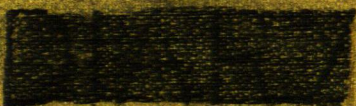


327



FIELD BOOK



82-1435
1-17-52
80-56-47
14 34



The paper in this book is
made of 50% high grade rag stock with
a WATER RESISTING surface sizing.

KEUFFEL & ESSER CO.

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43	ROY ABEL	
44	JIM GROVES	
45	MAPLE LANDFILL	
48	MIKE ORTH	

1
8-27-68

Warm H. 70°

Al, Wayne + d to Whitefish Lake
ar. 9:10 pm 11:30 BK 183 - Woods T. pg 139

Then to Happy Landing Resort

ar. 1:00 pm 4:15 BK 183 Tag 139

8-28-68

Cool H. 65°

Homer + d to Gustafsons abd. to Br.

ar. 8:45 - 12:00 11:00 11:30

Then to Dagans Resort check measure-
ments on Traverse 3:00 - 4:50 BK 183

8-29-68

Warm 75°

Homer - Mark + d to Sec 24 - 137-27

9:30 - 4:30 BK 193

8-30-68

Cool some rain

Jeff - Tim + d to Daggett Lake

9:45 - 3:15 BK 155

Then to Cross Lake 3:30 - 4:30

9-3-68

Warm - Some Rain

Steve Tim + d to Gull Lake - Dr. Lee

70 mi 10:00 - 1:30

BK 155

Then to Joe Foster Lake Margaret

1:45 - 3:30 - rain 4:15 - 4:45

P

9-4-68

Cool 65°

35 mi

Wayne - Tim + d to Joe Foster at
Lake Margaret

9:15 - 4:30

BK 155

9-5-68

Cool 60° showers

70 mi

Steve - Tim + d to Woods of White-
fish Lake

9:30 - 4:30

9-6-68

Warm 75°

100 mi

Wayne - Bill + d to Bass Lake
Brittson Wayne drives too

10:45 - 4:00

9-9-68

Wayne + Mark + d to Hanceys at

80 mi

Upper Cullen Lake

9:00 - 11:30 Then to Woods at
Whitefish Lake

12:45 - 4:20

9-10-68

Warm 70°

70 mi

Steve - Mark + d to Woods

9:15 - 4:20

9-11-68 Warm 75°
 85 min Bill - Fred + I to Woodie
 9:30 - 3:30 - Then to Croge Lake
 Dam + Check Elev.
 3:50 - 4:15

9-12-68 Warm 85°
 20 min Bill - Don + I to John Sullivan
 8:45 - 4:50

9-13-68 Warm 65° chance of rain
 Mark - Don + I to Eklanda on
 Horseshoe Lake
 9:00 - 3:00 Then to John
 Sullivan 3:30 - 3:45 Then back to
 Office until 4:15 then back to
 Sullivan - 4:50

9-16-68 Rain
 Bill + I to Sullivan
 9:00 - 11:30 quit because of rain
 1:00 - 3:00 Then I work in
 the office till 5:00.

9-17-68 Rain
 all day in office

9-18-68 Rain
 all day in office

9-19-68 scattered showers
 Bill - Don + I to John Sullivan
 9:45 - 11:30 finished up
 11:45 we start work on Meyers on
 Perch Lake We work till 5:15

9-20-68 Warm
 Bill - Don + I to Silver Bay on
 upper Bull Lake
 9:30 - 12:00 finished up
 Then to Jarvis Abbeys on Bull Lake
 1:45 - 3:00 Then to Gustafsons
 3:30 - 4:50

9-23-68 Warm
 Work with John

9-24-68 Rainy + Cold
I meet Wally, Wayne, Fred + Dan
at Bass Lake 9:15 - 4:30

9-25 Coal 60°
Bill + I to Greens on Whitefish
Lake check chainage
9:15 - 10:30 Then to Meistere
on Pig Lake - Black Pine Beach
11:00 - 5:00

12-16-68 15°
Bill, Fred + I to Inground Parking
lot 1 hr. Then to Perch Lake - Paxton
10:30 - 4:45

12-17-68 Bill, Dave + I to Perch Lake
8:30 - 12:15 Then to Bendera Ruth
Lake 1:15 to 4:30 15°

12-18-68 Dave, Fred + I to Bendera Ruth
Lake 8:45 - 4:30 15° Windy

12-19-68 Dave, Fred + I to Bendera Ruth
Lake after we repair Tape

Dave gets sick and goes home at
noon snowing + windy - about 15°
9:30 - 12:10 1:10 - 4:30

12-20-68 Bill + I to Brommy Cotes Lake Marysville
move pipe Then to John Halden Gull
Lake 10:00 - 2:45

12

12-23-68 Jim Chise - Tim + I to John Halden
Gull Lake 8:30 - 4:00

12-24 Go to Staples with John K.

12-30 Cold 0 to 5 above Jim C. - Tim + I
to John Halden's Gull Lake Where we
meet wally 8:30 - 3:30 Then to Cass
Perch Lake

12-31-68 Do not work - 20°

1-2-69 Dan + I to Cass Perch Lake
2 hrs Then to Gleders Perch Lake
6 hrs

1-3-69 - -25° do not work

7
1-6-69

Dan + I go to East Perch Lake

8:30-10:30 Then to Benders Perch Lake

10:30-4:45

1-7-69

-10° Dan + I go with John to
John Holdens at Gull Lake

8:30-4:30

1-8-69

-10° Dan + I go with John to
~~Baxter~~ John Holdens Gull Lake

8:30-4:45

1-9-69

-10° Call Jim + I go to
Baxter 9:00-12:30 Then to

Benders 1:30-4:45

1-10-69

-25° do not work

1-13-69

Jim + I go to Benders Puth Lake

8:30-4:45

9-2-69 Ron - George + I To John Sullivan
15 mi 9:00 - 4:30 85° BK 199

9-3-69 Ron - George + I To John Sullivan
15 mi 8:30 - 5:00 81° BK 199

9-4-69 Ron - George + I To Baxter School
8:30 - 1:30 BK 208
3:00 - 4:45 - NISSWA OLAF HANSON

9-12-69 Mark + I to C. Bible 85°
30 8:00 - 4:30 BK 201

9-15-69 Mark - George + I to C. Bible
30 60° cloudy 8:30 - 2:30 Get Wet

9-16-69 Mark - George + I to C. Bible
25 80° 8:30 - 4:30

9-17-69 Tim + I to Genola
80 65° Partly cloudy 8:30 - 4:5

9-18-69 Mark - Tim + I to C. Tech Smaminian
70 Rain 8:30 - 12:00 Then To Fish Trap Lake
1:00

80 19 Ping

22 Rain

30 23 Bible - Sullivan arranged

50 24 Hyman Sullivan - rain

100 26 Skaminessen - Oen - Decker - Otto

25 Homer

29 Homer

10 30 Brainerd

WED Oct 1 Jeff + d to Medheims add. ^{5 hrs} then
85 mi to C. Bible then to marker lake

Thurs Oct 2-69 Jeff + d to lake Alexander
70 mi 5 hrs

Fri Oct 3-69 Jeff + d to C. Bible
15 mi 1:00 - 5:00

NEXT WEEK OFF

11-6-69 Royalton School Ray + d
100 mi
~~11-7-69~~

11-7-69 Ray + Dean S + d to Coleman + Rutledge
3 hrs Rutledge

Tue. Nov. 11 Dean + d to Rutledge 4 hrs.
Ray + d + Dean to Coleman

Wed Dean + Ray + d to Coleman
+ Rutledge

Thurs Dick + d to Coleman 8

Fri Dean + d + Ray to Rutledge 8

MONDAY, Nov 17 Ray + Dean S. + d to
110 mi Royalton 8

Tue. Nov 18 Barry + d to Staple-Haskins
83 mi 3 hrs DICK EBERT 1 hr.
Bible 1 hr

Wed Nov 19 Ray + Dean S + d To Pilager
35-7 8-3 then to W. Brainerd

Thurs 11-20 Russell + Dean + d to Royalton
110

Fri. 11-21 Russell - Dean + d to Pilager - 4 hrs
32 + 18 Bible 3 hrs

MON Nov 24 Russell - Deans. + d to Coleman 2 hrs.
68 Rutledge 3 hrs

Tue Nov 25 Russell - Deans + d to Rutledge 4 hrs
60 Nerda 4 hrs

Wed Nov 26 Barry - Dean S. + d to Benedict Point
Then to Pequot lakes

Thurs Nov 27

THANKS GIVING

Fri Nov 28

Barry - Deans + I to Pequot

45

6 hrs

Falk

Mi Rise 2 hrs

Mon Dec 1

Barry - Deans + I to Shameneau Lake

45 + 40

2 hrs - Mi Rise Apt. 4 hrs

85

Pequot 2 hrs

92

Tue Dec 2

Dick - Deans to Rush Lake 4 hrs

70

2 hrs

Pequot 2 hrs

Wed Dec 3

Russell Deans + I to Pequot 6 hrs

45

Lake Edna M. Johnson 1 hr

Thurs Dec 4

Barry - Russell + I to Damsman

50

6 hrs - Gull Lake 2

Fri Dec 5

Russell + I to Gull Lake

30

Mon Dec 8

Ron Jim C. + I to Lake Edward

45

then to Bremer - Pelican

Tues

Jim C. + Russell + I to Lake Edward

2 hrs

45

Then to Hardschoe

6 hrs

Wed

90

Thurs

90

Fri

70

Mon Dec 15

53

Tue Dec 16

Jim Russ + I to Bay Lake

90

Damsman then Pelican

Wed Dec 17

Deans + I to Damsman 2 hrs

40

pelican 4 hrs

Thurs Dec 18

Tim + Jim + I to Davis 8 hrs

90

Fri Dec 19 Tim Russ + Jim + I to

70 mi

Herda Bay lake - Hamilton

Mon Dec 22 Russ + I + Tim Pelican 4h

45

Bramard 4h Mary Ave.

Tues Dec 23 Baxter Tim - Jim + I

25

8h

Wed Dec 24 with John

Mon Dec 29 George Hope Bush lake

75

Tue Office

435 mi

AC 4 BS 3

0-0-15
180-0-28 108-57-07
108-57-17
10 288-57-34 108-57-08
263-27-24 263-27-09
5 83-26-44 263-28-16

58.44

AP 10 BS Y

00-00-26 2993.61
180-0-37 59-52-06 89-56-40 7/2 454 2993.598
59-52-32 4184.00
7 139-52-50 59-52-13 90-01-50 1275.279 4183.974

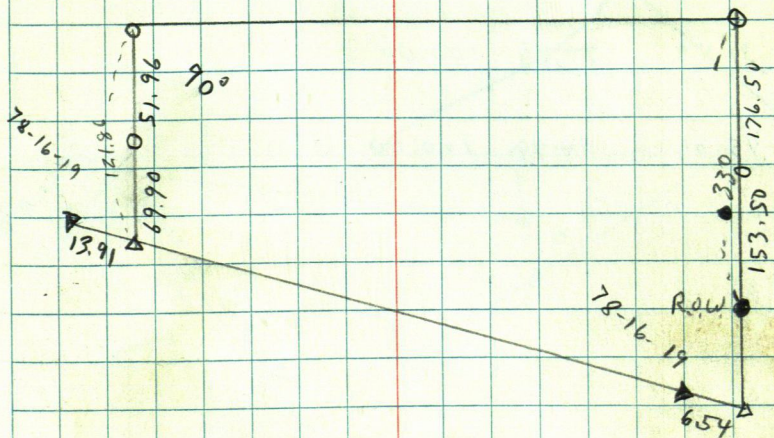
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180-00-31 178-58-54
178-59-16
8 358-59-28 178-58-57
00-00-14
181-01-16 181-01-02

AC 8 BS 7

00-00-13
180-00-32 180-11-10 90-56-23 636.09 635.998
180-11-23 192.878
9 00-11-40 180-11-08 90-26-21 ~~636.09~~ 2009.85
00-00-15 179-48-52 179-48-52 192.878 62.401 2009.78

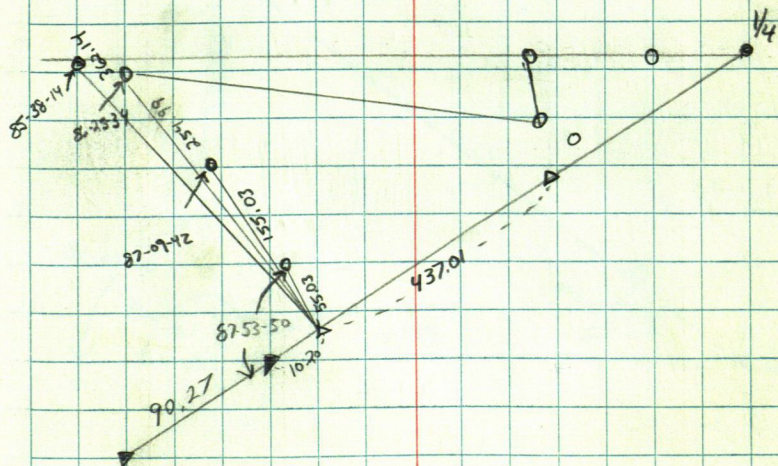
330.50
153.50
176



WILSON JCT

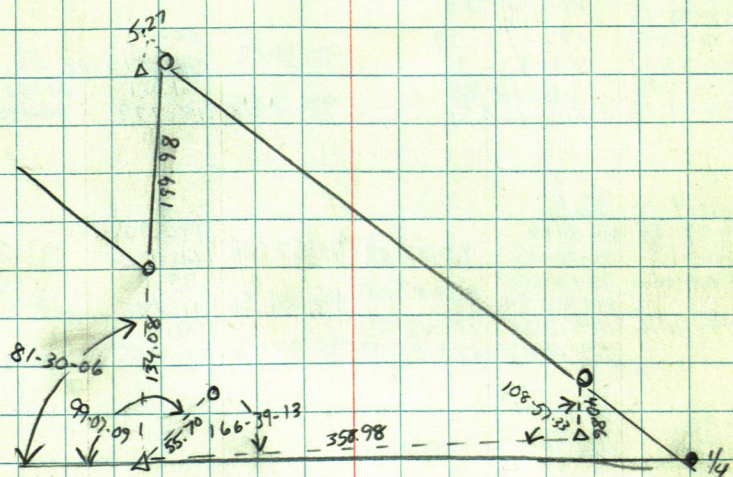
88-59-01	106.05 32.323	106.03 90.27 15.76
----------	------------------	--------------------------

88-59-52	55.00
88-15-54	99.99 100.00
87-31-49	99.99 100.00
86-45-09	99.99 100.00



WILSON JOT.

JULY 6, 1990 D FARWAN - G. MARTIN 12



GERALD KUEHL

π@2 BS1

00-00-26			241.66	
180-00-24	155-32-13	91-24-04	73.657	241.585
155-32-39			118.18	
3) 335-32-38	155-32-14	93-19-49	36.025	117.986

π@3 BS2

00-00-21				
180-00-26	88-22-47			
88-23-08				
4) 218-23-25	88-22-59			
172-53-59	172-53-39	92-39-02	52.17	
5) 352-53-57	172-53-31		52.17 52.115	
214-17-06	214-16-45		61.61	61.507
6) 34-17-17	214-16-51	93-18-58	18.779	52.115

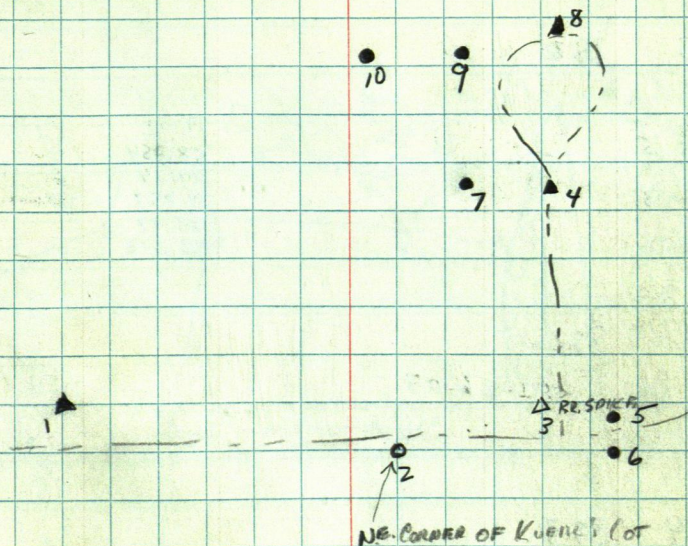
π@4 BS3

00-00-28	00-00-09			196.90	
180-01-19	180-00-15	93-03-53	91-57-55	60.016	196.784
9305-03	93-04-02			39.03	
7) 179-13-46	273-03-50	93-03-05	94-45-50	11.895	38.893
	179-12-33	179-12-24		90.11	
8) 265-06-47	359-12-24	179-11-39	91-07-48	27.465	90.091

π@8 BS4

00-00-19					
180-00-00	69-55-17				
69-55-36				36.53	
9) 249-55-12	69-55-12	94-08-09	11.136	36.437	
85-06-56	85-06-37		103.02		
10) 265-06-47	85-06-47	94-48-40	31.401	102.657	

July 6, 1990 D. FARNHAM - G. MARSH



KEN STONE

102 BS 1

1)		90-27-30	1005,04
5)	173-30-36		207,61
	281-14-54		63,280
3)	202-29-06	201-14-37	577,36
		90-12-09	175,978
			577,352

103 BS 2

6) $105-43-15$	191.12
	58.254
7) $151-19-33$	309.24
	94.257
8) $206-09-06$	503.87
	153.578

103 BS2

262-26-06 262-26-03

4) 164-52-05

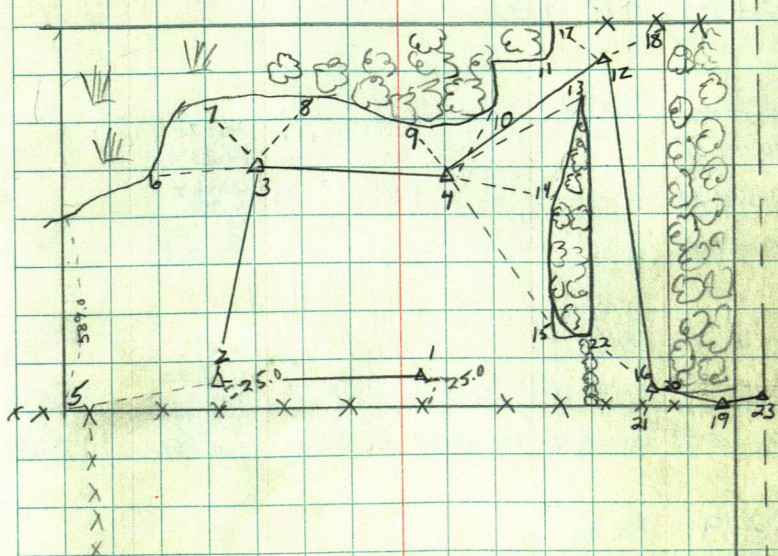
104 BS3

140-41-38		90-13+19	685.11 208.822	685.104
12) 281-23-04	140-41-32	90-25-26	1052.29 320.737	1052.255

πe4	BS3
-----	-----

9) 85-44-28	457.43 139.421 644.86
10) 132-12-79	196.554 902.33
11) 135-48-12	275.030 837.36
13) 139-39-35	255.225 654.76
14) 148-45-42	199.567 533.02
15) 225-14-19	162.465

JULY 9, 1990 D. FARNHAM - G. MARTIN 14



KEN STONE

 $\pi @ 12$ BS4

17) 88-48-56

148.10

45.142

18) 184-32-18

258.67

78.844

 $\pi @ 12$ BS4

297-49-46

16) 235-39-36 297-49-43

 $\pi @ 16$ BS 12

20) 100-41-05

46.70

14.234

21) 210-43-27

22.64

6.902

22) 301-48-36

351.22

107.052

 $\pi @ 16$ BS 12

101-44-13

101-44-12

89-56-24

1150.52

350.677

1150.51

19) ~~203-27-51~~

203-27-36

101-43-48

89-18-14

527.73

160.852

527.689

 $\pi @ 19$ BS 16

169-56-48

169-56-43

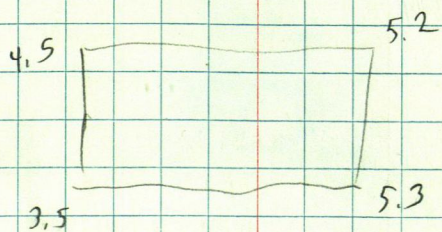
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91-29-21

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44.729

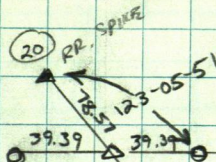
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33

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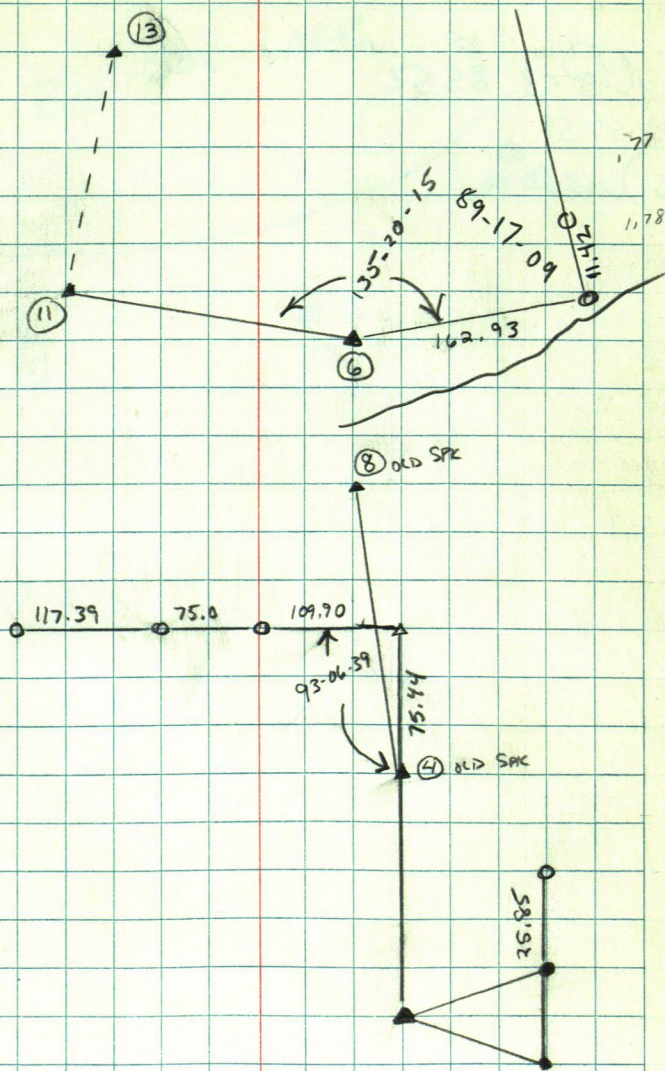
D. FARNAM - G. MARTIN



