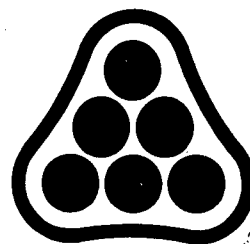


DRAINAGE PLAN  
AND  
SUPPORTING CALCULATIONS



**P**ROFESSIONAL  
**E**NGINEERING  
**C**ONSULTANTS  
PROFESSIONAL ASSOCIATION

FOR  
GRAF-GOLDSTON ADDITION  
To  
WICHITA, KANSAS

PREPARED BY  
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.  
ENGINEERS  
WICHITA, KANSAS

AUGUST, 1984

DRAINAGE PLAN  
AND  
SUPPORTING CALCULATIONS

FOR  
GRAF-GOLDSTON ADDITION  
To  
WICHITA, KANSAS

PREPARED BY  
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.  
ENGINEERS  
WICHITA, KANSAS

AUGUST, 1984

STORM SEWERS











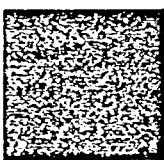
# HYDROLOGY DATA SHEET

PAGE 6 OF 6

PROJECT: Graf-Goldstone Addition PROJECT NO. 36-84167

ITEM: Storm Sewer System 200 DATE: 8-20-84

RETURN PERIOD: 2 COMPUTATIONS BY: CSB REVISIONS BY: \_\_\_\_\_



**PROFESSIONAL  
ENGINEERING  
CONSULTANTS**  
PROFESSIONAL ASSOCIATION

1440 EAST ENGLISH  
WICHITA, KANSAS 67211  
(316) 262-2691

SCHMATIC DIAGRAM:

| SUB-BASIN<br>(11) | TRIBUTARY AREA |                        |                     |                         |                                     |                                  |                                | HYDROLOGY SUMMATION                |                      |                    |                      |                          | CONDUIT DATA         |                                |                          |                                     |  |
|-------------------|----------------|------------------------|---------------------|-------------------------|-------------------------------------|----------------------------------|--------------------------------|------------------------------------|----------------------|--------------------|----------------------|--------------------------|----------------------|--------------------------------|--------------------------|-------------------------------------|--|
|                   | C<br>(2)       | AREA<br>(acres)<br>(3) | SLOPE<br>(%)<br>(4) | LENGTH<br>(feet)<br>(5) | T <sub>co</sub><br>(minutes)<br>(6) | I <sub>0</sub><br>in./hr.<br>(7) | Q <sub>0</sub><br>(cfs)<br>(8) | T <sub>c</sub><br>(minutes)<br>(9) | I<br>in./hr.<br>(10) | Q<br>(cfs)<br>(11) | Σ Q<br>(cfs)<br>(12) | PIPE<br>(inches)<br>(13) | SLOPE<br>(%)<br>(14) | VELOCITY<br>(ft./sec.)<br>(15) | LENGTH<br>(feet)<br>(16) | T <sub>r</sub><br>(minutes)<br>(17) | T <sub>c</sub> + T <sub>r</sub><br>(minutes)<br>(18) |
| 204               | 0.5            | 0.40                   | -                   | -                       | 15                                  | 4.06                             | 0.8                            | 16.2                               | 3.94                 | 0.8                | 43.5                 | 36                       | 0.4                  | 6.2                            | 690                      | 1.9                                 | 18.1   |
| 202               |                |                        |                     |                         |                                     |                                  |                                |                                    |                      |                    |                      |                          |                      |                                |                          |                                     |  |
| 203               | 0.5            | 4.24                   | -                   | -                       | 15                                  | 4.06                             | 8.6                            | 15                                 | 4.06                 | 8.6                | 8.6                  | 18                       | 0.65                 | 4.8                            | 35                       | 0.1                                 | 15.1   |
| 202               |                |                        |                     |                         |                                     |                                  |                                |                                    |                      |                    |                      |                          |                      |                                |                          |                                     |  |
| 202               | 0.5            | 4.22                   | -                   | -                       | 15                                  | 4.06                             | 8.6                            | 18.1                               | 3.77                 | 8.0                | 59.5                 |                          |                      |                                |                          |                                     |  |
| 201               | 0.5            | 7.47                   | -                   | -                       | 15                                  | 4.06                             | 15.2                           | 18.3                               | 3.75                 | 14.0               | 73.5                 | 42                       | 0.38                 | 6.2                            | 70                       | 0.2                                 | 18.3   |
| 200               |                |                        |                     |                         |                                     |                                  |                                |                                    |                      |                    |                      | 48                       | 0.27                 | 6.0                            | 140                      | 0.4                                 | 18.7   |

consideration of  
ple, the apron  
dings. Inlets  
ble flexibility  
the likelihood  
inlets. Sec-  
d be isolated  
seal traps or  
ent transmis-  
he system.

Coeff. "n"

0.012

0.012

0.021

0.023

0.026

0.024

0.027

0.031

0.012

0.015

0.017

0.018 to 0.021

Coeff. "n"

