Final Drainage Report

Wolf Ranch Subdivision
Tank Site

Colorado Springs, Colorado

Prepared for:
Associated Design Professionals
1861 Austin Bluffs Parkway
Colorado Springs, CO 80918

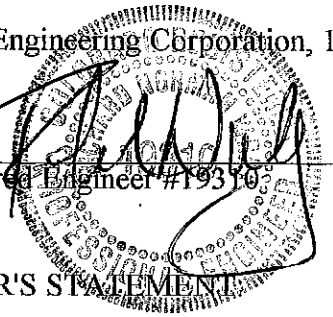
Prepared by:
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904

Kiowa Project No. 04036
May 18, 2004
Revised June 8, 2004

ENGINEER'S STATEMENT:

The attached drainage plan and report was 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 any negligent acts, errors and omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, CO 80904



Registered Engineer #19310 Date 6/8/04

OWNER'S STATEMENT:

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

BY: _____ Date 6/19/04

ADDRESS:

City of Colorado Springs Department of Utilities

111 South Cascade

Colorado Springs, CO 80903

CITY OF COLORADO SPRINGS

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

_____ June 29, 2004

City Engineer Dated

INTRODUCTION

This report has been prepared in support of the Colorado Springs Department of Utilities land acquisition of a water tank site of 4.97 acres in the Black Forest. The tank site is within the Wolf Ranch Development that is being developed by the Nor'wood Development Company. The intent of this report is to identify and solve specific drainage issues related to the construction of the tanks and a future water booster station.

The project scope and phasing is as follows (refer to Figure 2): The Phase 1 tank on the western side of the parcel will be the first to be constructed. The development to the south, which consists of 1300 acres will be primarily residential, and will be served by this facility. Development will start at the south and proceed to the north. As more demand occurs for water the Phase 2 tank on the eastern side will be constructed. Then, finally, as more development occurs and the north side of the site is built up, a booster pump station will be constructed to maintain pressure at the higher elevations near the tanks. The tanks are to be constructed as post-tensioned concrete structures. The tanks will be buried. After they are constructed and backfilled the tops will be covered with earth backfill and topsoil and then re-seeded. The finished earth grade at the top, middle of the tanks will be at an elevation 1-foot higher then the outer walls, resulting in a slope of about one-percent for positive drainage. Although the Site Grading Plan will encompass only the west half of the parcel for the Phase 1 tank, the scope of the Drainage Plan and Report will include the entire site for the ultimate plan.

The Wolf Ranch Tank Site is located in the NE Corner of NE1/4-NE1/4, of Section 25, Township 12 South, Range 66 West of the 6th Principal Meridian, City of Colorado Springs, Colorado, El Paso County, Colorado, and is zoned Agricultural. The location of the site is shown on Figure 1. The site is bordered on the north by South Forest Subdivision, on the northwest by Prospect Point Subdivision, on the west, south, and east by unplatted land. The area covered by the tank site property lies within the Cottonwood Creek drainage basin.

The soils on the site are from the Kettle and the Pring soil series. These soils are gravelly loamy sands, 3-8% slopes, which consist of deep well-drained soils, located on valley side slopes and uplands. The soil has a permeability of 6-20 inches per hour. These soils have a hydrologic soil classification of B.

The site is presently undeveloped, and is about 25% covered with trees. The land to the north of the tank parcel (South Forest Subdivision) is heavily forested. The land drains from the north to the south. Approximately 4.7 acres of the offsite land to the north flows onto the tank site. Ultimately the tank site will be seeded, the entrance road will be graveled and the only impervious area will be the future booster pump station roof.

PREVIOUS REPORTS

The following reports and plans were reviewed in the process of preparing this final drainage report:

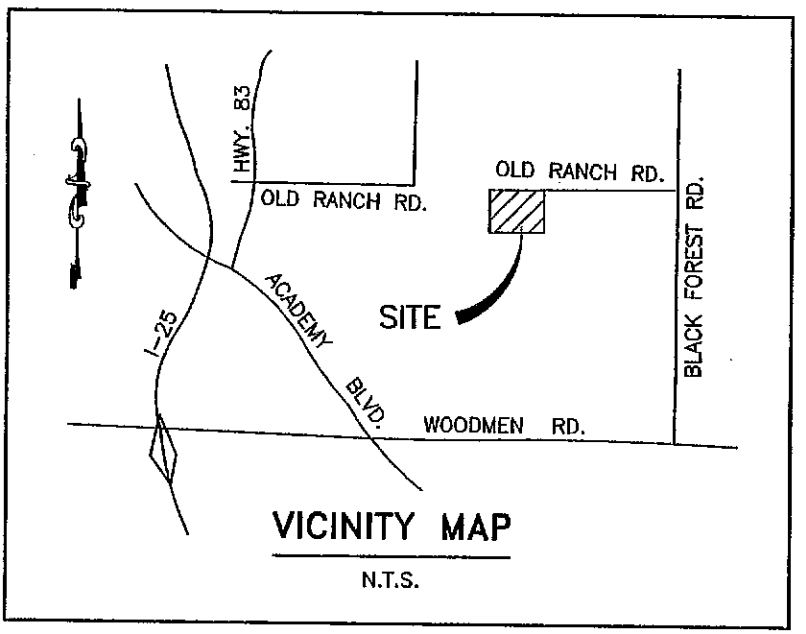


Figure 1: Vicinity Map

City of Colorado Springs / El Paso County Drainage Criteria Manual, dated November 1991

City of Colorado Springs and El Paso County Flood Insurance Study, prepared by the Federal Emergency Management Agency, dated March 1997.

Soil Survey for El Paso County, Colorado, U. S. Department of Agriculture, Soil Conservation Service, dated June, 1980.

A Master Development Drainage Plan is being prepared for the Wolf Ranch Development by Kiowa Engineering Corporation but has not as yet been approved by the City of Colorado Springs.

EXISTING DRAINAGE PATTERNS

The drainage from this site both now and after development will be basically sheet flow to the south onto the proposed residential development. The existing discharges at design point 1 (see Figure 2 in map pocket) are estimated at 3.0 and 7.1 cubic feet per second for the 5-year and 100-year storms respectively. At design points 3 and 4, there would be no increase in the peak discharges for these frequencies since there would be no substantial changes in the vegetative cover or surface area draining to these design points.