⑪

GERALD KOEHL

JULY 13, 1990 D. FARNAM - G. MARTIN



ARLAND BENSON

 $\pi @ 53$ BSS2

131-57-59

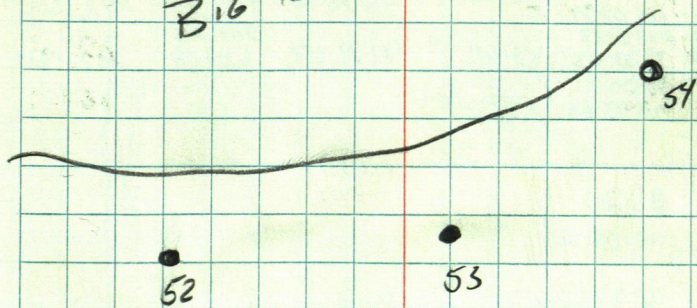
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54) 263-55-46

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JULY 16, 1990 - D. FARNAM - G. MARTIN

BIG BOY LAKE



Tom MURPHY - ROGER HEINZE

T@2

BS 1

00-00-14	00-00-16	211-53-06	90-20-14	1072.62	1072.6007
180-00-27	180-00-34			326.937	
212-09-59	211-53-22			207.25	
3) 72-09-54	31-53-23	211-52-49	91-19-02	63.168	207.1914
00-00-19	00-00-21				
147-50-75	148-07-28	148-07-07			

T@3

BS 2

00-00-30	98-55-08				
180-00-28					
98-55-38					
4) 278-55-41	98-55-13				
00-00-18					
261-05-13	261-04-55				

T@4

BS 3

00-00-20	57-19-36	84-58-00	215.97	215.1335
180-00-14			65.826	
57-19-56			99.22	
5) 237-19-50	57-19-36	89-12-45	30.243	99.2114
00-00-07				
302-40-14	302-40-07			

T@5

BS 6

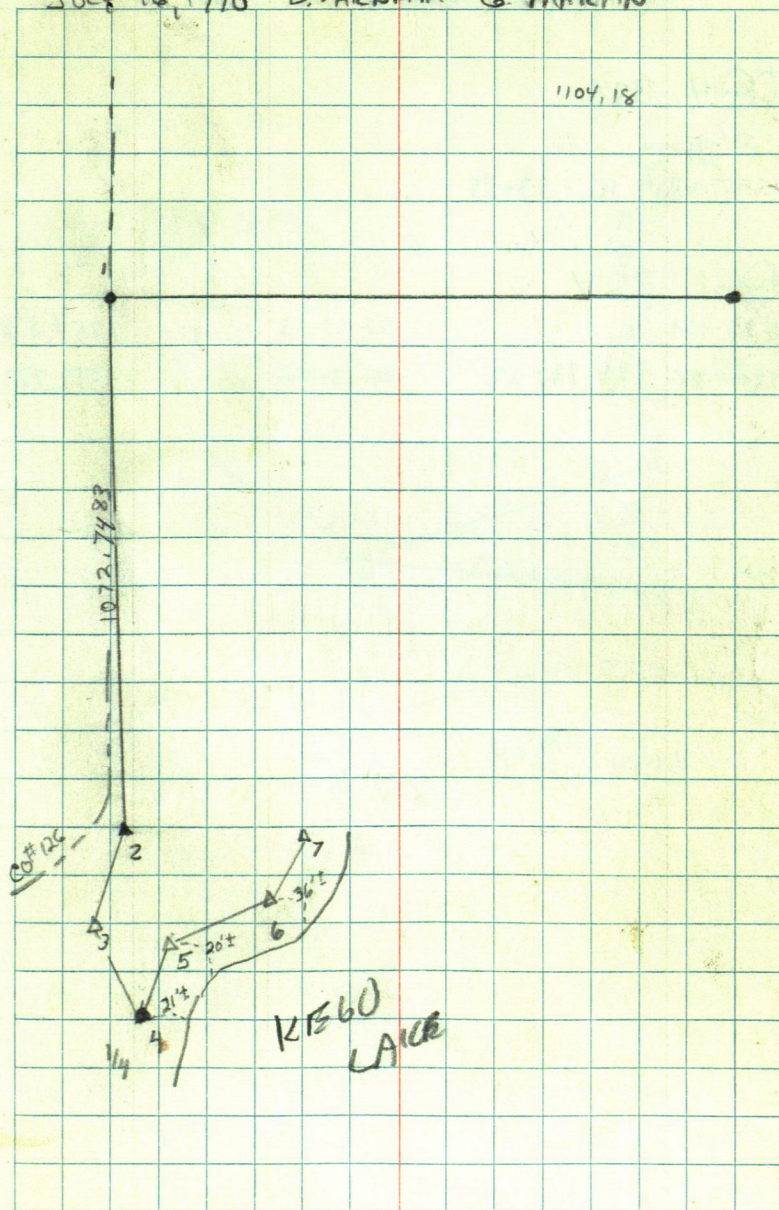
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129-55-43	180-00-47	131-34-02		
131-33-38	131-34-42			
4) 211-33-44	311-34-47	131-24-00		
00-00-26				
228-26-25		228-25-59		

T@6

BS 5

00-00-21	149-52-43	91-52-01	255.34	255.2007
180-00-09			77.826	
149-53-04			104.88	
7) 221-53-11	141-53-02	89-20-07	31.970	104.8767
00-00-24				
210-07-21	210-06-57			

JULY 16, 1990 D. FARNAM - G. MARTIN



DAN DUNN

π@4 BSG

112-54-11

2) 225-47-49 112-53-55

π@6 BSG

129-32-40

92-03-33

1055.57

321.733

1054.876

7) 259-04-44

129-32-22

90-13-52

1512.74

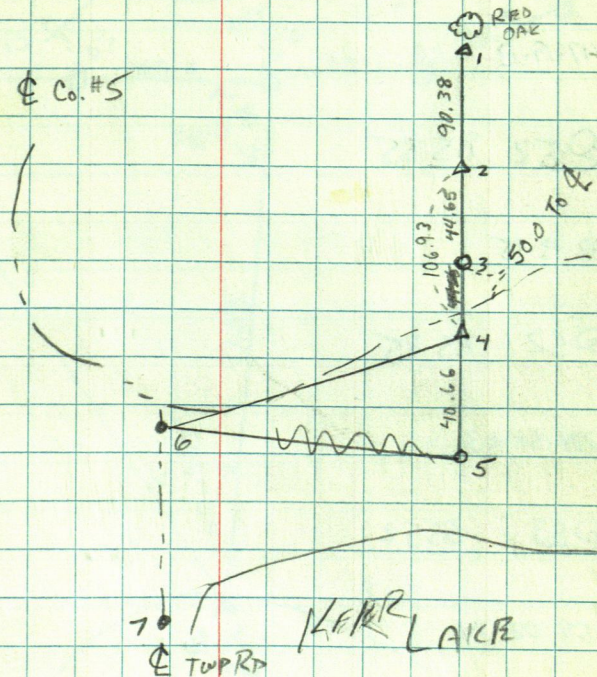
461.083

1512.721

JULY 17, 1990 D. FARNHAM - G. MARTIN

212

Co. #5



ARLAND BENSON

T@ 35 BS 36

52) 47-19-13

97.55

T@ 52 BS 35

51) 98-13-35

100.0

T@ 52 BS 35

53) 77-58-03

100.0

T@ 53 BS 52

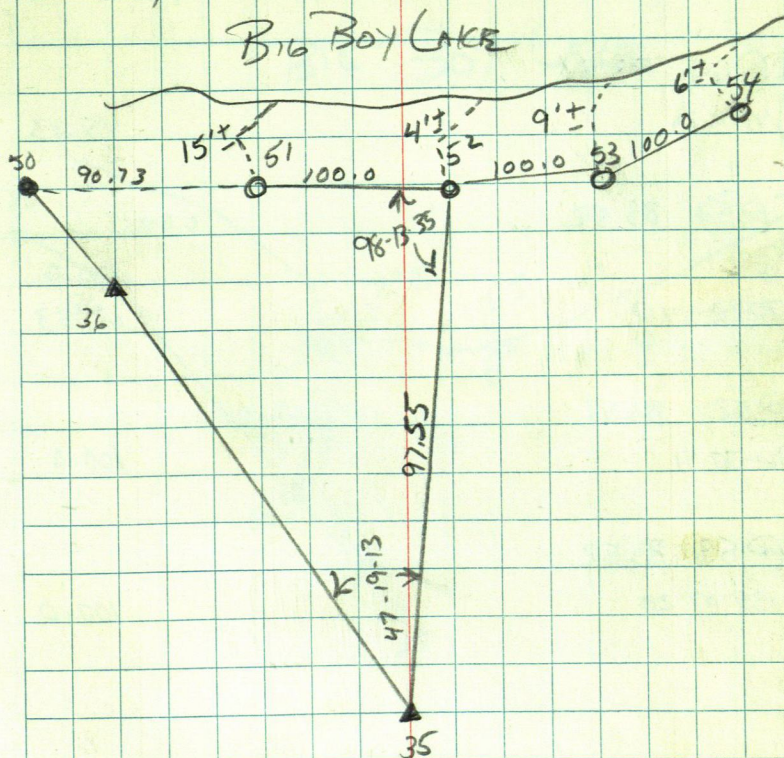
54) 155-02-14

100.0

NOTE: WRONG ANGLE
TURNED ON 1ST SET-UP.
ALL PIPE MUST BE MOVED
SEE PAGE 23. Ark

JULY 17, 1990 D. FARNAM - G. MARTIN

BIG BOY LAKE



NOTE: PIPES THAT WERE SET ALONG ROAD
ARE ALL STILL IN PLACE. Dale

ARLAND BENSON

K@65 BS 36

51) 45-46-20

45.83

K@51 BS 52

100.0

65) 70-48-44

45.83

K@52 BS 51

53) 161-37-41

100.0

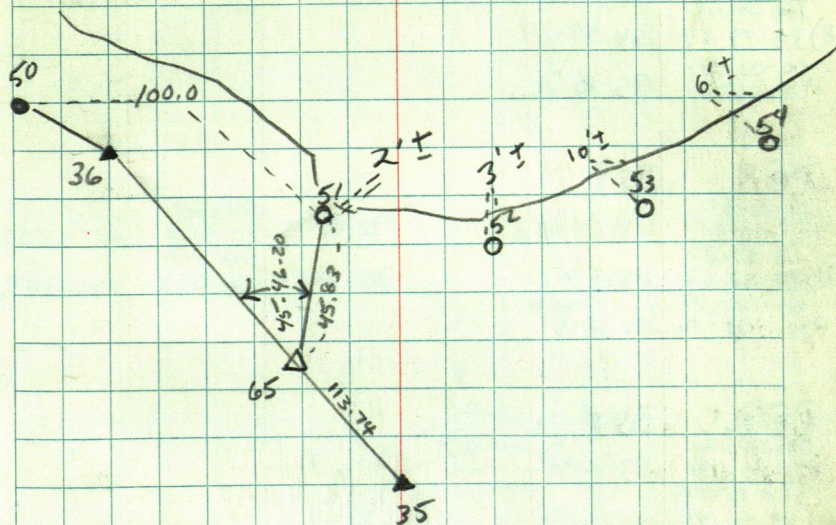
K@53 BS 52

54) 155-07-20

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JULY 18, 1990 D. FARNAM - G. MARTIN

BIG BOY LAKE



Tom MURPHY - ROGER HEINCE

T@7

BS 6

00-00-24

180-00-35

164-49-49

8) 344-49-59

00-00-14

195-10-45

164-49-25

164-49-24

195-10-31

T@8

BS 9

00-00-32

180-00-34

118-57-39

7) 278-57-52

00-00-29

241-03-14

118-57-07

118-57-18

241-02-51

92-09-11

277.25

84.507

277.0550

90-17-07

118.24

36.034

118.2289

T@9

BS 8

00-00-12

180-00-18

223-25-52

10) 43-26-04

00-00-23

136-34-38

223-25-52

223-25-46

136-34-15

T@10

BS 9

00-00-31

180-00-31

63-11-14

11) 63-11-45

00-00-27

296-49-06

63-11-14

63-11-22

296-48-39

89-51-01

168.65

51.405

168.6495

90-11-20

250.44

76.335

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T@11

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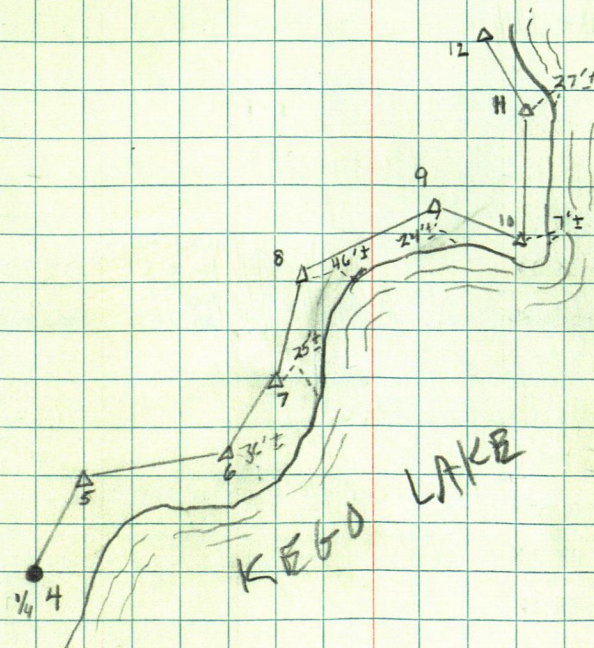
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202-37-38

JULY 19, 1990 D. FARNAM G. MARTIN

24



Tom MURPHY - ROGER HEINZ

π@12 BS 11

00-00-14			137.56	
180-00-29	241-42-51	90-38-42	41.928	137.5502
241-43-05		88-35-04	187.48	
13) 61-43-17	241-42-48		57.143	187.4205
00-00-39				
118-17-48	118-17-09			

π@13 BS 12

00-00-29				
180-00-38	219-41-31			
219-42-00				
14) 39-42-02	219-41-24			
00-00-41				
140-19-08	140-18-27			

π@14 BS 15

00-00-24			233.97	
180-00-35	226-58-28	90-24-20	71.313	233.7614
226-58-52		93-33-36	100.94	
13) 46-58-55	226-58-20		30.767	100.7456
00-00-01				
133-01-36				

π@15 BS 14

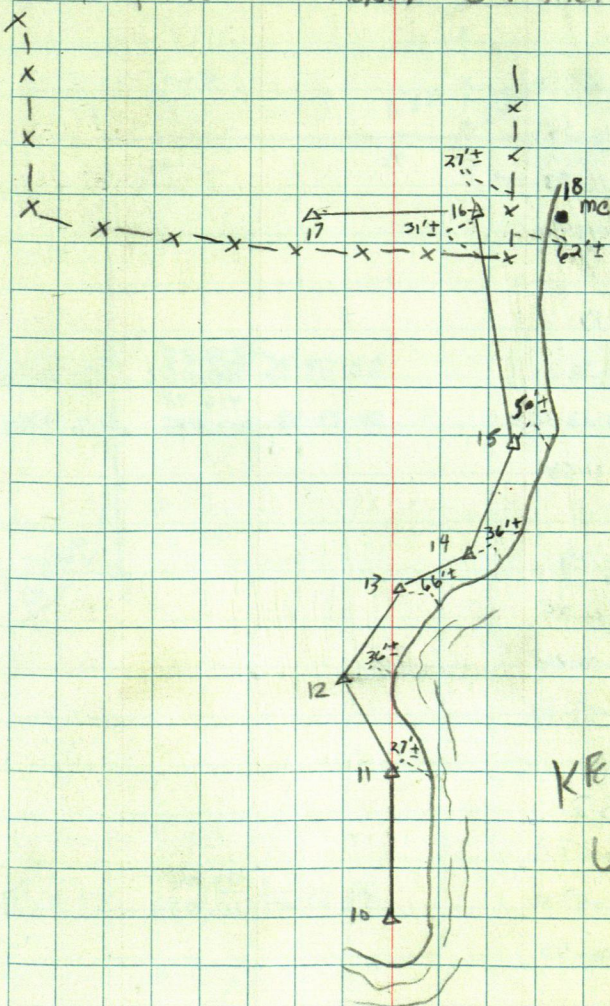
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180-00-14	141-04-47			
141-04-53				
16) 321-04-58	141-04-44			
00-00-34				
218-55-47	218-55-13			

π@16 BS 15

00-00-24			248.67	
180-00-38	93-24-47	88-54-06	75.796	248.6255
93-25-11		88-14-48	228.20	
17) 273-25-23	93-24-55		69.558	228.0965
280-28-37	280-28-13	94-18-37	101.71	
18) 100-28-38	280-28-02		31.001	101.4215
00-00-23				
266-35-43	266-35-20			

July 19, 1990 D. FARNHAM - G. MARTIN

25



TOM MORPHY - ROGER HEINZE

T@2 BS 1

00-00-22				
180-00-36	48-39-17			
21) 228-37-37	48-39-07	90-36-06	160.83 49.022	160.822
00-00-46				
311-21-28	311-20-42			

T@22 BS 2

00-00-33	00-00-17			
180-00-21	269-59-14	91-10-10	94.75 28.879	94.729
21) 219-59-44	269-59-27			
23) 89-59-29	269-59-08			

T@23 BS 22

00-00-41				
180-00-36	87-01-32	86-30-28	138.50 42.216	138.244
21) 87-02-12				
267-02-23	87-01-47			

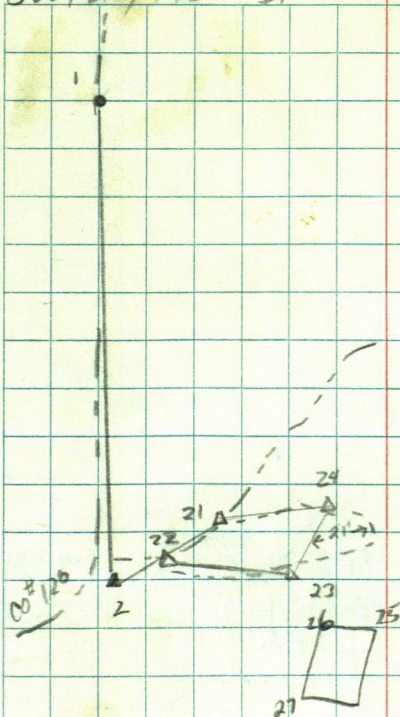
T@24 BS 23

00-00-49				
25) 334-49-17			129.78 39.562	
26) 393-18-12			114.04 34.759	
27) 353-27-25			151.80 46.271	

T@24 BS-23

00-00-09				
180-00-08	63-14-23	92-05-35	141.18 43.031	141.084
63-14-32			150.84	
21) 243-14-27	63-14-19	89-27-27	45.976	150.833

JULY 20, 1990 D. KARNAM - G. MARTIN 27



Tom MURPHY - ROGER HEINZE

K@21

BS24

00-00-12
 180-00-17 119-44-37
 119-44-49
 2) 299-44-54 119-44-37

K@21

BS2

00-00-15 170-16-32
 180-00-21 186-11-30
 28) 170-16-47
 350-17-00 170-16-39
 00-00-22
 189-43-48 189-43-26

K@28

BS21

00-00-20
 180-00-24 186-11-30 88-55-06 209.95 209.934
 186-11-50
 29) 06-11-53 186-11-29 92-01-21 173.17 173.058
 00-00-25
 173-48-51 173-48-16

K@29

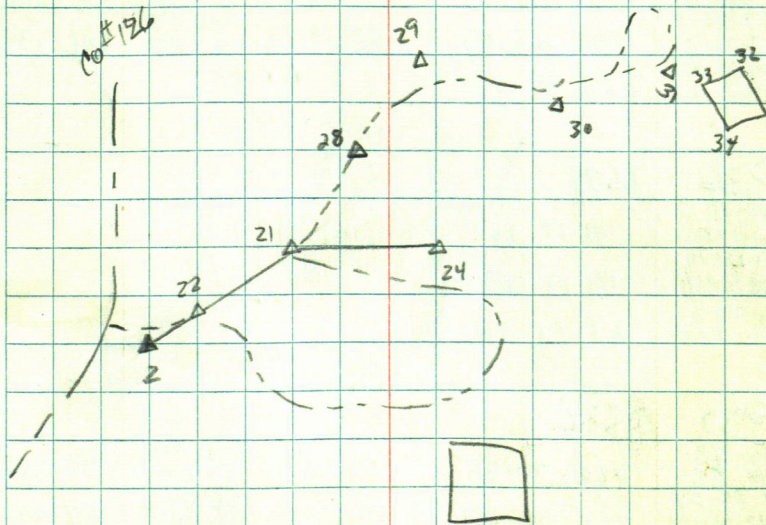
BS28

00-00-40
 180-00-47 00-00-14
 267-21-34 180-00-20 267-12-03
 30) 87-21-27 267-12-17
 00-00-21 87-12-13 267-11-53
 92-48-19 92-47-58

K@30

BS29

00-00-28
 180-00-38 144-02-26 91-21-36 165.15 165.100
 144-02-58
 31) 324-02-46 144-02-08 91-42-38 164.90 164.824
 00-00-11
 215-59-53 215-59-42



DAVE ANDERSON

4-4-138-30

30

71.16
 71.89
 103-37.54

71.16

0

6

Δ

Δ

Jim GROVES

1001	BS2			
00-00-04				
179-59-55	97-08-51			
3) 97-08-55				
2) 97-08-00	97-08-05			39.72

1002	BS1	89-50-10		
00-00-12			1283.34	
180-00-10	265-42-14	94-17-56	391.128	1293.334
265-42-26			1345.65	
4) 85-42-34	265-42-24	90-03-38	410.155	1345.644
00-00-14				
94-17-56	94-17-42			

