PUBLIC WORKS/HYDROLOGY

G16/D64

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G16/D64

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0000 0000 0821

home planning development co.

February 7, 1975

City Engineers
400 Marquette Ave. NW
P. O. Box 1293
Albuquerque, New Mexico 87102

RECEIVED
FEB 12 1975
CITY ENGINEERS

Attention: Bob Kielich

Dear Bob,

Don Martin, the chief of Woods Brothers operations in Albuquerque, is concerned with the drainage of his lots in Academy Place 1 and 3 that abut Academy Place # 4 subdivision.

It appears from the drainage plan that the lots in Academy Place # 1 and # 3 will drain onto the back of the lots in Academy Place # 4. As you may recall, AMAFCA eliminated the original drainage channel between these subdivisions, and we don't recall what was to happen with the overflow water from the Woods Brothers' lots.

Can you please provide us with a solution for this potential problem?

Sincerely,

HOME PLANNING DEVELOPMENT COMPANY

Frank Hines

Frank L. Hines
Vice President

FH/mt

Done by replat
10' drainage to be
maintained by owners

homes with the ACCENT on individuality

25×10

0000 0000 0822

Fred Rhodes
Mr. Campbell

home planning development co

142 meadow lane
white rock
los alamos, n. m. 87544
phone 505-672-3811

4201 carlisle, n. e.
albuquerque, n. m. 87107
phone 505-296-5451

Don'

RECEIVED
AUG 6 1973
CITY ENGINEERS

August 3, 1973

The Academy for Boys Trust
% Mr. John Gannaway
Albuquerque National Bank
P. O. Box 1344
Albuquerque, New Mexico 87103

Thru

Roger Cox & Associates
115 2nd St. S. W.
Albuquerque, New Mexico 87102

file 2 p 184
MB

Gentlemen:

The Albuquerque School Board recently contracted to purchase a 20 acre tract of land in Academy Place for a Junior High School site and plan for it to be opened in September 1974. Due to the terrain and numerous arroyos in this area (see attachment), drainage is a significant problem. AMAFCA has recommended that a comprehensive overall drainage report be made and approved before any of this land is developed.

Bohannan Westman Huston, & Co., has agreed to make an overall drainage report of the area for $14,000. We request that you participate in the cost of this report. There are a total of 1060 acres to be included in this report; 100 acres are owned by the Academy for Boys Trust or 9.4% for a cost of $1,316.

The city of Albuquerque has placed Juan Tabo Blvd. in Special Assessment District #184 for utility and paving design. The engineering contract for this work has been let, but construction will most probably not commence until the fall of 1974.

We propose that the Albuquerque Public School, the Academy for Boys Trust, minor property owners and Home Planning, Inc. approach the city and request that we be allowed to do this work by private contract on a pro-rata basis. Such work would still be engineered and supervised by the city.

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If all partners concur and the city will allow us to do this, we will not only save several months in construction time; but approximately 10-15% in total construction contract costs.

It is imperative that drainage problems be solved, utilities be extended and streets constructed if the Albuquerque Public School is to meet this schedule.

Please advise if the Academy for Boys Trust will pay the pro-rata cost of the drainage study and the Sewer, Water and Street costs on streets abutting, using the private contract method.

We again call to your attention the urgency time-wise of this request. The Albuquerque School system has indicated that if all arrangements can be made to build the Junior High on this location it will prevent them from having to build a temporary school on another location further south.

Sincerely,

HOME PLANNING DEVELOPMENT CO. INC.,

By: Ed Leslie
Ed Leslie - President

Copy to: Albuquerque Public School - Bill McMillian
AMAFCA - John Robert
City Engineering Dept.- Fred Rhodes

EL/bl

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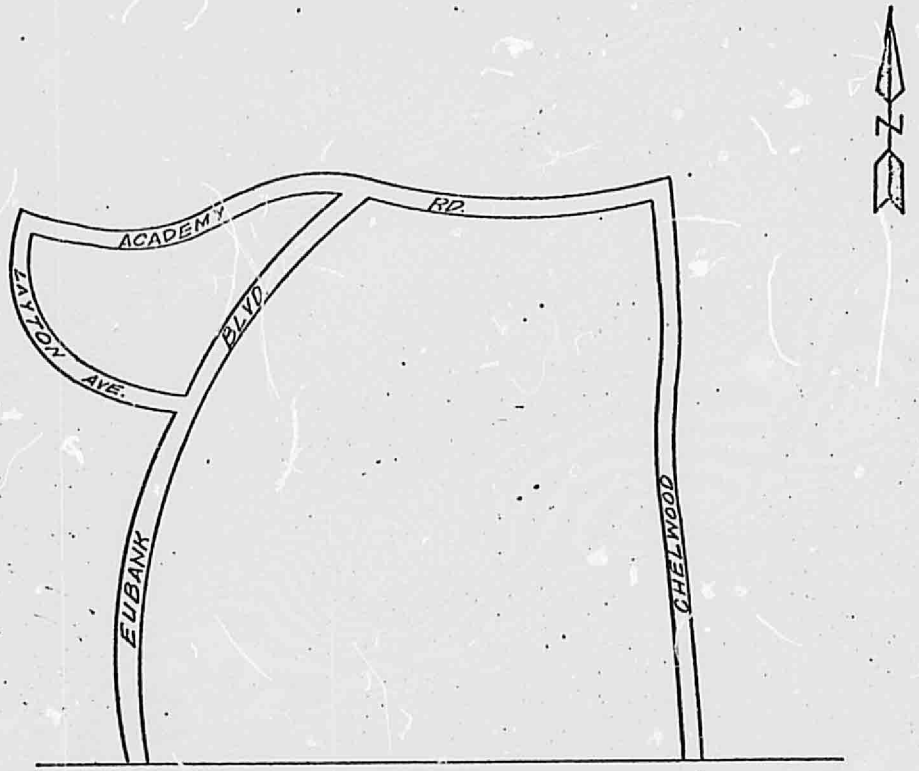
A TO BE INCLUDED IN THE DRAINAGE MASTERPLAN

ACADEMY PLACE



The North Border is Academy Rd.
The South Border is the Ellena Gallegoes Grant.
The East Border is Chelwood Rd. (Approximate Extension)
The West Border is composed of Layton Ave. and Eubank Blvd.

Total Area = 1060.32 Acres

25×10

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Logged 5/1/72
Debbie

May 1, 1972

V.M. Kimmick
City Engineer
P.O. Box 1293
Albuquerque, New Mexico 87103

Dear Mr. Kimmick:

Attached are three copies each of the following:

3 copies of Drainage Report - Academy Place #1
3 copies of Drainage Report - Academy Place #2
3 copies of Drainage Report - Academy Place #3
3 copies of Soils Analysis - Academy Place #1
3 copies of Soils Analysis - Academy Place #2
3 Copies of Soils Analysis - Academy Place #3

These are submitted for your consideration as part of the requirements for subdivision approval particularly Academy Place, Units 1 and 3.

Thank you.

Very truly yours,

John R. Mendius
Home Planning Dev. Co.

JRM:dt
Attachments (18)

25×10

0000 0000 0826

CAMPBELL-HICKS and ASSOCIATES, Inc.
Soils Testing Laboratory
Consulting Civil Engineers
232 Muriel Street, N.E. • Phone (505) 296-7139 • Albuquerque, New Mexico 87123

PRELIMINARY DRAINAGE STUDY
RELATIVE TO THE DEVELOPMENT OF
ACADEMY PLACE, UNIT 1

APRIL 1972

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DRAINAGE STUDY INDEX

DESCRIPTION	PAGE NO.
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II. Location	1
III. Existing Drainage Conditions	1
A. General	
B. Topography	
C. Drainage Areas and Channels	
IV. Proposed Drainage Plans	2
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B. Drainage Areas	
C. Runoff Quantities	
D. Drainage Channels and Facilities	
V. Conclusions and Recommendations	4
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B. Master Plan of Drainage - Unit 1	7
C. Summary of Runoff Computations	8
D. Summary of Street Carrying Capacities and Computer Output Sheets	23
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PRELIMINARY DRAINAGE STUDY RELATIVE TO THE DEVELOPMENT OF ACADEMY PLACE, UNIT 1

I. GENERAL

This report has been prepared to present findings of a study of storm drainage conditions in an area proposed for development as Academy Place, Unit 1, and to describe proposed methods for providing adequate storm drainage in the area.