DRAINAGE PLAN

Hydrologic Analysis

The hydrology for this site was estimated using the methods outlined in the *City of Colorado Springs & El Paso County Drainage Criteria Manual*. The topography for the site was provided by aerial photography compiled at a two-foot contour interval. The proposed drainage basins and facilities are shown on the Drainage Plan, Figure 2 contained within the pocket at the rear of this report. The peak flow rates for the drainage basins were estimated by using the Rational Method. Runoff for the 5-year and 100-year recurrence intervals was determined. Runoff estimates were made for both the existing and proposed land use conditions.

The runoff coefficients for the development were determined using Table 5-1 of the *City of Colorado Springs & El Paso County Drainage Criteria Manual* which is attached to the Appendix of this report along with the calculations.

Hydraulic Analysis

Onsite stormwater storage is not planned for the tank property since detention will be handled regionally within the greater Wolf Ranch development. There are no proposed drainage facilities required for the tank property as it is intended that the runoff from the site will exit the property in a sheet flow manner. A buried riprap swale is proposed at the southeast corner of the site where the drain for the tanks is located, however this swale is not intended to be used for the collection and conveyance of stormwater runoff from the site.

PROPOSED DRAINAGE FACILITIES

There are no drainage facilities planned for this site as it will sheet flow from north to south adequately with no necessity for culverts for all phases of tank and booster station development.

At design point 1 runoff from this site is estimated at 6.0 cubic feet per second and 11.9 cubic feet per second for the 5 and 100-year storms respectively. At design point 4 located at the southwest corner of the site the estimated runoff is 1.3 cubic feet per second and 2.7 cubic feet per second for the 5 and 100-year storms respectively. Though these flows represent an increase over runoff estimated for the existing conditions, the runoff will not cause excessive erosion or downstream channel degradation due to flow concentration at these two locations.

EROSION CONTROL

The primary land disturbing activity on the site will be associated with tree removal, excavation and backfill for the tanks. No grading outside of the property is anticipated. It is the developer's responsibility to monitor the condition of the temporary erosion control features shown on the drawings. Should any of the erosion control facilities become in disrepair prior to the establishment of the native or natural erosion control measures, the developer is responsible for the cost of such maintenance. The developer is also responsible for the clean up of offsite areas affected by any excessive erosion that may leave the site. Control of erosion from areas disturbed by utility construction or home building will be the responsibility of the respective contractor. All erosion control measures shown on the plan shall be installed and maintained in accordance with Volume 3-Best Management Practices-Urban Storm Drainage. The erosion control measures have been shown on the Grading and Erosion Control Plan.

The primary erosion control features to be utilized in this project will be seeding and mulching of all disturbed areas with the native seed mix. The roadside ditches will be protected by using topsoil, native seeding and erosion control fabric along the swales, in combination with straw bales. All disturbed areas shall be seeded and mulched within sixty days after the rough grading has occurred. All cut or fill slopes exceeding three-to-one will be reseeded and protected with erosion control fabric. Erosion control for the site will include a silt fence. Silt fencing will be placed at the foot of cut or fill slopes.

DRAINAGE FEES

Drainage and Bridge Fees for the year 2004 are required for the Cottonwood Creek Drainage Basin as follows:

1. Drainage Fee/Acre = $8,530 x 4.97Acres = $42,394.10
2. Bridge Fee/Acre = $696 x 4.97Acres = $3,459.12

DMI

land development contracting
and project management

June 14, 2004

Mr. Tim Mitros
City Engineering Services
30 South Nevada #700
Colorado Springs Colorado 80903

RE: Wolf Ranch Water Tank Final Drainage Report, Colorado Spring, Colorado

Dear Mr. Mitros:

On behalf of Development Management, Inc., I acknowledge our receipt and review of the final drainage report for the above referenced project. As a result of our review I understand that the City Department of Utilities proposes to release runoff from the tank site onto our property. I also understand that this runoff is being released at historic rates at generally the southeast corner of the tank site property.

Development Management agrees to accept the surface runoff at this location onto Wolf Ranch and will provide for its conveyance through Wolf Ranch.

If can be of any further assistance please do not hesitate to contact me.

