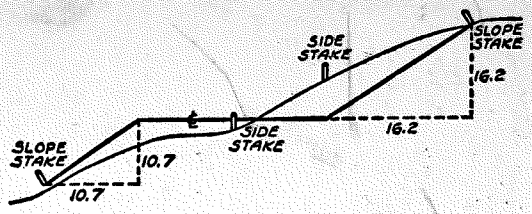


Distances from Side Stakes for Cross-Sectioning

Slope 1 to 1. Roadway of Any Width

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0
1	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	1
2	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	2
3	3.00	3.10	3.20	3.30	3.40	3.50	3.60	3.70	3.80	3.90	3
4	4.00	4.10	4.20	4.30	4.40	4.50	4.60	4.70	4.80	4.90	4
5	5.00	5.10	5.20	5.30	5.40	5.50	5.60	5.70	5.80	5.90	5
6	6.00	6.10	6.20	6.30	6.40	6.50	6.60	6.70	6.80	6.90	6
7	7.00	7.10	7.20	7.30	7.40	7.50	7.60	7.70	7.80	7.90	7
8	8.00	8.10	8.20	8.30	8.40	8.50	8.60	8.70	8.80	8.90	8
9	9.00	9.10	9.20	9.30	9.40	9.50	9.60	9.70	9.80	9.90	9
10	10.00	10.10	10.20	10.30	10.40	10.50	10.60	10.70	10.80	10.90	10
11	11.00	11.10	11.20	11.30	11.40	11.50	11.60	11.70	11.80	11.90	11
12	12.00	12.10	12.20	12.30	12.40	12.50	12.60	12.70	12.80	12.90	12
13	13.00	13.10	13.20	13.30	13.40	13.50	13.60	13.70	13.80	13.90	13
14	14.00	14.10	14.20	14.30	14.40	14.50	14.60	14.70	14.80	14.90	14
15	15.00	15.10	15.20	15.30	15.40	15.50	15.60	15.70	15.80	15.90	15
16	16.00	16.10	16.20	16.30	16.40	16.50	16.60	16.70	16.80	16.90	16
17	17.00	17.10	17.20	17.30	17.40	17.50	17.60	17.70	17.80	17.90	17
18	18.00	18.10	18.20	18.30	18.40	18.50	18.60	18.70	18.80	18.90	18
19	19.00	19.10	19.20	19.30	19.40	19.50	19.60	19.70	19.80	19.90	19
20	20.00	20.10	20.20	20.30	20.40	20.50	20.60	20.70	20.80	20.90	20
21	21.00	21.10	21.20	21.30	21.40	21.50	21.60	21.70	21.80	21.90	21
22	22.00	22.10	22.20	22.30	22.40	22.50	22.60	22.70	22.80	22.90	22
23	23.00	23.10	23.20	23.30	23.40	23.50	23.60	23.70	23.80	23.90	23
24	24.00	24.10	24.20	24.30	24.40	24.50	24.60	24.70	24.80	24.90	24
25	25.00	25.10	25.20	25.30	25.40	25.50	25.60	25.70	25.80	25.90	25
26	26.00	26.10	26.20	26.30	26.40	26.50	26.60	26.70	26.80	26.90	26
27	27.00	27.10	27.20	27.30	27.40	27.50	27.60	27.70	27.80	27.90	27
28	28.00	28.10	28.20	28.30	28.40	28.50	28.60	28.70	28.80	28.90	28
29	29.00	29.10	29.20	29.30	29.40	29.50	29.60	29.70	29.80	29.90	29
30	30.00	30.10	30.20	30.30	30.40	30.50	30.60	30.70	30.80	30.90	30
31	31.00	31.10	31.20	31.30	31.40	31.50	31.60	31.70	31.80	31.90	31
32	32.00	32.10	32.20	32.30	32.40	32.50	32.60	32.70	32.80	32.90	32
33	33.00	33.10	33.20	33.30	33.40	33.50	33.60	33.70	33.80	33.90	33
34	34.00	34.10	34.20	34.30	34.40	34.50	34.60	34.70	34.80	34.90	34
35	35.00	35.10	35.20	35.30	35.40	35.50	35.60	35.70	35.80	35.90	35
36	36.00	36.10	36.20	36.30	36.40	36.50	36.60	36.70	36.80	36.90	36
37	37.00	37.10	37.20	37.30	37.40	37.50	37.60	37.70	37.80	37.90	37
38	38.00	38.10	38.20	38.30	38.40	38.50	38.60	38.70	38.80	38.90	38
39	39.00	39.10	39.20	39.30	39.40	39.50	39.60	39.70	39.80	39.90	39
40	40.00	40.10	40.20	40.30	40.40	40.50	40.60	40.70	40.80	40.90	40
41	41.00	41.10	41.20	41.30	41.40	41.50	41.60	41.70	41.80	41.90	41
42	42.00	42.10	42.20	42.30	42.40	42.50	42.60	42.70	42.80	42.90	42
43	43.00	43.10	43.20	43.30	43.40	43.50	43.60	43.70	43.80	43.90	43
44	44.00	44.10	44.20	44.30	44.40	44.50	44.60	44.70	44.80	44.90	44
45	45.00	45.10	45.20	45.30	45.40	45.50	45.60	45.70	45.80	45.90	45
46	46.00	46.10	46.20	46.30	46.40	46.50	46.60	46.70	46.80	46.90	46
47	47.00	47.10	47.20	47.30	47.40	47.50	47.60	47.70	47.80	47.90	47
48	48.00	48.10	48.20	48.30	48.40	48.50	48.60	48.70	48.80	48.90	48
49	49.00	49.10	49.20	49.30	49.40	49.50	49.60	49.70	49.80	49.90	49
50	50.00	50.10	50.20	50.30	50.40	50.50	50.60	50.70	50.80	50.90	50

Distance of slope stake from side or shoulder stake for any width roadway, slope 1 to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

FORM NO. F-29

DIVISION OF FORESTRY

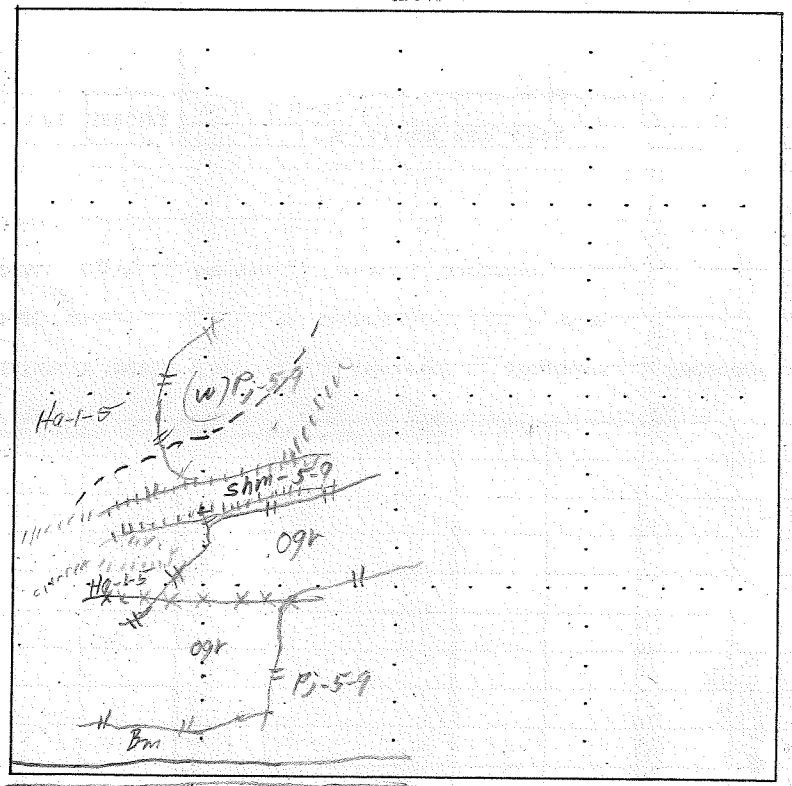
MAP SHEET

40 SWSE SEC 32 TWP 13S R 2E

AREA ..... MAGNETIC DECL. ..... DATE 1-31-41

COMPASSMAN ..... ESTIMATOR .....

Lo Blanc



TOPOGRAPHY		SOIL		STONE	
Level	..... A.	Sand	..... A.	Free	..... A.
Gentle slope	..... A.	Sandy loam	..... A.	Stony	..... A.
Steep slope	..... A.	Clay loam	..... A.	Very stony	..... A.
Mountainous	..... A.	Peat	..... A	Rock outcrop	..... A

Special use if any: .....

40 ..... SEC ..... TWP ..... R .....

TIMBER VOLUME

TYPE	SPECIES	TIMBER VOLUME BD. FT.	TIMBER VOLUME CORDS POLES	TIMBER VOLUME CORDS MATURE	OTHER PRODUCTS TIES	OTHER PRODUCTS POLES	OTHER PRODUCTS POSTS	

CONDITION OF TIMBER: *Thrifty*____ *Mature*____ *Stagnant*____ *Decadent*____

DAMAGE: *Insect*_____ % *Disease*_____ % *Fire*_____ %

WINDFALL: *Light*____ *Medium*____ *Dense*____ *Location:*_____

REMARKS: .....

.....

REPRODUCTION

TYPE	SPECIES	NUMBER PER ACRE 0-1	1-5	6	8	10 1/2	1" 1/2	
4W"	P							
Plot	Ha	10	20					
	Hk							

139-28

Book 2

HARCO
TRADE MARK REG.

139-28

139-28

T. 139 N.
R. 28 W.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

139-28

26+40 Set # cor ~~[illegible]~~ oak 4" 1/12 139-28
No evidence of B.T.

13+20 Set approx. 1/4 cor oak

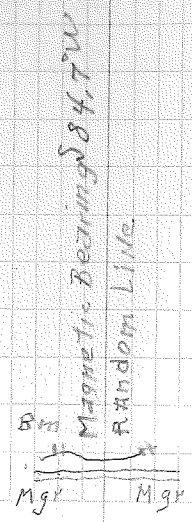
2+00 Type change
1+64 Hit Road – Old R.R. Grade.

0+00 Started west from 1/12 139-28

Dec. 9, 1938. 1.
STegelvik
Herbert
Seymour

Look for: Found:
Aspen 8" N. 6 lks. No evidence orig.
" 10", S. 10 E. 55lks.

Var. 5.3°



139-28

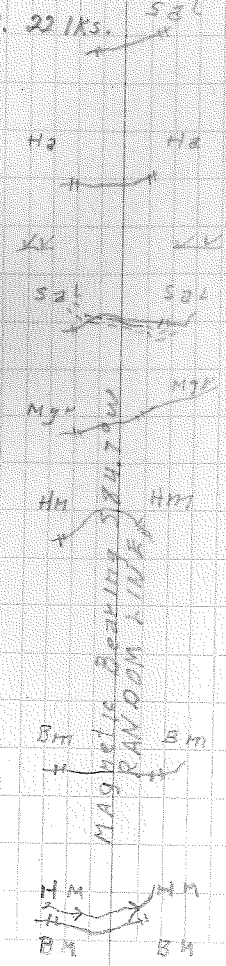
50+17	Iron pipe for sec. cor 2/11/12	139-28
	40 feet south.	
50+17	Hit Fence Running N.	
49+90	Type change	
46+80	Type change	
43+70	Type change	
41+20	Type change	
41+16	Hit Road Running N 135° E	
39+60	Set Approx 24" Cor Birch 4"	
37+79	Type change	
36+00	Type change	
30+50	Type change	
27+70	Hit creek	
26+95	Type change	
	Continued west from 1/12	139-28

Look for:

cedar 6" N. 75 E. 21 lks.
" 8" N. 10 W. 30 lks.
" 9" S 16 E 18 lks.
" 12" S 80 W. 22 lks.

Found:

Iron pipe 2"



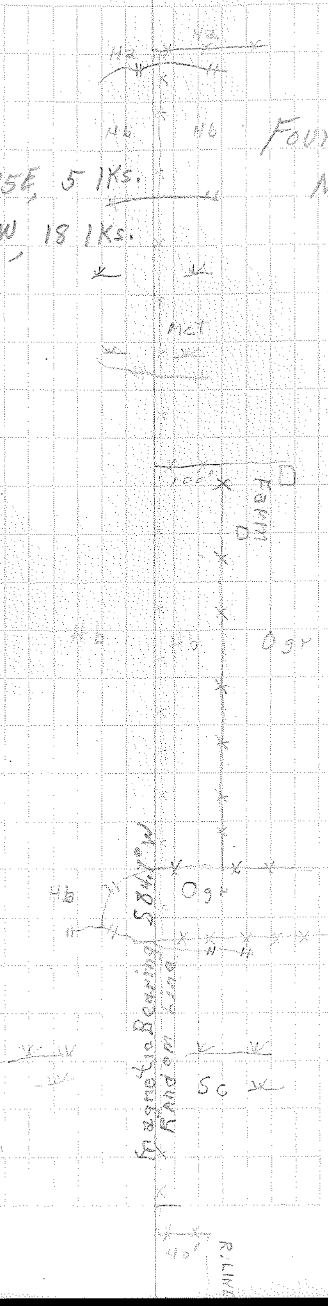
2/11 139-28

26+40 Set APPROX ¼ COR 3" Ash
25+09 Fence N No Evidence of Orig. Cor.
24+90 Type change
22+00
19+50 Swamp
16+44 Fence N
13+20 set APP. E 1/16 COR
8+00 Fence N
6+42 Type change & fence N.
0+00 Started West, from 2|1 / 11|12 139-28

Dec 12, 1938 3,
Stegelvik
Herbert
Seymour
Mattson

Look for:
Aspen, 8" N 75 E, 5 lks.
" , 7" S 20 W, 18 lks.

Found:
No evidence Orig.

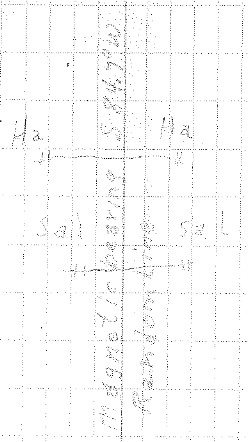


VAR. 5.3°

50+19	Found ORIG Cor 21+TS $\frac{3.}{10}\Big|\frac{2.}{11}$ 139-28 offset 21' So	
48+63	Creek & TYPE change	
46+00	Type change	
39+60	Set APPROX W¼ COR ASH 3 in.	
34+80	Type change	
32+49	Type change	
26+40	continued west from $\frac{2}{11}$ 139-28	

Look for:
Cherry 5" N70E, 20lks.
Spr. 7" N22W, 7lks.
Cedar 8" S55E, 4lks.
Spr. 9" S53° W, 36lks.
MIXED
Ash &
Aspen

Found
17.1' 9" B.t. T139N R28W
S2 BT
15.9' 8" Bt. T139N R28W
S3 BT



139-28

26+41	Set approx ¼ Corn. 4" Spruce 10 Found no evidence of corner	3	139-25
24+71	HIT Type change		
21+91	HIT Trail		
21+00	Type change		
16+93	TYPE change		
15+46	HIT Fence Running SE.		
13+20	Set APPROX ¼ CORN 3IN Ash		
12+93	Type change		
10+65	Off SET 10E South		
9+00	TYPE change		
8+78	HIT TRAIL		
7+49	HIT Creek		
6+23	Hay Field		
4+25	Trail To Field		
2+00	Type change		
0+29	Fence Started East from	4/3 9/10	138-28

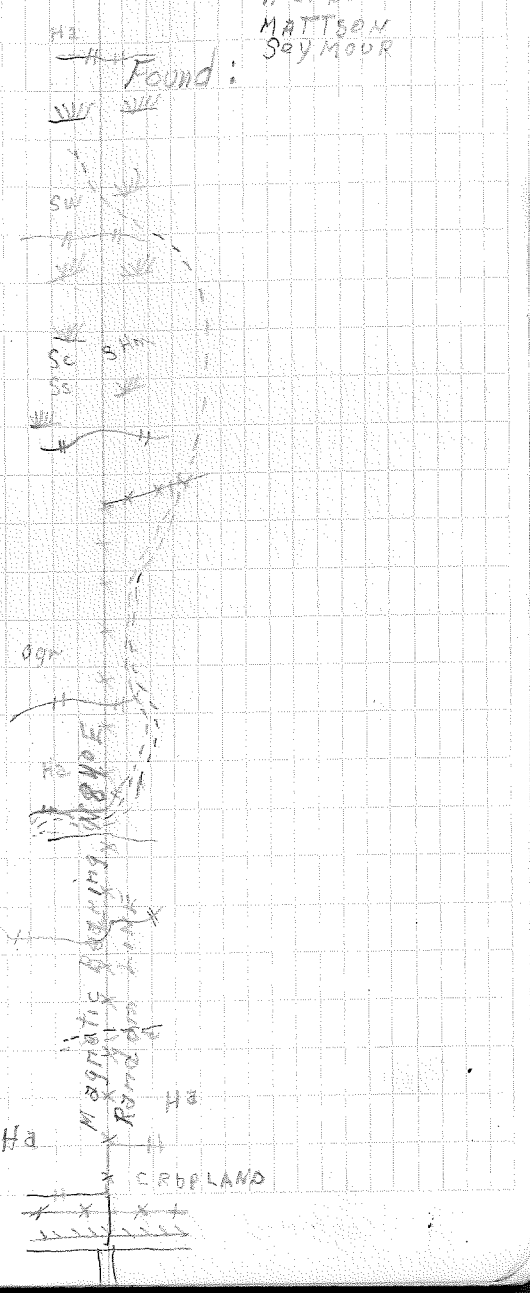
140-28

Dec. 15, 1988
Stegelvik
Herbert
MATTSON
Seymour

5.