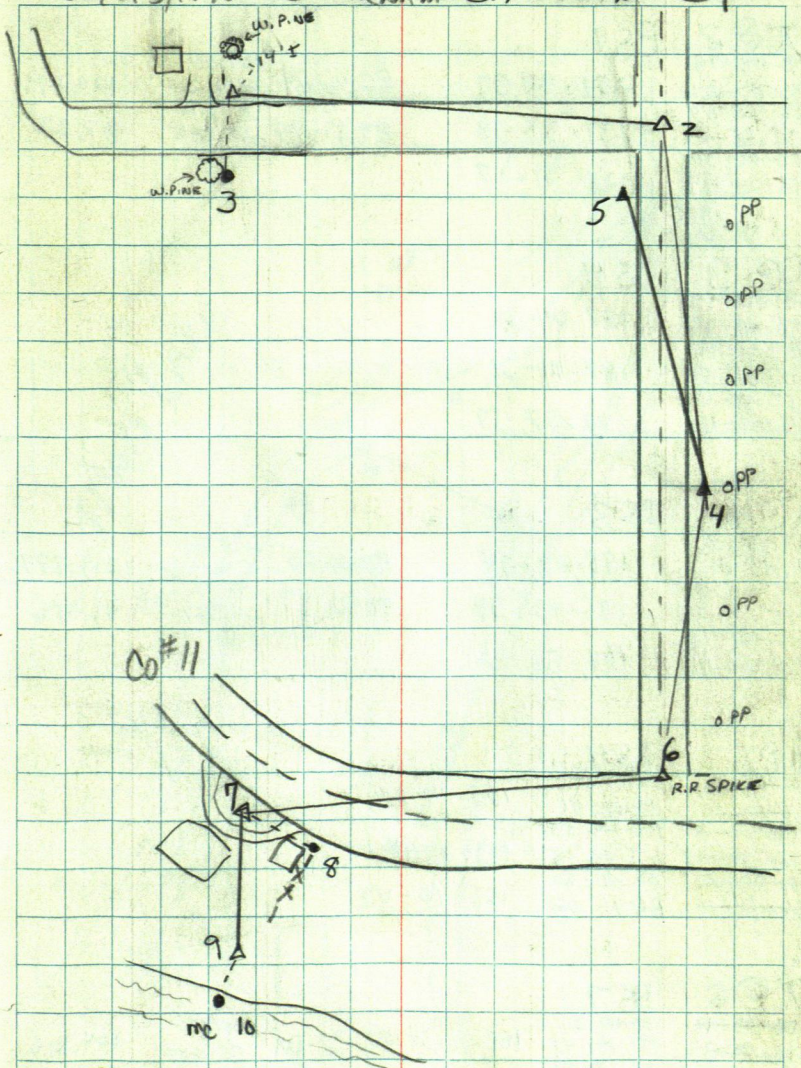
1004	BS5			
00-00-19				
180-00-30	0-49-03			
00-49-22				
2) 180-49-46	0-49-16			

1004	BS5			
00-00-30			1251.06	
180-00-40	187-15-31	89-54-03	381.326	1251.057
187-16-01			946.47	
2) 07-16-16	187-15-36	90-58-28	288.486	946.332
00-00-22				
172-44-41	172-44-19			

1006	BS4			
00-00-01				
180-00-16	268-48-03			
268-48-04				
7) 88-48-25	268-48-09			
00-00-14				
91-12-04	91-11-50			

1007	BS6			
00-00-17			1495.78	
13-36-22	180-00-23	12-31-14	455.913	1495.753
8) 12-31-31			81.15	
13-36-22	197-31-42	17-31-19	24.736	81.134
9) 63-36-22	63-36-05	91-19-03	154.44	
243-36-19	63-35-36		47.072	154.396

JULY 23, 1990 D. FARNAM-G. MARTIN 31



IXL LAKE

1009	BS8					
00-00-17						
180-00-23	197-40-11					
10) 17-40-28	197-40-02	108-17-15	43.73	47.518		
17-40-24			13.827			

706	B57			
00-00-18	00-00-32			105.01
180-01-32	180-00-40	108-10-54	86.32-D1	32.006
108-11-17	108-10-56			104.816
5) 288-11-12	288-11-02	108-10-22	88-39-34	103.69
00-00-27				31.605
251-50-16		251-49-49		103.661

BILL HAAS

KQ7 BS8

00-00-20	
180-00-38	98-52-09
98-52-29	
6) 278-52-33	98-51-55
00-00-43	
261-08-40	261-07

KQ8 BS9

00-00-11			715.24	
180-00-13	355-21-08	92-28-42	218.005	714.567
355-21-19			287.17	
7) 175-21-29	355-21-16	94-51-52	87.528	286.132
00-00-19				
04-39-00	4-38-41			

KQ6 BS5

00-00-05			103.78	
180-00-01	97-23-59	88-31-55	31.631	103.744
97-24-04			171.81	
10) 297-23-50	97-23-49	90-51-06	52.366	171.788

KQ10 BS6

00-00-31				
180-00-19	273-59-40			
271-00-11			286.78	
14) 94-00-00	273-59-41		87.409	286.78
278-59-27	276-58-56		236.53	
13) 98-59-24	278-59-05		72.094	236.53
308-08-08	308-07-37		170.04	
12) 128-08-01	308-07-42		51.827	170.04
331-33-30	331-32-59		148.70	
11) 151-33-18	331-32-59		45.322	148.70

JULY 24, 1990

33

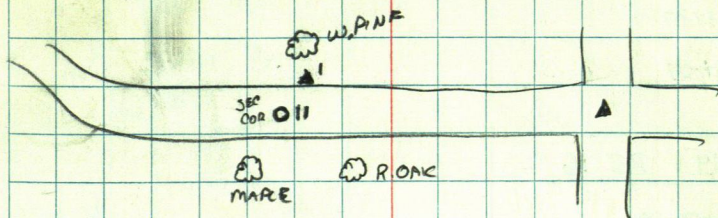
JIM GROVES

USED EXISTING TIES TO
SET SEC. CORNER (CAPPED MONUMENT)

26" W.PINE	N 10° EAST	27.35
15" R. OAK	S 70° E	47.95
12" MAPLE	S 30° W	31.36

121 BS2

00-00-05	121-46-30	
180-00-25		
121-46-35		
11) 301-46-20	121-45-55	12.43



Jim GROVES

TC 13 BS 2

14) 91-34-07

16) 91-34-07

TC 14 BS 16

15) 270-00-00

4.00

TC 16 BS 14

17) 90-00-00

4.00

TC 17 BS 15

15)

88-42-47

196.11

59.774

196.0591

18) 180-00-00

90-44-30

269.78

82.228

269.7564

TC 17 BS 18

00-07-53

19) 00-15-52

94-46-57

120.50

36.729

120.0809

TC 20 BS 18

15)

86-43-41

105.20

32.065

105.0281

21) 180-00-00

104-12-42

108.43

33.049

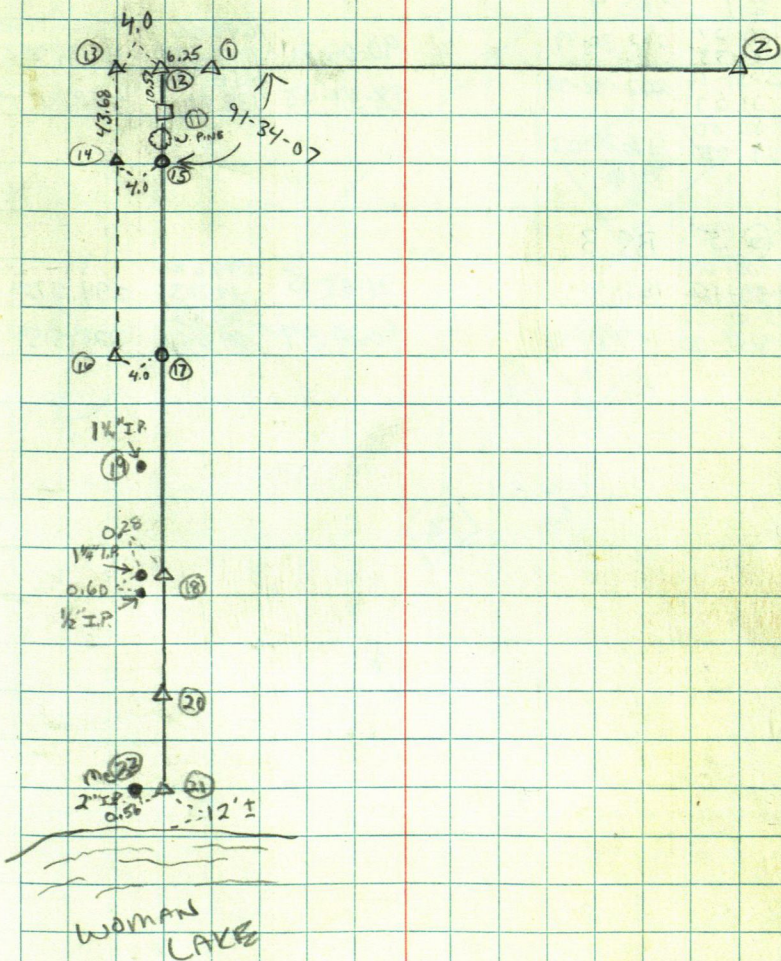
105.1103

75° OVERCAST - MU66Y

JULY 25, 1990

D. FARNAM - G. MARTIN

35



BOB

NELSON

 $\pi @ 1$ BS 4

00-00-27

262-30-49

180-00-33

90-06-31

1649.06

1649.0523

3) 262-31-16

262-30-50

88-37-43

502.635

458.8579

82-31-23

00-00-00

97-29-03

97-29-03

 $\pi @ 5$ BS 3

00-00-09

183-40-41

180-00-12

91-03-35

294.62

294.5729

6) 183-40-50

183-40-48

90-22-37

89.803

228.5159

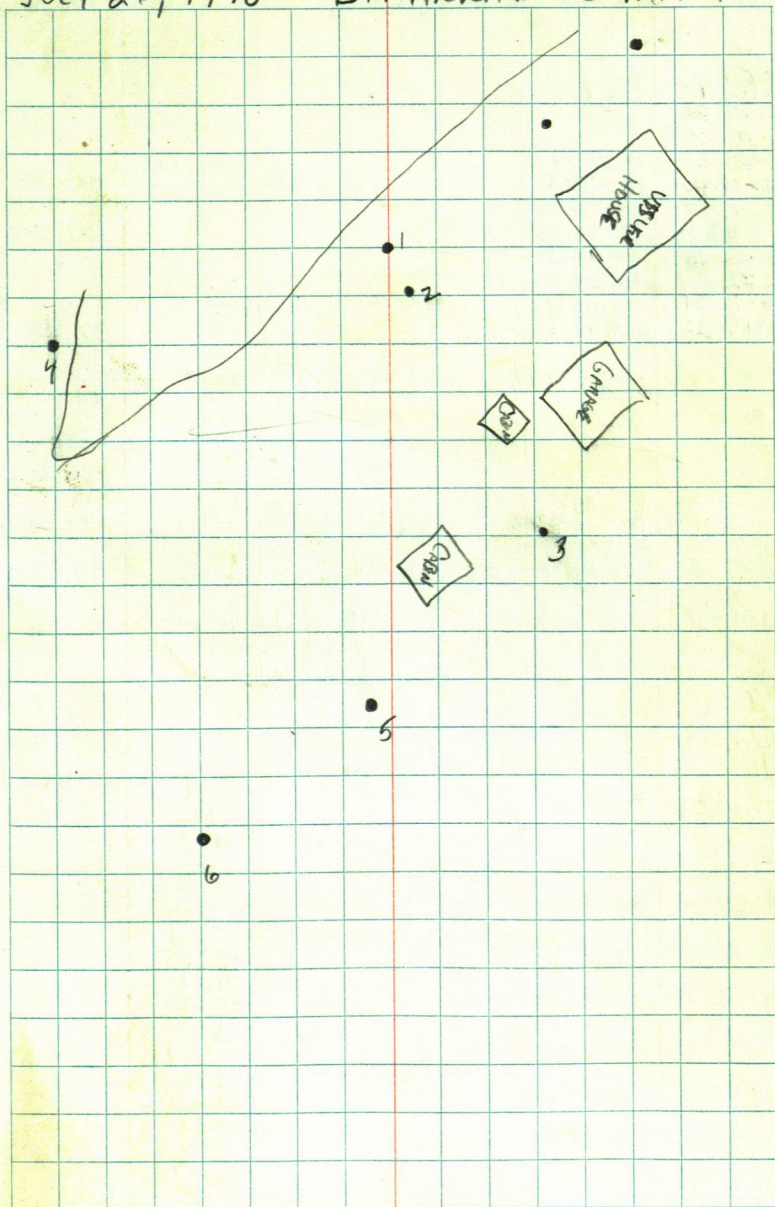
03-41-00

228.52

69.654

JULY 26, 1990

D. FARNAM - G. MARTIN



BOB NELSON

TQ4

BS 1

00-00-22				
180-00-35				
10-24-32	10-24-22		1152.10	
7) 190-24-40	10-24-05	90-00-58	351.162	1152.0980
23-49-18	23-46-56			
8) 203-47-20	23-46-45			107.27
110-22-12	110-21-50			
9) 216-22-21	110-21-46			
216-16-51	216-16-29			
10) 36-17-25	216-16-50			37.64

TQ9

BS 4

00-00-09			154.15	
150-00-15		89-42-15	46.987	154.1507
185-26-52	185-26-43		300.34	
11) 05-26-59	185-26-44	86-56-09	91.543	299.9082
203-11-00	203-10-51		47.94	
12) 23-11-16	203-11-01	90-52-31	14.612	47.9340
345-43-20	345-43-11			
13) 165-43-19	345-43-04			42.56

TQ9

BS 4

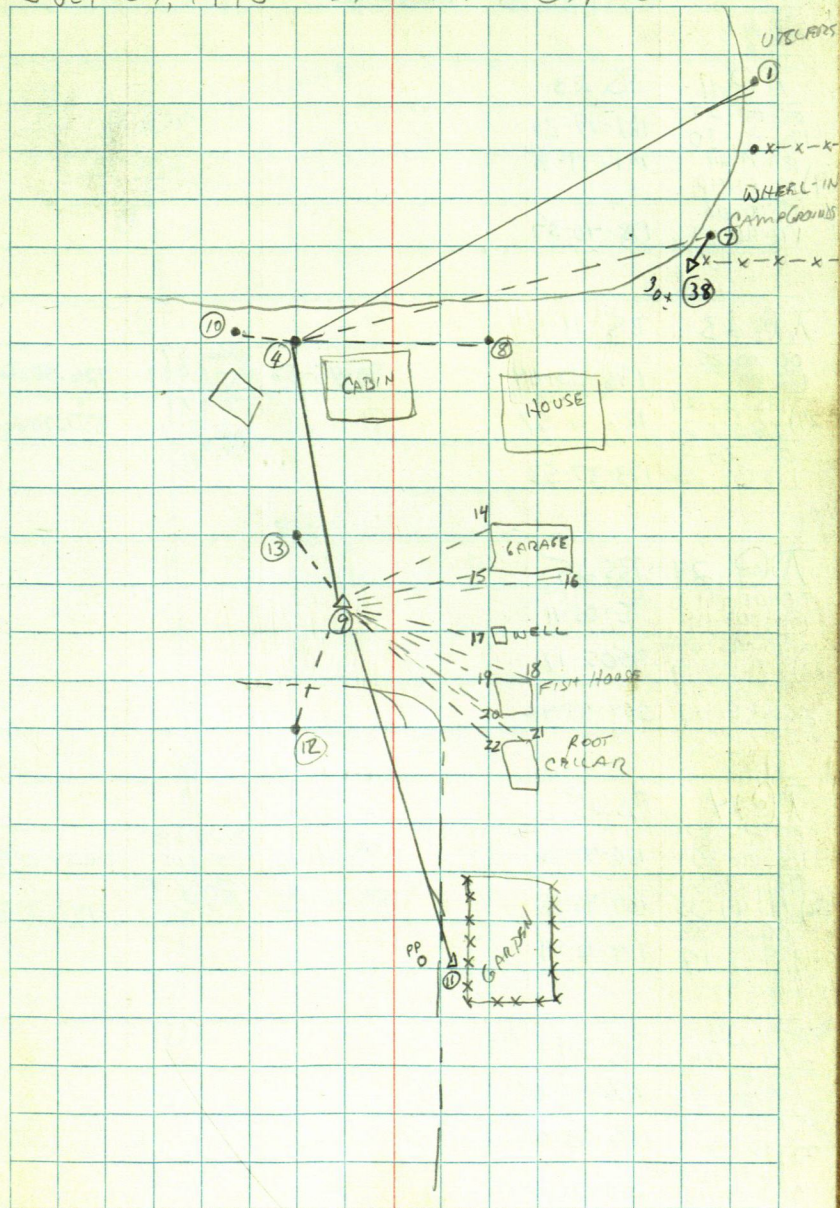
00-00-02				
14) 72-42-23	72-42-21		71.98	
			21.942	
15) 88-57-02	88-57-00		66.35	
			20.223	
16) 90-54-11	90-54-09		90.48	
			27.581	
17) 126-08-14	126-08-12		51.03	
			15.555	
18) 151-52-32	151-52-30		71.01	
			21.650	
19) 156-18-44	156-18-42		66.82	
			20.367	
20) 158-54-38	158-54-36		70.96	
			21.630	
21) 160-21-20	160-21-18		101.63	
			30.946	
22) 166-24-23	166-24-21		96.47	
			29.405	

80° OVERCAST - HUMID

37

24

JULY 27, 1990 D. FARNAM - G. MARTIN



BOB NELSON

TC 11 BS 23

00-00-24	181-19-20
180-00-30	
181-19-44	151-19-18
9) 01-19-48	
00-00-30	
178-40-59	178-40-39

TC 23 BS 11

00-00-25	186-22-04	90-45-58	726.57	
180-00-29			221.459	726.5026
24) 186-22-29			337.79	
06-22-26	186-21-57	91-16-14	102.959	337.7065
00-00-30				
173-38-23	173-37-53			

TC 24 BS 25

00-00-11	95-05-11
180-00-18	
95-05-22	9505-17
23) 275-05-35	
00-00-03	
264-54-45	264-54-42

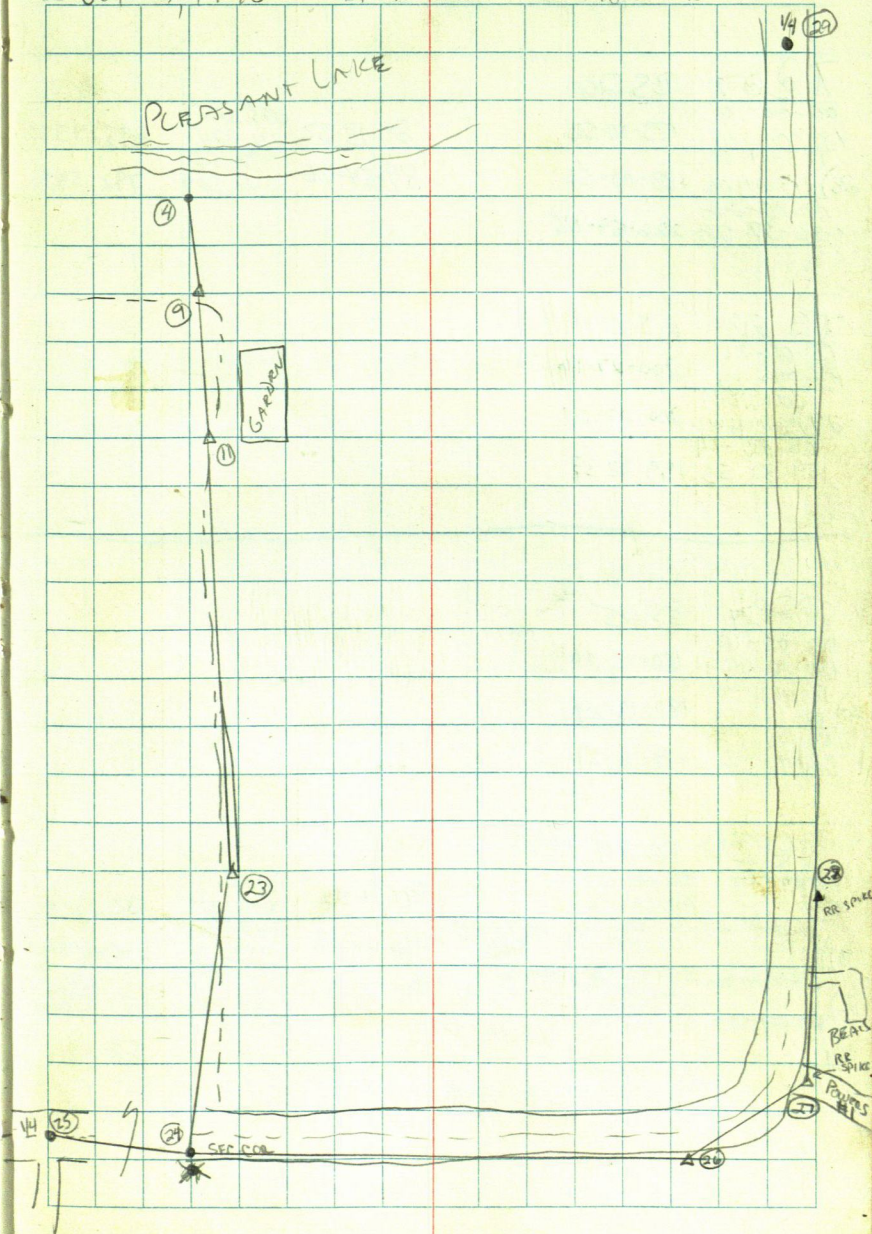
TC 24 BS 25

00-00-28	180-47-06	89-41-42	2624.68	
180-00-37			800.005	2624.6354
180-47-34			1747.46	
26) 00-47-35	180-46-58	89-44-35	532.629	1747.4400
00-00-28				
179-13-17	179-12-49			

TC 26 BS 24

00-00-20	156-43-08
180-00-33	
156-43-28	156-43-00
27) 336-43-33	
00-00-04	
203-17-10	203-17-06