Sincerely,

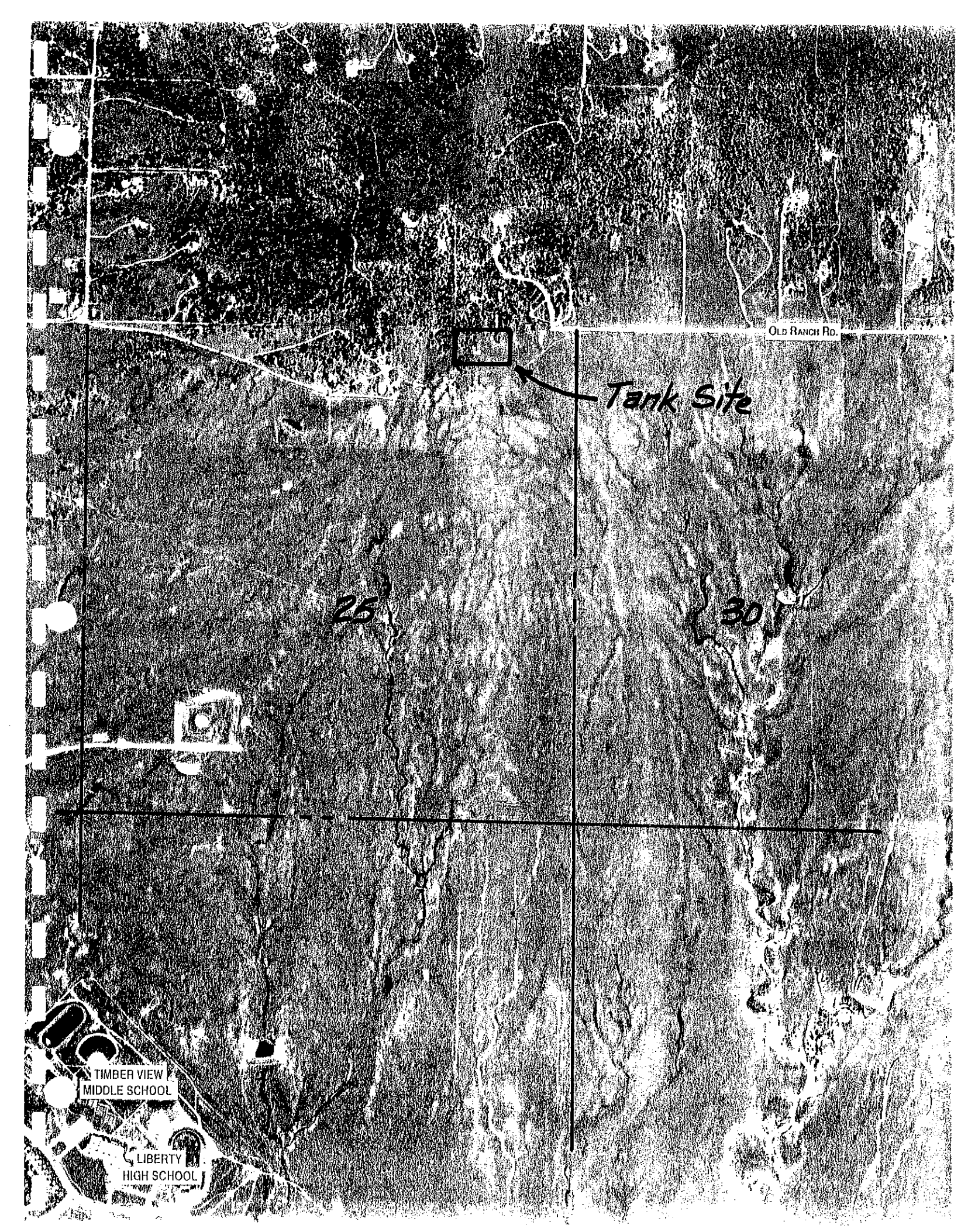
Ralph A. Braden

cc: Richard Wray, Kiowa Engineering
Kent Rockwell, Rockwell Consulting

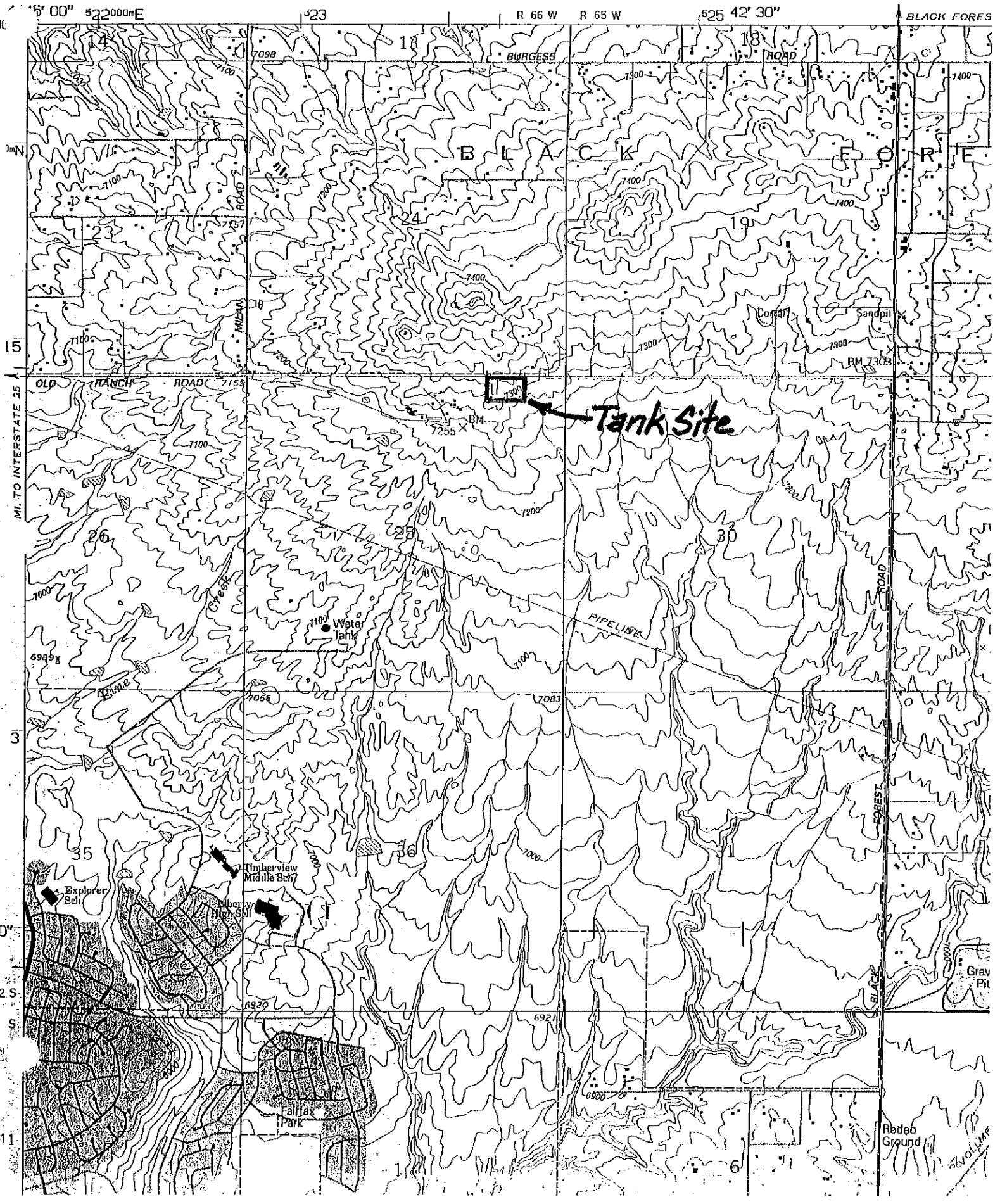
Development Management, Incorporated
4065 North Sinton Road □ Suite 200 □ Colorado Springs, Colorado 80907
(719) 593-2600 □ Fax (719) 633-0545

