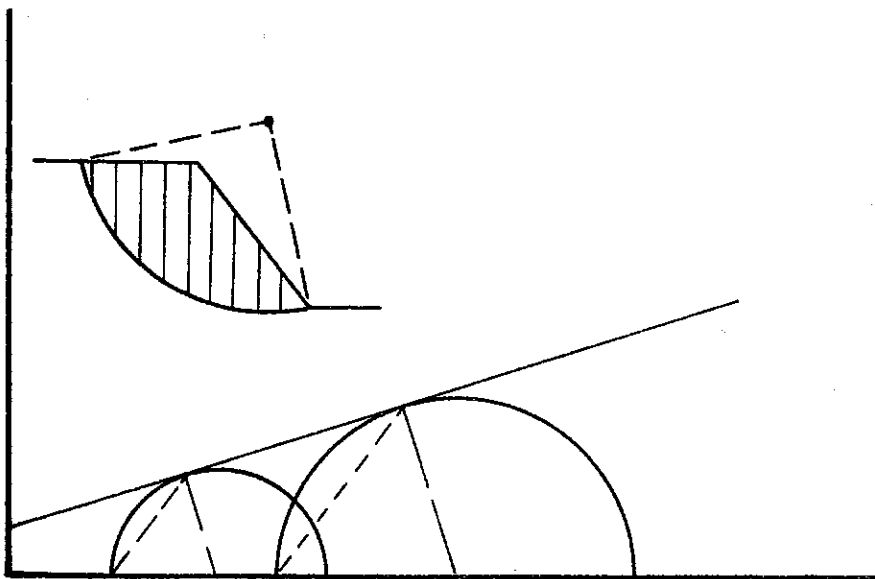


CITY ENGINEERING
CHECK-OUT COPY #1

19TH ST.

MARCH, 1964

THE LINCOLN DEVORE TESTING LABORATORY
COLORADO SPRINGS, COLORADO



SCANNED

THE LINCOLN-DeVORE TESTING LABORATORY

1000 W. Fillmore
Colorado Springs, Colorado

Geo. D. Morris, P.E.
Phone:
632-3593

MEMBER: A.S.T.M.

March 4, 1964

Soil Testing

Foundation-
Evaluation

Concrete
Testing

Concrete
Batch Design

Soil-Cement
Design

Asphalt Mix
Design

Geologic
Interpretation

Reports

by

Registered
Professional
Engineers

Director of Public Works
City of Colorado Springs
City Hall
Colorado Springs, Colorado

Dear Sir:

Included herewith is the report on the
internal drainage of the 19th Street Drainage Basin
in west Colorado Springs, Colorado.

Respectfully submitted,

LINCOLN-DeVORE TESTING LAB.


George D. Morris, P. E.

GDM/jb

INTERNAL DRAINAGE
OF THE 19TH STREET DRAINAGE BASIN
WEST COLORADO SPRINGS, COLO.

March 4, 1964

GENERAL:

The 19th Street Drainage Basin is a relatively small, enclosed basin in western Colorado Springs. It is bounded on the north and east by Mesa Road, on the west by Ridgeline, which is an extension of Friendship Lane, and on the south by Uintah Street. The overall drainage basin extends southerly to the Fountain Creek, but for the purposes of this report, Uintah Street has been selected as the low or southernmost point of the basin.

Topographically, this Drainage Basin is an elongated, steep sided bowl. It is surrounded on east and west sides by high, steep hills. Although a small portion of the center is relatively level, this level portion of land is confined to an area a few hundred feet in width surrounding 19th Street and Oswego Street. At its southernmost end, the entire Basin drains into a sump area which has been used as a reservoir by the City for many years.

This reservoir site has been studied twice. The most recent report was that of United Western Engineers, dated February 7, 1964. The report of February 7th was requested by the Director of Public Works of the City of Colorado Springs and concerned the size and capacity of a reservoir which is proposed by the owners of the land on which the reservoir site is located.

This report should be considered as an extension of the previous one. It is concerned with the upper portion of the Drainage Basin above the reservoir. With the exception of the estimated cost

of improving the reservoir site, this report shall assume the presence of the reservoir and will make no further study of it.

The soils in the basin are threefold. The Pierre Shale underlies the entire area and can be considered as the basic soil type. Over this, a cover of Mesa Gravel is found on the higher elevations, and to some extent, on the slopes. The center, or relatively flat area, of the basin is composed of a mixture of these two types, but is predominantly of the shale formation. The soils found in the lower areas are typical of torrential stream wash and are highly stratified. Runoff in the basin is high and rapid. This is due not only to the steep slopes to be found on the side of the basin, but to the relatively impervious character of the underlying soil. In general, this soil can be classified as Type "C" or "D" under the Soil Conservation Service classification.