II. LOCATION

The area considered in this report is bounded on the west and southwest by undeveloped land; on the northwest by Eubank Blvd., N.E. (proposed); on the northeast, west and north by undeveloped land; on the east by Academy Place, Unit 3 (proposed); and on the south by undeveloped land and Academy Place, Unit 2 (proposed). It is situated in the Elena Gallegos Grant mainly in the northwest one-quarter (NW 1/4) of Section 33, Township 11 North, Range 4 East, N.M.P.M.

III. EXISTING DRAINAGE CONDITIONS

A. General

The presently undeveloped area proposed for this development lies within the watershed of the Bear Arroyo and the Bear Arroyo Tributary. There are also three other smaller watersheds with well defined channels within the subdivision.

The runoff conditions and quantities at the eastern boundary of Academy Place, Unit 3 (Juan Tabo Blvd.,N.E.) were determined by the Corps of Engineers, Reference #7.

B. Topography

The area of the proposed development, a nine to ten mile wide clinoplain known as the Sandia Mesa, slopes gradually upward toward the Sandia Mountains at a nearly uniform rate of about 125 feet per mile. This mesa was built by deposits of gravels and clays from the Rio Grande River, intermixed with sand and gravels carried from the mountains by smaller streams. The mesa is crossed by sandy arroyos or usually dry stream channels which carry large volumes of water runoff for a few

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hours once or twice each summer.

Arroyo cutting is a problem in the area and is most acute during the rainy season. Peculiarities of drainage, differences in erodability of the soils, or variation in the density of protective vegetation allows the feeders of one arroyo to cut into and capture the headwaters of adjacent arroyos leading to the concentration of runoff in the second arroyo. Concomintantly, the amount of flow in the first arroyo, the headwaters of which were "pirated"*away, is diminished.

C. Drainage Areas and Channels

At the present time there are three separate drainage areas contributing runoff from the east. However, there appears to be only one semi-major and two minor channels flowing from east to west. The channels are will defined. The largest incoming drainage area contributes about 100 c.f.s. at Juan Tabo Blvd., N.E. (proposed), the eastern boundary of Academy Place, Unit 3.

The runoff from the semi-major and minor drainage areas can be carried by aligning master planned streets in such a way (set property lines high enough) as to carry water across the development and redepositing it in its original channel.

IV. PROPOSED DRAINAGE PLANS

A. General

In order to provide an adequate system of storm drainage for the proposed development it was necessary to:

(1) Determine the drainage areas which can and will contribute storm runoff during a 100 year design storm.

(2) Determine the amount of runoff which could be expected after the entire area is developed.

(3) Determine the points where the storm runoff will concentrate.

(4) Prepare a table of street carrying capacities for use in sizing streets and overflow sections (section above high curb to property line).

(5) Determine the ability of each of the drainage channels, streets plus overflow sections, and structured to handle the runoff that may concentrate on them.

*Reference #1.

25×10

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(5) Determine the ability of each of the drainage channels, streets plus overflow sections, and structured to handle the runoff that may concentrate on them.

*Reference #1.

25×10

(6) Determine and recommend the means by which the expected runoff can be safely carried across the subdivision in the same proportion as it now exists.

(7) Design additional channels and structures adequate to handle the runoff in the area to be developed.

B. Drainage Areas

A study of the photography, Exhibit "A," to determine the areas which could conceivably contribute runoff to the proposed development was made, for which a copy of computatiions is contained in Exhibit "C" of this report. Finally, Exhibit "B", the Master Plan of Drainage, was prepared showing the entire area with directions of flow as well as runoff quantities.

C. Runoff Quantities

The quantities of storm runoff to be expected from each drainage area were determined using the Rational Formula, Q = CIA, where: Q=quantity of storm runoff in cubic feet per second; C=coefficient of runoff dependent upon the type of surface drained; I=intensity of rainfall in inches per hour for a duration equal to the total accumulation time in minutes; and A=area of contributing watershed in acres.

The area (A) of each separate contributing area was determined by outlining the watershed on a scale photograph or the contour map and measuring the area (by planimeter) in acres.

The intensity of rainfall (I) was determined by assuming a 100 year frequency rainfall and then urilizing Intensity Duration Frequency Curves (Chart I) for the Albuquerque Area, "Master Plan of Drainage - City of Albuquerque, New Mexico and Environs," 1963, prepared by Gordon Herkenhoff and Associates, Consulting Engineers, together with expected accumulation of runoff from each of the areas. The total accumulation times are determined by a combination of Yarnell's Method and probable future streets and drainage channel alignments and grades, as shown; assuming overland flows to cross either poor grass, asphalt pavement or bare soil surfaces, depending upon the probable type of development in each area and estimating the probable type of grading to be done in each area; assuming future streets to be asphalt paved with concrete curbs and crowned with either full crown (8"), 3/4 crown (6"), or 1/2 crown (4"). These times of flow were calculated by use of tables on pages 5.00, 5.04, and 5.05 of Design by E.E. Seelye.

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The coefficient of runoff (C) was determined by assuming the maximum possible development in the areas under consideration. A coefficient of 0.65 is used for areas where dense residential development was most probable. A coefficient of 0.70 should be used for commercial areas or where a large amount of the exposed surface is impermeable.

The quantities of runoff are shown along with the areas after development on Exhibit "C", the Master Plan of Drainage for this subdivision.

D. Drainage Channels and Facilities

All existing structure capacities, as well as any future proposed structured, were verified from computer output sheets which form a part of Exhibit "D" and are based on Manning's Equation, Q = AV, where $V=\frac{1.486}{n} R^{2/3} S^{1/2}$ when A=cross-sectional area of the channel or structure; R=hydraulic radius of channel or area divided by wetted perimeter; S=slope of channel or facility in feet per foot; and "n" values of 0.015 for concrete and asphalt surfaces, 0.013 for concrete pipes, and 0.0225 for dirt lined channels or a composite "n" value based on proportional wetted surfaces with different values.

V. CONCLUSIONS AND RECOMMENDATIONS

On the basis of this study and its calculations, it is concluded that the development of this area can be accomplished satisfactorily provided adequate storm drianage is done as recommended below:

1. Flood pervention measures such as proposed in Reference #2 or a similar solution must be operational to prevent the uncontrolled flooding in the area.

2. Runoff quantities furnished in Reference #7 were based on the assumption that the operational channels were in place.

3. Design streets to carry maximum runoffs contained in Exhibit "E" through the use of tables in Exhibit "D". If at all possible, these runoffs should be carried in the streets reserving the overflow sections for excessive (greater than incoming flows shown) runoffs caused after development to the east or Standard Project Floods.

4. Provide diversionary walls on north and south of the area as indicated on Exhibit "B".

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5. A suggested profile of Eubank Blvd., N.E., is shown on page 10 (Exhibit "D") of Reference #8.

6. The proposed drainage study was done under the assumption that Academy Place, Unit 3, would be built prior to or concurrently with Unit 1.

If all of the above recommendations and conclusions are followed, this should provide a very satisfactory subdivision.