Look for:

Found:



53+98 Found Original Cor. 159' No. $\frac{3}{10}\Big|\frac{2}{11}$

46+00 Type Change

42+40 Type Change

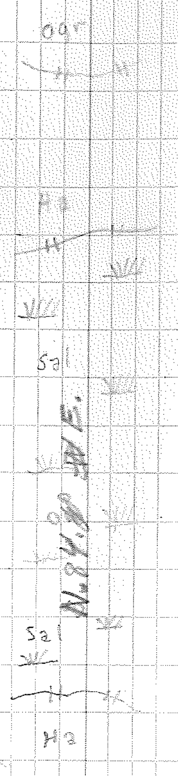
39+60 Set Approx E. $\frac{1}{16}$ Corner 4" ash
39+00 Type Change

29+35 Type Change

Continued East from $\frac{3}{10}$ 139-28.

Look for: / Found:

Cherry 5"	N70°E	20.1 Ks.	17.1'	9" B.T.	T 139 N R29	S2 BT
Spr. 7"	N22°W	7.1 Ks.	15.9'	8" B.T.	T 139 N R29	S3 BT
Cedar 8"	S55°E	4.1 Ks.				
Spr. 9"	S53°W	36.1 Ks.				



139-28

26+32 - Fence going N. and S. - Fence starts W. Trail starts down fence on N. side of road

23+00 - Hit pasture

19+00 - Hit tag Alder on N. side of road

16+00 Hit tag Alder on S. side of road

13+16 Fence runs north

9+90 Hit Birch and Aspen mixed.

~~3+30~~

4+00 Started west 4/3 9/10 - 139-28

140-28

Oct. 27, 1938
π - Howe
Estenson
Chupka

Cropland

Aspen

Look for:
Aspen, 6", N35W, 131ft.
" , 5", S10E, 71ft.

Found:
No evidence of Cor.

Tag Alder

Tag Alder

Birch and Aspen mixed.

Mag. Declination 19°37'W

Pasture

Pasture

Grubbed

52+58 - Found 2" I.P. with cap, scribed [illegible] Void Oct. 28 K.W. 8/5 5/4 5/4 2/9

39+60 - Trail runs S.
39+45 - Fence runs South

39+40 - Trail runs N.W.

28+34 - Road to farm house; App. 18 ft.

26+90 Continued N. from App 4/9 139-28

8

Pasture 4'

Look for.
J.P. 14", N75E 18 KS
Maple 6", N30W 12 KS
Aspen 12", S80E 38 KS
Maple 5", S30W 34 KS

Found:
2" iron pipe

Aspen

Cropland

Mat Bedding Grass

Ransom Line

Aspen saplings.

25+00 - Hit trail going S.W.

13+00 - Hit brush, mixed.

8+00 - Hit mixed Hardwoods
7+23 - Trail going N.

5+50 - Hit mixed Hardwoods

0+00 - ~~Left~~ Started West from 5 1 4 / 8 1 9 - 139-28

Oct. 27, 1938
T. Howe
9.

Extension of Chap K 6

Look for
Aspen 9" S 20W 141 Ks
Birch 7" N 25 W 191 Ks.

Mixed brush

Mixed brush

Mixed hardwoods

Mag. Bearing S. 85 W

Mixed hardwoods

Pasture

Aspen Saplings

53+25 Found B.T. but no cor. post 6/5 139-28
~~52+20 - Lee hits road again~~
B.T. - W. Pine Stump badly burned out only
~~49+50 Road curves S.W. Void Oct. 29 R.H.~~ N B.T.'s were visible
49+50 - Road curves S.W. No other evidence

45+50 - Hit aspen

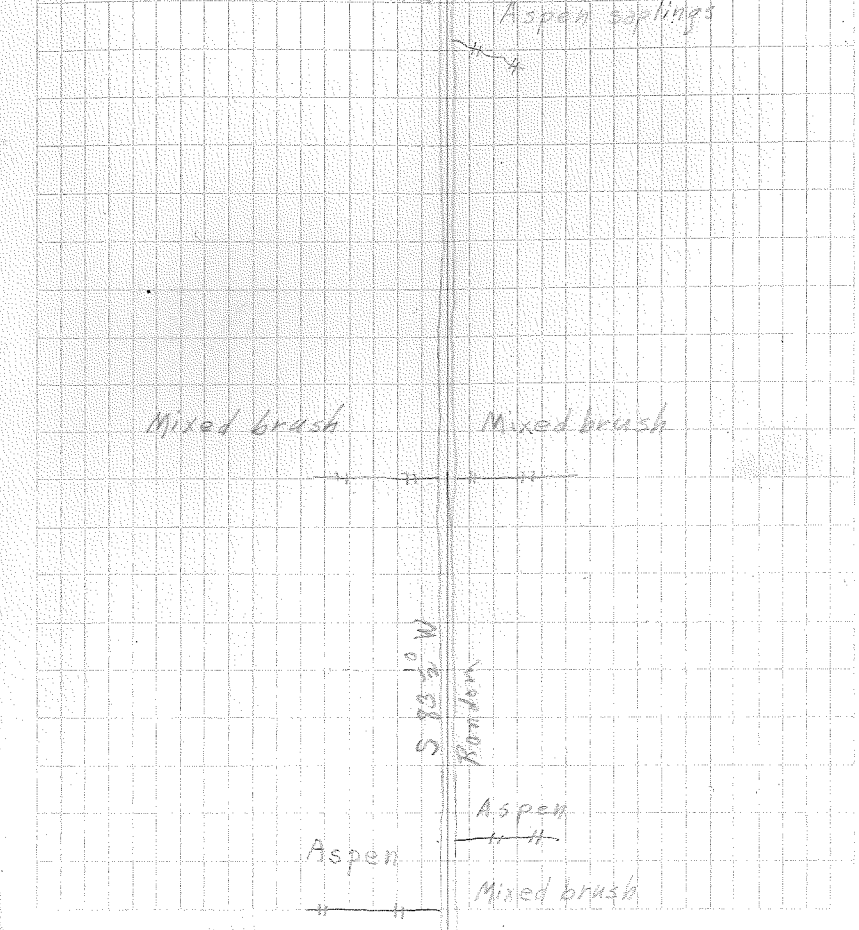
36+00 - Hit mixed brush

28+38 - Hit Aspen

27+00 - Hit aspen

~~26+40 Continued N. from Hpf~~ 5/6 139-28

Look for:		Found:
Aspen: 4"	N 30 E 20 lks.	28" W. Pine Stump = 1½ Lt.
" 7"	N 42 W 16 lks.	Set temp. cor. post
" 4"	S 15 E 19 lks.	at S. 11½ W.
" 5"	S 21 W 22 lks.	



26+40 Set Approx ¼ cor 3" Birch 6/7 137-28
Found 8" Elm B.T.
set approx ¼ stake 2.4 shot
on B.T.

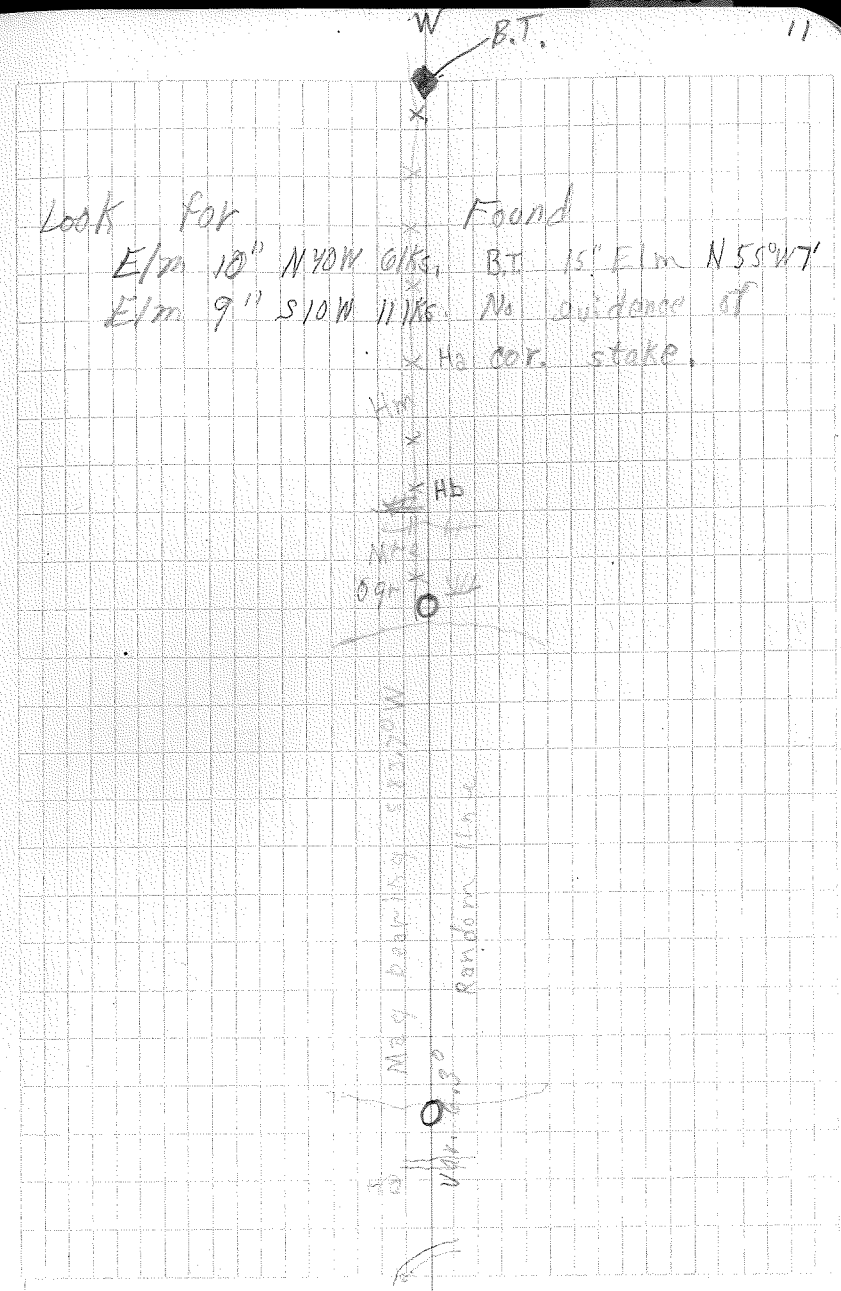
16+13 Type change
15+23 HIT M.C. 2" I.P. capped 6/7 137-28
14+70 WEST End of Lake

13+20 Set approx E¼ cor 3" Birch

4+43 HIT M.C. 2" I.P. capped 6/7 139-29
4+31 HIT M.C.
3+29 ~~HIT M.C.~~ HIT Road Runn. N.

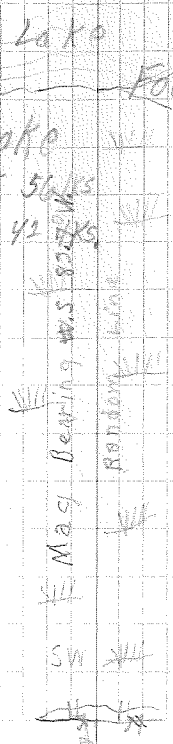
6+39 HIT Road Running N.W. 6/7 139-25
0+00 Started West from

11



40+29 40+65	Lakeshore Found N.C. 2" IP 40 FT. -SO.		℄ 139-28
~~38+65~~		6/7	139-28
36+60	Set Approx. W/L Wit 3" Birch		
27+49 27+45	TYPE CHANGE FENCE		

Look for Lake Found.
N.C. on Lake 2" Iron Pipe
Tom 4" S 58 E 56 LKS
Tom 4" N 20 E 42 LKS



139-28

26+40 Set Approx ¼. 13/24 139-28

19+06 Center of old R.R. grade

11+40 Left open field

9+50 entered open field

7+20 Left M.g.r.

5+73 entered M.g.r.

0+00 Started West from 13/24/18/19 T 139 R. 28-27

140-28

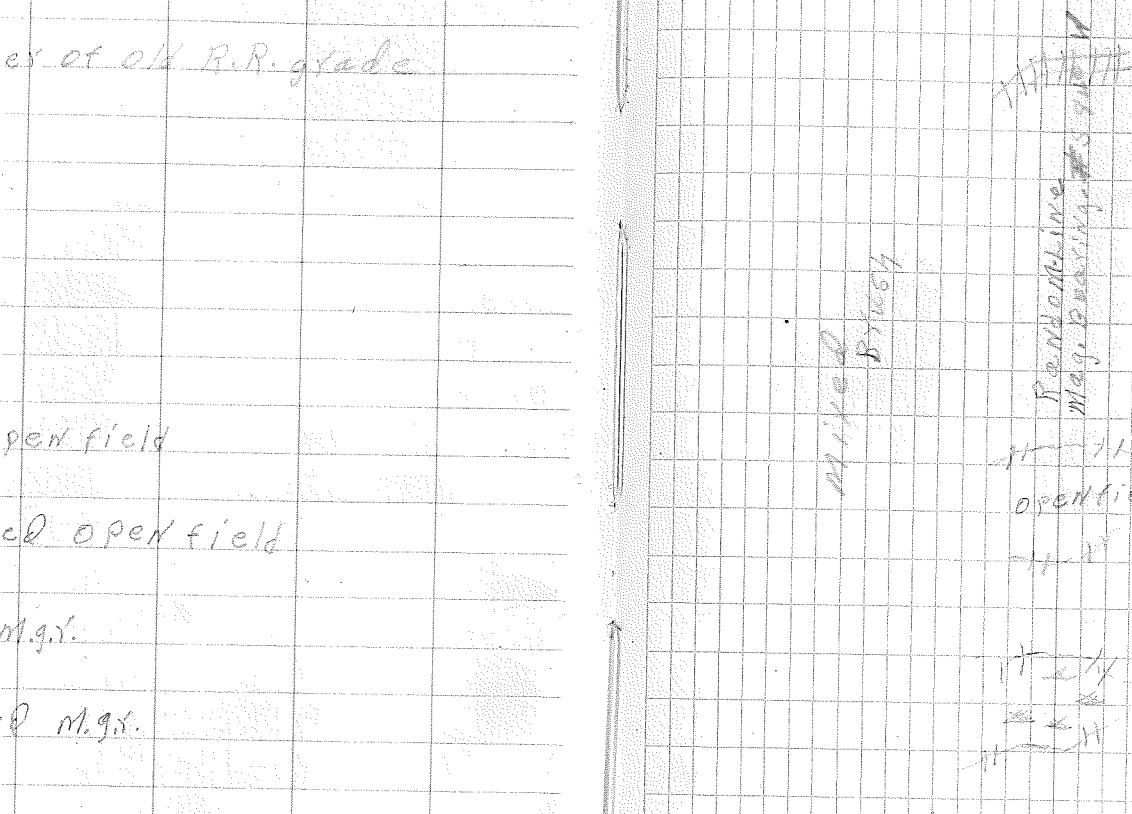
13

Dec. 21, 1938.

