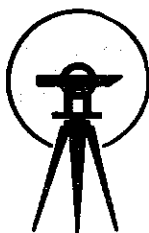


RETURN WITHIN 2 WEEKS TO:
CITY OF COLORADO SPRINGS
STORM WATER & SUBDIVISION
101 W. COSTILLA, SUITE 113
COLORADO SPRINGS, CO 80902
(719) 578-6212

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

MASTER DRAINAGE REPORT
for
BASIN IV, IV-A, IV-B & VII-B
CHEYENNE MOUNTAIN RANCH
COLORADO SPRINGS, COLORADO



DREXEL, BARRELL & CO.

ENGINEERS — SURVEYORS

1700 38TH STREET

BOULDER, COLORADO 80301

(303) 442-4338

MASTER DRAINAGE REPORT
for
BASIN IV, IV-A, IV-B & VII-B
CHEYENNE MOUNTAIN RANCH
COLORADO SPRINGS, COLORADO

RECEIVED
PUBLIC WORKS/ENGINEERING
COLORADO SPRINGS COLO.

JUL 20 1983
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM

Prepared for:

Gates Land Company
155 West Lake Avenue
Colorado Springs, Colorado 80906
(303) 892-5950

Prepared by:

Drexel, Barrell & Co.
1700 38th Street
Boulder, Colorado 80301
(303) 442-4338

Revised July 18, 1983

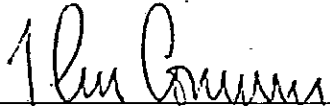
E-2528

CERTIFICATIONS

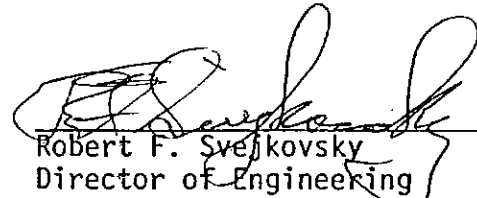
The attached drainage plan and report for Basin IV, IV-A, IV-B
and VII-B, part of Cheyenne Mountain Ranch

were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by the negligent acts, errors, or omissions on my part in preparing this report.

For: DREXEL, BARRELL & CO.

By: 
John Common, P.E. #11956

The developer has read and will comply with all of the requirements specified in this drainage report as approved by the City Engineer.

By: 
Robert F. Svejksky
Director of Engineering

E-2528

Filed in accordance with Section
10-3-036 of the Code of the City
of Colorado Springs, 1980, as
amended.

Gary R. Hayes 10-6-83
City Engineer Date

Subject to: 1. State Highway approval
2. Final details with each filing
3. Conceptual plan only.

MASTER DRAINAGE REPORT

for

BASIN IV, IV-A, IV-B & VII-B

CHEYENNE MOUNTAIN RANCH

This report updates and expands upon part of the Master Drainage Report entitled "Drainage Basin Hydrologic Studies, Cheyenne Mountain Ranch, El Paso County, Colorado" dated May 17, 1971 prepared by Hartzell-Pfeiffenberger and Associates, Inc. Flows generated in the Hartzell-Pfeiffenberger report are re-calculated here because they were based on methods now obsolete. Basin IV and part of Basin VII are analyzed here. These basins are located in parts of Section 12, T15S, R67W and Sections 5, 6, 7 and 8, T15S, R67W all part of the 6th P.M. Generally, the basins are located directly north and west of Fort Carson. The area lies east of Cheyenne Mountain and slopes east to Loomis Street, which is located about 4,000 feet east of State Highway 115.

Most of the area in question will be developed in the future. A tentative master plan has been formulated showing intended land uses. Major labeled street locations are expected to remain essentially the same, but detailed design will occur as each area is platted. In this report, adequacy of existing drainage structures is analyzed based on proposed land uses. Preliminary sizes for drainage conveyance structures are formulated. Channels, culverts, rights-of-way and access roads are indicated at required locations. As areas become platted, drainage structure design right-of-way and access requirements will be finalized to conform to Colorado Springs criteria at that time. Please refer to the drainage plan accompanying this report.

Drainage criteria is taken from the City of Colorado Springs "Determination of Storm Runoff Criteria" manual and "Procedures for Determining Peak Flows in Colorado" prepared by the Soil Conservation Service in March, 1980. The 6 hour, 5-year and 100-year frequency storm is analyzed for developed conditions. Drainage structures are sized to handle the 100-year storm if the 100-year flow exceeds 500 c.f.s. For lesser flows, structures are sized for the 5-year storm. The procedures used for hydrograph configuration are based on discussions with S. Glade Wilkins from the Soil Conservation Service Office in Denver. For each peak flow determination, runoff from a given area equals the volume under the hydrograph drawn for that area. Soil types are determined from maps published by the Soil Conservation Service. Basin designations are taken from the Hartzell-Pfeiffenberger report. Please refer to the Appendix for vicinity map, soils map and calculations.

Approximately 160 acres are historically tributary to an existing 72" C.M.P. under State Highway 115 just north of the Academy Road Interchange. This land generally drains to a swale in the center of the area flowing east at a 10% grade. East of Highway 115, the ground flattens to about 3% and the historic swale continues east ultimately flowing into Fountain Creek.

The Cheyenne Mountain Ranch Master Plan shows single family housing at the western portion of the site. As the site slopes east, commercial areas dominate along with multi-family housing at Highway 115. East of Highway 115, most of the land use is single family with some multi-family areas interspered.

This master plan is conceptual in nature and actual land use may vary as development occurs.

West of the commercial, school, and multi-family areas at Broadmoor Bluffs Drive single family housing is planned for Area IV. The single family area is to be situated such that the major swale for Area IV can be left in a natural state and dedicated as open space. Lots will be out of the 100-year flood plain. Calculations showing the 100 year flood have been performed, based on a 100 scale topo, however, actual cross sections taken prior to platting will more accurately give flood plain widths. No maintenance of this existing swale is proposed. A concrete lined channel is planned through the proposed commercial areas west and east of Broadmoor Bluffs Drive to the 72" culvert at State Highway 115. A twelve foot road will provide access. A pipe under Broadmoor Bluffs Drive is indicated.

Area VII-B is located south of Area IV and generally drains to Area IV. The westernmost section is planned as single family housing. A park is shown west and adjacent to Broadmoor Bluffs Drive. The attached plan shows drainage collecting in Broadmoor Bluffs Drive where it flows north to Area IV. As the street capacity is exceeded in Area IV inlets and storm sewer will be placed as required.

All drainage structures west of State Highway 115 have been designed for the 5-year storm. The 72" culvert under Highway 115 has been designed by the State to pass the 50-year storm with provisions for the 100-year storm. Our calculations show the culvert capacity is adequate for the 100-year storm. Ponding behind the Highway 115 off-ramp will occur. Two 36" culverts drain minor flow from the area between the on and off ramps of Highway 115 north of Academy Boulevard. This flow will be directed north to the outlet of the 72" culvert mentioned above.

About half of the projected land use east of the highway is single family. The remainder is mostly multi-family and possibly a park, school, or church. East of Highway 115, the peak 100 year flow exceeds 500 c.f.s. and, therefore, the 100-year flow is analyzed from the highway to the outflow at Cheyenne Meadows Channel. East of the 72" pipe under Highway 115 an additional 72" pipe extending east thru the multi-family area is proposed. This pipe continues east along Westmeadow and changes to an 84" pipe as it flows north in Eastmeadow to Cheyenne Meadows Channel. The pipe and road section contain the major 100-year flow. The Cheyenne Meadows Channel improved section is planned to extend to the Gates east property line to provide adequate capacity in the existing right-of-way. Downstream of the Gates east property line an existing 10' by 21.5' wide culvert will be overtopped by about one foot of water during the 100-year storm.

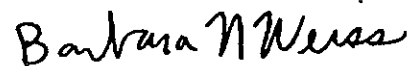
Area IV-B has two outlet points. Approximately one-third of the area is directed to a 24" R.C.P. draining south under Academy Boulevard to Fort Carson. Only the minor flow equal to the pipe capacity will be directed to Fort Carson. In April, 1981, Gates contacted Fort Carson concerning maintenance of the outfall ditch and it was cleaned up to carry the necessary flow. The remainder of flow for Area IV-B drains to a 24' x 30" C.M.P. and Headwall along the east property line. This pipe has adequate capacity for a minor storm. This flow daylight in a railroad borrow ditch and continues north to Cheyenne Meadows Channel extended. The means of directing flow to the culvert along the east property line is by a privately owned channel along the east property line.

By agreement with the City of Colorado Springs, no drainage basin fees are paid by Gates Land Company. Proposed drainage facilities will be built and paid for by Gates Land Company.