1 to 0.020

to 0.017

to 0.030

0.020

0.020

0.020

0.020

0.025

to 0.150\*

0.08

0.06

has light

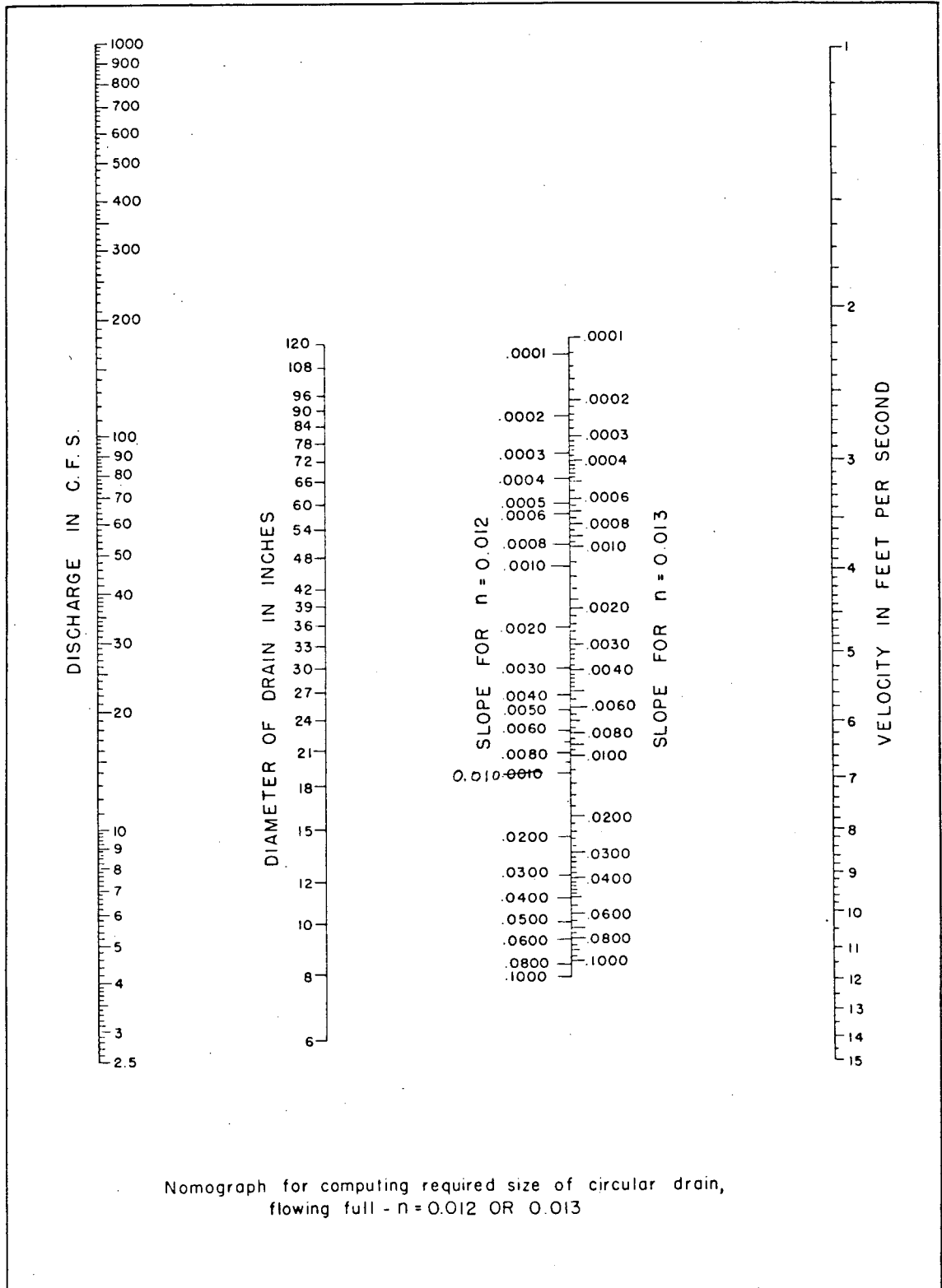


FIGURE 9. Nomograph for computing required size of circular drain for n 0.012 or 0.013.

## RAINFALL INTENSITY TABLE

for

## SEDGWICK COUNTY KANSAS

The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40.

| DURATION<br>IN MINUTES | RETURN PERIODS OF |      |      |       |       |       |        |
|------------------------|-------------------|------|------|-------|-------|-------|--------|
|                        | 1-YR              | 2-YR | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR |
| 5                      | 4.67              | 6.23 | 8.00 | 9.34  | 10.67 | 12.23 | 13.79  |
| 6                      | 4.35              | 5.80 | 7.45 | 8.70  | 9.94  | 11.39 | 12.84  |
| 7                      | 4.09              | 5.46 | 7.02 | 8.19  | 9.36  | 10.72 | 12.09  |
| 8                      | 3.88              | 5.18 | 6.66 | 7.77  | 8.89  | 10.18 | 11.48  |
| 9                      | 3.71              | 4.95 | 6.36 | 7.43  | 8.49  | 9.72  | 10.96  |
| 10                     | 3.56              | 4.75 | 6.11 | 7.13  | 8.15  | 9.33  | 10.52  |
| 11                     | 3.43              | 4.58 | 5.89 | 6.87  | 7.85  | 8.99  | 10.14  |
| 12                     | 3.32              | 4.43 | 5.69 | 6.64  | 7.59  | 8.69  | 9.80   |
| 13                     | 3.21              | 4.29 | 5.51 | 6.43  | 7.35  | 8.42  | 9.50   |
| 14                     | 3.12              | 4.17 | 5.36 | 6.25  | 7.14  | 8.18  | 9.23   |
| 15                     | 3.04              | 4.06 | 5.21 | 6.08  | 6.95  | 7.97  | 8.98   |
| 16                     | 2.96              | 3.96 | 5.09 | 5.93  | 6.78  | 7.77  | 8.76   |
| 17                     | 2.90              | 3.86 | 4.97 | 5.79  | 6.62  | 7.59  | 8.55   |
| 18                     | 2.83              | 3.78 | 4.86 | 5.67  | 6.48  | 7.42  | 8.37   |
| 19                     | 2.77              | 3.70 | 4.76 | 5.55  | 6.34  | 7.27  | 8.19   |
| 20                     | 2.72              | 3.63 | 4.66 | 5.44  | 6.22  | 7.12  | 8.03   |
| 21                     | 2.67              | 3.56 | 4.57 | 5.34  | 6.10  | 6.99  | 7.88   |
| 22                     | 2.62              | 3.49 | 4.49 | 5.24  | 5.99  | 6.86  | 7.74   |
| 23                     | 2.57              | 3.43 | 4.41 | 5.15  | 5.89  | 6.74  | 7.60   |
| 24                     | 2.53              | 3.38 | 4.34 | 5.07  | 5.79  | 6.63  | 7.48   |
| 25                     | 2.49              | 3.32 | 4.27 | 4.99  | 5.70  | 6.53  | 7.36   |
| 26                     | 2.45              | 3.23 | 4.21 | 4.91  | 5.61  | 6.43  | 7.25   |
| 27                     | 2.42              | 3.13 | 4.15 | 4.84  | 5.53  | 6.33  | 7.14   |
| 28                     | 2.38              | 3.05 | 4.09 | 4.77  | 5.45  | 6.25  | 7.04   |
| 29                     | 2.35              | 2.97 | 4.02 | 4.68  | 5.38  | 6.16  | 6.95   |
| 30                     | 2.32              | 2.89 | 3.92 | 4.56  | 5.31  | 6.08  | 6.79   |
| 31                     | 2.29              | 2.82 | 3.82 | 4.44  | 5.19  | 6.00  | 6.62   |
| 32                     | 2.26              | 2.75 | 3.73 | 4.33  | 5.07  | 5.87  | 6.45   |
| 33                     | 2.24              | 2.68 | 3.64 | 4.23  | 4.95  | 5.73  | 6.30   |
| 34                     | 2.19              | 2.62 | 3.55 | 4.13  | 4.83  | 5.60  | 6.16   |
| 35                     | 2.14              | 2.57 | 3.47 | 4.04  | 4.73  | 5.47  | 6.02   |
| 36                     | 2.09              | 2.51 | 3.40 | 3.95  | 4.62  | 5.35  | 5.89   |
| 37                     | 2.05              | 2.46 | 3.33 | 3.87  | 4.52  | 5.23  | 5.76   |
| 38                     | 2.00              | 2.41 | 3.26 | 3.79  | 4.43  | 5.13  | 5.64   |
| 39                     | 1.96              | 2.36 | 3.19 | 3.71  | 4.34  | 5.02  | 5.53   |
| 40                     | 1.92              | 2.32 | 3.13 | 3.64  | 4.26  | 4.92  | 5.42   |
| 41                     | 1.89              | 2.27 | 3.07 | 3.57  | 4.18  | 4.83  | 5.32   |
| 42                     | 1.85              | 2.23 | 3.01 | 3.51  | 4.10  | 4.74  | 5.22   |
| 43                     | 1.82              | 2.19 | 2.96 | 3.44  | 4.02  | 4.65  | 5.13   |
| 44                     | 1.78              | 2.15 | 2.91 | 3.38  | 3.95  | 4.56  | 5.03   |
| 45                     | 1.75              | 2.11 | 2.86 | 3.32  | 3.88  | 4.48  | 4.95   |

