LAND DEVELOPM

DRAINAGE REPORT

OF

CURR RESERVOIR & FISHERS CANYON

Tributary Areas to Colorado State Highway 115
Colorado Springs, Colorado

prepared for
GATES LAND COMPANY

DREXEL, BARRELL & CO.

ENGINEERS — SURVEYORS

1700 38TH STREET BOULDER, COLORADO 80301 (303) 442-4338

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Prepared by:

DREXEL, BARRELL & CO.
March 5, 1980

DRAINAGE REPORT
OF
CURR RESERVOIR & FISHERS CANYON
TRIBUTARY AREAS TO COLORADO STATE HIGHWAY 115
COLORADO SPRINGS, COLORADO

This report covers drainage areas containing about 3.8 square miles which are tributary to Curr Reservoir and Fishers Canyon to Colorado State Highway 115. This basin is located mostly in Section 5, R66W, T15S and Sections 1, 2, 11, 12, R67W, T15S, all in the 6th P.M., City of Colorado Springs, County of El Paso. More particularly, the area is located between Cheyenne Mountain and State Highway 115 and north and south of Star Ranch Road at its intersection with Highway 115.

The basin is located on an eastern facing slope, starting at a ridge and steeply sloping, in excess of fifty percent, for the first half mile and gradually flattening to approximately four percent slope at Highway 115. Trees exist at higher elevations with sparse grass prevalent at lower elevations, with some scrubs centering on major swales. The basin is tributary to two points at Highway 115. Curr Reservoir, the larger northern portion, drains about 2.5 square miles. Curr Dam and Reservoir, located directly west and adjacent to Highway 115, was constructed to its present configuration after 1971. The spillway drains to an existing 7'x7' box culvert under Highway 115. Fishers Canyon, the southern basin, contains about 1.3 square miles and has a fairly well defined swale throughout the length of the basin. The swale flattens about 500 feet west of the highway. No culvert exists under State Highway 115 at the base of Fishers Canyon.

Criteria for determining flows was taken from the Soils Conservation Service Manual entitled "Procedures for Determining Peak Flows in Colorado" including Technical Release No. 55. The six hour 100 year storm was used and values were obtained from "NOAA Atlas 2, Volume III" prepared for the S.C.S. (Soils Conservation Service). Culvert hydraulics were taken from "Hydraulic Engineering Circulars No. 13 and No. 5" prepared by the Federal Highway Administration. Colorado Springs uses a modified S.C.S. method as shown in the "City of Colorado Springs Runoff Criteria" manual.

Colorado State Highway 115 represents a barrier to drainage from both Curr Reservoir and Fishers Canyon. The existing 7'x7' box culvert is inadequate to pass the 100 year storm under the highway as required by the City of Colorado Springs. As previously indicated, the drainage is divided into two parts, the larger being Curr Reservoir. About 1700 c.f.s. from this area is historically tributary to the existing box culvert under Highway 115. The capacity of the existing box is limited to 300 c.f.s. when the highway overtops at a point approximately 800' south of the culvert. If Fishers Canyon flow, an additional 980 c.f.s., is considered, it is clear under historic conditions that the existing box culvert under State Highway 115 is inadequate.

Existing and proposed development has and will alter the drainage patterns of this area considerably. Curr Dam & Reservoir now has the capacity to store the 100 year storm for both existing and proposed development with the spillway outflow reduced to 500 c.f.s. Details can be found on this subject prepared by Hartzell, Pfeiffenberger & Associates, Inc. on April 21, 1971. Unless modifications are made, the existing 7'x7' box culvert at the base of the dam cannot handle this reduced 100 year developed flow. Development is proceeding along

Fishers Canyon increasing the need for a culvert under the highway at this point. The flow determination at this point varies by method. The S.C.S. method used in this report shows 1130 c.f.s. tributary to this point. Colorado Springs methodology and approved flow is 1355 c.f.s. The State of Colorado feels the S.C.S. method produces high results in this case and recommends a design discharge of 900 c.f.s. They also recommend a double 10'x6' box culvert be used at this point. At this report's design, flow of 1130 c.f.s. water will pond to a point 1.5' above the inside top of the culvert. The City of Colorado Springs approved flow causes ponding 3' above the inside top of the culvert. Thus it appears the culvert as recommended by the State Highway Department is adequate.

In summary, it is obvious that additional culvert capacity is necessary under Colorado State Highway 115 to prevent drainage overtopping the highway and to adhere to the City of Colorado Springs policies. Drainage calculations and data are included for your review.