JULY 27, 1990 D. FARNHAM & MARTIN



BOB NELSON

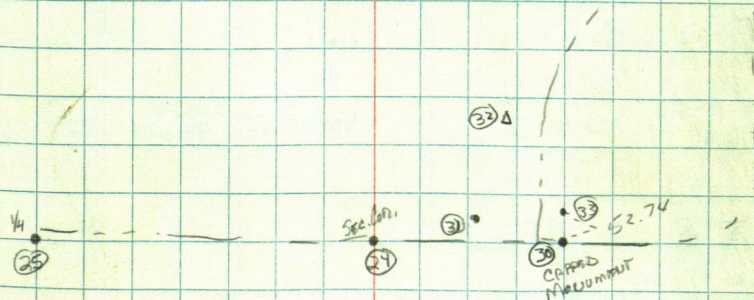
TC 27	BS 26			
00-00-10				
180-00-15	133-00-52	89-13-52	695.52	695.4535
133-01-02			211.994	
28) 313-01-06	133-00-51	89-54-26	792.55	792.5451
00-00-23			241.569	
026-59-28	226-59-05			

TC 28	BS 29			
00-00-31				
180-00-46	200-27-16			
200-27-47				
27) 20-27-47	200-27-07			
00-00-14				
159-32-53	159-32-39			

TC 24	BS 25			
00-00-10				
180-00-25	180-13-70			
180-13-50				
30) 00-13-54	180-13-29			
00-00-17				
179-46-36	179-46-39			

TC 30	BS 24			
00-00-14	00-00-25			
180-00-38	180-00-38	90-31-58	1321.41	1321.3491
13-24-50	13-23-00	90-35-48	402.767	
31) 64-52-52	64-50-39	64-50-34	260.06	260.0476
244-51-13	64-50-35	91-37-30	79.268	
87-48-23	87-46-57		277.97	277.8582
32) 87-46-32			84.726	
33) 00-00-14				52.74
195-09-33	295-09-19			

July 27 1990 D. FARNHAM - G. MARTIN



BOB NELSON

π 32 BS 34

00-00-28

180-00-41

159-32-06

30) 334-32-20

00-00-13

200-28-23

159-31-38

159-31-39

200-28-10

π 34 BS 32

00-00-10

180-00-06

218-28-45

35) 218-28-45

00-00-15

141-31-25

218-28-35

218-28-40

141-31-10

87-19-24

84-20-02

629.89

191.991

303.21

92.419

629.2009

301.7282

π 35 BS 34

00-00-08

180-00-24

36) 145-02-03

325-01-55

145-01-55

145-01-31

90-57-40

189.60

57.788

189.5691

π 28 BS 27

00-00-32

180-00-54

150-01-23

37) 330-01-37

150-00-51

150-00-43

90-40-55

324.88

99.024

324.8565

π 7 BS 4

322-45-01

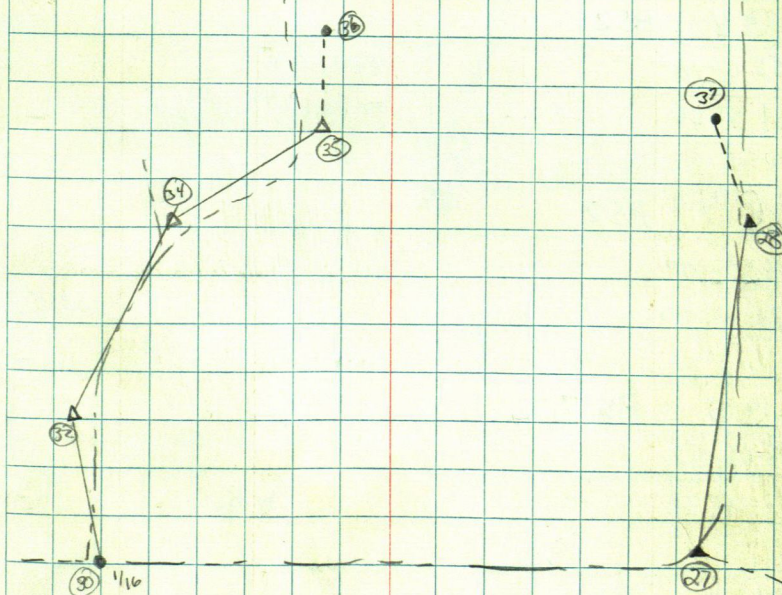
38

86.59.6 60.39

JULY 30, 1990 D. FARNAM - G. MARTIN

REDSANT LAKE

WHEEL IN CAMPGROUNDS



22
14
8

ROY

ABEL

 $\pi @ 2$ BS4

163-56-17

3) 327-52-25

49.72

 $\pi @ 2$ BS4

343-12-12

1) 226-24-46

50.23

 $\pi @ 4$ BS2

152-02-10

5) 304-04-48

88-22-49	164.55
	50.156
89-53-45	234.41
	71.447

 $\pi @ 4$ BS2

136-36-07

6) 273-12-00

103.57

 $\pi @ 5$ BS7

175-06-52

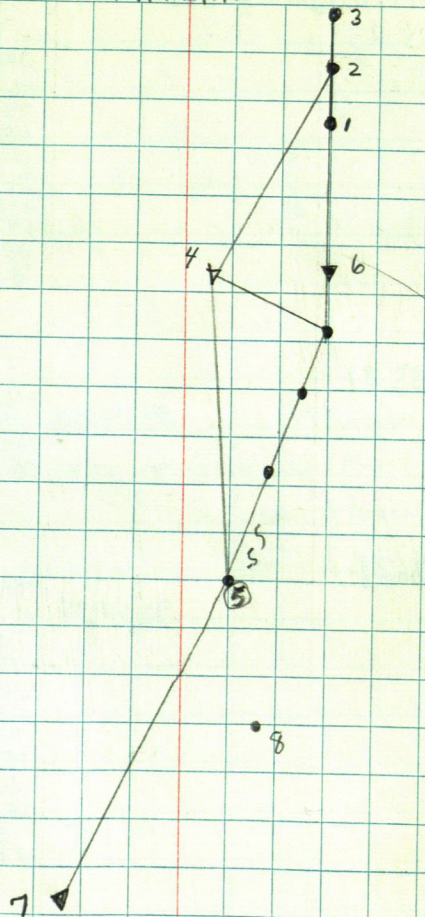
4) 350-13-38

 $\pi @ 5$ BS7

8) 356-19-58

152.95

JULY 31, 1990

 E. CURD
 P. FARNAM
 G. MARTIN
41⁸²

Jim GROUPE

T@21 BS 23

25) 00-09-33	381.96	
	116.422	
26) 354-28-18	358.03	
	109.127	
	308.75	
27) 344-48-32	94.100	
	212.84	
28) 317-42-34	64.867	
	257.71	
29) 301-07-53	78.549	

T@23 BS 21

89-45-00	432.88	432.871
	131.940	
	120.39	
31) 180-00-00	90-37-45	120.381
	36.694	

T@30 BS 21

21)	90-52-38	399.26	
		121.695	
32) 02-26-52		386.08	
		117.676	
33) 14-10-39		388.00	
		118.262	
34) 17-57-27		520.20	
		158.559	
35) 25-57-15		600.21	
		182.945	
36) 28-14-30		575.55	
		175.465	

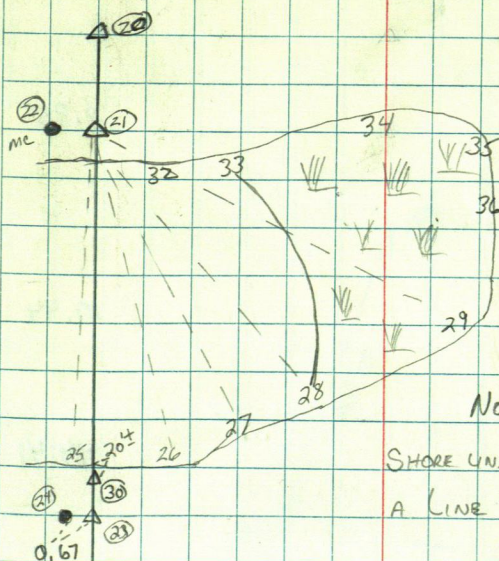
T@37 BS 31

89-48-05	510.58	510.572
	155.623	
89-46-30	436.19	436.175
	132.945	

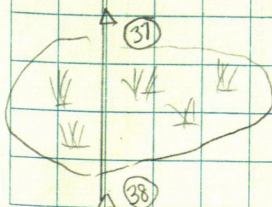
80° - SUNNY

JULY 31, 1990 D. FAENAN - G. MARTIN

42 84



NOTE: USUABLE

SHORE LINE ENDS APPROX. AT
A LINE BETWEEN P. 33 & P. 28.

ROY ABEL

٢٠ ١٨ ٣٥ ٥

73) 135-50-33

11.85

$\pi @ 16$ BS 17

77) 90°

10.44

$\pi @ 17$ BS16

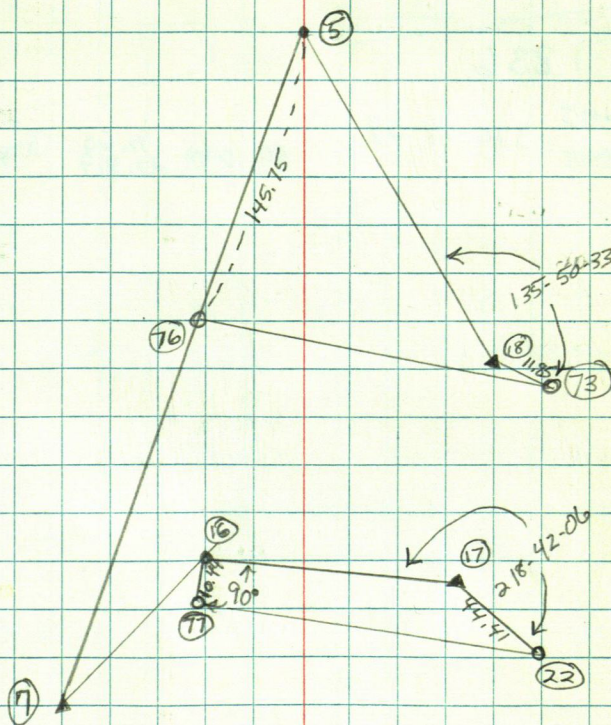
22) 218-4206

44.41

80° CLEAR - WINDY

AUG. 1, 1990

80° CLEAR - WINDY
AUG. 1, 1990 D. FARNAM - G. MARTIN 43°



Jim Grouse

$\pi @ 38$ BS37

239-37-18

239-37-10

7) 19-14-19

$\pi @ 7$ BS6

330-14-03

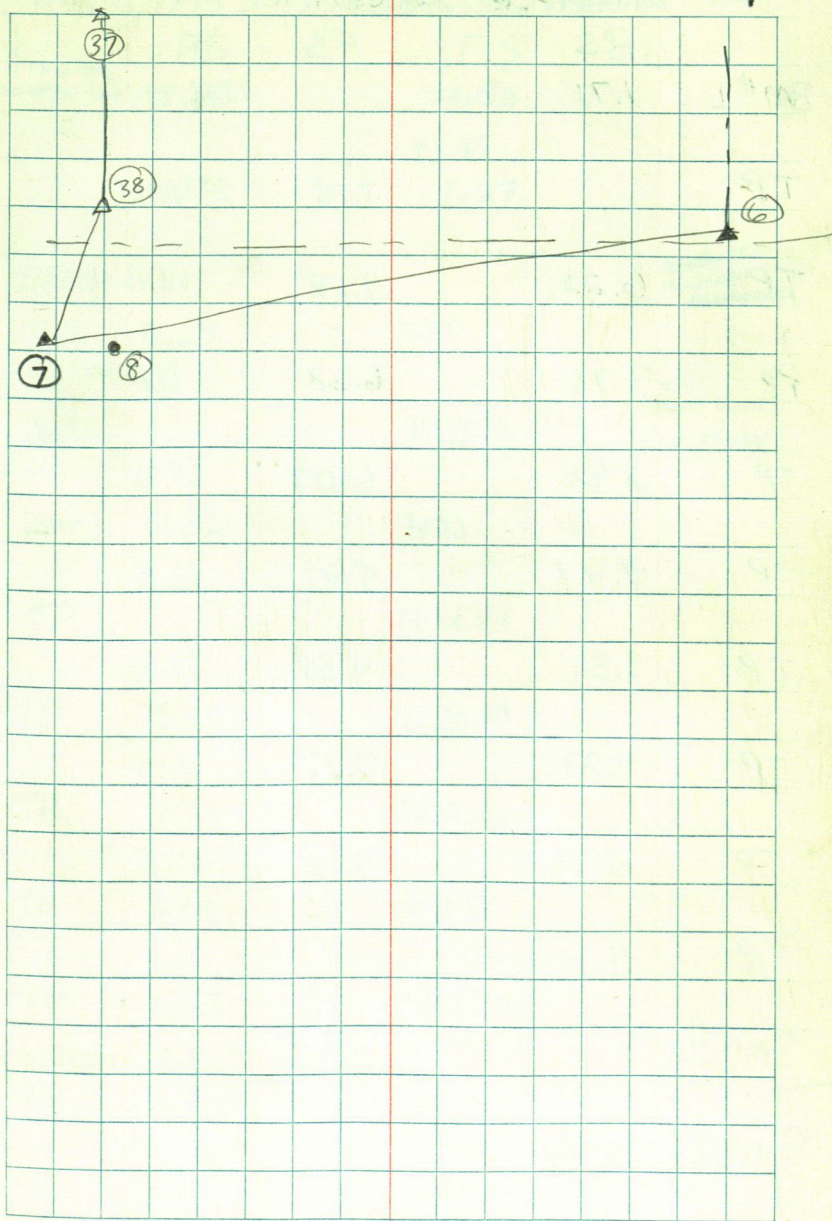
330-14-09

38) 300-28-18

89-10-49

91.60
27.919

91.589



MARPLE LANDFILL

	BS		FS	
Bm#1	1.71		1276.43	Bm WE SET IN CONCRETE
		78.14		
TP			7.18	70.96
TP	6.22		9.68	68.46
		74.68		
TP	3.76		6.68	68.00
		71.76		
TP	2.92		6.03	65.73
		68.65		
TP	4.47		5.89	62.76
		67.23		
TP	3.39		4.86	62.37
		65.76		
TP	4.29		3.77	61.99
		66.28		
TP	5.29		4.18	62.10
		67.39		
TP	4.31			
Bm#2			5.95	1258.57 USGS marker
Bm#2	5.89			
TP			7.79	

72° CLEAR

AUG 6, 1990

D. FAENAM - G. MARTIN

45°

	BS		FS	
TP	5.05		4.50	
TP	4.73		1.27	
Bm#3				WELL FOR MARK ONE
TP	4.29			
Bm#3			1.80	1263.17 EAST WELL FILE MARK
Bm#3	2.36			
TP			4.61	
TP	5.33		4.00	
TP	2.73		2.23	
TP	2.04		2.90	
TP	5.22		2.90	
TP	6.53			
North Bm Well #4			5.49	1263.24 S.W. CORNER SLAB OF CHS WELL #5

MAPLE LANDFILL
 NORTH WELL BM#4 BS 5.95 FS S.W. CORNER OF SCAB

NORTH WELL #5 2.66 TOP OF CASING NO FILE MARK

NORTH WELL #5 3.08

TP 7.30

TP 8.84 1.11

TP 10.45 3.63

TP 8.66

BM#1 11.05 1274.48

BM#1 10.61

TP 3.25

TP 11.24 5.29

TP 2.62 13.09

TP 1.13

AUG 6, 1990 D. FARNAM - G. MARTIN 46⁹²

SOUTH WELL #8 BS FS 8.97 N.E. CORNER OF SCAB

BM#5 8.94

SOUTH WELL #8 7.14 TOP OF CASING NO FILE MARK

SOUTH WELL #8 8.49 ~~6.07~~

TP 5.37

TP 9.74 3.64

TP 10.57 3.52

TP 4.05 7.96

TP 3.31 11.15

TP 0.84 8.76

WEST WELL ~~BM#5~~ TP 4.38

WEST WELL #1 BM#6 4.91 N.W. CORNER OF SCAB

BS

FS

Bm#6 5.03

WEST WELL
#1

3.22

FILE MARK
ON CASING

WEST WELL 2.96

TP 2.49

TP 10.77 1.57

TP 11.57 5.86

TP 7.73 5.23

TP 2.78 9.10

TP 2.14 8.13

TP 4.04

Bm#1 4.31

MIKE ORTH

$$\pi \circ z \quad \text{BS 3}$$

00-00-19					2646.91	
180-00-20	89-49-37		89-45-55		806.780	2646.880
89-49-56					1321.02	
269-50-03	89-49-43		89-52-46		402.649	1321.015
00-00-33						
270-10-50	270-10-17					

$\pi @ 3$ BS 4

00-00-26	
180-00-43	180-51-05
180-51-37	
2) 00-51-40	180-50-57
00-60-31	
179-09-36	179-09-05

TE4 BS 6

00-00-36			2666.88	
180-00-37	91-54-38	89-57-10	812.864	2666.866
91-55-14			2646.88	
3) 271-55-06	91-54-29	90-01-41	806.767	2646.865
00-00-37				
268-06-03	268-05-26			

$\pi e 7$ BS6

00-00-33				
180-00-46	50-57-36			
50-58-09				
10230-58-13	50-57-27	90-06-40	710.60 216.592	710.597

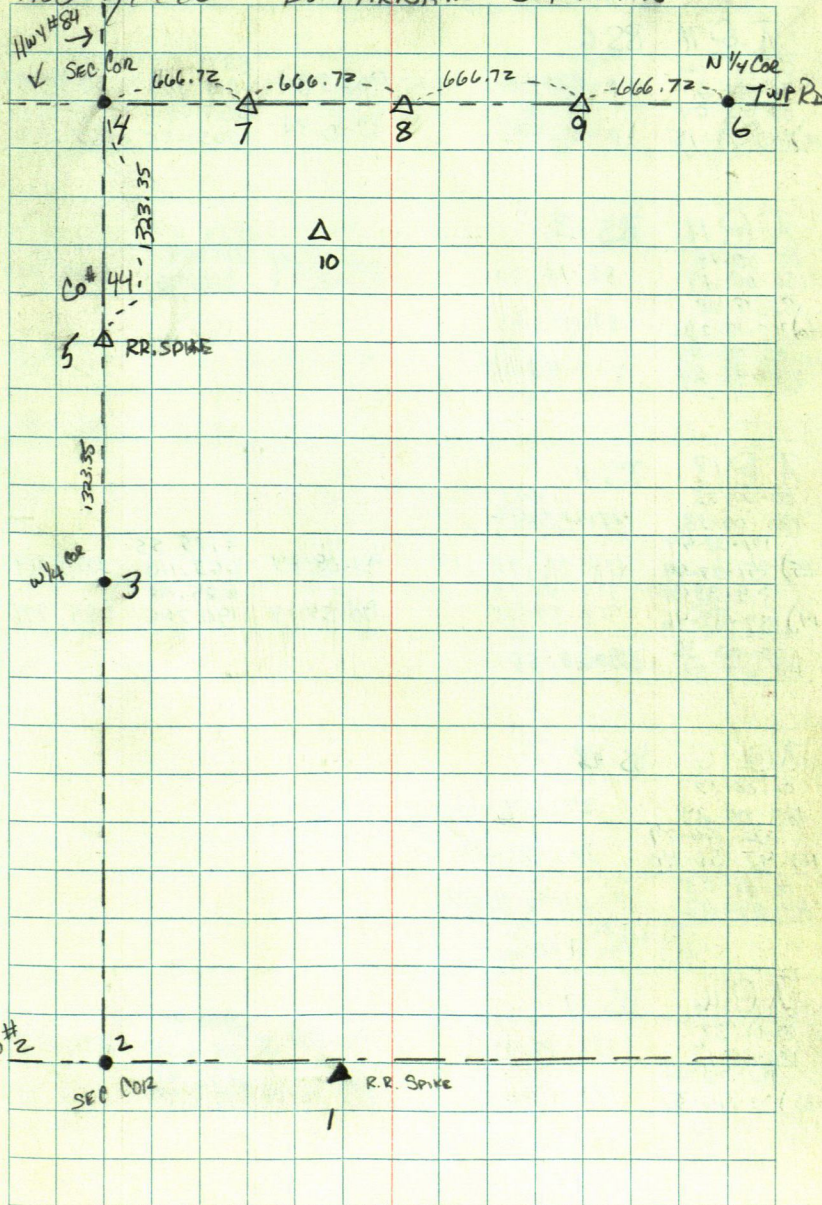
A06
BS

00-00-25	
180-00-24	179-54-01
179-54-26	
40) 359-54-24	179-54-00
00-00-11	
180-06-09	180-05-58

T-2 90° Hazy - Wind!