| <u>DURATION<br/>IN MINUTES</u> | <u>RETURN PERIODS OF</u> |             |             |              |              |              |               |
|--------------------------------|--------------------------|-------------|-------------|--------------|--------------|--------------|---------------|
|                                | <u>1-YR</u>              | <u>2-YR</u> | <u>5-YR</u> | <u>10-YR</u> | <u>25-YR</u> | <u>50-YR</u> | <u>100-YR</u> |
| 46                             | 1.72                     | 2.08        | 2.81        | 3.27         | 3.82         | 4.41         | 4.86          |
| 47                             | 1.69                     | 2.04        | 2.76        | 3.21         | 3.75         | 4.33         | 4.78          |
| 48                             | 1.67                     | 2.01        | 2.72        | 3.16         | 3.69         | 4.26         | 4.70          |
| 49                             | 1.64                     | 1.98        | 2.67        | 3.11         | 3.63         | 4.19         | 4.63          |
| 50                             | 1.61                     | 1.95        | 2.63        | 3.06         | 3.58         | 4.13         | 4.56          |
| 51                             | 1.59                     | 1.92        | 2.59        | 3.01         | 3.52         | 4.06         | 4.49          |
| 52                             | 1.56                     | 1.89        | 2.55        | 2.97         | 3.47         | 4.00         | 4.42          |
| 53                             | 1.54                     | 1.86        | 2.51        | 2.92         | 3.42         | 3.94         | 4.35          |
| 54                             | 1.52                     | 1.84        | 2.48        | 2.88         | 3.37         | 3.88         | 4.29          |
| 55                             | 1.50                     | 1.81        | 2.44        | 2.84         | 3.32         | 3.83         | 4.23          |
| 56                             | 1.47                     | 1.79        | 2.41        | 2.80         | 3.27         | 3.77         | 4.17          |
| 57                             | 1.45                     | 1.76        | 2.37        | 2.76         | 3.23         | 3.72         | 4.11          |
| 58                             | 1.43                     | 1.74        | 2.34        | 2.73         | 3.19         | 3.67         | 4.06          |
| 59                             | 1.42                     | 1.72        | 2.31        | 2.69         | 3.14         | 3.62         | 4.01          |
| 60                             | 1.40                     | 1.69        | 2.28        | 2.65         | 3.10         | 3.57         | 3.95          |
| 61                             | 1.38                     | 1.67        | 2.25        | 2.62         | 3.06         | 3.53         | 3.90          |
| 62                             | 1.36                     | 1.65        | 2.22        | 2.59         | 3.02         | 3.48         | 3.85          |
| 63                             | 1.34                     | 1.63        | 2.20        | 2.55         | 2.99         | 3.44         | 3.81          |
| 64                             | 1.33                     | 1.61        | 2.17        | 2.52         | 2.95         | 3.40         | 3.76          |
| 65                             | 1.31                     | 1.59        | 2.14        | 2.49         | 2.92         | 3.35         | 3.71          |
| 66                             | 1.30                     | 1.57        | 2.12        | 2.46         | 2.88         | 3.31         | 3.67          |
| 67                             | 1.28                     | 1.56        | 2.09        | 2.44         | 2.85         | 3.27         | 3.63          |
| 68                             | 1.26                     | 1.54        | 2.07        | 2.41         | 2.81         | 3.24         | 3.59          |
| 69                             | 1.25                     | 1.52        | 2.05        | 2.38         | 2.78         | 3.20         | 3.54          |
| 70                             | 1.24                     | 1.50        | 2.02        | 2.35         | 2.75         | 3.16         | 3.51          |
| 71                             | 1.22                     | 1.49        | 2.00        | 2.33         | 2.72         | 3.13         | 3.47          |
| 72                             | 1.21                     | 1.47        | 1.98        | 2.30         | 2.69         | 3.09         | 3.43          |
| 73                             | 1.20                     | 1.46        | 1.96        | 2.28         | 2.66         | 3.06         | 3.39          |
| 74                             | 1.18                     | 1.44        | 1.94        | 2.25         | 2.63         | 3.03         | 3.36          |
| 75                             | 1.17                     | 1.43        | 1.92        | 2.23         | 2.61         | 3.00         | 3.32          |
| 76                             | 1.16                     | 1.41        | 1.90        | 2.21         | 2.58         | 2.96         | 3.29          |
| 77                             | 1.15                     | 1.40        | 1.88        | 2.18         | 2.55         | 2.93         | 3.25          |
| 78                             | 1.13                     | 1.38        | 1.86        | 2.16         | 2.53         | 2.90         | 3.22          |
| 79                             | 1.12                     | 1.37        | 1.84        | 2.14         | 2.50         | 2.88         | 3.19          |
| 80                             | 1.11                     | 1.36        | 1.82        | 2.12         | 2.48         | 2.85         | 3.16          |
| 81                             | 1.10                     | 1.34        | 1.81        | 2.10         | 2.46         | 2.82         | 3.13          |
| 82                             | 1.09                     | 1.33        | 1.79        | 2.08         | 2.43         | 2.79         | 3.10          |
| 83                             | 1.08                     | 1.32        | 1.77        | 2.06         | 2.41         | 2.76         | 3.07          |
| 84                             | 1.07                     | 1.31        | 1.75        | 2.04         | 2.39         | 2.74         | 3.04          |
| 85                             | 1.06                     | 1.30        | 1.74        | 2.02         | 2.37         | 2.71         | 3.01          |
| 86                             | 1.05                     | 1.28        | 1.72        | 2.00         | 2.34         | 2.69         | 2.99          |
| 87                             | 1.04                     | 1.27        | 1.71        | 1.99         | 2.32         | 2.66         | 2.96          |
| 88                             | 1.03                     | 1.26        | 1.69        | 1.97         | 2.30         | 2.64         | 2.93          |
| 89                             | 1.02                     | 1.25        | 1.68        | 1.95         | 2.28         | 2.62         | 2.91          |
| 90                             | 1.01                     | 1.24        | 1.66        | 1.93         | 2.26         | 2.59         | 2.88          |