Respectfully submitted,

Donald L. Campbell
P.E. & L.S. No. 3633

25×10

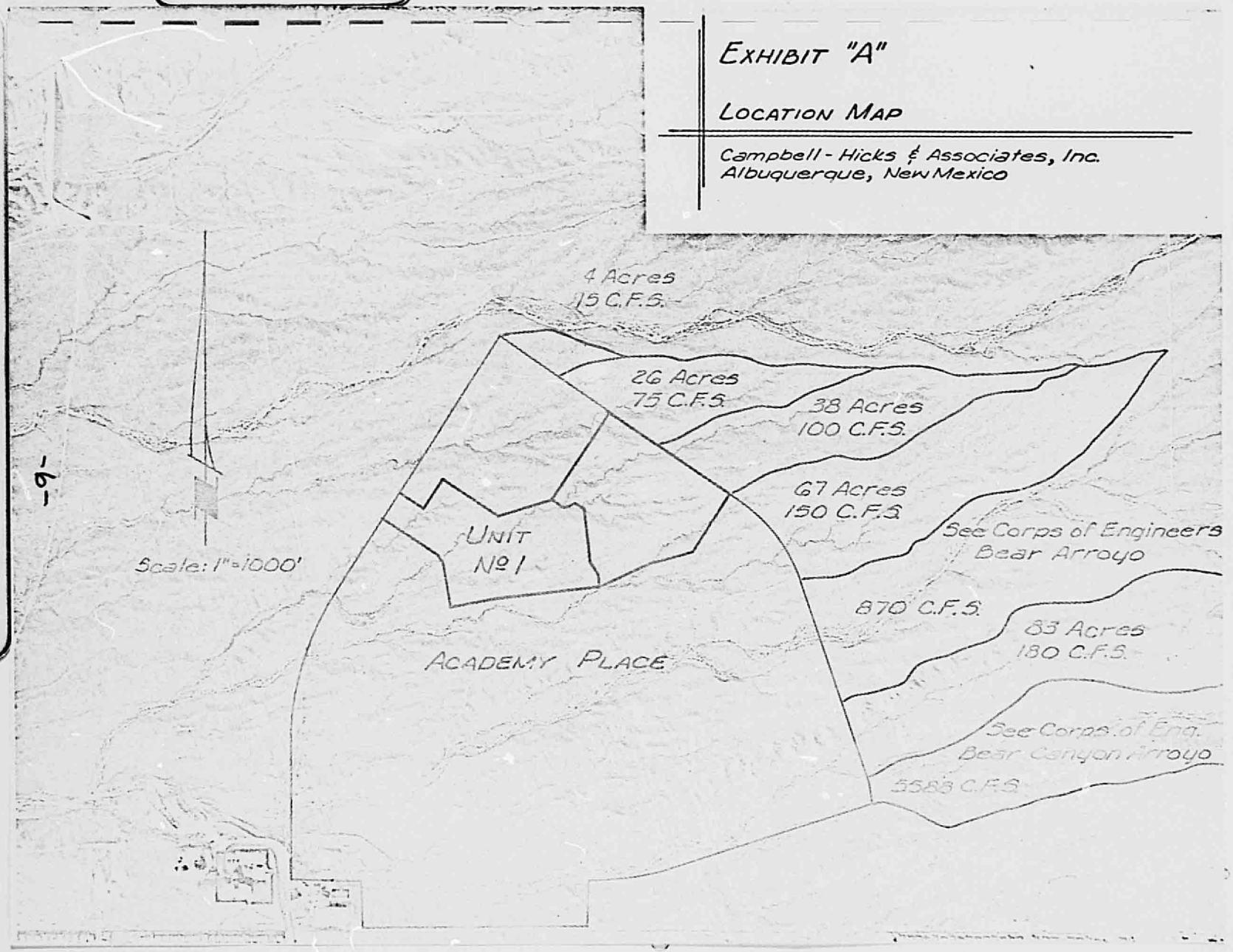

EXHIBIT "A"

LOCATION MAP

Campbell - Hicks & Associates, Inc.
Albuquerque, New Mexico

25 X
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EXHIBIT C

SUMMARY OF RUNOFF COMPUTATIONS

Sheet No.	Area No.	Area in Acres Individual	Area in Acres Total	Expected Runoff (in c.f.s.) Individual	Expected Runoff (in c.f.s.) Total
1	1	3	19	9	50
2	2	2		6	
3	3	1	54	3	148
4	4	1	57	3	157
5	5	2		6	
6	6	1	60	3	166
7	7	5		15	
8	8	1	66	3	184
9	9	3		9	
10	10	1	70	3	196
11	11	5		14	
12	12	1	76	3	213
13	13	3		9	
14	14	2	81	6	228

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RUNOFF COMPUTATIONS

Sheet No. 1

Job No. ACADEMY PLACE UNIT Nº 1

Drainage Area No. 1

Area = 3 acres

Maximum Overland Flow: L = 130' S = 4.6%

Maximum Channel Flow:

Channel No. 1 L = 325' S = 0.5%

Channel No. 2 L = 154' S = 3.9%

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.0 min.

Channel No. 1 Flow:

Velocity= 2.5 ft/sec; Time= $\frac{325}{2.5 \times 60}$ = 2.2 min.

Channel No. 2 Flow:

Velocity= 14.2 ft/sec; Time= $\frac{154}{14.2 \times 60}$ = 0.2 min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 14.4 min.

$I = \frac{189}{T+25} = \frac{189}{39.4} = 4.80$

Q = CIA = (0.65)(4.80)(3) = 9 c.f.s.

TOTALS:

ACRES = 16* + 3 = 19

Q = 41* + 9 = 50

* From Unit-3

Date: 4-18-72

Comp. by: HP

Checked by: TA

25×10

0000 0000 0897

RUNOFF COMPUTATIONS

Sheet No. 2

Job No. ACADEMY PLACE UNIT No 1

Drainage Area No. 2

Area = 2 acres

Maximum Overland Flow: L = 120' S = 1.7%

Maximum Channel Flow:

Channel No. 1 L = 282' S = 1.2%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 13.9 min.

Channel No. 1 Flow:

Velocity= 3.7 ft/sec; Time= $\frac{282}{3.7 \times 60}$ = 1.3 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 15.2 min.

$I = \frac{189}{T+25} = \frac{189}{40.2} = 4.70$

Q = CIA = (0.65)(4.70)(2) = 6 c.f.s.

Date: 4-18-72

Comp. by: HKP

Checked by: TH

25×10

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RUNOFF COMPUTATIONS

Sheet No. 3

Job No Academy Place Unit No 1

Drainage Area No. 3

Area = 1 acres

Maximum Overland Flow: L = 110' S = 3.6%

Maximum Channel Flow:

Channel No. 1 L = 60' S = 0.5%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.0 min.

Channel No. 1 Flow:

Velocity= 2.5 ft/sec; Time= $\frac{60}{2.5 \times 60}$ = 0.4 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 12.4 min.

$I = \frac{189}{T+25} = \frac{189}{37.4} = 5.05$

Q = CIA = (0.65)(5.05)(1) = 3 c.f.s.

Date: 4-18-72

Comp. by: HGP

Checked by: TA

TOTALS:

ACRES = 53* + 1 = 54

Q = 145* + 3 = 148

* From Unit-3

25×

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RUNOFF COMPUTATIONS

Sheet No. 4

Job No Academy Place Unit No 1

Drainage Area No. 4

Area = 1 acres

Maximum Overland Flow: L = 110' S = 1.8%

Maximum Channel Flow:

Channel No. 1 L = 234' S = 4.7%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 13.9 min.

Channel No. 1 Flow:

Velocity= 7.8 ft/sec; Time= $\frac{234}{7.8 \times 60}$ = 0.5 min.

Channel No. 2 Flow:

Velocity=_____ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____min.

Channel No. 3 Flow:

Velocity=_____ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____min.

Total Accumulation Time: T = 14.4 min.

$I = \frac{189}{T+25} = \frac{189}{39.4} = 4.80$

Q = CIA = (0.65)(4.80)(1) = 3 c.f.s.

Date: 4-18-72

Comp. by: HP

Checked by: TA

TOTALS:

ACRES = 54+2+1 = 57

Q = 148+6+3 = 157

25×10

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RUNOFF COMPUTATIONS

Sheet No. 5

Job No. ACADEMY PLACE UNIT No 1

Drainage Area No. 5

Area = 2 acres

Maximum Overland Flow: L = 125' S = 4.8%

Maximum Channel Flow:

Channel No. 1 L = 405' S = 1.6%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.0 min.

Channel No. 1 Flow:

Velocity= 4.4 ft/sec; Time= $\frac{405}{4.4 \times 60}$ = 1.5 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 13.5 min.

$I = \frac{189}{T+25} = \frac{189}{38.5} = 4.91$

Q = CIA = (0.65)(4.91)(2) = 6 c.f.s.

Date: 4-18-72

Comp. by: HGP

Checked by: TA

25×10

0000 0000 0841

RUNOFF COMPUTATIONS

Sheet No. 6

Job No ACADEMY PLACE UNIT Nº 1

Drainage Area No. 6

Area = 1 acres

Maximum Overland Flow: L = 125' S = 4.3%

Maximum Channel Flow:

Channel No. 1 L = 270' S = 2.9%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.1 min.

Channel No. 1 Flow:

Velocity= 6.0 ft/sec; Time= $\frac{270}{6.0 \times 60}$ = 0.8 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 12.9 min.

$I = \frac{189}{T+25} = \frac{189}{37.9} = 4.99$

Q = CIA = (0.65)(4.99)(1) = 3 c.f.s.

Date: 4-18-72

Comp. by: HP

Checked by: TH

TOTALS:

ACRES = 57+2+1 = 60

Q = 157+6+3 = 166

25×10

0000 0000 0842

RUNOFF COMPUTATIONS

Sheet No. 7

Job No Academy Place Unit No 1

Drainage Area No. 7

Area = 5 acres

Maximum Overland Flow: L = 145' S = 2.3%

Maximum Channel Flow:

Channel No. 1 L = 842' S = 1.7%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 14.1 min.