Woods. T
Chupka-ch. axe
Olson - axe
Anderson + axe-ch

Look for:
W. Maple 7" N 85, 12 lks.
B. Oak " S 10 W, 26 lks.

Found:
No evidence of ori. cor.



50+83 Offset 202.9 feet South
To 2" I.P. scribed 14/13/23/24 139-28

26+40 Continued West from 13/24 139-28

Date: Dec. 21, 1974
Woods
Chunka
Eastern

Look for:

B. Oak 12" N18E, 40 lks. BT
W. Maple, 6", N55W 25 lks
W. Pine, 30", S62E 19 lks
" , 36", S48W 41 lks

Found:

Boak 14" scribed
T139-R28-S-23-B.T.
Distance 58'
Va. S 52½° W

Random Line
Mag. Bearing S 84° W

N11x20 Brass Cap

N11x20 Brass Cap

26+39	Found ¼ corner 20's.		14 / 23	139-28	
25+73	Edge of N. [illegible]				
13+20	set temp. E¼ corner				
0+00	Started	West	from P.I.	14 / 23 | 13 / 24	139-28

June 20, 1939 15

Woods-Ch, Kans
E St'ven-Ch.

Look for: Found:

Tam. 8" N35W, 15 lks. 2" I.P. 30' South of Line

Spr. 6" S40E, 8 lks.

Road

Bottom Land

N 83° E

0.

53+71	OFFSet 16' South.	15/14 22/23	139-28
49+60	Set Steel M.g.R.		
30+60	Set Aspen W 1/16		
28+71	Left Willow SWamp		
	Continued West from	14/23	139-28

Jan. 20 1946

Woods, Cut-Notch

Established

M.g.Y.

Look for:

W. Pine 6" N55E 51 lks.

W. Birch 7" N45W 18 lks.

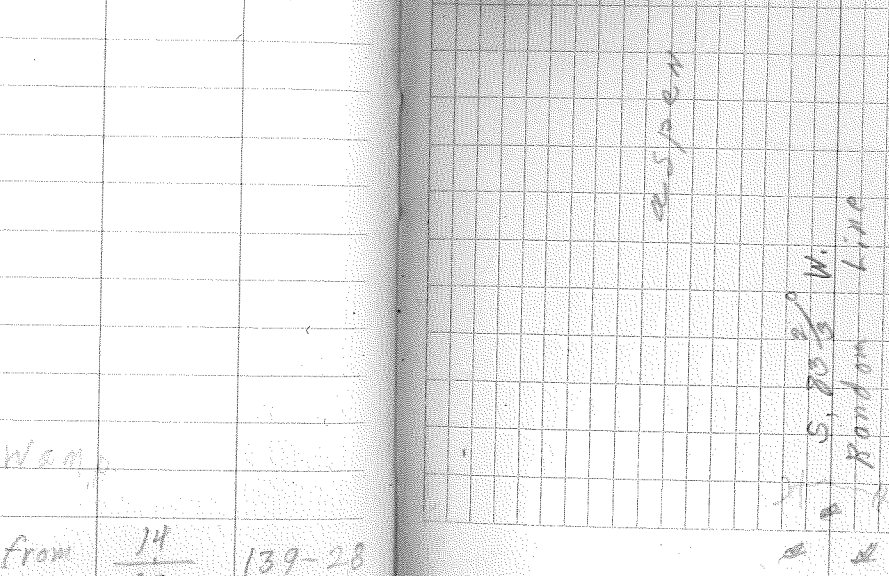
W. Pine 6" S30W 60 lks.

Found:

2" I.P. W/ thicket

Serviced 15/14

22/23



2.6 x 40. 1½" I.P. 2.5' North

15
22

139-22

15+00 Set Hub on E ¼ Corner.

8+43 Left Rt. & West

0+00 Started East from

15 14
22 23
21 26 15
21 27

139-28

Jan. 20 1939 17
Woods-ch. Notes
EST YEM ch.

Look for:
Linn. 5", N28W, 33 lks,
W. Birch 6", S45E, 30 lks

Found:
1½" I.P. 2.5' North of E Line

6½° OFFset 53' South
To line From west.

52+43 Found 2" IP 2'/22 16/15 ~~15/14~~ ~~22/20~~ 139-28

Up to entered M.gr.

40+13 entered Mixed Brush
34+00 Set Aspo W/14 corner

Continued East from 15/22 139-28

June 20. 1938 18
Woods. ck notes
Estrem ck.

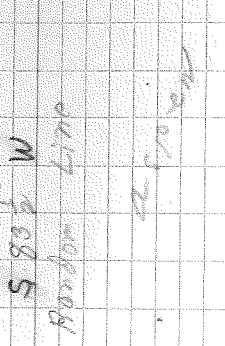
M.gr. M.R.

Look for: Found:
Spike Eagle X6 2" I.P. with cap
scribed 14/15
21/22

Dist. 52.41'

Mixed Brush

Mixed Brush



16/21 139-28

2+67 fence South

13+67 fence South

2+00 Farm House Approx 50' South of

0+00 Started ⊥ east From 12½ Cor. T 139 R 28

Dec 16, 1939 19.

Look for:
Aspen 7" N28E 31 lks
" 7" S42E 71 lks. Found:

Woods-T-ch.
Chuppa-ch.
Anderson-ale
Schwartz-ale
Stevens-ale

Aspen Aspen

Aspen Aspen

Random Line
Mag. Bearing N 1½ W

Line

52+80	Off Set 280 ft North Side Lefroy Hole Lake	6/15 - 21/22
39+60	edge of Hole Lake	

B.S. 234'
F.I. 10½ W

Look for:
- J. Pine 8" N 10 E, 275 lks
- Jam. 5" N 67½ W, 113 lks
- W.P. 9" S 68 E, 132 lks
- J. Pine 5" S 42 W, 250 lks

Found:
- 2" I.S.W. Iron Cap
- Scribed 16 lks
- W.P. 12" Scribed
- T 139 - R 25 W 5th - 16 - B.T.
- N 10½ W
- Distance 234'

Road runs

Ranching. N 84 E.

Mud

139-28

26+71	Type change			
26+40	Set Approx	¼	18/19	139-28
25+00	Type change			
24+72	Found Best B.T.			
13+20	Set Approx.	E	¼	
5+75	Type change			
4+54	Type change			
1+00	Started work from		17/18 20/21	139 - 28

140-28

Dec. 21, 1938 21

Fotenzen
Michaelson
Fauvre
Greulich

Look For:
Tom. 4" N15W, 1416
Spr. 4" S 5218
½ Mi. 26 Inc long

Found:
W. Pine BT
N-2W'
No other mk.

Asphalt 20 Ft.

May Farming 20 Ft.

Asphalt 8m

Bm

Asphalt

Var. 6½°

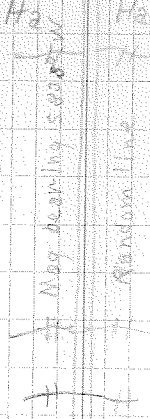
52+80	Set Approx Sec Cor No evidence of Cor	18/17 19/20	139-28
49+81	Telephone line		
44+81	Type change		
40+00	Off Set 45FT S.		
37+34	Type change		
31+83	Type change		
29+22	Hay Field		

22

T Herbert
Stegelink
Fairbanker
Forman
Mathson

Look for: Found:

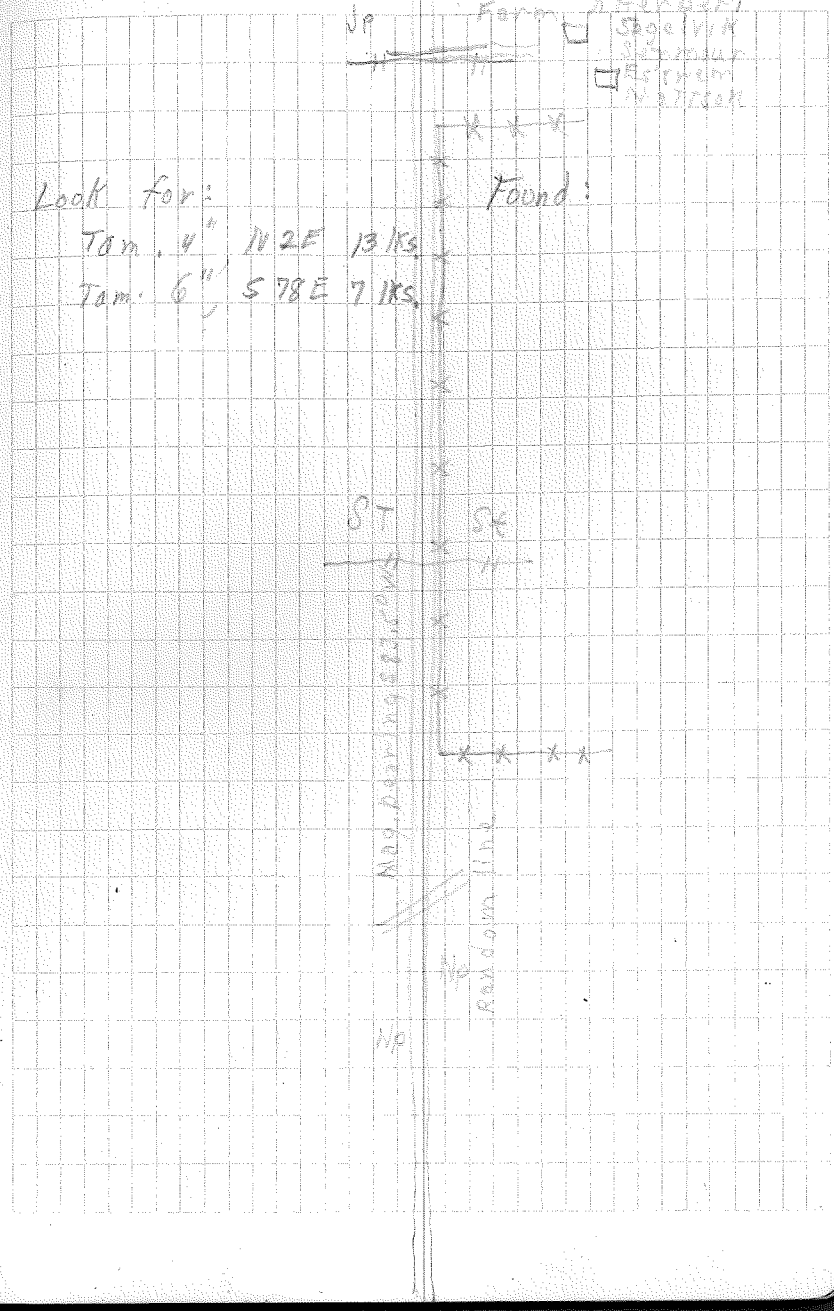
N. Pine 16" N50E 16 lks
N. Pine 18" N15W 23 lks
W Pine 18" S40E 42 lks
N. Pine 20" S55W 28 lks
Mile is 52 lks. long



P.
095

26+40	Set Approx ¼ Cor Found No Evidence of Corner	17/20	139-28
25+00	Type change + Road To E and		
24+90	END of Fence OFF SET 60' So		
14+82	Type change		
13+20	Set Epp. E. ⅛ 31" Birch		139-28
10+30	Fence Begins		
7+64	Road Running N 340 W		
0+00	Started West From	10/12 Pkd	139-28

Dec. 21, 1938
J. Herbert



44+84	Found 2" I.P. Sec Corner 19/29 1939-27 No other evidence
43+50	Type change
40+10	Type change
40+00	Fence Runs N
39+90	Set Approx ± 3" P;
39+00	Road Turns C.W. 1939-28
35+62	Type change
33+00	Type change
27+00	Fence Begins

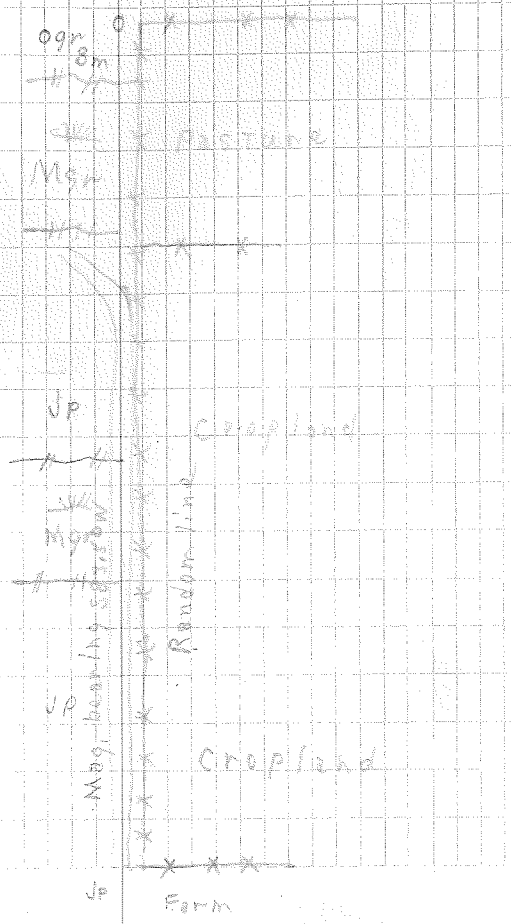
Dec-21, 1939 24

T Newbert
Stegavich
Stegavich
Eberhorn
Mattson

Look for:

Found:
1. Pipe

Dist. 5108.4'



25+69	Type change		
24+45	Type change		
13+20	Set APK Ed. Con Aspen 3'		
1+718	Old P.I. Grade N30°E		
1+65	Type Change		
0+00	Started West from I.P.	25/36	139-28

25

Stegelvik
Estenson
Gruelich
Fourre

Jan. 4 1939

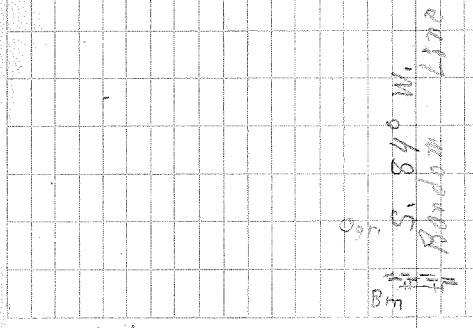
Off set 28' N.

Look for:

Aspen 9" N37E 19 lks.
W. Birch 7" S55E 51 lks.
Dist. is 2667'

Found:

2" i.p. 2' Tan.
I.P. is 28' No.
of random line



52+80 Set APP Sec C.R. 25/26 35/36 139-28

No Evidence at Orig Cor.