| <u>DURATION<br/>IN MINUTES</u> | <u>RETURN PERIODS OF</u> |             |             |              |              |              |               |
|--------------------------------|--------------------------|-------------|-------------|--------------|--------------|--------------|---------------|
|                                | <u>1-YR</u>              | <u>2-YR</u> | <u>5-YR</u> | <u>10-YR</u> | <u>25-YR</u> | <u>50-YR</u> | <u>100-YR</u> |
| 91                             | 1.00                     | 1.23        | 1.65        | 1.92         | 2.24         | 2.57         | 2.86          |
| 92                             | 1.00                     | 1.22        | 1.63        | 1.90         | 2.22         | 2.55         | 2.83          |
| 93                             | 0.99                     | 1.21        | 1.62        | 1.89         | 2.20         | 2.53         | 2.81          |
| 94                             | 0.98                     | 1.20        | 1.61        | 1.87         | 2.19         | 2.51         | 2.79          |
| 95                             | 0.97                     | 1.19        | 1.59        | 1.85         | 2.17         | 2.49         | 2.76          |
| 96                             | 0.96                     | 1.18        | 1.58        | 1.84         | 2.15         | 2.46         | 2.74          |
| 97                             | 0.96                     | 1.17        | 1.57        | 1.82         | 2.13         | 2.44         | 2.72          |
| 98                             | 0.95                     | 1.16        | 1.56        | 1.81         | 2.12         | 2.42         | 2.70          |
| 99                             | 0.94                     | 1.15        | 1.54        | 1.80         | 2.10         | 2.41         | 2.67          |
| 100                            | 0.93                     | 1.14        | 1.53        | 1.78         | 2.08         | 2.39         | 2.65          |
| 101                            | 0.93                     | 1.13        | 1.52        | 1.77         | 2.07         | 2.39         | 2.65          |
| 102                            | 0.92                     | 1.13        | 1.51        | 1.75         | 2.05         | 2.35         | 2.61          |
| 103                            | 0.91                     | 1.12        | 1.50        | 1.74         | 2.04         | 2.33         | 2.59          |
| 104                            | 0.90                     | 1.11        | 1.49        | 1.73         | 2.02         | 2.31         | 2.57          |
| 105                            | 0.90                     | 1.10        | 1.47        | 1.72         | 2.01         | 2.30         | 2.55          |
| 106                            | 0.89                     | 1.09        | 1.46        | 1.70         | 1.99         | 2.28         | 2.54          |
| 107                            | 0.88                     | 1.09        | 1.45        | 1.69         | 1.98         | 2.26         | 2.52          |
| 108                            | 0.88                     | 1.08        | 1.44        | 1.68         | 1.96         | 2.25         | 2.50          |
| 109                            | 0.87                     | 1.07        | 1.43        | 1.67         | 1.95         | 2.23         | 2.48          |
| 110                            | 0.87                     | 1.06        | 1.42        | 1.65         | 1.93         | 2.21         | 2.46          |
| 111                            | 0.86                     | 1.06        | 1.41        | 1.64         | 1.92         | 2.20         | 2.45          |
| 112                            | 0.85                     | 1.05        | 1.40        | 1.63         | 1.91         | 2.18         | 2.43          |
| 113                            | 0.85                     | 1.04        | 1.39        | 1.62         | 1.89         | 2.17         | 2.41          |
| 114                            | 0.84                     | 1.03        | 1.38        | 1.61         | 1.88         | 2.15         | 2.40          |
| 115                            | 0.84                     | 1.03        | 1.37        | 1.60         | 1.87         | 2.14         | 2.38          |
| 116                            | 0.83                     | 1.02        | 1.36        | 1.59         | 1.86         | 2.12         | 2.36          |
| 117                            | 0.82                     | 1.01        | 1.36        | 1.58         | 1.84         | 2.11         | 2.35          |
| 118                            | 0.82                     | 1.01        | 1.35        | 1.57         | 1.83         | 2.09         | 2.33          |
| 119                            | 0.81                     | 1.00        | 1.34        | 1.56         | 1.82         | 2.08         | 2.32          |
| 120                            | 0.81                     | 0.99        | 1.33        | 1.55         | 1.81         | 2.07         | 2.30          |
| 121                            | 0.80                     | 0.99        | 1.32        | 1.54         | 1.80         | 2.05         | 2.29          |
| 122                            | 0.80                     | 0.98        | 1.31        | 1.53         | 1.78         | 2.04         | 2.27          |
| 123                            | 0.79                     | 0.97        | 1.30        | 1.52         | 1.77         | 2.03         | 2.26          |
| 124                            | 0.79                     | 0.97        | 1.30        | 1.51         | 1.76         | 2.01         | 2.24          |
| 125                            | 0.78                     | 0.96        | 1.29        | 1.50         | 1.75         | 2.00         | 2.23          |
| 126                            | 0.78                     | 0.96        | 1.28        | 1.49         | 1.74         | 1.99         | 2.22          |
| 127                            | 0.77                     | 0.95        | 1.27        | 1.48         | 1.73         | 1.98         | 2.20          |
| 128                            |                          |             |             |              |              |              |               |
| 129                            |                          |             |             |              |              |              |               |
| 130                            |                          |             |             |              |              |              |               |
| 131                            |                          |             |             |              |              |              |               |
| 132                            |                          |             |             |              |              |              |               |
| 133                            |                          |             |             |              |              |              |               |
| 134                            |                          |             |             |              |              |              |               |
| 135                            |                          |             |             |              |              |              |               |

INLET REQUIREMENTS



Date Aug. 20, 1984 Page 1 of 2

Project Graf Goldston Addition

Item Inlet Requirements

DETERMINE NO. OF INLETS REQUIRED AT EACH NODE.

