

KRYMES ROAD
BR. # 2795
OFFTAKE - No. 80

⑦

⑦

FIELD BOOK

361

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Fly levels beginning approx 1/2 mile south of The Hawk's guttering	}	1-4
East for approximately 1/2 mile		
Dirch take tower.		
Stationing of piling on Gir		11-12
Elevations on top of piles on Gir		13-
OFF-TAKE DITCH IN MILE TEN (10) SR. #80 (TRANSIT)		23-26
OFF-TAKE DITCH IN MILE TEN (10) SR. #80 (LEVELS)		27-30
Expense on OFF-TAKE mile (10) SR. #80		104

Point	HS	HI	Rod	FS	Flas
1	810	108.10			1000.0
2			6.7		014
3			6.3		018
T.P.	553	107.33		6.30	01.80
4			5.8		01.5
5			6.2		01.1
6			6.0		01.3
7			6.1		01.2
8	360	0520		5.73	01.60
9			4.6		00.6
10			4.8		00.4
T.P.	445	105.18		4.47	00.73
11			5.0		00.2
12			5.3		99.9
13			5.7		99.5
T.P.	443	104.30		5.33	99.5
14			4.7		99.6
15			5.4		98.9
B.M.	740	107.60			10000
			4.7		2.9
			4.9		1.7
			4.9		1.0
			6.5		1.1
			6.4		1.2
			6.1		01.5

Hyd. Levels
 3 F.P.
 Sept 1918.

in low place

At base

incr Bed

incr "

incr "

incr "

incr "

on Rock

incr

Rock

incr

incr

incr

Bottom of culvert across Road of culvert

in low place

on dam right of low place

3

Point	B.S.	I.I.	Red	F.S.	Fle.
	923	10813			9890
T.P.	103	10399		817	9996
1			7.8		982
2			5.3		987
T.P.	150	10329		520	9877
T.P.	534	10367		796	9833
T.P.	548	10323		592	9775
T.P.	722	10209		534	9787
T.P.	694	10520		383	9826
T.P.	380	10242		658	9862
3			5.2		972
T.P.	715	10464		793	9749
1			7.3		973
T.P.	559	10488		535	9929
5			7.9		970
T.P.	360	10285		563	9925
6			6.8		961
T.P.	380	10272		393	9892
7			4.4		961
8			7.4		953
T.P.	105	10139		638	9734
9				5.8	956
				4.8	969
				5.8	956
				6.3	951
				7.9	935

Fly. Sept 7 1918
Levels.

4

East of culvert

Bottom of culvert

Bottom of Cr. 144

" " " "

" " " "

" " " "

Bottom of Cr.

in Cr bottom

in Cr bottom

in " "

" " "

" " "

" " "

Top ground near Beaver Dam

Low place to West of Beaver

in low place North of beaver dam.

TABLE FOR PILE DRIVING

 $\frac{1}{2}$ ton hammerFormula - $\frac{2WH}{S+1}$ 10 ton bearingFall Penetration necessary
Av. last 3 blows, in inches

32' 2.7 inches

31 2.1 "

30 2.0 "

29 1.9 "

28 1.8 "

27 1.7 "

26 1.6 "

25 1.5 "

24 1.4 "

23 1.3 "

22 1.2 "

21 1.1 "

20 1.0 "

19 .9 "

18 .8 "

17 .7 "

~~18~~~~17~~

16 .6

15 .5

14 .4

13 .3

12 .2

11 .1

10 .0

7 NO.	PENETRATION					BRIDGE #27.95'		TON WEIGHT					F	
	1	2	3	4	5	1	2	3	4	5	6	7		8
BENT 1	1-15'	2-13'	3-15'	4-15'	5-15½'	10	9	11	10	10½	11	10	10	9
	6-16'	7-15'	8-15'	9-15'					13	(all 25' piling)				
BENT 2	1-16'	2-15½'	3-17'	4-16'		10	10	10	11	(all 25' piling)				
BENT 3	1-17'	2-16'	3-18'	4-17½'		10+	10+	10	10	(all 25' piling)				
BENT 4	1-17½'	2-18'	3-17½'	4-18'		10	10	11	10+	(all 30' piling)				
BENT 5	1-17'	2-16½'	3-17'	4-17'		10	10	9½	10	(all 30' piling)				
BENT 6	1-16½'	2-15'	3-16'	4-15½'		10	10	10+	10	(all 30' piling)				
BENT 7	1-17'	2-16'	3-16½'	4-17'		10+	11	10+	10	(all 30' piling)				
BENT 8	1-17'	2-17½'	3-16½'	4-17'		10	10	10	10	(all 30' piling)				
BENT 9	1-16'	2-16½'	3-15½'	4-16'		10	10	10	10	(all 30' piling)				
BENT 10	1-15'	2-14½'	3-15'	4-15'		10	10	10	10	(all 30' piling)				
BENT 11	1-15'	2-15'	3-15'	4-15'		10	10	10	10	(all 30' piling)				
BENT 12	1-15½'	2-16'	3-15'	4-15'		10+	10	9	10	(all 35' piling)				
BENT 13	1-15'	2-14'	3-15'	4-15'		9+	10	10	10	all 40' piling				

CONTINUE ON PAGE 1011

9

PENETRATION

BR. # 2795

TONS WEIGHT.

