CLARKSTON
DRAINAGE
2-80-001

82 0020

# Weatherproof Field Book

"...in the Rain" paper

32 pages

4⅝" x 7¼"

Keuffel & Esser Co., Morristown, N. J. 07960 Made in U.S.A.

## CURVE FORMULAS

$T = R \tan \frac{1}{2} I$

$T = \frac{50 \tan \frac{1}{2} I}{\text{Sin. } \frac{1}{2} D}$

$\text{Sin. } \frac{1}{2} D = \frac{50}{R}$

$\text{Sin. } \frac{1}{2} D = \frac{50 \tan \frac{1}{2} I}{T}$

$R = T \cot. \frac{1}{2} I$

$R = \frac{50}{\text{Sin. } \frac{1}{2} D}$

$E = R \text{ ex. sec } \frac{1}{2} I$

$E = T \tan \frac{1}{4} I$

$\text{Chord def.} = \frac{\text{chord}^2}{R}$

$\text{No. chords} = \frac{I}{D}$

Tan. def. = ½ chord def.

The square of any distance, divided by twice the radius, will equal the distance from tangent to curve. very nearly.

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for 1° for 1 ft.) and divide given deflection by the product.

Rule 2. Multiply given deflection by 57.3, and divide the product by the given distance.

To find deflection for a given angle and distance. Multiply the angle by .01745, and the product by the distance.

## GENERAL DATA

RIGHT ANGLE TRIANGLES. Square the altitude, divide by twice the base. Add quotient to base for hypotenuse.

Given Base 100, Alt. $10.10^2 \div 200 = .5$. $100 + .5 = 100.5$ hyp.

Given Hyp. 100, Alt. $25.25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 =$ Base.

Error in first example, .002; in last, .045.

To find Tons of Rail in one mile of track: multiply weight per yard by 11, and divide by 7.

LEVELING. The correction for curvature and refraction, in feet and decimals of feet is equal to $0.574\,d^2$, where d is the distance in miles. The correction for curvature alone is closely, $\frac{2}{3}d^2$. The combined correction is negative.

PROBABLE ERROR. If $d_1, d_2, d_3$, etc. are the discrepancies of various results from the mean, and if $\Sigma d^2$ = the sum of the squares of these differences and n = the number of observations, then the probable error of the mean $= \pm 0.6745 \sqrt{\frac{\Sigma d^2}{n(n-1)}}$

### MINUTES IN DECIMALS OF A DEGREE

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1′ | .0167 | 11′ | .1833 | 21′ | .3500 | 31′ | .5167 | 41′ | .6833 | 51′ | .8500 |
| 2 | .0333 | 12 | .2000 | 22 | .3667 | 32 | .5333 | 42 | .7000 | 52 | .8667 |
| 3 | .0500 | 13 | .2167 | 23 | .3833 | 33 | .5500 | 43 | .7167 | 53 | .8833 |
| 4 | .0667 | 14 | .2333 | 24 | .4000 | 34 | .5667 | 44 | .7333 | 54 | .9000 |
| 5 | .0833 | 15 | .2500 | 25 | .4167 | 35 | .5833 | 45 | .7500 | 55 | .9167 |
| 6 | .1000 | 16 | .2667 | 26 | .4333 | 36 | .6000 | 46 | .7667 | 56 | .9333 |
| 7 | .1167 | 17 | .2833 | 27 | .4500 | 37 | .6167 | 47 | .7833 | 57 | .9500 |
| 8 | .1333 | 18 | .3000 | 28 | .4667 | 38 | .6333 | 48 | .8000 | 58 | .9667 |
| 9 | .1500 | 19 | .3167 | 29 | .4833 | 39 | .6500 | 49 | .8167 | 59 | .9833 |
| 10 | .1667 | 20 | .3333 | 30 | .5000 | 40 | .6667 | 50 | .8333 | 60 | 1.0000 |

### INCHES IN DECIMALS OF A FOOT

| 1-16 | 3-32 | ⅛ | 3-16 | ¼ | 5-16 | ⅜ | ½ | ⅝ | ¾ | ⅞ |
|---|---|---|---|---|---|---|---|---|---|---|
| .0052 | .0078 | .0104 | .0156 | .0208 | .0260 | .0313 | .0417 | .0521 | .0625 | .0729 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| .0833 | .1667 | .2500 | .3333 | .4167 | .5000 | .5833 | .6667 | .7500 | .8333 | .9167 |

PAGE JOB NO. DESCRIPTION INDEX

1 LEVELS FOR BM AT CLARKSTON

| STA. | + | HI | — | ELEV |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| BM | | | | 4460.00 |
| | | | | |
| | | | | |
| | | | | |

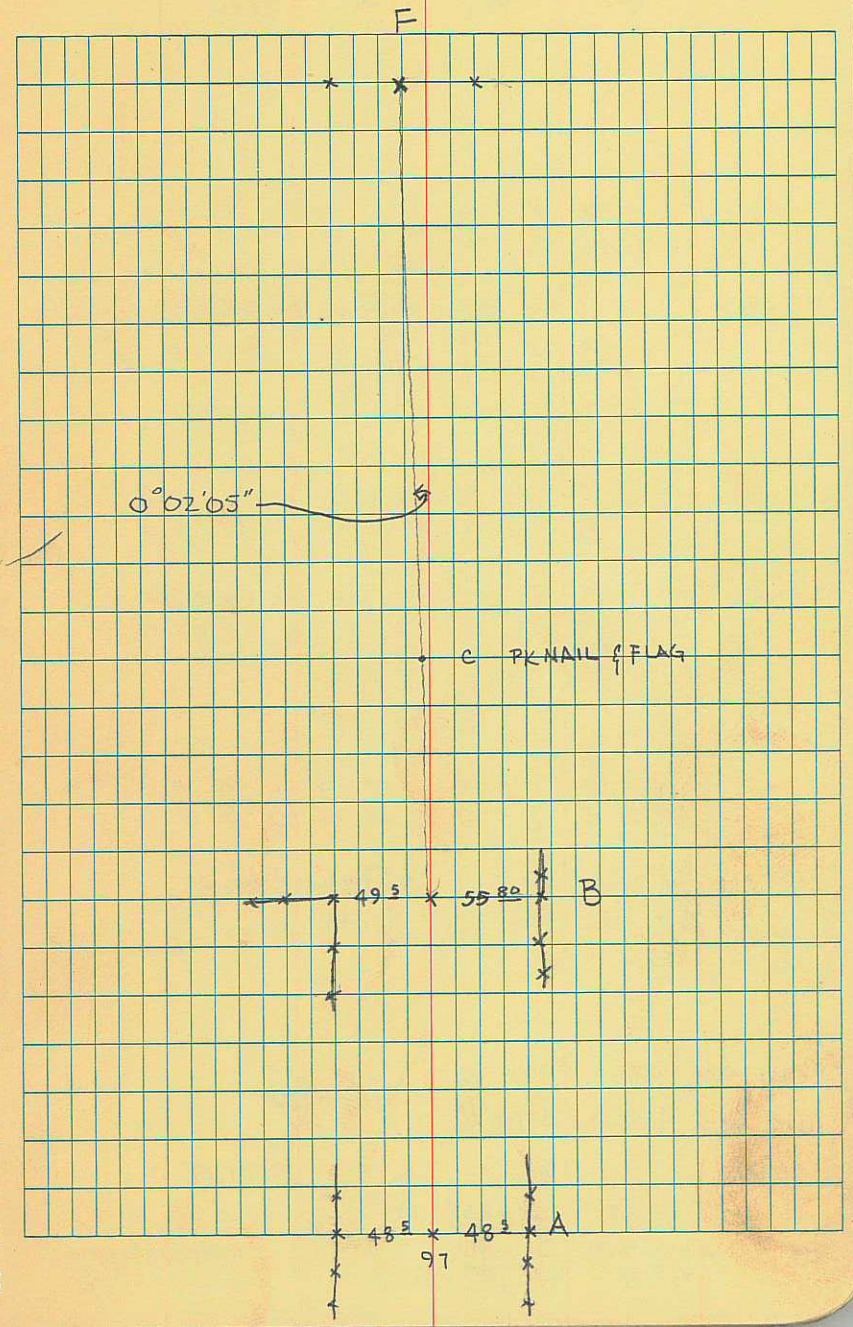
| STA | + | HI | − | ELEV | |
|---|---|---|---|---|---|