46+00 Type change

39+60 Set APP. W. ½ COR Birch 2"

33+27 Type change — ? Type

32+21 Type change — ? "

27+40 Control West from 25/36 139-28

Look for: Found

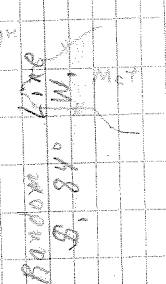
W. Pine 8", N 78° E, 3.37 lks.

" 10", S 8° E, 1.68 lks.

" 10", S 40° W, 65 lks. Bm

No other tree convenient.

Dist. 5333.5'



$\frac{26}{35}$ 139-28.

0+00 Started West from $\frac{26|25}{35|86}$ 139-28

27

Look for: Found:

Aspen 6", N50W, 5 lks

" 10", S30E, 6 lks

Dist. 2614.9'

S. 83 1/3° W.

Random Line

Var. 6 1/3°

53+27 Offset 83' No. to I.P. 27/34 26/35 139-28.

-39+60 Sat Temp to cor.

Contined West from ~~27~~ 26/35 139-28

Look for: Found:

W. Pine 5" N17E 103 lks	I.P. 2"
Tam. 5" N 40W 167 lks	Offset 83' No
Tam. 7" S12E 152 lks.	to I.P. cor.
Tam. 7" S 45W 270 lks.	

Random Line
S 89 3/4° W.

26+40	~~Set [illegible] ¼ Corner~~	27 34	139-28
25+50	Hit Road Run NW		
25+27	Found 2" I. P.		
20+23	Hit trail running NE and SW.		
13+20	Set A.P. E ¹⁄₁₆ Cor		
6+56	Type change		
6+00	Hit road running S. 73° W.		
0+23	Type change		
0+00	Started West from	27 | 26 34 | 35	139-28

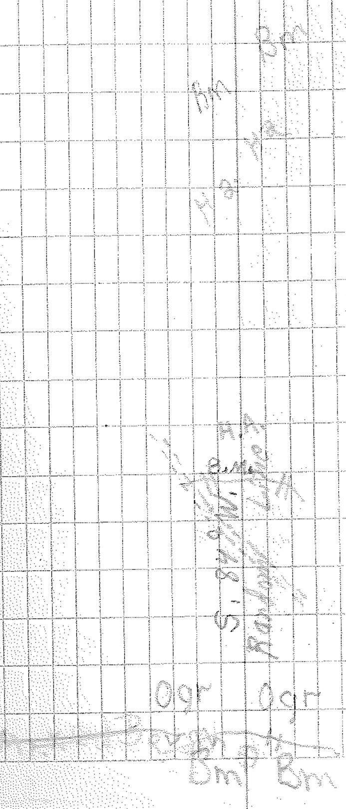
6°

Jan 6 1939
Estenson
Woods
[illegible]
Gutknecht

¹⁄₁₆

Look for:
W. Birch 6" S 24 W, 19 lks.
Aspen 7" N 15 E, 16 lks.

Found:
B.T. 6" Jackpine / only nail no scribe.
S. 54° E 17.9 FT
B.T. T 139 N 27 W
8" Aspen N 27 E 7.5 FT
All line trees.



52+90	Set App Sec Cor 28/33 27/34		139-28
	Found No Evidence OF Corner		139-27
	Set App Sec Cor 36 Ft N in Center of Road		
44+57	Hit Harroad Running NW		
39+60	Set App W 1/4 Cor		
38+30	Hit Road Running N		
36+30	Type Change		
30+43	Type Change		
~~25+57~~	~~Hit East Road Running NW~~		
	Continued West from	27/34	

Jan 6 1939 30

Eastensch

Found

Look for:

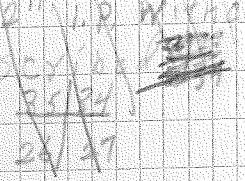
Aspen -10" N 46 E 20 lks

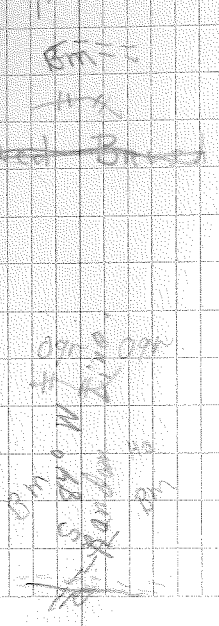
" -12" N 38 W 25 lks

W. Birch -8" S 20 E .5 lks

Aspen -10" S 45 W 56 lks.

Dist. 5280'

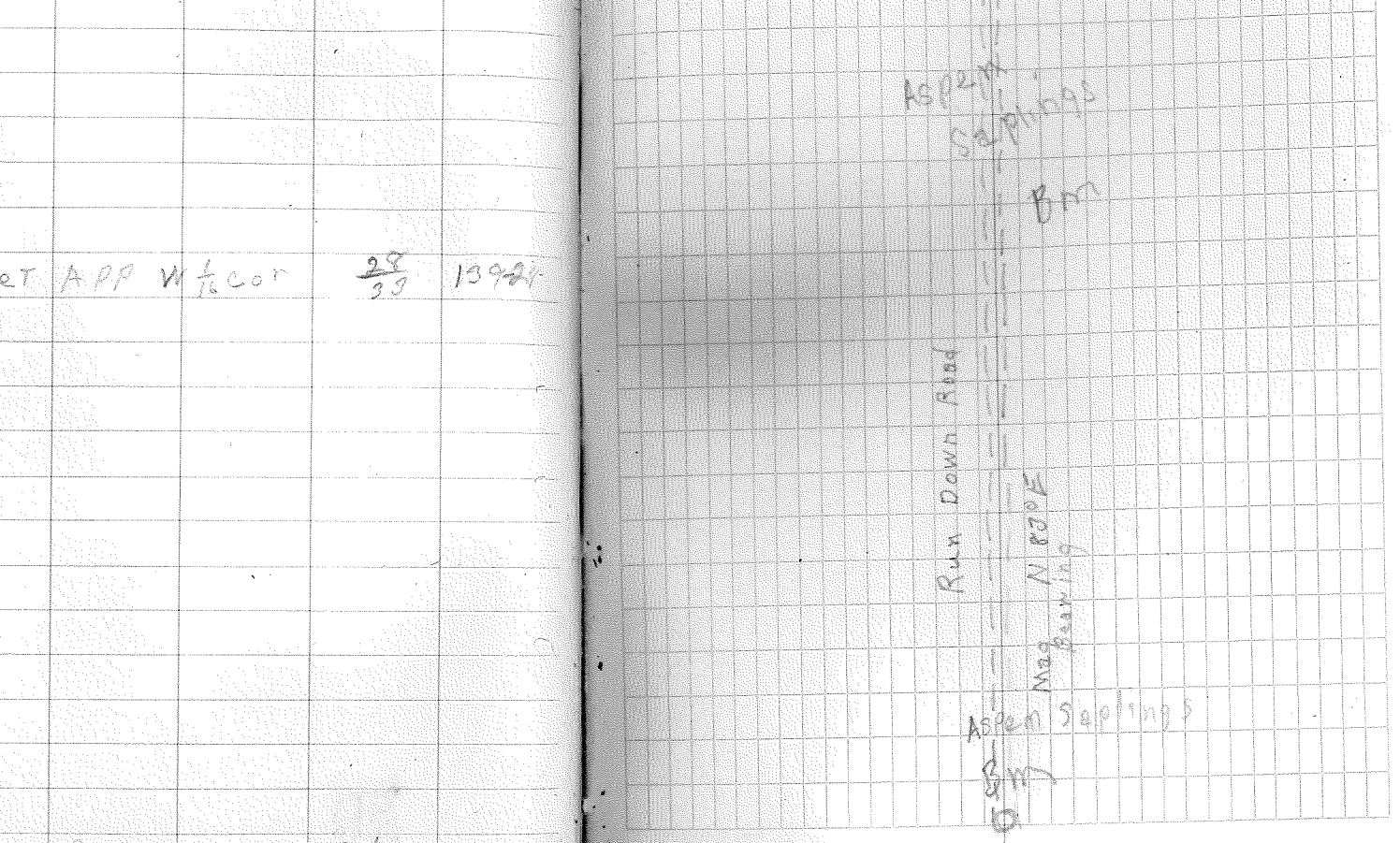




26+40	Set App ¼ Cor No evidence of cor.	25/39	139-28	
13+20	Set App W ¼ Cor	25/39	139-28	
0+00	Station East from	29/25 32/39	139-1	

Jan. 14, 1938

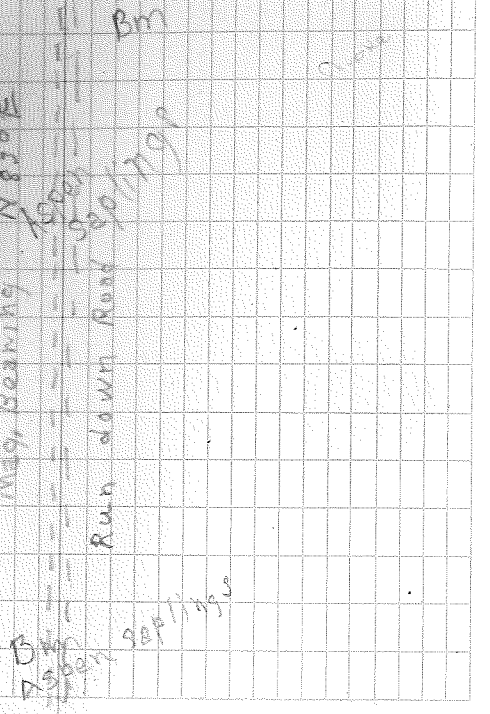
Fillenwarth
Olson
Harland
Fourre
Chupka



52+51	Set App Sec Cor	28/27 33/34	139-29
	Found No evidence of Sec Cor		
39+60	Set APP E 1/16 Cor	28/27	139-29
Acres	continued East of	28/33	139-28

32

Jan. 14, 1938
Herbert
Olson
Harland
Fearn
Chupka



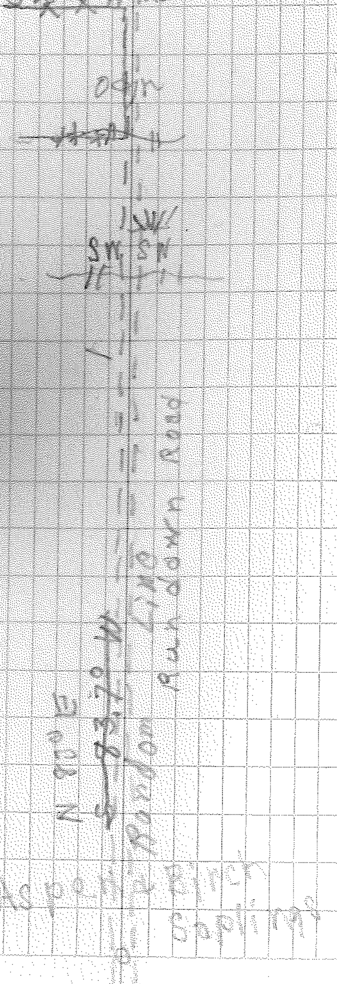
26+40	Set App $\frac{1}{4}$ cor in Road	$\frac{29}{32}$	139-28
25+90	Type change		
23+90	Type change		
23+00	Road going N Fence N		
18+30	Type change - fence starts		
15+34	Type change		
13+20	App W $\frac{1}{16}$ cor		
0+00	started W East from	$\frac{30 \mid 29}{31 \mid 32}$	139-28

Jan 11, 1938

Herbert notes
Olson - picket
Harland ch
Fourre ch
Chupka - axe

Aspen Sapl N98

Look for:
Aspen 15" N30E 21 lks Pole
" 12" S2~~[illegible]~~ lks.



6.3° var.

140-28

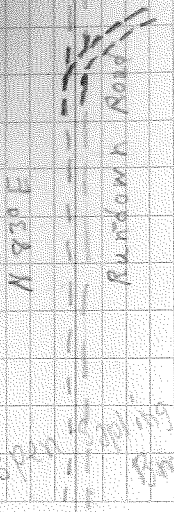
52+80	Set App Sec Cor Found No Evidence of Cor.	29/28 32/33	139-28
39+60	Set App E 1/16 Cor		139-28
36+50	Road running SE		
26+40	Continued East from 29/32		139-28

34

Jan 11, 1938

Herbert F
Olson
Harland
Fourre
Chupka

Look for:
Aspen 12" N40E 17 lks.
" 11", S38E 9 lks.
Fir 11", S21W 29 lks.



26+40	Set App $\frac{1}{4}$ Cor Cor in Road	$\frac{30}{31}$	139-28
24+00	Fence ends Telephone line N		
23+00	Type change		
21+43	Fence going SE.		
17+67	Type change Road Running Fence Ends N		
16+85	Road South To Fence S		
13+20	Set App W $\frac{1}{4}$ Cor	$\frac{30}{31}$	139-27
8+20	Type Change		
4+25	Type change		
0+00	Started East	$\frac{25}{21}\frac{30}{31}$	139-28

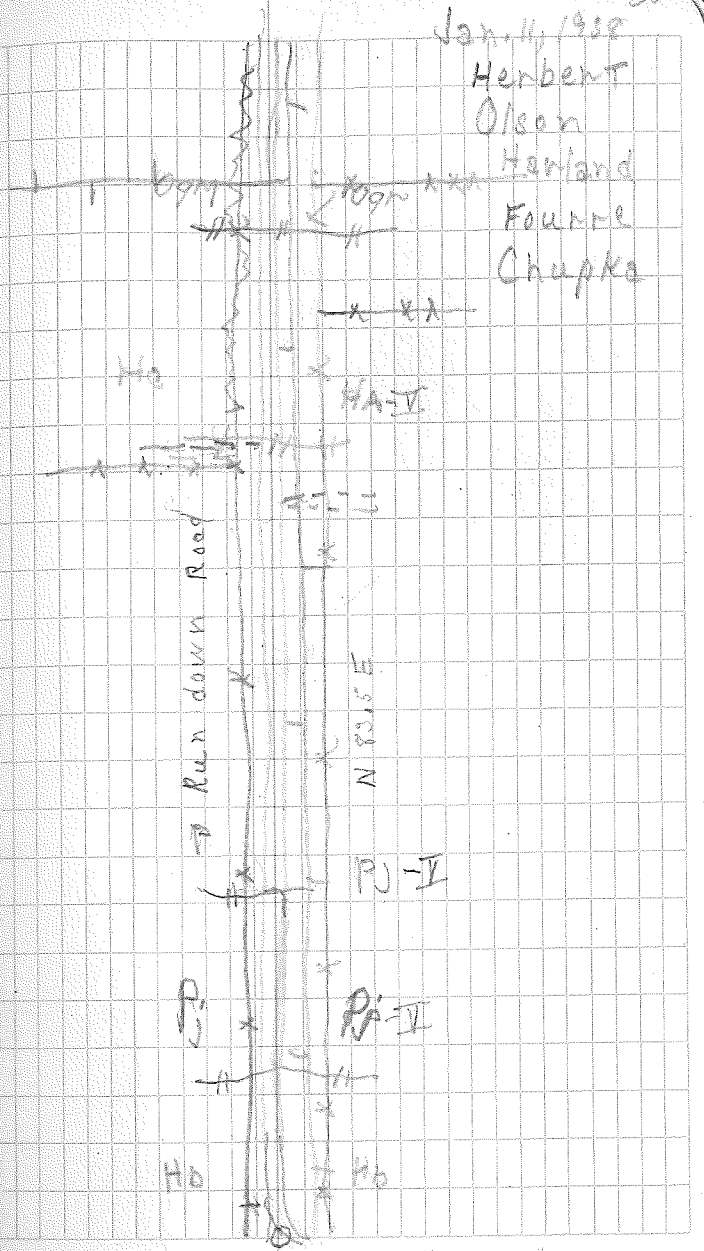
35

Jan. 4, 1928

Herbert Olson

Harland Fourne

Chupka

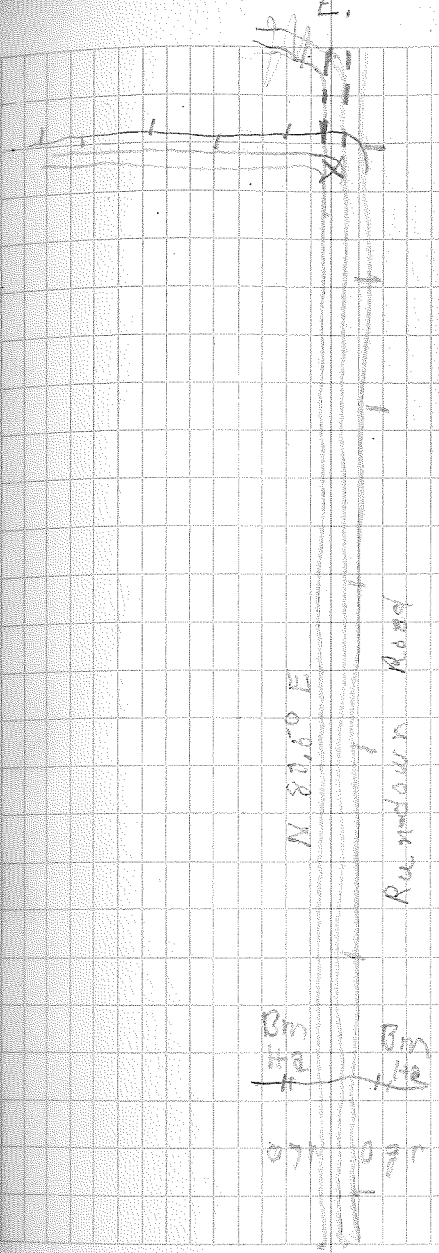


B.T. 6" Jackpine
N 42° W 2.82 FT

49+60	Sec. Corner in center of Road	30/29 31/32 139-28
39+60	Set APP E 1/10 Cor	
30+97	Type change	
26+40	Continued East From 30/31	137-28