10

BENT 14 1-14 2-15 3-14½ 4-15

BENT 15 1-15 2-14 3-15 4-14½

BENT 16 1-15 2-14 3-15 4-15 5-15
6-15'

BENT 17 1-15 2-14½ 3-15 4-15 5-15
6-14½

CLUSTER NO. I. ①② 1-15' 2-15'
3-15'

CLUSTER NO. II. ①③ 1-15' 2-15'

60' SPAN

BENT 18 1-15 2-15 3-15½ 4-15 5-14½
6-15'

CLUSTER NO. 4 ①③ 1-15' 2-16' 3-15'

CLUSTER NO. 3 ①③ 1-14 2-14½ 3-14

BENT 19 1-15 2-15 3-15 4-15 5-15
6-15

BENT 20 1-14 2-15 3-14½ 4-15

BENT 21 1-15 2-13½ 3-13 4-15

CONT'D. ON PAGE (17)

1	2	3	4	5	6
WT. 10	WT. 10+	WT. 10	WT. 9½	ALL 40' PILING	
SDS 10	WT. 10+	WT. 9½	WT. 10	ALL 40' PILING	
WT. 10	BT 9	WT. 10	WT. 10	WT. 10	ALL 40' PILING
WT. 10	BT 10+	BT 10	SDS 10	BT 10	
WT. 10	BT 10	WT. 10	ALL 40' PILING		
AS. 10	WT. 9	AS. 10	ALL 40' PILING		
BT 10	BT 10+	BT 10	BT 10	BT 10	ALL 40' PILING
BT 10	AS. 10	AS. 10	BT 10	AS. 10	ALL 40' PILING
AS. 10	AS. 10	AS. 10	AS. 10+	ALL 40' PILING	
AS. 10	AS. 10+	AS. 10	SDS 10	ALL 40' PILING	

CONT'D. ON PAGE (17)

can 4 below

5+123

5+293

5+123

4+973

4+823

4+673

4+533

4+508

3+91.5

3+89

3+75

3+60

3+45

3+30

3+15

3+00

2+85

2+70

2+55

2+40

2+25

2+10

1+95

1+80

1+65

15" Ben ts

15" Ben ts

7+223

7+073

6+923

6+773

6+623

6+473

6+323

6+173

6+023

5+873

5+723

5+573

12/17/18

Grid area on page 12

Elevations of hubs on line used for cut offs

0.82 10082

				Elev of Hubs
5+27.3	A 44° 54' R			100.00
5+12.3			4.27	99.55
4+97.3	6.59	95.43	11.93	88.89
21	8.23		8.20	87.23
20	1.73		9.93	85.51
19	5.33		10.24	85.19
18	1+50.8		10.18	85.25
17	3+91.3	Draw	10.23	85.22
16	8.9		10.08	85.35
15	7.5		10.17	85.26
14	6.0		10.20	85.23
13	4.5		10.33	85.10
12	3.0		9.81	85.62
11	1.5		4.78	89.65
10	3+00		5.61	89.30
9	8.5		5.89	89.54
8	7.0		6.34	89.99
7	5.5		6.73	88.70
6	4.0		7.93	89.54
5	2.5		6.98	88.55
4	2 10		6.43	89.30
3	1.5		5.03	88.80
2	8.0		4.96	88.80
1+65	11.93	10346	3.90	91.53

U.S. BM @ sta 5+27.3 in side of Pipe

Elev top of piling	Distance from hub to cut off in ft.	
103.29	3.29	20'
103.87	9.32	25'
104.45	15.56	35'
105.03	17.80	40'
105.61	20.11	40'
106.25	21.06	40'
106.25	21.00	40'
106.25	21.05	40' DRAW
106.25	20.90	✓
105.63	20.37	✓
105.07	19.84	✓
104.51	19.41	✓
103.94	18.32	✓
103.38	12.73	✓
102.82	13.00	✓
102.25	12.71	✓
101.69	12.60	✓
101.13	12.93	✓
100.56	13.06	✓
100.00	11.53	✓
99.44	10.44	✓
98.88	9.08	✓
98.31	7.84	✓
97.75	6.22	✓

Continued on Page 15

103.46

1432

11.9

92.1

1+00

3.50 99.96

Continued from sta 5+273

B.M.