Channel No. 1 Flow:

Velocity= 4.6 ft/sec; Time= $\frac{842}{4.6 \times 60}$ = 3.1 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 17.2 min.

$I = \frac{189}{T+25} = \frac{189}{42.2} = 4.48$

Q = CIA = (0.65)(4.48)(5) = 15 c.f.s.

Date: 4-18-72

Comp. by: HR

Checked by: TL

25×10

0000 0000 0843

RUNOFF COMPUTATIONS

Sheet No. 8

Job No. ACADEMY PLACE UNIT No 1

Drainage Area No. 8

Area = 1 acres

Maximum Overland Flow: L = 145' S = 3.5%

Maximum Channel Flow:

Channel No. 1 L = 270' S = 2.7%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 13.2 min.

Channel No. 1 Flow:

Velocity= 5.8 ft/sec; Time= $\frac{270}{5.8 \times 60}$ = 0.8 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 14.0 min.

$I = \frac{189}{T+25} = \frac{189}{39.0} = 4.85$

Q = CIA = (0.65)(4.85)(1) = 3 c.f.s.

TOTALS:

ACRES = 60+5+1 = 66

Q = 166+15+3 = 184

Date: 4-18-72

Comp. by: HEP

Checked by: TA

25×10

0000 0000 0844

RUNOFF COMPUTATIONS

Sheet No. 9

Job No. ACADEMY PLACE
Unit No. 1

Drainage Area No. 9

Area = 3 acres

Maximum Overland Flow: L = 150' S = 3.3%

Maximum Channel Flow:

Channel No. 1 L = 423' S = 0.5%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.8 min.

Channel No. 1 Flow:

Velocity= 2.5 ft/sec; Time= $\frac{423}{2.5 \times 60}$ = 2.8 min.

Channel No. 2 Flow:

Velocity=_____ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____min.

Channel No. 3 Flow:

Velocity=_____ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____min.

Total Accumulation Time: T = 15.6 min.

$I = \frac{189}{T+25} = \frac{189}{40.6} = 4.66$

Q = CIA = (0.45)(4.66)(3) = 9 c.f.s.

Date: 4-18-72

Comp. by: HP

Checked by: TA

25×10

0000 0000 0845

RUNOFF COMPUTATIONS

Sheet No. 10

Job No. ACADEMY PLACE UNIT No 1

Drainage Area No. 10

Area = 1 acres

Maximum Overland Flow: L = 145' S = 5.3%

Maximum Channel Flow:

Channel No. 1 L = 212' S = 4.4%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.1 min.

Channel No. 1 Flow:

Velocity= 7.5 ft/sec; Time= $\frac{212}{7.5 \times 60}$ = 0.5 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 12.6 min.

$I = \frac{189}{T+25} = \frac{189}{37.6} = 5.03$

Q = CIA = (0.65)(5.03)(1) = 3 c.f.s.

Date: 4-18-72

Comp. by: HP

Checked by: TA

TOTALS:

AREA = 66+3+1 = 70

Q = 184+9+3 = 196

25×10

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RUNOFF COMPUTATIONS

Sheet No. 11

Job No. Academy Acres Unit No 1

Drainage Area No. 11

Area = 5 acres

Maximum Overland Flow: L = 195-' S = 1.6 %

Maximum Channel Flow:

Channel No. 1 L = 744 S = 1.5 %

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 17.3 min.

Channel No. 1 Flow:

Velocity= 4.3 ft/sec; Time= $\frac{744}{4.3 \times 60}$ = 2.9 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\times 60}$ = _____ min.

Total Accumulation Time: T = 20.2 min.

$I = \frac{189}{T+25} = \frac{189}{45.2} = 4.18$

Q = CIA = (0.65)(4.18)(5) = 14 c.f.s.

Date: 4-18-72

Comp. by: HP

Checked by: TH

25×

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RUNOFF COMPUTATIONS

Sheet No. 12

Job No. ACADEMY PLACE UNIT No 1

Drainage Area No. 12

Area = 1 acres

Maximum Overland Flow: L = 145' S = 3.4%

Maximum Channel Flow:

Channel No. 1 L = 198' S = 1.3%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 13.3 min.

Channel No. 1 Flow:

Velocity= 4.0 ft/sec; Time= $\frac{198}{4.0 \times 60}$ = 0.8 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 14.1 min.

$I = \frac{189}{T+25} = \frac{189}{39.1} = 4.83$

Q = CIA = (0.65)(4.83)(1) = 3 c.f.s.

TOTALS:

ACRES = 70+5+1 = 76

Q = 196+14+3 = 213

Date: 4-18-72

Comp. by: HP

Checked by: TA

25×10

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RUNOFF COMPUTATIONS

Sheet No. 13

Job No. ACADEMY PLACE UNIT No 1

Drainage Area No. 13

Area = 3 acres

Maximum Overland Flow: L = 195' S = 4.2 %

Maximum Channel Flow:

Channel No. 1 L = 679' S = 1.5 %

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 14.3 min.

Channel No. 1 Flow:

Velocity= 4.3 ft/sec; Time= $\frac{679}{4.3 \times 60}$ = 2.6 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 16.9 min.

$I = \frac{187}{T+25} = \frac{189}{41.9} = 4.51$

Q = CIA = (0.65)(4.51)(3) = 9 c.f.s.

Date: 4-18-72

Comp. by: HEP

Checked by: TA

25×10

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RUNOFF COMPUTATIONS

Sheet No. 14

Job No ACADEMY PLACE UNIT NO 1

Drainage Area No. 14

Area = 2 acres

Maximum Overland Flow: L = 130' S = 4.6%

Maximum Channel Flow:

Channel No. 1 L = 388' S = 2.6%

Channel No. 2 L = _____ S = _____

Channel No. 3 L = _____ S = _____

Accumulation Time

Overland Flow: 12.1 min.

Channel No. 1 Flow:

Velocity= 5.7 ft/sec; Time= $\frac{388}{5.7 \times 60}$ = 1.1 min.

Channel No. 2 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Channel No. 3 Flow:

Velocity= _____ ft/sec; Time= $\frac{\quad}{\quad \times 60}$ = _____ min.

Total Accumulation Time: T = 13.2 min.

$I = \frac{189}{T+25} = \frac{189}{38.2} = 4.95$

Q = CIA = (0.65)(4.95)(2) = 6 c.f.s.

Date: 4-18-72

Comp. by: [illegible]

Checked by: [illegible]

TOTAL

ACRES = 76+3+2 = 81

Q = 213+9+6 = 228

25×10

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09/21/71. 09.48.14.
PROGRAM SAPLAN

EXHIBIT D

FACE TO FACE = ? 32
CORE = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	7.1111	33.3703	.0050	.0707	.2131	.3568	2.4992	17.7719
.0150	7.1111	33.3703	.0100	.1000	.2131	.3568	3.5344	25.1333
.0150	7.1111	33.3703	.0150	.1225	.2131	.3568	4.3287	30.7819
.0150	7.1111	33.3703	.0200	.1414	.2131	.3568	4.9984	35.5439
.0150	7.1111	33.3703	.0250	.1581	.2131	.3568	5.5883	39.7392
.0150	7.1111	33.3703	.0300	.1732	.2131	.3568	6.1217	43.5322
.0150	7.1111	33.3703	.0350	.1871	.2131	.3568	6.6122	47.0201
.0150	7.1111	33.3703	.0400	.2000	.2131	.3568	7.0687	50.2666

FACE TO FACE = ? 32
CORE = ? 8
CROWN = ? 6

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	10.6667	33.3542	.0050	.0707	.3198	.4676	3.2759	34.9430
.0150	10.6667	33.3542	.0100	.1000	.3198	.4676	4.6398	49.4169
.0150	10.6667	33.3542	.0150	.1225	.3198	.4676	5.6740	60.5231
.0150	10.6667	33.3542	.0200	.1414	.3198	.4676	6.5518	69.8660
.0150	10.6667	33.3542	.0250	.1581	.3198	.4676	7.3252	78.1350
.0150	10.6667	33.3542	.0300	.1732	.3198	.4676	8.0243	85.5926
.0150	10.6667	33.3542	.0350	.1871	.3198	.4676	8.6678	92.4505
.0150	10.6667	33.3542	.0400	.2000	.3198	.4676	9.2667	98.8338