APPENDIX A

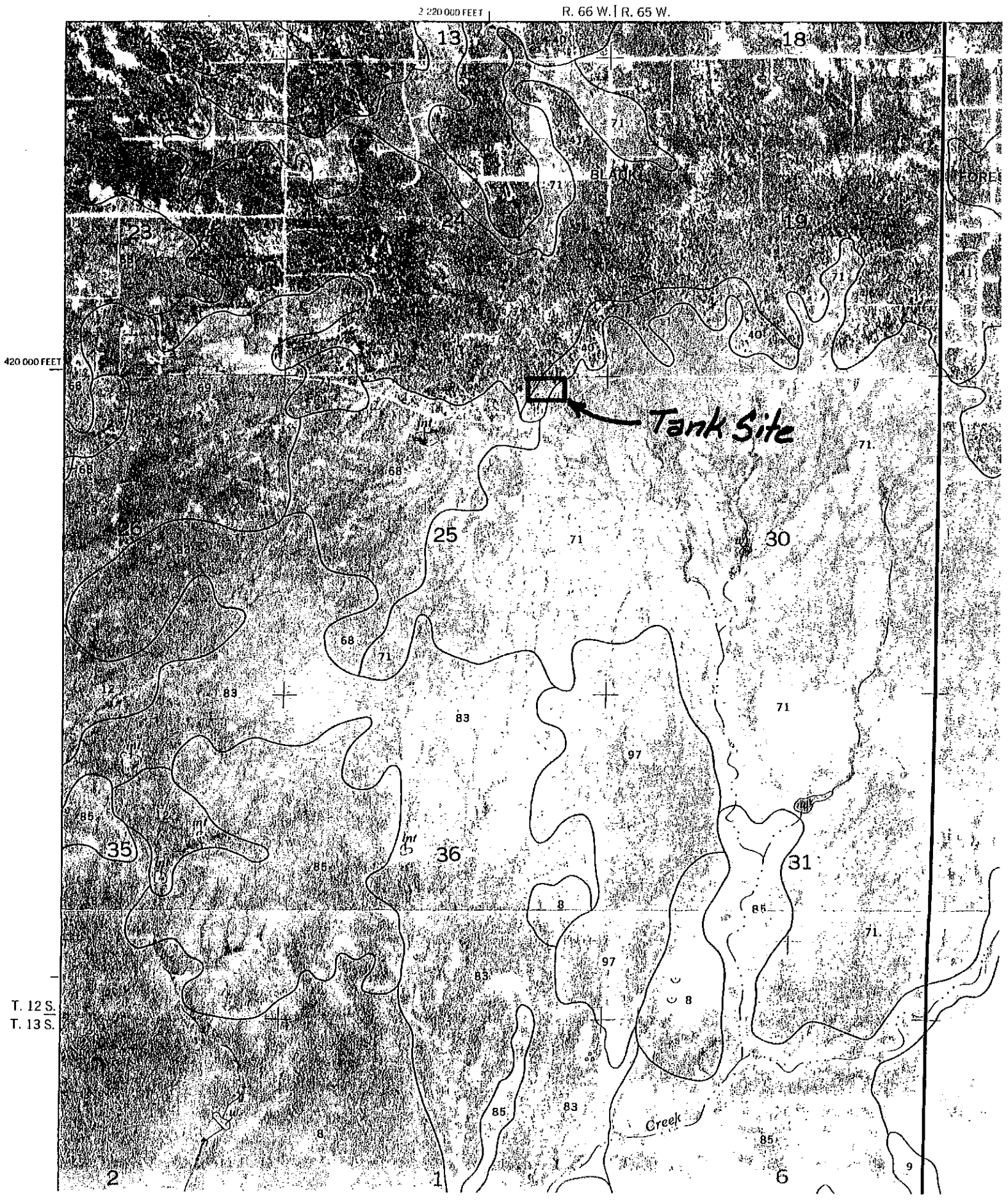
Hydrologic and Hydraulic Calculations

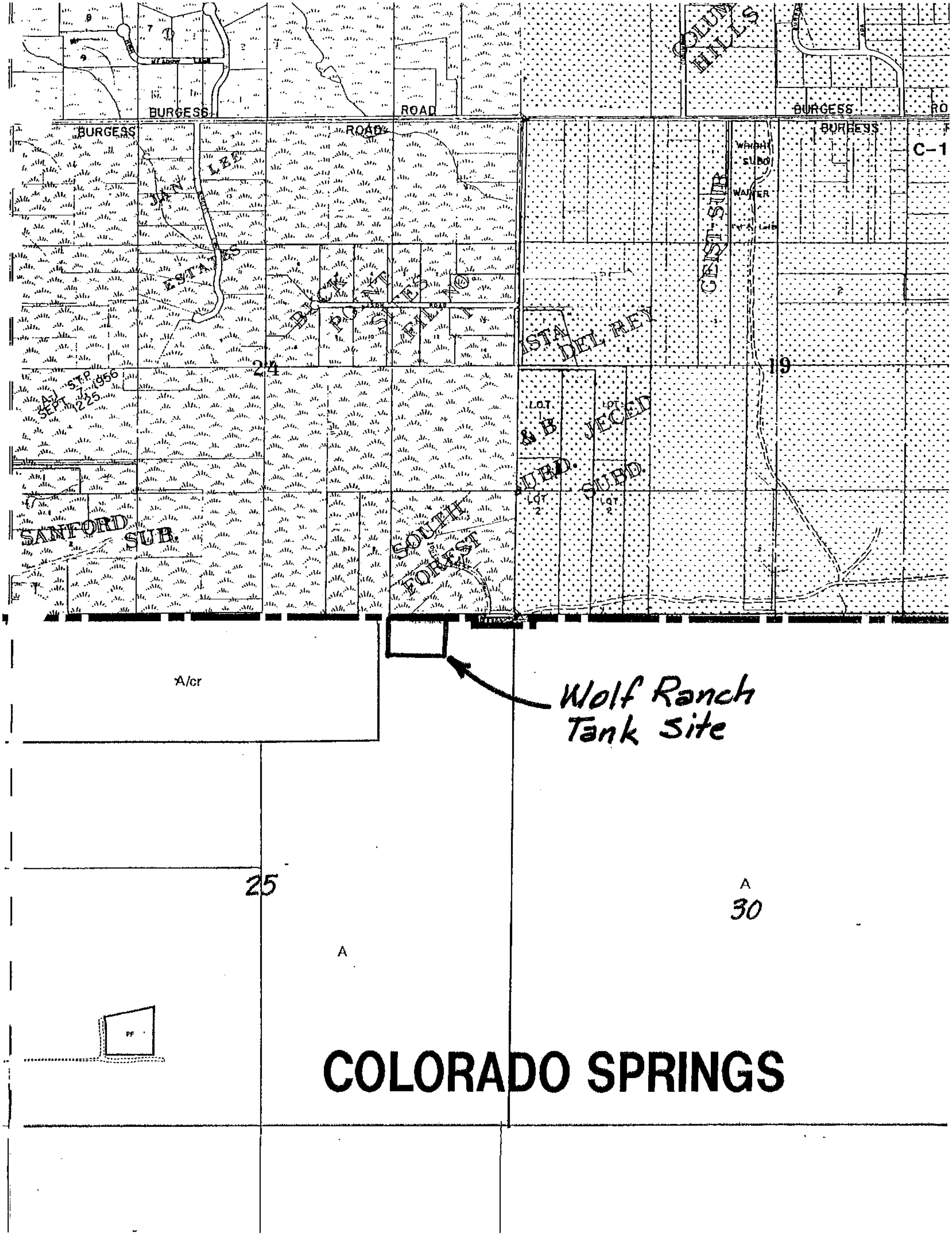

OLD RANCH RD.
Tank Site
26
30
TIMBER VIEW
MIDDLE SCHOOL
LIBERTY
HIGH SCHOOL

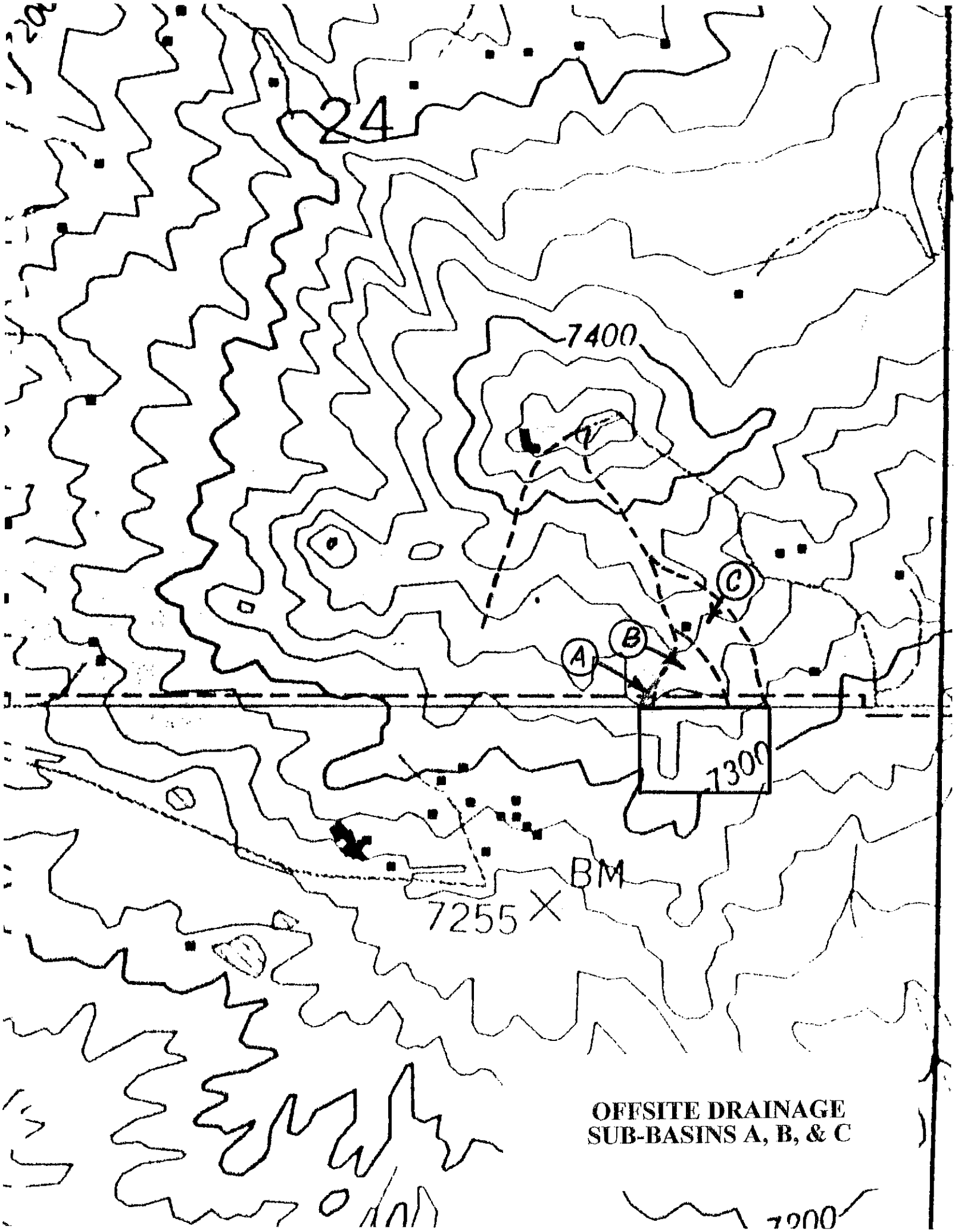
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE




BURGESS
ROAD
BURGESS
ROAD
BURGESS
C-1
ESTATES
24
19
LOT 1
LOT 2
& B
SUBD.
SUBD.
SANFORD
SUB.
SOUTH
FOREST
A/cr
Wolf Ranch
Tank Site
25
A
30
A
PF
COLORADO SPRINGS