Nearly all of the development found in this basin is found either in the low, relatively flat areas or at the summit of the mesa along the edges of the basin. Practically no development has taken place on the steep slopes. Development in this area will probably be retarded due to the steepness of the slopes. These slopes can, however, be developed, and this report assumes that development has taken place on the basis of 1/2 to 1--acre lots.

INTERNAL DRAINAGE:

The internal drainage of this Basin is very simple. In general, the water enters the Basin from the east and west, flowing rather rapidly down steep slopes. At the low point in the Basin, it turns thence southerly and runs in a small natural stream or gully most of the way to Uintah Street. At Uintah Street, it is ponded by the high bank of the street in a marshy, low lying area. The amount of water flowing down this central stream is far too great for any street to handle without help. This help may be given in the way of sewers or by routing the water in ditches through the low spot. A third method of routing the water is available and is probably less expensive. This method would be to place several streets parallel to the main north-south flow and allow each street to carry a certain portion of the water. Unfortunately, the planning which has previously occurred in this Basin eliminates this method of conducting the water, except in the case of 18th Street, lying to the east of the main stream; and except for an unnamed street which could be placed to connect Tonka Ave. with Columbine Ave.

At the present time, the location of this unnamed street is private ground which is completely undeveloped from a subdivision standpoint. The large amount of water which flows over this land between Tonka and Columbine indicates that a ditch would be the most efficient method of transporting the water through this tract.

Therefore, the greenbelt system has been utilized to accomplish this. Water would enter this ditch from both Tonka Ave. and Oswego Ave. and from 19th Street, in part, and fall southerly more or less parallel to 19th Street. At a point approximately even with the section corner, this ditch should be turned to the east and enter a large pipe crossing 19th Street. On the east side of 19th Street, the ditch should be resumed to carry this water directly south to the proposed reservoir previously mentioned.

18th Street, lying east of this proposed ditch should be utilized to cut off water entering from the eastern slope. This water could then be carried southerly on an extension of 18th Street to the reservoir site. An identical cutting off function can be performed by Tonka Ave. Unfortunately, Tonka Ave is so placed that it will only cut off one sub-basin. This basin is the one numbered "6" on the plan. Other than this one sub-basin, Oswego Street must carry the remaining water. Since Oswego Street is incapable of doing so without help, a storm sewer has been proposed for this street.

OUTFALL POINT:

A single outfall point is all that is required for this Basin. For the purposes of this report, it is assumed to be a reservoir previously mentioned, lying immediately north of Uintah

street. The outfall point of the reservoir is a small 36-inch pipe which now exists beneath Uintah Street. Flow control can be accomplished by use of this pipe so that large ditches will not be required south of the Uintah Street crossing.

At the present time, the water flowing through this pipe dissipates among several streets in Old Colorado City. After being thus dissipated, it eventually enters Fountain Creek about 1/2 mile south of Uintah Street. If the basin were left uncontrolled, this arrangement would be utterly unsatisfactory. With the presence of the controlling reservoir and the 36-inch outlet pipe, however, this flow can be controlled and kept to a small enough size that no major trouble should develop.

COST ESTIMATE - 19TH STREET DRAINAGE

Total Acreage in Basin - 34.34

Upper Basin:

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Total</u>
54" Ø CMP	200'	\$25.30	\$5,060.00
48" Ø CMP	200'	20.00	4,040.00
42" Ø CMP	200'	16.80	3,360.00
30" Ø CMP	200'	13.60	2,720.00
18" Ø CMP	330'	7.40	2,442.00
Std. Curb Inlets	11	385.00	4,235.00
Std. Overflow Inlets	1	480.00	480.00
Earth Ditch	1150 lin. ft.	1.26	1,450.00
Sodding	34500 sq. ft.	0.12	4,140.00
SUB TOTAL			27,927.00

Lower Basin:

Alt. #1 - 19th Street Crossing:

84" Ø CMP	360'	71.00	25,560.00
Concrete Head & Wingwalls	9 cu. yd.	65.00	585.00
Earth Ditch	1070 lin. ft.	1.26	1,348.00
Sodding	32100 sq. ft.	0.12	3,852.00
SUB TOTAL ALTERNATE			31,345.00

The reservoir actually exists - no extra earthwork required by the City of Colorado Springs. The owner may wish to cut down the extent of the reservoir by filling, as mentioned in the previous report. If so, this cost should be part of the land cost. The only item required on the reservoir, then, is:

30" CMP	5'	13.60	68.00
Headwall	3 cu yd	65.00	195.00
Trash Rack	1	L.S.	220.00
SUB TOTAL			483.00

COST ESTIMATE - 19TH STREET DRAINAGE Con't

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Total</u>
Alternate #2 - 19th St. Crossing:			
To conserve headroom, a concrete box culvert may be constructed, in which case, the cost will be approximately:			
84" CMP	102'	\$71.00	\$7,242.00
Conc. head & wing-walls	4 cu. yds	65.00	260.00
Culvert	1	L. S.	11,800.00
Earth Channel	120 lin. ft.	1.26	151.00
Sodding	3600 sq. ft.	0.12	440.00
SUB TOTAL ALTERNATE #2			19,893.00