| STA | + | HI | — | ELEV |
|---|---|---|---|---|

B-F 0°02'05"

~~3~~ DEF LT

BACK A



| STA | + | HI | − | ELEV |
|---|---|---|---|---|
| 21+50 | | | 4 77 | 4700.60 |
| 21+00 | | | 4 78 | 4700.59 |
| 20+50 | | | 4 52 | 4700.85 |
| (CROSS SEC HI | | | | → |
| BM Ass. | 4700.00 | 4705 98 | | |
| C-20+00 | | | 4.18 | 4701.19 |
| | 5.37 | 4705 37 | | |
| BM | ASSUMED 4700 | PROFILE ONLY | | |

W E

02 03 01 99 06 04 02 98 98
58 57 58 68 54 × 58 74 78
43 30 19 17 8 ER 16 ER 33 46 FEN

03 04 03 99 00 06 03 01 98
57 56 57 67 58 54 × 57 62 73
47 34 20 18 13 3 ED 15 ED 28 46 FEN

07 07 99 02 06 00 04 07 99 98 95
53 53 68 58 54 × 56 63 62 65
30 19 17 14 6 ED 14 ED 20 31 38

98 98 01 08 97
73 74 49 × 52 86
17 12 FE 6 ER 14 ER 18 FE

CROSS SECTION HI 4705 98

| | + | HI | − | ELEV |
|---|---|---|---|---|
| 24+00 | | | 5 30 | 4700.07 |
| (Cross. Sec HI | +5 48 | 4705 60 | −5 86 | 4700 12/2) → |
| 23+50 | | | 5 08 | 4700.29 |
| 23+00 | | | 4 94 | 4700.43 |
| 22+50 | | | 4 96 | 4700.41 |
| 22+00 | | | 4 90 | 4700.47 |

PROFILE HI 4705 37 (CROSS SEC HI 4705 98 − 5 86/12) →

W E

99.2 99.2 99.5 99.9 99.1 99.0 99.1 99.2 98.8 98.8 98.2 97.9 97.2 95.2

5 2 5 2 6 1 6 0 6 5 5 6 × 5 2 6 2 7 4 9 9 10 4

200 158 100 42 18 4 ER 16 ER 36 46 FEN 100 200

4705.60 HI

99.6 99.2 99.0 98.4 98.2

6 4 6 8 5 8 × 6 0 7 6 7 8

34 18 4 ER 16 ER 35 48 FEN

99.3 99.2 98.8 98.5 98.3 98.3 98.1 98.2 97.3 95.9 94.5 94.8

5 7 5 8 6 2 6 5 6 7 5 7 × 5 8 7 8 8 1 10 1 11 5 11 2

200 150 100 47 17 4 ER 16 ER 33 46 FEN 100 161 200

99.2 99.0 98.1 97.3

6 0 6 8 5 8 × 5 9 7 2 8 7

45 17 4 ER 16 ER 36 51 FEN

99.4 99.1 98.8 98.2 98.1 98.1 98.3 98.1 98.2 95.9 94.8 93.7

5 6 6 1 6 2 6 3 6 0 5 9 6 9 5 7 × 5 8 7 5 7 8 10 1 11 2 12 1

200 150 100 66 44 20 18 7 ER 16 ER 35 46 FEN 100 155 200

4705 98

|  | + | HI | − | ELEV |  |
|---|---|---|---|---|---|
| 26+50 |  |  | $4^{93}$ | 4700.32 |  |
| 26+00 |  |  | $5^{04}$ | 4700.21 | 0 5 2 5<br>5 04<br>0 21 |
| PROFILE | $5^{30}$ → | $4705^{25}$ |  |  |  |
| 25+50 |  |  | $5^{24}$ | 4700.01 |  |
| 25+00 |  |  | $5^{42}$ | $4699^{95}$ | TP |
| 24+50 |  |  | $5^{37}$ | 4700.00 |  |
|  |  | $4705^{37}$ |  |  |  |

W — E

|  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| $0^{4}$ | $0^{3}$ | $0^{6}$ | $99^{4}$ | $0^{4}$ | $0^{3}$ | $99^{8}$ | $98^{0}$ |
| $\frac{5^{2}}{100}$ | $\frac{5^{3}}{58}$ | $\frac{5^{0}}{19}$ | $\frac{6^{2}}{17}$ | $\frac{5^{2}}{6}$ ER | × | $\frac{5^{8}}{18}$ ER | $\frac{7^{6}}{31}$ |

DITCH +5 DEEP
ON STATION

|  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $99^{9}$ | $99^{9}$ | $0^{4}$ | $99^{4}$ | $0^{3}$ | $0^{2}$ | $99^{8}$ | $98^{1}$ | $97^{6}$ | $98^{6}$ | $97^{4}$ | $96^{8}$ | $95^{6}$ |
| $\frac{5^{7}}{200}$ | $\frac{5^{7}}{100}$ | $\frac{5^{2}}{18}$ | $\frac{6^{2}}{17}$ | $\frac{5^{3}}{7}$ ER | × | $\frac{5^{8}}{17}$ ER | $\frac{7^{5}}{37}$ | $\frac{8^{2}}{39}$ | $\frac{7^{0}}{45}$ | $\frac{8^{3}}{52}$ | $\frac{8^{8}}{78}$ | $\frac{10^{0}}{100}$ |

|  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $99^{6}$ | $0^{0}$ | $99^{4}$ | $99^{7}$ | $0^{0}$ | $99^{6}$ | $98^{3}$ | $98^{6}$ | $97^{6}$ | $98^{9}$ | $97^{3}$ | $96^{3}$ |
| $\frac{6^{0}}{100}$ | $\frac{5^{6}}{19}$ | $\frac{6^{3}}{17}$ | $\frac{5^{9}}{11}$ ER | × | $\frac{6^{0}}{16}$ ER | $\frac{7^{4}}{26}$ | $\frac{7^{0}}{36}$ | $\frac{8^{0}}{39}$ | $\frac{6^{7}}{45}$ | $\frac{8^{3}}{56}$ | $\frac{9^{3}}{100}$ |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $99^{5}$ | $99^{7}$ | $0^{3}$ | $98^{9}$ | $99^{9}$ | $0^{0}$ | $0^{0}$ | $99^{5}$ | $98^{4}$ | $97^{7}$ | $98^{2}$ | $97^{0}$ | $96^{4}$ |
| $\frac{6^{1}}{200}$ | $\frac{5^{9}}{100}$ | $\frac{5^{3}}{19}$ | $\frac{6^{7}}{18}$ | $\frac{5^{7}}{12}$ | $\frac{5^{6}}{2}$ ER | × | $\frac{6^{1}}{16}$ ER | $\frac{7^{3}}{35}$ | $\frac{7^{9}}{41}$ | $\frac{7^{4}}{44}$ | $\frac{8^{6}}{52}$ | $\frac{9^{3}}{100}$ |