AUG 9, 1990 D. FARNHAM - G. MARTIN

4/8⁹⁶



MIKE ORTH

π@11 BSG				
00-00-16			3332.55	
180-00-31	0-02-48	90-23-34	1015.769	3332.47
00-03-04			667.49	
12) 180-03-15	0-02-44	92-10-34	203.455	667.012

π@11 BS13				
00-00-18			3149.84	
180-00-19	82-18-00	89-56-59	960076	3149.833
82-18-18				
6) 262-18-22	82-18-03			
00-00-24				
277-42-24	277-42-00			

π@13 BS11				
00-00-33				
180-00-38	171-33-16			
171-33-49			2175.55	
15) 351-33-49	171-33-11	91-08-24	663.110	2175.114
319-39-41	319-39-08		625.88	
14) 137-39-46	319-39-08	90-54-14	190.766	625.796
00-00-36				
188-27-31	188-26-55			

π@15 BS13				
00-00-17				
180-00-29	272-56-12			
272-56-29				
16) 92-56-40	272-56-11			
00-00-05				
87-04-02	87-03-57			

π@16 BS17				
00-00-37			290.80	
180-00-19	182-45-49	90-07-08	88.635	290.797
182-46-26			252.91	
15) 02-46-30	182-46-11	89-36-00	77.089	252.908
00-00-16				
177-14-24	177-14-08			

T-2 P/C 75° WINDY

AUG. 10, 1990 D. FARWELL - G. MARTIN

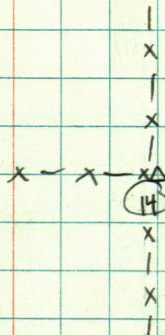
98
49

N. 1/4 COR

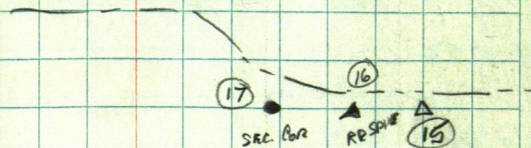
(6)

RE. SPIRE
SEC. COR
(12)

(11)



(13)



97

MIKE ORTH

$\pi @ 7$ BS 6
18) 92-09-43 17.83

$\pi @ 8$ BS 6
19) 92-10-54 19.37

$\pi @ 9$ BS 6
20) 92-19-06 17.97

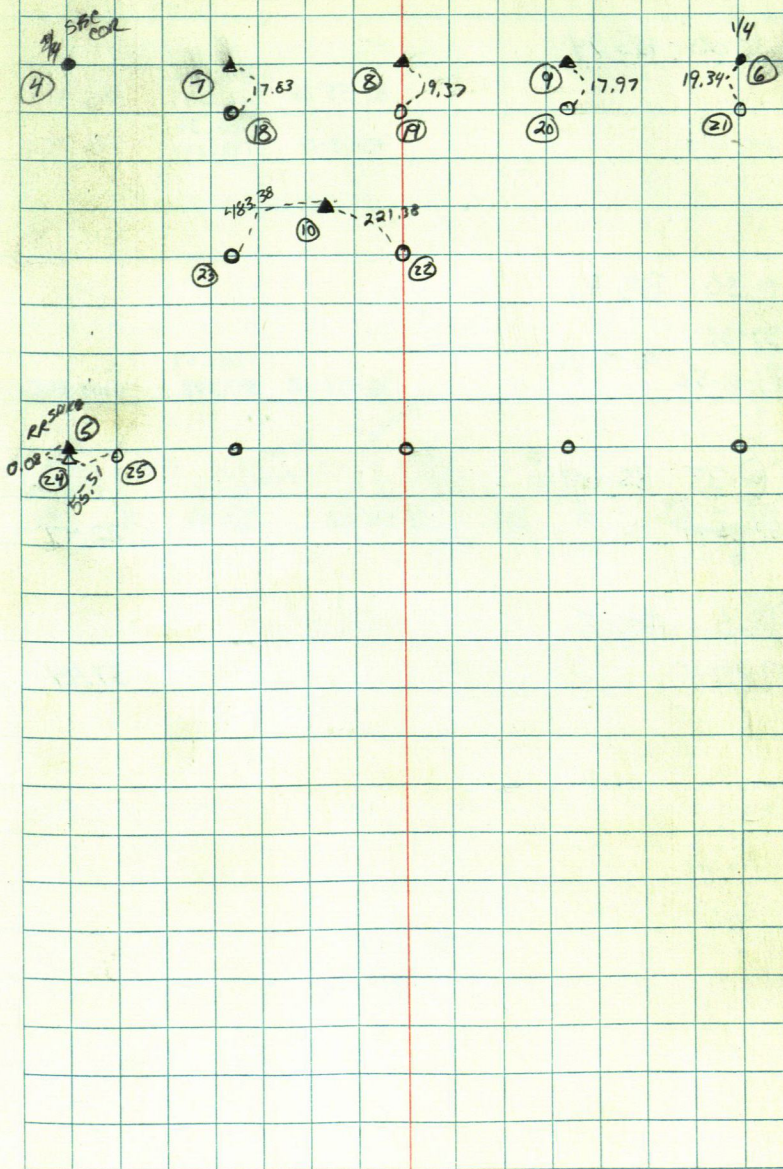
$\pi @ 6$ BS 9
21) 272-27-21 19.34

$\pi @ 10$ BS 7
22) 157-48-46 221.38

$\pi @ 10$ BS 7
23) 296-07-52 483.38

$\pi @ 24$ BS 4
25) 87-50-30 55.51

AUG 13, 1990 P. FARNAM-6 MARTIN 50°



MIKE ORTH

 $\pi @ 26$ BS 24

24)	89-55-16	545.40 166.239	545.399
28) 180-00-00	90-13-14	486.36 148.241	486.352

 $\pi @ 30$ BS 31

91-39-31	91-39-26	1304.04	
35) 183-18-52	90-09-12	397.478	1304.040

 $\pi @ 35$ BS

36) 231-32-19			
51-32-49			22.47

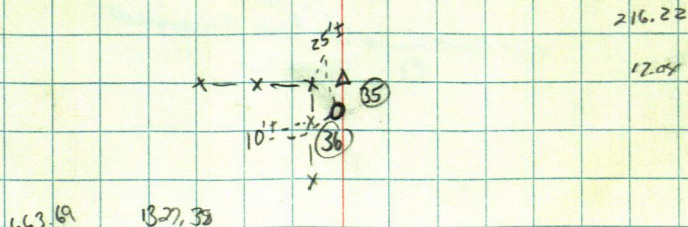
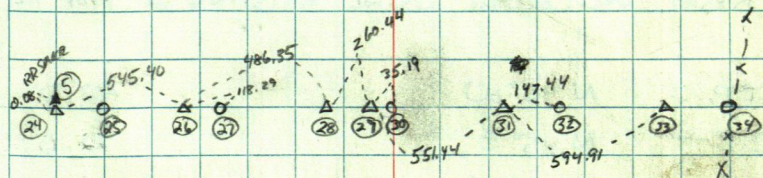
 $\pi @ 3$ BS 5

37) 89-40-35			57.44
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72° WINDY P/C

AUG 13, 1990 D. FARNAM - G. MARTIN

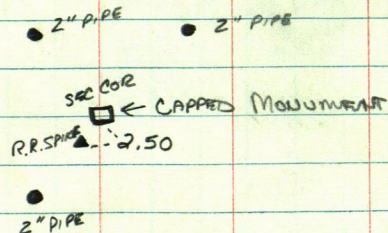
51



② ③

T 138 R 29
CORNER MONUMENTATION

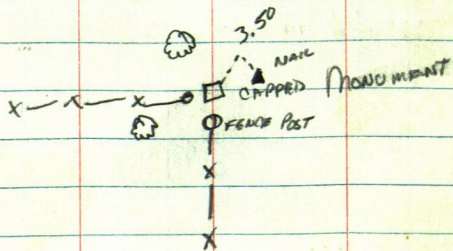
T 138 R 29 N.E. CORNER SEC 33



RESET SEC. CORNER USING EXISTING 2" PIPE TIES

2" I.P.	N 45° W	42.0
2" I.P.	N 45° E	42.0
2" I.P.	S 45° W	42.0

SET E 1/4 CORNER SEC 33 T 138 R 29



16" W. OAK	NORTH 30° WEST	10.55
5" W. OAK	SOUTH 60° WEST	16.53

920 Hgt!! HUMID.

AUG 15, 1990

D. FARNAM - G. MARTIN

52¹⁰⁴

PINE POINT

π@5 BS3

5)	91-56-50	116.51 35.514	116.745
6) 180-00-00	89-59-13	250.05 76.216	250.050

π@8 BS6

9) 207-46-20 110.56

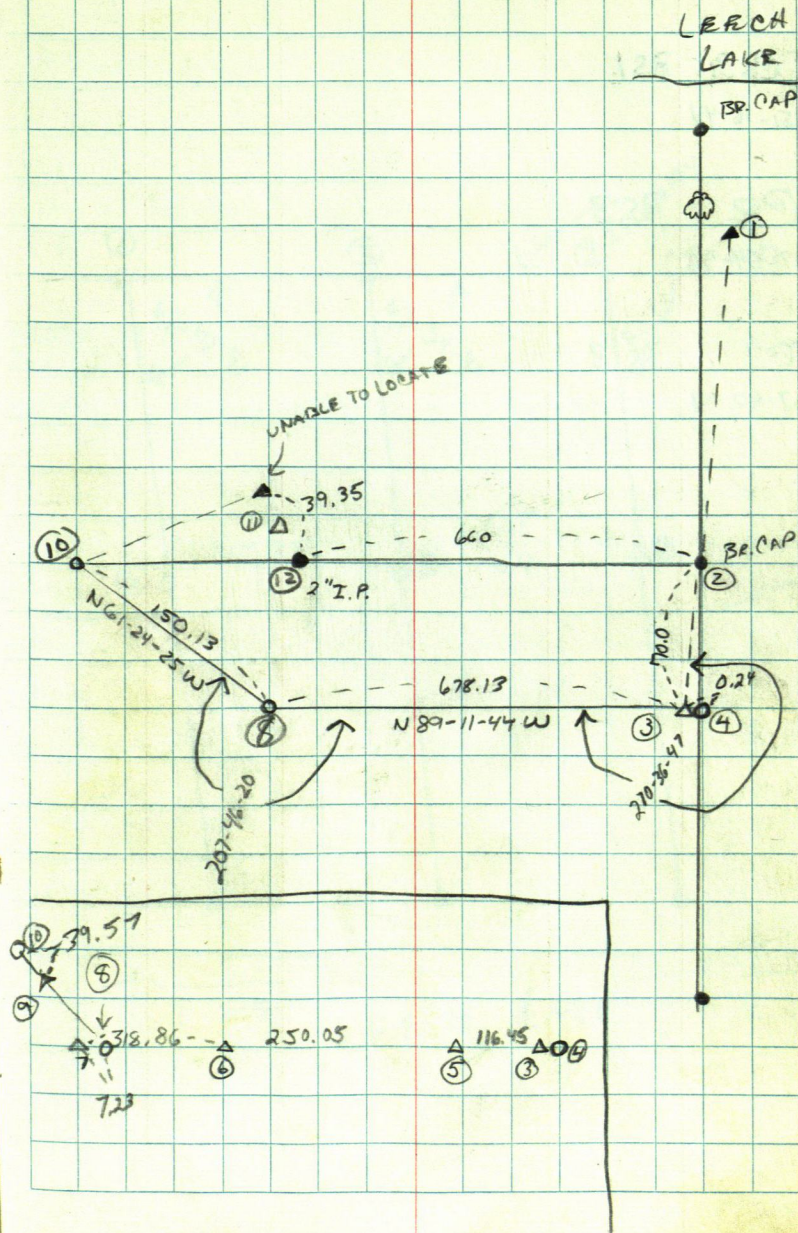
π@10 BS11

39-15-49
8) 78-31-07

π@11 BS10

283-08-14	87-53-23	154.09 46.967
12) 206-16-33	97-14-54	28.68 8.740

90° HOT!! HUMID.
AUG 16, 1990 D. FARNAM - G. MARTIN 53



BILL GRIGGS - PINE POINT

TC3 BS1

4) 251-16-44

TC2 BS3

5) 67-54-40

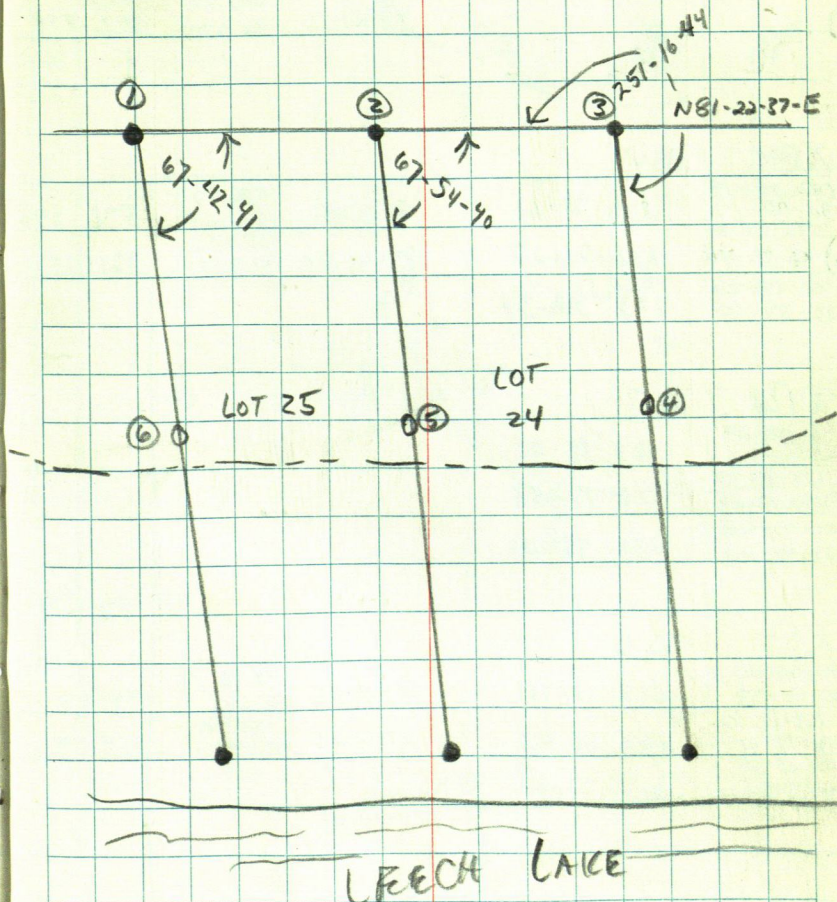
TC1 BS3

6) 67-42-41

67° - COOL - OVERCAST

AUG 20, 1990

D. FARNAM - G. MARTIN

54¹⁹³

OSCAR FISHER — BOWEN LAKE

SEC 32
T. 139 R. 30

A02 BS1

3)

90-01-24	1298.32 395.726	1298.311
92-21-10	126.88 38.674	126.774

A05 BS4

00-00-18			
180-00-17	236-21-21	89-57-31	536.296
236-21-39			
6) 56-21-44	236-21-27	89-46-20	321.115
00-00-24			
123-39-00	123-38-36		

A06 BS5

00-00-29			
180-00-35	128-18-01		
128-18-30			
7) 308-18-33	128-17-58		
00-00-28			
231-42-28	231-42-00		

A07 BS6

00-00-20			
180-00-33	268-17-56	90-04-31	94.117
268-18-16			
8) 88-18-41	268-18-08	87-17-23	158.74
00-00-29			
91-42-24	91-41-55		

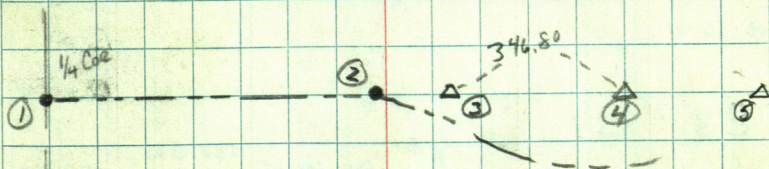
63° - OURCAST

AUG. 20, 1990

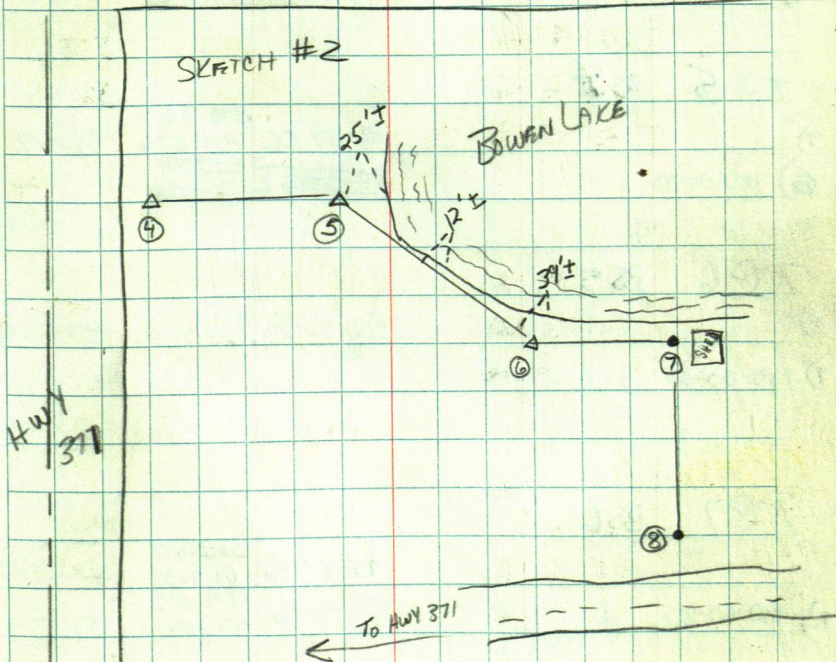
D. FARNHAM - G. MARTIN

55

SKETCH #1



SKETCH #2



ORAL RUBITSCHUNG

$\pi @ 1$ B 2

3) 00-56-11

$\pi @ 3$ B 51

1)

92-73-26 132.32 40.332 132.206

4) 180-00-00

93-38-40 84.77 25.836 84.595

$\pi @ 5$ B 54

4)

86-37-06 340.66 103.836 340.07

6) 180-00-00

~~88-51-02~~ ~~96.770~~

$\pi @ 6$ B 55

5)

92-35-33 406.02 123.757 405.606

7) 180-00-00

$\pi @ 7$ B 56

8) 180-00-00

93-47-46 202.47 61.712 202.023
90-23-36 154.57 47.109 154.559

AUG 24, 1990 - D. FARNAM - G. MARTIN ^{1/2} 56

1
3 A
2
4 A

1319.06
5 A

6 A

7 A

9 0
8 1/4
50.0 FRM E

GORDON JENKS

K@4

BS5

00-00-14			170.11	
180-00-15	209-36-53	90-10-26	51.850	170.109
209-37-07			165.23	
3) 29-37-19	209-37-04	90-47-17	50.363	165.215
00-00-33				
150-23-26	130-22-53			

K@3

BS4

00-00-24	00-00-08			
180-00-31	180-10-15	168-48-37		
168-47-07	168-48-45			
2) 348-48-45	348-48-58	168-48-38		
00-00-20				
191-11-40	191-11-20			

K@2

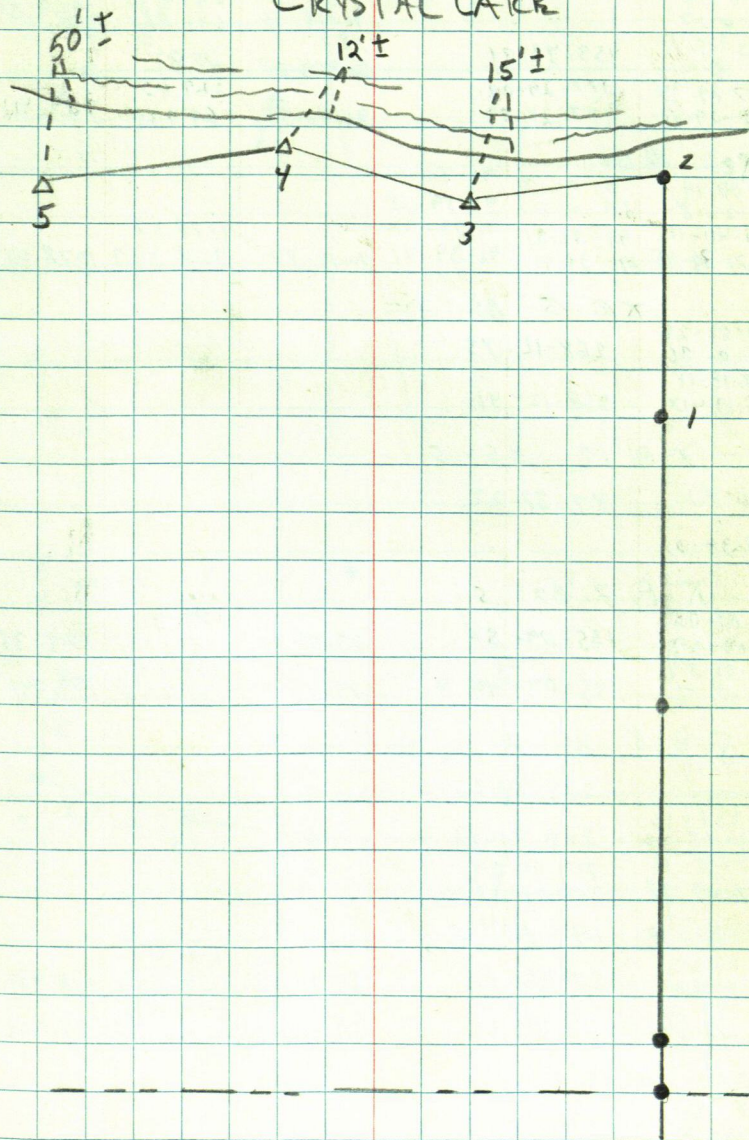
BS1

00-00-10			231.39	
180-00-20	112-10-54	86-59-30	70.527	231.069
112-11-04			112.74	
3) 292-11-13	112-10-53	91-35-00	34.369	112.706
00-00-05				
247-49-18	247-49-17			

90° Hot Humid.