In conclusion, this report generates design flows at major points in Basin IV and VII-B. The 5-year flow is analyzed west of State Highway 115 and for Area IV-B. The 100-year flow is analyzed for Area IV-A. The design flows were used in conjunction with the Cheyenne Mountain Ranch Master Plan to design drainage facility improvements. Each drainage facility shown is one of many possible solutions available to convey flow for each indicated reach. Although, for example, a concrete ditch may be specified now, a pipe may be preferred at a later date. This Master Plan is preliminary and will be changed as the land is platted and developed. Final design for drainage facilities shown in this report will depend on platting configuration and will conform to the City of Colorado Springs criteria at time of design. In summary, this Master Plan reflects the current land layout and present City criteria. Design flows will be refined and used as a basis for construction plans.

Drainage plan, calculations and other support information follow in the Appendix.

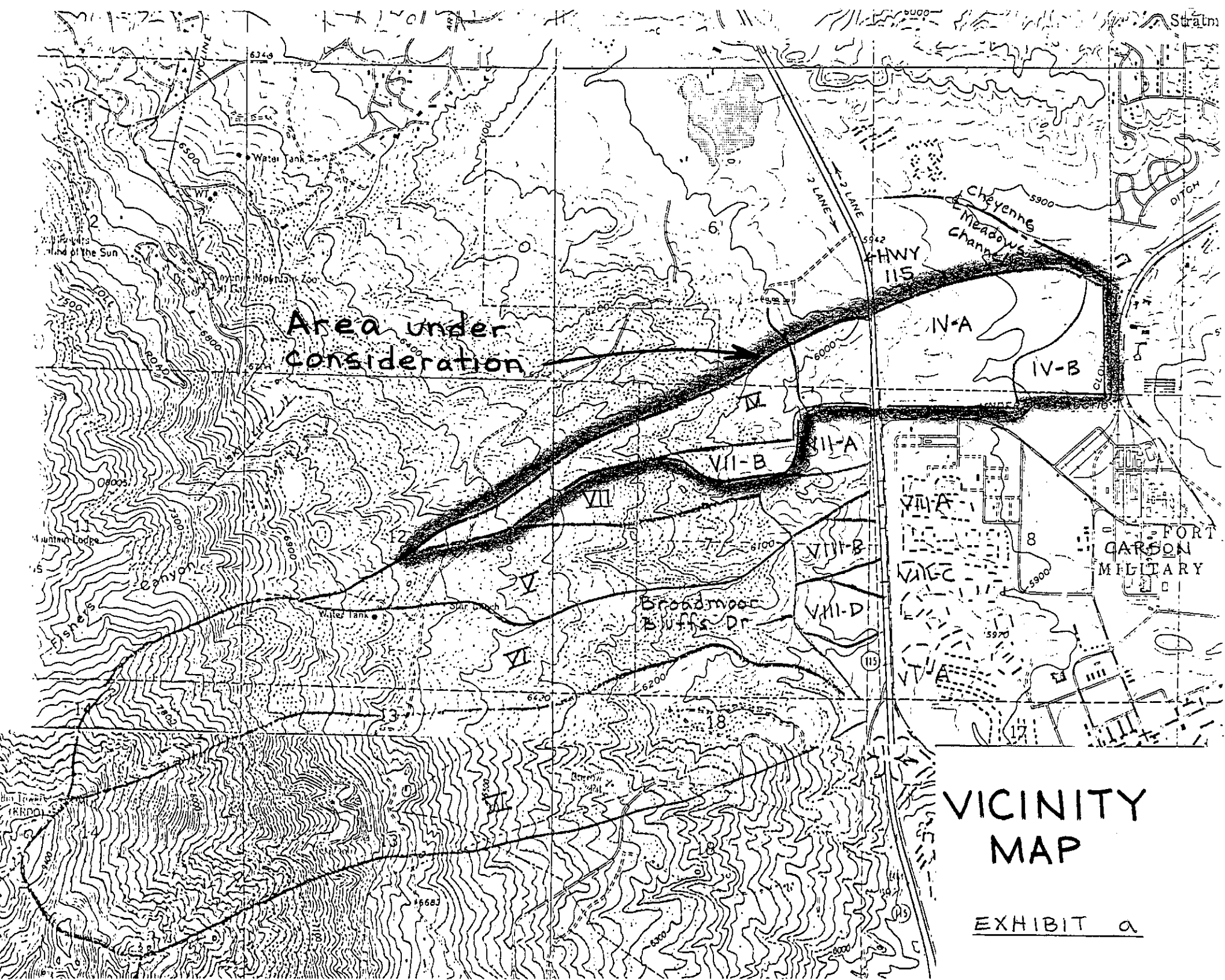
Respectfully submitted,

A handwritten signature in cursive script that reads "Barbara N. Weiss".

Barbara N. Weiss

APPENDIX

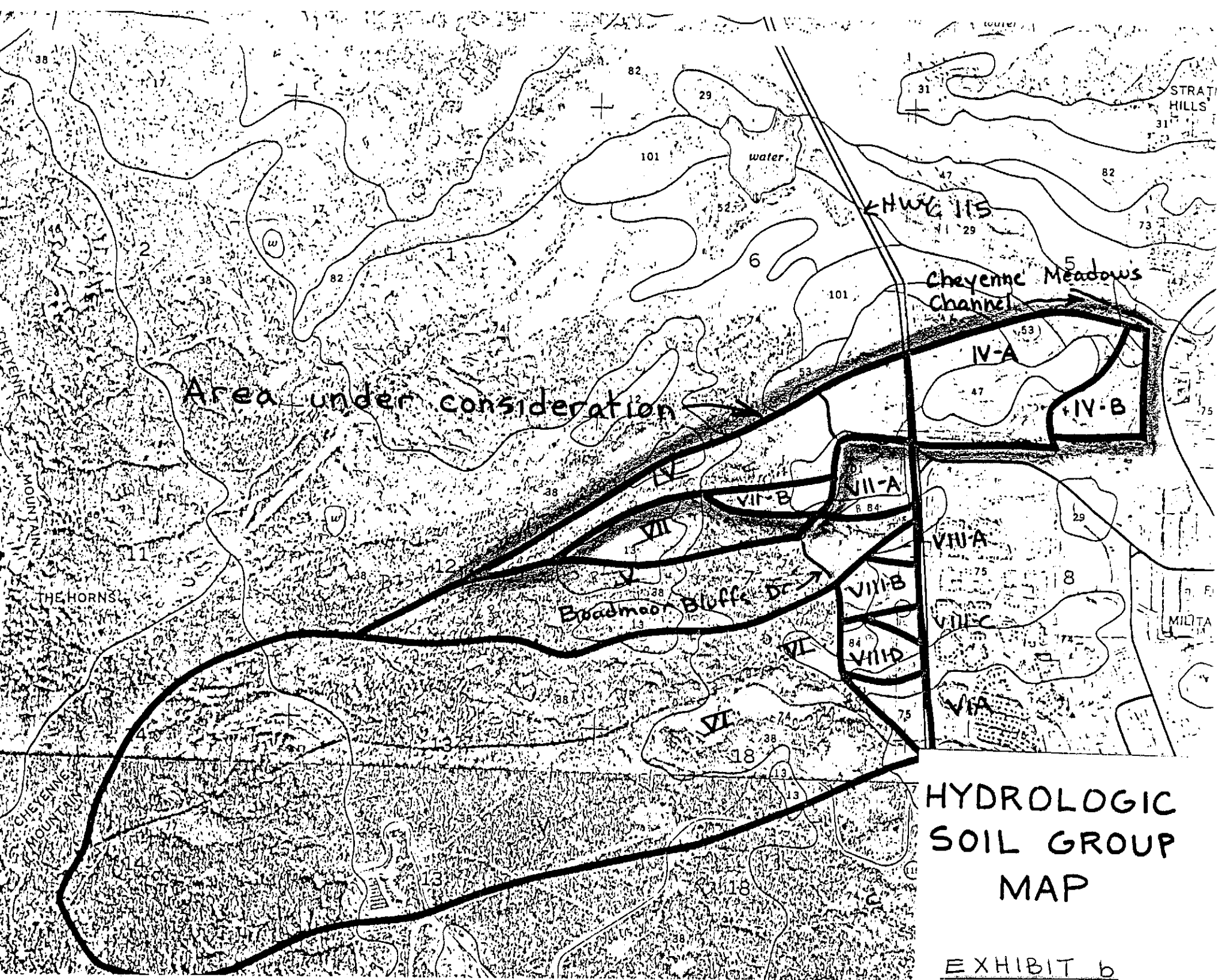
<u>Subject</u>	<u>Exhibit</u>
Vicinity Map	a
Hydrologic Soil Group	b 1 & 2
Determination of Hydrograph Procedure	c 1 & 2
Basin Data Summary Chart	d 1
Detail Basin Parameters	e 1
Hydrographs at Design Point	f 1
Outlet Capacities and Sizing Improvements	g 1 - 8
Outfall at Cheyenne Meadows Channel	h 1 - 12
Existing Flood Plain Determination	j