BASIN CONSTRUCTION COST = \$59,735.00 With Alternate #1
or 174.01 Per Acre (Total Area)

= 48,303.00 With Alternate #2
or 140.66 Per Acre (Total Area)

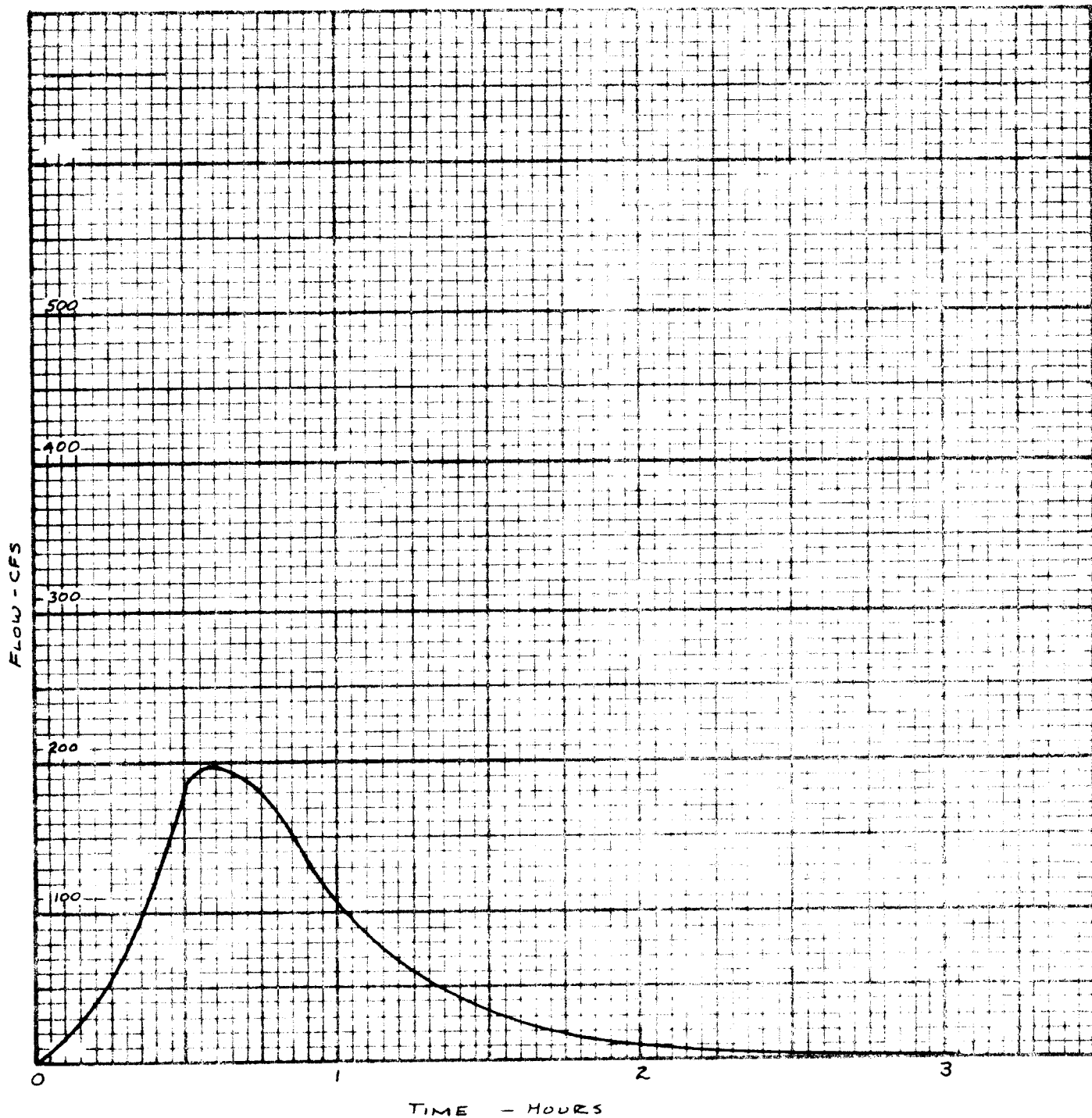
BASIN LAND COST = 2.5 Acres @ \$3000.00 = \$7,500.00
or \$21.84 Per Acre (Total Area)