FOR INLETS IN SUMP CONDITION, USE CHART 1073.03 (COPY ATTACHED)  $Q_{ALLOW} = 10$  cfs.

FOR INLETS ON GRADE, ASSUME 50% IS INTERCEPTED & 50% BYPASS TO NEXT DOWNSTREAM INLET

| <u>NODE</u> | <u><math>Q_2</math></u>    | <u>INLET CONDITION</u> | <u>REQ'D INLETS</u> |
|-------------|----------------------------|------------------------|---------------------|
| 101         | 14.7                       | SUMP                   | 2 - COW Type IA     |
| 102         | 10.2                       | SUMP                   | 2 - COW Type IA     |
| 103         | MH                         | -                      | -                   |
| 104         | 1.8                        | SUMP                   | 1 - COW Type IA     |
| 105         | 3.0                        | SUMP                   | 1 - COW Type IA     |
| 106         | $5.3 + 1.7 = 7.0$<br>(108) | SUMP                   | 1 - COW Type IA     |
| 107         | 6.3                        | SUMP                   | 1 - COW Type IA     |
| 108         | 3.3                        | ON GRADE               | 1 - COW Type IA     |
| 109         | 3.8                        | SUMP                   | 1 - COW Type IA     |
| 110         | 6.7                        | SUMP                   | 1 - COW Type IA     |
| 111         | 10.7                       | SUMP                   | 2 - COW Type IA     |
| 112         | 8.7                        | SUMP                   | 1 - COW Type IA     |



Date Aug. 20, 1984 Page 2 of 2

Project Graf-Goldston Addition

Item Inlet Requirements

| <u>Node</u> | <u>Q<sub>2</sub></u> | <u>Inlet Condition</u> | <u>Req'd Inlets</u> |
|-------------|----------------------|------------------------|---------------------|
| 201         | 15.2                 | Sump                   | 2-COW Type IA       |
| 202         | 8.6                  | Sump                   | 1-COW Type IA       |
| 203         | 8.6                  | Sump                   | 1-COW Type IA       |
| 204         | 0.8                  | Sump                   | 1-COW Type IA       |
| 205         | 12.4                 | Sump                   | 1-COW Type IA *     |
| 206         | 1.2                  | Sump                   | 1-COW Type IA       |
| 207         | 1.3                  | Sump                   | 1-COW Type IA       |
| 208         | 15.4                 | Sump                   | 1-COW Type IA *     |
| 209         | 0.8                  | Sump                   | 1-COW Type IA       |
| 210         | 1.0                  | Sump                   | 1-COW Type IA       |
| 211         | 0.7                  | Sump                   | 1-COW Type IA       |
| 212         | 10.8                 | Sump                   | 1-COW Type IA *     |

\* With 21" Stub West.

\* Although these 3 inlets violate min. criteria for 1 inlet, most of the approach Q will ultimately be in the 21" pipe (stub) from the West. Therefore only one inlet is needed at each of these 3 locations.