Area under consideration

VICINITY MAP

EXHIBIT a



HYDROLOGIC
SOIL GROUP
MAP

EXHIBIT b

EXHIBIT b

HYDROLOGIC SOIL GROUPS

12/13	Bresser	B
16	Chaseville	A
29	Fluvaquentic Haplaquolls	B/D
31	Fort Collins	B
38	Jarre Tecolote Complex	B
46	Kutler	C/D
47	Limon	C
52/53	Manzanola	C
59	Nunn	C
73/74	Razor Stony Clay Loam	C
75	Razor	C/D
77	Rock Outcrop	D
80	Satanta	B
82	Schamber/Razor	A/C
84	Stapleton	B
86	Stoneham	B
101	Ustic Torrifluventa, Loamy	B

Project Master Drainage Study Exhibit C		Job No E-2551
Client Gates	By BNW	Date 4/6/82

determination of hydrograph
for Peak Flows in Colorado
in Colorado Springs

assumptions :- total precipitation -

5 yr 6hr storm = 2.1 in
100 yr 6hr storm = 3.5 in

- Type II A storm
Figure I rev 7-13-77

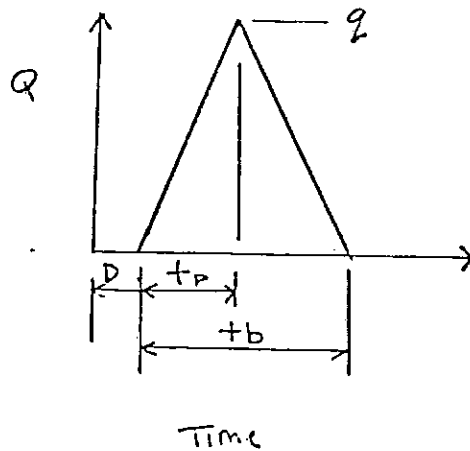
} CSprings
Deter. of
storm
Runoff
Criteria
March '77

* - Q (Runoff in inches) over
Basin equals volume
under hydrograph } S. Glace Wilkes
SCS - Denver

- $t_b = 2.67 t_p$

- q (Peak flow) = $\frac{2.48}{A} P A Q$
cs/in - area of Basin

- use triangular hydrograph
recommended by S. Glace Wilkes - SCS



Project

Master Drainage Study Exhibit C

Job No

E-2551

Client

Gais

By

BNW

Date

4/6/82

$$\therefore \text{area basin} \times \text{runoff} = \text{volume hydrograph}$$

$$A \times Q = \frac{tb}{2} \times q$$

$$\text{solve unknown } tb = \frac{AQZ}{q}$$

units

$$(\text{hr}) = \frac{59 \text{ mi}^2 (\text{in})}{\text{ft}^3} \div \frac{\text{ft}^3}{\text{sec}}$$

$$= \frac{\text{mi}^2 \text{ in sec}}{\text{ft}^3} \times \left[\frac{43560 \frac{\text{ft}^2}{\text{AC}} \times 640 \frac{\text{AC}}{\text{MITE}}}{12 \text{ in/ft} \times 3600 \frac{\text{sec}}{\text{hr}}} \right]$$

→

$$tb = \frac{1290 AQ}{q}$$

$$\text{let } D = .133 T_c$$

EXHIBIT d

BASIN DATA SUMMARY SHEET

<u>BASIN DESIGNATION</u>	<u>AREA (Ac.)</u>	<u>CN</u>	<u>Tc (hr)</u>	<u>qp (csm/in)</u>	<u>100 YR. Q (in.)</u>	<u>PEAK FLOWS (cfs) Q 100 YR.</u>	<u>PEAK FLOW (cfs) Q 5 YR.</u>	<u>5 YR. Q (in.)</u>
IV	140	81	0.45	780	1.71	292	116	.68
VII-B	20	81	0.16	1150	1.71	61	24	.67
IV-A	138	87	0.28	950	2.12	446	203	.99
IV-B	43	89	0.30	910	2.36	144	68	1.12

DESIGN POINT

Basin IV at
Highway 115

CUMULATIVE
Q (cfs)
100 YR.

342

Basin IV-A AT
Cheyenne
Mountain
Channel

666

Project: Master Drainage Exhibit e Job No: E-2528

Client: Gates By: BNW Date: 3/21/83

Area IV

	Soil Group	Acreage	Use	CN	%	% CN
	1/2 C/B	27	open space	72	25	18
Area IV	C	54	1/2 ACSF	80	49	139
Upper	B	14	1/2 ACSF	70	12	18
110 Ac	B	15	Comm.	92	14	13
(w/ Brandmore Blvd Dr)						CN = 78

$T_c = .11 + .08 + .1 + .14 = .43 \text{ hr}$

 $L = 1500' \quad H = 30' \quad L = 1000' \quad H = 200' \quad L = 1500' \quad H = 120'$

 sheet flow $L = 2200' \quad H = 220'$

$q_{5 \text{ yr}} = \frac{(110)(54)}{640} \cdot 790 = 84 \text{ cfs}$

$q_{100 \text{ yr}} = \frac{110}{640} (1.5) \cdot 790 = 227 \text{ cfs}$

Area IV

lower	C	10	MF.	90	33	30
30 Ac	C	20	Comm.	94	67	63
						CN = 93

both upper & lower

$CN = \frac{30}{140} (93) + \frac{110}{140} (78) = 81$

$T_T = 1 \text{ min}$

 $T_c = .45 \text{ hr}$

$L = 1300$ assume conc channel @ 20 ft

$q_{50} =$

$q_{100} = \frac{140}{640} (1.71) (780) = 292 \text{ cfs}$

Project: Master Drainage Exhibit e. Job No: E-2528

Client: Gates By: BNW Date: 3/21/83

	Soil Group	Acreage	Use	C.N	%	% C.N
Area VII	B	15	1/2 Ac S.F	70	16	11
(incl VII-B)	C	45	1/2 Ac S.F	80	49	39
92 Ac	C	22	open space	78	24	19
	B	17	open space	68	8	5
	C	3	School	80	03	2
					CN =	76

Area VII only

$T_c = .36 \text{ hr}$ $q_p = 840 \text{ csm/in}$

$q_{5yr} = \frac{72}{640} (840) .47 = 4.4 \text{ cfs}$

$q_{100yr} = \frac{72}{640} (840) 1.36 = 12.9 \text{ cfs}$

Area VII-B Area = 20 Ac use CN = 81

$L = 1500' \quad H = 190' \quad L = 600' \quad H = 30'$

$T_c = .09 + .07 = .16 \text{ hr}$

$q_5 = \frac{20}{640} (.67) 1150 = 2.4 \text{ cfs}$

$q_{100} = \frac{20}{640} (.71) 1150 = 6.1 \text{ cfs}$

Project: Master Drainage Exhibit c Job No: E-2528

Client: Gates By: Bmw Date: 6/12/83

Calculate flow leaving 36" RCP
N of Hwy 115 and Academy

Area = 15 Ac pt area IV & pt area IV-A

CN = (C soil group) 5 Ac of asphalt 98
10 Ac open space 70

$$CN = \frac{1}{3} (98) + \frac{2}{3} (70) = 79 \quad P = 5.58 \text{ in} \quad P_{100} = 1.57 \text{ in}$$

$$T_c = (20' \text{ drop in } 700') + T_T (3 \text{ min}) = 1.13 \text{ hr}$$

$$q_p = 1200 \text{ csm/in}$$

$$q_s = \frac{15}{640} (1200) (.58) = 16.3 \text{ cfs}$$

$$q_{100} = \frac{15}{640} (1200) (1.57) = 44.2 \text{ cfs}$$

$$\text{capacity} = HW/D = 1 = 30 \text{ cfs}$$

Project Master Drainage Exhibit e		Job No E-2528	
Client Gates		By BNW	Date 6/9/83

Basin IV

Area to west of Φ = 35 Ac ✓

Area to unnamed road 1250' east of west of Φ
= 60 Ac

Size culvert @ road

CN = 78 $Q_5 = .54$ in.

$Q_{100} = 1.50$ in.