6.49

100.49

Elev. of
Hobs on line 100.00

25) 5+42.3

2.19 98.30

26) 5+57.3

7.24 93.23

27) 5+72.3

8.56 91.93

28) 5+87.3

9.70 90.79

29) 6+12.3

10.97 89.52

30) 6+17.3

11.98 88.51

31) 6+32.3

13.30 87.19

32) 6+47.3

11.74 88.75

33) 6+62.3

11.09 89.40

34) 6+77.3

10.40 90.09

35) 6+92.3

9.53 90.96

36) 7+07.3

10.05 90.44

37) 7+22.3

10.05 90.44

12/18/18

ground elevation

Top spike used as HOB.

U.S. B.M.:

Elev top of piling

Distance from HOB

102.71

4.41²⁰ TO cutoff

102.13

8.90²⁵ ✓

12/18.18

101.53

9.62²⁵ ✓

100.97

10.18³⁰ ✓

100.39

10.87³⁰ ✓

99.81

11.30³⁰ ✓

99.23

12.04³⁰ ✓

98.65

12.90³⁰ ✓

98.07

13.67²⁵ ✓

97.49

14.10²⁵ ✓

96.91

14.95²⁵ ✓

96.33

15.89²⁵ ✓

95.75

16.31²⁵ ✓

17

= PENETRATION =

= BRIDGE # 2195 =

= TONS WEIGHT =

18

BENT-22 1-14 2-15 3-14 4-13

BENT-23 1-15 2-14 3-14½ 4-13½
BEI

BENT-24 1-13 2-13½ 3-13 4-13½

BENT-25 1-14 2-13 3-13 4-12½

BENT-26 1-14 2-14½ 3-14 4-14

BENT-27 1-15 2-15 3-14½ 4-14½

BENT-28 1-15 2-14½ 3-15 4-15

BENT-29 1-15 2-15½ 3-15 4-15

BENT-30 1-15½ 2-15 3-15½ 4-15

BENT-31 1-16 2-17 3-16½ 4-17

BENT-32 1-17 2-16½ 3-15 4-15½

BENT-33 1-15 2-15½ 3-15 4-13

BENT-34 1- 2- 3- 4-15

BT. 10	AS. 10	BT. 10	BT. 10	} ALL 40' PILING
BT. 30 10 cut 40	BT. 30 10 cut 40	SDS-30 10+ cut 40	BT. 30 10	
AS-20 10 cut 40	BT-25 10 cut 40	AS-23 10 cut 30	SDS-25 10	} 3-25' piling 1-20' piling
BT-25 10 cut 40	AS-20 10 cut 40	SDS-25 10+	SDS-25 10+	
WT-30 10	BT-25 10	BT-25 10	BT-25 10	} 1-30' piling ALL 25' piling
SDS 10	WT 10	SDS 10	SDS 10	
BT. 10	BT. 10	BT. 10	BT. 10	} ALL 30' piling
BT. 10	BT. 10+	BT. 10	BT. 10	
BT. 10	BT. 10+	BT. 40 9	BT. 9½	} ALL 30' piling
AS. 10	AS. 10	BT. 10	AS. 10	
BT. 9	BT. 9½	AS. 10+	AS. 10	} ALL 30' piling
BT. 10+	BT. 9½	BT. 10	BT. 8	
SDS 9½	SDS 10+	BT-30 10	SDS 10	} ALL 25' piling

19

— PENETRATION. —

BENT-35 1-15 2-15 $\frac{1}{2}$ 3-15 4-16BENT-36 1-15 2-15 3-15 $\frac{1}{2}$ 4-15 $\frac{1}{2}$

BENT-37 1-15 2-15 3-14 4-14 5-14

6-14 7-14 8-13 9-14

BRIDGE = #2795.

20

— TONS WEIGHT. —

BT-30 10+	BT-30 10	BT-30 10	BT-25 10+	ALL 25' piling
AS-25 9	WT-25 9 $\frac{1}{2}$	AS-25 9	BS-25 10	ALL 25' piling
BT-25 9	BT-25 10	SPS-25 10+	AS-30 10	AS-30 10
SPS-25 9	SPS-25 10+	AS-25 10+	AS-25 10	

23

STA

Δ

M.B.

T.B.

