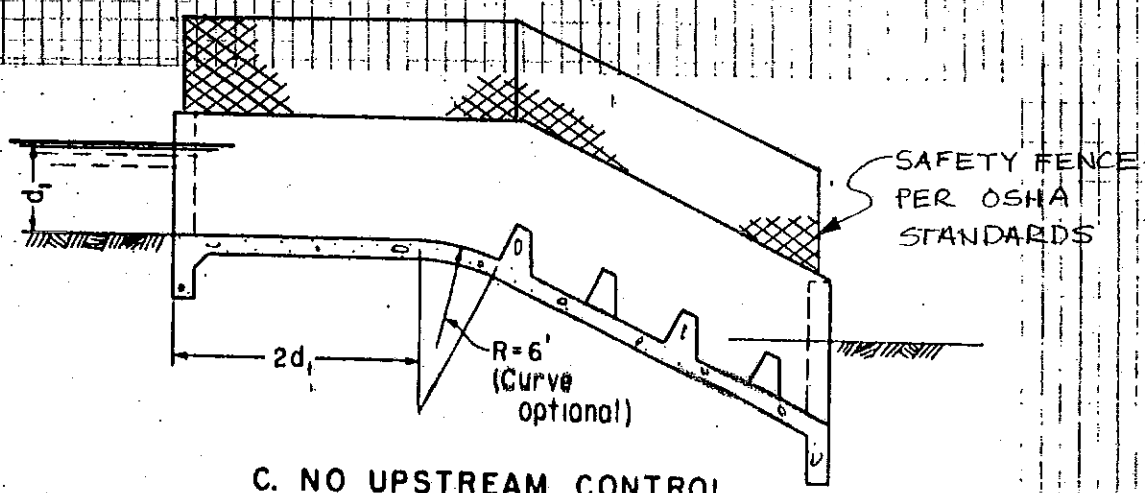
BAFFLED CHUTE DROP

HYDRAULIC PROPERTIES OF THE UPSTREAM STUDY-

DESIGN FLOW	$Q = 1465$ cfs
BOTTOM WIDTH	$B = 30$ ft
WATER SURFACE ELEV.	$d_1 = 2.70$ FT
AREA @ d_1	$A_1 = 81.00$ ft^2
VELOCITY @ d_1	$V_1 = 18.04$ fps
ROUGHNESS COEF.	$n = 0.015$
SLOPE @ d_1	$S = 1.10\%$
SLOPE OF DROP	$S = 50\%$ (2:1)
CRITICAL DEPTH	$d_c = 4.18$ FT
FROUDE NUMBER @ D_1	$Fr = 1.77$
UNIT FLOW	$q = 48.5$ cfs/ft

ASSUMPTIONS -

INLET WITHOUT CONTROL WILL BE USED SINCE THE UPSTREAM CONCRETE CHANNEL CAN TAKE THE HIGH VELOCITY OF 18.04 fps. A CURVE AT THE GRADE CHANGE WILL BE USED TO ALLOW THE FLOW TO STRIKE THE FIRST ROW OF BLOCKS IN A NORMAL DIRECTION TO REDUCE SPLASHING.



C. NO UPSTREAM CONTROL

ASSUMPTIONS CONT.-

BOTTOM WIDTH WILL BE 30.00-FEET AS INDICATED FROM A PRELIMINARY DESIGN. THE CHANNEL UP-STREAM WILL HAVE A 25.00-FOOT BOTTOM WIDTH.

A DROP OF 21.0-FEET IN ELEVATION WILL BE NEEDED.

DETERMINE THE UNIT DISCHARGE-

$$q = \frac{Q}{B} = \frac{1455}{30} = 48.5 \text{ cfs/ft}$$

DETERMINE THE BAFFLE BLOCK DIMENSIONS BASED ON THE CRITICAL DEPTH (d_c) -

$$d_c = \left(\frac{q^2}{g}\right)^{1/3} = \left(\frac{48.5^2}{32.2}\right)^{1/3} = 4.18 \text{ ft}$$

BLOCK HEIGHT- $h_b = 0.9\, d_c = 3.76'$ SAY $3'-9''$

BLOCK WIDTH -

MIN. $W = h_b = 3.76'$

MAX. $W = 1.5\, h_b = 5.64'$

DETERMINE THE EXACT BOX DIMENSIONS-

ASSUME THAT A PARTIAL BLOCK $W_P = \frac{1}{2} h_b$

ROWS 1, 3, 5 ...

2	FULL	BLOCKS	=	2W
3	FULL	SPACES	=	3W
2	HALF	BLOCKS	=	1W
				6W

ROWS 2, 4, 6 ...

3	FULL	BLOCKS	=	3W
2	FULL	SPACES	=	2W
2	HALF	SPACES	=	1W
				6W

∴ $6W = 30'$

$W = 30/6 = 5.0'$

CHECK $W_{MIN.} < W < W_{MAX.}$

$3.76 < W < 5.64$ WHICH IS O.K.

CHECK $W_{P\,MIN} < W_P < W_{P\,MAX.}$

$\frac{1}{3} h_p < W_P < \frac{2}{3} h_p$

$1.25 < 2.50 < 2.51$ WHICH IS O.K.

∴ $W_P = \frac{1}{2} W = 2'-6''$ (2.50')

$W = 5'-0''$ (5.00')

$d_c = 4'-2\frac{3}{32}''$ (4.18')

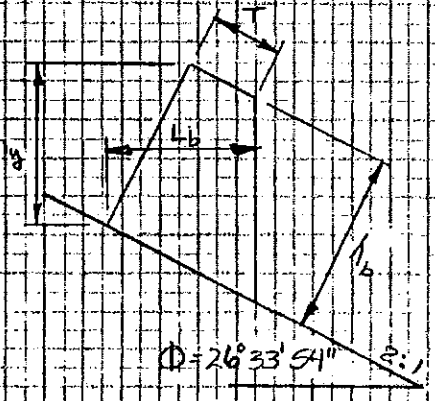
$h_b = 3'-9''$ (3.75')

$h_p = \cos\phi\, h_b = 3'-4\frac{1}{4}''$ (3.35)

$T = 9''$ (0.75')

$L_b = [T + h_b \tan\phi] \cos\phi$

$= 2'-4''$ (2.35')



DETERMINE THE INLET LENGTH, L_1

$$L_1 = 2d_c = 2(2.70) = 5.40'$$

DETERMINE CRITICAL VELOCITY OVER CREST, V_c

$$V_c = \frac{Q}{A_c} = \frac{Q}{d_c B} = \frac{1485}{(4.18)(30)} = 11.60 \text{ fps}$$

DETERMINE CREST LENGTH, L_2

USING A RADIUS, R = 6 ft.

$\phi = 26° 33' 54''$
$\gamma = 25° 56' 06''$
CHORD = 2.69'
$\tan \phi = 0.5000 = y/x$
$\gamma/2 = 12° 58' 03''$
$\tan \gamma/2 = 0.2307 = z/R$

$z = 0.2303\ R = 1.38'$
$y = 0.63$ FROM COORDINATES
$x = 0.63/0.5 = 1.24'$

$L_2 = x + z = 2.62'$

SEE COORDINATES ON THE FOLLOWING PAGE

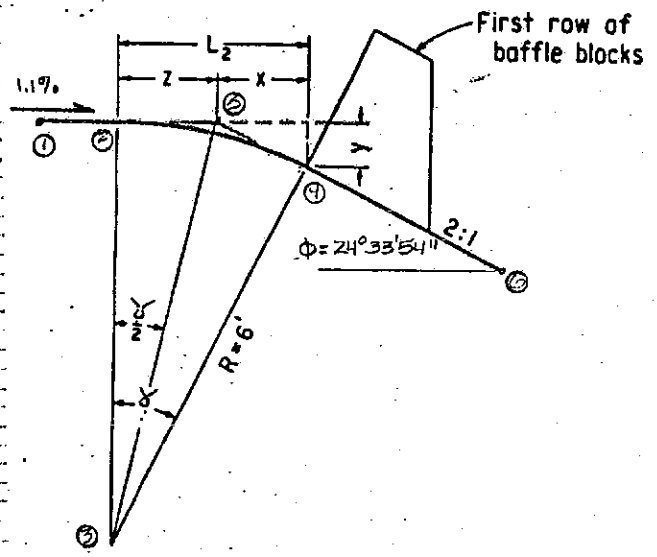


Figure 6-6. Sill curve dimensions. 103-D-1336

DETERMINE THE SLOPE DISTANCE, S, BETWEEN ROWS OF BAFFLE BLOCKS, AS SHOWN IN FIG. 6-5.

$$S = 2h_b = 2(3.75) = 7.50'$$

DETERMINE MINIMUM DEPTH OF COVER, j, OVER THE LAST ROW OF BAFFLES AT THE OUTFALL -

$S_y = S \sin\phi = 7.50' (\sin 26°33'54") = 3.354' \quad (3'-4\frac{1}{4}")$

$h_y = h_b \cos\phi = 3.75' (\cos 26°33'54") = 3.35' \quad (3'-4\frac{1}{4}")$

$j = S_y + h_y = 6.70' \quad (6'-8\frac{1}{2}")$

DETERMINE APRON LENGTHS, L_3 AND L_4 FOR A DROP, F = 21.0 FT. -

$L_y = F + j = 21.0' + 6.70' = 27.70'$

MINIMUM ROWS OF BLOCKS = $\frac{L_4}{S_y} = \frac{27.70}{3.35} = 8.3$

∴ USE 8 ROWS OF BLOCKS

$L_3 = 8S = 8(7.50) = 60.00$

$L_4 = 8S_4 = 8(3.35) = 26.80$

$L_3 = 8(7.50 \cos\phi) = 63.68$

OVERALL LENGTH IS -

$L = L_1 + L_2 + L_3$

$= 5.40 + 2.62 + 53.68$

$= 61.70' \quad (61'-8\frac{13}{32}")$

DETERMINE THE WALL HEIGHTS -

$h_1 = d_1 + 1ft = 2.70 + 1 = 3.7'$

WE WILL USE 6.0' TO CONTAIN SOME OF THE SPLASH AT THE FIRST BAFFLE BLOCK

$h_3 = 3h_b = 3(3.75) = 11.25'$

DETERMINE DIMENSIONS FOR DOWNSTREAM WINGWALLS -

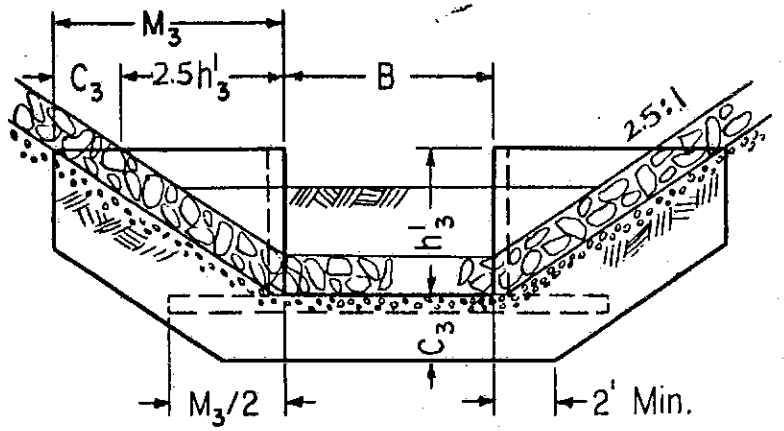


Figure 6-8. **Downstream wingwalls. 103-D-1338**

$C_3 = 2.5$ ft.