Respectfully submitted,

DREXEL, BARRELL & CO.

Barbara N. Weiss

Barbara N. Weiss
P.E. 15471

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project	Job No
Fishers Canyon, Curr Reservoir	E-1986

Client	By	Date
Gates	BNW	

Summary of Flows - S.C.S.

Curr Reservoir	historic	1683 c/s
	developed	2080 c/s
Fishers Canyon	historic	977 c/s
	developed	1130 c/s

DREXEL, BARRELL & CO.

LAND SURVEYORS
CIVIL ENGINEERS

Project	Job No
Fishers Canyon	E-1986
Client	**By** / **Date**
Gates	BNW / 3-4-80

ck capacity of double 10'x6' high box culvert

@ Q = 900 cfs Hf = 6'

@ Q = 1130 cfs Hf = 1.25(6') = 7.5'

@ Q = 1355 cfs Hf = 1.5 (6') = 9'

1700 38TH STREET (303) 442-4338
BOULDER, COLORADO 80301

3405 N. EL PASO STREET (303) 633-5029
COLORADO SPRINGS, COLORADO 80907

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project: Curr Reservoir — Job No: E-1986

Client: Gates — By: BNW — Date: Oct 19, 1979

Total area to state Hwy 115
(1 to Curr Reservoir)

Soil Group - C (85%) B (15%)

A = 1,600 Ac = 2.5 sq. mile

Historic condition

poor - good range land

CN = .85(80) + .15(70) = 78.5

determine $T_c = (11.9L^3/H)^{.385}$

	to el 8880	T_c =	2 min
H = 8880 - 7000' = 1800'	L = 3100'	T_c =	5 min
H = 400'	L = 2400'	T_c =	7 min
H = 400'	L = 3500'	T_c =	10 min
H = 200'	L = 4000'	T_c =	15 min
H = 80'	L = 2000'	T_c =	10 min
	T_c (total)	=	49 min
		=	.82 hr

P = 3.5 in. (6 hr - 100 yr storm) (NOAA Atlas II)

Q = 1.53 (Tech. release #55)

q_p = 440 csm/in. Type II storm (Tech. release #55)

$q = q_p A Q$

$q = 440(2.5)1.53 = 1,683$ c/s

1425 PEARL STREET (303) 442-4338
BOULDER, COLORADO 80302

3405 N. EL PASO STREET (303) 633-5029
COLORADO SPRINGS, COLORADO 80907

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project	Job Nº
Curr Reservoir	E-1986

Client	By	Date
Gates	BNW	Feb 1980

Developed

30% 1/4 Acre lots CN = .3[.85(83)+.15(75)] = 24.5

50% 1 Acre lots CN = .5[.85(79)+.15(68)] = 38.7

20% exist. CN = 78.5(.2) = 15.7

CN(total) = 78.9

Tc - assume channels for tributary flow paved for 4000' thru 1/4 Acre lots @ 20 f/s → 3.3 mm/hr, or Tc = 37 min = .62 hr

Q = 1.6 & qp = 520 csm/hr

q = qp Q A

q = 520 (1.6) 2.5 = 2080 cfs

- EXIST BOX UNDER STATE HWG 115 - ft. el. 35 (approx) size 7'x7'

→ Break-out point el 41 @ Star Ranch Rd @ Hwy 115
∴ capacity 300 cfs

→ berm to 42.5 el of exist. 115 @ culvert
capacity 420 cfs

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COLORADO SPRINGS, COLORADO 80907

DREXEL, BARRELL & CO. LAND SURVEYORS CIVIL ENGINEERS

Project: Fisher Canyon Channel | Job Nº: E-1986

Client: Gates [from Peak Flows in Co, SCS #55, 100 yr, 6 hr storm] | By: BWW | Date: April 10, 1979

Total area to state Hwy 115 = 850 Ac

determine CN — Tc — Intensity

- above el 7200 A = 360 Ac
- mostly I-1-EF & I-3-EF (rock outcrop & Cold Creek - Tolman complex & Cutler Broadmoor)
  30% D 70% C - from SCS office C. Springs
- poor

CN = .30 (83) + .70 (77) = 80 - historic & proposed = CN

- to al point approx 500' W of 115 A = 270 Ac
- X-16-F (Jarre Geocolote complex) B
- poor range land