AUG 27, 1990 D. FARNHAM - G. MARTIN 57

CRYSTAL LAKE



GLEN VICKERSON

K @ 2 BS 1

0-0-16			2269.89	
180-0-17	1	90-10-16	691.864	2269.807
3 153-49-17	153-49-01	90-24-08	20.89	
177-29-24	177-29-08		229.43	
4 357-29-16	177-28-59	90-46-38	69.932	229.411

K @ 2 BS 1

00-00-14	0-0-13	91-40		
180-0-8	180-0-6	91-39-18		
91-40-14	91-39-31	91-39-37	1078.03	
5 271-39-45	271-39-41	91-39-41	90-18-47	328.583 1078.008

K @ 5 BS 2

00-00-26				
180-0-36	268-12-45			
268-13-11				
7 88-13-17	268-12-41			

K @ 12 BS 5

0-0-43	87-37-22			
13 87-38-05				

K @ 7 BS 5

00-00-03			179.36	
180-00-07	185-09-54	89-57-48	54.670	179.36
185-09-57			107.04	
8 05-09-56	185-09-49	89-49-8	32.627	107.041

K @ 8 BS 7

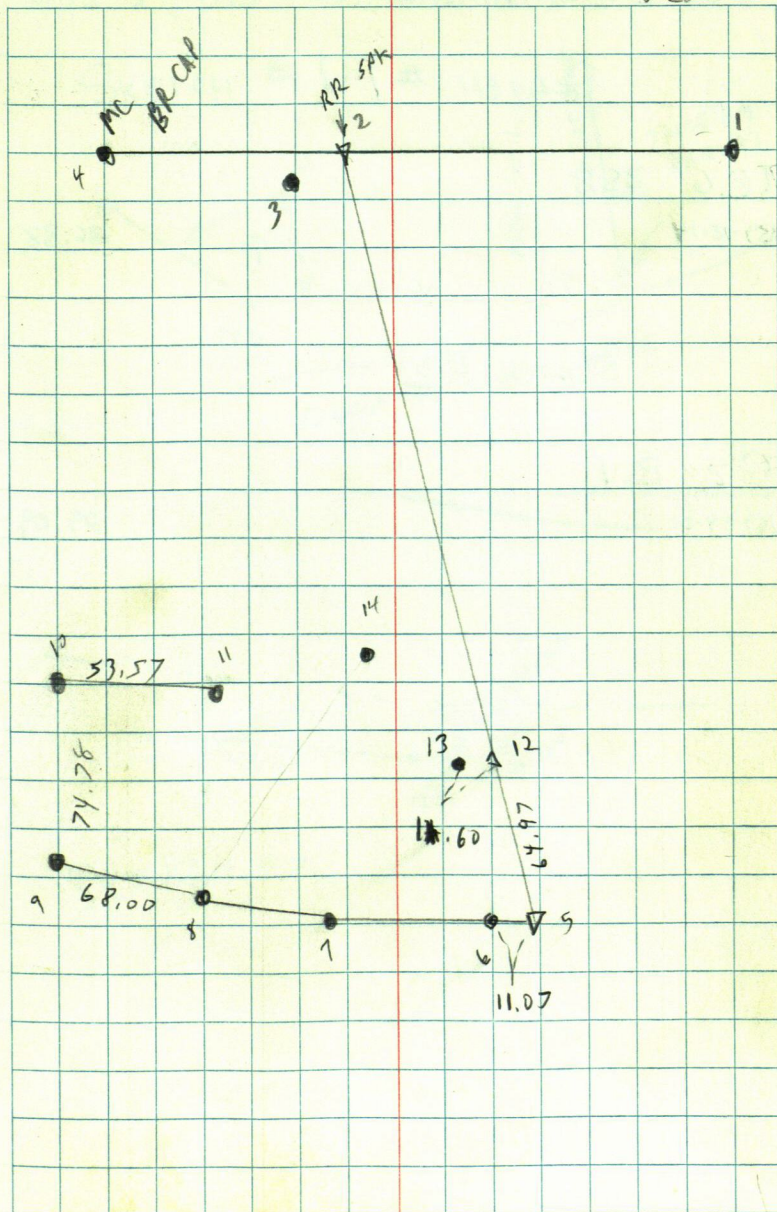
0-0-44				
180-01-0	203-14-22			
203-15-6				
9 23-15-43	203-14-43			
317-5-13	317-04-29			
14 137-05-15	317-04-15			

K @ 14 BS 8

0-0-20			130.69	
180-0-20	37-48-07	89-42-45	29.833	130.686
37-48-27			80.21	
11 217-48-28	37-48-08	89-43-59	24.448	80.209

K @ 11 BS 14

0-0-45				
180-0-52	201-01-29			
10 201-02-14				
21-02-30	201-01-38			



GERALD KURHL

SKETCH #1

π@6 BS8

1) 139-18-14

136.38

SKETCH #2

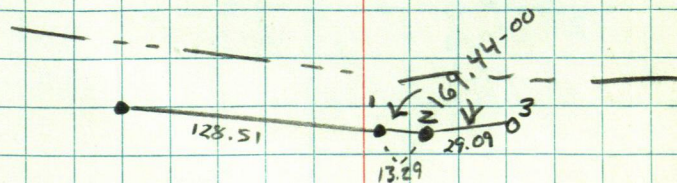
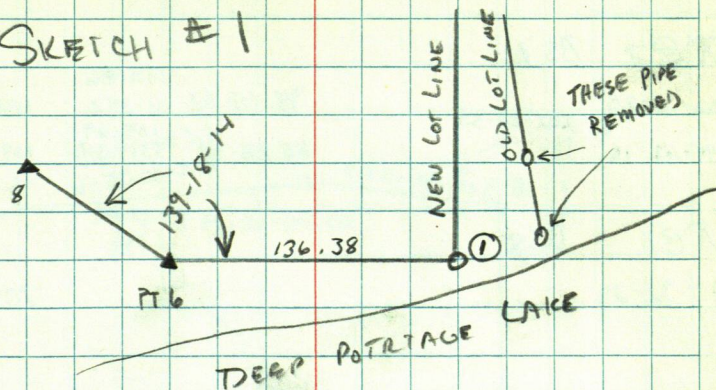
π@2 BS1

3) 169-44-00

29.09

AUG. 29, 1990 D. FARNAM - G. MARTIN 59

SKETCH #1



SKETCH #2

REV. HARRY L. PETERSON

T02 BS1

202-21-20	202-21-35	94-15-52	102.86 31.352	102.575
3) 44-43-10		85-25-14	109.69 33.434	109.340

T01 BS2

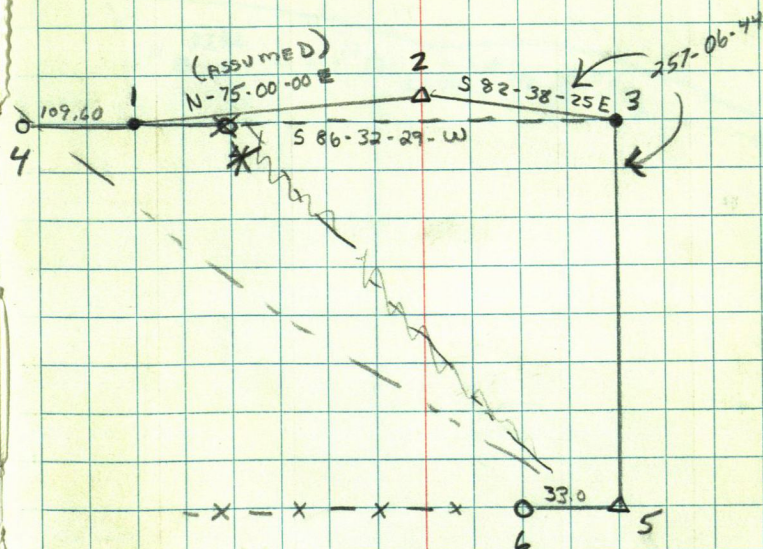
4) 11-32-29				109.60
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T03 BS2

5) 257-06-44	86-48-34	216.83 66.090		
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AUG 29, 1990 D. FARNAM - G. MARTIN

120 60

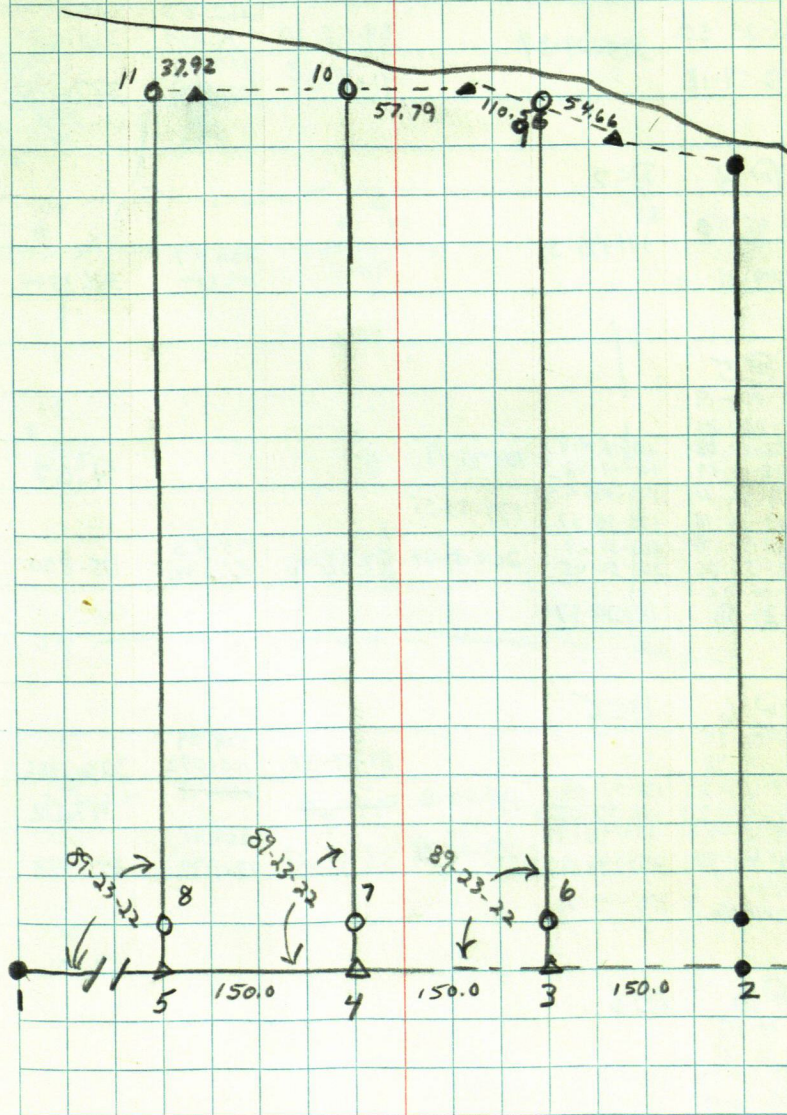


GORDON JENKS

AUG 29, 1990

D. FARNAM - G. MARTIN

62



KEN STONE

π@3 BS2

275-29-30	275-29-39	89-53-30	262.03 79.867	262.029
4) 190-59-18		91-18-04	337.63 102.909	337.540

π@3 BS2

174-45-50	174-45-35	90-50-06	386.57 117.837	386.544
5) 349-31-10				

π@5

00-00-19				
180-00-21				
108-17-08	108-16-49	108-17-19		9.67
7) 288-18-09	108-17-48			
179-36-11	179-35-52	179-35-55		
6) 359-36-18	179-35-57			
268-34-78	268-34-29	268-34-37	175.83 53.592	175.800
8) 288-35-06	268-34-45	88-58-46		
00-00-01				
180-24-58	180-24-57			

π@6 BS5

00-00-25			328.34	
180-00-32		89-54-37	100.092	328.386
138-47-25	138-47-00	138-47-03	254.77	47.02
9) 318-47-37	138-47-05	93-17-27		
254-45-52	254-45-27		254.91	
10) 74-46-02	254-45-30	93-17-27	77.690	254.478
00-00-21				
105-14-46	105-14-25			

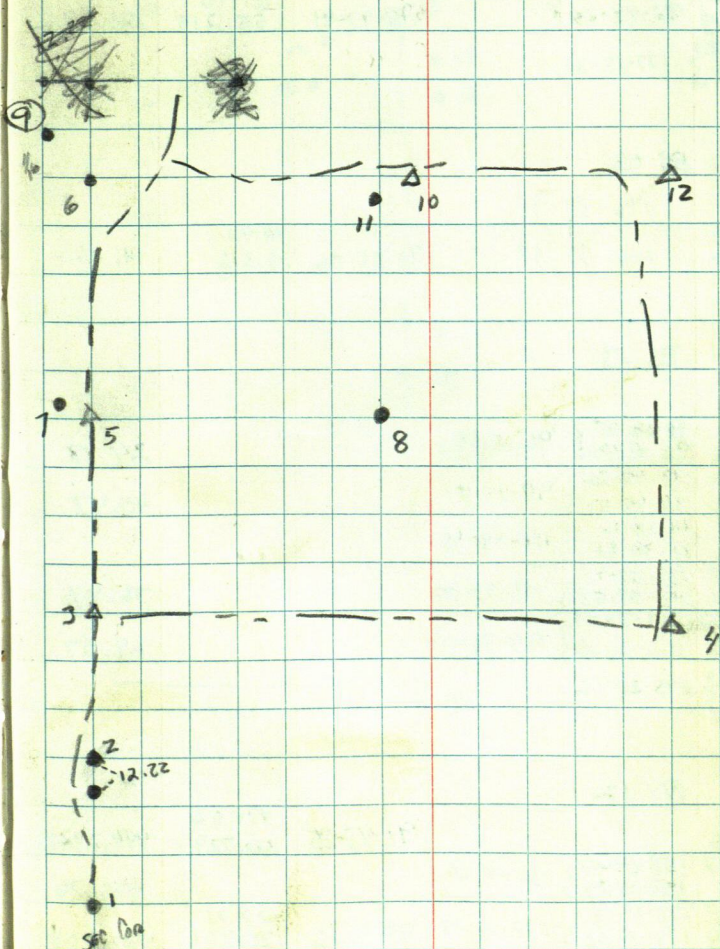
π@10 BS6

00-00-19				
180-00-29				
182-40-20	182-40-03	182-40-12		
12) 02-40-49	182-40-20			
11) 333-23-44	333-23-31	333-23-37		35.03
153-24-11	333-23-42			
00-00-41				
174-20-00				

Aug 31, 1990

D. FARNHAM - G. MARTIN

62



KEN STONE

TC 12 BS 10				
00-00-12			265.43	
180-00-29	182-44-38	89-25-09	80.904	265.417
182-44-45	182-44-27		181.15	
13) 02-44-49	182-44-20	92-47-41	55.215	180.935
00-00-02				
177-15-33	177-15-31			

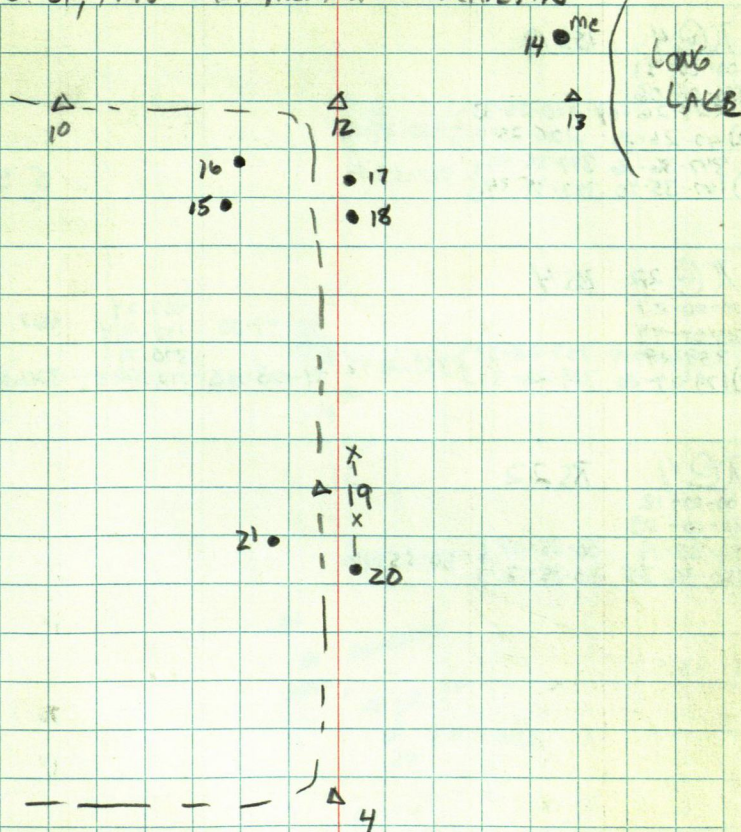
TC 13 BS 12				
00-00-20				
180-00-23	146-58-38			
146-58-58			41.06	
14) 326-58-20	146-57-57	90-21-06	12.516	41.06

TC 12 BS 13				
00-00-26				
180-00-29				
96-09-11	96-08-45	96-08-48		
17) 276-09-19	96-08-50		24.18	
99-46-02	99-45-36	99-45-44		
18) 279-46-20	99-45-51		40.47	
111-39-02	111-38-36	111-38-45		
19) 291-39-22	11-38-53			
159-58-14	159-57-48	159-57-50	76.47	
15) 339-58-21	159-57-52			
163-36-35	163-36-09	163-36-09	69.07	
16) 343-36-37	163-36-08			
00-00-04				
248-21-16	248-21-12			

TC 19 BS 12				
00-00-32			494.52	
180-00-46		91-43-35	150.729	494.292
158-05-23	158-04-51	158-04-40		
20) 338-05-15	158-04-29		48.20	
178-19-46	178-19-14	178-19-08	427.71	
4) 358-19-48	178-19-02	89-56-16	130.366	427.708
291-24-33	291-24-01	291-23-54		
21) 111-24-32	291-23-46		52.97	
00-00-25				
181-41-10	181-40-45			

AUG. 31, 1990 D. FARNAM - G. MARTIN

63



127

00-00-51

180-01-06

220-26-04 220-25-33 } 220-25-24
22) 40-26-20 220-25-14 }

23) 347-36-16 347-35-45 } 347-35-09
167-35-40 347-34-34 }

5.50

00-00-27

180-00-49

90-47-00

467.24

467.193

24) 179-29-20	359-28-52	359-28-31	359-28-42	91-03-32	370.71	112.992	370.644
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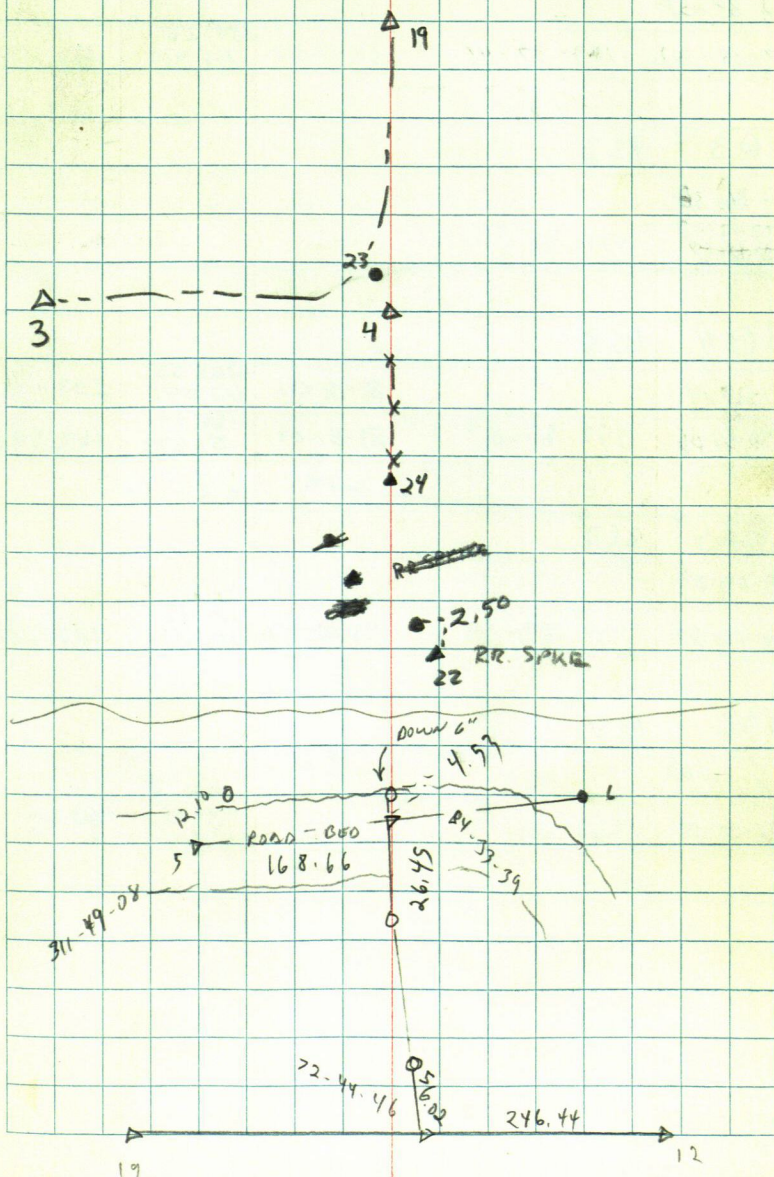
00-00-12

180-00-22

50-35-19

50-35-07 } 50-35-10
50-35-12 }

3) $230 \cdot 35 \cdot 35$ $50 \cdot 35 \cdot 12$ $50 \cdot 35 \cdot 10$



129

PT LOT ~~1~~ SPARKLING WATERS

HAYNES

1 @ 2 BS 1

183-37-54

3 07-15-32	183-37-46	89-47-00	106,760	350,257
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$\pi @ 3$ BS 2

101-36-36

4) 203-13-03
~~203-12-54~~

101-36-32

X@4 BS3

350-27-14

5) 340-54-06	350-27-03	89-51-09	169,54 51.673	169,534
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PC4 BS3

135-04-09

6270-07-57	135-03-59	93-02-42	100.42 30.610	100.281
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πC6	BS 4
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266-00-00

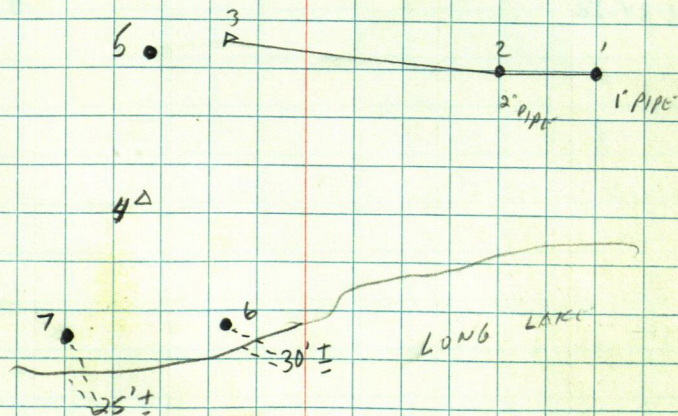
7) 172.00.00 266.00

99.95

E. CULE
D. FARNUM

136

9-11-90



HAYNES

TEZ BSZ

167-04-00 } 167-04-02

167-04-00 } 167-04-02
8) 334-08-04 }

T08 BS2

218-28-08 } 218-28-08

10) 076-56-16

93-17-46

324.60

98.936

324,058

91.95

$\pi @ 8$ BSZ

301-47-06 } 301-47-19

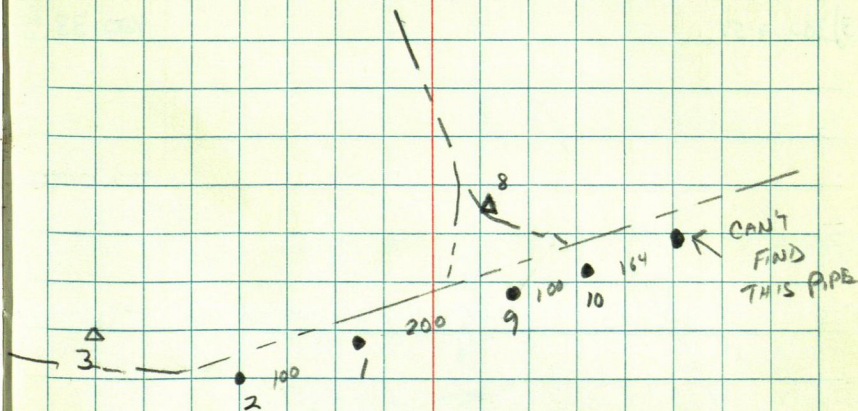
9) 243-34-38

51.53

SEPT 5, 1990

SEPT 5, 1990 D. FARNAM - G. MARTIN

132
66



WILLIS (10-MILE LAKE)