Then the total cost = \$67,235.00 - \$195.85/Acre, or
55,803.00 - 162.50/Acre,

depending on the alternate chosen

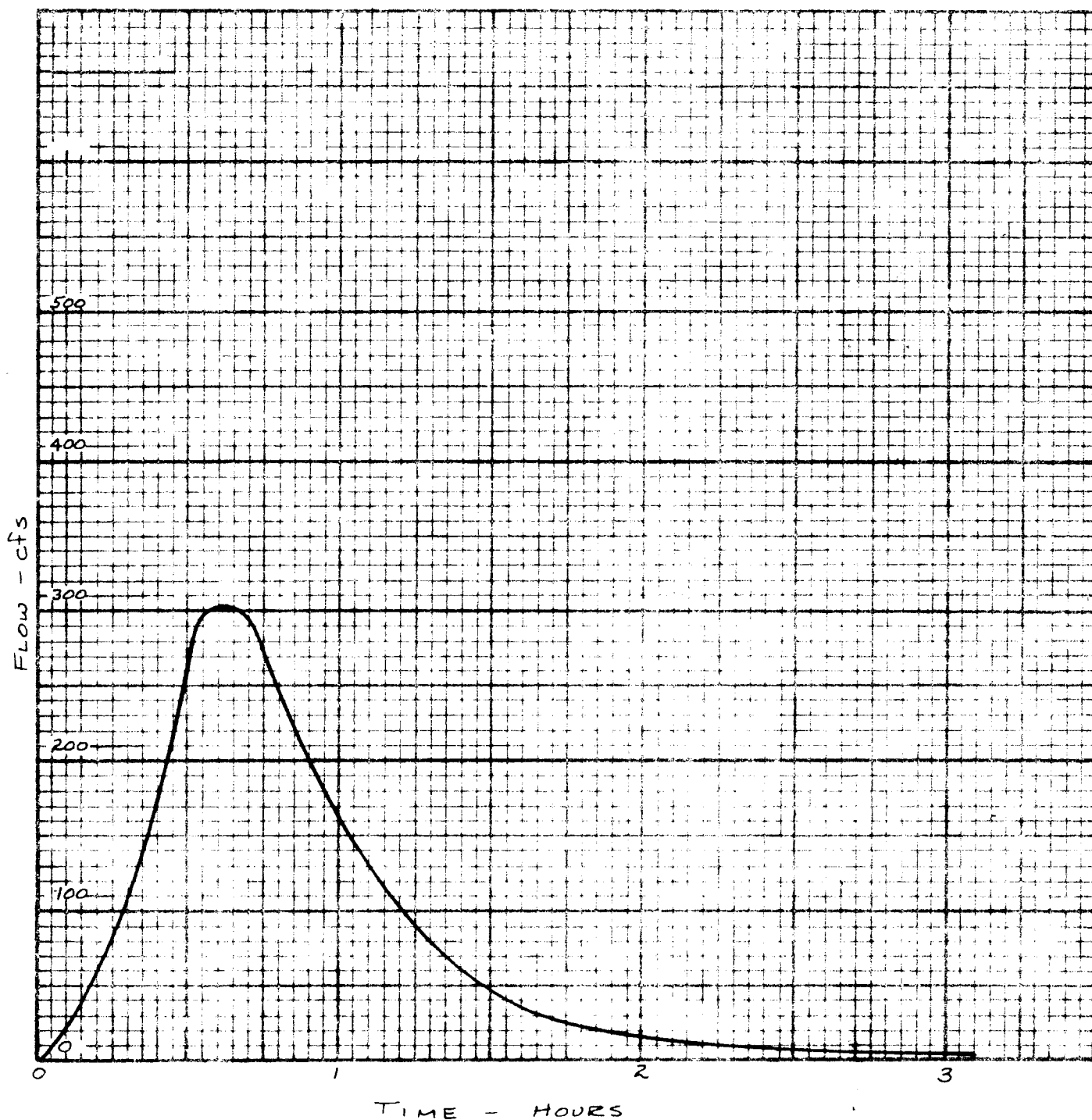
BIBLIOGRAPHY:

1. "Hydrology Guide for Use in Watershed Planning", Sec. 4, Supplement A, U. S. Dept. of Agriculture, Soil Conservation Service.
2. "Design of Small Dams", U. S. Dept. of Interior, U. S. Bureau of Reclamation, 1960.
3. "Hydrology for Engineers", Lindsey, Kohler & Paulhus, McGraw-Hill Book Co., 1958
4. Tech Paper No. 28, "Rainfall Intensities for Local Drainage Design in Western United States", Dept. of Commerce, 1956.
5. Survey Report "Runoff, Waterflow, Retardation & Soil Erosion Prevention - Fountain River & Tributaries, Colorado", Soil Conservation Service, 1939.
6. "Peak Rates of Runoff from Small Watersheds", Bureau of Public Roads, U. S. Dept. of Commerce, 1961.
7. "Rainfall Frequency Atlas of the United States", Weather Bureau, U. S. Dept. of Commerce, 1961.
8. "Hydraulic & Hydrologic Aspects of Flood-Plan Planning" U. S. Geological Survey & Water-Supply Paper, 1526, 1961.