|  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
| $99^{5}$ | $99^{7}$ | $99^{0}$ | $0^{0}$ | $0^{0}$ | $99^{6}$ | $98^{8}$ | $98^{1}$ | $98^{8}$ | $98^{0}$ | $97^{3}$ |
| $\frac{6^{1}}{100}$ | $\frac{5^{9}}{19}$ | $\frac{6^{6}}{18}$ | $\frac{5^{6}}{3}$ ER | × | $\frac{6^{0}}{16}$ ER | $\frac{6^{8}}{38}$ | $\frac{7^{5}}{40}$ | $\frac{6^{8}}{44}$ | $\frac{7^{6}}{50}$ | $\frac{8^{3}}{94}$ |

$4705^{60}$

| | + | HI | − | ELEV. |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 29+00 | | | 4 22 | 4701.03 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 28+50 | | | 4 56 | 4700.69 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 28+00 | | | 4 68 | 4700.57 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 27+50 | | | 4 86 | 4700.39 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 27+00 | | | 4 96 | 4700.29 |
| | | | | |
| | | 4705 25 | | |

+4 44 4708 05 −1 99 4703 61 BM
FENCE POST

2 1 0 99 0 10 0 98 99 0

3 2 4 2 5 2 6 3 4 7 × 4 9 6 2 6 4 5 5
200 100 18 16 2 ER 18 34 39 46 FEN

0 0 0 99 0 07 0 98 99 99 0

4 9 5 1 6 3 5 9 × 5 4 7 3 6 2 6 5 5 6
100 18 15 2 ER 18 ER 32 35 38 41

0 0 0 99 0 08 0 98 99 99

4 7 5 0 4 8 6 3 5 1 × 5 4 7 3 6 3 6 0
200 100 20 16 2 ER 18 ER 31 34 46 FEN

0 0 0 99 1 04 0 0 0

5 3 5 0 6 4 5 3 × 5 4 4 8 5 4
100 25 17 5 ER 13 ER 31 46

0 0 0 0 99 0 03 99 99 97

4 8 5 3 5 4 5 4 6 2 5 4 × 5 2 6 2 8 9
200 100 55 19 17 7 ER 13 18 ER 32

4705 60
1 99
3 61

| | + | HI | − | ELEV. | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| 31+50 | | | 6 62 | 4702.09 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 31+00 | | | 6 87 | 4701.84 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | 7 19 | 4708 71 | | | |
| 30+50 | | | 3 73 | 4701 52 | TP |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 30+00 | | | 3 88 | 4701.37 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 29+50 | | | 4 03 | 4701.22 | |
| | | | | | |
| | | 4705 25 | | | |



2 8 1 04 2 1 2 01 2 03 1 6 2 4

6 0 6 2 7 6 6 0 6 9 7 2 6 4 5 6
100 18 15 3 19 ER 34 37 45

7 2 1 3 1 4 0 2 1 7 1 8 1 6 9 6 1 0 1 7

0 3 6 7 6 9 7 8 6 3 6 4 8 4 7 0 6 3
200 100 21 14 1 ER 19 ER 33 37 45 FEN

3 1 1 99 1 5 1 4 0 2 3 5 0 1

4 9 6 9 8 4 6 6 6 6 7 3 8 7 7 5 7 0
100 18 15 1 ER 20 ER 27 33 36 45 FEN

4 7 2 1 0 5 3 99 1 4 1 2 0 2 0 8 0 8

3 3 5 3 7 0 8 5 6 7 6 8 7 8 7 2 7 3
200 100 18 15 2 ER 18 ER 33 45 FEN 47

1 6 1 4 0 3 99 1 2 0 5 0 3 9 8 8 9 6 1 0

6 4 7 6 8 7 6 9 7 1 7 2 9 1 8 2 7 9
100 18 15 2 ER 18 ER 27 33 39 45 FEN

4708 05

| | + | HI | − | ELEV | |
|---|---|---|---|---|---|
| 34+00 | | | 3 93 | 4704.78 | |
| 33+56 | WATER LINE | HI 4708 05 | −8 1 | | 8' LT |
| 33+50 | OLD PIPE 12" | HI 4708 05 | −5 7 | | 20' LT |
| | WATER LINE 4" | HI 4708 05 | −8 0 | | 50' LT |
| 33+43 | | | | | |
| | (REFER TO TOPOG. PG. 25) | | | | |
| | (NO STA. SET AT 33+50) | | | | |
| 33+00 | | | 4 90 | 4703.81 | |
| 32+50 | | | 5 78 | 4702.93 | |
| 32+00 | | | 6 23 | 4702.48 | |
| | | 470871 | | | |

W E

4708 05

| STA | + | HI | − | ELEV. | |
|---|---|---|---|---|---|
| | 5 64 | 4711 81 | | | |
| 36+50 | | | 2 54 | 4706 17 | FP |
| 36+00 | | | 2 66 | 4706.05 | |
| 35+50 | | | 3 00 | 4705.71 | |
| 35+00 | | | 3 19 | 4705.52 | |
| 34+50 | | | 3 54 | 4705.17 | |
| | | 4708 71 | | HI & PROFILE | |



5 7 | 5 5 | 4 6 | 4 8 | 5 6 | 5 8 | 6 +

5 8 6 5 6 4 5 3 × 5 2 4 2
32 20 13 4 17 26
FEN ER ER

8 8 | 7 3 | 5 4 | 4 2 | 4 2 | 5 8 | 6 - | 5 5 | 5 2 | 4 3

2 7 3 7 5 6 6 8 6 3 5 3 × 5 2 5 8 6 7
200 100 32 19 13 3 18 26 43
FEN ER ER FOOTINGS

8 5 | 5 5 | 4 4 | 5 7 | 5 3 | 6 3 | 5 5

6 2 6 5 5 6 × 5 7 4 7 4 5
32 14 4 17 32 45
FEN ER ER

7 8 | 5 4 | 5 5 | 4 4 | 3 4 | 5 2 | 5 5 | 5 8 | 6 1 | 8 3 | 7 5

3 2 5 1 5 2 6 6 7 1 5 8 × 6 2 8 4 7 2 5 2
200 100 33 17 14 8 19 32 36 47
FEN ER ER FEN

4710 98 HI CROSS SECTION

FIRE HYDR. B.M. +5 57 HI 4710.98 − 2 64 4705.41
4705.41

4 6 | 4 4 | 3 2 | 4 8 | 5 2 | 4 7 | 2 0 | 1 3 | 4 8

3 4 3 6 4 3 3 2 × 3 2 6 2 4 2 3 2
33 17 14 2 19 35 40 47
ER ER FEN

4708 05
2 64

| STA | + | HI | — | ELEV |
|---|---|---|---|---|
| 39+00 | | | 4 77 | 4707.04 |
| 38+50 | | | 4 67 | 4707.14 |
| 38+00 | | | 4 96 | 4706.85 |
| 37+50 | | | 5 29 | 4706.52 |
| 37+00 | | | 5 49 | 4706.32 |
| | | 4711 81 | | |