24
7400
A
B
C
1300
BM
7255
OFFSITE DRAINAGE
SUB-BASINS A, B, & C

DRAINAGE CALCULATIONS

WOLF RANCH TANK SITE

Project No. 02015

Rational Method Formula: Q=CIA

Existing Development Condition

Sub-Basin	Area Acres	Basin Length Feet	Basin Slope Percent	Runoff Coefficient 5 Year	Runoff Coefficient 100 Year	Time of Concen. 5 Year Minutes	Time of Concen. 100 Year Minutes	5 Year Intensity In./Hr.	100 Year Intensity In./Hr.	5 Year Peak Flow CFS	100 Year Peak Flow CFS
A (Offsite)	0.12	100	10.0	0.10	0.15	8.0	8.0	4.3	7.5	0.1	0.1
B (Offsite)	1.60	350	10.0	0.10	0.15	15.0	15.0	3.4	5.8	0.5	1.4
C (Offsite)	3.00	750	10.0	0.10	0.15	22.0	22.0	2.8	5.0	0.8	2.3
D	0.55	160	8.3	0.15	0.20	11.0	11.0	4.0	6.8	0.3	0.7
E	0.90	250	9.1	0.15	0.20	13.0	13.0	3.7	6.3	0.5	1.1
F	3.52	380	10.0	0.15	0.20	15.0	15.0	3.4	5.8	1.8	4.1
									Total	4.1	9.7
									Onsite Total	2.6	6.0

Developed Condition

Composite "C" for Sub-basin F

		C_5	C_{100}
Pump Station Roof	0.044 ac @	0.90	0.95
Gravel Entrance Road	0.26 ac @	0.80	0.85
Seeded w/ Native Grasses	3.22 ac @	0.30	0.35

$$C_5 = 0.044(.90) + 0.26(.80) + 3.22(.30)/3 = 0.40$$

$$C_{100} = 0.044(.95) + 0.26(.85) + 3.22(.35)/3 = 0.46$$

Remainder of Onsite (Sub-basins D & E) will be seeded with native mix ie. $C_5 = 0.30$ & $C_{100} = 0.35$

SUB-BASIN RUNOFF CALCULATIONS
PROJECT: WOLF RANCH WATER TANK, COLORADO SPRINGS, COLORADO
PROJECT NO: 04036
RATIONAL METHOD FORMULA: Q=CIA

SUB-BASIN NO.	AREA (AC)	RUNOFF COEFFICIENTS C5	C100	RAINFALL INTENSITY I5	I100	RUNOFF (CFS) Q5	Q100
				(INCHES/HR)			
A	0.12	0.15	0.2	5.2	9.0	0.1	0.2
B	1.6	0.15	0.2	5.2	9.0	1.2	2.9
C	3.0	0.15	0.2	5.2	9.0	2.3	5.4
D	0.49	0.3	0.35	5.2	9.0	0.8	1.5
E	0.86	0.3	0.35	5.2	9.0	1.3	2.7
F	2.82	0.4	0.46	5.2	9.0	5.9	11.7
G	0.16	0.2	0.25	5.2	9.0	0.2	0.4
H	0.09	0.2	0.25	5.2	9.0	0.1	0.2
I	0.43	0.2	0.25	5.2	9.0	0.4	1.0

DESIGN POINTS

Design Pt. 1: SBA + SB F

$Q_5 = .1 + 5.9 = 6.0$ cfs

$Q_{100} = .2 + 11.7 = 11.9$ cfs

DESIGN PT. 2: SB C + SB I

$Q_5 = 2.3 + .4 = 2.7$ cfs

$Q_{100} = 5.4 + 1.0 = 6.4$ cfs

DESIGN PT 3: SB A + SB D

$Q_5 = .1 + .8 = .9$ cfs

$Q_{100} = .2 + 1.5 = 1.7$ cfs

DESIGN PT 4: = SB E

$Q_5 = 1.3$ cfs

$Q_{100} = 2.7$ cfs

Existing Flow Comparison to Developed.

@ DP 1

Ea Subbasin Area = B + F = 1.6 + 2.8 = 4.4

Assume minimum t_c = 5 min

$\therefore I_5 = 5.2$"/hr $I_{100} = 9$"/hr

$$C_5 = \frac{1.6(.10) + 2.8(.15)}{4.4} = .13$$

$$C_{100} = \frac{1.6(.15) + 2.8(.20)}{4.4} = .18$$

$Q_5 = .13(5.2)(4.4) = \underline{3.0 \text{ cfs}}$

$Q_{100} = .18(9)(4.4) = \underline{7.1 \text{ cfs}}$

Developed @ DP 1 $Q_5 = 6.0$ $Q_{100} = 11.9$

@ DP 4: Existing runoff amounts would remain substantial unchanged; no changes in runoff coeff or area.

@ DP 3: Same as DP 4.