12

11

10

9

8

7

6

5

4

+50

3

2

1

00

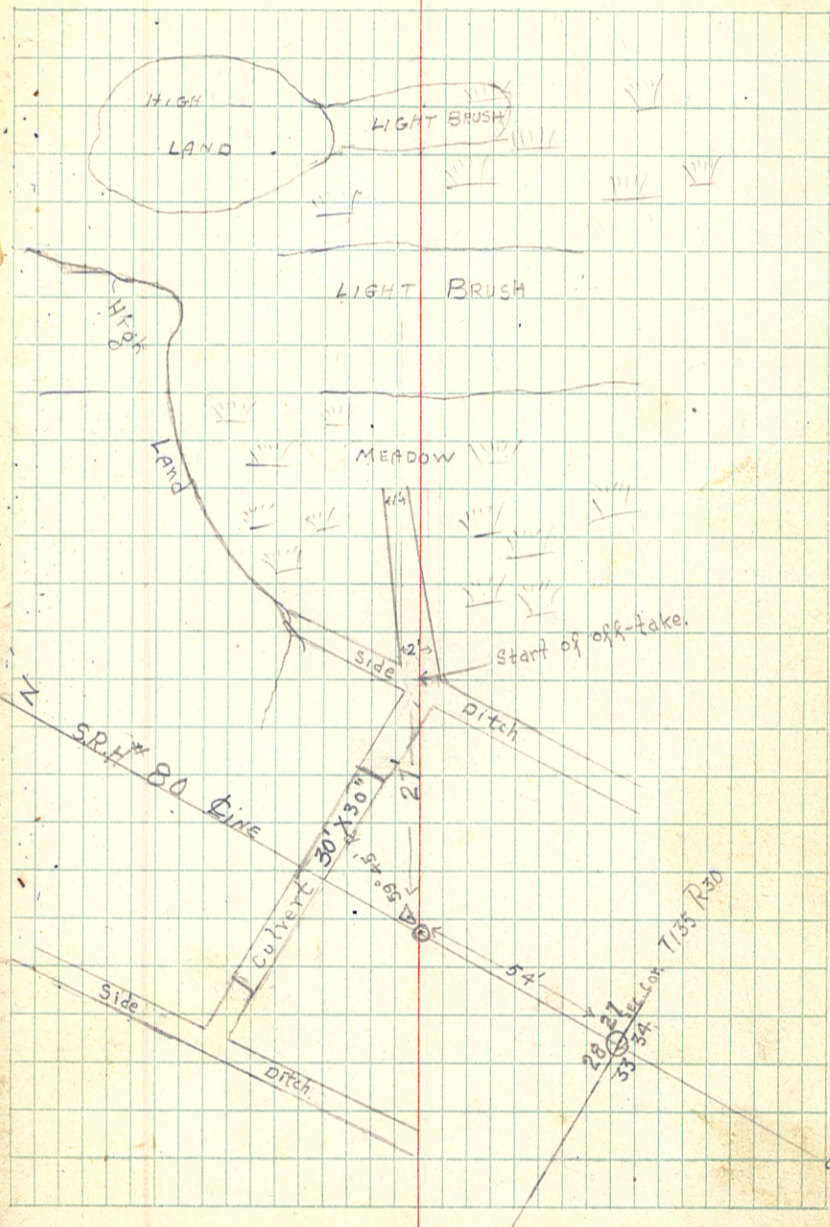
N51E

End of old off-take

O.R.
F.E.M.
H.W.

Sept. 5th 1919

24



25

Sta.



MB

TB

+73

+69.5

33

32

31

30

29

28

27

26

25

24

23

22

21

20

19

18

17

16

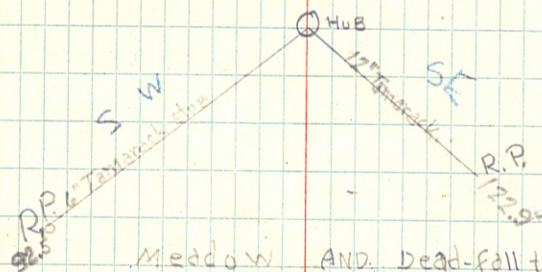
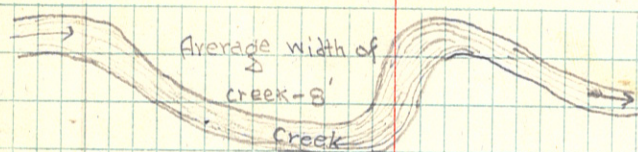
15

14

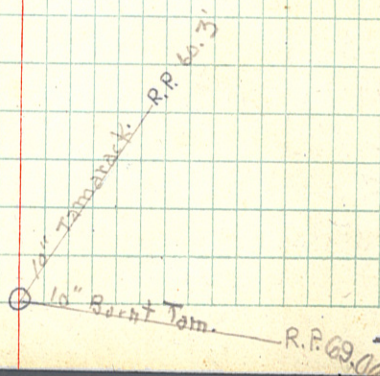
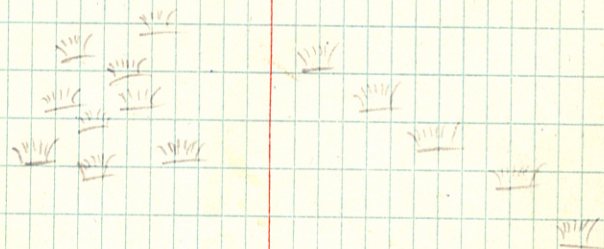
13+00 35°53'L N14°30'E

Tamarack Hub.