$T_c = .43 - .1 = .33$ hr $q = 890$ cs/in

$q_5 = \frac{60}{640} 890(.54) = 45$ cfs $42"$ RCP $H_w/D = 1$
 $Q = 55$ cfs

$q_{100} = \frac{60}{640} 890(1.50) = 125$ cfs $54"$ RCP $H_w/D = 1.2$

Area to west of Φ = 35 Ac

$T_c = .33$ hr - .08 = .25 hr $q = 1000$ cs/in

CN = 78 $Q_5 = .54$ in

$Q_{100} = 1.5$ in

$q_5 = \frac{35}{640} (1000) .5 = 27$ cfs

$q_{100} = \frac{35}{640} (1000) 1.5 = 82$ cfs

Project
Master Drainage

Exhibit F

Client
Gates

By
BMD

Date
3/25/83

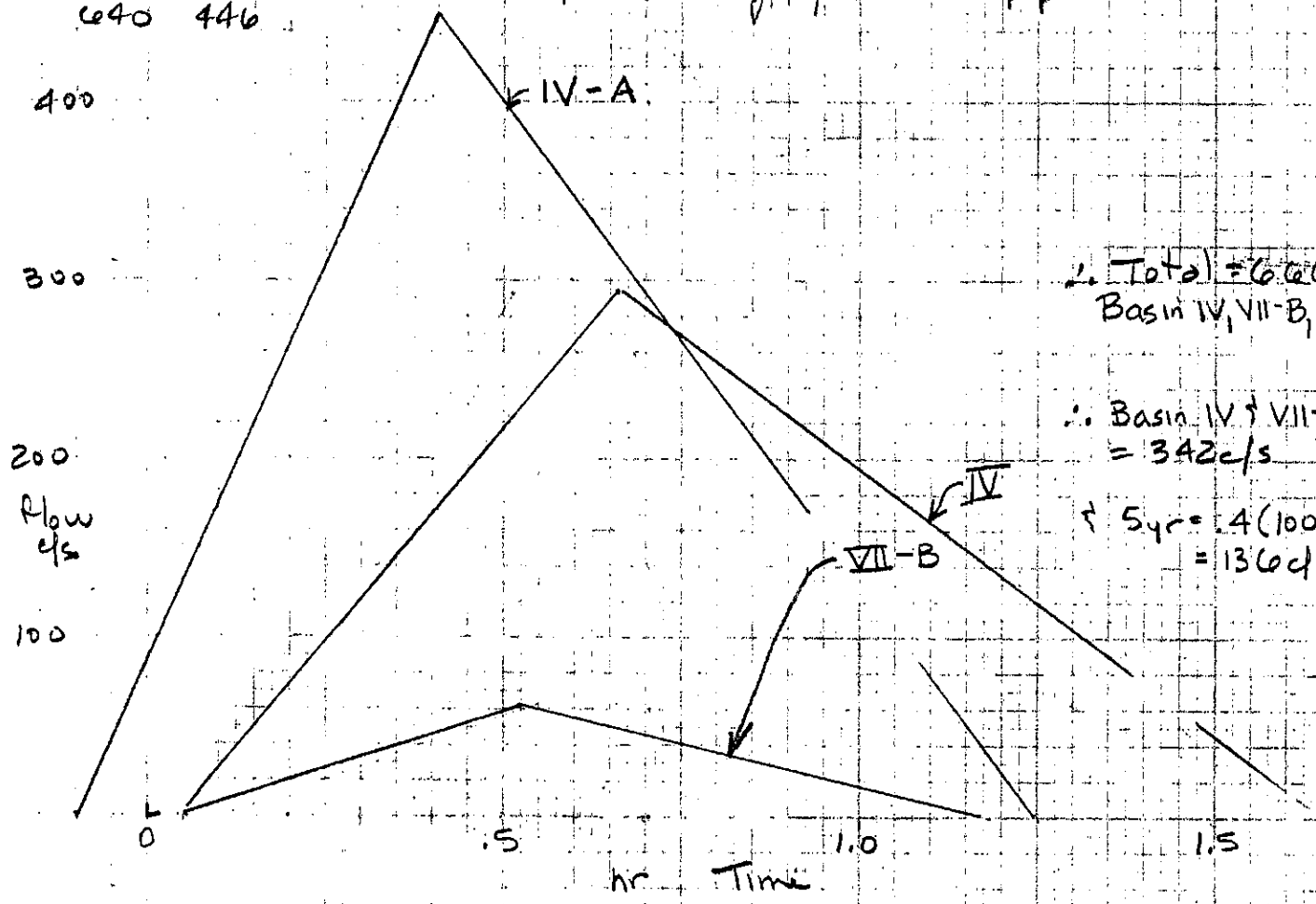
Job No
E-2528

Area IV $t_b = \frac{1290 (140)}{640} \cdot 1.71 = 1.65$ $t_p = .62$ Area

Area VII-B $t_b = \frac{1290 (20)}{640} \cdot 1.71 = 1.13$ $t_p = .42$

Area IV-A $t_b = \frac{1290 (138)}{640} \cdot 2.18 = 1.35$ $t_p = .51$

lag by .04 hr = channel along B'more Bluffs
700' @ 5 fps
lag by .15 hr pipe flow



\therefore Total = 6.6 cfs
Basin IV, VII-B, IV-A

\therefore Basin IV + VII-B
= 342 cfs

\uparrow 5 yr = 4 (100 yr)
= 136 cfs

w/o

Project: Master Drainage Exhibit g Job # E-2528

Client: Gates By: BNW Date: 4/22/83

Basin IV Outlet pipe capacity

outlet @ HWY 115 = 72" pipe w/ improved inlet

Inv. @ 41.74 W 25.66 E

edge asphalt = 60.0

A HW for 300 cfs = 5951.0 50 YR Flow } per
420 cfs over ramp (el 600) 100 YR Flow } CDH

opening 9' wide x 6' high

ck Hw/D = 1.5 Q = 300 cfs ✓

Hw/D = 3.0 Q = 500 cfs @ el 61.0 ∴ flow
over ramp

but @ Q₁₀₀ = 342 cfs Hw/D = 1.8 (to el 52.54)

Project Master Drainage Exhibit g Job No E-2528

Client Gates By BNW Date 5/10/83

Basin IV Size pipe @ Broadmore Bluffs
Size channel to Hwy 115

$Q_5 = 115 \text{ cfs}$
 $(Q_{100} = 288 \text{ cfs})$ } Broadmore Bluffs Dr.

60" RCP w/ HW/D = 1

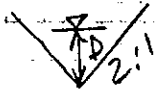
ck 100 yr HW/D = 2.0 or HW = 10'

$Q_5 = 137 \text{ cfs}$
 $Q_{100} = 342 \text{ cfs}$ } @ Hwy 115

exist. channel slope $S = 2.5\%$ to 8%

concrete channel

$Q = 137 \text{ cfs}$
 $n = 0.015$
 $S = 5\%$
 $D = 1.9'$
 $V = 19 \text{ fps}$
 $D_c = 3.1'$



for 100 yr storm $D = 2.6'$

Project Master Drainage Exhibit g		Job No E-2529
Client Gates	By BNW	Date 5/3/83

Preliminary design Storm Sewer
Westmeadow → Eastmeadow

Basin IV-A 100 yr Q = 446 cfs A = 138 Ac

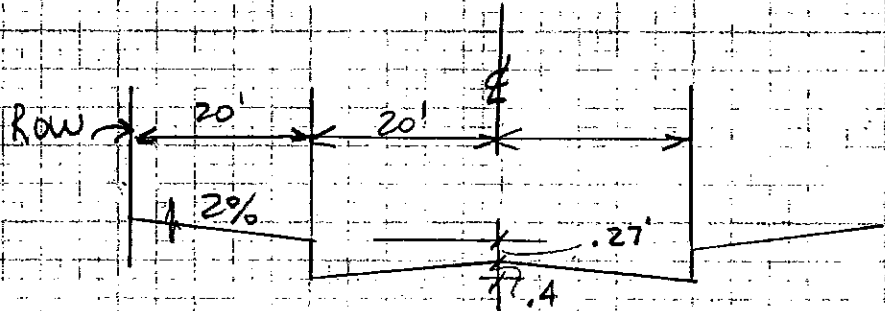
1st Area = 33 Ac or 24% 107 cfs
area west of N-S extension of Westmeadow

2nd Area = 55 Ac or 40% 178 cfs
area draining to E-W portion of Westmead

3rd Area = 50 Ac or 36% 161 cfs
remainder area draining to Eastmeadow

Project Master Drainage <u>Exhibit g</u>		Job No E-2528
Client Gates	By BNW	Date 3/25/83