FACE TO FACE = ? 32
CORE = ? 8
CROWN = ? 4

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	14.2222	33.3426	.0050	.0707	.4265	.5666	3.9694	56.4537
.0150	14.2222	33.3426	.0100	.1000	.4265	.5666	5.6136	79.8375
.0150	14.2222	33.3426	.0150	.1225	.4265	.5666	6.8752	97.7806
.0150	14.2222	33.3426	.0200	.1414	.4265	.5666	7.9388	112.9073
.0150	14.2222	33.3426	.0250	.1581	.4265	.5666	8.8758	126.2342
.0150	14.2222	33.3426	.0300	.1732	.4265	.5666	9.7230	138.2927
.0150	14.2222	33.3426	.0350	.1871	.4265	.5666	10.5020	149.3623
.0150	14.2222	33.3426	.0400	.2000	.4265	.5666	11.2278	159.6751

FACE TO FACE = ? 32
CORE = ? 8
CROWN = ? 2

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	17.7778	33.3356	.0050	.0707	.5333	.6576	4.6067	81.8979
.0150	17.7778	33.3356	.0100	.1000	.5333	.6576	6.5149	115.8201
.0150	17.7778	33.3356	.0150	.1225	.5333	.6576	7.9791	141.8501
.0150	17.7778	33.3356	.0200	.1414	.5333	.6576	9.2134	163.7944
.0150	17.7778	33.3356	.0250	.1581	.5333	.6576	10.3009	183.1977
.0150	17.7778	33.3356	.0300	.1732	.5333	.6576	11.2841	200.6064
.0150	17.7778	33.3356	.0350	.1871	.5333	.6576	12.1882	216.6796
.0150	17.7778	33.3356	.0400	.2000	.5333	.6576	13.0898	231.6403

FACE

0.640 / 1.192 /

25×10

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50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	15.3611	51.3731	.0050	.0707	.2990	.4472	2.8545	43.8477
.0165	15.3611	51.3731	.0100	.1000	.2990	.4472	420368	62.0100
.0165	15.3611	51.3731	.0150	.1225	.2990	.4472	4.9441	75.9464
.0165	15.3611	51.3731	.0200	.1414	.2990	.4472	5.7089	87.6954
.0165	15.3611	51.3731	.0250	.1581	.2990	.4472	6.3828	98.0464
.0165	15.3611	51.3731	.0300	.1732	.2990	.4472	6.9920	107.4045
.0165	15.3611	51.3731	.0350	.1871	.2990	.4472	7.5522	116.0101
.0165	15.3611	51.3731	.0400	.2000	.2990	.4472	8.0736	124.0200

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	18.9167	51.3569	.0050	.0707	.3683	.5138	3.2801	62.0482
.0165	18.9167	51.3569	.0100	.1000	.3683	.5138	4.6387	87.7494
.0165	18.9167	51.3569	.0150	.1225	.3683	.5138	5.6813	107.4706
.0165	18.9167	51.3569	.0200	.1414	.3683	.5138	6.5602	124.0964
.0165	18.9167	51.3569	.0250	.1581	.3683	.5138	7.3345	138.7439
.0165	18.9167	51.3569	.0300	.1732	.3683	.5138	8.0345	151.9864
.0165	18.9167	51.3569	.0350	.1871	.3683	.5138	8.6783	164.1640
.0165	18.9167	51.3569	.0400	.2000	.3683	.5138	9.2775	175.4988

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	22.4722	51.3453	.0050	.0707	.4377	.5765	3.6797	82.6903
.0165	22.4722	51.3453	.0100	.1000	.4377	.5765	5.2038	116.9417
.0165	22.4722	51.3453	.0150	.1225	.4377	.5765	6.3734	143.2238
.0165	22.4722	5123453	.0200	.1414	.4377	.5765	7.3593	165.3806
.0165	22.4722	51.3453	.0250	.1581	.4377	.5765	8.2280	184.9011
.0165	22.4722	51.3453	.0300	.1732	.4377	.5765	9.0133	202.5490
.0165	22.4722	51.3453	.0350	.1871	.4377	.5765	9.7355	218.7780
.0165	22.4722	51.3453	.0400	.2000	.4377	.5765	10.4077	233.8835

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	26.0278	51.3384	.0050	.0707	.5070	.6358	4.0585	105.6348
.0165	26.0278	51.3384	.0100	.1000	.5070	.6358	5.7396	149.3901
.0165	26.0278	51.3384	.0150	.1225	.5070	.6358	7.0296	182.9648
.0165	26.0278	51.3384	.0200	.1414	.5070	.6358	8.1171	211.2696
.0165	26.0278	51.3384	.0250	.1581	.5070	.6358	9.0752	236.2066
.0165	26.0278	51.3384	.0300	.1732	.5070	.6358	9.9414	258.7513
.0165	26.0278	51.3384	.0350	.1871	.5070	.6358	10.7379	279.4834
.0165	26.0278	51.3384	.0400	.2000	.5070	.6358	11.4793	298.7803

25×10

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50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	24.3611	51.3904	.0050	.0707	.4740	.6080	3.8805	94.5336
.0165	24.3611	51.3904	.0100	.1000	.4740	.6080	5.4879	133.6907
.0165	24.3611	51.3904	.0150	.1225	.4740	.6080	6.7212	163.7370
.0165	24.3611	51.3904	.0200	.1414	.4740	.6080	7.7610	189.0672
.0165	24.3611	51.3904	.0250	.1581	.4740	.6080	8.6771	211.3836
.0165	24.3611	51.3904	.0300	.1732	.4740	.6080	9.5053	231.5591
.0165	24.3611	51.3904	.0350	.1871	.4740	.6080	10.2669	250.1124
.0165	24.3611	51.3904	.0400	.2000	.4740	.6080	10.9757	267.3814

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	27.9167	51.3742	.0050	.0707	.5434	.6659	4.2502	118.6523
.0165	27.9167	51.3742	.0100	.1000	.5434	.6659	6.0107	167.7996
.0165	27.9167	51.3742	.0150	.1225	.5434	.6659	7.3616	205.5117
.0165	27.9167	51.3742	.0200	.1414	.5434	.6659	8.5005	237.3045
.0165	27.9167	51.3742	.0250	.1581	.5434	.6659	9.5038	265.3145
.0165	27.9167	51.3742	.0300	.1732	.5434	.6659	10.4109	290.6375
.0165	27.9167	51.3742	.0350	.1871	.5434	.6659	11.2451	313.9244
.0165	27.9167	51.3742	.0400	.2000	.5434	.6659	12.0215	335.5993

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	31.4722	51.3626	.0050	.0707	.6127	.7214	4.6045	144.9124
.0165	31.4722	51.3626	.0100	.1000	.6127	.7214	6.5117	204.9371
.0165	31.4722	51.3626	.0150	.1225	.6127	.7214	7.9751	250.9957
.0165	31.4722	51.3626	.0200	.1414	.6127	.7214	9.2089	289.8248
.0165	31.4722	51.3626	.0250	.1581	.6127	.7214	10.2959	324.0340
.0165	31.4722	51.3626	.0300	.1732	.6127	.7214	11.2786	354.9615
.0165	31.4722	51.3626	.0350	.1871	.6127	.7214	12.1822	383.4022
.0165	31.4722	51.3626	.0400	.2000	.6127	.7214	13.0234	409.8742

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	35.0278	51.3557	.0050	.0707	.6821	.7748	4.9454	173.2267
.0165	35.0278	51.3557	.0100	.1000	.6821	.7748	6.9939	244.9795
.0165	35.0278	51.3557	.0150	.1225	.6821	.7748	8.5657	300.0374
.0165	35.0278	51.3557	.0200	.1414	.6821	.7748	9.8908	346.4534
.0165	35.0278	51.3557	.0250	.1581	.6821	.7748	11.0583	387.3466
.0165	35.0278	51.3557	.0300	.1732	.6821	.7748	12.1137	424.3170
.0165	35.0278	51.3557	.0350	.1871	.6821	.7748	13.0843	458.3147
.0165	35.0278	51.3557	.0400	.2000	.6821	.7748	13.9877	489.9590

25×10

50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	33.3611	51.4236	.0050	.0707	.6488	.7494	4.7822	159.5397
.0165	33.3611	51.4236	.0100	.1000	.6488	.7494	6.7631	225.6231
.0165	33.3611	51.4236	.0150	.1225	.6488	.7494	8.2830	276.3308
.0165	33.3611	51.4236	.0200	.1414	.6488	.7494	9.5644	319.0793
.0165	33.3611	51.4236	.0250	.1581	.6488	.7494	10.6933	356.7415
.0165	33.3611	51.4236	.0300	.1732	.6488	.7494	11.7140	390.7908
.0165	33.3611	51.4236	.0350	.1871	.6488	.7494	12.6525	422.1023
.0165	33.3611	51.4236	.0400	.2000	.6488	.7494	13.5261	451.2463