26



Meadow AND. Dead-fall tamarack.



STA	+S	⌈	-S	R	ELEVATION
B.M.	4.07	104.07			100.00
				4.4	99.67 ✓
				7.4	96.67 ✓
				7.7	96.37 ✓
		2		-7.0	97.07 ✓
00				7.9	96.17 ✓
1				8.5	95.57 ✓
2				6.7	97.37 ✓
3				6.9	97.17 ✓
4				7.0	97.07 ✓
T.P	2.55	99.87	6.75		97.32 ✓
5				3.4	96.47 ✓
6				4.6	95.27 ✓
7				4.3	95.57 ✓
8				4.6	95.27 ✓
9				4.9	94.97 ✓
10				4.9	94.97 ✓
11				5.2	94.67 ✓
12				5.6	94.27 ✓
13				5.7	94.17 ✓
B.M	2.97	97.71	5.13		94.74 ✓
14				3.8	93.91 ✓
15				4.4	93.31 ✓
16				4.5	93.21 ✓
17				4.7	93.01 ✓

O.A.R.
H.W.W.
F.E.M.

Sept. 6th 1919.

28.

75' L of STA 1 spike in 6" poplar tree
center of S.R.H. 80
inside culvert
bottom of ditch at culvert.
water elevation:

	LEFT		RIGHT
	$\frac{6.6}{1}$	79	$\frac{6.8}{1}$
LEAVE old ditch	$\frac{6.4}{1}$	85	$\frac{6.6}{1}$

8" TAMARACK STUMP 15' R. 13 f10 (spike)

29	STA	+S	↑	-S	ROD	ELEV
18					5.2	92.51 ✓
19					5.4	92.31 ✓
20					5.7	92.01 ✓
21					6.0	91.71 ✓
22					6.7	91.01 ✓
TP+25	2.68	94.64		5.75		91.96 ✓
23					3.7	90.94 ✓
24					3.9	90.74 ✓
25					4.1	90.54 ✓
26					4.4	90.24 ✓
BM				2.98		91.66 ✓
27					4.5	90.14 ✓
28					4.9	89.74 ✓
29					5.1	89.54 ✓
30					5.6	89.04 ✓
TP	3.60	93.42		4.82		89.82 ✓
31					4.1	89.32 ✓
32					4.6	88.82 ✓
33					4.7	88.72 ✓
+73					5.5	87.92 ✓
					8.2	85.22
					7.3	86.12
BM ₃₂ 50				2.57		90.85 ✓

Spike in 8" Tamarack 4' Sta. 26

Flex. Bottom creek.
Water elevation

12" Tamarack 54' R: Spike ³²⁺⁵⁰

CASS CO IN ACCOUNT WITH
 ED. KNOWLES.
 BALL CLUB,
 MINN.

SKIDDING PILING OFF MISSISSIPPI RIVER

MARCH 25th

1 hour and more 5 hrs. @ 20% pts. by Edward

107 JOE WAKEFIELD IN ACCT WITH
CASS CO

	PEELING	PILING	2¢ per FOOT	
MAR. 7, 19	8	40'	A. SONQUIST'S	\$ 6.40
	2	30'	PILING.	\$ 1.20
MAR. 8, 19	7	40'	7-	\$ 5.60
			2-	\$ 13.20

ACCOUNT PAID BY SONQUIST, (OWNER OF
PILING)

CASS COUNTY IN ACCT.

WITH

ELKHART BRIDGE CO.

Mpls. MINN.

RECAPPING BENTIG AND IT.

TIME	NO MEN	NAMES	PRICE 45¢ per hr.	AMOUNT.
3/31 3 1/2 HRS	3	CLOUGH. DAGELS. RIDDLIE	45¢	\$4.74
3/31/19 4 1/2 HRS	2	DAGELS RIDDLIE	45¢	\$4.05
3/31/19 4 1/2 HRS	2	DAGELS RIDDLIE	45¢	\$4.05
				<u>12.84</u>

NOTE

FOREMAN LYONS WENT TO DEER RIVER

3/31/19 AFTER ENGINE REPAIRS.


CASS CO. IN ACCT. WITH

ANDREW SONQUIST.

BALL CLUB, MINN.