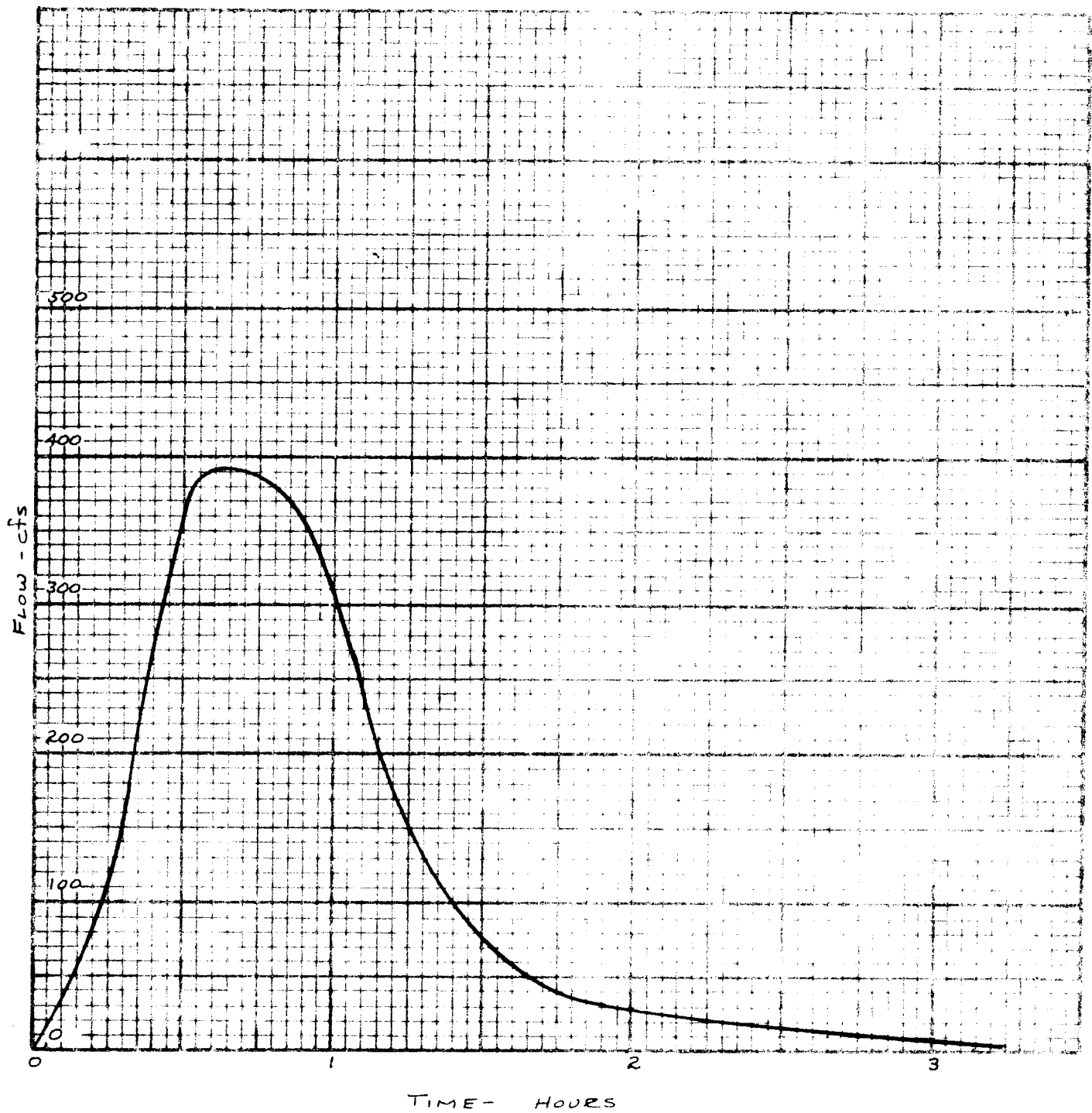
19TH ST. DRAINAGE BASIN
FLOW - POINT B

UNITED WESTERN ENGINEERS
COLORADO SPRINGS, COLORADO



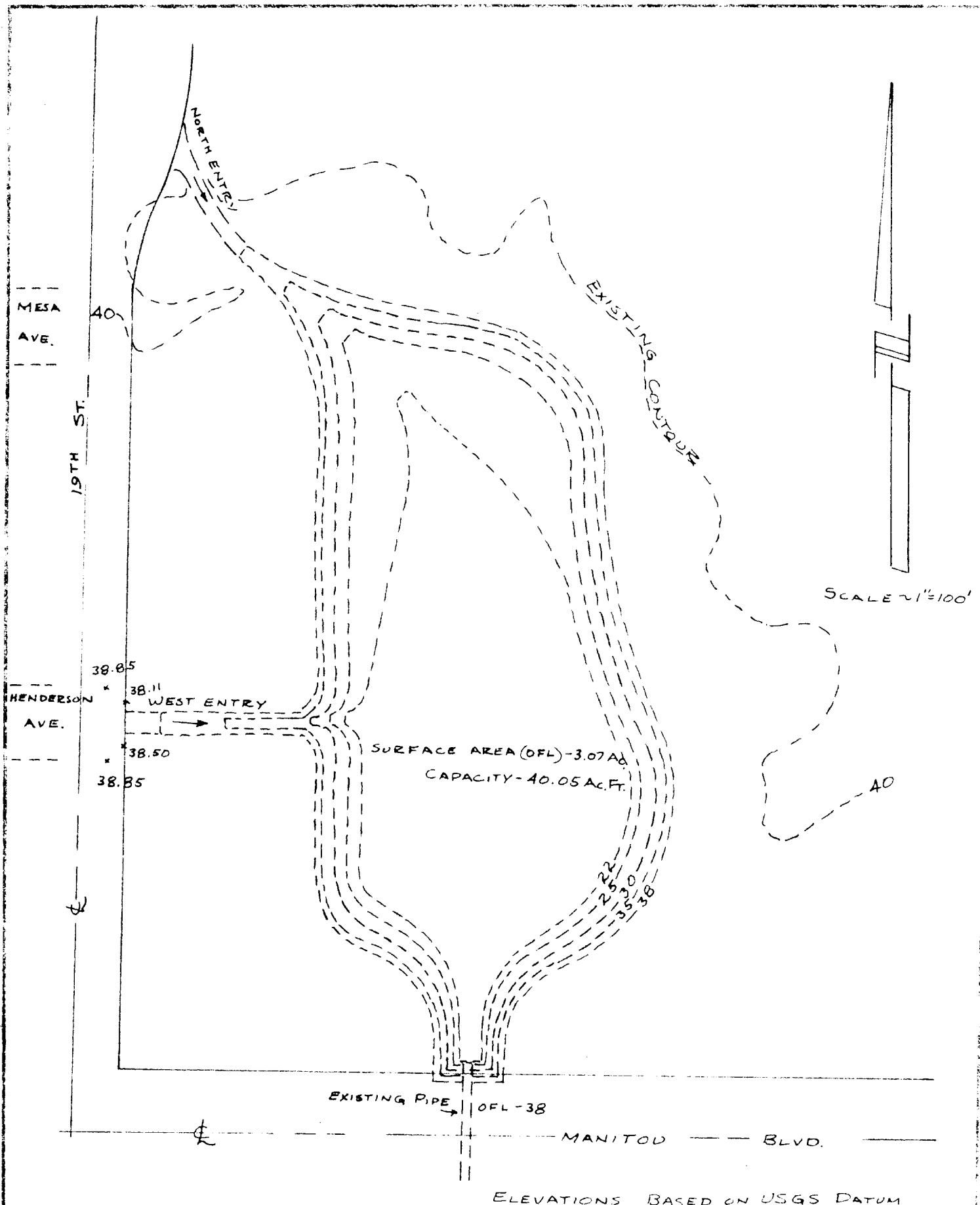