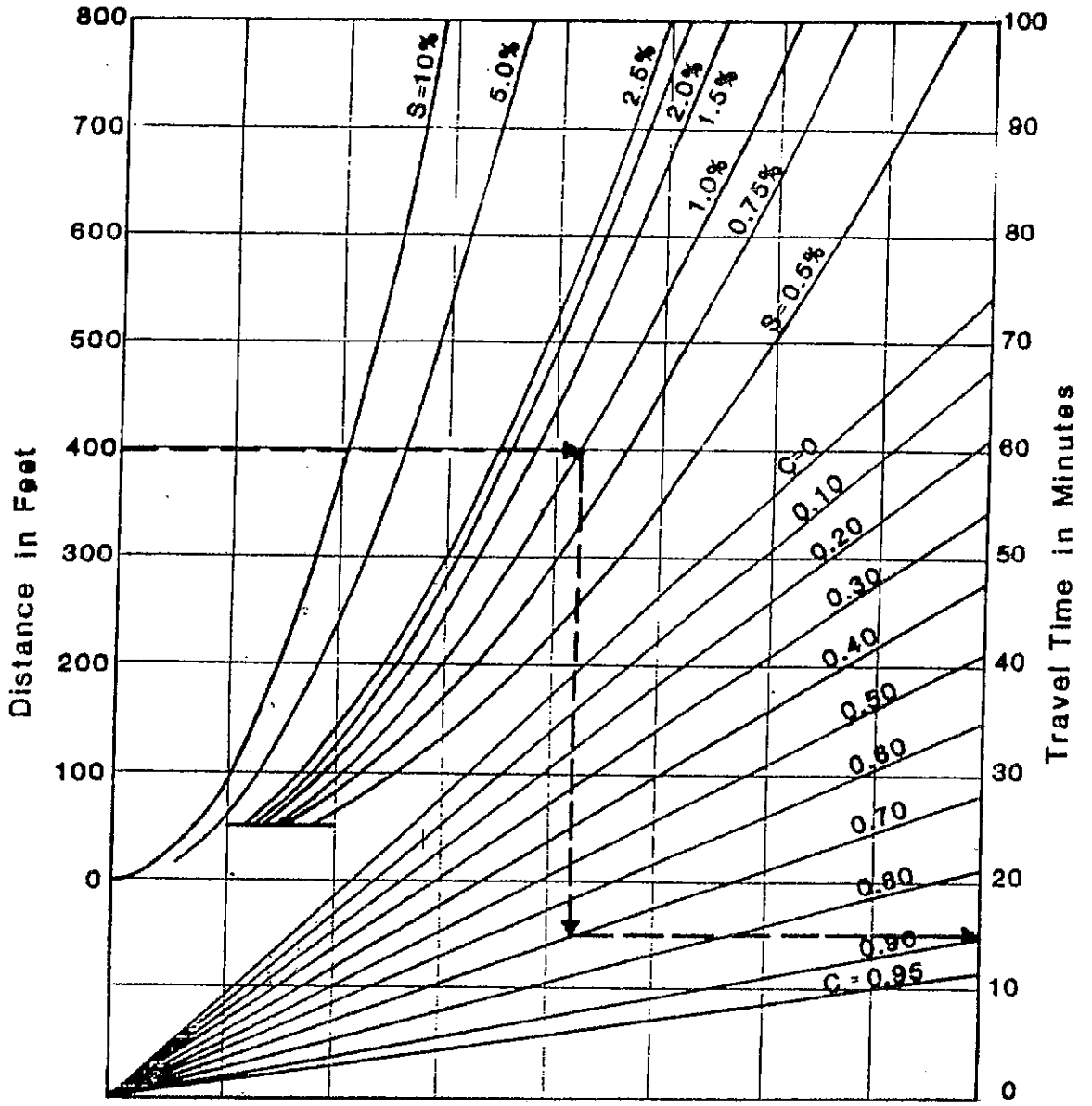
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



REFERENCE : Wright – McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1, Denver Regional Council of Governments, Denver, Co. 1977

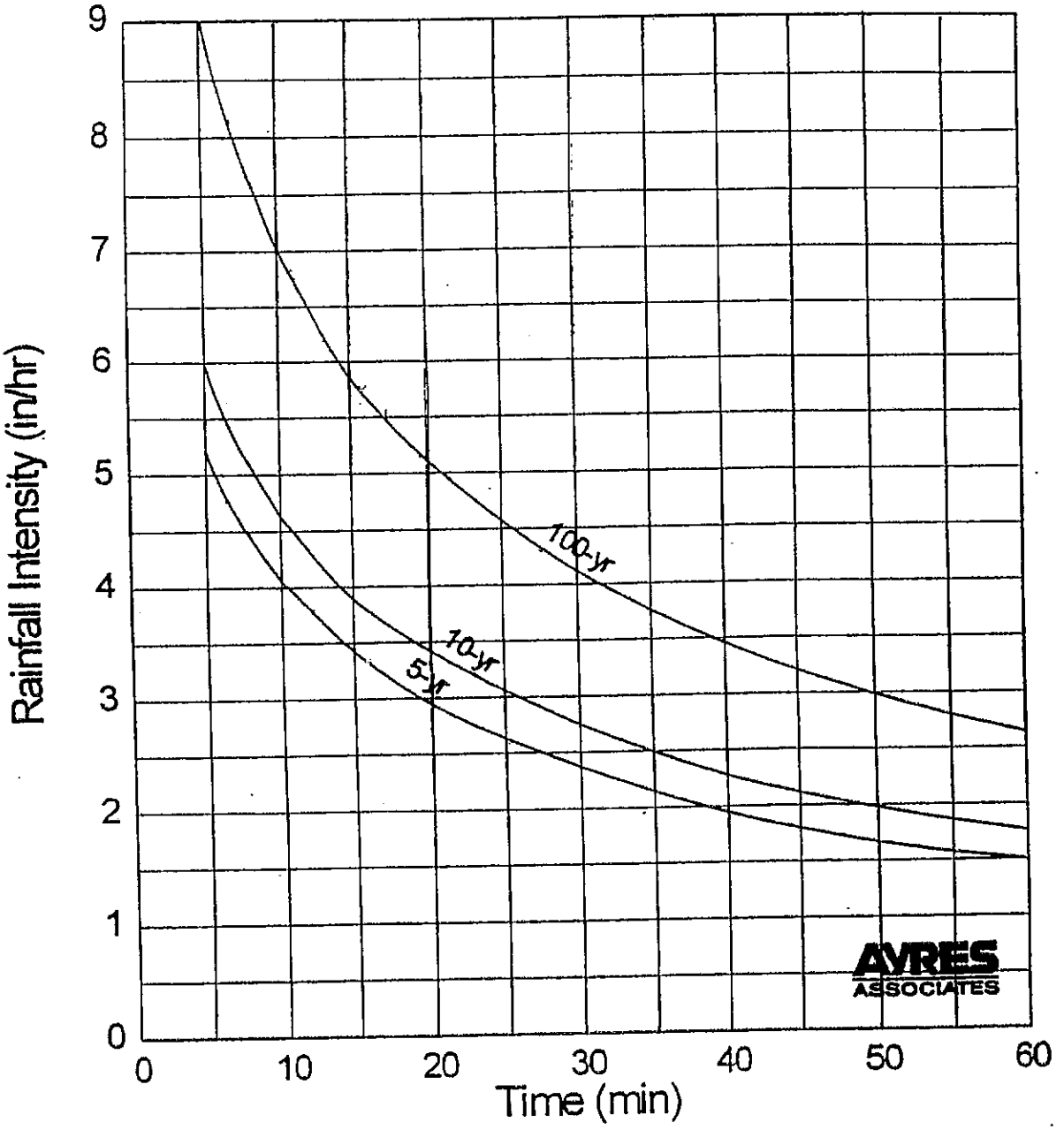
HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