PILING ACCOUNT.

NO. DELIVERED	LENGTH	DATE	EXCEPT	REJECTED	NO. USED.
2	40 W. PINE	2/20/19	2	—	2
{ 2	40 W. PINE	2/21/19	2	—	2
{ 1	30 W. PINE	2/21/19		1 cut 25'	
5	40 NORWAY	2/24/19	4	1 cut 25'	111
7	40 NORWAY	2/25/19	7	0	1111
{ 3	40 W. PINE	2/26/19	2	1 cut 25'	1
{ 1	30 NORWAY	2/26/19		1 cut 25'	1
1	30	3/14/19.			
3	25	3/14/19.			



DEDUCT \$13.20 OUT OF SONQUIST'S

PILING ACCOUNT FOR PEELING
OF 15 - 40 FOOTERS @ 20 FT.
2 - 30 " @ 25 FT.

NOTE:- SONQUIST PAID WAKEFIELD.

Cass Co. in Acct.
 With BEN TIBBETTS.
 BELL CLUB,
 MINN.

PILING ACCOUNT.

NO. DEL.	LENGTH	DATE	EXCEPT	REJECT	KIND	NO. USED.
8	40'	2/16/19	8	0	TAMARACK	8
11	40'	2/22/19	9	2 ^{cut}	TAMARACK	7 11 (9)
13	40'	2/23/19	9	4 ^{cut}		11
1	30'	2/23/19	1	0		
16	30'	3/2/19	13	5	TAM. & CEDAR	
1	30'	3/2/19	1	0		
15	30'	3/8/19				
12	25'	3/8/19	11			

145

CASS COUNTY IN ACCT WITH

SEAVEY LUMBER CO.

PILING ACCOUNT.

NO. USED LENGTH

17 25' 425' LINEAL FT.

34 30' 1020' LINEAL FT.

{ 6 40' } 240' LINEAL FT.

{ 3 40' } 120' LINEAL FT.

7805 LINEAL FT. USED TO

DATE 2/22/19.

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CASS COUNTY IN ACCOUNT
WITH W^M TIBBETTS
BALL CLUB
MINN.

PILING ACCOUNT:

NO. DELIVERED	LENGTH	DATE	EXCEPT	REJECTED	REASON
4	40'	1/30/19	2	2	unsound.
✓ 1	35'	1/30/19	0	1	ROTTEN.
5	40'	2/3/19	4	1	crooked ^{cut off} _{cut off}
3	40'	2/6/19	3	0	dead.
✓ 3	35'	2/6/19	0	3	dead.
✓ 2	25'	2/6/19	0	2	dead.
4	40'	2/13/19	4	0	
2	30'	2/13/19	2		
24			15	9	

NO. USED

2

4

3

4

$$13 - 40' @ 1.8¢ = 93.60$$

40

520 LINEAL FT.

.18¢ PER FT.

41.60

520

\$93.60

Natural Tangents.