CN = 79 historic

CN = (assume 1/2 Acre lots) 73

- lower 220 Acres
- C5E Razor stony clay loam - C
- poor range land

CN = 86 historic

CN = (assume 1/4 acre lots) 86 (86%) + (commercial) 94 (14%) 13
= 87

determine Tc

to el 9300	2 min			
to el 7200	H = 2100'	L = 5700'	Tc = 9 min	figure 5-5
to el 6500	H = 700	L = 5400'	Tc = 13 min	"
to el 6200	H = 300'	L = 3000'	Tc = 9 min	"
*to el 6000	H = 200	L = 3100	Tc = 10	
*to el 5950	H = 50'	L = 1,700	Tc = 9 min	

Tc Historic Total = 52 min

* Historic only

proposed to el 5950 L = 4800 @ 20 fps Tc = 4 min

Tc proposed Total = 37 min

1425 PEARL STREET (303) 442-4338 BOULDER, COLORADO 80302
3405 N. EL PASO STREET (303) 633-5029 COLORADO SPRINGS, COLORADO 80907

Project: Fisher Canyon Channel | Job No: E-1986

Client: Gates | By: BMW | Date: April 10, 1979

rev'd to Tech #55 March - 80

CN

$$CN_{historic} = \frac{360}{850}(80) + \frac{270}{850}(79) + \frac{220}{850}(86) = 81$$

$$CN_{(proposed)} = \frac{360}{850}(80) + \frac{270}{850}(73) + \frac{220}{850}(87) = 80$$

$q_p = q_p A Q$

historic $q_p = 430$ csm/in (Technical Release #55)

$Q = 1.71$ in (for P=3.5 in C Springs)

$$q_p = 430 \frac{(850)}{640} 1.71 = 977 \text{ cfs}$$

proposed $q_p = 520$ csm/in (Technical Release #55)

$Q = 1.64$ (for P=3.5" in C Springs)

$$q_p = 520 \left(\frac{850}{640}\right) 1.64 = 1130 \text{ cfs}$$

E-1986

Steve Buchberger
Hydraulics Unit
Colorado Dept of Highways
4201 E. Arkansas Avenue
Denver, CO 80222
Sept. 25, 1979

Barbara Weiss
Drexel, Barrell & CO

Dear Barbara –

Per your request, enclosed please find a copy of the letter to District Engineer, Mr. Watt Harris, which documents the drainage structure recommended by the Hydraulics Unit for the Fishers Canyon Crossing. Although we acknowledge that your estimated design discharge is based on accepted procedure, we feel that the Soil Conservation Service method gives results which are somewhat high – especially when considering the streamflow history for this area. Consequently, we feel a design discharge of 900 cfs is more reasonable.

If you have any questions, please contact me.

Sincerely,

Steven G. Buchberger

ENCLOSURE

DOH Form No. 37

DIVISION OF HIGHWAYS
STATE OF COLORADO
4201 E. Arkansas Ave.
DENVER, COLORADO 80222

District 2 Miscellaneous
SH 115 [Formerly D-AD 16(1)]
South of Colorado Springs

Design File 09402

May 23, 1979

TO: H. W. HARRIS

FROM: D. L. VERNON

SUBJECT: REVIEW OF DRAINAGE STRUCTURE FOR FISHERS CANYON

On Thursday, April 5, 1979, a meeting between Gary Haynes (office of City Engineer - Colorado Springs), Barbara Weiss (Drexel, Barrell and Company), and Steven Buchberger (CDOH) was held to discuss and to resolve the difference between design discharges for Fishers Canyon at SH 115. Following the meeting, the Hydraulics Unit reviewed its hydrologic analysis for Fishers Canyon.

Results of our re-evaluation again show that our estimated design flow is less than the design discharge proposed by Drexel, Barrell and Company. However, recognizing the uncertainty involved in such an analysis and in order to provide an additional margin of safety, we recommend that a DBL 10' x 6' CBC be used at the site rather than the DBL 8' x 6' CBC referenced in our letter to you dated March 7, 1979.