36

Jan 14, 1938
Herbert
Olson
Harland
Fourne
Chupka



140-28

26+00 FOUND IP and wood post 5 137-28

25+50 Road Turns Southwest

23+50 Type change to Birch

20+00 Type change to Balsam

13+20 set App. Ft

10+20 Road Turns on line

7+44 - Type change to ASPEN

~~3+30 Set Appt.~~

~~0+50~~ Type change to Balsam

0+00 started West from 5 137-26

37

Brush

Birch

Look for:
Tan. 20" N 26½ W 45 lks
Spr. 8" S 54½ W 10"

FOUND:
¾" IRON PIPE
and PINE POST
Scribed
Jan. 10, 1939
Party
Michaelson
Jost
Harland
Greulich

Mag. Bearing S. 83.0° W.

Random Line

ASPEN

Balsam

Var. 6.1°

Marsh grass

140-28

52+80 Set Appr Sect cor. 4 Tam. Post
52+70 Lake Shore 6 5 139-28
Talked with settler living there & he states that the corner is Approx. where we set our stake.
48+52 Level of Lake
47+00 Type change to Birch

42+97 Road crosses Line bearing
42+40 Type change to ASPEN
41+02 INTermittant Stream S 10° E

39+60 Set Appr. W 1/4

35+59 TYPE change TO Hardwoods
34+10 Water level

32+67 water level

30+64 High water Mark

26+60 Continued West from 5 139-28

January 1939
Party
M. Epperson
Just
Harland
Gilchrist

Birch and ASPEN
Look for:
Tam. 6" N 11 E 63 lks
Tam 6" N 43 W 66 lks
Found:
No evidence of Sect. Cor.
No B.T. or Mds.

ASPEN

N 55° W

Creek UNION

Random

BLACK ASH

N 60° W 6.00 Meas. Bearing

Lake

SWAMP Grass

Brush

I.P.

26+40 Set Appr 1/4 Cor 1/4 — 6 139-28

25+92 Wagon Trail South

15+70 Driveway to farm
15+50 Type change to Aspen

13+20 Set App. E 1/16

11+93 Driveway to farm

11+76 Road enters line from NE

3+57 Type change to Mixed Hardwoods

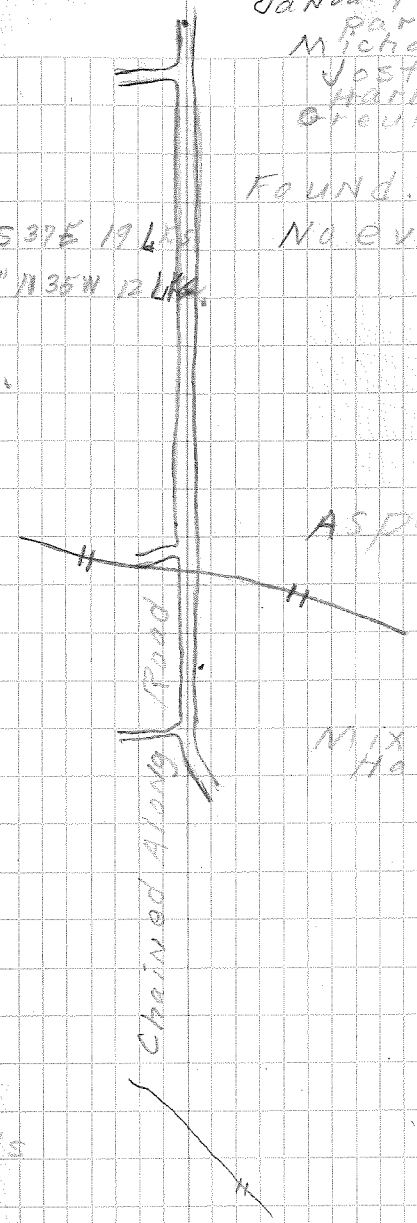
0+00 Started West from 1/4 C 1/16 139-28

January 20, 1939
Party
Michaelson
Jost
Hartland
Grunich

Look for:
Lime 7" S 32E 19 Lks
N. Mgd 5" N 35W 12 Lks.

Found:
No evidence

40 chains.



6.1° 5280 From IP.

Appr. Sect. Cor
NO I.P.

140-28

52+80 Set Appr. Sect Cor — 139-25
51+00 Type change To Nor. Pine

42+20 Type change To ASPEN

40+70 Type change to Marsh grass
39+70 Set Appr. W 1/6
38+82 Wagon trail runs N 35° E

26+40 Continued West from 6 — 139-55

January 20, 1939
Same party

3" ASPEN post

Look for:

Found:
No evidence

ASPEN

77 chs.
5082'

Mgt

ASPEN

Chained Along Road

ASPEN

Var 6.1°

140-28

Subdividing
Sec 36, T 139 - 28

140-28

25+61.5 Found I.P. - Interior ¼ cor. 20' West.

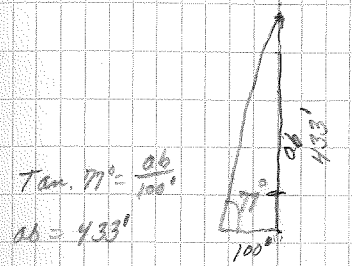
9+00 Another swamp - used triangulation

5+00 Triangulation used on swamp -

0+00 Started from North ¼ — 139-28
went South on 6½° 36

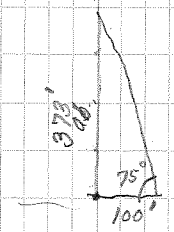
139-28

⊙ I.P.



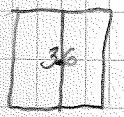
Tan. 77° = $\frac{ab}{100'}$

ab = 433'



Tan 75° = 3.73

Tan 75° = $\frac{ab}{100'}$



⊙ I.P.

140-28

Wabedo Twp

T. 140 - 28

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

140-28

25+90 Enter Cedar Swamp

18+10 Enter Balsam

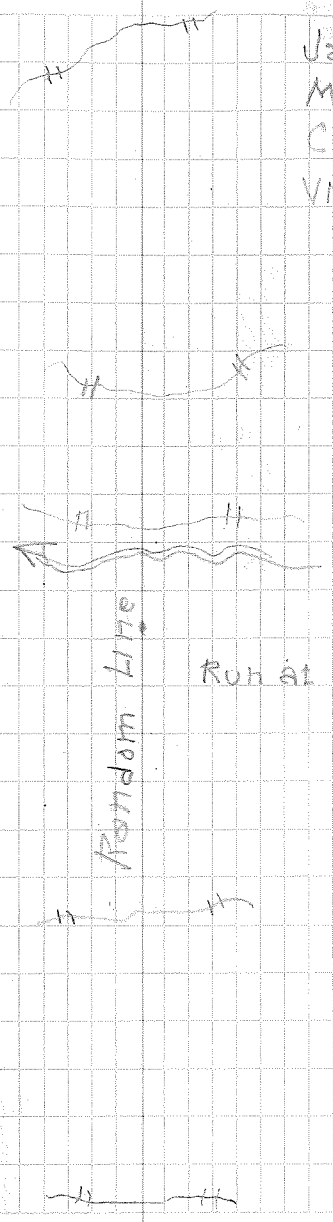
15+10 Enter Mixed Hardwoods
14+93 Hit Creek
13+20 Set APPR. S 1/16 Cor

7+33 Enter Swamp Alder

1+10 Enter Mixed Hardwoods
0+00 Started From center of road

30°36'

Jan. 26 1939
Maltson Notes
Chase Ch.
Vierling Ch.



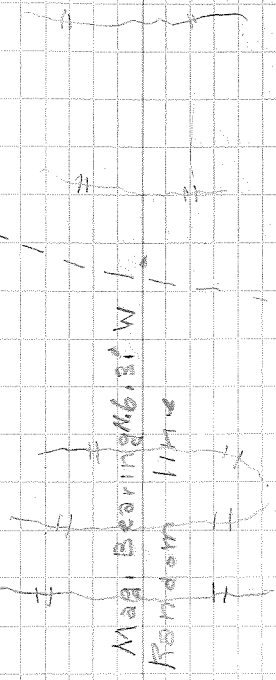
Run at 6.3° Variation

140-28

53+25	Alt Iron Pipe — 12.6' ~~We~~ East of random line
47+10	Enter Aspen
44+65	Enter Balsam
41+00	Enter Swamp Alder
39+60	Set APPR. N. ¼ Cor.
39+45	Found Sled trail
35+46	Enter Balsam
34+00	Enter Swamp Alder
32+63	Enter Live Cedar Swamp
28+24	Enter Flooded, Cutover, Dead Cedars
26+40	Set APPR. ¼ Cor.

Found Iron Pipe

Look For	Set up Stake At end
Aspen 8" N. 51° W 40 Lks.	of Picket line
Aspen 8" N. 82° E 31 Lks.	No Evidence of Bear-
Aspen 10" S 45° E 22 Lks.	ing Trees
Aspen 8" S 49° W 23 Lks.	Missed Pipe By 12.6 Ft.



Jan 26 1939
Mattson Notes
Chase Ch.
Vierling Ch.

Look For
Spruce N. 25.° E 7. Lks.
Aspen 7"
S. 66° E 32 Lks.

Could not Find ¼ Cor
Or Evidence of B.T.S.

140-28

26+40	¼ Cor Falls in road - Set Along road
26+27	Hit Longville road — At 26+46
25+42	Enter Scattered Alders
20+10	Enter Mixed Hardwoods
17+32	Hit Sled trail
15+60	Enter Aspen
14+10	Enter Norway Pine
13+20	Set S. ¼ Cor
8+47	Enter Jack Pine
1+44	Hit Sled trail
0+00	Started At Iron PIPE

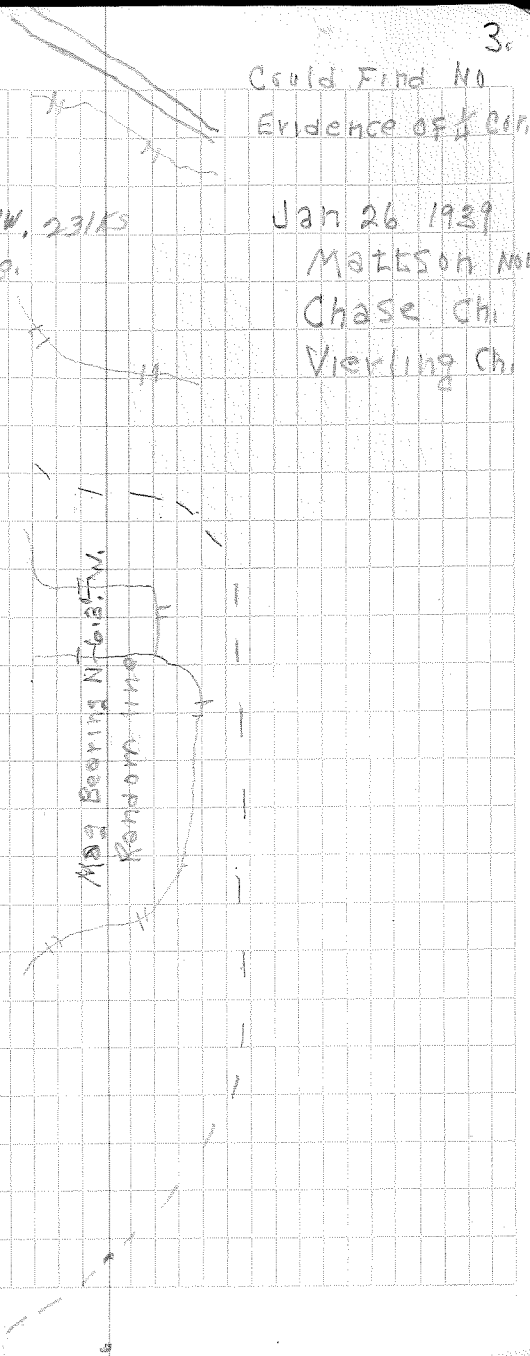
26 | 25
35 | 36

3.

Could Find No Evidence of ¼ Cor.

Look for
Dry Spr. 3' S 77 W, 23 LS
No other trees.

Jan 26 1939
Mattson Notes
Chase Ch.
Vierling Ch.



140-28

52+80 Set Picket And Continued on Ranging

50+10 Enter ASpen

46+35 Enter Norway Pine

39+60 Set APP. N. ¼ Cor. (QUIT For day Jan 26 1927

37+16 Enter Mixed Hardwoods

29+90 Enter Swamp Brush

28+38 Hit Black Spruce

Could Not Find Sec. Cor.
Continued on Same line

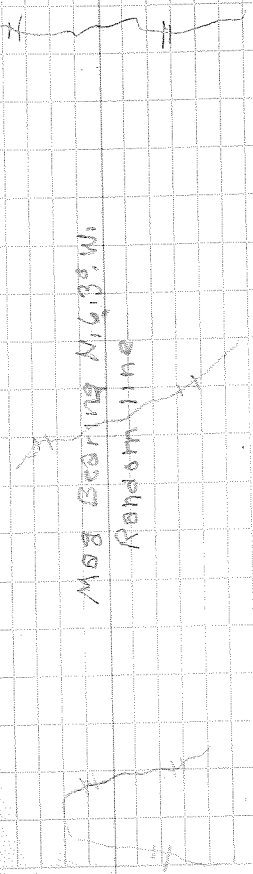
Look for:

W. Pine 25" S 50 E 25 lks

" 26" S 58 W 36 lks

" 5" N 70 W 29 lks

Maple 7" N 59 E 30 lks



140-28

26+40	Set App. # Cor.
26+35	Enter M.G.R.
24+90	Enter Aspen
20+05	Enter M. G.R.
17+10	Enter Mixed Brush
15+00	Enter ASPen
13+20	Set APP. S. # Cor
12+55	Enter M.G.R.
8+00	Enter Mixed Brush
0+00	Still in Aspen

23/24
26/25

January 31 1939

Look for:
N. Pine 13" 360W 50 lks
" 20" N60E 30 lks

Matson Notes
Vierling Ch.
Chase Ch.
Lake

Mag. Bearing N. 6.30 W.
Rainbow Line

140-28

11 | 13 | 140
23 | 24 | ~~139~~-28

52+80 Set APP Sec. Cor.