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	36.9167	51.4074	.0050	.0707	.7181	.8019	5.1172	188.9082
.0165	36.9167	51.4074	.0100	.1000	.7181	.8019	7.2367	267.1566
.0165	36.9167	51.4074	.0150	.1225	.7181	.8019	8.8632	327.1987
.0165	36.9167	51.4074	.0200	.1414	.7181	.8019	10.2343	377.8165
.0165	36.9167	51.4074	.0250	.1581	.7181	.8019	11.4423	422.4116
.0165	36.9167	51.4074	.0300	.1732	.7181	.8019	12.5344	462.7288
.0165	36.9167	51.4074	.0350	.1871	.7181	.8019	13.5387	499.8042
.0165	36.9167	51.4074	.0400	.2000	.7181	.8019	14.4735	534.3132

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	40.4722	51.3958	.0050	.0707	.7875	.8527	5.4414	220.2241
.0165	40.4722	51.3958	.0100	.1000	.7875	.8527	7.6953	311.4440
.0165	40.4722	51.3958	.0150	.1225	.7875	.8527	9.4247	381.4394
.0165	40.4722	51.3958	.0200	.1414	.7875	.8527	10.8827	440.4483
.0165	40.4722	51.3958	.0250	.1581	.7875	.8527	12.1673	492.4362
.0165	40.4722	51.3958	.0300	.1732	.7875	.8527	13.3286	539.4368
.0165	40.4722	51.3958	.0350	.1871	.7875	.8527	14.3965	582.6583
.0165	40.4722	51.3958	.0400	.2000	.7875	.8527	15.3905	622.8879

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .6' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	44.0278	51.3889	.0050	.0707	.8568	.9021	5.7560	253.4243
.0165	44.0278	51.3889	.0100	.1000	.8568	.9021	8.1402	358.3961
.0165	44.0278	51.3889	.0150	.1225	.8568	.9021	9.9697	438.9438
.0165	44.0278	51.3889	.0200	.1414	.8568	.9021	11.5120	506.8487
.0165	44.0278	51.3889	.0250	.1581	.8568	.9021	12.8708	566.6741
.0165	44.0278	51.3889	.0300	.1732	.8568	.9021	14.0993	620.7603
.0165	44.0278	51.3889	.0350	.1871	.8568	.9021	15.2290	670.4978
.0165	44.0278	51.3889	.0400	.2000	.8568	.9021	16.2805	716.7923

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50' R.O.W. 32' FACE-FACE 8" CURB 8" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	37.8611	51.4461	.0050	.0707	.7359	.8151	5.2008	196.9066
.0165	37.8611	51.4461	.0100	.1000	.7359	.8151	7.3550	278.4680
.0165	37.8611	51.4461	.0150	.1225	.7359	.8151	9.0080	341.0523
.0165	37.8611	51.4461	.0200	.1414	.7359	.8151	10.4015	393.8132
.0165	37.8611	51.4461	.0250	.1581	.7359	.8151	11.6293	440.2966
.0165	37.8611	51.4461	.0300	.1732	.7359	.8151	12.7392	482.3207
.0165	37.8611	51.4461	.0350	.1871	.7359	.8151	13.7599	520.9659
.0165	37.8611	51.4461	.0400	.2000	.7359	.8151	14.7100	556.9360

50' R.O.W. 32' FACE-FACE 8" CURB 6" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	41.4167	51.4299	.0050	.0707	.8053	.8656	5.5225	228.7225
.0165	41.4167	51.4299	.0100	.1000	.8053	.8656	7.8100	323.4624
.0165	41.4167	51.4299	.0150	.1225	.8053	.8656	9.5652	396.1589
.0165	41.4167	51.4299	.0200	.1414	.8053	.8656	11.0449	457.4449
.0165	41.4167	51.4299	.0250	.1581	.8053	.8656	12.3486	511.4390
.0165	41.4167	51.4299	.0300	.1732	.8053	.8656	13.5272	560.2533
.0165	41.4167	51.4299	.0350	.1871	.8053	.8656	14.6111	605.1428
.0165	41.4167	51.4299	.0400	.2000	.8053	.8656	15.6199	646.9248

50' R.O.W. 32' FACE-FACE 8" CURB 4" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	44.9722	51.4184	.0050	.0707	.8746	.9146	5.8349	262.4101
.0165	44.9722	51.4184	.0100	.1000	.8746	.9146	8.2518	371.1039
.0165	44.9722	51.4184	.0150	.1225	.8746	.9146	10.1064	454.5076
.0165	44.9722	51.4184	.0200	.1414	.8746	.9146	11.6699	524.8202
.0165	44.9722	51.4184	.0250	.1581	.8746	.9146	13.0473	586.7668
.0165	44.9722	51.4184	.0300	.1732	.8746	.9146	14.2926	642.7709
.0165	44.9722	51.4184	.0350	.1871	.8746	.9146	15.4378	694.2719
.0165	44.9722	51.4184	.0400	.2000	.8746	.9146	16.5037	742.2079

50' R.O.W. 32' FACE-FACE 8" CURB 2" CROWN .7' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0165	48.5278	51.4114	.0050	.0707	.9439	.9622	6.1390	297.9142
.0165	48.5278	51.4114	.0100	.1000	.9439	.9622	8.6819	421.3143
.0165	48.5278	51.4114	.0150	.1225	.9439	.9622	10.6331	516.0025
.0165	48.5278	51.4114	.0200	.1414	.9439	.9622	12.2781	595.8284
.0165	48.5278	51.4114	.0250	.1581	.9439	.9622	13.7273	666.1564
.0165	48.5278	51.4114	.0300	.1732	.9439	.9622	15.0375	729.7377
.0165	48.5278	51.4114	.0350	.1871	.9439	.9622	16.2424	788.2068
.0165	48.5278	51.4114	.0400	.2000	.9439	.9622	17.3638	842.6286

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FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 8

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	10.6667	49.3580	.0050	.0707	.2161	.3601	2.5227	26.9084
.0150	10.6667	49.3580	.0100	.1000	.2161	.3601	3.5676	38.0543
.0150	10.6667	49.3580	.0150	.1225	.2161	.3601	4.3694	46.6068
.0150	10.6667	49.3580	.0200	.1414	.2161	.3601	5.0453	53.8169
.0150	10.6667	49.3580	.0250	.1581	.2161	.3601	5.6409	60.1691
.0150	10.6667	49.3580	.0300	.1732	.2161	.3601	6.1792	65.9120
.0150	10.6667	49.3580	.0350	.1871	.2161	.3601	6.6743	71.1931
.0150	10.6667	49.3580	.0400	.2000	.2161	.3601	7.1352	76.1086

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 6

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	16.0000	49.3472	.0050	.0707	.3242	.4720	3.3061	52.8978
.0150	16.0000	49.3472	.0100	.1000	.3242	.4720	4.6755	74.8088
.0150	16.0000	49.3472	.0150	.1225	.3242	.4720	5.7264	91.6216
.0150	16.0000	49.3472	.0200	.1414	.3242	.4720	6.6122	105.7955
.0150	16.0000	49.3472	.0250	.1581	.3242	.4720	7.3927	118.2830
.0150	16.0000	49.3472	.0300	.1732	.3242	.4720	8.0983	129.5726
.0150	16.0000	49.3472	.0350	.1871	.3242	.4720	8.7471	139.9544
.0150	16.0000	49.3472	.0400	.2000	.3242	.4720	9.3511	149.6175

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 4

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	21.3333	49.3395	.0050	.0707	.4324	.5718	4.0055	85.4504
.0150	21.3333	49.3395	.0100	.1000	.4324	.5718	5.6646	120.8451
.0150	21.3333	49.3395	.0150	.1225	.4324	.5718	6.9377	148.0044
.0150	21.3333	49.3395	.0200	.1414	.4324	.5718	8.0110	170.9007
.0150	21.3333	49.3395	.0250	.1581	.4324	.5718	8.9565	191.0728
.0150	21.3333	49.3395	.0300	.1732	.4324	.5718	9.8114	209.3098
.0150	21.3333	49.3395	.0350	.1871	.4324	.5718	10.5975	226.0804
.0150	21.3333	49.3395	.0400	.2000	.4324	.5718	11.3292	241.6901