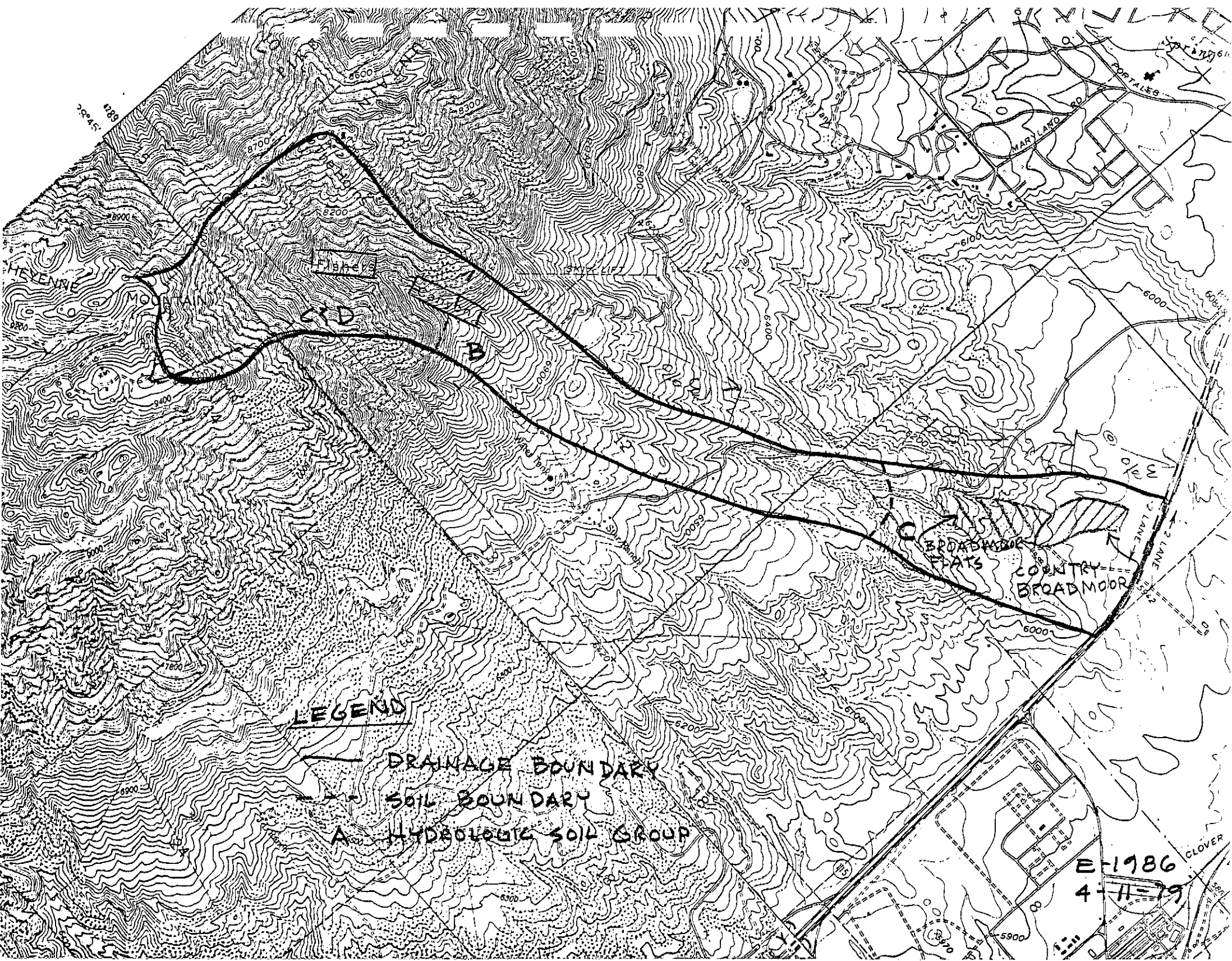
This structure will pass 900 cfs and, thereby, will decrease substantially any risk of flooding SH 115 at the drainage crossing of Fishers Canyon. The cost of the DBL 10' x 6' is approximately $550 per linear foot.