TP +2 16 EL 4708 82 +3 27 HI 4712.09

4710 98

2 16 82

| STA | + | HI | − | |
|---|---|---|---|---|
| 41+00 | | | | |
| 40+50 | | | | |
| CROSS SECT. CHECK | | | 2 16 | 4708 82 |
| NORTH END OF EAST WALL | | | 2 98 | 4708 83 B.M. |
| ~~4~~0+00 | | | | |
| 39+80 05 | | | 4 26 | 4707.55 |
| 39+50 | | | 4 46 | 4707.35 |
| | | 4711.81 2 98 | | |



6.5 6.1 6.6 6.4

1 09

-3 27

4708 82 B.M. CHECK

5.5 6.0 6.6 6.4

7 7 7 7 7 7 7 7

5 2 4 6 4 7 6 2 5 0 4 3 4 3 4 4 5 6 4 0 5 5 5 2

63 31 FEN 28 25 15 5 ER 13 ER 24 32 38 68

6 9 6 2 6 4 7 2 7 1 7 5 7 6 7 4 7 1 6 9 6 8 6 9

5 2 5 4 7 4 4 2 5 4 4 6 4 5 4 7 5 8 3 2 5 8

31 29 26 21 15 5 ER 14 ER 23 33 39

6 9 6 5 6 4 6 6 7 3 7 5 7 1 6 9 6 7 6 9

5 7 6 8 8 4 5 2 ~~5 8~~ 4 8 4 6 5 0 5 7 4 8 5 9

59 31 27 12 6 ER 15 ER 25 32 42

6 9 6 3 6 2 6 8 6 5 7 3 7 0 7 5 7 5

5 7 7 8 9 3 6 2 5 3 5 4 6 2 6 6

31 FEN 26 21 14 6 ER 15 ER 19 34

4712 09

D-LINE

STA

8+00

7+00

6+00

0 90 4701 11

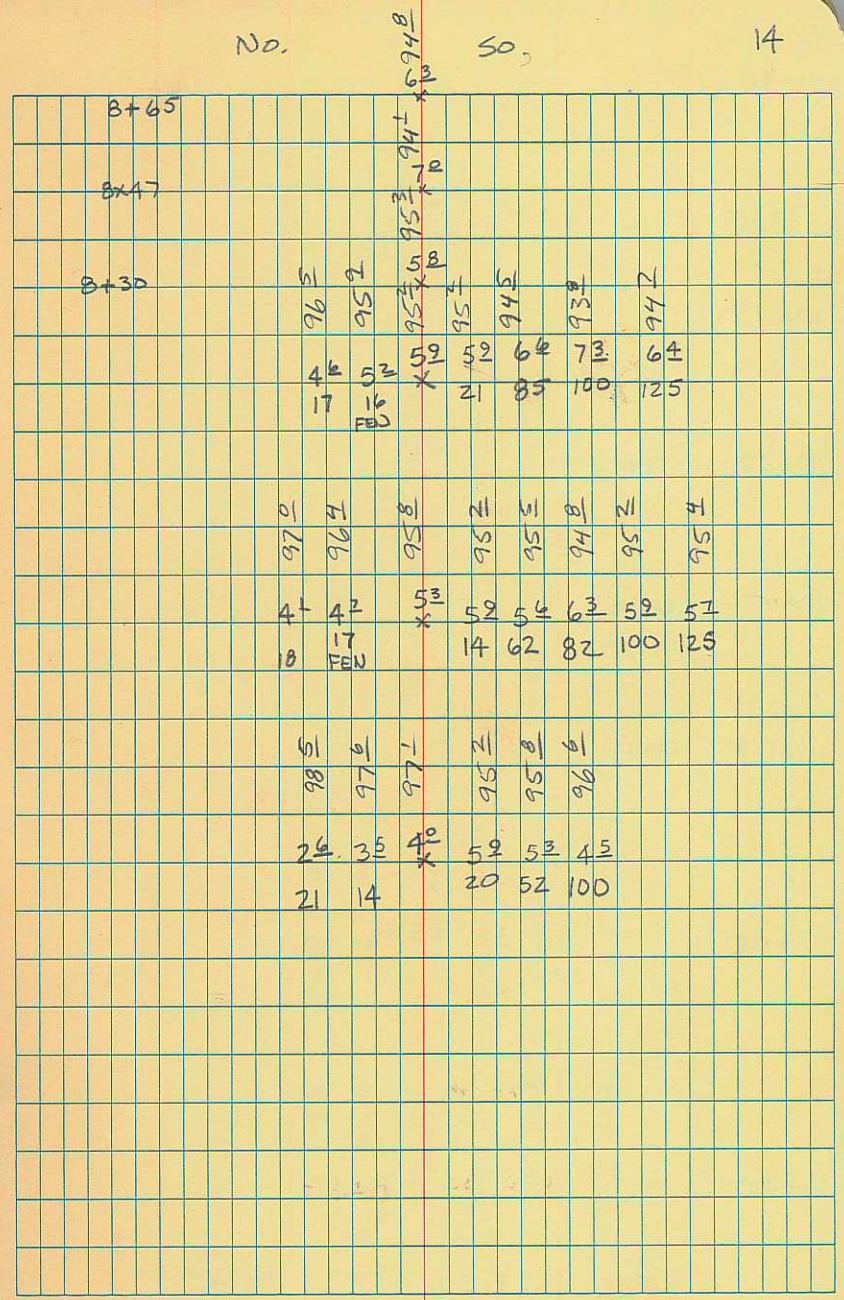
BM STA 26 ELEV. 4700 21

STA 5+00 EQ 26+32 ~~4700 21~~

D-LINE

DITCH LINE 90° OFF BASE

No. 50, 14



| STA | | | | |
|---|---|---|---|---|
| 10+40 | | | | |
| 10+35 | | | | |
| 10+27 | | | | |
| 10+20 | STREAM FE | | | |
| 10+15 | BANK | | | |
| 11+00 | | | | |
| 10+11.5 | FENCE | | | |
| 10+00 | | | | |
| 9+00 | | | | |
| | 4.48 | 4699.57 | 6.02 | 4695.09 (4.48) / 4701.11 (6.02) |
| D-LINE | | | | |

93.1 6.3 89.2 10.3 79.2 10.3 90.4 9.2 93.3 6.3 93.2 5.7

94.2 94.2 94.2 93.4 92.8

49 17 FEN | 49 15 | 54 | 57 45 | 68 100

95.4 95.2 94.5 93.2 94.1 93.8

43 17 FEN | 44 16 | 51 | 52 17 | 55 38 | 58 100

4699.57

SEE Pg. 19

7+25

HI +2 08' 91 47174

825-7425

DEF RT 55°28'00"

8+25

8+50

9+25

9+50

10+00 EQUA 39+00

C-LINE No. SIDE OF CREEK 90° OFF BASE



E W

STREAM INLET +12'

N S

-2.68

9.06

47174

14+00

3 86 4706 71 4712 15 9 30 4702 85 3 86

13+00

12+00

11 - 12 57°24'10"

℄ DEF RT

11+00

+3 32 4712 15

C-LINE STA — 10+50

BM 4708 83 3 32

4706 71

4712 15

17+50 FENCE

17+00

3 32 4704 57

5 46 4701 25/32

4706 71/5 46

16-17

℄ DEF RT 13°30'

16+00

104 6
108

938

15+00

℄ LINE



4704 57 →

95 1/2
11 1/2
78

4706 71

5+50

6+50

= 3.13 4711 96

7+25 - 6+50

Δ DEF RT 15°40'

BM 4708 83 +

BM BRIDGE NE COR
ELEV ASSUM. 4708 83

E W 19

N 8 2 8 1 8 0 6 9 6 8 7 6 8 2 9 3 3 6

3 8 3 6 4 2 5 1 5 2 4 4 3 3 2 7 8 4
125 100 80 65 40 33 × 40 42

N 7 2 7 0 6 8 6 9 7 0 7 5 7 6 1 9 1 9

4 8 5 0 5 2 6 2 5 0 4 5 4 5 10 1 10 1
125 100 84 45 30 × 15 27 47

SEE PG 16

4711 96

C-LINE (CONTINUED)

1+00 (1' OFFSET SO.)