$h_3' = h_3 / \cos\phi$

$= 12.58'$

$M_3 = 2.5 h_3' + C_3$

$= 2.5(12.58) + 2.5$

$= 33.94$

$B = 30$ ft

DOWNSTREAM CHANNEL -

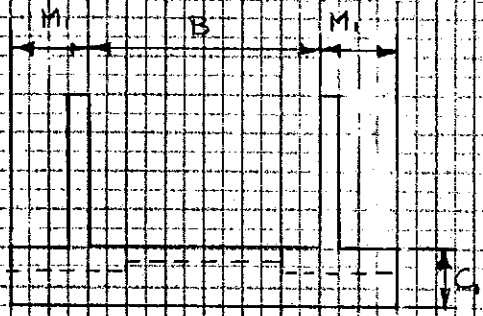
B = 30
n = 0.045
S = 11.1%
Z = 2.5
D = 4.30
V = 7.87
Fr = 0.74
FREEBOARD = 1.0'

Greiner Engineering

☐ DENVER, COLORADO
☐ COLORADO SPRINGS, COLORADO
☐ ALBUQUERQUE, NEW MEXICO
☐ KEMMERER, WYOMING

PROJECT STETSON HILLS CHANNEL NO. 3
JOB NUMBER 5156520 SHEET A12 OF A31
CALCULATED BY LCR DATE 5/87
CHECKED BY SWT DATE 8/4/87

DETERMINE DIMENSIONS OF UPSTREAM WINGWALLS -



$C_1 = 3.5$ FT
$B = 30$ FT
$M_1 = 3.50$ FT

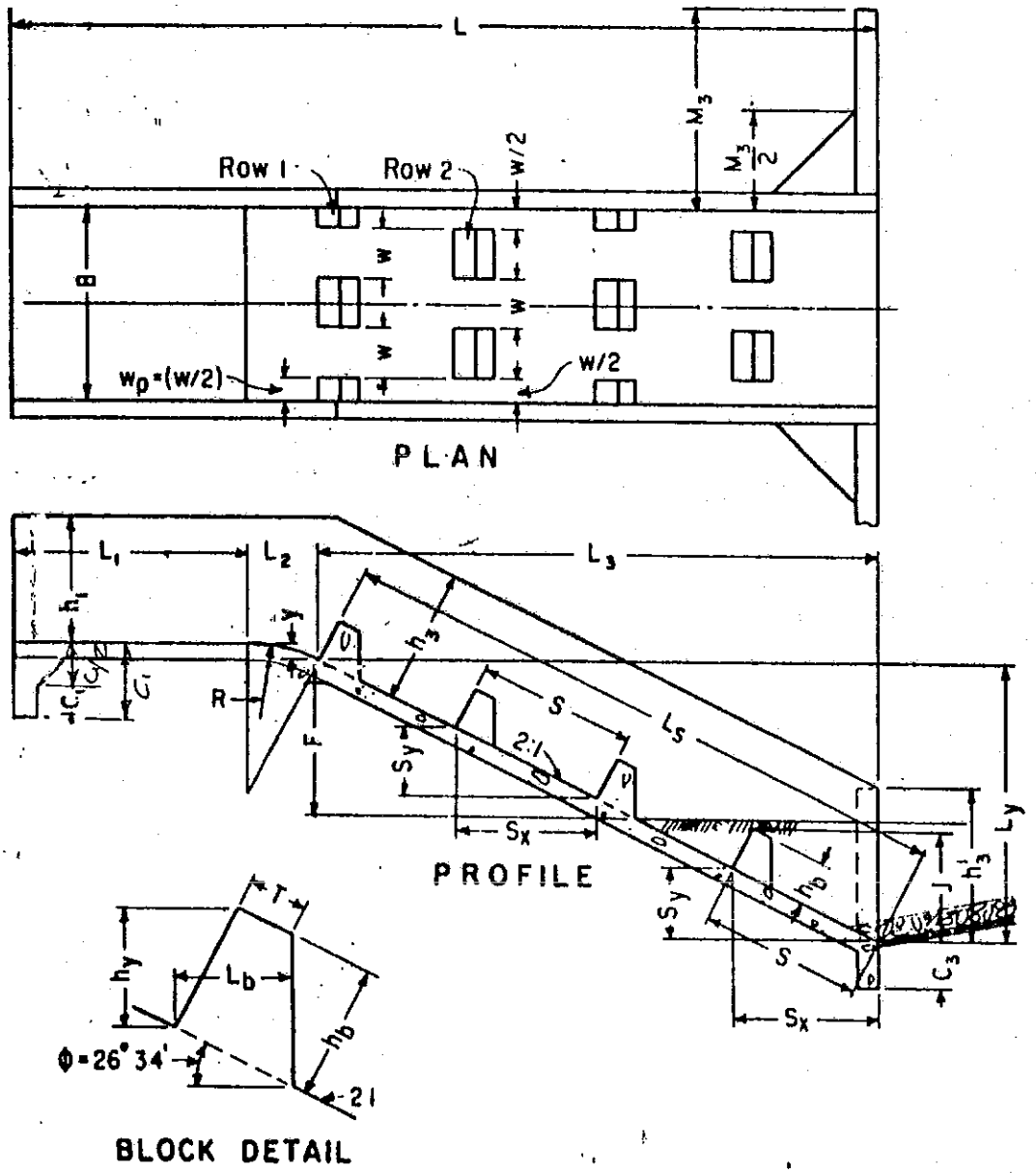


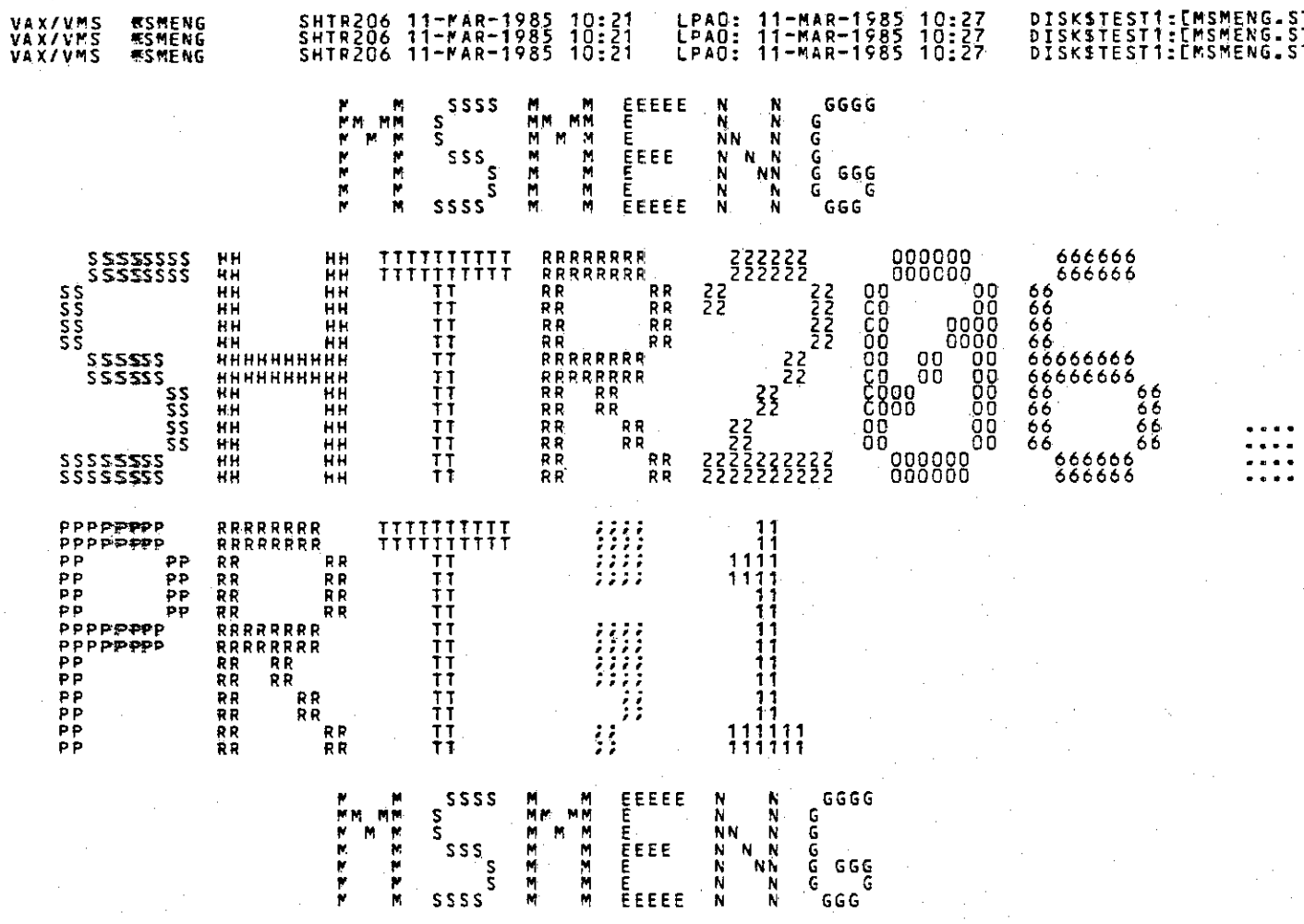
Figure 6-5. **Baffled apron drop design. 103-D-1335**

h_y = 3.35 FT
T = 0.75 FT
L_b = 2.35 FT
h_b = 3.75 FT

L = 61.70 FT
L_1 = 5.49 FT
L_2 = 2.62 FT
L_3 = 53.68 FT
B = 30 FT
W = 5.00 FT
W_p = 2.50 FT
M_3 = 33.94 FT
$M_3/2$ = 16.97 FT
h_1 = 6.0 FT
h_3 = 11.25 FT
R = 6.00 FT
y = 0.63 FT
F = 21.18 FT
S_y = 3.35 FT
S = 7.50 FT
S_x = 6.71 FT
C_3 = 2.50 FT
h_3' = 12.58 FT
L_y = 6.70 FT
L_{L_y} = 20.80 FT
M1 = 3.50 FT
M1/2 = 1.75 FT
C_1 = 3.50 FT
L_s = 60.00 FT
$C_{1/2}$ = 1.75 FT

TR-20

VAX/VMS MSMENG SHTR206 11-MAR-1985 10:21 LPA0: 11-MAR-1985 10:27 DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1 VAX/VMS
VAX/VMS MSMENG SHTR206 11-MAR-1985 10:21 LPA0: 11-MAR-1985 10:27 DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1 VAX/VMS



VAX/VMS MSMENG SHTR206 11-MAR-1985 10:21 LPA0: 11-MAR-1985 10:27 DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1 VAX/VMS
VAX/VMS MSMENG SHTR206 11-MAR-1985 10:21 LPA0: 11-MAR-1985 10:27 DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1 VAX/VMS
VAX/VMS MSMENG SHTR206 11-MAR-1985 10:21 LPA0: 11-MAR-1985 10:27 DISK$TEST1:[MSMENG.STETHYD]SHTR206.PRT;1 VAX/VMS

```
******************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY******************

JOB TR-20                                             SUMMARY   NOPLOTS
TITLE     STETSON HILLS JN-5161701 5 AND 100 YEAR STORMS
TITLE     24 HR TYPE IIA STORM & 6 HR
 5 RAINFL 1                    0.25
 8                  0.000          .018         .032         .055         .080
 8                   .106          .132         .181         .228         .400
 8                   .590          .650         .698         .740         .780
 8                   .810          .835         .860         .885         .905
 8                   .925          .942         .962         .981        1.000
 9 ENDTBL
 5 RAINFL 2                    0.25
 8                   .000          .000         .001         .002         .003
 8                   .004          .005         .008         .010         .011
 8                   .012          .013         .014         .017         .020
 8                   .025          .030         .040         .050         .055
 8                   .060          .080         .100         .130         .700
 8                   .725          .750         .765         .780         .790
 8                   .800          .810         .820         .825         .830
 8                   .835          .840         .845         .850         .855
 8                   .860          .863         .865         .867         .870
 8                   .877          .885         .888         .890         .895
 8                   .900          .903         .905         .907         .910
 8                   .912          .915         .918         .921         .924
 8                   .927          .930         .933         .936         .940
 8                   .942          .945         .948         .950         .953
 8                   .955          .956         .960         .963         .965
 8                   .968          .970         .973         .975         .978
 8                   .980          .981         .982         .984         .986
 8                   .988          .990         .991         .992         .993
 8                   .994          .995         .996         .997         .998
 8                   .999         1.000        1.000        1.000        1.000
 9 ENDTBL
 2 XSECTN    002          1.0        5.0
 8                                  0.0          0.0          0.0
 8                                  1.0        185.0         49.0
 8                                  2.0        650.0        116.0
 8                                  3.0       1410.0        201.0
 8                                  4.0       2499.0        304.0
 8                                  5.0       3954.0        425.0
 8                                  6.0        5811.        564.0
 8                                  7.0        8150.        721.0
 8                                  8.0       10869.        896.0
 9 ENDTBL
 2 XSECTN    004          1.0        5.0
 8                                  0.0          0.0          0.0
 8                                  1.0        487.0        123.0
```

```
**********80-80 LIST OF INPUT DATA (CONTINUED)**********
8                                  2.0       1627.0        272.0
8                                  3.0       3370.0        447.0
8                                  4.0       5739.0        648.0
8                                  5.0       8770.0        875.0
8                                  6.0      12503.0       1128.0
8                                  7.0      16981.0       1407.0
8                                  8.0      22246.0       1712.0
8                                  9.0      28342.0       2043.0
8                                 10.0      35309.0       2400.0
9 ENDTBL
2 XSECTN    006          1.0          5.0
8                                  0.0          0.0           0.0
8                                  1.0        277.0          69.0
8                                  2.0        987.0         166.0
8                                  3.0       2165.0         291.0
8                                  4.0       3873.0         444.0
8                                  5.0       6174.0         625.0
8                                  6.0       9131.0         834.0
8                                  7.0      12803.0        1071.0
8                                  8.0      17246.0        1336.0
9 ENDTBL
2 XSECTN    007          1.0          5.0
8                                  0.0          0.0           0.0
8                                  1.0        134.0          33.0
8                                  2.0        490.0          82.0
8                                  3.0       1098.0         147.0
8                                  4.0       1998.0         228.0
8                                  5.0       3231.0         325.0
8                                  6.0       4832.0         438.0
8                                  7.0       6839.0         567.0
8                                  8.0       9286.0         712.0
9 ENDTBL
2 XSECTN    009          1.0          5.0
8                                  0.0          0.0           0.0
8                                  1.0        109.0          27.0
8                                  2.0        401.0          68.0
8                                  3.0        908.0         123.0
8                                  4.0       1665.0         192.0
8                                  5.0       2707.0         275.0
8                                  6.0       4066.0         372.0
8                                  7.0       5775.0         483.0
8                                  8.0       7864.0         608.0
8                                  9.0      10362.0         747.0
8                                 10.0      13298.0         900.0
9 ENDTBL
2 XSECTN    012          1.0          5.0
```

```
**********80-80 LIST OF INPUT DATA (CONTINUED)**********
8                                    0.0          0.0          0.0
8                                    1.0        271.0         70.0
8                                    2.0        926.0        160.0
8                                    3.0       1960.0        270.0
8                                    4.0       3405.0        400.0
8                                    5.0       5295.0        550.0
8                                    6.0       7668.0        720.0
8                                    7.0      10559.0        910.0
8                                    8.0      14005.        1120.0
9 ENDTBL
2 XSECTN   013            1.0          5.0
8                                    0.0          0.0          0.0
8                                    1.0        271.0         70.0
8                                    2.0        926.0        160.0
8                                    3.0       1960.0        270.0
8                                    4.0       3405.0        400.0
8                                    5.0       5295.0        550.0
8                                    6.0       7668.0        720.0
8                                    7.0      10559.0        910.0
8                                    8.0      14005.0       1120.0
9 ENDTBL
2 XSECTN   037            1.0          4.0
8                                    0.0          0.0          0.0
8                                    1.0         47.0         13.0
8                                    2.0        171.0         32.0
8                                    3.0        379.0         57.0
8                                    4.0        685.0         88.0
8                                    5.0       1101.0        125.0
8                                    6.0       1640.0        168.0
8                                    7.0       2314.0        217.0
8                                    8.0       3133.0        272.0
9 ENDTBL
2 XSECTN   042            1.0          4.0
8                                    0.0          0.0          0.0
8                                    1.0         47.0         13.0
8                                    2.0        171.0         32.0
8                                    3.0        379.0         57.0
8                                    4.0        685.0         88.0
8                                    5.0       1101.0        125.0
8                                    6.0       1640.0        168.0
8                                    7.0       2314.0        217.0
8                                    8.0       3133.0        272.0
9 ENDTBL
6 RUNOFF 1 001       6               6.13         78.5         1.851 1    1 1
6 REACH  3 002   6   7            2000.                            1      1
6 RUNOFF 1 002       5               0.07         80.3         0.271       1
```