$\pi @ 2$ BS1

00-00-09			90-47-40	558.28	
180-00-20				170.165	558.226
127-54-44	127-54-35	127-54-34	89-41-54	212.73	212.724
3) 307-59-52	127-54-32			64.839	
154-47-41	154-47-32	154-47-29			53.67
4) 334-47-46	154-47-26				
00-00-05					
232-05-32	232-05-27				

$\pi @ 3$ BS2

00-00-30					
180-00-33					
202-05-40	202-05-10	202-05-18			
5) 22-05-59	202-05-26				
00-00-40					
157-55-18	157-54-38				

$\pi @ 5$ BS3

00-00-21			87-33-14	294.42	
180-00-37				89.739	294.150
159-57-08	159-56-47	159-56-39	90-56-13	309.31	309.266
6) 339-57-08	159-56-31			94.277	
00-00-22					
200-03-35	200-03-13				

$\pi @ 6$ BS5

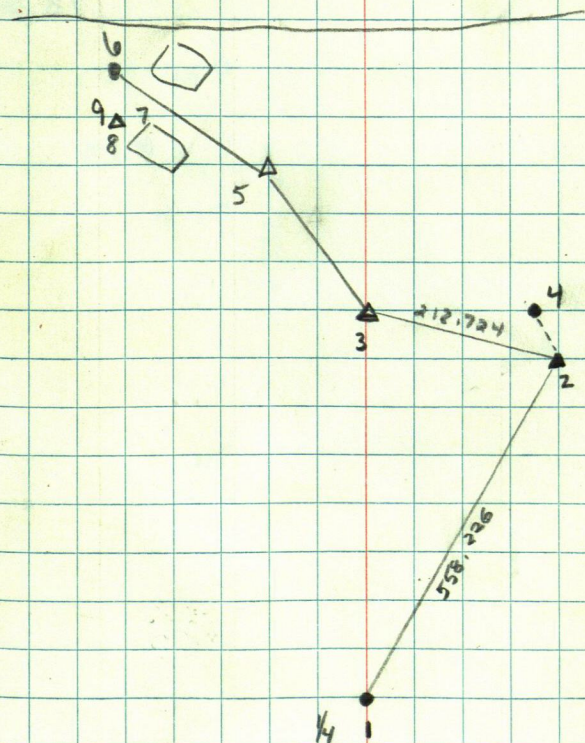
05-23-41					
7) 02-22-43				145.82	
				44.447	
8) 08-36-14				147.60	
				44.988	

$\pi @ 6$ BS5

9) 05-23-41					138.52
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SEPT 7, 1990 D. FARNHAM - G. MARTIN

10 MILE LAKE



WILLIS

 $\pi @ 6$ BS 5

9) 13-03-08

116.96

 $\pi @ 5$ BS 6

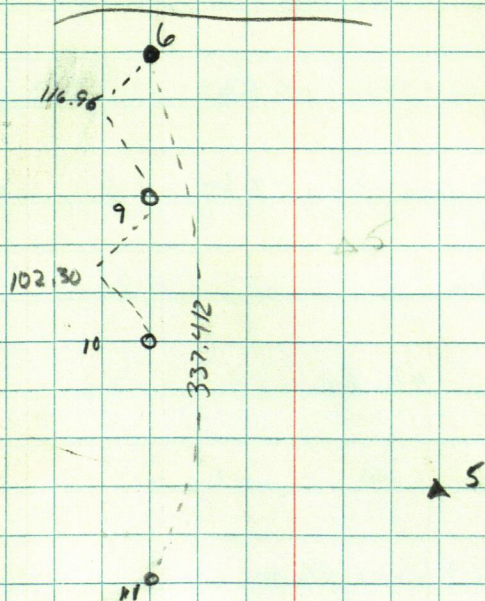
11) 255-41-46

78.64

SEPT 11, 1990

D. FARNAM - G. MARTINO

10 MILE LAKE



Time

Woodi	4 days - 2 hrs - 2½ hrs - 6 hrs - 3½ - 6 hrs - 6 hrs
Happy Landing Resort	4 hrs - 4 hrs - 3 hrs - 4 hrs - 4 hrs - 3¼ hrs
Gustafson	2 hrs - 3¼ hrs - ½ hr.
Bender.	3½ days - 3 hrs - 4 hrs - 2 days 1½ days
sec 24-137-25	6 hrs
Baggett Lake	4½ hrs
Cross Lake	1 hr
Dr Lee	7 hrs - 2½ hrs
Joe Foster	1½ hrs
Britton	5¼ hrs 5¼ hrs
Nanceys	2½ hrs
Sullivan	7 hrs - 1 hr - 2 hrs - 4 hrs
Ecklund	5 hrs

Meyers	4½ hrs
Silver Bay	7 hrs - 7 hrs - 3 hrs - 2½ hrs
Largey Abbey	1 hr
Perish Lake	1½ hrs
"	Trailer 8 hrs
Hollin	6 hr - 6 hrs - 6 hrs
Whelan	1 hr - 8 hrs - 1 hr.
Richardson	7 hrs - 1 hr. - 3 hrs ½ hr
Cote	2½ hrs
Sullivan	8 hrs - 5 hrs - 5 hrs - 5 hrs - 5 hrs - 8 hrs - 8 hrs 4 hrs ^F

HAYNES (LONG LAKE)

 $\pi @ 3$ BS 4

8) 346-41-16

10.57

 $\pi @ 5$ BS 4

9) 58-35-31

38.93

10) 173-27-31

16.50

 $\pi @ 4$ BS 3

11) 73-54-34

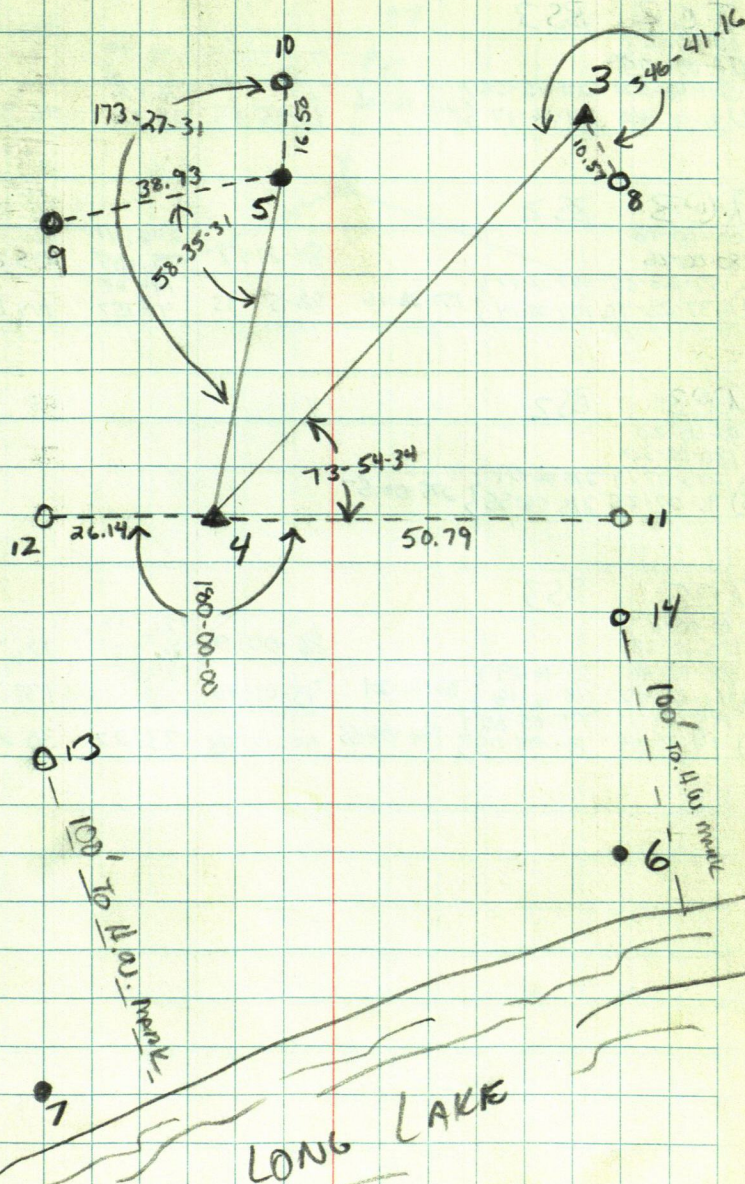
50.79

12)

26.14

SEPT. 11, 1990 D. FARNHAM - G. MARTIN

71



KIEFFERS

T02 BS3

00-00-27
180-00-25

211-46-22

1) 31-46-42

211-45-55}

211-46-17}

211-46-06

93-15-13

76.52

23.321

76.393

T03 BS2

00-00-18

180-00-26

157-28-35

4) 337-28-40

157-28-17}

157-28-14}

157-28-16

84-21-17

88-57-33

246.41

75.105

144.87

44.157

245.213

144.847

T03 BS2

00-00-20

180-00-30

275-07-19

5) 95-07-25

275-06-59}

275-06-55}

275-06-57

T05 BS3

00-00-11

180-00-22

88-16-40

6) 268-16-40

194-05-11

7) 14-05-09

88-16-29}

88-16-18}

194-05-00}

194-04-45}

88-16-24

93-01-40

94-04-53

114-13-08

86-00-06

93-01-40

114-13-08

126.48

38.551

137.93

42.039

33.22

126.1714

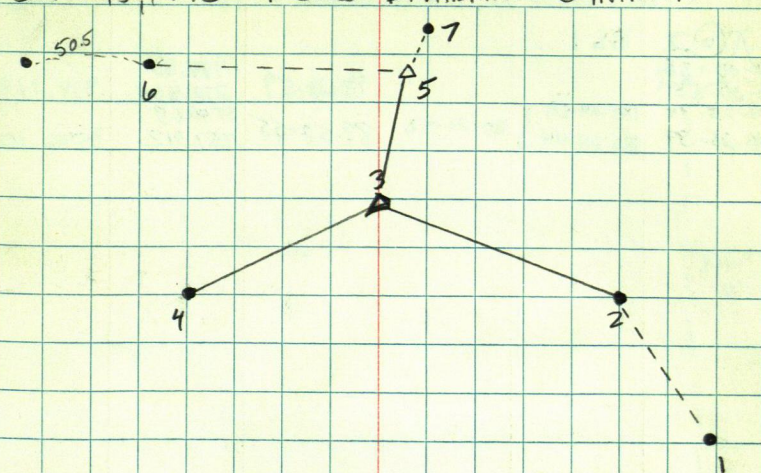
137.734

137.734

30.296

SEPT 13, 1990 F. CURRO - D. FARNHAM - G. MARTIN

72



RUNYAN

T@2		BS 1			
00-00-36					
180-00-55			90-28-59	944.80	914.768
180-25-35	180-24-59	180-24-52		278.834	
3) 00-25-39	180-24-44		89-52-55	3546.63	
				1081.012	3546.606

SEPT. 14, 1990

D. FARNAM - G. MARTIN

73

1/4 -

TWP
RD

43

1 RR SPIKE

2 NAIL

HON 200

HARRY OBARSKI

PC2 BS 1

1)		91-55-59	283.09 86.288	282.931
3)	180-00	90-11-50	168.56 51.377	168.557

PC3 BS 2

00-00-19				
180-00-20				
192-28-44	192-28-25	192-28-17		
5) 12-28-29	192-28-09			
00-00-09				
167-31-35	167-31-26			

PC5 BS 3

00-00-24			214.94	
180-00-33		85-12-46	65.515	214.191
137-10-11	137-09-47		92.51	
3) 17-10-16	137-09-43	137-09-45	28.196	90.889
		100-44-03		

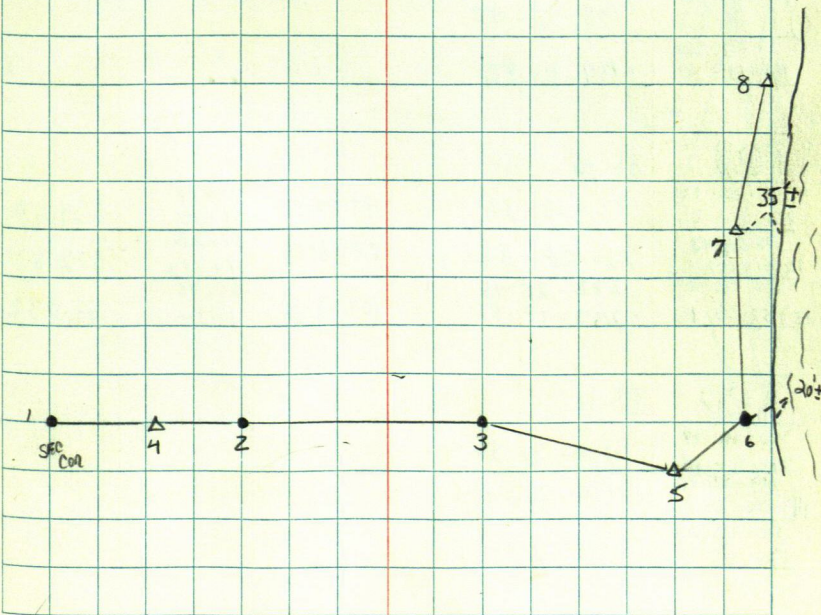
PC6 BS 5

00-00-42	139-56-21			
180-00-50				
139-57-03				
7) 319-57-10	139-56-20			
00-00-24				
220-03-39	220-03-15			

PC7 BS 6

00-00-29			179.27	
180-00-20	197-42-22	92-57-09	54.640	179.029
197-42-51			186.22	
8) 17-42-50	197-42-30	93-38-15	56.761	185.846
00-00-19				
162-17-47	162-17-28			

SEPT. 17, 1990 D. FARNAM - G. MARTIN

74⁸

15

HARRY OZANSKI

Te 17		BS 12	
00-00-25			204.87
180-00-34	89-17-19	89-59-32	62.441
89-17-44			624.58
15) 269-17-51	89-17-17	89-42-52	190.374
00-00-12			624.573
270-42-58	270-42-46		

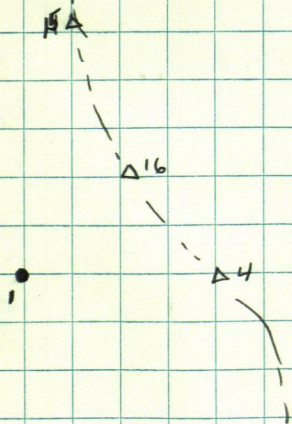
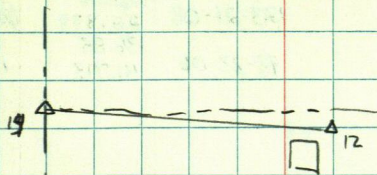
Te 14		BS 14	
00-00-12			
180-00-21	165-13-47		
165-13-59			
16) 345-14-09	165-13-48		
00-00-15			
194-48-09	194-47-54		

Te 16		BS 15	
00-00-39			297.61
180-00-34	171-49-52	88-47-43	90.711
171-50-31			373.53
4) 351-50-46	171-50-12	94-31-28	113.852
			297.542
			372.364

Te 4		BS 16	
00-00-04			
180-00-14	254-48-37		
254-48-41			193.76
1) 74-48-41	254-48-27	92-03-18	59.056
00-00-48			193.631
105-12-12	105-11-24		

Sept. 17, 1920

76



π@2 BS1

3) 180-00

123-21-08	75.06 22.878	62.697
93-22-06	136.85 41.713	136.614

π@3 BS2

179-24-12 }
4) 358-48-10 } 179-24-05

π@4 BS3

182-38-36 } 5) 05-16-40 }	182-38-20	88-06-08	251.10 76.535 64.85 19.769	250.961 64.836
		91-22-24		

π@1 BS2

76-58-09 }
6) 153-56-04 } 76-58-02

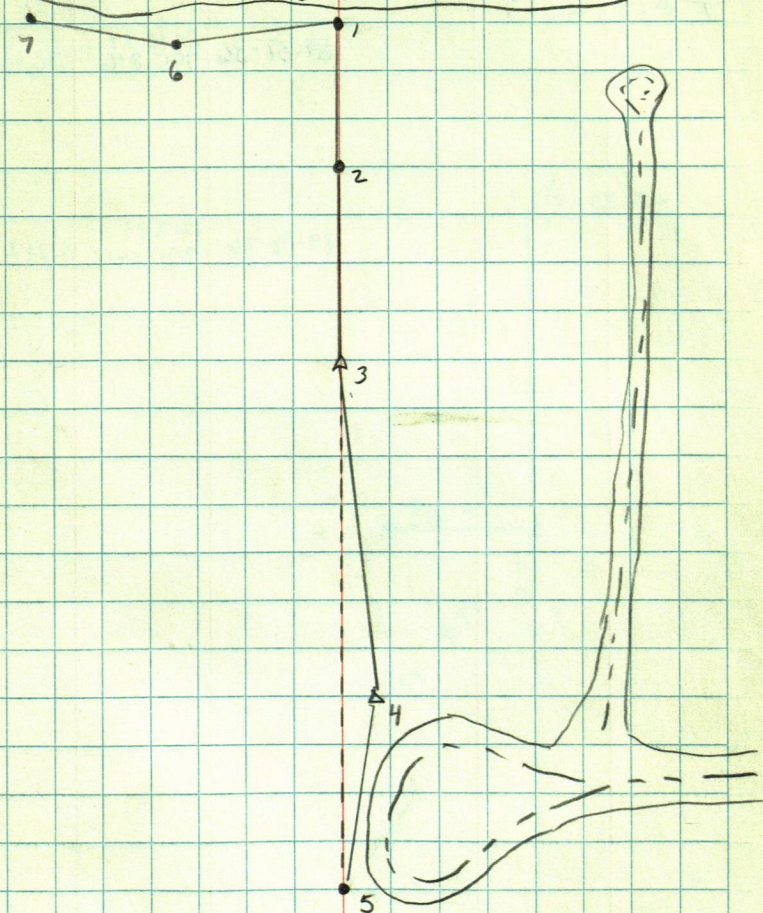
175.0

π@6 BS1

168-09-15 }
7) 336-18-18 } 168-09-09

150.0

SEPT 9, 1990 D. FARNA M. - G. MARTIN
BLACK WATER LAKE

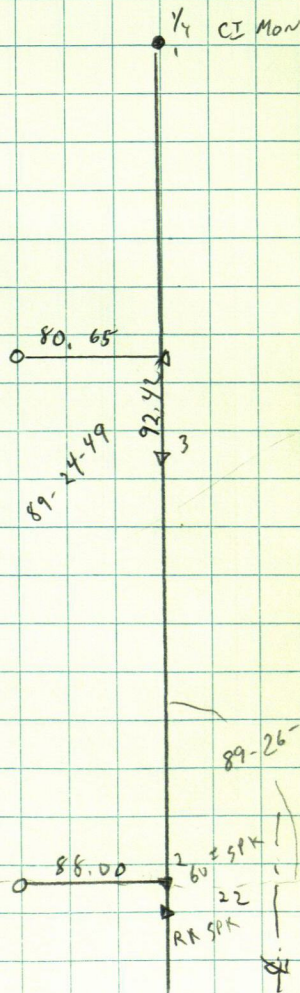


PINE RIVER BANK (JOHN ZAPPA)

Te 2 35 1

89-58-36	2610.94 795.816	2610.930
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89-38-36	1217.39 371.061	1217.362
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 E. CURD
 SEPT 20, 1990 D. FARNHAM - G. MARTIN


$$\begin{array}{r} 110 \\ 22 \\ \hline 8 \end{array}$$

TABLE I. — Tangents and External to a 1° Curve.
Chord = 100 ft.

V

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
64°	3580.3	1026.6	71°	4086.9	1308.2	78°	4639.8	1643.0
10'	3591.9	1032.8	10'	4099.5	1315.6	10'	4653.6	1651.7
20	3603.5	1039.0	20	4112.1	1322.9	20	4667.4	1660.5
30	3615.1	1045.2	30	4124.8	1330.3	30	4681.3	1669.2
40	3626.8	1051.4	40	4137.4	1337.7	40	4695.2	1678.1
50	3638.5	1057.7	50	4150.1	1345.1	50	4709.2	1686.9
65	3650.2	1063.9	72	4162.8	1352.6	79	4723.2	1695.8
10	3661.9	1070.2	10	4175.6	1360.1	10	4737.2	1704.7
20	3673.7	1076.6	20	4188.5	1367.6	20	4751.2	1713.7
30	3685.4	1082.9	30	4201.2	1375.2	30	4765.3	1722.7
40	3697.2	1089.3	40	4214.0	1382.8	40	4779.4	1731.7
50	3709.0	1095.7	50	4226.8	1390.4	50	4793.6	1740.8
66	3720.9	1102.2	73	4239.7	1398.0	80	4807.7	1749.9
10	3732.7	1108.6	10	4252.6	1405.7	10	4822.0	1759.0
20	3744.6	1115.1	20	4265.6	1413.5	20	4836.2	1768.2
30	3756.5	1121.7	30	4278.5	1421.2	30	4850.5	1777.4
40	3768.5	1128.2	40	4291.5	1429.0	40	4864.8	1786.7
50	3780.4	1134.8	50	4304.6	1436.8	50	4879.2	1796.0
67	3792.4	1141.4	74	4317.6	1444.6	81	4893.6	1805.3
10	3804.4	1148.0	10	4330.7	1452.5	10	4908.0	1814.7
20	3816.4	1154.7	20	4343.8	1460.4	20	4922.5	1824.1
30	3828.4	1161.3	30	4356.9	1468.4	30	4937.0	1833.6
40	3840.5	1168.1	40	4370.1	1476.4	40	4951.5	1843.1
50	3852.6	1174.8	50	4383.3	1484.4	50	4966.1	1852.6
68	3864.7	1181.6	75	4396.5	1492.4	82	4980.7	1862.2
10	3876.8	1188.4	10	4409.8	1500.5	10	4995.4	1871.8
20	3889.0	1195.2	20	4423.1	1508.6	20	5010.0	1881.5
30	3901.2	1202.0	30	4436.4	1516.7	30	5024.8	1891.2
40	3913.4	1208.9	40	4449.7	1524.9	40	5039.5	1900.9
50	3925.6	1215.8	50	4463.1	1533.1	50	5054.3	1910.7
69	3937.9	1222.7	76	4476.5	1541.4	83	5069.2	1920.5
10	3950.2	1229.7	10	4489.9	1549.7	10	5084.0	1930.4
20	3962.5	1236.7	20	4503.4	1558.0	20	5099.0	1940.3
30	3974.8	1243.7	30	4516.9	1566.3	30	5113.9	1950.3
40	3987.2	1250.8	40	4530.4	1574.7	40	5128.9	1960.2
50	3999.5	1257.9	50	4544.0	1583.1	50	5143.9	1970.3
70	4011.9	1265.0	77	4557.6	1591.6	84	5159.0	1980.4
10	4024.4	1272.1	10	4571.2	1600.1	10	5174.1	1990.5
20	4036.8	1279.3	20	4584.8	1608.6	20	5189.3	2000.6
30	4049.3	1286.5	30	4598.5	1617.1	30	5204.4	2010.8
40	4061.8	1293.6	40	4612.2	1625.7	40	5219.7	2021.1
50	4074.4	1300.9	50	4626.0	1634.4	50	5234.9	2031.4

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
60°	T=.21 E=.056	.42 .112	.63 .168	.84 .225	1.05 .283	1.27 .340	1.49 .398	1.71 .457	1.94 .516	2.17 .575	2.38 .636	2.60 .697	2.83 .774	3.07 .851
65°	T=.23 E=.067	.46 .135	.69 .204	.93 .273	1.16 .343	1.40 .412	1.64 .483	1.88 .554	2.13 .625	2.38 .697	2.63 .771	2.88 .845	3.13 .922	3.39 1.01
70°	T=.25 E=.080	.51 .159	.76 .240	1.02 .321	1.28 .403	1.54 .485	1.80 .568	2.06 .652	2.33 .735	2.60 .819	2.88 .906	3.16 .994	3.44 1.08	3.72 1.17
75°	T=.27 E=.095	.56 .182	.83 .286	1.12 .383	1.40 .480	1.69 .578	1.98 .678	2.27 .777	2.57 .877	2.87 .977	3.16 1.07	3.47 1.18	3.78 1.29	4.09 1.39
80°	T=.30 E=.110	.61 .220	.91 .332	1.22 .445	1.53 .558	1.84 .671	2.15 .787	2.46 .903	2.78 1.02	3.10 1.13	3.44 1.25	3.78 1.38	4.12 1.50	4.46 1.62
85°	T=.33 E=.128	.66 .259	1.00 .391	1.33 .524	1.68 .657	2.02 .790	2.36 .926	2.70 1.06	3.05 1.20	3.40 1.34	3.77 1.47	4.14 1.62	4.55 1.76	4.89 1.91

TABLE I. — Tangents and External to a 1° Curve.
Chord = 100 ft.