Capacity
Eastmeadow



@ $S = 1\%$
 $S^{1/2} = .1$
 $n = .02$

$Q = 1.49 AR^{2/3} S^{1/2} / n$
 $= 7.5 AR^{2/3}$

@ $D = 1.07'$ (ft) 30' Row
 $A = 18.8' + 8' + 16'$
 $A = 42.8'$
 $P = 81.3' R^{2/3} = .65$
 $Q = 7.5(42.8) .65$
 $= 209 \text{ cfs allow}$
 100 yr storm

$V = 5 \text{ fps}$

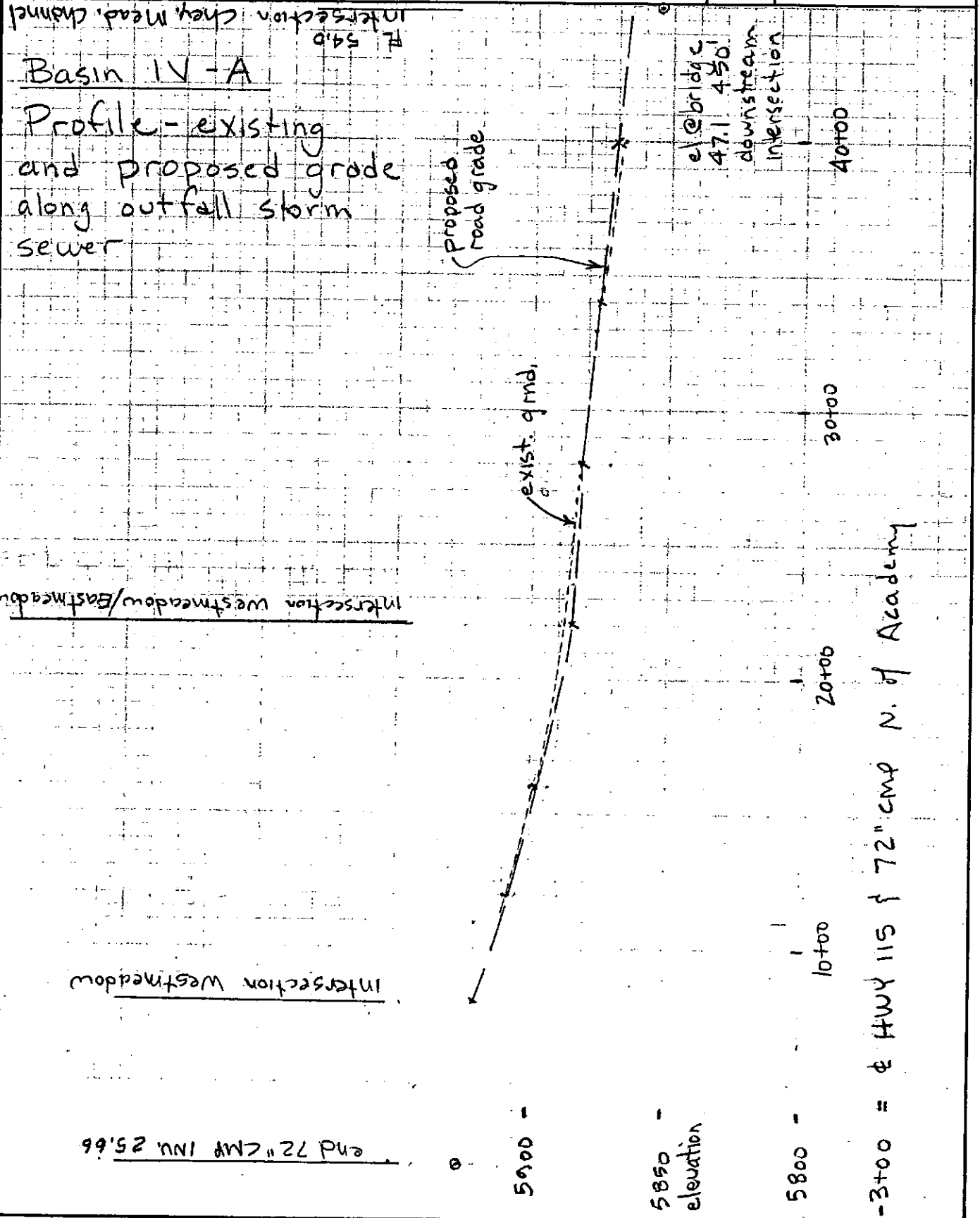
$S = 1\%$ use \rightarrow

@ $D = .87'$ (ft) 60' Row
 $A = 18.8 + 8' + 2' = 28.8'$
 $P = 61.3 R^{2/3} = .6$
 $Q = 7.5(28.8) .6 = 131 \text{ cfs}$

$S = 2.6\%$ $S^{1/2} = .16$ $Q = 20.6 \text{ cfs}$

Project: Master Drainage Exhibit g Job No: E-2528

Client: Gates By: BNW Date: 3/25/83



Project Master Drainage <u>Exhibit g</u>		Job No E-2528
---	--	------------------

Client Gates	By BNW	Date 5/5/83
-----------------	-----------	----------------

Preliminary Storm Sewer Design
Eastmeadow - Westmeadow Basin IV-A

assume road capacity = 131 cfs for 3rd Area
or Eastmeadow
∴ Q = 540 cfs

84" RCP @ 1.0% ← use
or 2 - 60" RCP @ 1.1%

2nd area assume Q = 412 cfs

72" RCP @ 1%
or 1 - 60" RCP & 1 - 48" @ 1%
or 2 - 54" RCP @ 1.1%

1st area assume Q = 333 cfs

60" RCP @ 1.6%
72" CMP @ 2.0%

Project

Master Drainage

Exhibit g

Job No

E-2528

Client

Gates

By

BNW

Date

5/4/83

Capacity check

Basin IV-B - outlet pipes

24" under Academy

if HW=4' inlet control Q=25 cfs

if TW=2' outlet control, if Q=25 cfs HW=3.4'
(2.212 - B)

24" x 30" CMP ? along E. E

assume 27" CMP (but use 2' for D - conservative)

if HW/D = 4 (el 61.0) Q = 50 cfs HW/D avail > 5 @ el 63.9

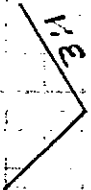
if HW/D = 2 Q = 35 cfs

Project: Master Drainage Exhibit g Job NR: E-2528

Client: Gates By: B.N.W. Date: 4/5/83

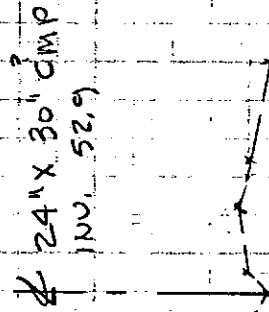
Outfall ditch to 24x30" C.M.P.
Basin IV-B

design swale 5 year storm - capacity 24" R.C.P.
under Academy -
Q = 60 cfs - 25 cfs = 43 cfs



S = 0.5%
n = 0.04
Depth = 2.3'
V = 2.8 fps

@ D = 3.6' = Q = 144 cfs 100 yr storm
V = 3.8 fps



5900

elevation

5850

5800 -

5100 10100 15400 20700

Distance along East Property line

0+00 = SE corn Cheyenne south

Project Master Drainage - Cheyenne Meadows Job No E-2528

Client Gates Channel By BNW Date 6/21/83

Generate Hydrograph
Area K - from sht 3/9 "Drainage - Star Ranch Rd/
40 AC St Hwy 115" Aug '78