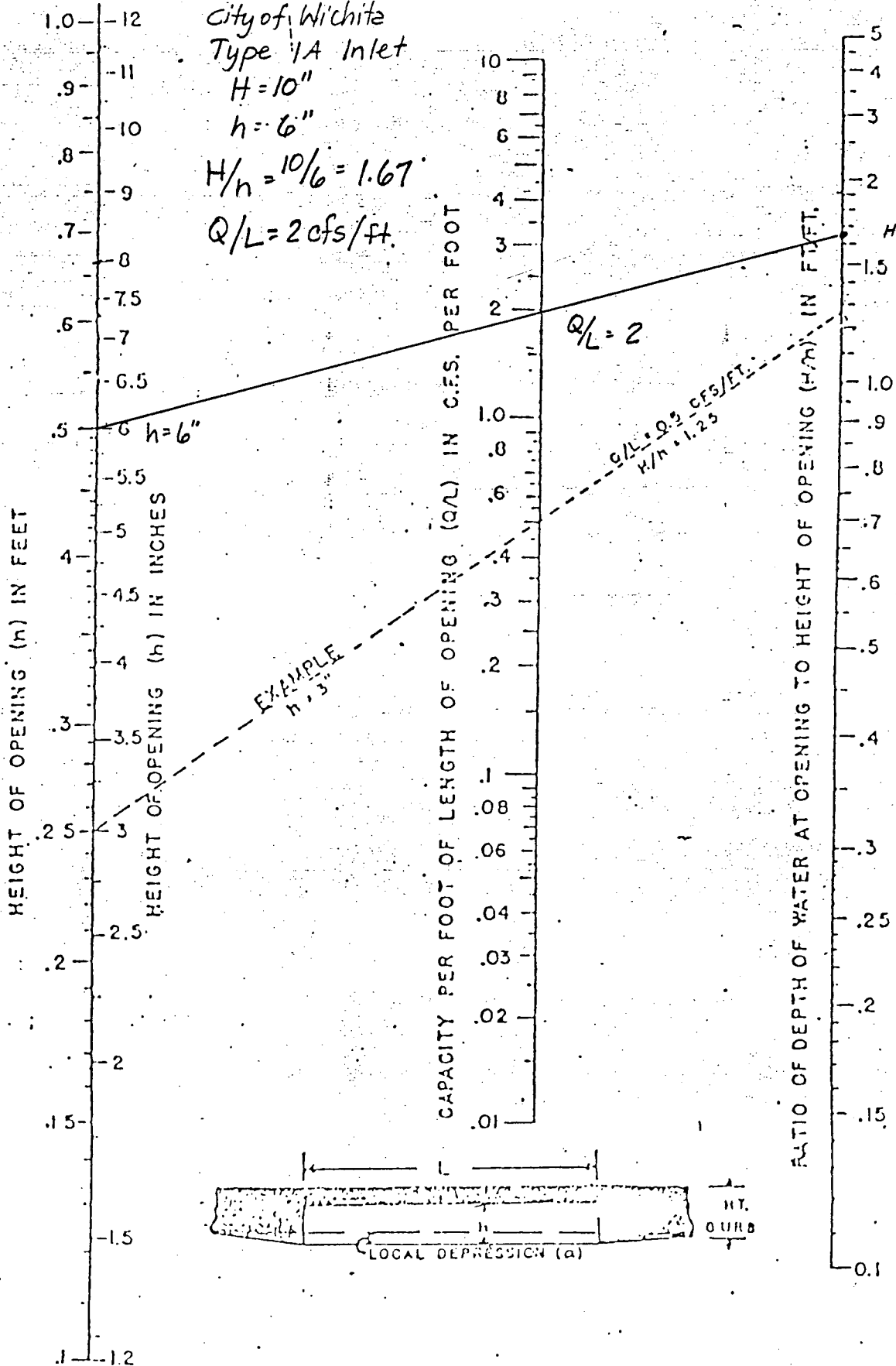
# SUMP CONDITION ONLY

1073.03

City of Wichita  
Type 1A Inlet  
 $H = 10''$   
 $h = 6''$

$H/h = 10/6 = 1.67$

$Q/L = 2 \text{ cfs/ft.}$



JAN., 1951

STREET FLOW



Date August 20, 1984 Page 1 of 4

Project Graf - Goldston Addition

Item Street Flow - 2yr

Check 2-yr. Flow in streets as it approaches inlet  
 Assume Std curb (0.55')  
 Use Flow in Triangular Channels (Graph Attached)

| <u>NODE</u> | <u>STREET SLOPE %</u> | <u>Q<sub>ALLOW</sub><br/>(Top curb)</u> | <u>Q<sub>2</sub><br/>actual</u> | <u>Comment</u>                |
|-------------|-----------------------|---|---------------------------------|-------------------------------|
| 101         | 0.32                  | 12                                      | 14.7                            | 6.7 (South)<br>8.0 (North) OK |
| 102         | 0.32                  | 12                                      | 10.2                            | OK                            |
| 103         | MH                    |   |                                 |                               |
| 104         | 0.32                  | 12                                      | 1.8                             | OK                            |
| 105         | 0.32                  | 12                                      | 3.0                             | OK                            |
| 106         | 0.32                  | 12                                      | 7.0                             | OK                            |
| 107         | 0.32                  | 12                                      | 6.3                             | OK                            |
| 108         | 0.44                  | 14                                      | 3.3                             | OK                            |
| 109         | 0.44                  | 14                                      | 3.8                             | OK                            |
| 110         | 0.50                  | 16                                      | 6.7                             | OK                            |
| 111         | 0.50                  | 16                                      | 10.7                            | OK                            |
| 112         | 0.53                  | 16                                      | 8.7                             | OK                            |



Date August 21, 1984 Page 2 of 4

Project Graf-Goldston Addition

Item Street Flow - 2yr.

| <u>NODE</u> | <u>STREET SLOPE %</u> | <u>Q<sub>ALLOW</sub><br/>(top curb)</u> | <u>Q<sub>2</sub><br/>actual</u> | <u>Comment</u>       |
|-------------|-----------------------|---|---------------------------------|----------------------|
| 201         | 0.32                  | 12                                      | 15.2                            | 7.6-N<br>7.6-S<br>OK |
| 202         | 0.36                  | 13                                      | 8.6                             | OK                   |
| 203         | 0.32                  | 12                                      | 8.6                             | OK                   |
| 204         | 0.32                  | 12                                      | 0.8                             | OK                   |
| 205         | 0.32                  | 12                                      | 12.4                            | OK *                 |
| 206         | 0.32                  | 12                                      | 1.2                             | OK                   |
| 207         | 0.32                  | 12                                      | 1.3                             | OK                   |
| 208         | 0.32                  | 12                                      | 15.4                            | OK *                 |
| 209         | 0.32                  | 12                                      | 0.8                             | OK                   |
| 210         | 0.32                  | 12                                      | 1.0                             | OK                   |
| 211         | 0.32                  | 12                                      | 0.7                             | OK                   |
| 212         | 0.32                  | 12                                      | 10.8                            | OK *                 |

\* Although these 3 locations violate minimum criteria for street flow, most of the approach Q will ultimately be in the 21" pipe (stub) from the west. Therefore, street flow is OK.



Date Aug 20, 1984 Page 3 of 4

Project Grsf - Goldston Addition

Item Street Flow - 100 yr.

Check Street Flow During 100 yr storm

Assume 2-yr flow in pipe

$$\text{Street Flow} = Q_{100} - Q_2$$

System 100

Flow on Bella Vista St., just west of Nodes 101-102

$$D.A. = 30.6 \text{ Ac.}$$

$$C = 0.5$$

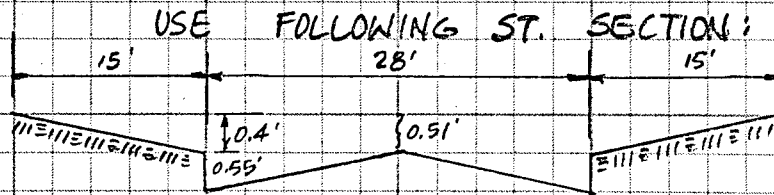
$$t_c = 20 \text{ min}$$

$$I_{100} = 0.03$$

$$Q_{100} = 0.5 \times 0.03 \times 30.6 = 122.9 \text{ cfs}$$

$$Q_2 \text{ (from storm sewer calcs)} = \approx 61 \text{ cfs}$$

$$Q_{100} - Q_2 = 123 - 61 = 62 \text{ cfs in street.}$$



$$Q_{allow} = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$= \frac{1.486}{0.02065} \times 26.44 \times (0.41968)^{2/3} \times (0.0032)^{1/2}$$

$$= 71.96 \times 26.44 \times 0.56054 \times 0.05656$$

$$= 60.33$$

$$\text{where } n = \frac{(30 \times 0.025) + (28 \times 0.016)}{58}$$

$$n = 0.02065$$

$$A = 2 \left( \frac{1}{2} \times 15' \times 0.4' \right) + 2 \left( 14 \times \frac{0.95 + 0.51}{2} \right)$$

$$A = 6.00 + 20.44 = 26.44 \text{ ft}^2$$

$$P = 63$$

$$R = A/P = 26.44/63 = 0.41968$$

$$S = 0.0032$$

MARGINAL, BUT OK



Date Aug. 20, 1984 Page 4 of 4

Project Graf-Goldston Addition

Item Street Flow - 100 yr.