**********80-80 LIST OF INPUT DATA (CONTINUED)**********

```
 6 ADDHYD  4 002    7 5 6                                          1 1    1
 6 SAVMOW  5 002    6   1                                          1      1
 6 RUNOFF  1 021        5          0.14          80.6       0.231         1
 6 RUNOFF  1 022        6          0.12          84.5       0.231         1
 6 ADDHYD  4 022    5 6 7                                          1      1
 6 RUNOFF  1 023        5          0.04          83.7       0.321         1
 6 ADDHYD  4 023    7 5 6                                          1      1
 6 RUNOFF  1 024        5         0.026          83.3       0.191         1
 6 ADDHYD  4 024    5 6 7                                          1      1
 6 SAVMOW  5 003    1   5                                          1      1
 6 ADDHYD  4 003    7 5 6                                          1 1    1
 5 REACH   3 004    6   5          1200.                           1      1
 6 RUNOFF  1 004        6          0.03          81.8       0.221         1
 6 ADDHYD  4 004    5 6 7                                          1 1    1
 6 SAVMOW  5 004    7   1                                          1      1
 6 RUNOFF  1 025        5          0.10          84.5       0.241         1
 6 RUNOFF  1 026        5          0.17          83.4       0.271         1
 6 SAVMOW  5 026    5   2                                          1      1
 6 RUNOFF  1 031        5          1.49          76.0        .691         1
 6 RUNOFF  1 032        6          0.19          75.4       0.341         1
 6 ADDHYD  4 032    5 6 7                                          1      1
 6 RUNOFF  1 033        5         0.027          81.9       0.181         1
 6 ADDHYD  4 033    7 5 6                                          1      1
 6 RUNOFF  1 034        5          0.17          75.8       0.261         1
 6 RUNOFF  1 035        5          0.27          75.1       0.331         1
 6 ADDHYD  4 036    6 5 7                                          1      1
 6 REACH   3 037    7 2 5          2200.                           1      1
 6 RUNOFF  1 037        6          0.09          78.0       0.241         1
 6 ADDHYD  4 037    5 6 7                                          1      1
 6 SAVMOW  5 005    1   6                                          1      1
 6 ADDHYD  4 005    7 6 5                                          1 1    1
 6 SAVMOW  5 005    2   7                                          1      1
 6 ADDHYD  4 005    5 7 6                                          1 1    1
 6 RESVOR  2     05 6   7                                          1      1
 6 REACH   3 006    7   5          3000.                           1      1
 6 RUNOFF  1 006        6          0.53          71.4       0.641         1
 6 ADDHYD  4 006    5 6 7                                          1 1    1
 6 RESVOR  2     06 7   5                                          1      1
 6 REACH   3 007    5   6          3200.                           1      1
 6 RUNOFF  1 007        5          0.17          78.8       0.341         1
 6 ADDHYD  4 007    6 5 7                                          1 1    1
 6 SAVMOW  5 007    7   1                                          1      1
 6 RUNOFF  1 041        5          0.26          84.5       0.261         1
 6 REACH   3 042    5   6          3800.                           1      1
 6 RUNOFF  1 042        5          0.36          80.9       0.521         1
 6 ADDHYD  4 042    6 5 7                                          1      1
```

```
**********80-80 LIST OF INPUT DATA (CONTINUED)**********

 6 SAVMOV  5 008    1   6                                          1     1
 6 ADDHYD  4 008    7 6 5                                          1 1   1
 6 REACH   3 009    5   6          1800.                           1     1
 6 RUNOFF  1 009        5          0.075          79.0          0.391     1
 6 ADDHYD  4 009    6 5 7                                          1 1   1
 6 SAVMOV  5 009    7   1                                          1     1
 6 RUNOFF  1 051        6            .15          92.0          0.231     1
 6 REACH   3 052    6   5          6200.            .50          1.391     1
 6 RUNOFF  1 052        6          1.30           76.3          0.691     1
 6 ADDHYD  4 052    5 6 7                                          1     1
 6 SAVMOV  5 010    1   6                                          1     1
 6 ADDHYD  4 010    7 6 5                                          1 1   1
 6 RESVOR  2     10 5   6                                          1     1
 6 REACH   3 012    6   5          2000.                           1     1
 6 RUNOFF  1 012        6          0.31           84.2          0.581     1
 6 ADDHYD  4 012    5 6 7                                          1 1   1
 6 REACH   3 013    7   6          1200.                           1     1
 6 RUNOFF  1 013        7          0.29           83.8          0.371     1
 6 ADDHYD  4 013    6 7 5                                          1     1
 5 RUNOFF  1 061        6          0.53           91.3          0.381     1
 6 ADDHYD  4 014    5 6 7                                          1 1   1 1
   ENDATA
 7 LIST
 7 INCREM  6                      0.083
 7 COMPUT  7 001    014             0.0           2.1           1.01 2   2   1
   ENDCMP  1
 7 COMPUT  7 001    014             0.0           3.5           1.01 2   2   2
   ENDCMP  1
 7 COMPUT  7 001    014             0.0           2.7           1.02 2   2   3
   ENDCMP  1
 7 COMPUT  7 001    014             0.0           4.5           1.02 2   2   4
   ENDCMP  1
   ENDJOB  2

**********END OF 80-80 LIST**********
```

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS 1	2	3	4	DESIGN POINT
		5 YEAR 6HR	100YR-6HR	5YR-24HR	100YR 24HR	
STRUCTURE 10 ALTERNATE 2	11.64	1044.37	3111.90	2383.81	7080.99	
STRUCTURE 6 ALTERNATE 2	9.32	860.20	2574.62	1466.83	4021.81	
STRUCTURE 5 ALTERNATE 2	8.79	835.46	2484.87	1444.60	3945.36	
XSECTION 1 ALTERNATE 2	6.13	637.92	1903.72	1250.16	3439.60	001
XSECTION 2 ALTERNATE 2	6.20	642.22	1915.53	1251.46	3446.07	002
XSECTION 3 ALTERNATE 2	6.53	670.07	1978.35	1268.14	3480.91	003
XSECTION 4 ALTERNATE 2	6.56	672.30	1983.98	1269.62	3484.01	004
XSECTION 5 ALTERNATE 2	8.79	835.46	2484.87	1444.60	3945.36	005
XSECTION 6 ALTERNATE 2	9.32	860.20	2574.62	1466.83	4021.81	006
XSECTION 7 ALTERNATE 2	9.49	871.04	2601.34	1470.67	4063.48	007
XSECTION 8 ALTERNATE 2	10.11	924.70	2739.60	1704.08	5096.24	008
XSECTION 9 ALTERNATE 2	10.19	930.11	2754.12	1727.43	5194.18	009
XSECTION 10 ALTERNATE 2	11.64	1044.37	3111.90	2383.81	7080.99	010 BARNES ROAD
XSECTION 12 ALTERNATE 2	11.95	1073.17	3190.89	2529.80	7657.89	012

CANO CREEK MASTER DRAINAGE PLANNING STUDY BY SIMONS, LI & ASSOCIATES FLOW = 6870

→ At D.P. H1A

© POINT OF COMPARISON-WITHIN 10%

A20

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS 1	2	3	4	DP
XSECTION 13 ALTERNATE 2	12.24	1099.33	3255.81	2611.03	8084.18	013
XSECTION 14 ALTERNATE 2	12.27	1161.35	3484.56	2845.78	9234.81	014
XSECTION 21 ALTERNATE 2	0.14	45.47	127.13	182.11	460.08	021
XSECTION 22 ALTERNATE 2	0.26	98.71	256.91	381.94	916.56	022
XSECTION 23 ALTERNATE 2	0.30	113.41	294.79	429.48	1031.42	023
XSECTION 24 ALTERNATE 2	0.33	124.22	321.99	473.58	1133.71	024
XSECTION 25 ALTERNATE 2	0.10	43.93	107.34	162.18	371.83	025
XSECTION 26 ALTERNATE 2	0.17	66.02	168.82	237.47	565.89	026
XSECTION 31 ALTERNATE 2	1.49	184.75	678.83	576.75	1740.75	031
XSECTION 32 ALTERNATE 2	1.68	205.65	754.38	633.25	1917.88	032
XSECTION 33 ALTERNATE 2	1.71	209.48	764.94	637.57	1928.66	033
XSECTION 34 ALTERNATE 2	0.17	32.74	116.70	143.42	424.54	034
XSECTION 35 ALTERNATE 2	0.27	42.72	162.91	180.88	548.77	035
XSECTION 36 ALTERNATE 2	1.98	238.47	883.77	745.08	2271.61	036

A21

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS 1	2	3	4	D.P.
XSECTION 37 ALTERNATE 2	2.07	246.37	912.32	748.56	2322.67	037
XSECTION 41 ALTERNATE 2	0.26	111.94	274.87	403.93	932.09	041
XSECTION 42 ALTERNATE 2	0.62	178.00	497.98	577.98	1455.19	042
XSECTION 51 ALTERNATE 2	0.15	107.62	211.75	377.47	724.02	051
XSECTION 52 ALTERNATE 2	1.45	222.03	726.35	656.41	1903.51	052
XSECTION 61 ALTERNATE 2	0.53	324.03	660.37	946.97	1870.88	061

CONSTRUCTION DRAWINGS

LEGEND

- GREINER ENGINEERING DESIGN COORDINATE POINT NUMBER
- PROPOSED MULTI-USE TRAIL
- PROPOSED BOX CULVERT
- SANITARY SEWER
- WATERLINE
- CHANNEL RIGHT-OF-WAY
- PROPOSED STORM SEWER
- OTHER GREINER ENGINEERING COORDINATE POINT NUMBER
- DETAIL NUMBER
- SHEET NUMBER WHERE DETAIL IS DRAWN
- SHEET NUMBER WHERE DETAIL IS TAKEN

ABBREVIATIONS

RCP	REINFORCED CONCRETE PIPE
DIP	DUCTILE IRON PIPE
ROW	RIGHT - OF - WAY
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVE
PT	POINT OF TANGENCY
CL	CENTER LINE
PL	PROPERTY LINE
WSEL	WATER SURGACE ELEVATION
N	MANNING'S ROUGHNESS COEFICIENT
NTS	NOT TO SCALE
FR	FROUDE NUMBER
EL	EASEMENT LINE

BENCHMARK
PIN AND CAP LS No 3854 LOCATED AT
SECTION CORNER 19, 20, 29 AND 30, T 15 S.
R 67 W. OF THE 6TH PM
ELEV = 6604.88' U.S.G.S. DATUM