CN = 80 Q = 2.1 in

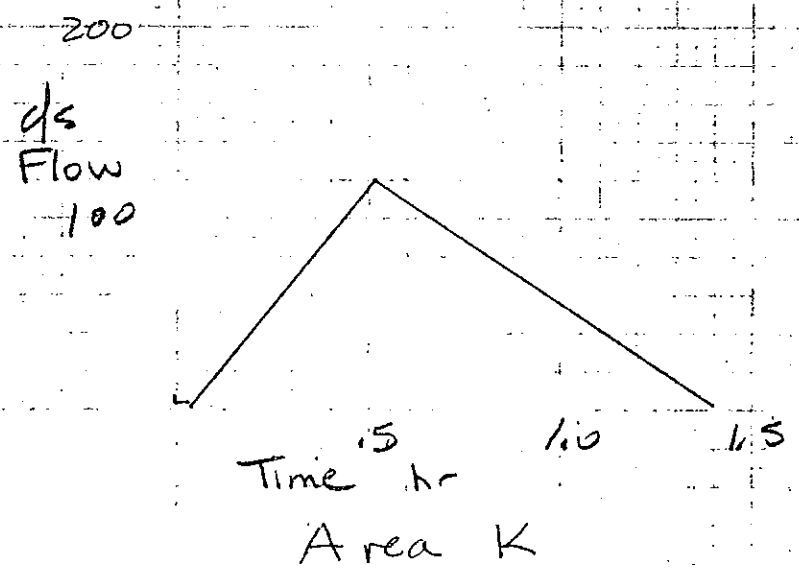
Tc = 18 min qp = 910 csm/in

q = 40 / 640 (2.1) 910 = 119 cfs

tp = 1290 (40) 2.1 / 919 (640) = 1.4 hr

tp = .52 hr

D = .133 Tc = .04



Project		Job No
Master Drainage <u>Exhibit h</u>		E-2528

Client	By	Date
Gates - Cheyenne Meadows Channel	BMW	6/21/83

Generate Hydrograph

Fisher Canyon from sht 1-9 "Drainage - Star Ranch Rd/
St. Hwy 115" Aug 78

$A = 850 \text{ Ac}$

$CN = 80 \quad Q = 1,164$

$T_c = .7 \text{ hr} \quad q_p = 620 \text{ cfs}$

$q = \frac{850}{640} (1,164) \times 620 \approx 1355 \text{ cfs}$

$t_b = \frac{1290}{640} \frac{850 (1,164)}{1355} = 2.1 \text{ hr}$

$t_p = .78 \text{ hr}$

$D = .09 \text{ hr}$

Project

Master Drainage

Exhibit h

Job No

E-2528

Client

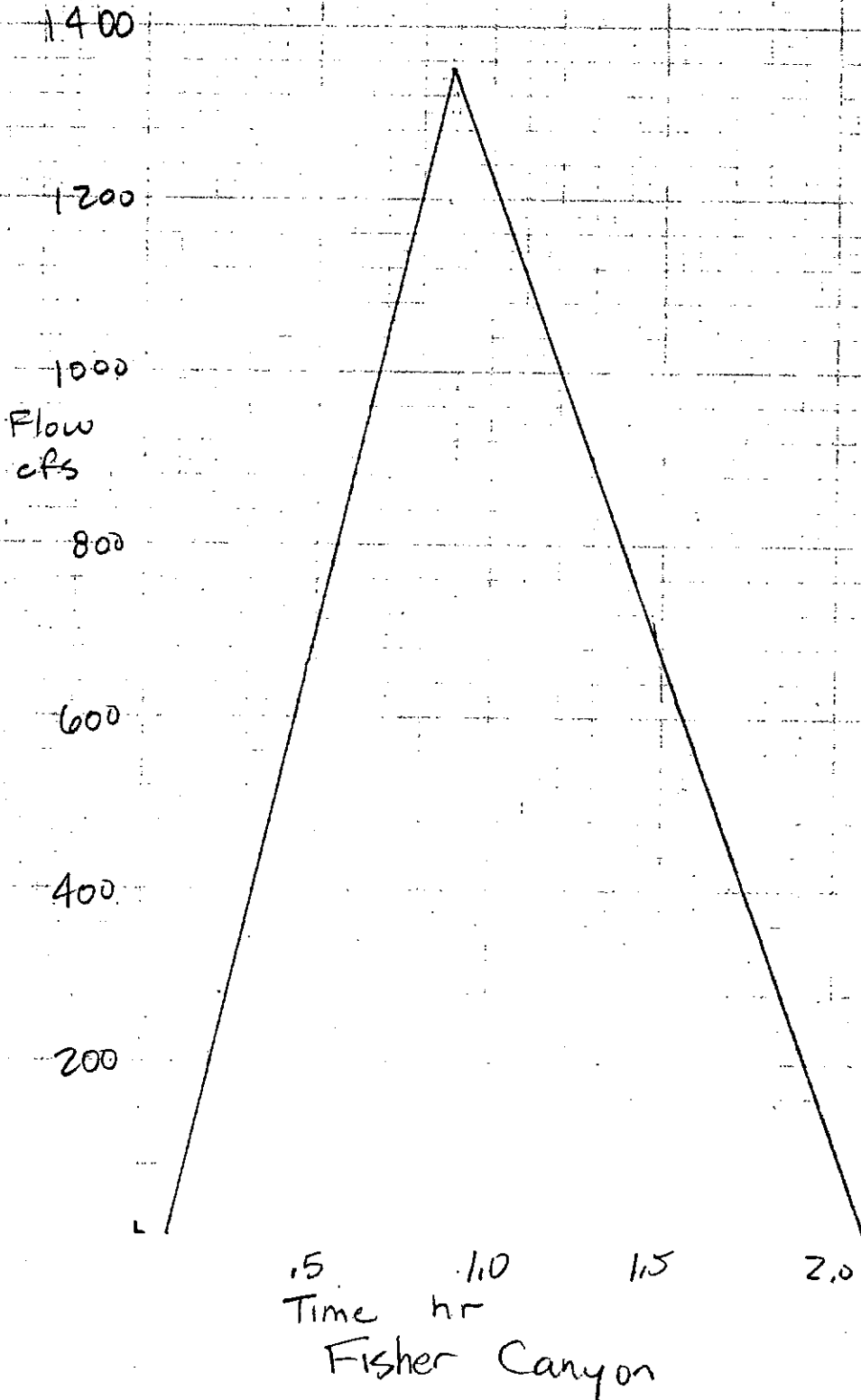
Gates - Cheyenne Meadows channel

By

BNW

Date

6/21/83



Project: Master Drainage Exhibit h Job No: E-2528

Client: Gates - Cheyenne Meadows Channel By: BNW Date: 6/21/83

Area P Q & R = 414 AC (E of 115 to E R Gates, Crosstail to S of chey. mead channel as indicated in H & P report)

Soil Group	82	Schamber / Razor	A/C
	73/74	Razor Stony clay loam	C
	47	Limon	C
	29	Fluvagentic Haploluvisols	B/D
	101	Ustic Torri fluventic, Loamy	B
	53	Manzanola	C

most area is C

88 Acres	m F	CN = 90	x .22	20
55 Acres	misc (park & school)	80	x .13	11
271 Acres	115 Acre S F	85	x .65	56
weighted CN =				87

$Q_5 = 110 \text{ in}$
 $Q_{100} = 2.18 \text{ in}$

$T_T \text{ from HWY 115 @ 8 fps (5800')} = 12 \text{ min} = .2$

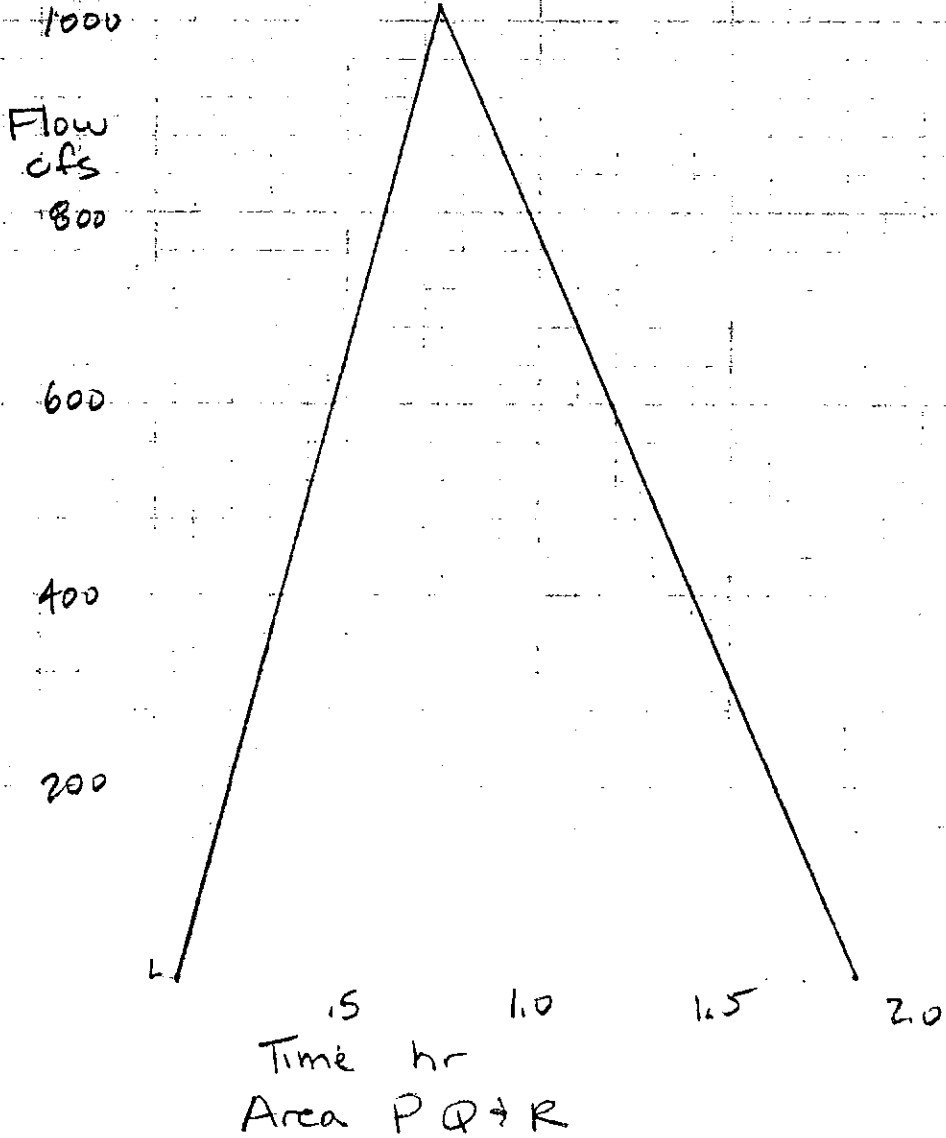
$T_i = (50' \text{ in } 3500') \times \text{trail} = \text{say } 18 \text{ min} = .3 \text{ hr}$