System 200

Check Flow on 20th street just west of Nodes 202-203

$$D.A. = 26.1 \text{ Ac } \pm$$

$$C = 0.5$$

$$t_c = 18 \text{ min}$$

$$I_{100} = 8.37$$

$$Q_{100} = 0.5 \times 8.37 \times 26.1 = 109.2 \text{ cfs}$$

$$Q_2 \text{ (from storm sewer calcs)} = 52.1 \pm$$

$$\text{Street Flow} = 109.2 - 52.1 = 57.1 \text{ cfs}$$

USE SAME STREET SECTION AS BELLA VISTA (SYS. 10)

$$Q_{\text{allow}} = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$n = 0.02065$$

$$A = 26.44 \text{ ft}^2$$

$$p = 63'$$

$$R = A/p = 0.41968$$

$$S = 0.0038$$

$$Q_{\text{allow}} = \frac{1.486}{0.02065} \times 26.44 \times (0.41968)^{2/3} \times (0.0038)^{1/2}$$

$$= 71.96 \times 26.44 \times 0.56054 \times 0.06164$$

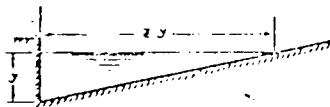
$$= 65.74$$

SYSTEM 200 OK  
USING 0.4' T.G. to sidewalk (R) Grade.

11 - ~~0.016~~ 0.016

~~2461~~  
 $Z/n = 2000$

1072.03



EQUATION:  $Q = 0.56 \left(\frac{z}{n}\right)^{1/3} y^{5/3}$

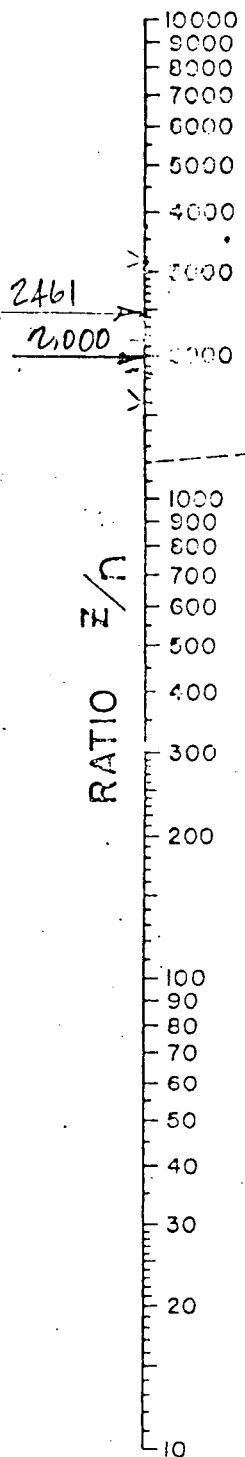
$n$  IS ROUGHNESS COEFFICIENT IN MANNING FORMULA APPROPRIATE TO MATERIAL IN BOTTOM OF CHANNEL

$Z$  IS RECIPROCAL OF CROSS SLOPE

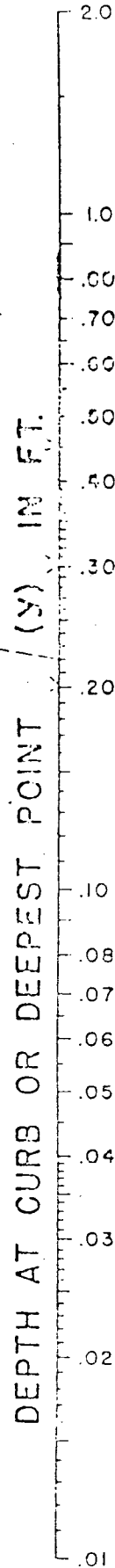
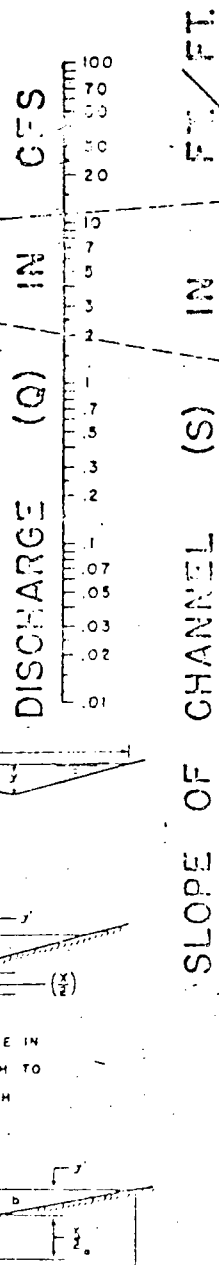
REFERENCE: M. R. & PROCEEDINGS 1946, PAGE 130, EQUATION (14)

EXAMPLE (SEE DASHED LINES)

GIVEN:  $n = 0.03$   
 $z = 24$   
 $n = .02$   
 $y = 0.22$   
 $Z/n = 1200$   
 FIND:  $Q = 2.0$  CFS



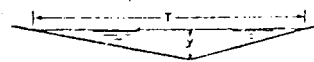
TURNING LINE



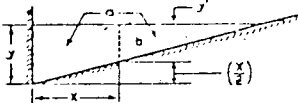
INSTRUCTIONS

1. CONNECT  $Z/n$  RATIO WITH SLOPE (S) AND CONNECT DISCHARGE (Q) WITH DEPTH (Y). THESE TWO LINES MUST INTERSECT AT TURNING LINE FOR COMPLETE SOLUTION.

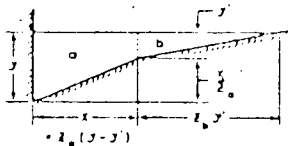
2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH WITH  $Z = \frac{T}{Y}$



3. TO DETERMINE DISCHARGE  $Q_b$  IN PORTION OF CHANNEL HAVING WIDTH X: DETERMINE DEPTH  $y$  FOR TOTAL DISCHARGE IN ENTIRE SECTION  $a$ . THEN USE NOMOGRAPH TO DETERMINE  $Q_b$  IN SECTION  $b$  FOR DEPTH  $y' = y - (\frac{x}{z})$ .



4. TO DETERMINE DISCHARGE IN COMPOSITE SECTION: FOLLOW INSTRUCTION 3 TO OBTAIN DISCHARGE IN SECTION  $a$  AT ASSUMED DEPTH  $y$ ; OBTAIN  $Q_b$  FOR SLOPE RATIO  $z$  AND DEPTH  $y'$  THEN  $Q_c = Q_a + Q_b$ .