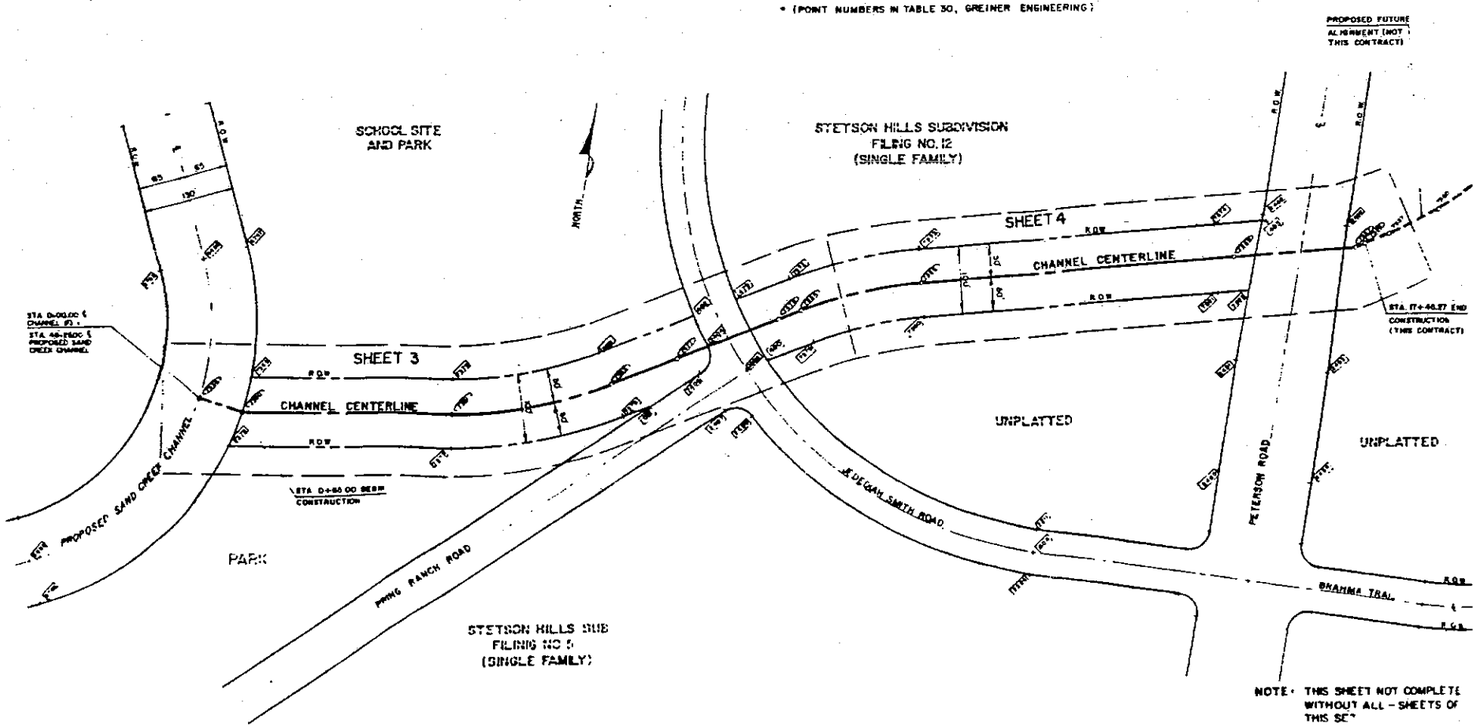
GREINER PT. 287
N 109,998.62 E 108,684.71 (TBL 43)

CENTER LINE STAKING INFORMATION

POINT No.*	NORTHING	EASTING		STATION	BEARING
7538	112776.4522	108542.3878		0.0000	S 79-41-58.8 E
PI 7550	112758.8297	108606.3403		65.0000	16-44-32.3 L N 83-33-28.9 E
PC 7551	112793.3041	108911.6668		372.2666	0- 0- 0.0 R N 83-33-28.9 E
CC 7552	113387.5157	108844.3686	RAD=	600.0000	22-30- 0.0 L
	DEGREE=	9-32-37.5	L=	235.6194	
PI	112806.6945	109030.2607	TAN=	119.3474	EXT= 11.7547
PT 7553	112864.4495	109134.7028		607.8860	N 61- 3-28.9 E 0- 0- 0.0 R N 61- 3-28.9 E
PI 7477	112914.0783	109224.4498		710.4411	0- 0- 0.0 L N 61- 3-28.9 E
PI 7476	112991.5061	109364.4475		870.4411	0- 0- 0.0 R N 61- 3-28.9 E
PC 7554	113008.5429	109395.3123		905.4879	0- 0- 0.0 R N 61- 3-28.9 E
CC 7555	112983.4967	109485.4665	RAD=	600.0000	14-55-11.2 R
	DEGREE=	9-32-57.5	L=	177.1834	
PI	113051.7488	109473.4082	TAN=	89.7413	EXT= 6.6004
PT 7556	113070.3349	109560.6922		1082.8715	N 77-58-40.1 E 0- 0- 0.0 R N 77-58-40.1 E
PI 7568	113164.3583	110007.1873		1534.2670	0- 0- 0.0 L N 77-58-40.1 E
PI 7557	113200.5804	110171.8991		1707.7844	16-55-11.2 L N 61- 3-28.9 E
PI 7558	113208.4766	110186.3229		1724.2649	0- 0- 0.1 R N 61- 3-29.0 E
PC 7537	113227.1162	110220.0302		1762.7847	0- 0- 0.1 L N 61- 3-28.9 E

POINT No.	NORTHING	EASTING		STATION	BEARING
CC 7559	113644.6713	109978.9484	RAD=	500.0000	9-10- 2.4 L
	DEGREE=	11-27-33.0	L=	80.0000	
PI	113724.5145	110255.1095	TAN=	40.0855	EXT= 1.4043
PCC7560	113271.2539	110286.4502		1842.7844	N 51-53-24.5 E 0- 0- 0.0 R N 51-53-24.5 E
CC 7561	113467.9626	110132.3593	RAD=	250.0000	19-20- 4.7 L
	DEGREE=	22-55- 5.9	L=	80.0000	
PI	113296.1533	110318.3949	TAN=	40.3449	EXT= 3.2345
PCC7562	113329.7745	110340.4956		1922.7844	N 33-33-21.8 E 0- 0- 0.0 L N 33-33-21.8 E
CC 7563	113406.1507	109924.8229	RAD=	500.0000	9-10- 2.4 L
	DEGREE=	11-27-33.0	L=	80.0000	
PI	113363.1796	110362.8530	TAN=	40.0854	EXT= 1.4043
PT 7564	113399.6881	110379.4054		2002.7844	N 24-24-19.4 E 0- 0- 0.0 R N 24-24-19.4 E
PC 7565	113453.0595	110403.4030		2061.3853	0- 0- 0.0 L
CC 7566	113244.5949	110858.9855	RAD=	500.0000	N 24-24-19.4 E 36-40- 9.5 R
	DEGREE=	11-27-33.0	L=	320.0000	
PI	113403.9484	110472.0226	TAN=	165.4947	EXT= 26.7397
PT 7567	113484.1520	110617.0232		2381.3853	N 41- 3-28.9 E 0- 0- 0.0 L N 41- 3-28.9 E
PI 7474	113719.3462	110680.4675		2454.1119	0- 0- 0.0 R N 41- 3-28.9 E
7475	113804.0328	110833.8118		2629.1119	

* (POINT NUMBERS IN TABLE 30, GREINER ENGINEERING)



NOTE: THIS SHEET NOT COMPLETE WITHOUT ALL - SHEETS OF THIS SET

PRELIMINARY

Greiner Engineering
Consulting Engineering Services Inc.
Denver, Colorado · Colorado Springs, Colorado
Albuquerque, N.M. · Kemmerer, Wyoming

Des. CCR
Drawn JLB
Check
Scale 1" = 100'

STETSON HILLS SUBDIVISION
STETSON HILLS CHANNEL No. 3
STAKING PLAN

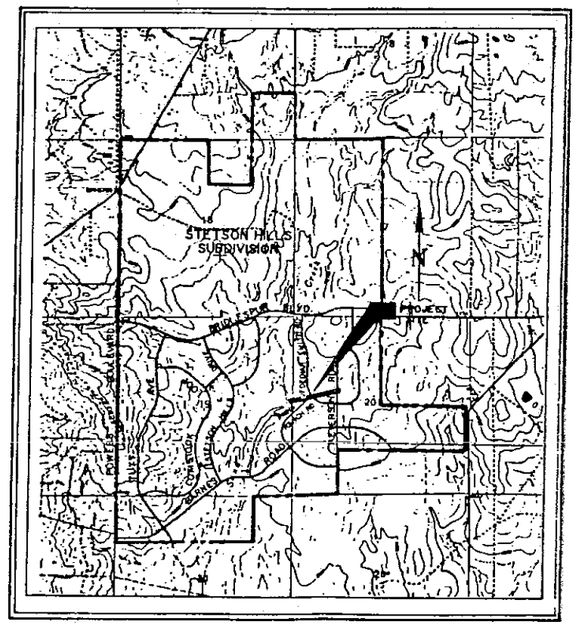
MAY 1987
Job No. 5156520
Sheet 2 9

A23

CONSTRUCTION PLANS
FOR

STETSON HILLS SUBDIVISION

PROPOSED
1740 FEET OF CHANNEL IMPROVEMENTS
FOR THE
STETSON HILLS CHANNEL No. 3
IN
THE CITY OF COLORADO SPRINGS.



VICINITY MAP
N.T.S

INDEX

PREPARED BY

Larry C. Roybal — 5/24/87
LARRY C. ROYBAL, DESIGN ENGINEER — DATE

PREPARED UNDER THE SUPERVISION OF

Barney J. Fick — 5/26/87
BARNEY J. FICK, P.E. NO. 20736, DIRECTOR OF ENGINEERING — DATE

COLORADO REGISTERED PROFESSIONAL ENGINEER 20736

PREPARED FOR:

AMWEST, INC.
5455 NORTH UNION BLVD.
COLORADO SPRINGS, COLORADO 80918-2061

STATEMENT:

The City of Colorado Springs recognizes the design engineer as having responsibility for the design. The City has limited its scope of review accordingly. Recertification will be required if construction has not commenced within 180 days after review date.

Drainage Design:

Filed in accordance with Section 15-3-906 of the Code of Colorado Springs, 1980, as amended.

Date _____

From _____ to _____

Drainage Basin _____

NOTE THIS SHEET NOT COMPLETE WITHOUT ALL 9 SHEETS OF THIS SET

PRELIMINARY

Revisions

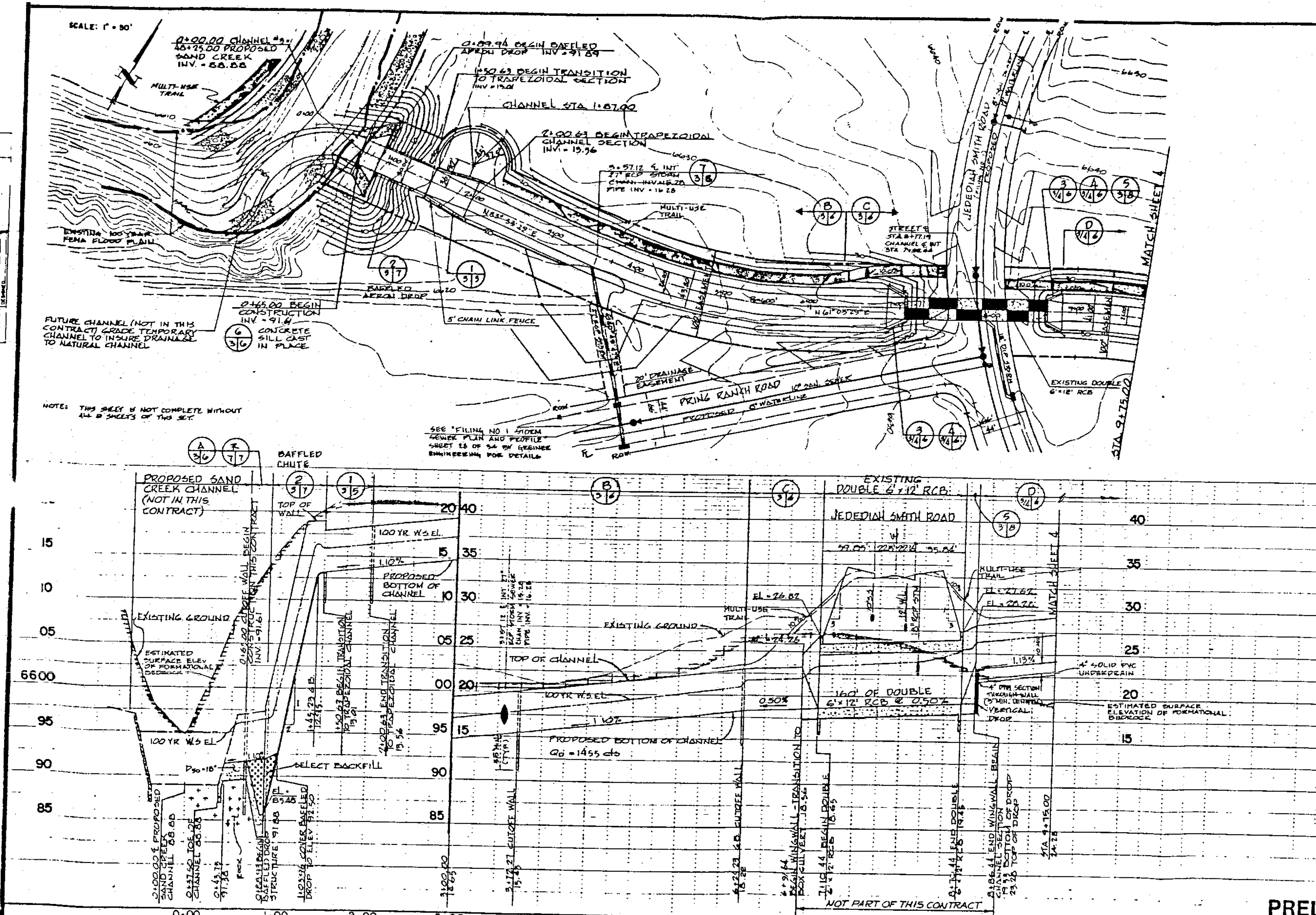
Grainer Engineering
Grainer Engineering Sciences, Inc
Denver, Colorado Colorado Springs, Colorado
Albuquerque, N.M. Kemmerer, Wyoming

Design LCR
Drawn BM
Check RDE
Scale As Shown

STETSON HILLS SUBDIVISION
STETSON HILLS CHANNEL No. 3
COVER SHEET

Date MAY 1987
Job No. 5156520
Sheet 1 of 9

A25



PRELIMINARY

These detailed plans and specifications were prepared under my direction and supervision. Said detailed plans and specifications have been prepared according to the criteria established by the City for detailed drainage plans and specifications, and said detailed plans and specifications are in conformity with the master plan of the drainage basin. Said detailed drainage plans and specifications meet the purpose for which the particular drainage facility is designed. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in preparation of the detailed drainage plans and specifications.