$T_c = .5 \text{ hr}$ $q_p = 720 \text{ csm/hr}$
 $q = \frac{414}{640} (720) \cdot 2.18 = 1015 \text{ cfs}$

$t_b = 1290 (2.18)(414) / 1015 (640) = 1.77$ $t_p = .67 \text{ hr} = .07 \text{ hr}$

Project Master Drainage Exhibit h Job No E-2528

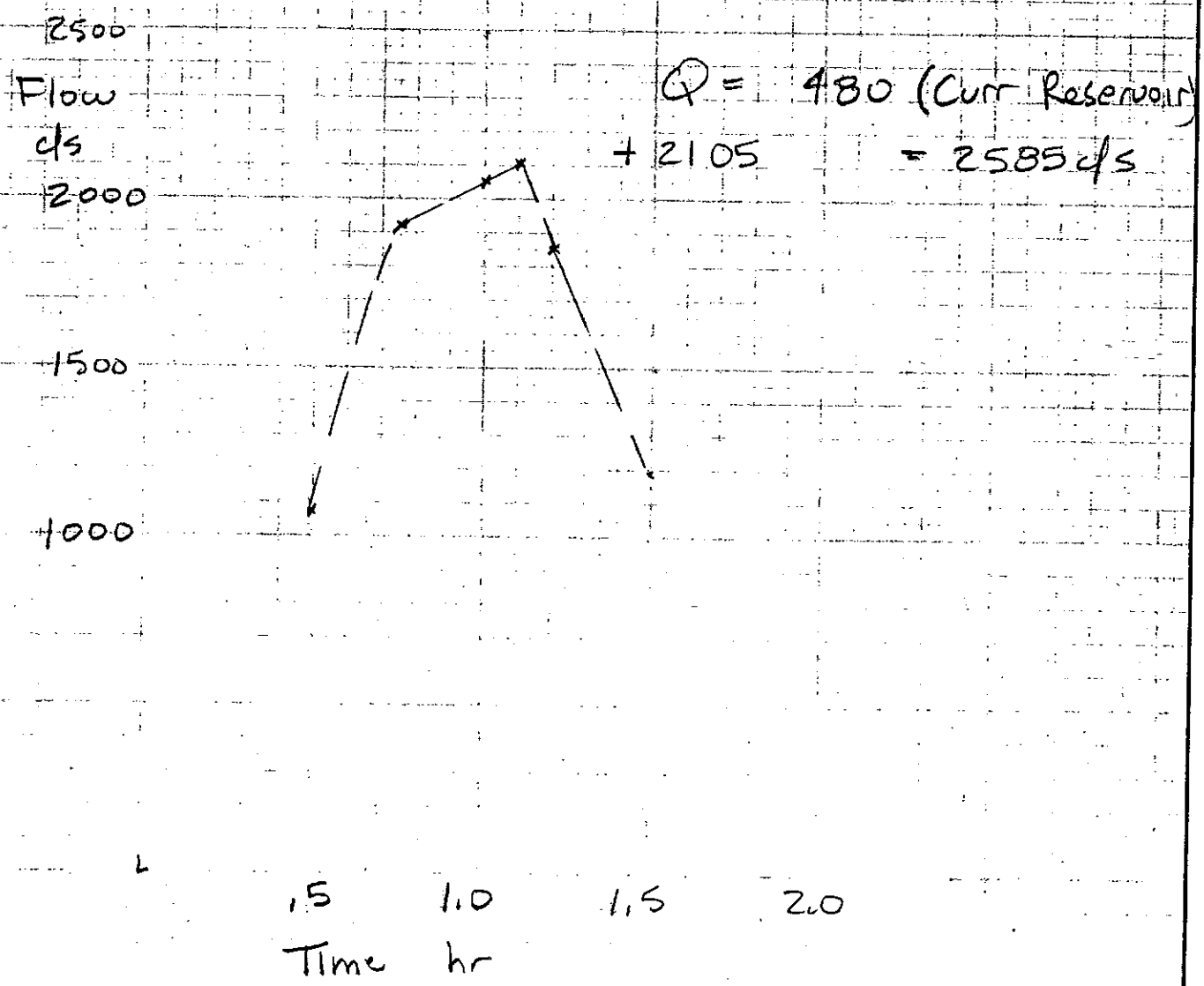
Client Gates - Cheyenne Meadows channel By BNW Date 6/21/83



Project: Master Drainage Exhibit h Job No: E-2528

Client: Gates - Cheyenne Meadows channel By: BNW Date: 6/21/83

lag Fisher Canyon \uparrow K by 12 min



Combined hydrograph
Fisher Canyon, K \uparrow P, Q \neq R

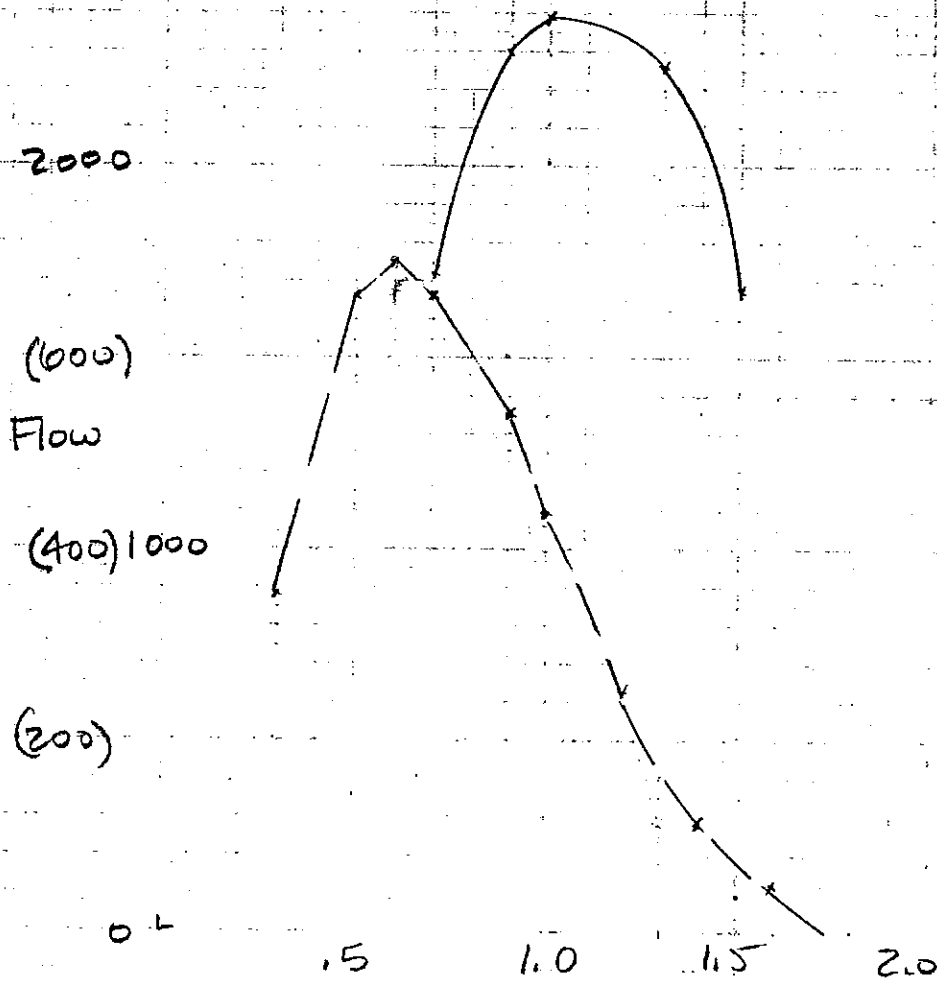
Project: Master Drainage Exhibit h Job No: E-2528

Client: Gates - Cheyenne Meadows Channel By: BMW Date: 6/22/83

Cheyenne Meadows Channel at
Gates E. P.