JUN. 1950 (REV.)  
 MAY 1949

OUTLET PIPES



Date Aug 21, 1984 Page 1 of       

Project Graf-Goldston Addition

Item Outlet Pipes

Last section of each storm sewer system needs to be designed for  $Q_{100}$

Pipe 100-101

$$D.A. = 36.7 \text{ Ac.}$$

$$C = 0.5$$

$$t_c = 20 \text{ min}$$

$$I_{100} = 8.03$$

$$Q_{100} = 0.5 \times 8.03 \times 36.7$$
$$= 147.4 \text{ cfs}$$

USE 60" RCP @  $s = 0.34\%$

# Inlets @ Node 101:

$$H = 10'' + 0.3' = 1.133'$$

$$h = 6'' = 0.5'$$

$$H/h = 2.266$$

$$\therefore Q/L = 2.7 \text{ cfs/ft}$$

$$Q_{\text{street}} = 147.4 - 70.7 \text{ in pipe}$$
$$= 76.7$$

$$L = 76.7 / 2.7 = 28.4' \text{ inlet}$$



Date Aug 21, 1984 Page 2 of 2

Project Graf - Goldston

Item Outlet Pipes

Pipe 200-201

$$D.A. = 37.8$$

$$C = 0.5$$

$$t_c = 10 \text{ min}$$

$$I_{100} = 8.37$$

$$Q_{100} = 0.5 \times 8.37 \times 37.8$$

$$= 158.2 \text{ cfs}$$

USE 60" @  $S = 0.38\%$

# Inlets @ Node 201

$$H = 10'' + 0.3' = 1.133'$$

$$h = 6'' = 0.5'$$

$$H/h = 1.133/0.5 = 2.266$$

$$\therefore Q/L = 2.7 \text{ cfs/ft.}$$

$$Q_{\text{street}} = 158.2 - 73.5 \text{ in pipe}$$

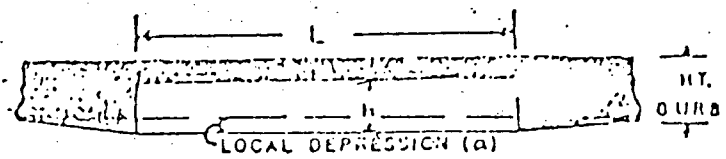
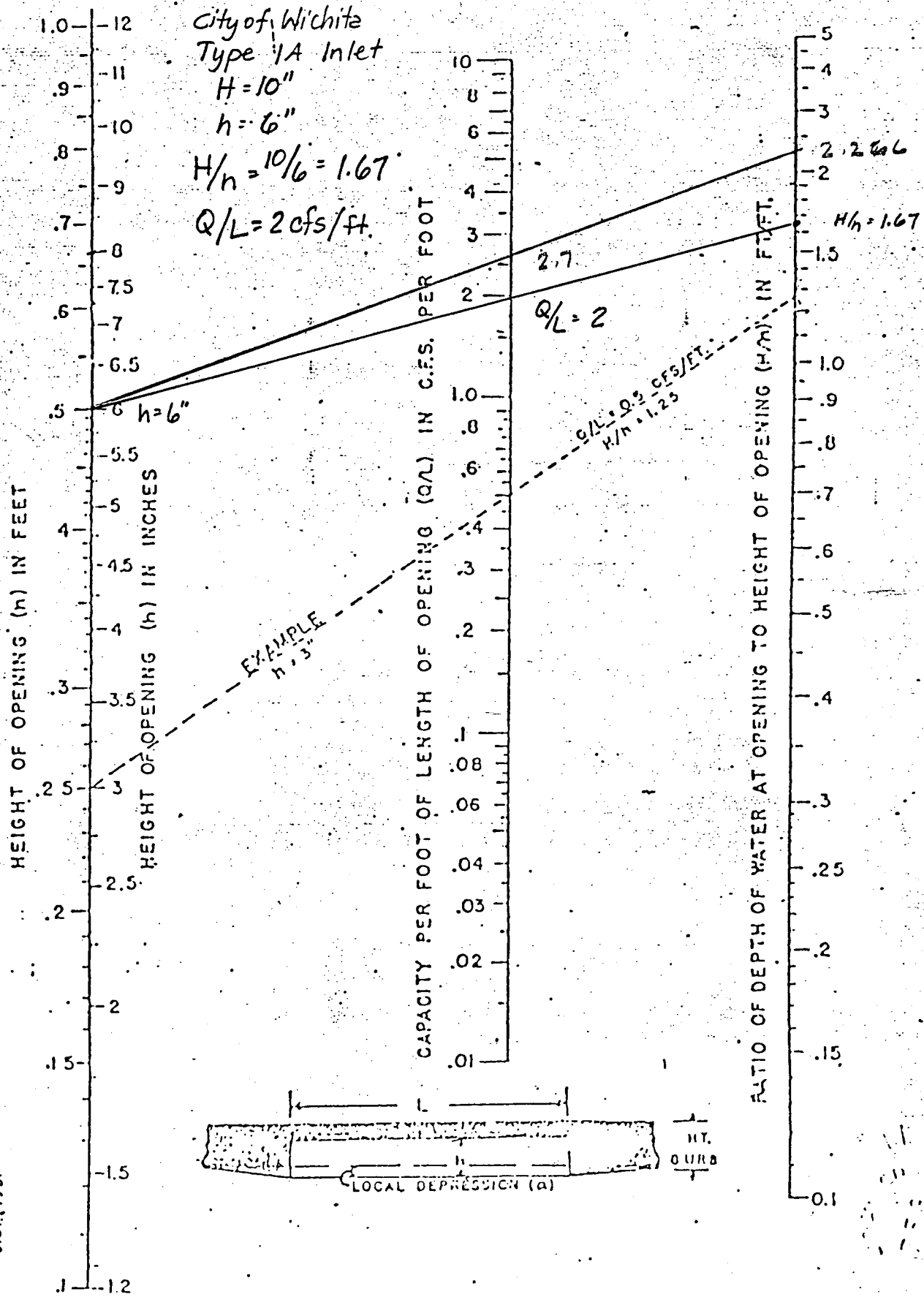
$$= 84.7 \text{ cfs}$$

$$L = \frac{84.7 \text{ cfs}}{2.7 \text{ cfs/ft}} = 31.4' \text{ inlet.}$$

SUMP CONDITION ONLY

1073.03

City of Wichita  
 Type 1A Inlet  
 $H = 10''$   
 $h = 6''$   
 $H/h = 10/6 = 1.67$   
 $Q/L = 2 \text{ cfs/ft.}$



JAN., 1951

DRAINAGE PLAN