Prepared under the supervision of:

Date 9/2/87

Director of Engineering, Greiner Engineering, Inc.

The design shown conforms to the approved plans or plat on file with the City of Colorado Springs. It is understood that subsequent revisions to this plan may be required by the City if adjacent zoning, platting or master development plan changes occur.

Developer or Owner — Date 9/2/87

FOR BURIED UTILITY INFORMATION
48 HOURS BEFORE YOU DIG
CALL 636-5333 (CITY UTILITIES)
634-3778 (TELEPHONE)
FOR LOCATING & MARKING GAS, ELECTRIC, & TELEPHONE LINES

STATEMENT

THE CITY OF COLORADO SPRINGS RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN. THE CITY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY.
RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW:

STREET DESIGN
ROUGH CUT REVIEW ______ DATE ______
FINAL REVIEW ______ DATE ______
DRAINAGE DESIGN
FILED IN ACCORDANCE WITH SECTION 15 3 90E OF THE CODE OF COLORADO SPRINGS 1980 AS AMENDED ______ DATE ______

DESIGN DATA:

SIDEWALKS WIDTH ______
LOCATION Attached ☐
Detached 6' from P L ☐
CURB TYPE 1 ☐ 2 ☐ 3 ☐
R/W WIDTH ______ F C - F/C ______
STREET TYPE ______ HVEEM ______
ASPHALT THICKNESS
AC Surface ______
AC Base ______
AGG BASE THICKNESS
Class 6 ______
Class 5 ______
Class 2 ______

SCALE: HORIZ 1" = 50' VERT. 1" = 5'
BENCHMARK
PIN AND CAP L.S. No. 3854 LOCATED AT SECTION CORNER 19, 20, 29 AND 30, T 13 S, R 67 W. OF THE 6TH PM
ELEV = 6604.88' U.S.G.S. DATUM

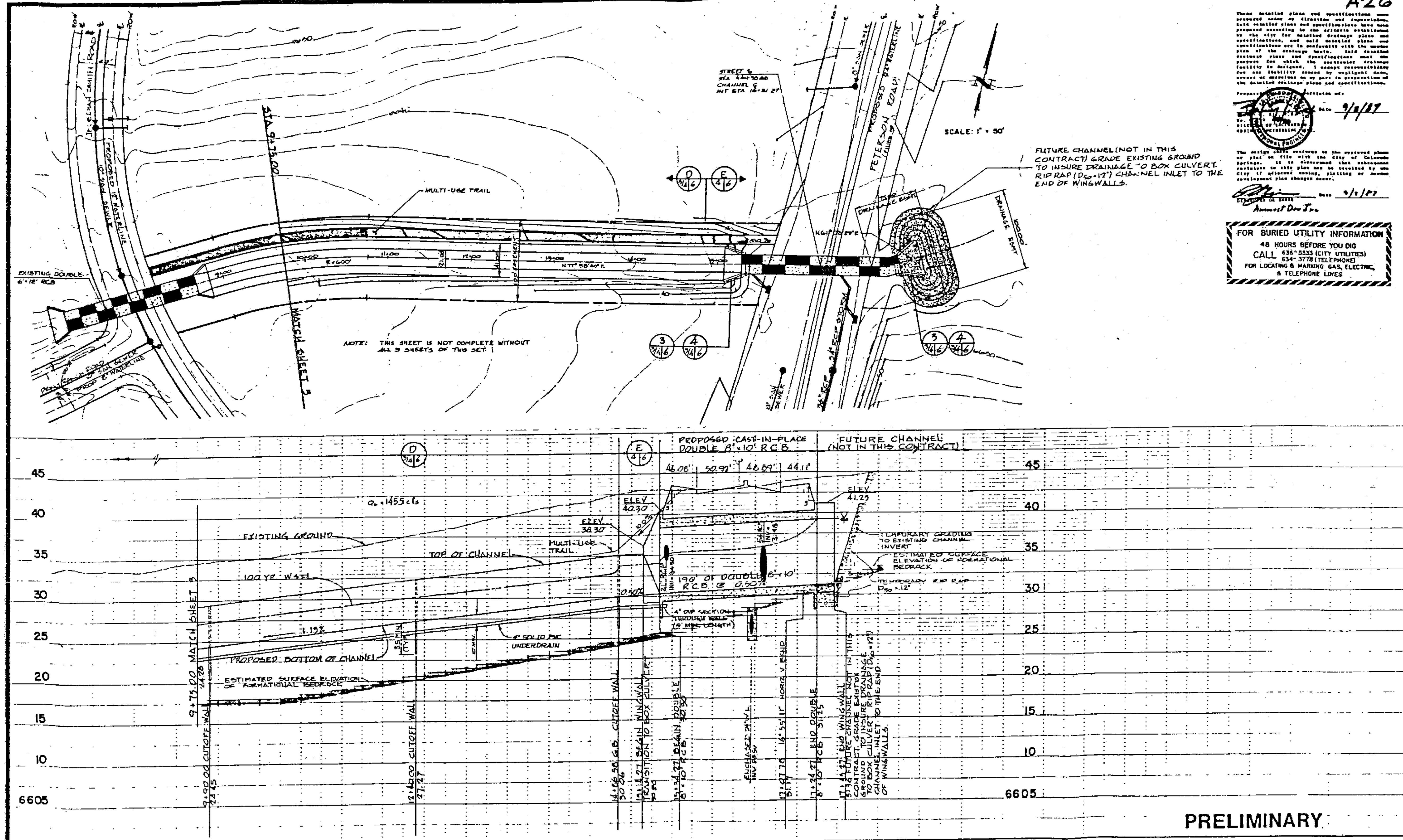
REVISIONS

NO	DESCRIPTION	DATE

ENGINEER:
GREINER ENGINEERING SCIENCES, INC.
5373 North Union Boulevard
Suite 200
Colorado Springs, Colorado 80918
(303) 593-0212
DESIGNED BY LCR DATE 5/87
DRAWN BY JLB DATE 5/87
CHECKED BY LWC DATE 5/87

PROJECT STETSON HILLS SUBDIVISION CHANNEL NO 3
FROM 0+00.00 TO 9+75.00
SUBDIVISION STETSON HILLS SUBDIVISION
DRAINAGE BASIN SAND CREEK
JOB NO 5156520
SHEET 3 OF 8

A26



9+00	10+00	11+00	12+00	13+00	14+00	15+00	16+00	17+00	18+00

STATEMENT

THE CITY OF COLORADO SPRINGS RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN. THE CITY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY.
RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE

REVIEW

STREET DESIGN
ROUGH CUT REVIEW ______ DATE ______
FINAL REVIEW ______ DATE ______
DRAINAGE DESIGN
FILED IN ACCORDANCE WITH SECTION 16-3-906 OF THE CODE OF COLORADO SPRINGS 1980 AS AMENDED ______ DATE ______

DESIGN DATA

SIDEWALKS WIDTH ______
LOCATION Attached ☐
Detached 8" from P/L ☐
CURB TYPE 1 ☐ 2 ☐ 3 ☐
R/W WIDTH ______ F/C - F/C ______
STREET TYPE ______ HVEEM ______

ASPHALT THICKNESS
AC Surface ______
AC Base ______
AGG. BASE THICKNESS
Class 6 ______
Class 5 ______
Class 2 ______

SCALE: HORIZ 1" = 50 VERT 1" = 5

BENCHMARK
PIN AND CAP L.S. No. 3854 LOCATED AT SECTION CORNER 19, 20, 29 AND 30, T 13 S., R 67 W., OF THE 6TH PM
ELEV = 6604.88' U.S.G.S. DATUM

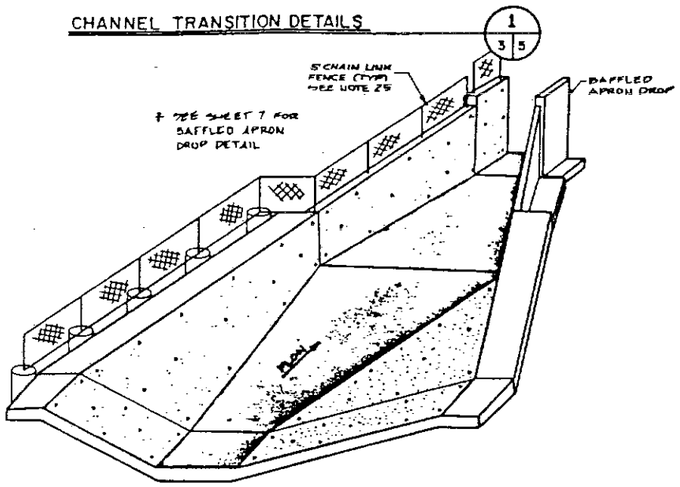
REVISIONS

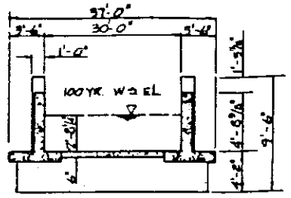
NO	DESCRIPTION	DATE

ENGINEER:
GREINER ENGINEERING SCIENCES, INC.
5373 North Union Boulevard
Suite 200
Colorado Springs, Colorado 80918
(303)593-0212
DESIGNED BY LGE DATE 5/87
DRAWN BY JLB DATE 6/87
CHECKED BY [illegible] DATE 8/87

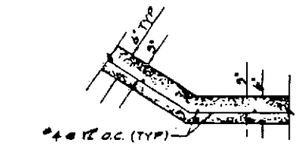
PROJECT STETSON HILLS SUBDIVISION CHANNEL NO. 3
FROM 9+75.00 TO 17+45.27
SUBDIVISION STETSON HILLS SUBDIVISION
DRAINAGE BASIN SAND CREEK
JOB NO 5156520 SHEET 4 OF 9

CHANNEL TRANSITION DETAILS



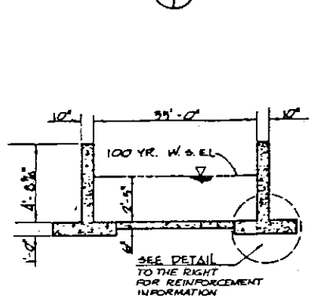


SECTION F (5|5)

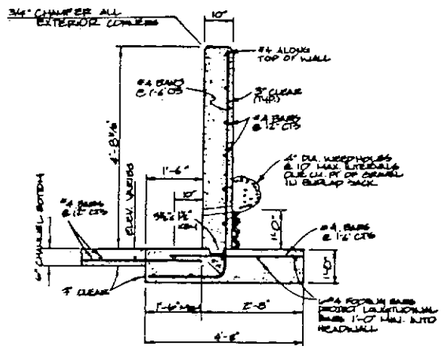


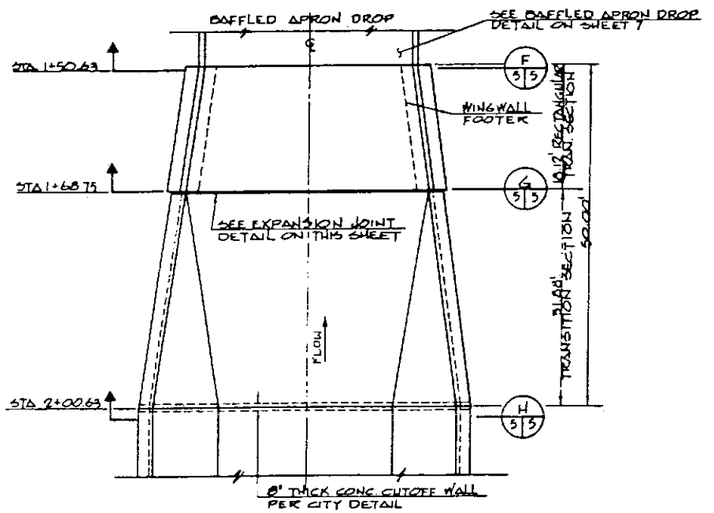
TYPICAL CHANNEL REINFORCEMENT

BETWEEN STATION 1+50.63 TO 2+00.63

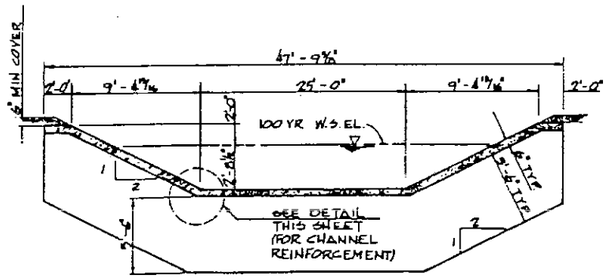


SECTION G (5|5)