2+00

51 BANK, SO.
2+43 LINE CROSSING 9 7/53 BOTTOM, 4 WIDE
BANK NO.

2+89

3+00

4+00

6 44 4715 27

BM BRIDGE 4708 83/6 44

37+65 EQ 5+00

S - LINE 90° OFF BASE LINE

SOUTH SIDE OF CREEK



S NORTH ✠ SOUTH

1+00

12 3/4 11 3/4 11 3/4 12 3/4 13 3/4 10 1/4 13 1/2 13 1/2 13 0/4

3 0/0 3 4/4 4 0/0 3 0/0 2 1/4 5 2/4 × 2 1/4 2 1/4 2 3/4

100 76 67 56 1 1 5 45

2+00

10 8/8 10 3/4 10 7/8 10 1/4 5 2/4 × 9 7/8 7 4/4 11 1/4 10 8/8

4 5/4 5 0/0 4 6/4 5 6/4 7 2/4 4 3/4 4 5/4

100 82 27 3 5 8 30

2+89

9 5/8 9 7/8 5 8/8 4 8/8 8 8/8

5 8/8 6 4/8 9 5/8 10 5/8 6 5/8 ×

51 38 35 30 27

3+00

0 7/8 8 2/8 8 2/8 4 7/8 3 6/8 8 2/8 8 2/8 8 8/8 9 1/8 9 7/8

15 1/4 6 6/8 6 6/8 11 1/4 11 7/8 7 1/4 6 6/8 × 6 5/8 6 2/8 6 1/4

49 46 44 39 34 30 29 64 100

9 8/8 5 1/8 6 7/8 6 8/8 6 6/8 6 8/8 7 5/8 7 6/8

16 6/8 9 5/8 9 1/4 8 5/8 8 7/8 × 8 5/8 7 8/8 7 7/8

68 46 16 15 43 77 100

4715 27/44

| | | | | |
|---|---|---|---|---|
| 6+00 | | | | |
| | 4 81 | 4702 71 | | |
| | | | 8 21 | 4697 90 |
| BM 4700 00 | 6 11 | 4706 11 | | |
| 2+00 | | | | |
| TP | 5 67 | 4708 02 | 3 39 | 4702 35 |
| 3+00 | | | | |
| 4+00 | | | | |

20+25 EQ 5+00

J - LINE 90° OFF BASE LINE

| | | |
|---|---|---|
| BM 4700 00 | 4705 74 | |
| 5 74 | 3 39 | |

97 98 98 95 95 97 98
48 44 47 75 73 52 43
× 18 23 32 35 37 42
SOUTH SIDE

4702 71

28 19 38 1 30 2 31 25 25
54 34 42 69 77 43 30 57 55
37 31 29 25 22 20 18 9 ×
SOUTH SIDE

4708 02

16 13 99 99 25 31 19 23
41 26 61 62 29 20 38 34
34 25 21 18 16 13 7 ×
SOUTH

13 32 99 98 71 02 12
44 34 67 72 43 52 45
36 29 26 22 20 10 ×
SOUTH

4705 74

| | + | HI | − | ELEV |
|---|---|---|---|---|
| 10+80 | | | | |
| 10+00 | | | | |
| | ) | | | |
| 9+00 | | | | |
| TP | 4 13 | 4698 40 | 8 44 | 4694 27 |
| 8+00 | | | | |
| 7+00 | | | | |
| J-LINE | | 4702 71 / 844 | | |



4698 40 HI THIS SIDE

THIS SIDE HI 4699 2

+340 HI = 4699 2

STA 7+00 ELEV 958

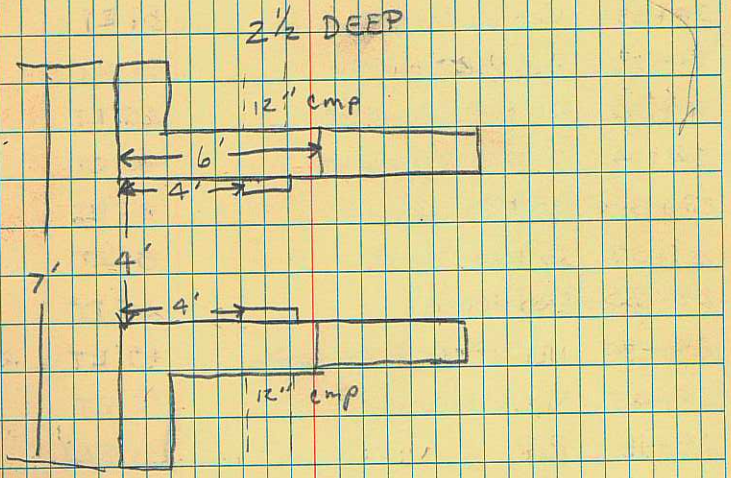
HI LINE

HI THIS SIDE ONLY

4702 71

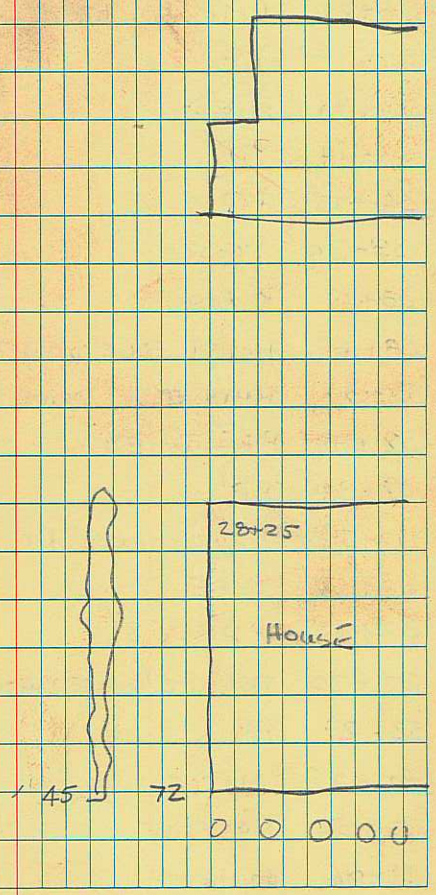
| | | | |
|---|---|---|---|
| 27+97 | P.P. | | |
| 27+77 | FIRE HYDR. | | 52 HI 4705 60 |
| 27+61 | NO. END PIPE | 29 RT | 83 HI 4705 60 |
| 27+44 | FENCE | 45 RT | |
| 27+25 | SO. END PIPE | 29.5 RT | 8° HI 4705 60 |
| 27+14 | WATER METER | 46.5 RT | 68 HI 4705 60 |
| 27+06 | FENCE | 53 RT | |
| 27+04 | NO. EDGE BUILD | 80 RT | |
| 26+90 | T.P. | 37 'RT | |
| 26+89 | NO. END PIPE | 30' RT | 85 HI 4705 60 |
| 26+69 | SO. END PIPE | 30' RT | 81 HI 4705 60 |
| 26+54 | SO EDGE BUILD. | 79 'RT | |
| 26+51 | TREE | 55' LT | |
| 26+21 | P.P. | 20' LT | |
| 24+86 | T.P. | 36' RT | |
| 24+30 | CULVERT OUTLET | 19' RT | 81 4705 60 HI |
| 24+05 | P.P | 20' LT | |
| 22+80 | T.P. | 35.5 RT | |
| 21+95 | P.P | 21' LT | |
| 20+76 | ~~P.P.~~ T. | 34' RT | |
| 20+48 | TREES (7) | 43' RT | |
| 19+98 | IRR BOX. | 27' RT | 88 |
| 20+02 | PIPE | | |
| 19+98 | PIPE | INLET 11 LT 73 75 | OUTLET 17 RT 89 85 |
| 19+89 | P. P. | 22' LT | |
| 19+87 | WATER VALVE | 10' LT | 51 |