19TH ST. DRAINAGE BASIN
FLOW - POINT C

UNITED WESTERN ENGINEERS
COLORADO SPRINGS, COLORADO



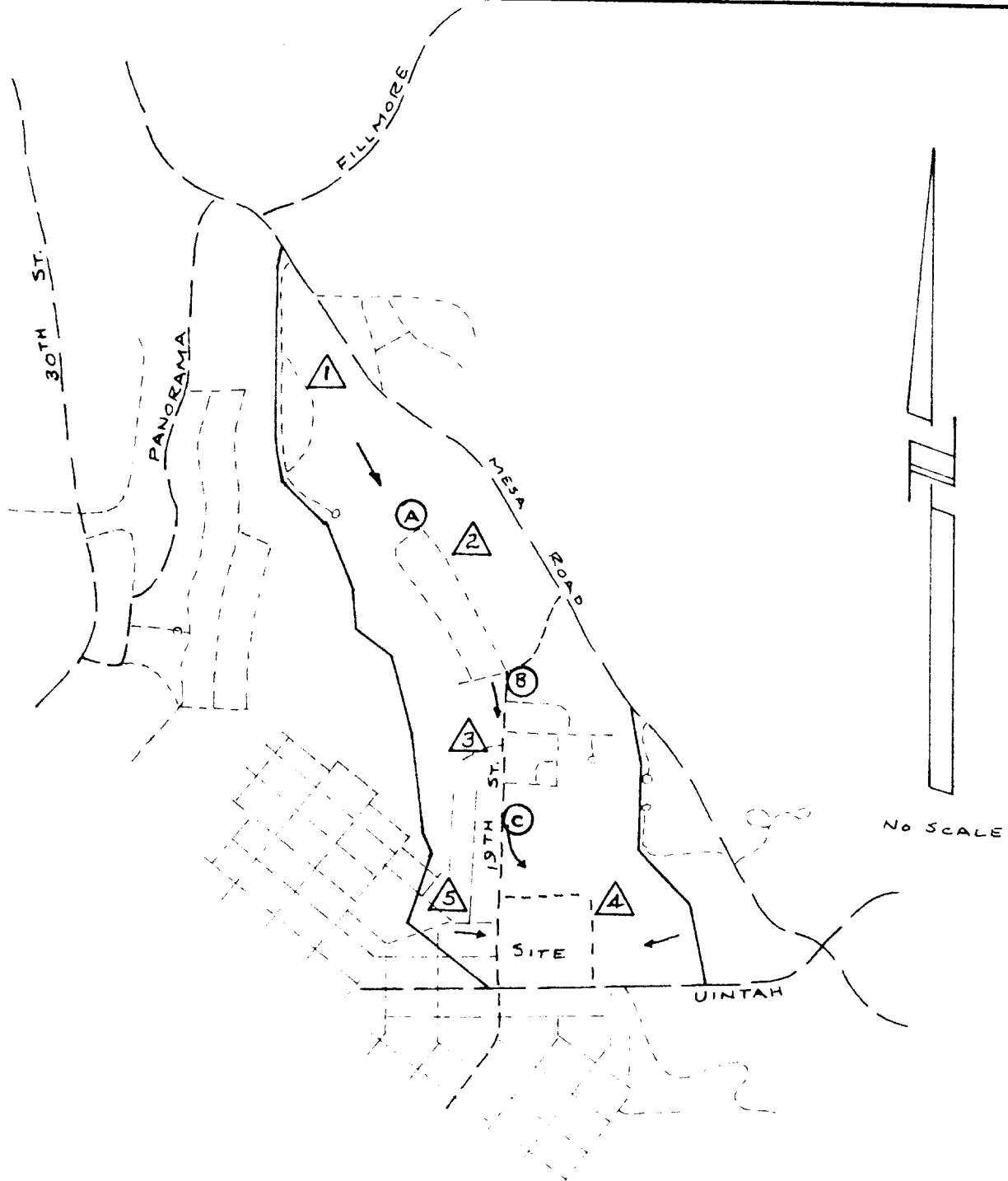
19TH ST. DRAINAGE BASIN
FLOW - POINT 2