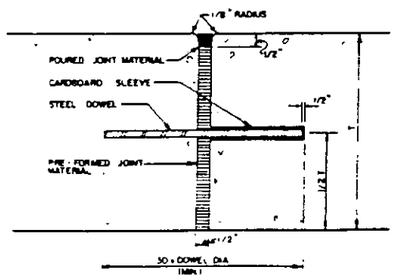




TRAPEZOIDAL CHANNEL



SECTION H (5|5)
CUTOFF WALL DETAIL

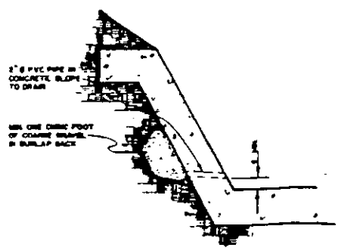


EXPANSION JOINT DETAIL

SEE GENERAL NOTE 8 FOR SPACING

NOTE:

1. No. 40 galvanized steel screen or filter fabric may be used in lieu of burlap sack. (See City Specifications).
2. Miter P.V.C. pipe flush with concrete.
3. Additional volume of coarse gravel or a complete rock underdrain system may be required if local groundwater and/or soil conditions dictate per resident soils engineer).
4. Weep hole shall be spaced 20' O.C.



WEEP HOLE DETAIL

These detailed plans and specifications were prepared under my direction and supervision. Said detailed plans and specifications have been prepared according to the criteria established by the City for detailed drainage plans and specifications, and said detailed plans and specifics ,ons are in conformity with the master plan of the drainage basin. Said detailed drainage plans and specifications meet the purposes for which the particular drainage facility is designed. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in the preparation of the detailed drainage plans and specifications.

Prepared under the supervision of:

Date 9/2/87

[illegible] P.E. #[illegible]
DIRECTOR OF [illegible]
GREINER ENGINEERING SCIENCES, INC.

GENERAL NOTES

1. All work shall conform to the City of Colorado Springs, Department of Public Works, Standard Specifications, or the Colorado Division of Highways, M & S Standards, whichever is applicable.
2. The Contractor shall contact all appropriate utility companies and the City of Colorado Springs inspectors prior to the beginning of construction. Contractor shall be responsible for locating and relocation of any existing utilities (including depths) which may conflict with the proposed construction. All existing utilities shall be protected from damage by the Contractor. Damaged utilities shall be repaired by the Contractor at his own expense.
3. All items shown on the Plans as existing are shown in approximate locations only. The actual location may vary from the Plans, especially in the case of utilities. Whenever Contractor discovers a discrepancy in locations, he shall contact the Engineer immediately.
4. The Contractor shall obtain at his expense all permits which are necessary to perform the proposed work.
5. All concrete shall have a 28-day strength of 3000 psi using Type II Portland Cement. All concrete shall have 5-7% entrained air content. Ten Cylinders shall be taken for each 100 cubic yards of concrete poured, in each class. There shall be a minimum of two cylinders formed each day strength testing. The results of the test are to be submitted to the owner and Engineer at the Contractors expense. The testing firm must be approved by Greiner Engineering.
6. All reinforcement shall be Grade 60.
7. 1/2-inch construction joints shall be a maximum of 20' spacing.
8. Expansion joints shall be a maximum of 100' spacing per City Standard detail shown below left.
9. The channel slab thickness shall be 4 inches and reinforced with 6x6 6/6 welded wire fabric,except in the transition area and drop structures. Construction procedures shall insure the WWF and 6/6 is properly positioned mid-depth in concrete lining. Reinforcement for the transition area and drop structures is called out on the respective details.
10. The channel surface shall be that of a broom finish.
11. Cutoff walls will be provided at intervals shown on the plan and profile sheets 3 and 4. See City Specifications for cutoff wall details. Cutoff walls located in non-rippable rock shall be reduced in depth to 1.0 feet into the rock.
12. Headwalls and wingwall will conform to the Colorado Division of Highways M & S standards.
13. Weep holes shall be spaced a minimum of 20 feet O.C.
14. The multi-use trail will be located 3-feet from the top of the channel, as shown on the Channel Dimension Detail on Sheet 6. The trail will flare away from the channel at the culverts, as shown on the plan and profile sheets. The trail will be 6" compacted aggregate base course Class 6 as per section 304, subsection 703.03 of the CDOH specifications.
15. Topography provided by Analytical Surveys, Inc., P.O. Box 7361, Colorado Springs, Colorado. The photography date was May 1983.
16. Topography shown may not reflect recent grading performed adjacent to the channel. Contractor shall inspect the Site to determine current topographic conditions.
17. The Contractor shall be responsible for all flows and drainage entering the channel construction area, diverting the flows, dewatering and protecting his work. The cost of such water control shall be made incidental to the cost of the channel construction. Diversion structures require approval of the Owner. Contractor shall submit a sketch plan of such facilities to the Owner and the Engineer for approval.
18. Railings shall be primed prior to shipment to the site and painted with two coats of Thanmec/Chromacolors Kodiak AK 12.
19. The Contractor will be responsible for the coordination with other contractors in the project area.
20. For storm sewer details, see "Stetson Hills Filings No. 1 and 2 Storm Sewer Plans," Sheets 11 of 34 and 26 of 34.
21. Railing shop drawings shall be submitted to the Engineer for review prior to fabrication.
22. Backfill of channel structures shall be Class I base course in conformance with AASHTO M-147 or as specified by soils engineer. All material shall be placed and compacted at optimum moisture (+ 2%). The compaction shall be continued until the base course has a density of not less than 95% of its modified Proctor Density at optimum moisture in accordance with AASHTO T-180 or 100% standard Proctor Density at optimum moisture in accordance with AASHTO T-99.
23. Any required construction staking and related surveying needed to construct this project is to be done by Greiner Engineering Sciences, Inc. The Contractor is to provide said surveys at his cost. Control Points will be provided by the Owner one time only.
24. Underdrain pipe shall conform to ASTM D 3034, SDR35 and shall be joined with integral bell, bell-and-spigot type rubber gasketed joints.
25. Chain link fence shall conform to the Colorado Division of Highways, M&S Standard M-607-2. See handrail on sheet 6 for setting of line posts into walls and bases along the channel.
26. If water is encountered during construction of the channel, the Soils Engineer shall be notified, and they will direct the Contractor as to the use of perforated pipe for the underdrain.

PRELIMINARY

Revisions

Greiner Engineering

Greiner Engineering Sciences Inc
Denver Colorado Colorado Springs Colorado
Albuquerque N.M. Kammerer Wyoming

Designed LCB
Drawn JLB
Checked BCS
Scale N.T.S.

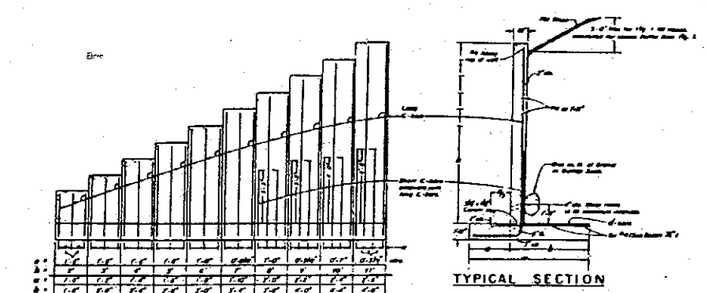
STETSON HILLS SUBDIVISION
STETSON HILLS CHANNEL No.3
DETAIL SHEET

Date MAY 1987
Job No. 5156520
Sheet 5 of 9

WINGWALL DETAIL
STANDARD M-601-20

3 / 3/4 | 6

COLORADO STATE HWY. DEPARTMENT



TYPICAL SECTION

DESIGN TABLE

GENERAL NOTES

All work shall be done in accordance with the Standard Specifications applicable to the project.

All exposed corners on concrete shall be chamfered ¾".

Wingwall footings and floor of Box Culvert shall be placed monolithically.

Expansion Joint Material shall conform to AASHTO M-213 and payment therefor shall be included in the price for Concrete, (Box Culvert) or (Wall).

Dimensions "H," "Ba," "Rise," "A," "J'," "n" and angles for wingwalls shall be as shown on the plans.

The minimum splice length for common bar sizes shall be:

BAR SIZE	#8	#9
SPLICE LENGTH	1'-0"	1'-6"

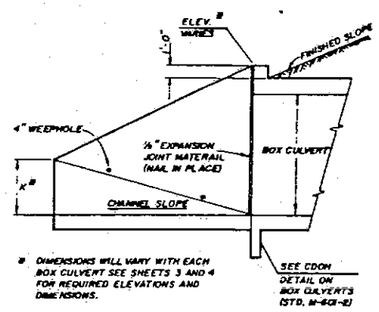
DESIGN DATA:

Unit Stresses: f_s = 20,000 psi
f_c = 1,200 psi
n = 10

Equivalent Fluid Pressure = 30 lbs./cu.ft.
Maximum Toe Pressure = 1 Ton/sq. ft.

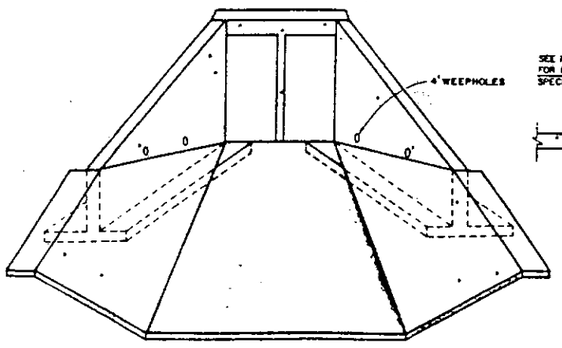
All construction joints shall be thoroughly cleaned before fresh concrete is poured.

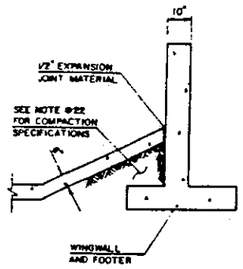
Wingwall Concrete shall be:
Concrete, Class A (Box Culvert) for C&C's.
Concrete, Class A, B or D (Wall) for Piers.



DIMENSIONS WILL VARY WITH EACH BOX CULVERT SEE SHEETS 3 AND 4 FOR REQUIRED ELEVATIONS AND DIMENSIONS.

WING ELEVATION

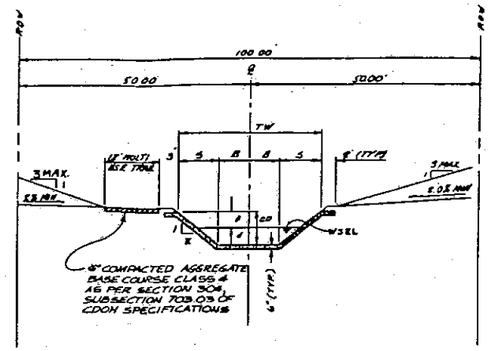




SEE WINGWALL DIMENSIONS AND REINFORCEMENT ABOVE SEE DETAIL AND GENERAL NOTES FOR CHANNEL REINFORCEMENT

CHANNEL CROSS SECTIONS

A 3/6 | B 3/6 | C 3/6 | D 4/6 | E 4/6

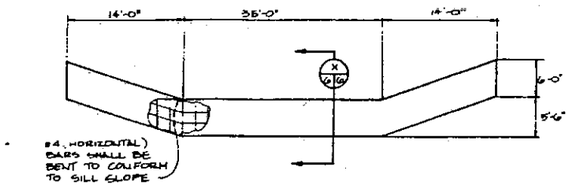


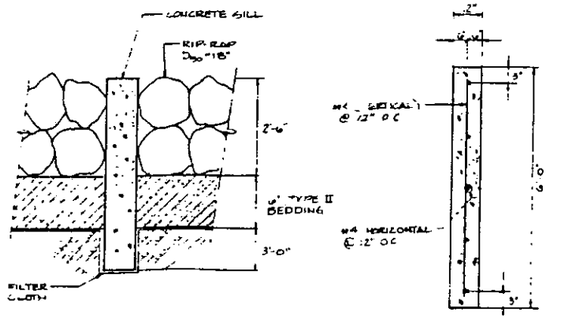
Section	Slope T	Qdesign (cfs)	Velocity (fps)	Froude Number	Alternate Depth(Ft)	Segment Depth(Ft)	TW (ft)	A (ft²)	B (ft)	d (ft)	f (ft)	CD (ft)	Z	n
A	1.10	1455	7.87	0.76	-	-	37.50	13.73	19.00	4.96	1.18	1.00	2.5	0.045
B	1.10	1455	17.69	3.06	7.18	6.07	43.80	9.68	12.36	3.73	1.99	4.78	3.0	0.015
C	0.30	1455	13.52	1.43	5.22	5.00	43.00	9.68	12.36	3.39	1.31	4.78	2.0	0.015
D	1.13	1455	16.42	2.09	7.80	6.36	41.90	10.08	10.36	2.96	2.06	5.00	2.0	0.015
E	0.30	1455	13.09	1.43	5.29	5.06	41.00	10.08	10.50	3.69	1.38	5.00	3.0	0.015

1. Section "A" is riprap. The remaining sections are concrete.
2. See channel transition on sheet 3 for depth of flow through transition.
3. Underdrain to be determined by the resident soils engineer.
4. Superelevation around the curves is included in the freeboard.