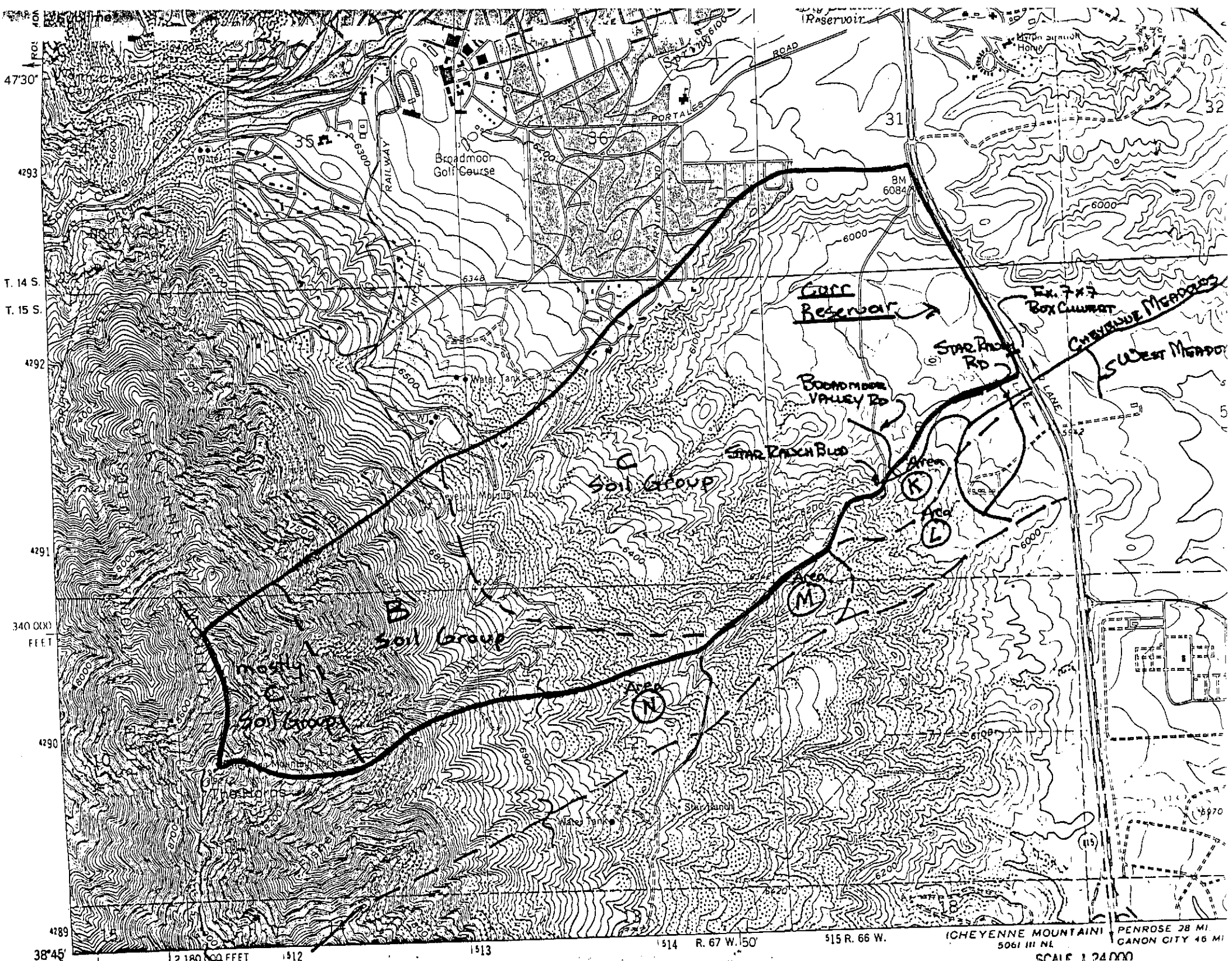
A field survey is needed before final design can be completed.

D. L. VERNON
Staff Design Engineer

By
D. H. HEIDERSTADT
Coordinating Engineer

DHHnl
cc: Vernon/Kasenga
D H Heiderstadt
J L Pim
R Q Brown


LEGEND
DRAINAGE BOUNDARY
SOIL BOUNDARY
A HYDROLOGIC SOIL GROUP
A
B
C
D
Fishers Peak
CHEYENNE MOUNTAIN
BROADMOOR FLATS COUNTRY BROADMOOR
MARYLAND
PORT ALEB
E-1986
4-11-79


Golf Reservoir
Ex. 7×7 Box Culvert
Broadmoor Valley Rd
Star Ranch Blvd
Soil Group C
Area K
Area L
Area M
Area N
Soil Group B
mostly C Soil Groups
Broadmoor Golf Course
Cheyenne Mountain
The Broadmoor
Water Tank
Spring
Reservoir
PORTALES
RAILWAY
INCLINE
MARYLAND RD
BM 6084
T. 14 S.
T. 15 S.
R. 67 W.
R. 66 W.
CHEYENNE MOUNTAIN
5061 III NE
PENROSE 28 MI
CANON CITY 46 MI
SCALE 1:24000