UNITED WESTERN ENGINEERS
COLORADO SPRINGS, COLORADO



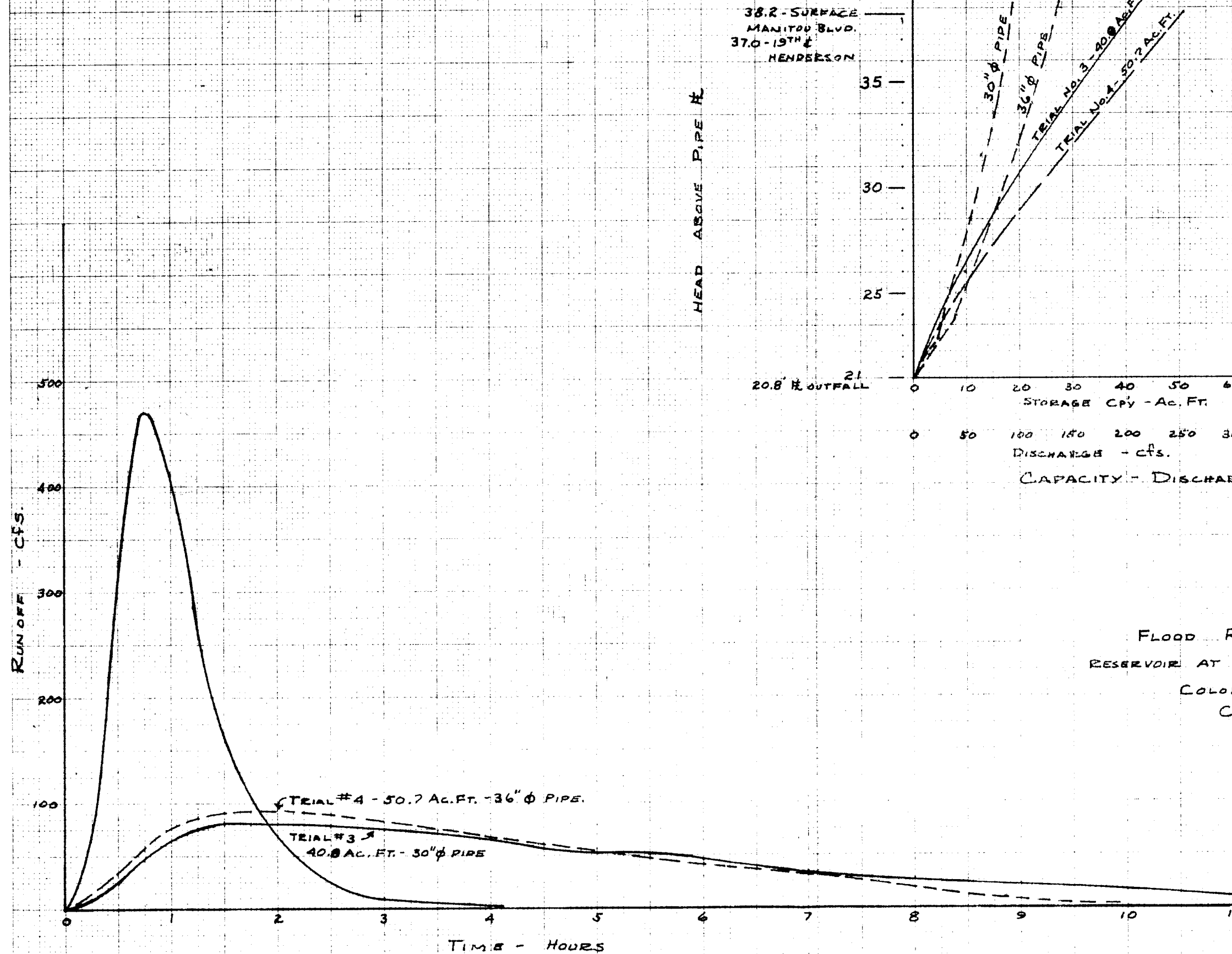
PROPOSED RESERVOIR SITE No. 3
 19TH & MANITOU BLVD., COLORADO SPRINGS