CONCRETE SILL DETAIL

6 / 3 6

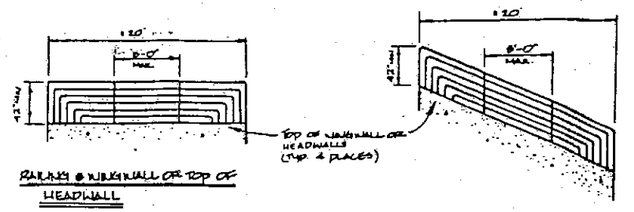


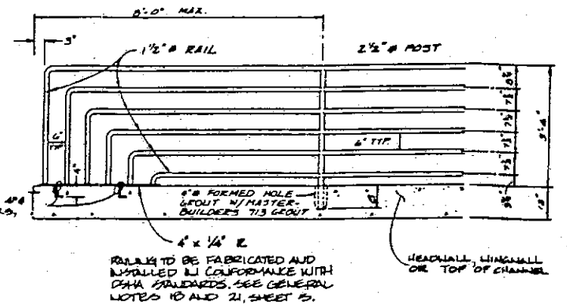


SECTION X 6/6

HANDRAIL DETAIL

4 / 3/4 | 6

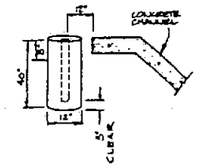




TYP. RAILING DETAIL

SCALE 1/2" = 1'-0"

HAND RAILING ALONG THE CHANNEL SECTION WILL BE EMBEDDED 6 INCHES INTO A 8" DIAMETER X 30" CYLINDER ALONG SIDE THE CHANNEL



Hand railing will be located at the box culverts on Jedediah Smith Road and Peterson Road. Railing at Jedediah Smith Road will consist of 2-26' sections along the headwalls, 2-20' sections on west wingwalls, 2-17' sections on east wingwalls and 7-10' sections on the trapezoidal channel upstream of the east wingwalls. The railing at Peterson Road will consist of 2-22' sections along the headwalls, 2-22' sections on the west wingwalls, and 2-22' sections on the east wingwalls. A 5-foot chain link fence shall be constructed around the transition area and baffled apron drop. See General Note No. 18 for railing joint specifications.

These detailed plans and specifications were prepared under my direction and supervision. Said detailed plans and specifications have been prepared according to the criteria established by the City for detailed drainage plans and specifications, and said detailed plans and specifications are in conformity with the master plan of the drainage basin. Said detailed drainage plans and specifications meet the purpose for which the particular drainage facility is designed. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in the preparation of the detailed drainage plans and specifications.

Prepared by me or under my supervision of:

Date 7/4/87

BARNEY D. [illegible] 10736
DIRECTOR OF ENGINEERING
GREINER ENGINEERING, INC.

PRELIMINARY

Revisions

Greiner Engineering
Greiner Engineering Sciences Inc
Denver Colorado Colorado Springs Colorado
Albuquerque N.M. Kemmerer Wyoming

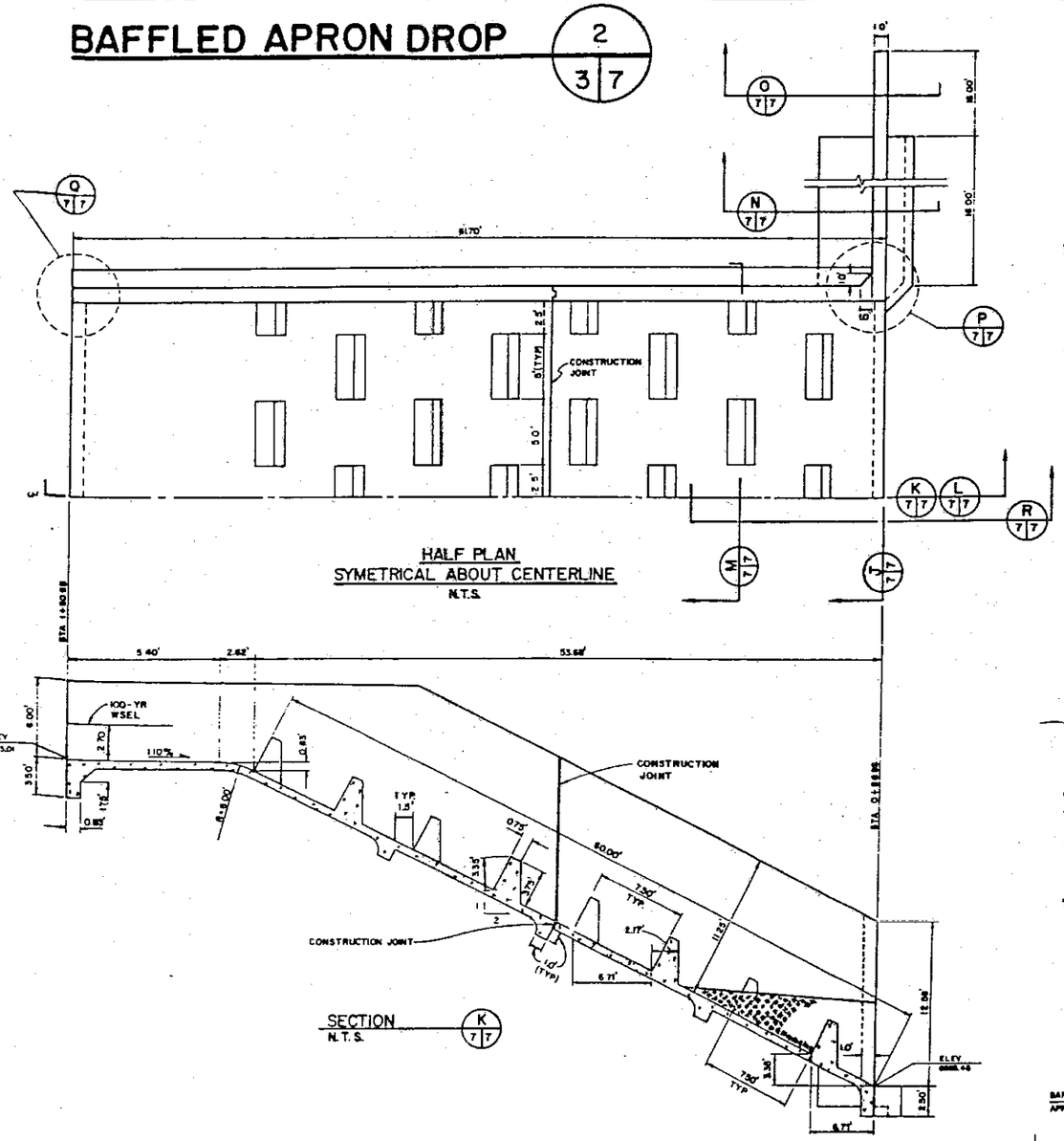
Design LCB
Drawn JLB
Check BLB
Scale N.T.S.

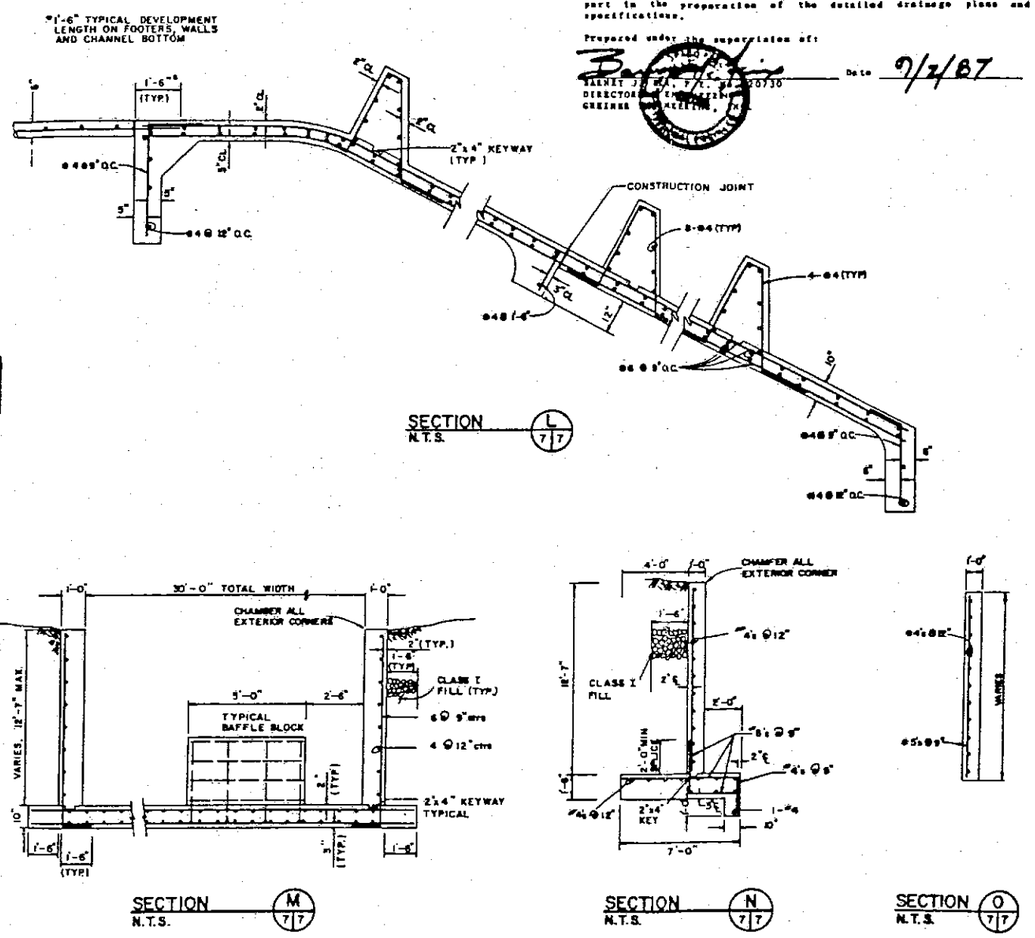
STETSON HILLS SUBDIVISION
STETSON HILLS CHANNEL No.3
DETAIL SHEET

Date MAY 1987
Job No. 9156520
Sheet 6 of 9

BAFFLED APRON DROP

2 / 3 7

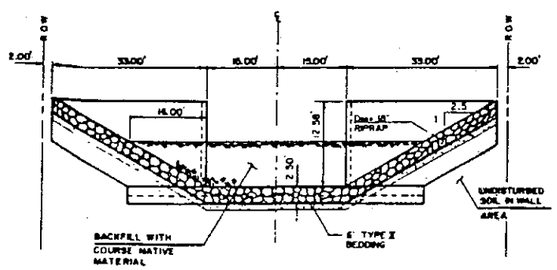


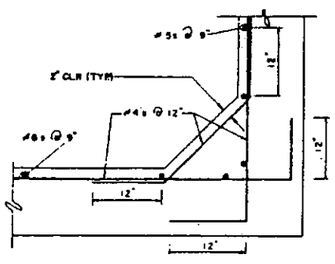


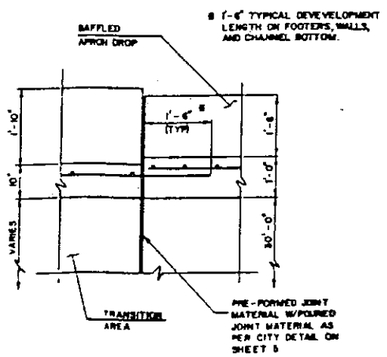
These detailed plans and specifications were prepared under my direction and supervision. Said detailed plans and specifications have been prepared according to the criteria established by the City for detailed drainage plans and specifications, and said detailed plans and specifications are in conformity with the master plan of the drainage basin. Said detailed drainage plans and specifications meet the purposes for which the particular drainage facility is designed. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in the preparation of the detailed drainage plans and specifications.

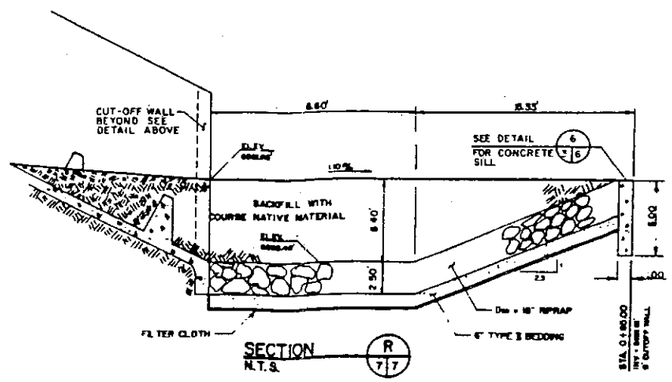
Prepared under the supervision of:

Date 9/2/87









PRELIMINARY

Revisions

Greiner Engineering

Greiner Engineering Sciences, Inc
Denver Colorado Colorado Springs, Colorado
Albuquerque, N.M. Kemmerer, Wyoming

Design	LCR
Drawn	JLB
Check	RLE
Scale	N.T.S.