HI 4705 98



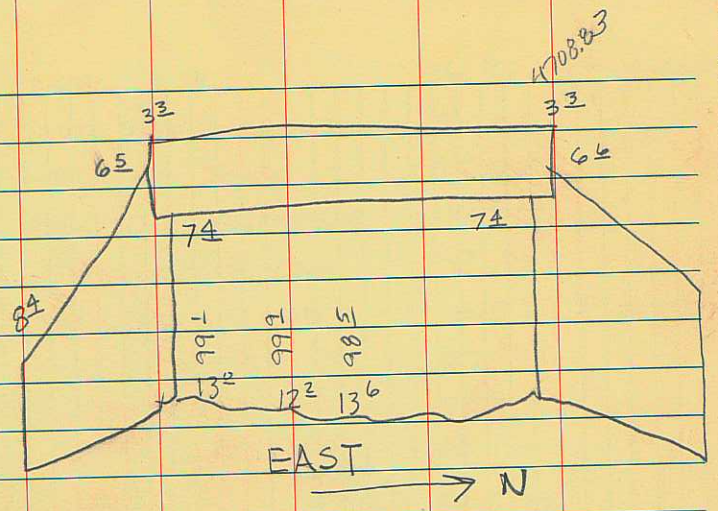

IRR BOX
STA 19+98 27' RT

| | | | |
|---|---|---|---|
| 31+75 | GRAINARY NO SIDE | 53 RT | |
| 31+60 | GRAINARY SO. SIDE | 53 RT | |
| 31+90 | CMP NO END | 33 RT | 7 6 |
| 31+74 | CMP SOUTH END | 33 RT | 7 5 |
| 31+76 | CONC PIPE NO END | 16 LT | 7 1 |
| 31+76 | DRIVE NO EDGE | 16 LT | |
| 31+59 | DRIVE SO. EDGE | 25 LT | 48 +66 3 8 |
| 31+55 | CONC. PIPE SO. END | 16 LT | 7 3 |
| 31+50 | FENCE | 45 RT | HI 4708 05 |
| 31+49 | PP | 42 RT | |
| 30+68 | T.P. | 37 RT | |
| 30+67 | T.P | 37 RT | |
| 30+51 | P. P. | 18.5 LT | |
| 30+39 | HEDGE NO END | 51 RT | |
| 30+23 | HEDGE SO. END | 51 RT | |
| 30+22 | NO END DRIVEWAY | 45 RT | |
| 30+04 | SO END DRIVEWAY | 45 RT | |
| 29+81 | NO END HOUSE | 87 RT | |
| 29+55 | SO END HOUSE | 81 RT | |
| 28+80 | END HEDGE | 43' RT | |
| 28+78 | NEW FENCE ON CONC. | 45' RT | |
| 28+25 | NO HOUSE | 72' RT | |
| 28+16 | P.P | 18.5 LT | |
| 27+61 | HEDGE | 45 RT | |
| 27+96 | HOUSE | 72 RT | |



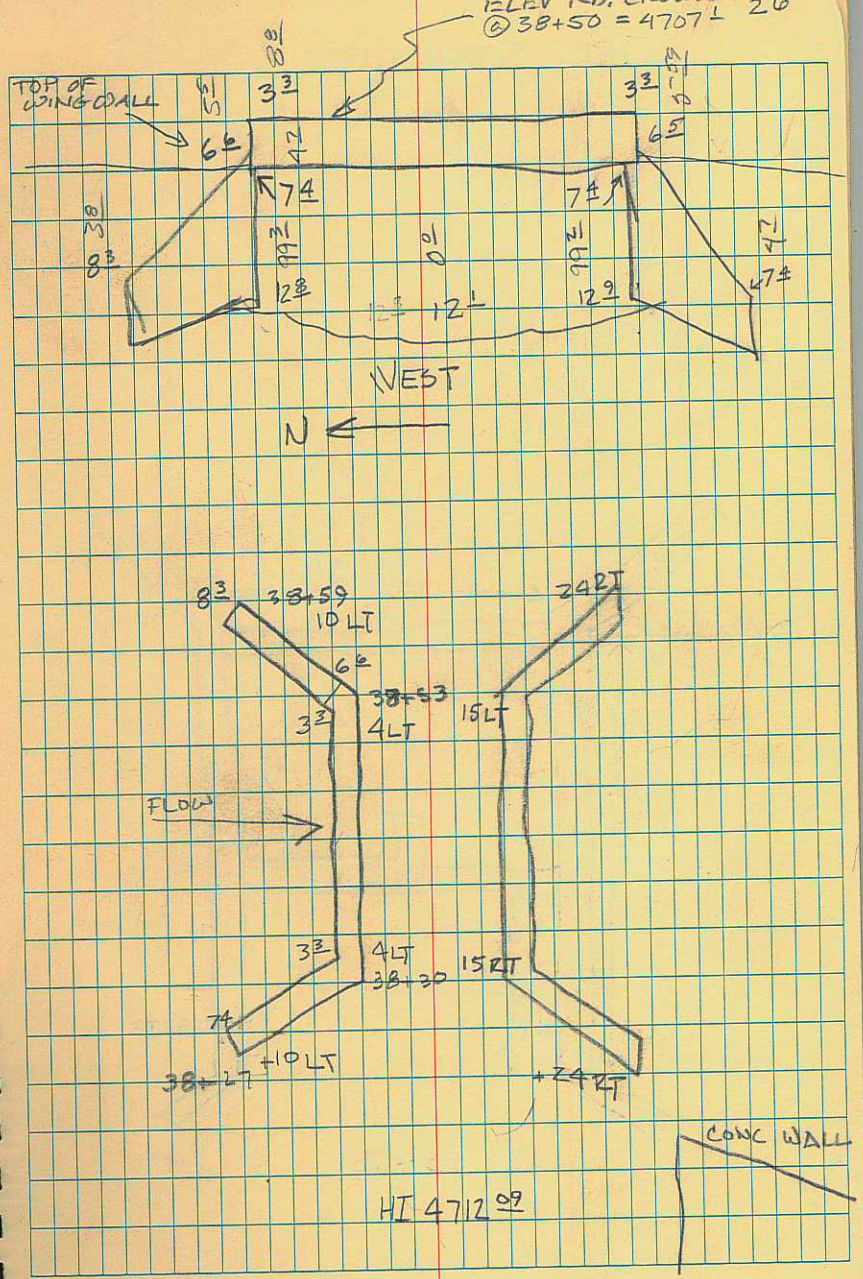
| | | | |
|---|---|---|---|
| 33+53 | WATER VALVE | 36' RT | 5 3 HI 470895 |
| 36+68 | SOUTH EDGE LOADING RAMP | 36 RT | |
| 36+68 | NORTH END SHED | 45 RT | |
| 35+53 | CONC. WALL SOUTH END | 40.5 RT | |
| 35+53 | SHED SOUTH EDGE | 42 RT | |
| 35+53 | CMP NORTH END | 30.5 RT | 8 L 471098 |
| 35+27 | SHED NO EDGE | 47 RT | |
| 35+27 | CMP So. EDGE | 31 RT | 8 3 471098 |
| 35+215 | P.P | 17 LT | |
| 34+94 | SHED | 48.5 RT | |
| 34+24 | P.P. | 17.5 LT | |
| 34+13 | P.P | 45 RT | SIGN 40' RT |
| 33+94 | FENCE | 45 RT | |
| 33+19 | R FENCE | 45 RT | |
| 33+60 | NORTH EDGE DRIVE | 35 LT | |
| 33+30 | SOUTH EDGE DRIVE | 35 LT | |
| 32+99 | FIRE HYRD. | 20' LT | 5 L 470805 HI |
| 32+94 | TP | 40' RT | |
| 32+78 | TRAILER HOUSE NO | 102' RT | |
| 32+71 | TREE | 47 RT | |
| 32+44 | PP | 19' LT | |
| 32+30 | TRAILER HOUSE SO | 102' RT | |
| 32+29 | PP | 44 RT | BOX RT 46.5 |
| 31+25 | METER | 41 RT | |
| 31+32 | NO HOUSE | 70 RT | |
| 31+06 | SO. HOUSE | 75 RT | |