UNITED WESTERN ENGINEERS
 COLORADO SPRINGS, COLORADO



BASIN LOCATION DIAGRAM
GENERAL FLOW

LINCOLN-DEVORE TESTING LABORATORY
COLORADO SPRINGS, COLORADO



FLOOD ROUTING CHART
RESERVOIR AT MANITOU BLVD. NEAR 19TH ST.
COLORADO SPRINGS
COLORADO

UNITED WESTERN ENGINEERS
COLORADO SPRINGS, COLORADO

THE LINCOLN-DeVORE TESTING LABORATORY

1000 W. Fillmore
Colorado Springs, Colorado

Geo. D. Morris, P.E.

Phone:

632-3593

MEMBER: A.S.T.M.

April 23, 1964

Mr. M. R. Pearce
Director of Public Works
Colorado Springs, Colorado

Re: 19th Street Drainage
Reservoir

Dear Sir:

We are sending the results of a rerouting of the total flood waters through the proposed 19th Street Reservoir. The previous variations have been combined and changed slightly so that the capacity of the Reservoir shown is 50+ Acre Feet and the outlet pipe has been choked to 24"Ø.

To summarize the various trials to date:

Reservoir Capacity	Pipe Size	Maximum Outflow	Maximum Storage	Retention Time
1. 36.52	36"Ø	128 cfs	22.6 Ac.Ft.	5+ hours
2. 27.77	36"Ø	140 cfs	21.4 " "	5+ "
4. 50.72	36"Ø	94 cfs	28.0 " "	9+ "
3. 40.05	30"Ø	79 cfs	29.7 " "	10+ "
5. 50.72	24"Ø	50 cfs	33.0 " "	16+ "
6. 40.05	24"Ø	57 cfs	33.8 " "	16+ "
7. existing equiv- reservoir alent	36"Ø	112 cfs	24.9 " "	6+ "

We still feel that, since the design storm produces only 40.06 Acre Feet of water and since none of the routing computations show an actual storage of more than 33 Ac. Ft., the reservoir need not have a capacity greater than 40 Acre Feet. However that may be, trial No. 5 combining the 50 Acre Feet capacity with a 24" pipe reduces outflow to about 45% of that now existing.

Incidentally, a typographical error appears on the cost estimate sheet of the 19th Street Basin Report. The sheet indicates a basin acreage of 34.34. The true basin acreage should

19th Street Drainage Reservoir
Page -2-

have been 343.4 Acres. All computations are based on the latter figure and have been rechecked:

The acreage in the basin can be divided as follows:

1.	Hill-Mesa Property-----	78.51
2.	Previously existing subdivision-----	36.33
3.	County Land along Mesa Road-----	112.20
4.	Raw Land-----	116.36
Total-----		343.40 *

If the raw land only can be used in computing the basin fees, then the following costs may be expected:

1. Eliminate storm sewer on Oswego St.
Alt. 1 $\frac{45,398}{116.36}$ \$390.15 Ac.
Alt. 2 $\frac{33,946}{116.36}$ \$291.73 Ac.
2. Assume all the work to be accomplished:
Alt. 1 $\frac{67,255}{116.36}$ \$577.99 Ac.
Alt. 2 $\frac{55,803}{116.36}$ \$479.57 Ac.

*The acreage figures are from the map and are not surveyed acreages.

Respectfully submitted,

LINCOLN-DeVORE TESTING LAB.

George D. Morris, P. E.

GDM/jb