3000

$$Q = 2400 + 480(\text{Curr Res}) = 2880 \text{ cfs}$$



Combined flow

Basin IV, VII-B & IV-A - dashed line (200)

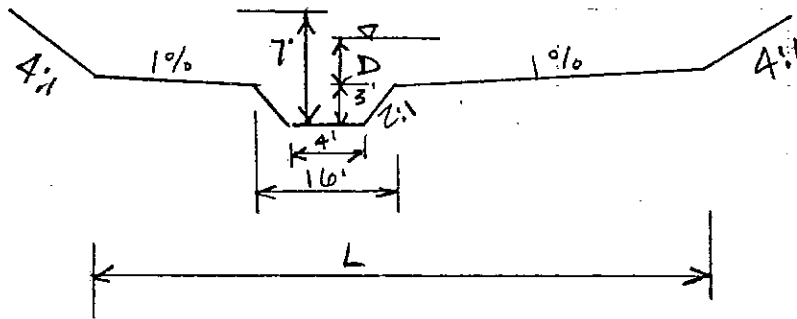
Basin IV, VII-B, IV-A, Fisher Canyon, K & P, Q & R

note lag Basin IV etc by .2

solid line

Project		Job No	
Master Drainage Study		2528	
Client		By	Date
Gates		BMW	6/21/83

Cheyenne Meadows channel EXISTING W of Eastmeadow
 $Q = 2562 \text{ cfs}$
 $S = 1.5\%$



if $L = 120$ w/o trickle channel
 $D = 2.5'$ $V = 8 \text{ fps}$
 $D_c = 2.4'$

Project

Master Drainage Study Exhibit h

Job No

E-2528

Client

Gates

By

BMW

Date

6/21/83

Cheyenne Meadows Channel Sta 55+50 - 59+00
 $Q = 2880 \text{ cfs}$ (add flow from Area IV & VII-B)

$$S = 1\%$$

continue same channel (see sheet B)

trickle channel

$$n = 0.04 \text{ (riprap)}$$

$$Q = 142 \text{ cfs}$$

$$V = 4.7 \text{ fps}$$

or $n = 0.015 \text{ conc.}$

$$Q = 427 \text{ cfs } D_c = 4$$

$$V = 14 \text{ fps}$$

main channel

$$D = 2.92$$

$$Q = 2743$$

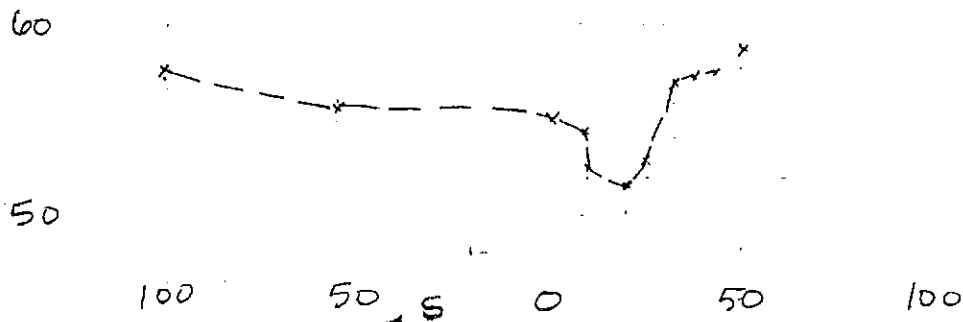
$$V = 7.1 \text{ fps}$$

$$D_c = 2.5'$$

Project Master Drainage		EXHIBIT h	Job No E-2528
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Client Gates	By BNW	Date 6/21/83
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EXISTING channel Capacity



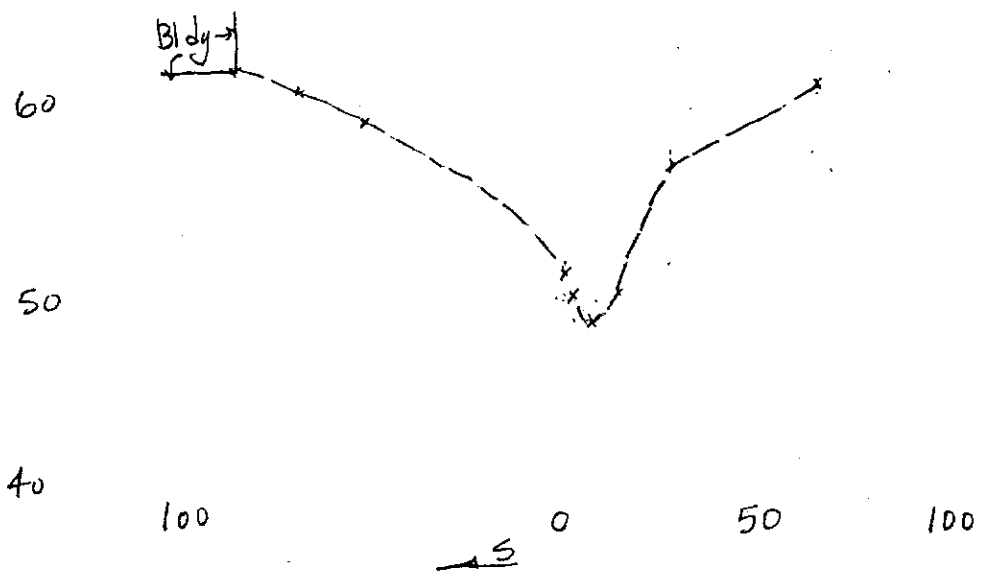
@ East R
 Sta 59+00
 Cheyenne Meadows Channel

$S = .01$
 $n = 0.04$

$\text{vel } 57.4 \quad A = 300 \text{ ft}^2 \quad P = 132' \quad R^{2/3} = 1.73$

$Q = 1933 \text{ cfs}$

Project Master Drainage		Job No E-2528	
Client Gates		By BNW	Date 6/21/83



Sta 60+00 - 100' east of E R
Cheyenne Meadows Channel

to el 61.5 $S = .01$ $n = 0.04$

$A = 750$ $P = 154$ $R^{2/3} = 2.87$

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} = 8018 \text{ cfs}$

to el 60.0

$A = 500$ $P = 120$ $R^{2/3} = 2.6$

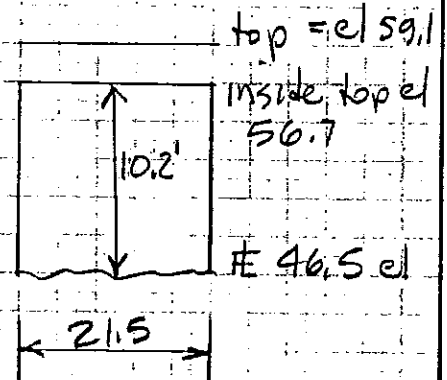
$Q = 4842 \text{ cfs}$

Project: Master Drainage Exhibit h Job No: E-2528

Client: Gates By: BNW Date: 6/20/83

Capacity Check

Bridge @ 1+50 east of Gates E. R. along Cheyenne Meadows Channel



@ Hw/D = 1' inlet control $Q/B = 84 - 95$ wing wall 30°-75°
 $Q = 1806 cfs - 2040 cfs$

@ top bridge Hw/D = 1.24 inlet control
 $Q/B = 112 - 120$ 30°-75° ww

2408 cfs - 2580 cfs

Overflow

@ 60. assume broad crested weir

$L = 150'$ $H = 1.0'$

$Q = 3 L H^{3/2}$

$Q = 450 cfs$

Project

Master Drainage

Exhibit j

Job No

E-2528

Client

Gates

By

BNW

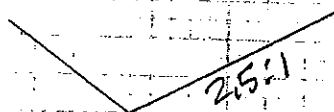
Date

5/11/83

Basin IV

100 YR Flood Plain Determination

$Q_{100} = 227 cfs$



from 100 scale
to 90

$S = .08$ $S' = .28$

$n = .07$

$D = 3.4'$ $V = 8 fps$

or 18' wide

* probably not accurate
enough to show