REFER TO P6. 10

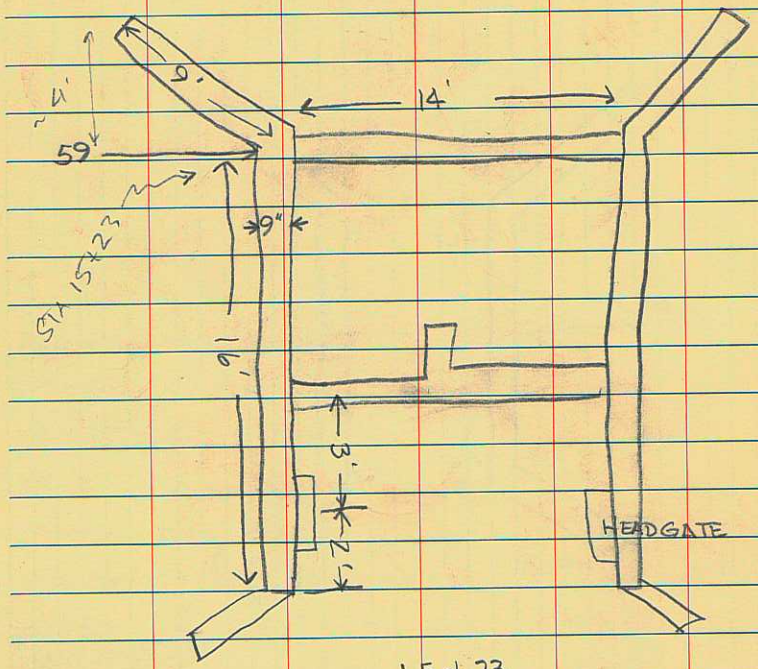



| | | | |
|---|---|---|---|
| 38+59 | NORTH WING | | |
| 38+53 | NORTH ABUT | | |
| 38+30 | SOUTH ABUT | | |
| 38+27 | SO WING WALL | | |
| 38+26 | CONC. WALL | 34 RT | 7.5 HI 4710.98 |
| 37+76 | SO END CONC. WALL | 34 RT | 7.5 HI 4710.98 |
| 37+55 | NO END BUILDING | 34 RT | |
| 36+79 | NO END CONC WALL | 35 RT | |
| 36+79 | SOUTH END BUILDING | 39 RT | |
| 36+73 | NORTH END LOADING RAMP | 36 RT | |