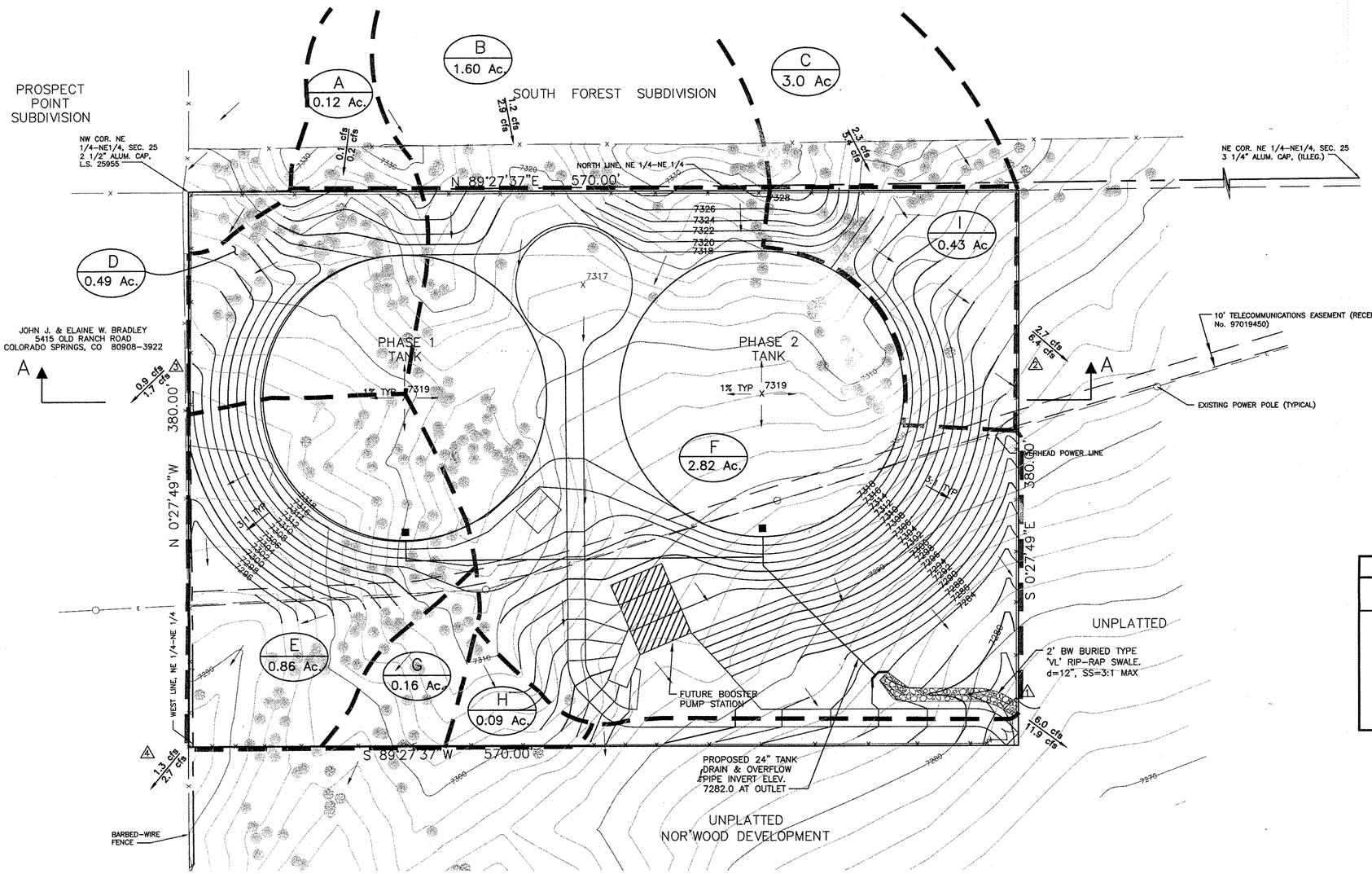
Overland Flow Curves

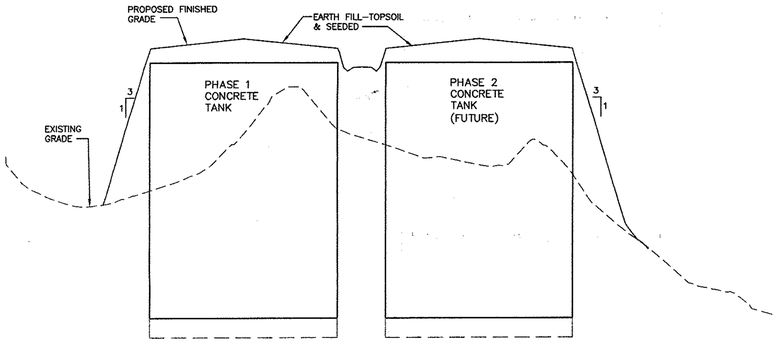
Date: OCT. 1987

Figure: 5-2



Interim Release October 12, 1994 , Rainfall Intensity Curves
City Of Colorado Springs Drainage Criteria Manual





SECTION A–A
SCALE N.T.S.

DESIGN POINT DISCHARGES (cfs)		
DESIGN POINT	Q_5	Q_{100}
1	6.0	11.9
2	2.7	6.4
3	0.9	1.7
4	1.3	2.7

SUB-BASIN DISCHARGES (cfs)		
DESIGN POINT	Q_5	Q_{100}
A	0.1	0.2
B	1.2	2.9
C	2.3	5.4
D	0.8	1.5
E	1.3	2.7
F	5.9	11.7
G	0.2	0.4
H	0.1	0.2
I	0.4	1.0

LEGEND

- R / 10.24 ac — SUB–BASIN DESIGNATION / SUB–BASIN AREA
- 3.8 cfs / 6.3 cfs — 5–YEAR RUNOFF / 100–YEAR RUNOFF
- 1 — DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION
- 1 — HYDRAULIC STRUCTURE IDENTIFIER
- 1 — PIPE IDENTIFIER

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904 - 4208
(719) 630-7342

WOLF RANCH TANK SITE
PROPOSED HYDROLOGY
FINAL DRAINAGE REPORT
COLORADO SPRINGS, COLORADO

Project No.:	04036
Date:	04/30/04
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

Fig. 2