Deg.	0'	10'	20'	30'	40'	50'	Deg.	Deg.	0'	10'	20'	30'	40'	50'	Deg.
0	0000	0029	0058	0087	0116	0145	89	40	8391	8441	8491	8541	8591	8642	49
1	0175	0204	0233	0262	0291	0320	88	41	8693	8744	8796	8847	8899	8952	48
2	0349	0378	0407	0437	0466	0495	87	42	9004	9057	9110	9163	9217	9271	47
3	0524	0553	0582	0612	0641	0670	86	43	9325	9380	9435	9490	9545	9601	46
4	0699	0729	0758	0787	0816	0846	85	44	9657	9713	9770	9827	9884	9942	45
5	0875	0904	0934	0963	0992	1022	84	45	1.0000	1.0058	1.0117	1.0176	1.0235	1.0295	44
6	1051	1080	1110	1139	1169	1198	83	46	1.0355	1.0416	1.0477	1.0533	1.0599	1.0661	43
7	1228	1257	1287	1317	1346	1376	82	47	1.0724	1.0786	1.0850	1.0913	1.0977	1.1041	42
8	1405	1435	1465	1495	1524	1554	81	48	1.1106	1.1171	1.1237	1.1303	1.1369	1.1436	41
9	1584	1614	1644	1673	1703	1733	80	49	1.1504	1.1571	1.1640	1.1708	1.1778	1.1847	40
10	1763	1793	1823	1853	1883	1914	79	50	1.1918	1.1988	1.2059	1.2131	1.2203	1.2276	39
11	1944	1974	2004	2035	2065	2095	78	51	1.2349	1.2423	1.2497	1.2572	1.2647	1.2723	38
12	2126	2156	2186	2217	2247	2278	77	52	1.2799	1.2876	1.2954	1.3032	1.3111	1.3190	37
13	2309	2339	2370	2401	2432	2462	76	53	1.3270	1.3351	1.3432	1.3514	1.3597	1.3680	36
14	2493	2524	2555	2586	2617	2648	75	54	1.3764	1.3848	1.3934	1.4019	1.4106	1.4193	35
15	2679	2711	2742	2773	2805	2836	74	55	1.4281	1.4370	1.4460	1.4550	1.4641	1.4733	34
16	2867	2899	2931	2962	2994	3026	73	56	1.4826	1.4919	1.5013	1.5108	1.5204	1.5301	33
17	3057	3089	3121	3153	3185	3217	72	57	1.5399	1.5497	1.5597	1.5697	1.5798	1.5900	32
18	3249	3281	3314	3346	3378	3411	71	58	1.6003	1.6107	1.6212	1.6319	1.6426	1.6534	31
19	3443	3476	3508	3541	3574	3607	70	59	1.6643	1.6753	1.6864	1.6977	1.7090	1.7205	30
20	3640	3673	3706	3739	3772	3805	69	60	1.7321	1.7437	1.7556	1.7675	1.7797	1.7917	29
21	3839	3872	3906	3939	3973	4006	68	61	1.8040	1.8165	1.8291	1.8418	1.8546	1.8676	28
22	4040	4074	4108	4142	4176	4210	67	62	1.8807	1.8940	1.9074	1.9210	1.9347	1.9486	27
23	4245	4279	4314	4348	4383	4417	66	63	1.9626	1.9768	1.9912	2.0057	2.0204	2.0353	26
24	4452	4487	4522	4557	4592	4628	65	64	2.0503	2.0655	2.0809	2.0965	2.1123	2.1283	25
25	4663	4699	4734	4770	4806	4841	64	65	2.1445	2.1609	2.1775	2.1943	2.2113	2.2286	24
26	4877	4913	4950	4986	5022	5059	63	66	2.2469	2.2637	2.2817	2.2998	2.3183	2.3369	23
27	5095	5132	5169	5206	5243	5280	62	67	2.3559	2.3750	2.3945	2.4142	2.4342	2.4545	22
28	5317	5354	5392	5430	5467	5505	61	68	2.4751	2.4960	2.5172	2.5386	2.5605	2.5826	21
29	5543	5581	5619	5658	5696	5735	60	69	2.6051	2.6279	2.6511	2.6746	2.6985	2.7228	20
30	5774	5812	5851	5890	5930	5969	59	70	2.7475	2.7725	2.7980	2.8239	2.8502	2.8770	19
31	6009	6048	6088	6128	6168	6208	58	71	2.9042	2.9319	2.9600	2.9887	3.0178	3.0475	18
32	6249	6289	6330	6371	6412	6453	57	72	3.0777	3.1084	3.1397	3.1716	3.2041	3.2371	17
33	6494	6536	6577	6619	6661	6703	56	73	3.2799	3.3052	3.3402	3.3759	3.4124	3.4495	16
34	6745	6787	6830	6873	6916	6959	55	74	3.4874	3.5261	3.5656	3.6059	3.6470	3.6891	15
35	7002	7046	7089	7133	7177	7221	54	75	3.7321	3.7760	3.8208	3.8657	3.9136	3.9617	14
36	7265	7310	7355	7400	7445	7490	53	76	4.0108	4.0611	4.1126	4.1653	4.2193	4.2747	13
37	7536	7581	7627	7673	7720	7766	52	77	4.3315	4.3897	4.4494	4.5107	4.5736	4.6382	12
38	7813	7860	7907	7954	8002	8050	51	78	4.7046	4.7729	4.8430	4.9152	4.9894	5.0658	11
39	8098	8146	8195	8243	8292	8342	50	79	5.1446	5.2257	5.3093	5.3955	5.4845	5.5764	10
Deg.	60'	50'	40'	30'	20'	10'	Deg.	Deg.	60'	50'	40'	30'	20'	10'	Deg.

Deg.	0'	10'	20'	30'	40'	50'	Deg.
80	5.6713	5.7694	5.8708	5.9758	6.0844	6.1970	9
81	6.3138	6.4348	6.5606	6.6912	6.8269	6.9682	8
82	7.1154	7.2687	7.4287	7.5958	7.7704	7.9530	7
83	8.1443	8.3450	8.5555	8.7769	9.0098	9.2553	6
84	9.5144	9.7882	10.078	10.385	10.711	11.059	5
85	11.430	11.826	12.250	12.706	13.197	13.727	4
86	14.300	14.924	15.605	16.350	17.169	18.075	3
87	19.081	20.206	21.470	22.903	24.542	26.432	2
88	28.636	31.242	34.368	38.189	42.964	49.104	1
89	57.290	68.750	85.940	114.588	171.885	343.77	0
Deg.	60'	50'	40'	30'	20'	10'	Deg.