FACE TO FACE = ? 48
CURB = ? 8
CROWN = ? 2

N	A	P	S	S1/2	R	R2/3	V	Q
.0150	26.6667	49.3349	.0050	.0707	.5405	.6636	4.6482	123.9532
.0150	26.6667	49.3349	.0100	.1000	.5405	.6636	6.5736	175.2963
.0150	26.6667	49.3349	.0150	.1225	.5405	.6636	8.0510	214.6932
.0150	26.6667	49.3349	.0200	.1414	.5405	.6636	9.2965	247.9064
.0150	26.6667	49.3349	.0250	.1581	.5405	.6636	10.3938	277.1678
.0150	26.6667	49.3349	.0300	.1732	.5405	.6636	11.3858	303.6221
.0150	26.6667	49.3349	.0350	.1871	.5405	.6636	12.2981	327.9493
.0150	26.6667	49.3349	.0400	.2000	.5405	.6636	13.1472	350.5926

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64' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	22.0000	65.3614	.0050	.0707	.3366	.4839	3.1940	70.2688
.0159	22.0000	65.3614	.0100	.1000	.3366	.4839	4.5170	99.3750
.0159	22.0000	65.3614	.0150	.1225	.3366	.4839	5.5322	121.7090
.0159	22.0000	65.3614	.0200	.1414	.3366	.4839	6.3881	140.5375
.0159	22.0000	65.3614	.0250	.1581	.3366	.4839	7.1421	157.1257
.0159	22.0000	65.3614	.0300	.1732	.3366	.4839	7.8238	172.1226
.0159	22.0000	65.3614	.0350	.1871	.3366	.4839	8.4506	185.9136
.0159	22.0000	65.3614	.0400	.2000	.3366	.4839	9.0341	198.7500

64' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	27.3333	65.3506	.0050	.0707	.4183	.5593	3.6917	100.9073
.0159	27.3333	65.3506	.0100	.1000	.4183	.5593	5.2209	142.7044
.0159	27.3333	65.3506	.0150	.1225	.4183	.5593	6.3943	174.7765
.0159	27.3333	65.3506	.0200	.1414	.4183	.5593	7.3835	201.8145
.0159	27.3333	65.3506	.0250	.1581	.4183	.5593	8.2550	225.6355
.0159	27.3333	65.3506	.0300	.1732	.4183	.5593	9.0429	247.1713
.0159	27.3333	65.3506	.0350	.1871	.4183	.5593	9.7674	266.9755
.0159	27.3333	65.3506	.0400	.2000	.4183	.5593	10.4418	285.4089

64' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	32.6667	65.3429	.0050	.0707	.4999	.6299	4.1579	135.8232
.0159	32.6667	65.3429	.0100	.1000	.4999	.6299	5.8801	192.0830
.0159	32.6667	65.3429	.0150	.1225	.4999	.6299	7.2016	235.2527
.0159	32.6667	65.3429	.0200	.1414	.4999	.6299	8.3157	271.6465
.0159	32.6667	65.3429	.0250	.1581	.4999	.6299	9.2972	303.7100
.0159	32.6667	65.3429	.0300	.1732	.4999	.6299	10.1846	332.6976
.0159	32.6667	65.3429	.0350	.1871	.4999	.6299	11.0006	359.3545
.0159	32.6667	65.3429	.0400	.2000	.4999	.6299	11.7602	384.1661

64' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN .2' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	38.0000	65.3383	.0050	.0707	.5816	.6968	4.5991	174.7662
.0159	38.0000	65.3383	.0100	.1000	.5816	.6968	6.5041	247.1567
.0159	38.0000	65.3383	.0150	.1225	.5816	.6968	7.9659	302.7039
.0159	38.0000	65.3383	.0200	.1414	.5816	.6968	9.1982	349.5324
.0159	38.0000	65.3383	.0250	.1581	.5816	.6968	10.2839	390.7891
.0159	38.0000	65.3383	.0300	.1732	.5816	.6968	11.2655	428.0880
.0159	38.0000	65.3383	.0350	.1871	.5816	.6968	12.1681	462.3879
.0159	38.0000	65.3383	.0400	.2000	.5816	.6968	13.0082	494.3134

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64' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN .3' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	28.0000	65.3697	.0050	.0707	.4283	.5682	3.7506	105.0174
.0159	28.0000	65.3697	.0100	.1000	.4283	.5682	5.3042	148.5171
.0159	28.0000	65.3697	.0150	.1225	.4283	.5682	6.4963	181.8955
.0159	28.0000	65.3697	.0200	.1414	.4283	.5682	7.5012	210.0349
.0159	28.0000	65.3697	.0250	.1581	.4283	.5682	8.3866	234.8261
.0159	28.0000	65.3697	.0300	.1732	.4283	.5682	9.1871	257.2391
.0159	28.0000	65.3697	.0350	.1871	.4283	.5682	9.9232	277.8500
.0159	28.0000	65.3697	.0400	.2000	.4283	.5682	10.6084	297.0342

64' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN .3' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	33.3333	65.3589	.0050	.0707	.5100	.6383	4.2133	140.4450
.0159	33.3333	65.3589	.0100	.1000	.5100	.6383	5.9586	198.6192
.0159	33.3333	65.3589	.0150	.1225	.5100	.6383	7.2977	243.2579
.0159	33.3333	65.3589	.0200	.1414	.5100	.6383	8.4267	280.8900
.0159	33.3333	65.3589	.0250	.1581	.5100	.6383	9.4213	314.0446
.0159	33.3333	65.3589	.0300	.1732	.5100	.6383	10.3206	344.0186
.0159	33.3333	65.3589	.0350	.1871	.5100	.6383	11.1475	371.5825
.0159	33.3333	65.3589	.0400	.2000	.5100	.6383	11.9172	397.2384

64' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN .3' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	38.6667	65.3512	.0050	.0707	.5917	.7048	4.6519	179.8736
.0159	38.6667	65.3512	.0100	.1000	.5917	.7048	6.5788	254.3797
.0159	38.6667	65.3512	.0150	.1225	.5917	.7048	8.0573	311.5502
.0159	38.6667	65.3512	.0200	.1414	.5917	.7048	9.3038	359.7472
.0159	38.6667	65.3512	.0250	.1581	.5917	.7048	10.4020	402.2096
.0159	38.6667	65.3512	.0300	.1732	.5917	.7048	11.3948	440.5986
.0159	38.6667	65.3512	.0350	.1871	.5917	.7048	12.3078	475.9009
.0159	38.6667	65.3512	.0400	.2000	.5917	.7048	13.1576	508.7594

64' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN .3' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	44.0000	65.3466	.0050	.0707	.6733	.7682	5.0706	223.1068
.0159	44.0000	65.3466	.0100	.1000	.6733	.7682	7.1709	315.5206
.0159	44.0000	65.3466	.0150	.1225	.6733	.7682	8.7826	386.4323
.0159	44.0000	65.3466	.0200	.1414	.6733	.7682	10.1412	446.2136
.0159	44.0000	65.3466	.0250	.1581	.6733	.7682	11.3382	498.8819
.0159	44.0000	65.3466	.0300	.1732	.6733	.7682	12.4204	546.4978
.0159	44.0000	65.3466	.0350	.1871	.6733	.7682	13.4156	590.2851
.0159	44.0000	65.3466	.0400	.2000	.6733	.7682	14.3418	631.0413

64' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	34.0000	65.3830	.0050	.0707	.5200	.6467	4.2680	145.1111
.0159	34.0000	65.3830	.0100	.1000	.5200	.6467	6.0358	205.2182
.0159	34.0000	65.3830	.0150	.1225	.5200	.6467	7.3923	251.3399
.0159	34.0000	65.3830	.0200	.1414	.5200	.6467	8.5359	290.2223
.0159	34.0000	65.3830	.0250	.1581	.5200	.6467	9.5435	324.4784
.0159	34.0000	65.3830	.0300	.1732	.5200	.6467	10.4544	355.4483
.0159	34.0000	65.3830	.0350	.1871	.5200	.6467	11.2920	383.9280
.0159	34.0000	65.3830	.0400	.2000	.5200	.6467	12.0717	410.4363

64' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	39.3333	65.3722	.0050	.0707	.6017	.7127	4.7038	185.0181
.0159	39.3333	65.3722	.0100	.1000	.6017	.7127	6.6522	261.6551
.0159	39.3333	65.3722	.0150	.1225	.6017	.7127	8.1473	320.4607
.0159	39.3333	65.3722	.0200	.1414	.6017	.7127	9.4077	370.0362
.0159	39.3333	65.3722	.0250	.1581	.6017	.7127	10.5181	413.7130
.0159	39.3333	65.3722	.0300	.1732	.6017	.7127	11.5220	453.1999
.0159	39.3333	65.3722	.0350	.1871	.6017	.7127	12.4452	489.5118
.0159	39.3333	65.3722	.0400	.2000	.6017	.7127	13.3045	523.3102

64' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	44.6667	65.3645	.0050	.0707	.6833	.7758	5.1204	228.7091
.0159	44.6667	65.3645	.0100	.1000	.6833	.7758	7.2413	323.4434
.0159	44.6667	65.3645	.0150	.1225	.6833	.7758	8.8687	396.1357
.0159	44.6667	65.3645	.0200	.1414	.6833	.7758	10.2407	457.4181
.0159	44.6667	65.3645	.0250	.1581	.6833	.7758	11.4495	511.4090
.0159	44.6667	65.3645	.0300	.1732	.6833	.7758	12.5422	560.2205
.0159	44.6667	65.3645	.0350	.1871	.6833	.7758	13.5472	605.1073
.0159	44.6667	65.3645	.0400	.2000	.6833	.7758	14.4825	646.8869

64' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN .4' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	50.0000	65.3599	.0050	.0707	.7650	.8364	5.5205	276.0236
.0159	50.0000	65.3599	.0100	.1000	.7650	.8364	7.8071	390.3563
.0159	50.0000	65.3599	.0150	.1225	.7650	.8364	9.5617	478.0869
.0159	50.0000	65.3599	.0200	.1414	.7650	.8364	11.0409	552.0472
.0159	50.0000	65.3599	.0250	.1581	.7650	.8364	12.3441	617.2075
.0159	50.0000	65.3599	.0300	.1732	.7650	.8364	13.5223	676.1169
.0159	50.0000	65.3599	.0350	.1871	.7650	.8364	14.6058	730.2897
.0159	50.0000	65.3599	.0400	.2000	.7650	.8364	15.6143	780.7126

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64' R.O.W. 48' FACE-FACE 8" CURB 8" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	40.0000	65.4013	.0050	.0707	.6116	.7205	4.7549	190.1976
.0159	40.0000	65.4013	.0100	.1000	.6116	.7205	6.7245	268.9800
.0159	40.0000	65.4013	.0150	.1225	.6116	.7205	8.2358	329.4319
.0159	40.0000	65.4013	.0200	.1414	.6116	.7205	9.5099	380.3952
.0159	40.0000	65.4013	.0250	.1581	.6116	.7205	10.6324	425.2947
.0159	40.0000	65.4013	.0300	.1732	.6116	.7205	11.6472	465.8870
.0159	40.0000	65.4013	.0350	.1871	.6116	.7205	12.5804	503.2155
.0159	40.0000	65.4013	.0400	.2000	.6116	.7205	13.4490	537.9600

64' R.O.W. 48' FACE-FACE 8" CURB 6" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	45.3333	65.3905	.0050	.0707	.6933	.7833	5.1692	234.3391
.0159	45.3333	65.3905	.0100	.1000	.6933	.7833	7.3104	331.4055
.0159	45.3333	65.3905	.0150	.1225	.6933	.7833	8.9534	405.8872
.0159	45.3333	65.3905	.0200	.1414	.6933	.7833	10.3385	468.6782
.0159	45.3333	65.3905	.0250	.1581	.6933	.7833	11.5588	523.9981
.0159	45.3333	65.3905	.0300	.1732	.6933	.7833	12.6620	574.0112
.0159	45.3333	65.3905	.0350	.1871	.6933	.7833	13.6765	620.0029
.0159	45.3333	65.3905	.0400	.2000	.6933	.7833	14.6208	662.8110

64' R.O.W. 48' FACE-FACE 8" CURB 4" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	50.6667	65.3828	.0050	.0707	.7749	.8437	5.5675	282.0874
.0159	50.6667	65.3828	.0100	.1000	.7749	.8437	7.8737	398.9318
.0159	50.6667	65.3828	.0150	.1225	.7749	.8437	9.6432	488.5897
.0159	50.6667	65.3828	.0200	.1414	.7749	.8437	11.1350	564.1748
.0159	50.6667	65.3828	.0250	.1581	.7749	.8437	12.4493	630.7666
.0159	50.6667	65.3828	.0300	.1732	.7749	.8437	13.6376	690.9702
.0159	50.6667	65.3828	.0350	.1871	.7749	.8437	14.7303	746.3331
.0159	50.6667	65.3828	.0400	.2000	.7749	.8437	15.7473	797.8637

64' R.O.W. 48' FACE-FACE 8" CURB 2" CROWN .5' OVERFLOW

N	A	P	S	S1/2	R	R2/3	V	Q
.0159	56.0000	65.3782	.0050	.0707	.8566	.9019	5.9519	333.3076
.0159	56.0000	65.3782	.0100	.1000	.8566	.9019	8.4173	471.3682
.0159	56.0000	65.3782	.0150	.1225	.8566	.9019	10.3090	577.3057
.0159	56.0000	65.3782	.0200	.1414	.8566	.9019	11.9038	666.6153
.0159	56.0000	65.3782	.0250	.1581	.8566	.9019	13.3089	745.2985
.0159	56.0000	65.3782	.0300	.1732	.8566	.9019	14.5792	816.4336
.0159	56.0000	65.3782	.0350	.1871	.8566	.9019	15.7473	881.8491
.0159	56.0000	65.3782	.0400	.2000	.8566	.9019	16.8346	942.7363

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MANNING'S EQUATION
Street Carrying Capacities
0.5' above high curb; 106' R/W; 2-21.5' streets with 43' median

```
n =        0.0188  S
A =          56.2  S
p =        108.69  S
S =         0.005  S
S^1/2     0.0707106  A?
R =       0.5170668  C?

R^2/3 =   0.6442121  A?
V =       3.6005904  A?
Q=      202.3531004  A?

                     V
           0.0188    S
             56.2    S
           108.69    S
             0.01    S
        0.1000000    A?
        0.5170668    C?

        0.6442121    A?
        5.0920159    A?
      286.1712935    A?

                     V
           0.0188    S
             56.2    S
           108.69    S
            0.015    S
        0.1224744    A?
        0.5170668    C?

        0.6442121    A?
        6.2364095    A?
      350.4562139    A?

                     V
           0.0188    S
             56.2    S
           108.69    S
             0.02    S
        0.1414213    A?
        0.5170668    C?

        0.6442121    A?
        7.2011914    A?
      404.7069566    A?
```



```
           0.0188    S
             56.2    S
           108.69    S
            0.025    S
        0.1581138    A?
        0.5170668    C?

        0.6442121    A?
        8.0511755    A?
      452.4760631    A?

                     S
                     V
           0.0188    S
             56.2    S
           108.69    S
             0.03    S
        0.1732050    A?
        0.5170668    C?

        0.6442121    A?
        8.8176223    A?
      495.6627732    A?

                     V
           0.0188    S
             56.2    S
           108.69    S
            0.035    S
        0.1870828    A?
        0.5170668    C?

        0.6442121    A?
        9.5262872    A?
      535.3773406    A?

                     V
           0.0188    S
             56.2    S
           108.69    S
             0.04    S
        0.2000000    A?
        0.5170668    C?

        0.6442121    A?
       10.1040319    A?
      572.3425927    A?
```

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EXHIBIT E

SUMMARY OF STREET AND RUNOFF QUANTITIES

STREET DESCRIPTION	MAXIMUM RUNOFF (in c.f.s.)
Delicado Place - SW corner at 15' drainage easement	50
Delicado Place - intersection with Malaguena Lane	6
Sabrosa Loop - East intersection with Malaguena Lane	6
Sabrosa Loop - West intersection with Malaguena Lane	15
Sonata Loop - East intersection with Malaguena Lane	9
Sonata Loop - West intersection with Malaguena Lane	14
Siboney Loop - intersection with Malaguena Lane	9
Malaguena Lane	228

25×10

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PLANS/PLATS ON FILE

FILE DESC: G116/D64

PLANS/PLATS 1

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HYDROLOGY G16/D64 NO DOCUMENTS 1 PLAN

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1 Plan

No Documents

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