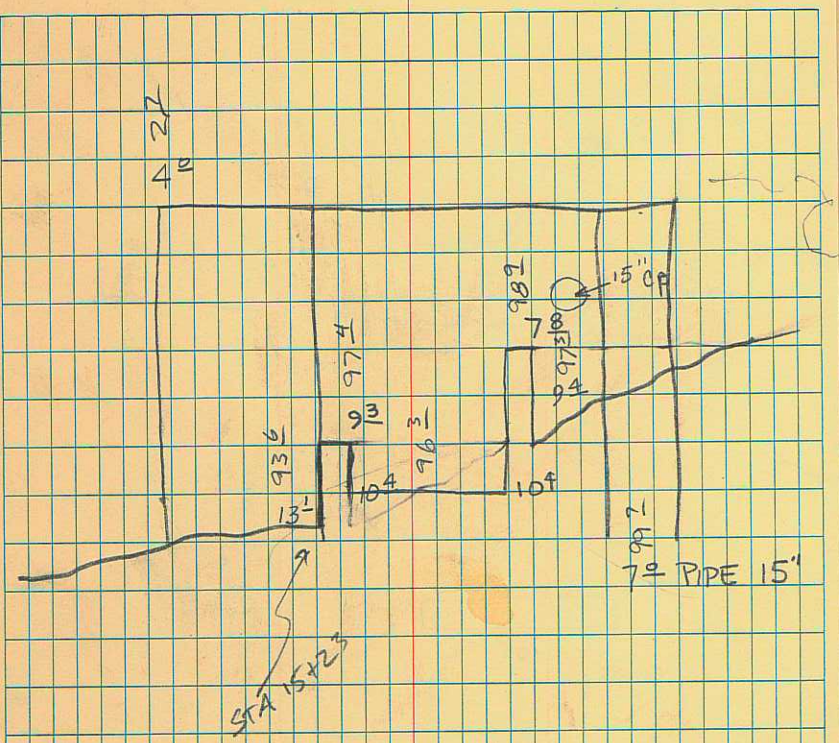
ELEV RD. CROWN @ 38+50 = 4707.1 26



# IRR. STRUCTURE



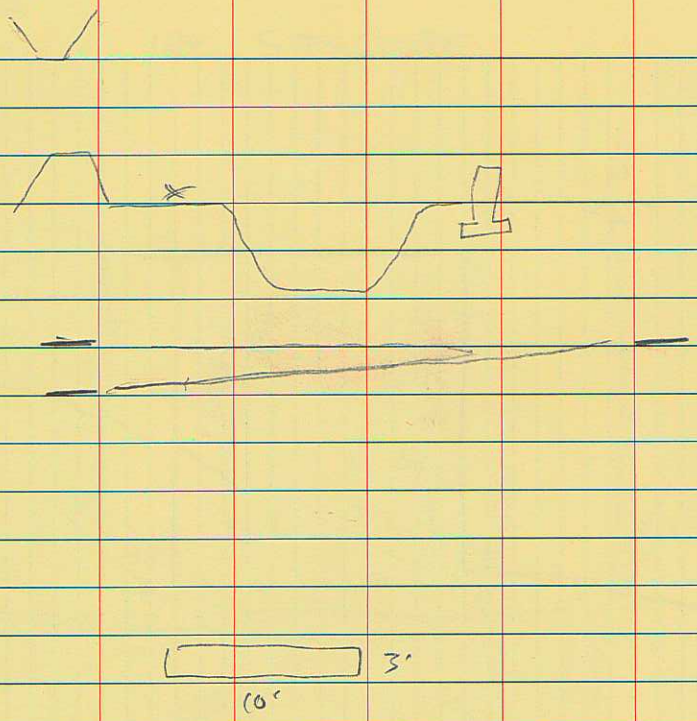

15+23

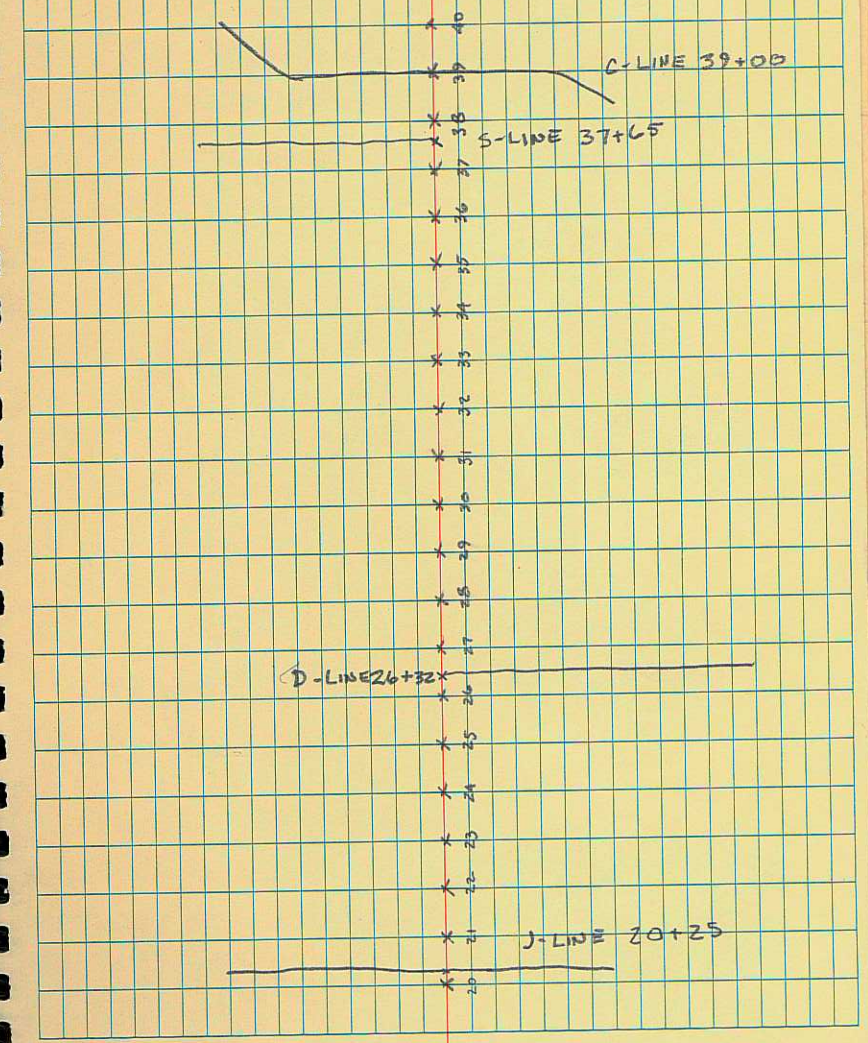



HI 4706.71

13

936


3'
10'


C-LINE 39+03
S-LINE 37+65
D-LINE 26+32
J-LINE 20+25
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20

30.05'

99 57
103
893

996
63
933

1 1
102 1
136
985
893
92

4705 37
542
4699 95
30
47052 5

101 1
4°
971
933
38

104

52.15
49 50
265

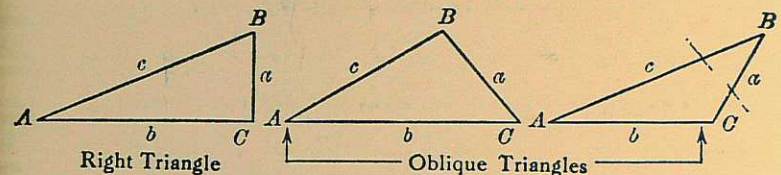
52.15
265
5580

200
1.99
1.93

101 1
7°
941
933
8

985
971
14

## TRIGONOMETRIC FORMULAS




Right Triangle — Oblique Triangles

### Solution of Right Triangles

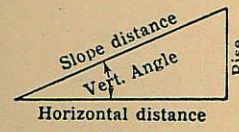
For Angle $A$. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

| Given | Required | |
|---|---|---|
| $a, b$ | $A, B, c$ | $\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = a\sqrt{1 + \frac{b^2}{a^2}}$ |
| $a, c$ | $A, B, b$ | $\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c+a)(c-a)} = c\sqrt{1 - \frac{a^2}{c^2}}$ |
| $A, a$ | $B, b, c$ | $B = 90° - A, b = a \cot A, c = \frac{a}{\sin A}$ |
| $A, b$ | $B, a, c$ | $B = 90° - A, a = b \tan A, c = \frac{b}{\cos A}$ |
| $A, c$ | $B, a, b$ | $B = 90° - A, a = c \sin A, b = c \cos A$ |

### Solution of Oblique Triangles

| Given | Required | |
|---|---|---|
| $A, B, a$ | $b, c, C$ | $b = \frac{a \sin B}{\sin A}, C = 180° - (A + B), c = \frac{a \sin C}{\sin A}$ |
| $A, a, b$ | $B, c, C$ | $\sin B = \frac{b \sin A}{a}, C = 180° - (A + B), c = \frac{a \sin C}{\sin A}$ |
| $a, b, C$ | $A, B, c$ | $A + B = 180° - C, \tan \frac{1}{2}(A - B) = \frac{(a-b)\tan \frac{1}{2}(A+B)}{a+b}, c = \frac{a \sin C}{\sin A}$ |
| $a, b, c$ | $A, B, C$ | $s = \frac{a+b+c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}}, \sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}}, C = 180° - (A+B)$ |
| $a, b, c$ | Area | $s = \frac{a+b+c}{2}$, area $= \sqrt{s(s-a)(s-b)(s-c)}$ |
| $A, b, c$ | Area | area $= \frac{bc \sin A}{2}$ |
| $A, B, C, a$ | Area | area $= \frac{a^2 \sin B \sin C}{2 \sin A}$ |

## REDUCTION TO HORIZONTAL




Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = 5° 10′. Since cos 5° 10′ = .9959, horizontal distance = 319.4 × .9959 = 318.09 ft.

Horizontal distance also = Slope distance minus slope distance times (1 − cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. Cosine 5° 10′ = .9959. 1 − .9959 = .0041. 319.4 × .0041 = 1.31. 319.4 − 1.31 = 318.09 ft.

When the rise is known, the horizontal distance is approximately the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance $= 302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.