49+70 Enter Swamp Alder

45+00 Enter White Birch

42+82 Enter Labrador tea Swamp

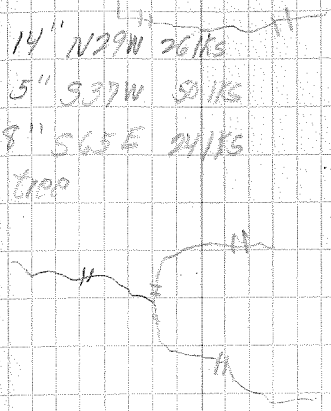
39+60 Set APP. N. 1/4 Cor.

27+47 Enter Mixed Brush

6

January 31, 1939
Mattson Notes
Viewing Ch.
Chase Ch.

Look for:
Dry Pine 14" N39W 26 lks
" Oak 5" S37W 50 lks
" Fir 8" S43E 24 lks
No other trees



Mag. Bearing, N. 6.30. W.
Random Line

140-28

140-28

140-28

140-28

140-28

140-28

140-28

140-28

24+40	Set ¼ Cor.	34/35	140-25
25+00	Enter Tamarack swamp leave Birch		
13+20	set south ¼ Cor.		
11+00	Enter Birch leave spruce swamp		
1+00	Enter spruce swamp		
0+00	started N. from center of road	34/35	140-25

14 ~~14~~

Feb. 8, 1929

Estram-notes
B. peterson-Ch.
Don-peterson-Ch
Chase-Rickets

Look for:
W. Pine 6" S 15 W 206 lks

Found no
Evidence

Spruce Swamp

Var. 6 1/3°

140-28

52+00	found t.p.		27 | 26 / 34 | 35
51+00	Enter Leave	Balsam Birch	
39+60	set North to cor.		
36+30	Enter Birch Leave Aspen		
29+00	Enter Aspen Leave Tamarack	Swamp	

Feb 8, 1939 19

Estimate meas. Estimate 2 rods. Double to check. Use set-arrows

Look for:

Found I.P.

Poplar 8" S 41 E 21 lks
Fir 4" N 77 E 22 lks
W. Birch 4" N 43 W 37 lks
Poplar 8" S 25 W 7 lks

39 ft E of line

140-28

26+40	set	¼ cor		
1320	set	South ¼ cor		
1+22	Enter	Lake Wabeno		
0+00	Started	North	from	27 26 / 34 35

140-28

15

In Lake

F. L. A. Water
B. Petroglyphs
Pictographs
Rock-petroglyphs

Lake Waters

At 165' Look for
M.C. post - Enter Lake
Fir 4" S63W 24 lks.
" 4", N87E, 19 lks.

Found no Evidence

140-28

	Date Feb 8, 1939		22 | 23 / 27 | 26		140-28
5240	Leave Lake-Wabada				
39+60	Set North 1/4 Cor.				
31+00	Leave Alder				
29+00	Enter Alder				
	Continued North from		27 | 26		140-28

16

Feb. 8 1939

Fostoria - Waters

Look for:

Post at 5280' — Determine Lat.

Leave Lake & set — Date - Set Traverse

N.C. post & cor. — Reference - Notes

to Sec. 22, 23, 26 & 27 — Found I.P.

Dry Oak 5" N 70E 25 lks. — 140 ft E. of line

" 8" S 60 W. 9 lks.

Lake Wabada

at 3168' intersect Lake

Look for: M.C. post &

Elm 7" S 80E. 16 lks, Oak 11" S 33 W, 28 lks.

at 2956.8' Leave

Lake & Look for:

N.C. post & — Found IP

Poplar 6" S 75 E 10 lks — Evidence

" 19" N 60 W. 10 lks.

140-28

				22/20	140-28
	Date Feb 9, 1939				
23+10	Enter Cedar swamp				
17+00	Hit trail				
	Enter Birch				
16+70	Leave Lake Webedo				
13+20	Set South ¼ cor				
11+21	Enter Lake Webedo				
11+00					
7+45	Hit trail				
1+00	Ent Sr Basswood				
1+00	Started North	from	22/23 / 20/20		140-28

Feb. 9 1939 19

Look for:
N. Pine 24", 340E, 6 lks.

Extreem Notes
Maxland - ok
Dan Peterson Cabin
Chase-pickets

Ori. Notes:
At 1722.2' Leave Lake
Look for: M.C. post
Poplar 8" N65E 11 lks.
" 5" N24W. 30 lks

At 1135.2' Intersect E. L. & I.P.
Little Bay Lake
Look for M.C. post
Blk. Ash 4" S20W 22 lks Found M.C. Post
" 7" East 29 lks.

Found B.T. N.27°E. 30 ft from I.P.

140-28

15 | 14
22 | 23

140-25

35+00

Continued North from 22/23 140-26

18

Look for:
At 3875.5' intersect
Little Bay Lake & Set
M.C. post &
Elm 5" S40W, 51 lks.

140-28

140-28

140-28

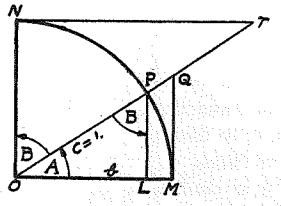


Table II

TRIGONOMETRIC FORMULAE

$\angle A = \angle MOP \qquad \angle B = \angle PON = \angle OPL$

$R = OB = c = 1$

$$\sin A = \frac{a}{c} = \frac{a}{1} = a = \cos B = LP$$

$$\cos A = \frac{b}{c} = \frac{b}{1} = b = \sin B = OL$$

$$\tan A = \frac{a}{b} = \frac{MQ}{OM} = \frac{MQ}{1} = MQ = \cot B = MQ$$

$$\cot A = \frac{NT}{ON} = \frac{NT}{1} = NT = \tan B = NT$$

$$\sec A = \frac{OQ}{OM} = \frac{OQ}{1} = OQ = \csc B = OQ$$

$$\csc A = \frac{OT}{ON} = \frac{OT}{1} = OT = \sec B = OT$$

$$\text{vers } A = \frac{LM}{OP} = LM = \text{covers } B \ \#$$

$$\text{covers } A = \frac{OP - LP}{OP} = OP - LP = \text{vers } B$$

$$\text{exsec } A = PQ = \text{coexsec } B$$

$$\text{coexsec } A = PT = \text{exsec } B$$

$$\sin \tfrac{1}{2}A = \sqrt{\frac{1 - \text{Cos } A}{2}} \qquad \cos \tfrac{1}{2}A = \sqrt{\frac{1 + \text{Cos } A}{2}}$$

$$\sin 2A = 2 \sin A \cos \qquad \cos 2A = \cos^2 A - \sin^2 A$$

$$\text{Law of Sines} \quad \frac{\sin A}{a} = \frac{\sin B}{B} = \frac{\sin C^1}{C}$$

$$\text{Law of Cosines} \quad c^2 = a^2 + p^2 - 2\,ab \cos C$$

$$\text{Law of Tangents} \quad \frac{a+b}{a-b} = \frac{\tan \tfrac{1}{2}(A+B)}{\tan \tfrac{1}{2}(A-B)}$$

Table II—Continued

TRIGONOMETRIC FORMULAE (continued)

In any triangle:

Given a, b, C; to find c, B, A.

Use Law of Tangents.

Given A, B, c; to find a, b, C.

Use Law of Sines.

Given a, b, c; to find A, B, C.

$$\text{Let } \frac{a+b+c}{2} = s, \sqrt{\frac{(s-a)}{s}\,\frac{(s-b)\,(s-c)}{s}} = r$$

$$\cos \tfrac{1}{2}A = \sqrt{\frac{s(s-a)}{bc}}$$

$$\tan \tfrac{1}{2}A = \frac{r}{s-a}$$

$$\tan \tfrac{1}{2}B = \frac{r}{s-b}$$

$$\tan \tfrac{1}{2}C = \frac{r}{s-c}$$

Area of a triangle:

$$\text{Area} = \tfrac{1}{2}\, ab \sin C$$

$$\text{Area} = \sqrt{s(s-a)\,(s-b)\,(s-c)}$$

PRISMOIDAL FORMULA

$$\text{Vol.} = \frac{h}{6}(B+b+4M)$$

h = altitude; b B = bases; M = midsection

Table III

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

Table IV

Inches in Decimals of a Foot

1/16 .0052	1/32 .0078	1/8 .0104	3/16 .0156	1/4 .0208	5/16 .0260	3/8 .0313	1/2 .0417	5/8 .0521	3/4 .0625	7/8 .0729

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

Table V.—Radii, Ordinates and Deflections

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot
0° 10′	34377.5	.036	.145	0.05′	7°	819.02	1.528	6.105	2.10′
20	17188.8	.073	.291	0.10	20′	781.84	1.600	6.395	2.20
30	11459.2	.109	.436	0.15	30	764.49	1.637	6.540	2.25
40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
50	6875.55	.182	.727	0.25	8	716.78	1.746	6.976	2.40
1	5729.65	.218	.873	0.30	20	688.16	1.819	7.266	2.50
10	4911.15	.255	1.018	0.35	30	674.69	1.855	7.411	2.55
20	4297.28	.291	1.164	0.40	40	661.74	1.892	7.556	2.60
30	3819.83	.327	1.309	0.45					
40	3437.87	.364	1.454	0.50	9	637.28	1.965	7.846	2.70
50	3125.36	.400	1.600	0.55	20	614.56	2.037	8.136	2.80
					30	603.80	2.074	8.281	2.85
2	2864.93	.436	1.745	0.60	40	593.42	2.110	8.426	2.90
10	2644.58	.473	1.891	0.65					
20	2455.70	.509	2.036	0.70	10	573.69	2.183	8.716	3.00
30	2292.01	.545	2.181	0.75	30	546.44	2.292	9.150	3.15
40	2148.79	.582	2.327	0.80	11	521.67	2.402	9.585	3.30
50	2022.41	.618	2.472	0.85	30	499.06	2.511	10.02	3.45
					12	478.34	2.620	10.45	3.60
3	1910.08	.655	2.618	0.90	30	459.28	2.730	10.89	3.75
10	1809.57	.691	2.763	0.95	13	441.68	2.839	11.32	3.90
20	1719.12	.727	2.908	1.00	30	425.40	2.949	11.75	4.05
30	1637.28	.764	3.054	1.05	14	410.28	3.058	12.18	4.20
40	1562.88	.800	3.199	1.10	30	396.20	3.168	12.62	4.35
50	1494.95	.836	3.345	1.15					
					15	383.07	3.277	13.05	4.50
4	1432.69	.873	3.490	1.20	30	370.78	3.387	13.49	4.65
10	1375.40	.909	3.635	1.25	16	359.27	3.496	13.92	4.80
20	1322.53	.945	3.718	1.30	30	348.45	3.606	14.35	4.95
30	1273.57	.982	3.926	1.35	17	338.27	3.716	14.78	5.10
40	1228.11	1.018	4.071	1.40	18	319.62	3.935	15.64	5.40
50	1185.78	1.055	4.217	1.45	19	302.94	4.155	16.51	5.70
5	1146.28	1.091	4.362	1.50	20	287.94	4.374	17.37	6.00
10	1109.33	1.127	4.507	1.55	21	274.37	4.594	18.22	6.30
20	1074.68	1.164	4.653	1.60	22	262.04	4.814	19.08	6.60
30	1042.14	1.200	4.798	1.65	23	250.79	5.035	19.94	6.90
40	1011.51	1.237	4.943	1.70	24	240.49	5.255	20.79	7.20
50	982.64	1.273	5.088	1.75					
					25	231.01	5.476	21.64	7.50
6	955.37	1.309	5.234	1.80	26	222.27	5.697	22.50	7.80
10	929.57	1.346	5.379	1.85	27	214.18	5.918	23.35	8.10
20	905.13	1.382	5.524	1.90	28	206.68	6.139	24.19	8.40
30	881.95	1.418	5.669	1.95	29	199.70	6.360	25.04	8.70
40	859.92	1.455	5.814	2.00	30	193.18	6.583	25.88	9.00

Note. Chord Deflection = 2 times tangent deflection.

TABLE VI.—TANGENTS AND EXTERNALS TO A 1° CURVE

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10′	58.34	.30	10′	560.11	27.31	10	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

TABLE VI.—TANGENTS AND EXTERNALS TO A 1° CURVE

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10′	1598.0	218.7	10′	2151.7	390.7	10′	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.8	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36	1861.7	294.9	46	2432.1	494.8	56	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37	1917.1	312.2	47	2491.3	518.2	57	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38	1972.9	330.2	48	2551.0	542.2	58	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39	2029.0	348.6	49	2611.2	566.9	59	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40	2085.4	367.7	50	2671.8	592.3	60	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

TABLE VI.—TANGENTS AND EXTERNALS TO A 1° CURVE

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
61°	3375.0	920.2	71°	4086.9	1308.2	81°	4893.6	1805.3
10′	3386.3	925.9	10′	4099.5	1315.6	10′	4908.0	1814.7
20	3397.5	931.6	20	4112.1	1322.9	20	4922.5	1824.1
30	3408.8	937.3	30	4124.8	1330.3	30	4937.0	1833.6
40	3420.1	943.1	40	4137.4	1337.7	40	4951.5	1843.1
50	3431.4	948.9	50	4150.1	1345.1	50	4966.1	1852.6
62	3442.7	954.8	72	4162.8	1352.6	82	4980.7	1862.2
10	3454.1	960.6	10	4175.6	1360.1	10	4995.4	1871.8
20	3465.4	966.5	20	4188.5	1367.6	20	5010.0	1881.5
30	3476.8	972.4	30	4201.2	1375.2	30	5024.8	1891.2
40	3488.3	978.3	40	4214.0	1382.8	40	5039.5	1900.9
50	3499.7	984.3	50	4226.8	1390.4	50	5054.3	1910.7
63	3511.1	990.2	73	4239.7	1398.0	83	5069.2	1920.5
10	3522.6	996.2	10	4252.6	1405.7	10	5084.0	1930.4
20	3534.1	1002.3	20	4265.6	1413.5	20	5099.0	1940.3
30	3545.6	1008.3	30	4278.5	1421.2	30	5113.9	1950.3
40	3557.2	1014.4	40	4291.5	1429.0	40	5128.9	1960.2
50	3568.7	1020.5	50	4304.6	1436.8	50	5143.9	1970.3
64	3580.3	1026.6	74	4317.6	1444.6	84	5159.0	1980.4
10	3591.9	1032.8	10	4330.7	1452.5	10	5174.1	1990.5
20	3603.5	1039.0	20	4343.8	1460.4	20	5189.3	2000.6
30	3615.1	1045.2	30	4356.9	1468.4	30	5204.4	2010.8
40	3626.8	1051.4	40	4370.1	1476.4	40	5219.7	2021.1
50	3638.5	1057.7	50	4383.3	1484.4	50	5234.9	2031.4
65	3650.2	1063.9	75	4396.5	1492.4	85	5250.3	2041.7
10	3661.9	1070.2	10	4409.8	1500.5	10	5265.6	2052.1
20	3673.7	1076.6	20	4423.1	1508.6	20	5281.0	2062.5
30	3685.4	1082.9	30	4436.4	1516.7	30	5296.4	2073.0
40	3697.2	1089.3	40	4449.7	1524.9	40	5311.9	2083.5
50	3709.0	1095.7	50	4463.1	1533.1	50	5327.4	2094.1
66	3720.9	1102.2	76	4476.5	1541.4	86	5343.0	2104.7
10	3732.7	1108.6	10	4489.9	1549.7	10	5358.6	2115.3
20	3744.6	1115.1	20	4503.4	1558.0	20	5374.2	2126.0
30	3756.5	1121.7	30	4516.9	1566.3	30	5389.9	2136.7
40	3768.5	1128.2	40	4530.4	1574.7	40	5405.6	2147.5
50	3780.4	1134.8	50	4544.0	1583.1	50	5421.4	2158.4
67	3792.4	1141.4	77	4557.6	1591.6	87	5437.2	2169.2
10	3804.4	1148.0	10	4571.2	1600.1	10	5453.1	2180.2
20	3816.4	1154.7	20	4584.8	1608.6	20	5469.0	2191.1
30	3828.4	1161.3	30	4598.5	1617.1	30	5484.9	2202.2
40	3840.5	1168.1	40	4612.2	1625.7	40	5500.9	2213.2
50	3852.6	1174.8	50	4626.0	1634.4	50	5517.0	2224.3
68	3864.7	1181.6	78	4639.8	1643.0	88	5533.1	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69	3937.9	1222.7	79	4723.2	1695.8	89	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70	4011.9	1265.0	80	4807.7	1749.9	90	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

TABLE VI.—TANGENTS AND EXTERNALS TO A 1° CURVE

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10′	5847.5	2457.1	10′	6971.3	3294.1	10′	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92	5933.2	2518.5	102	7075.5	3374.9	112	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93	6037.8	2594.0	103	7203.2	3474.4	113	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94	6144.3	2671.6	104	7333.6	3576.8	114	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95	6252.8	2751.3	105	7467.0	3682.3	115	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96	6363.4	2833.2	106	7603.5	3791.0	116	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97	6476.2	2917.3	107	7743.2	3902.9	117	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98	6591.2	3003.8	108	7886.2	4018.2	118	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99	6708.6	3092.7	109	8032.7	4137.1	119	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	5808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100	6828.3	3184.1	110	8182.8	4259.7	120	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

Table VII.—Corrections for Tangents and Externals

These corrections are to be added to the approximate values, found by dividing the tangent, or external, for a 1° curve (Table VI) by the degree of curve, in order to obtain the true tangents, or externals. Intermediate values may be obtained by interpolation.