Natural Cotangents.

PRICE PILING

12¢ per. 25' piling

15¢ per. 30' piling

18¢ per. 40' piling

White Pine - Tamarack - cedar & oak

40
14
0

30

59.45' R.

35.53

2.40

8

16

14
4
56
5
5
5
161

12 days

15 tan

x 30 = 30

210

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

ROADWAY 14 FEET WIDE. SIDE SLOPES 1 1/4 TO 1.

FOR SINGLE TRACK EMBANKMENT.

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	7.0	7.2	7.3	7.5	7.6	7.8	7.9	8.1	8.2	8.4	0
1	8.5	8.7	8.8	9.0	9.1	9.3	9.4	9.6	9.7	9.9	1
2	10.0	10.2	10.3	10.5	10.6	10.8	10.9	11.1	11.2	11.4	2
3	11.5	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	3
4	13.0	13.2	13.3	13.5	13.6	13.8	13.9	14.1	14.2	14.4	4
5	14.5	14.7	14.8	15.0	15.1	15.3	15.4	15.6	15.7	15.9	5
6	16.0	16.2	16.3	16.5	16.6	16.8	16.9	17.1	17.2	17.4	6
7	17.5	17.7	17.8	18.0	18.1	18.3	18.4	18.6	18.7	18.9	7
8	19.0	19.2	19.3	19.5	19.6	19.8	19.9	20.1	20.2	20.4	8
9	20.5	20.7	20.8	21.0	21.1	21.3	21.4	21.6	21.7	21.9	9
10	22.0	22.2	22.3	22.5	22.6	22.8	22.9	23.1	23.2	23.4	10
11	23.5	23.7	23.8	24.0	24.1	24.3	24.4	24.6	24.7	24.9	11
12	25.0	25.2	25.3	25.5	25.6	25.8	25.9	26.1	26.2	26.4	12
13	26.5	26.7	26.8	27.0	27.1	27.3	27.4	27.6	27.7	27.9	13
14	28.0	28.2	28.3	28.5	28.6	28.8	28.9	29.1	29.2	29.4	14
15	29.5	29.7	29.8	30.0	30.1	30.3	30.4	30.6	30.7	30.9	15
16	31.0	31.2	31.3	31.5	31.6	31.8	31.9	32.1	32.2	32.4	16
17	32.5	32.7	32.8	33.0	33.1	33.3	33.4	33.6	33.7	33.9	17
18	34.0	34.2	34.3	34.5	34.6	34.8	34.9	35.1	35.2	35.4	18
19	35.5	35.7	35.8	36.0	36.1	36.3	36.4	36.6	36.7	36.9	19
20	37.0	37.2	37.3	37.5	37.6	37.8	37.9	38.1	38.2	38.4	20
21	38.5	38.7	38.8	39.0	39.1	39.3	39.4	39.6	39.7	39.9	21
22	40.0	40.2	40.3	40.5	40.6	40.8	40.9	41.1	41.2	41.4	22
23	41.5	41.7	41.8	42.0	42.1	42.3	42.4	42.6	42.7	42.9	23
24	43.0	43.2	43.3	43.5	43.6	43.8	43.9	44.1	44.2	44.4	24
25	44.5	44.7	44.8	45.0	45.1	45.3	45.4	45.6	45.7	45.9	25
26	46.0	46.2	46.3	46.5	46.6	46.8	46.9	47.1	47.2	47.4	26
27	47.5	47.7	47.8	48.0	48.1	48.3	48.4	48.6	48.7	48.9	27
28	49.0	49.2	49.3	49.5	49.6	49.8	49.9	50.1	50.2	50.4	28
29	50.5	50.7	50.8	51.0	51.1	51.3	51.4	51.6	51.7	51.9	29
30	52.0	52.2	52.3	52.5	52.6	52.8	52.9	53.1	53.2	53.4	30
31	53.5	53.7	53.8	54.0	54.1	54.3	54.4	54.6	54.7	54.9	31
32	55.0	55.2	55.3	55.5	55.6	55.8	55.9	56.1	56.2	56.4	32
33	56.5	56.7	56.8	57.0	57.1	57.3	57.4	57.6	57.7	57.9	33
34	58.0	58.2	58.3	58.5	58.6	58.8	58.9	59.1	59.2	59.4	34
35	59.5	59.7	59.8	60.0	60.1	60.3	60.4	60.6	60.7	60.9	35
36	61.0	61.2	61.3	61.5	61.6	61.8	61.9	62.1	62.2	62.4	36

Calculated by Julien A. Hall, M. Am. Soc. C. E.