STETSON HILLS SUBDIVISION

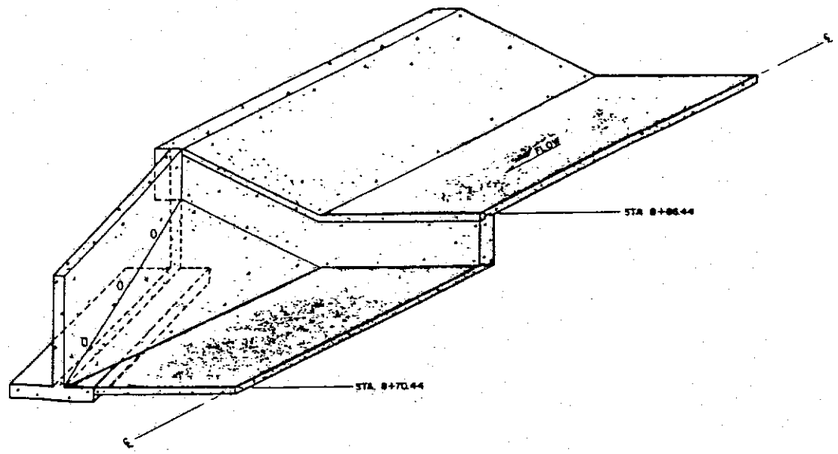
STETSON HILLS CHANNEL No. 3

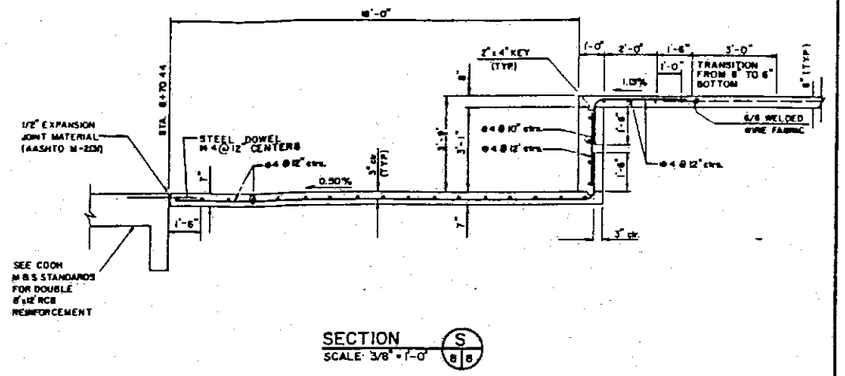
BAFFLED APRON DROP DETAIL

Date	MAY 1987
Job No	5156520
Sheet	of
	7 | 9

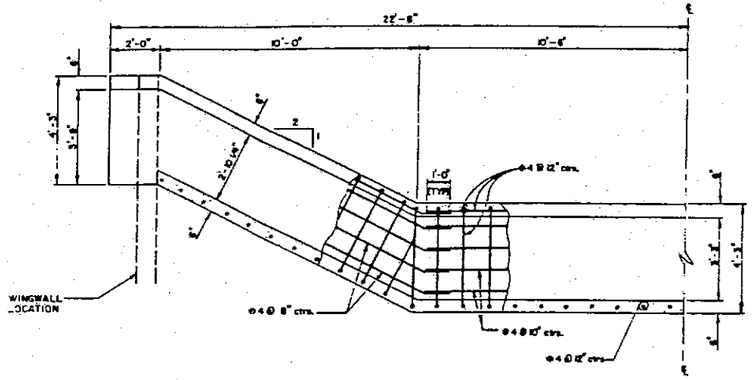
A29

VERTICAL DROP DETAIL (5 / 3 8)



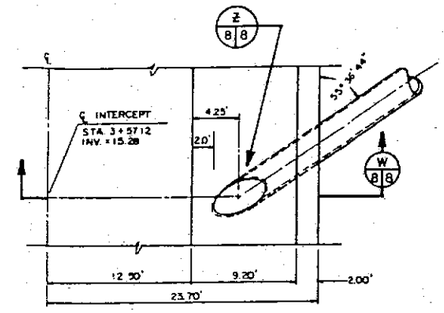


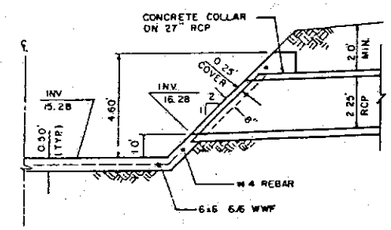
SECTION (S 8 8)
SCALE: 3/8"=1'-0"



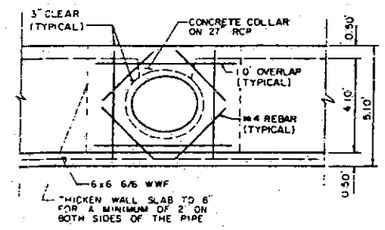
SECTION (T 8 8)
SCALE 3/8"=1'-0"

CONNECTION DETAIL (7 / 3 8)

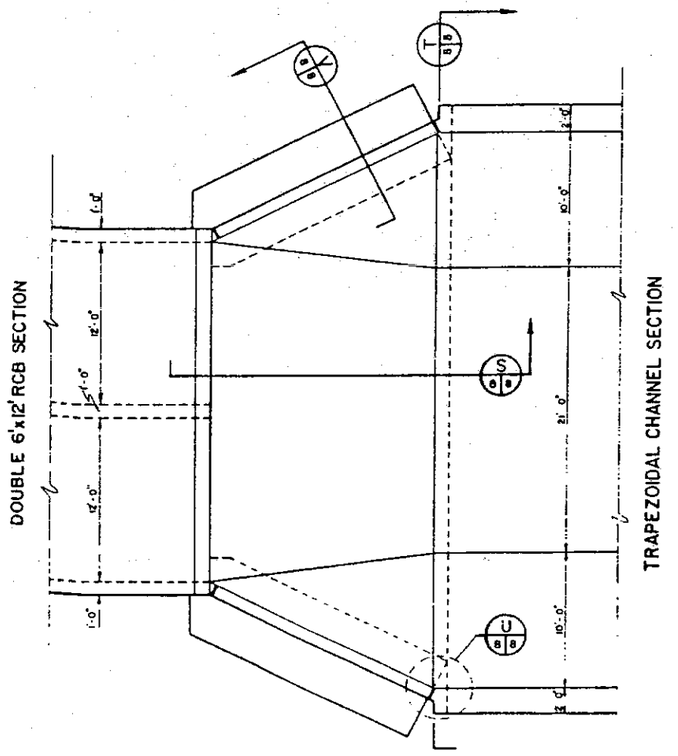


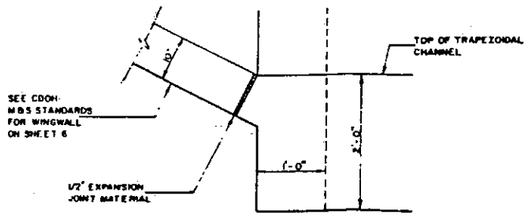


SECTION (W 8 8)
N.T.S.
NOTE: PRECUT 27" RCP AT AN ANGLE PARALLEL TO CHANNEL FACE.

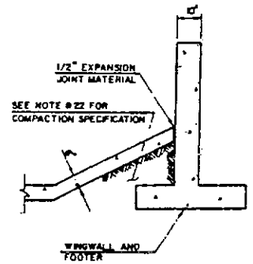


REINFORCEMENT DETAIL (Z 8 8)
NTS.





DETAIL (U 8 8)
NTS



SECTION (V 8 8)
N.T.S.

These detailed plans and specifications were prepared under my direction and supervision. Said detailed plans and specifications have been prepared according to the criteria established by the City for detailed drainage plans and specifications, and said detailed plans and specifications are in conformity with the master plan of the drainage basin. Said detailed drainage plans and specifications meet the purposes for which the particular drainage facility is designed. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in the preparation of the detailed drainage plans and specifications.

Prepared under the supervision of:

[signature] Date 9/2/87

[illegible] P.E. No. 10730
DIRECTOR OF [illegible]
GREINER ENGINEERING SCIENCES, INC.

PRELIMINARY

Revisions

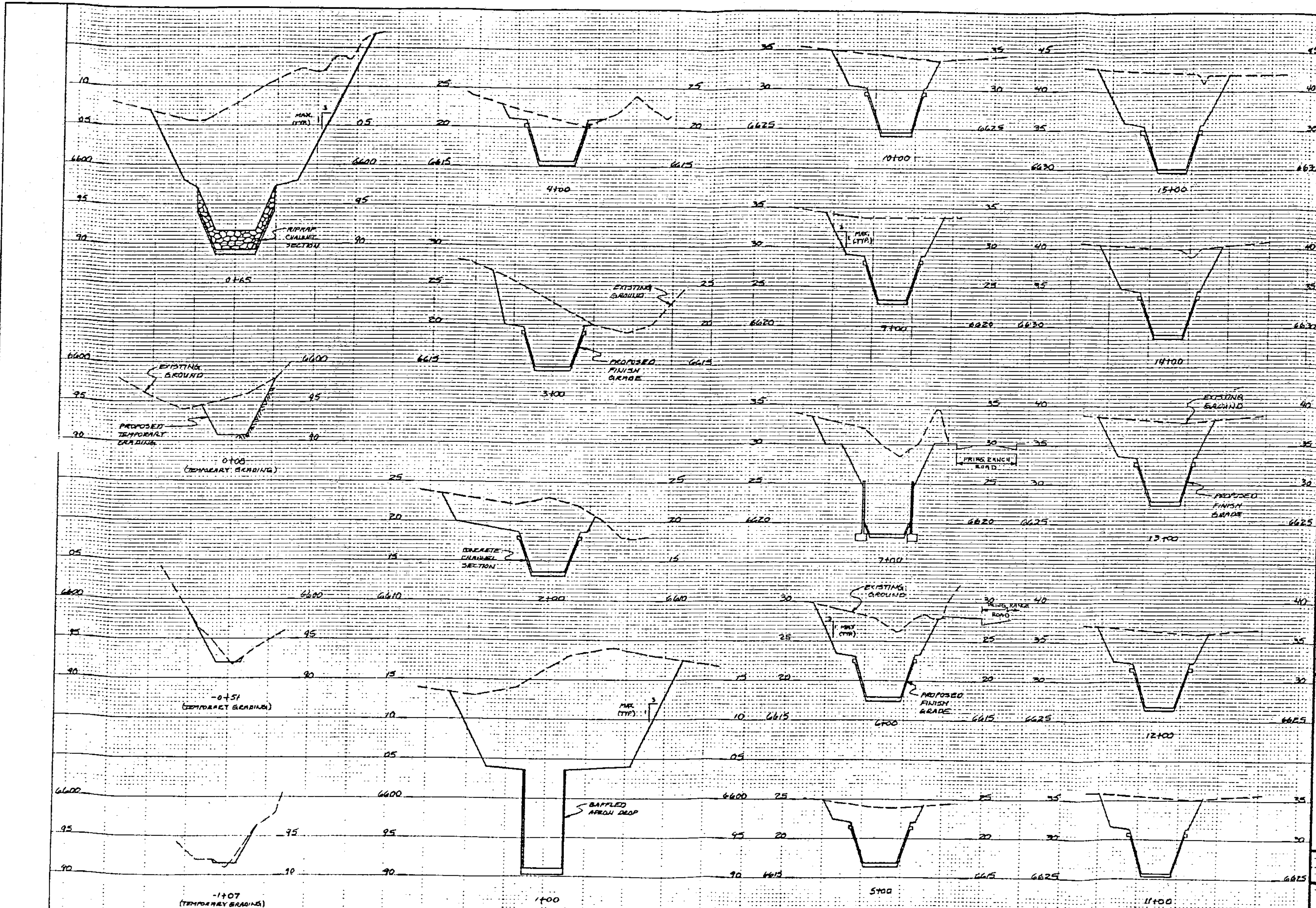
Greiner Engineering
Greiner Engineering Sciences Inc
Denver, Colorado Colorado Springs
Albuquerque N.M. Kemmerer Wyoming

Design LCE
Drawn JLS
Check LCE
Scale AS SHOWN

STETSON HILLS SUBDIVISION
STETSON HILLS CHANNEL No.3
DETAIL SHEET

Date MAY 1987
Job No. 9156320
Sheet 8 of 9

A31



PRELIMINARY

Greiner Engineering

Greiner Engineering Sciences Inc.

Design LCR
Drawn LCR

Scale VERT. 1" = 5'
HORIZ. 1" = 30'

STETSON HILLS SUBDIVISION

STETSON HILLS CHANNEL No. 3

CHANNEL CROSS SECTIONS

MAY 1987

5156520

9 9