For Tangents Add

Central Angle	Degree of Curve													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
20°	.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°	.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°	.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°	.11	.22	.34	.47	.58	.69	.70	.81	.92	1.04	1.29	1.42	1.54	1.66
40°	.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°	.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°	.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°	.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°	.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°	.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°	.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.98	5.38	5.83
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22

For Externals Add

Central Angle	Degree of Curve													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.711	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.985	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.32

Table VIII.—Corrections for Sub-Chords and Long Chords

D	For sub-chords add									Excess of Arc per 100 ft.
	10	20	30	40	50	60	70	80	90	
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72

D	Long chords				
	200	300	400	500
1	199.99	299.97	399.92	499.85
2	199.97	299.88	399.70	499.39
3	199.93	299.73	399.32	498.63
4	199.88	299.51	398.78	497.57
5	199.81	299.24	398.10	496.20
6	199.73	298.90	397.26	494.53
7	199.63	298.51	396.28	492.57
8	199.51	298.05	395.14	490.31
9	199.38	297.54	393.86	487.75
10	199.24	296.96	392.42	484.90
12	198.90	295.63	389.12	478.34
14	198.51	294.06	385.22	470.65
16	198.05	292.25	380.76	461.86
18	197.54	290.21	375.74	452.02
20	196.96	287.94	370.17	441.15
22	196.32	285.44	364.06	429.30
24	195.63	282.71	357.43	416.53
26	194.87	279.76	350.30	402.89
28	194.06	276.59	342.69	388.43
30	193.18	273.20	334.61	373.20
32	192.25	269.61	326.08	357.28
34	191.26	265.81	317.12	340.73
36	190.21	261.80	307.77	323.61
38	189.10	257.69	298.03	305.99
40	187.94	253.21	287.94	287.94
42	186.72	248.63	277.51	269.54
44	185.44	243.87	266.78	250.85
46	184.10	239.93	255.78	231.95
48	182.71	233.83	244.51	212.92

Note.—When a chord of less than 100 ft. is used the corrections given in the above table should be added to the nominal length of chord to get the length which should be used in order that the 100 ft. points will check with those obtained by using the standard 100 ft. chord. Thus in locating a 14° curve by 25 ft. chords measure 25'.06 for each chord. Long chords are useful in passing obstacles.

Table IX.—Middle Ordinates for Rails in Feet

Deg. of Curve	Length of rails							Deg. of Curve	Length of rails						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.037	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

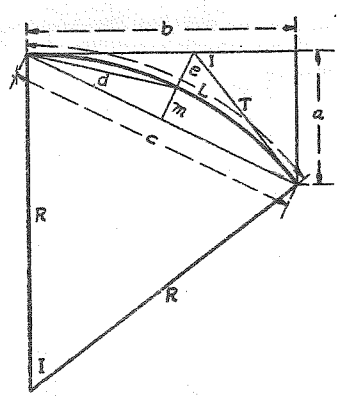


Table X
CURVE FORMULAE FOR SIMPLE CURVES
Compiled by J. Calvin Locke, C.E.

(1) $c = \sqrt{2Ra}$ (2) $c = \sqrt{a^2+b^2}$

(3) $c = \sqrt{2R\,(R-\sqrt{(R+b)\,(R-b)})} = \sqrt{2R(R-\sqrt{R^2-b^2})}$

(4) $c = 2\sqrt{m\,(2R-m)}$

(5) $c = 2R \sin \frac{1}{2} I$ (6) $c = 2T \cos \frac{1}{2} I$

(7) $e = R \operatorname{exsec} \frac{1}{2} I$

(8) $e = R \tan \frac{1}{2} I \tan \frac{1}{4} I$ (9) $e = T \tan \frac{1}{4} I$

(10) $b = \sqrt{a\,(2R-a)}$

(11) $b = \sqrt{\left(c+\frac{c^2}{2R}\right)\left(c-\frac{c^2}{2R}\right)} = \sqrt{c^2-\frac{c^4}{4R^2}}$

(12) $b = R \sin I$ (13) $b = a \cot \frac{1}{2} I$

(14) $R = \frac{a^2+b^2}{2a} = \frac{c^2}{2a}$ (15) $R = \frac{d^2}{2m} = \frac{c^2+4m^2}{8m}$

(16) $d = \sqrt{R\,(2R-\sqrt{(2R+c)\,(2R-c)})} = \sqrt{R(2R-\sqrt{4R^2-c^2})}$

(17) $d = \sqrt{2Rm}$ (18) $d = 2R \sin \frac{1}{4} I$ (19) $m = \frac{d^2}{2R}$

(20) $m = R \mp \sqrt{\left(R+\frac{c}{2}\right)\left(R-\frac{c}{2}\right)} = R \mp \sqrt{R^2-\frac{c^2}{4}}$

(21) $m = R \operatorname{vers} \frac{1}{2} I$ (22) $m = R \sin \frac{1}{2} I \tan \frac{1}{4} I$ (23) $m = \frac{1}{2} c \tan \frac{1}{4} I$

(24) $a = \frac{c^2}{2R}$ (25) $a = R-\sqrt{(R+b)\,(R-b)} = R-\sqrt{R^2-b^2}$

(26) $a = 2R\,(\sin^2 \frac{1}{2} I)^2$ (27) $a = R \operatorname{vers} I$ (28) $a = R \sin I \tan \frac{1}{2}$

(29) $a = b \tan \frac{1}{2} I$ (30) $a = T \sin I$ (31) $T = R \tan \frac{1}{2} I$

(32) $I = \frac{L}{R} \times 57.295780$ (33) $R = \frac{L}{I} \times 57.295780$

(34) $L = IR \times 0.01745329$ (35) $L = \frac{8d-c}{3}$

(36) Area Seg. $= \frac{LR-R^2 \operatorname{Sin} I}{2} = \frac{LR-Rb}{2}$

Table XI.—Calculation of Earthwork

Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.39	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if w = 16.2 and h = 5.3, cu. yds. = 1.48 + .028 + .089 = 1.597 cu. yds. or practically 160 cu. yds. per 100 ft. If w exceeds 40 ft., use one-half and multiply result by 2, if both w and h are large use one-half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) = h, and ½ the roadbed = w, add the triangles formed by taking the distance out to each break in turn (= w's) by the difference between the cuts (or fills) on each side of it (= h's) always subtracting the outer from the inner.

TABLE XII. STADIA REDUCTIONS
VERTICAL HEIGHTS

Minutes	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
0	0.00	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10
2	0.06	1.80	3.55	5.28	7.02	8.74	10.45	12.15	13.84	15.51	17.16
4	0.12	1.86	3.60	5.34	7.07	8.80	10.51	12.21	13.89	15.56	17.21
6	0.17	1.92	3.66	5.40	7.13	8.85	10.57	12.26	13.95	15.62	17.26
8	0.23	1.98	3.72	5.46	7.19	8.91	10.62	12.32	14.01	15.67	17.32
10	0.29	2.04	3.78	5.52	7.25	8.97	10.68	12.38	14.06	15.73	17.37
12	0.35	2.09	3.84	5.57	7.30	9.03	10.74	12.43	14.12	15.78	17.43
14	0.41	2.15	3.90	5.63	7.36	9.08	10.79	12.49	14.17	15.84	17.48
16	0.47	2.21	3.95	5.69	7.42	9.14	10.85	12.55	14.23	15.89	17.54
18	0.52	2.27	4.01	5.75	7.48	9.20	10.91	12.60	14.28	15.95	17.59
20	0.58	2.33	4.07	5.80	7.53	9.25	10.96	12.66	14.34	16.00	17.65
22	0.64	2.38	4.13	5.86	7.59	9.31	11.02	12.72	14.40	16.06	17.70
24	0.70	2.44	4.18	5.92	7.65	9.37	11.08	12.77	14.45	16.11	17.76
26	0.76	2.50	4.24	5.98	7.71	9.43	11.13	12.83	14.51	16.17	17.81
28	0.81	2.56	4.30	6.04	7.76	9.48	11.19	12.88	14.56	16.22	17.86
30	0.87	2.62	4.36	6.09	7.82	9.54	11.25	12.94	14.62	16.28	17.92
32	0.93	2.67	4.42	6.15	7.88	9.60	11.30	13.00	14.67	16.33	17.97
34	0.99	2.73	4.48	6.21	7.94	9.65	11.36	13.05	14.73	16.39	18.03
36	1.05	2.79	4.53	6.27	7.99	9.71	11.42	13.11	14.79	16.44	18.08
38	1.11	2.85	4.59	6.33	8.05	9.77	11.47	13.17	14.84	16.50	18.14
40	1.16	2.91	4.65	6.38	8.11	9.83	11.53	13.22	14.90	16.55	18.19
42	1.22	2.97	4.71	6.44	8.17	9.88	11.59	13.28	14.95	16.61	18.24
44	1.28	3.02	4.76	6.50	8.22	9.94	11.64	13.33	15.01	16.66	18.30
46	1.34	3.08	4.82	6.56	8.28	10.00	11.70	13.39	15.06	16.72	18.35
48	1.40	3.14	4.88	6.61	8.34	10.05	11.76	13.45	15.12	16.77	18.41
50	1.45	3.20	4.94	6.67	8.40	10.11	11.81	13.50	15.17	16.83	18.46
52	1.51	3.26	4.99	6.73	8.45	10.17	11.87	13.56	15.23	16.88	18.51
54	1.57	3.31	5.05	6.79	8.51	10.22	11.93	13.61	15.28	16.94	18.57
56	1.63	3.37	5.11	6.84	8.57	10.28	11.98	13.67	15.34	16.99	18.62
58	1.69	3.43	5.17	6.90	8.63	10.34	12.04	13.73	15.40	17.05	18.68
60	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10	18.73

HORIZONTAL CORRECTIONS

Dist.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
100	0.0	0.0	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.5	3.0
200	0.0	0.1	0.2	0.5	1.0	1.5	2.2	3.0	3.9	4.9	6.0
300	0.0	0.1	0.4	0.8	1.5	2.3	3.3	4.5	5.8	7.4	9.1
400	0.0	0.1	0.5	1.1	2.0	3.0	4.4	6.0	7.8	9.8	12.1
500	0.0	0.2	0.6	1.4	2.5	3.8	5.5	7.5	9.7	12.3	15.1
600	0.0	0.2	0.7	1.6	2.9	4.6	6.5	8.9	11.6	14.7	18.1
700	0.0	0.2	0.8	1.9	3.4	5.3	7.6	10.4	13.6	17.2	21.1
800	0.0	0.2	1.0	2.2	3.9	6.1	8.7	11.9	15.5	19.6	24.2
900	0.0	0.3	1.1	2.4	4.4	6.8	9.8	13.4	17.5	22.1	27.2
1000	0.0	0.3	1.2	2.7	4.9	7.6	10.9	14.9	19.4	24.5	30.2

TABLE XII. STADIA REDUCTIONS
VERTICAL HEIGHTS

Minutes	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
0	18.73	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14
2	18.78	20.39	21.97	23.52	25.05	26.55	28.01	29.44	30.83	32.18
4	18.84	20.44	22.02	23.58	25.10	26.59	28.06	29.48	30.87	32.23
6	18.89	20.50	22.08	23.63	25.15	26.64	28.10	29.53	30.92	32.27
8	18.95	20.55	22.13	23.68	25.20	26.69	28.15	29.58	30.97	32.32
10	19.00	20.60	22.18	23.73	25.25	26.74	28.20	29.62	31.01	32.36
12	19.05	20.66	22.23	23.78	25.30	26.79	28.25	29.67	31.06	32.41
14	19.11	20.71	22.28	23.83	25.35	26.84	28.30	29.72	31.10	32.45
16	19.16	20.76	22.34	23.88	25.40	26.89	28.34	29.76	31.15	32.49
18	19.21	20.81	22.39	23.93	25.45	26.94	28.39	29.81	31.19	32.54
20	19.27	20.87	22.44	23.99	25.50	26.99	28.44	29.86	31.24	32.58
22	19.32	20.92	22.49	24.04	25.55	27.04	28.49	29.90	31.28	32.63
24	19.38	20.97	22.54	24.09	25.60	27.09	28.54	29.95	31.33	32.67
26	19.43	21.03	22.60	24.14	25.65	27.13	28.58	30.00	31.38	32.72
28	19.48	21.08	22.65	24.19	25.70	27.18	28.63	30.04	31.42	32.76
30	19.54	21.13	22.70	24.24	25.75	27.23	28.68	30.09	31.47	32.80
32	19.59	21.18	22.75	24.29	25.80	27.28	28.73	30.14	31.51	32.85
34	19.64	21.24	22.80	24.34	25.85	27.33	28.77	30.19	31.56	32.89
36	19.70	21.29	22.85	24.39	25.90	27.38	28.82	30.23	31.60	32.93
38	19.75	21.34	22.91	24.44	25.95	27.43	28.87	30.28	31.65	32.98
40	19.80	21.39	22.96	24.49	26.00	27.48	28.92	30.32	31.69	33.02
42	19.86	21.45	23.01	24.55	26.05	27.52	28.96	30.37	31.74	33.07
44	19.91	21.50	23.06	24.60	26.10	27.57	29.01	30.41	31.78	33.11
46	19.96	21.55	23.11	24.65	26.15	27.62	29.06	30.46	31.83	33.15
48	20.02	21.60	23.16	24.70	26.20	27.67	29.11	30.51	31.87	33.20
50	20.07	21.66	23.22	24.75	26.25	27.72	29.15	30.55	31.92	33.24
52	20.12	21.71	23.27	24.80	26.30	27.77	29.20	30.60	31.96	33.28
54	20.18	21.76	23.32	24.85	26.35	27.81	29.25	30.65	32.01	33.33
56	20.23	21.81	23.37	24.90	26.40	27.86	29.30	30.69	32.05	33.37
58	20.28	21.87	23.42	24.95	26.45	27.91	29.34	30.74	32.09	33.41
60	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14	33.46

HORIZONTAL CORRECTIONS

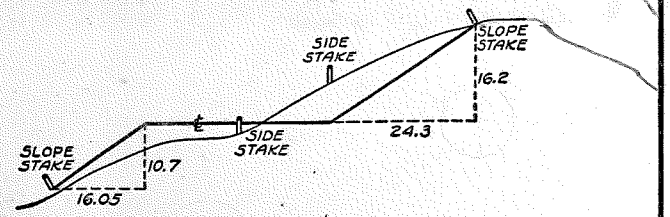
District	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
100	3.6	4.3	5.1	5.9	6.7	7.6	8.5	9.5	10.6	11.7
200	7.3	8.6	10.1	11.7	13.4	15.2	17.1	19.1	21.2	23.4
300	10.9	13.0	15.2	17.6	20.1	22.8	25.6	28.6	31.8	35.1
400	14.6	17.3	20.2	23.4	26.8	30.4	34.2	38.2	42.4	46.8
500	18.2	21.6	25.3	29.3	33.5	38.0	42.7	47.7	53.0	58.5
600	21.8	25.9	30.4	35.1	40.2	45.6	51.3	57.3	63.6	70.2
700	25.5	30.2	35.4	41.0	46.9	53.2	59.8	66.8	74.2	81.9
800	29.1	34.6	40.5	46.8	53.6	60.8	68.4	76.4	84.8	93.6
900	32.8	38.9	45.5	52.7	60.3	68.4	76.9	85.9	95.4	105.3
1000	36.4	43.2	50.6	58.5	67.0	76.0	85.5	95.5	106.0	117.0

TABLE XIII.—SINES, COSINES, TANGENTS, COTANGENTS

Deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	Deg.
0	0000	0000	0029	0029	0058	0058	0087	0087	0116	0116	0145	0145	89
1	175	0175	0204	0204	0233	0233	0262	262	291	291	320	320	88
2	349	349	378	378	407	407	436	437	465	466	494	495	87
3	523	524	552	553	581	582	610	612	640	641	669	706	86
4	698	699	727	729	756	758	785	787	814	816	843	864	85
5	872	875	901	904	929	934	958	963	987	992	1016	1022	84
6	1045	1051	1074	1080	1103	1110	1132	1139	1161	1169	190	198	83
7	219	228	248	257	279	287	305	317	334	346	363	376	82
8	392	405	421	435	449	465	478	495	507	524	536	554	81
9	564	584	593	614	622	644	650	673	679	703	708	733	80
10	736	763	765	793	794	823	822	853	851	883	880	914	79
11	908	944	937	974	965	2004	994	2035	2022	2065	2051	2095	78
12	2079	2126	2108	2156	2136	186	2164	217	193	247	221	278	77
13	250	309	278	339	306	370	334	401	363	432	391	462	76
14	419	493	447	524	476	555	504	586	532	617	560	648	75
15	588	679	616	711	644	742	672	773	700	805	728	836	74
16	756	867	784	899	812	931	840	962	868	994	896	3026	73
17	924	3057	952	3089	939	3121	3007	3153	3035	3185	3062	217	72
18	3090	249	3118	281	3145	314	173	346	201	378	228	411	71
19	256	443	283	476	311	508	338	541	365	574	393	607	70
20	420	640	448	673	475	706	502	739	529	772	557	805	69
21	584	839	611	872	638	906	665	939	692	973	719	4006	68
22	746	4040	773	4074	800	4108	827	4142	854	4176	881	210	67
23	907	245	934	279	961	314	987	348	4014	383	4041	417	66
24	4067	452	4094	487	4120	522	4147	557	173	592	200	628	65
25	226	663	253	699	279	734	305	770	331	806	358	841	64
26	384	877	410	913	436	950	4462	986	488	5022	514	5059	63
27	540	5095	566	5132	592	5169	617	5206	643	243	669	280	62
28	695	317	720	354	746	392	772	430	797	467	823	505	61
29	848	543	874	581	899	619	924	658	950	696	975	735	60
30	5000	774	5025	5812	5050	851	5075	890	5100	930	5125	969	59
31	150	6009	175	6048	200	6088	225	6128	250	6168	275	6208	58
32	299	249	324	289	348	330	5373	371	398	412	422	453	57
33	446	494	471	536	495	577	519	619	544	661	568	703	56
34	592	745	616	787	640	830	664	873	688	916	712	959	55
35	736	7002	760	7046	783	7089	807	7133	831	7177	854	7221	54
36	878	265	901	310	925	355	948	400	972	445	995	490	53
37	6018	536	6041	581	6065	627	6088	673	6111	720	6134	766	52
38	157	813	180	860	202	907	225	954	248	8002	271	8050	51
39	293	8098	316	8146	338	8195	361	8243	383	292	406	342	50
40	428	391	450	441	472	491	494	541	517	591	539	642	49
41	561	693	583	744	604	796	626	847	648	899	670	952	48
42	691	9004	713	9057	734	9110	756	9163	777	9217	799	9271	47
43	820	325	841	380	862	435	884	490	905	545	926	601	46
44	947	657	967	713	988	770	7009	827	7030	884	7050	942	45
45	7071	1.0000	7092	1.0058	7112	1.0117	133	1.0176	153	1.0235	173	1.0295	44
	60′	60′	50′	50′	40′	40′	30′	30′	20′	20′	10′	10′	
Deg.	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	Deg.

TABLE XIII.—SINES, COSINES, TANGENTS, COTANGENTS (Continued)

Deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	Deg.
46	7193	1.0355	7214	1.0416	7234	1.0477	7254	1.0533	7274	1.0599	7294	1.0661	43
47	314	.0724	333	.0786	353	.0850	373	.0913	392	.0977	412	.1041	42
48	431	.1106	451	.1171	470	.1237	490	.1303	509	.1369	528	.1436	41
49	547	.1504	566	.1571	585	.1640	604	.1708	623	.1778	642	.1847	40
50	660	1.1918	7679	1.1988	7698	1.2059	7716	1.2131	7735	1.2203	7753	1.2276	39
51	771	.2349	790	.2423	808	.2497	826	.2572	844	.2647	862	.2723	38
52	880	.2799	898	.2876	916	.2954	934	.3032	951	.3111	969	.3190	37
53	986	.3270	8004	.3351	8021	.3452	8039	.3514	8056	.3597	8073	.3680	36
54	8090	.3764	107	.3848	124	.3934	141	.4019	158	.4106	175	.4193	35
55	192	.4281	208	.4370	225	.4460	241	.4550	258	.4641	274	.4733	34
56	290	.4826	307	.4919	323	.5013	339	.5108	355	.5204	371	.5301	33
57	387	.5399	403	.5497	418	.5597	434	.5697	450	.5798	465	.5900	32
58	480	.6003	496	.6107	511	.6212	526	.6319	542	.6426	557	.6534	31
59	572	.6643	587	.6753	601	.6864	616	.6977	631	.7090	646	.7205	30
60	660	1.7321	8675	1.7437	8689	1.7556	8704	1.7675	8718	1.7797	8732	1.7917	29
61	746	.8040	760	.8165	774	.8291	788	.8418	802	.8546	816	.8676	28
62	829	.8807	843	.8940	857	.9074	870	.9210	884	.9347	897	.9486	27
63	910	.9626	923	.9768	936	.9912	949	2.0057	962	2.0204	975	2.0353	26
64	988	2.0503	9001	2.0655	9013	2.0809	9026	.0965	9038	.1123	9051	.1283	25
65	9063	.1445	075	.1609	088	.1775	100	.1943	112	.2113	124	.2286	24
66	135	.2460	147	.2637	159	.2817	171	.2998	182	.3183	194	.3369	23
67	205	.3559	216	.3750	228	.3945	239	.4142	250	.4342	261	.4545	22
68	272	.4751	283	.4960	293	.5172	304	.5386	315	.5605	325	.5826	21
69	336	.6051	346	.6279	356	.6511	367	.6746	377	.6985	387	.7228	20
70	397	2.7475	9407	2.7725	9417	2.7980	9426	2.8239	9436	2.8502	9446	2.8770	19
71	455	.9042	465	.9319	474	.9600	483	.9887	492	3.0178	502	3.0475	18
72	511	3.0777	520	3.1084	528	3.1397	537	3.1716	546	.2041	555	.2371	17
73	563	.2709	572	.3052	580	.3402	588	.3759	596	.4124	605	.4495	16
74	613	.4874	621	.5261	628	.5656	636	.6059	644	.6470	652	.6891	15
75	659	.7321	667	.7760	674	.8208	681	.8657	689	.9136	696	.9617	14
76	703	4.0108	710	4.0611	717	4.1126	724	4.1653	730	4.2193	737	4.2747	13
77	744	.3315	750	.3897	757	.4494	763	.5107	769	.5736	775	.6382	12
78	781	.7046	787	.7729	793	.8430	799	.9152	805	.9894	811	5.0658	11
79	816	.1446	822	5.2257	827	5.3093	833	5.3955	838	5.4845	843	.5764	10
80	9848	5.6713	9853	5.7694	9858	5.8708	9863	5.9758	9868	6.0844	9872	6.1970	9
81	877	6.3138	881	6.4348	886	6.5606	890	6.6912	894	.8269	899	.9682	8
82	903	7.1154	907	7.2687	911	7.4287	914	7.5958	918	7.7704	922	7 9530	7
83	925	8.1443	929	8.3450	932	8.5555	936	8.7769	939	9.0098	942	9.2553	6
84	945	9.5144	948	9.7882	951	10.078	954	10.385	957	10.711	959	11.059	5
85	962	11.430	964	11.826	967	12.250	969	12.706	971	13.197	974	13.727	4
86	976	14.300	978	14.924	980	15.605	981	16.350	983	17.169	985	18.075	3
87	986	19.081	988	20.206	989	21.470	990	22.903	992	24.542	993	26.432	2
88	994	28.636	9995	31.242	9996	34.368	997	38.189	997	42.964	9998	49.104	1
89	9998	57.290	9999	68.750	9999	85.940	9999	114.58	1.000	171.88	1.000	343.77	0
	60′	60′	50′	50′	40′	40′	30′	30′	20′	30′	10′	10′	
Deg.	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	Deg.



Distances from Side Stakes for Cross-Sectioning

Slope 1½ to 1. Roadway of Any Width

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.00	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	0
1	1.50	1.65	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	1
2	3.00	3.15	3.30	3.45	3.60	3.75	3.90	4.05	4.20	4.35	2
3	4.50	4.65	4.80	4.95	5.10	5.25	5.40	5.55	5.70	5.85	3
4	6.00	6.15	6.30	6.45	6.60	6.75	6.90	7.05	7.20	7.35	4
5	7.50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	5
6	9.00	9.15	9.30	9.45	9.60	9.75	9.90	10.05	10.20	10.35	6
7	10.50	10.65	10.80	10.95	11.10	11.25	11.40	11.55	11.70	11.85	7
8	12.00	12.15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	8
9	13.50	13.65	13.80	13.95	14.10	14.25	14.40	14.55	14.70	14.85	9
10	15.00	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	10
11	16.50	16.65	16.80	16.95	17.10	17.25	17.40	17.55	17.70	17.85	11
12	18.00	18.15	18.30	18.45	18.60	18.75	18.90	19.05	19.20	19.35	12
13	19.50	19.65	19.80	19.95	20.10	20.25	20.40	20.55	20.70	20.85	13
14	21.00	21.15	21.30	21.45	21.60	21.75	21.90	22.05	22.20	22.35	14
15	22.50	22.65	22.80	22.95	23.10	23.25	23.40	23.55	23.70	23.85	15
16	24.00	24.15	24.30	24.45	24.60	24.75	24.90	25.05	25.20	25.35	16
17	25.50	25.65	25.80	25.95	26.10	26.25	26.40	26.55	26.70	26.85	17
18	27.00	27.15	27.30	27.45	27.60	27.75	27.90	28.05	28.20	28.35	18
19	28.50	28.65	28.80	28.95	29.10	29.25	29.40	29.55	29.70	29.85	19
20	30.00	30.15	30.30	30.45	30.60	30.75	30.90	31.05	31.20	31.35	20
21	31.50	31.65	31.80	31.95	32.10	32.25	32.40	32.55	32.70	32.85	21
22	33.00	33.15	33.30	33.45	33.60	33.75	33.90	34.05	34.20	34.35	22
23	34.50	34.65	34.80	34.95	35.10	35.25	35.40	35.55	35.70	35.85	23
24	36.00	36.15	36.30	36.45	36.60	36.75	36.90	37.05	37.20	37.35	24
25	37.50	37.65	37.80	37.95	38.10	38.25	38.40	38.55	38.70	38.85	25
26	39.00	39.15	39.30	39.45	39.60	39.75	39.90	40.05	40.20	40.35	26
27	40.50	40.65	40.80	40.95	41.10	41.25	41.40	41.55	41.70	41.85	27
28	42.00	42.15	42.30	42.45	42.60	42.75	42.90	43.05	43.20	43.35	28
29	43.50	43.65	43.80	43.95	44.10	44.25	44.40	44.55	44.70	44.85	29
30	45.00	45.15	45.30	45.45	45.60	45.75	45.90	46.05	46.20	46.35	30
31	46.50	46.65	46.80	46.95	47.10	47.25	47.40	47.55	47.70	47.85	31
32	48.00	48.15	48.30	48.45	48.60	48.75	48.90	49.05	49.20	49.35	32
33	49.50	49.65	49.80	49.95	50.10	50.25	50.40	50.55	50.70	50.85	33
34	51.00	51.15	51.30	51.45	51.60	51.75	51.90	52.05	52.20	52.35	34
35	52.50	52.65	52.80	52.95	53.10	53.25	53.40	53.55	53.70	53.85	35
36	54.00	54.15	54.30	54.45	54.60	54.75	54.90	55.05	55.20	55.35	36
37	55.50	55.65	55.80	55.95	56.10	56.25	56.40	56.55	56.70	56.85	37
38	57.00	57.15	57.30	57.45	57.60	57.75	57.90	58.05	58.20	58.35	38
39	58.50	58.65	58.80	58.95	59.10	59.25	59.40	59.55	59.70	59.85	39
40	60.00	60.15	60.30	60.45	60.60	60.75	60.90	61.05	61.20	61.35	40
41	61.50	61.65	61.80	61.95	62.10	62.25	62.40	62.55	62.70	62.85	41
42	63.00	63.15	63.30	63.45	63.60	63.75	63.90	64.05	64.20	64.35	42
43	64.50	64.65	64.80	64.95	65.10	65.25	65.40	65.55	65.70	65.85	43
44	66.00	66.15	66.30	66.45	66.60	66.75	66.90	67.05	67.20	67.35	44
45	67.50	67.65	67.80	67.95	68.10	68.25	68.40	68.55	68.70	68.85	45
46	69.00	69.15	69.30	69.45	69.60	69.75	69.90	70.05	70.20	70.35	46
47	70.50	70.65	70.80	70.95	71.10	71.25	71.40	71.55	71.70	71.85	47
48	72.00	72.15	72.30	72.45	72.60	72.75	72.90	73.05	73.20	73.35	48
49	73.50	73.65	73.80	73.95	74.10	74.25	74.40	74.55	74.70	74.85	49
50	75.00	75.15	75.30	75.45	75.60	75.75	75.90	76.05	76.20	76.35	50

Distance of slope stake from side or shoulder stake for any width roadway, slope 1½ to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

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BARCOL

FIELD BOOK