VII

Int. Angle	Tangent	External	Int. Angle	Tangent	External	Int. Angle	Tangent	External
106°	7603.5	3791.0	111°	8336.7	4386.1	116°	9169.4	5082.7
10'	7626.6	3809.4	10'	8362.7	4407.6	10'	9199.1	5107.9
20	7649.7	3827.9	20	8388.9	4429.2	20	9229.0	5133.3
30	7672.9	3846.5	30	8415.1	4450.9	30	9259.0	5158.8
40	7696.3	3865.2	40	8441.5	4472.7	40	9289.2	5184.5
50	7719.7	3884.0	50	8468.0	4494.6	50	9319.5	5210.3
107	7743.2	3902.9	112	8494.6	4516.6	117	9349.9	5236.2
10	7766.8	3921.9	10	8521.3	4538.8	10	9380.5	5262.3
20	7790.5	3940.9	20	8548.1	4561.1	20	9411.3	5288.6
30	7814.3	3960.1	30	8575.0	4583.4	30	9442.2	5315.0
40	7838.1	3979.4	40	8602.1	4606.0	40	9473.2	5341.5
50	7862.1	3998.7	50	8629.3	4628.6	50	9504.4	5368.2
108	7886.2	4018.2	113	8656.6	4651.3	118	9535.7	5395.1
10	7910.4	4037.8	10	8684.0	4674.2	10	9567.2	5422.1
20	7934.6	4057.4	20	8711.5	4697.2	20	9598.9	5449.2
30	7959.0	4077.2	30	8739.2	4720.3	30	9630.7	5476.5
40	7983.5	4097.1	40	8767.0	4743.6	40	9662.6	5504.0
50	8008.0	4117.0	50	8794.9	4766.9	50	9694.7	5531.7
109	8032.7	4137.1	114	8822.9	4790.4	119	9727.0	5559.4
10	8057.4	4157.3	10	8851.0	4814.1	10	9759.4	5587.4
20	8082.3	4177.5	20	8879.3	4837.8	20	9792.0	5615.5
30	8107.3	4197.9	30	8907.7	4861.7	30	9824.8	5643.8
40	8132.3	4218.4	40	8936.3	4885.7	40	9857.7	5672.2
50	8157.5	4239.0	50	8965.0	4909.9	50	9890.8	5700.9
110	8182.8	4259.7	115	8993.8	4934.1	120	9924.0	5729.7
10	8208.2	4280.5	10	9022.7	4958.6	10	9957.5	5758.6
20	8233.7	4301.4	20	9051.7	4983.1	20	9991.0	5787.7
30	8259.3	4322.4	30	9080.9	5007.8	30	10025.0	5817.0
40	8285.0	4343.6	40	9110.3	5032.6	40	10059.0	5846.5
50	8310.8	4364.8	50	9139.8	5057.6	50	10093.0	5876.1

90-11-25
92-25-49
1317.897

Corrections to be Added (T = Tangent. E = External.)

Int. Angle	Curve 5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
100°	T=.43 E=.200	.86 .401	1.30 .604	1.74 .809	2.18 1.01	2.62 1.22	3.06 1.43	3.50 1.64	3.95 1.85	4.40 2.06	4.88 2.28	5.37 2.50	5.85 2.73	6.34 2.96
105°	T=.46 E=.230	.94 .470	1.42 .700	1.90 .938	2.38 1.17	2.87 1.42	3.34 1.65	3.84 1.90	4.35 2.14	4.84 2.39	5.35 2.64	5.87 2.90	6.40 3.16	6.93 3.41
110°	T=.50 E=.260	1.03 .535	1.55 .808	2.08 1.08	2.60 1.36	3.14 1.63	3.66 1.91	4.21 2.19	4.76 2.49	5.31 2.61	5.86 3.05	6.43 3.35	7.01 3.65	7.59 3.95
115°	T=.54 E=.307	1.13 .624	1.70 .939	2.29 1.26	2.86 1.57	3.45 1.89	4.03 2.21	4.63 2.54	5.23 2.87	5.83 3.20	6.44 3.53	7.07 3.88	7.70 4.23	8.35 4.58
120°	T=.61 E=.339	1.25 .720	1.89 1.08	2.52 1.45	3.16 1.82	3.81 2.20	4.44 2.56	5.11 2.95	5.78 3.33	6.44 3.72	7.11 4.10	7.80 4.50	8.51 4.91	9.21 5.32

VIII

TABLE II. — Radii, Ordinates and Deflections. Chord = 100 ft.

Deg.	Radius	Mid. Ord.	Tan. Dist.	Def. Dist.	Def. for 1 Ft.	Deg.	Radius	Mid. Ord.	Tan. Dist.	Def. Dist.	Def. for 1 Ft.
	ft.	ft.	ft.	ft.			ft.	ft.	ft.	ft.	
0° 10'	34377.	.036	.145	.291	0.05	7°	819.0	1.528	6.105	12.21	2.10
20	17189.	.073	.291	.582	0.10	20'	781.8	1.600	6.395	12.79	2.20
30	11459.	.109	.436	.873	0.15	30	764.5	1.637	6.540	13.08	2.25
40	8594.4	.145	.582	1.164	0.20	40	747.9	1.673	6.685	13.37	2.30
50	6875.5	.182	.727	1.454	0.25	50	716.8	1.746	6.976	13.95	2.40
1	5729.6	.218	.873	1.745	0.30	20	688.2	1.819	7.266	14.53	2.50
10	4911.2	.255	1.018	2.036	0.35	30	674.7	1.855	7.411	14.82	2.55
20	4297.3	.291	1.164	2.327	0.40	40	661.7	1.892	7.556	15.11	2.60
30	3819.8	.327	1.309	2.618	0.45	50	637.3	1.965	7.846	15.69	2.70
40	3437.9	.364	1.454	2.909	0.50	20	614.6	2.037	8.136	16.27	2.80
50	3125.4	.400	1.600	3.200	0.55	30	603.8	2.074	8.281	16.56	2.85
2	2864.9	.436	1.745	3.490	0.60	40	593.4	2.110	8.426	16.85	2.90
10	2644.6	.473	1.891	3.781	0.65	50	573.7	2.183	8.716	17.43	3.00
20	2455.7	.509	2.036	4.072	0.70	30	546.4	2.292	9.150	18.30	3.15
30	2292.0	.545	2.181	4.363	0.75	40	521.7	2.402	9.585	19.16	3.30
40	2148.8	.582	2.327	4.654	0.80	50	499.1	2.511	10.02	20.04	3.45
50	2022.4	.618	2.472	4.945	0.85	20	478.3	2.620	10.45	20.91	3.60
3	1910.1	.655	2.618	5.235	0.90	30	459.3	2.730	10.89	21.77	3.75
10	1809.6	.691	2.763	5.526	0.95	40	441.7	2.839	11.32	22.64	3.90
20	1719.1	.727	2.908	5.817	1.00	50	425.4	2.949	11.75	23.51	4.05
30	1637.3	.764	3.054	6.108	1.05	20	410.3	3.058	12.18	24.37	4.20
40	1562.9	.800	3.199	6.398	1.10	30	396.2	3.168	12.62	25.24	4.35
50	1495.0	.836	3.345	6.689	1.15	40	383.1	3.277	13.05	26.11	4.50
4	1432.7	.873	3.490	6.980	1.20	50	370.8	3.387	13.49	26.97	4.65
10	1375.4	.909	3.635	7.271	1.25	20	359.3	3.496	13.92	27.84	4.80
20	1322.5	.945	3.718	7.561	1.30	30	348.5	3.606	14.35	28.70	4.95
30	1273.6	.982	3.926	7.852	1.35	40	338.3	3.716	14.78	29.56	5.10
40	1228.1	1.018	4.071	8.143	1.40	50	319.6	3.935	15.64	31.29	5.40
50	1185.8	1.055	4.217	8.433	1.45	20	302.9	4.155	16.51	33.01	5.70
5	1146.3	1.091	4.362	8.724	1.50	30	287.9	4.374	17.37	34.73	6.00
10	1109.3	1.127	4.507	9.014	1.55	40	274.4	4.594	18.22	36.44	6.30
20	1074.7	1.164	4.653	9.305	1.60	50	262.0	4.814	19.08	38.16	6.60
30	1042.1	1.200	4.798	9.596	1.65	20	250.8	5.035	19.94	39.87	6.90
40	1011.5	1.237	4.943	9.886	1.70	30	240.5	5.255	20.79	41.58	7.20
50	982.6	1.273	5.088	10.18	1.75	40	231.0	5.476	21.64	43.28	7.50
6	955.4	1.309	5.234	10.47	1.80	50	222.3	5.697	22.50	44.99	7.80
10	929.6	1.346	5.379	10.76	1.85	20	214.2	5.918	23.35	46.69	8.10
20	905.1	1.382	5.524	11.05	1.90	30	206.7	6.139	24.19	48.38	8.40
30	881.9	1.418	5.669	11.34	1.95	40	199.7	6.360	25.04	50.07	8.70
40	859.9	1.455	5.814	11.63	2.00	50	193.2	6.583	25.88	51.76	9.00

The middle ordinate in inches for any cord of length (O) is equal to .0012 C² multiplied by the middle ordinate taken from the above table. Thus, if it desired to bend a 30 ft. rail to fit a 10 degree curve, its middle ordinate should be .0012×900×2.183 or 2.36 inches.

TABLE III. Deflections for Sub Chords for Short Radius Curves.

Degree of Curve	Radius 50	$\frac{1}{2}$ sub chord = sin of $\frac{1}{2}$ def. angle				Length of arc for 100 ft.
	sin. $\frac{1}{2}$ def. ang.	12.5 Ft.	15 Ft.	20 Ft.	25 Ft.	
30°	193.18	1° 51'	2° 17'	2° 58'	3° 43'	101.15
32°	181.39	1° 59'	2° 25'	3° 10'	3° 58'	101.33
34°	171.01	2° 06'	2° 33'	3° 21'	4° 12'	101.48
36°	161.80	2° 13'	2° 41'	3° 33'	4° 26'	101.66
38°	153.58	2° 20'	2° 49'	3° 44'	4° 40'	101.85
40°	146.19	2° 27'	2° 57'	3° 55'	4° 54'	102.06
42°	139.52	2° 34'	3° 05'	4° 07'	5° 08'	102.29
44°	133.47	2° 41'	3° 13'	4° 18'	5° 22'	102.53
46°	127.97	2° 48'	3° 21'	4° 29'	5° 36'	102.76
48°	122.92	2° 55'	3° 29'	4° 40'	5° 50'	103.00
50°	118.31	3° 02'	3° 38'	4° 51'	6° 04'	103.24
52°	114.06	3° 09'	3° 46'	5° 02'	6° 17'	103.54
54°	110.11	3° 16'	3° 54'	5° 13'	6° 31'	103.84
56°	106.50	3° 22'	4° 02'	5° 23'	6° 44'	104.14
58°	103.14	3° 29'	4° 10'	5° 34'	6° 57'	104.43
60°	100.00	3° 35'	4° 18'	5° 44'	7° 11'	104.72

CURVE FORMULAS

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

$$T = \frac{50 \tan \frac{1}{2} I}{\sin \frac{1}{2} D}$$

$$\sin \frac{1}{2} D = \frac{50}{R}$$

$$\sin \frac{1}{2} D = \frac{50 \tan \frac{1}{2} I}{T}$$

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

$$R = \frac{50}{\sin \frac{1}{2} D}$$

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

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

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

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

$$\text{Tan. def.} = \frac{1}{2} \text{ chord def.}$$

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

To find angle for a given distance and deflection.

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

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

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

GENERAL DATA

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

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

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

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

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

LEVELING. The correction for curvature and refraction, in feet and decimals of feet is equal to $0.574d^2$, where d is the distance in miles. The correction for curvature alone is closely, $\frac{3}{8}d^2$. The combined correction is negative.

PROBABLE ERROR. If d_1, d_2, d_3 , etc. are the discrepancies of various results from the mean, and if Σd^2 = the sum of the squares of these differences and n = the number of observations, then the probable error of the mean =

$$= 0.6745 \sqrt{\frac{\Sigma d^2}{n(n-1)}}$$

SOLAR EPHEMERIS. Attention is called to the Solar Ephemeris for the current year, published by Keuffel & Esser Co., and furnished upon request. This handy booklet, $3\frac{3}{4} \times 6$ in., has about 190 pages of data very useful to the Surveyor; such as the adjustments of transits, levels and solar attachments; directions and tables for determining the meridian and the latitude from observations on the sun and Polaris; stadia measurements; magnetic declination; arithmetic constants, etc.

TABLE IV.—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 V.—Inches in Decimals of a Foot.

1-16	3-32	$\frac{1}{4}$	3-16	$\frac{1}{2}$	5-16	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{7}{8}$
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

X

Natural Trigonometrical Functions

Angle. Sin. Tan. Sec. Cosec. Cotg. Cosin.

Angle. Sin. Tan. Sec. Cosec. Cotg. Cosin.

Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	Angle.	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.
0°	0	0	1.	∞	∞	1.	90°	1	∞	∞	0	0	0
10	.0029	.0029		343.8	343.8	1.	50	.1421	.1435	1.0102	7.040	6.968	.98986
20	.0058	.0058		171.9	171.9	.99998	40	.20	.1449	.1465	1.0107	6.900	6.827
30	.0087	.0087		114.6	114.6	.99996	30	.30	.1478	.1495	1.0111	6.766	6.691
40	.0116	.0116	1.0001	85.94	85.94	.99993	20	40	.1507	.1524	1.0115	6.636	6.561
50	.0145	.0145	1.0001	68.76	68.75	.99989	10	50	.1536	.1554	1.0120	6.512	6.435
1	.0175	.0175	1.0002	57.30	57.29	.99985	89	9	.1564	.1584	1.0125	6.394	6.314
10	.0204	.0204	1.0002	49.11	49.10	.99979	50	10	.1593	.1614	1.0129	6.277	6.197
20	.0233	.0233	1.0003	42.98	42.96	.99973	40	20	.1622	.1644	1.0134	6.166	6.084
30	.0262	.0262	1.0003	38.20	38.19	.99966	30	30	.1650	.1673	1.0139	6.059	5.976
40	.0291	.0291	1.0004	34.38	34.37	.99958	20	40	.1679	.1703	1.0144	5.955	5.871
50	.0320	.0320	1.0005	31.26	31.24	.99949	10	50	.1708	.1733	1.0149	5.855	5.769
1	.0349	.0349	1.0006	28.65	28.64	.99939	88	10	.1736	.1763	1.0154	5.759	5.671
10	.0378	.0378	1.0007	26.45	26.43	.99929	50	10	.1765	.1793	1.0160	5.665	5.576
20	.0407	.0407	1.0008	24.56	24.54	.99917	40	20	.1794	.1823	1.0165	5.575	5.485
30	.0436	.0437	1.0010	22.93	22.90	.99905	30	30	.1822	.1853	1.0170	5.488	5.396
40	.0465	.0466	1.0011	21.49	21.47	.99892	20	40	.1851	.1883	1.0176	5.403	5.309
50	.0494	.0495	1.0012	20.23	20.21	.99878	10	50	.1880	.1914	1.0181	5.320	5.226
3	.0523	.0524	1.0014	19.11	19.08	.99863	87	11	.1908	.1944	1.0187	5.241	5.145
10	.0552	.0553	1.0015	18.10	18.07	.99847	50	10	.1937	.1974	1.0193	5.164	5.066
20	.0581	.0582	1.0017	17.20	17.17	.99831	40	20	.1965	.2004	1.0199	5.089	4.989
30	.0610	.0612	1.0019	16.38	16.35	.99813	30	30	.1994	.2035	1.0205	5.016	4.915
40	.0640	.0641	1.0020	15.64	15.60	.99795	20	40	.2022	.2065	1.0211	4.945	4.843
50	.0669	.0670	1.0022	14.96	14.92	.99776	10	50	.2051	.2095	1.0217	4.877	4.773
4	.0698	.0699	1.0024	14.34	14.30	.99756	86	12	.2079	.2126	1.0223	4.810	4.705
10	.0727	.0729	1.0027	13.76	13.73	.99736	50	10	.2108	.2156	1.0230	4.745	4.638
20	.0756	.0758	1.0029	13.23	13.20	.99714	40	20	.2136	.2186	1.0236	4.682	4.574
30	.0785	.0787	1.0031	12.75	12.71	.99692	30	30	.2164	.2217	1.0243	4.620	4.511
40	.0814	.0816	1.0033	12.29	12.25	.99668	20	40	.2193	.2247	1.0249	4.560	4.449
50	.0843	.0846	1.0036	11.87	11.83	.99644	10	50	.2221	.2278	1.0256	4.502	4.390
5	.0872	.0875	1.0038	11.47	11.43	.99619	85	13	.2250	.2309	1.0263	4.445	4.331
10	.0901	.0904	1.0041	11.10	11.06	.99594	50	10	.2278	.2339	1.0270	4.390	4.275
20	.0929	.0934	1.0043	10.76	10.71	.99567	40	20	.2306	.2370	1.0277	4.336	4.219
30	.0958	.0963	1.0046	10.43	10.39	.99540	30	30	.2334	.2401	1.0284	4.284	4.165
40	.0987	.0992	1.0049	10.13	10.08	.99511	20	40	.2363	.2432	1.0291	4.232	4.113
50	.1016	.1022	1.0052	9.839	9.788	.99482	10	50	.2391	.2462	1.0299	4.182	4.061
6	.1045	.1051	1.0055	9.567	9.514	.99452	84	14	.2419	.2493	1.0306	4.133	4.011
10	.1074	.1080	1.0058	9.309	9.255	.99421	50	10	.2447	.2524	1.0314	4.086	3.962
20	.1103	.1110	1.0061	9.065	9.010	.99390	40	20	.2476	.2555	1.0321	4.039	3.914
30	.1132	.1139	1.0065	8.834	8.777	.99357	30	30	.2504	.2586	1.0329	3.994	3.867
40	.1161	.1169	1.0068	8.614	8.556	.99324	20	40	.2532	.2617	1.0337	3.949	3.821
50	.1190	.1198	1.0072	8.405	8.345	.99290	10	50	.2560	.2648	1.0345	3.906	3.776
7	.1219	.1228	1.0075	8.206	8.144	.99255	83	15	.2588	.2679	1.0353	3.864	3.732
10	.1248	.1257	1.0079	8.016	7.953	.99219	50	10	.2616	.2711	1.0361	3.822	3.689
20	.1276	.1287	1.0082	7.834	7.770	.99182	40	20	.2644	.2742	1.0369	3.782	3.647
30	.1305	.1317	1.0086	7.661	7.596	.99144	30	30	.2672	.2773	1.0377	3.742	3.606
40	.1334	.1346	1.0090	7.496	7.429	.99106	20	40	.2700	.2805	1.0386	3.703	3.566
50	.1363	.1376	1.0094	7.337	7.269	.99067	10	50	.2728	.2836	1.0394	3.665	3.526

82°

74°

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

90-16-39 2686.11 818,726 54

Natural Trigonometrical Functions

90-01-02 2607.43 199,752 18

Angle. Sin. Tan. Sec. Cosec. Cotg. Cosin.

Angle. Sin. Tan. Sec. Cosec. Cotg. Cosin.

0							
16	.2756	.2867	1.0403	3.628	3.487	.96126	74
10	.2784	.2899	1.0412	3.592	3.450	.96046	50
20	.2812	.2931	1.0423	3.556	3.412	.95964	40
30	.2840	.2962	1.0429	3.521	3.376	.95882	30
40	.2868	.2994	1.0438	3.487	3.340	.95799	20
50	.2896	.3026	1.0448	3.453	3.305	.95715	10
17	.2924	.3057	1.0457	3.420	3.271	.95630	73
10	.2952	.3089	1.0466	3.388	3.237	.95545	50
20	.2979	.3121	1.0476	3.357	3.204	.95459	40
30	.3007	.3153	1.0485	3.326	3.172	.95372	30
40	.3035	.3185	1.0495	3.295	3.140	.95284	20
50	.3062	.3217	1.0505	3.265	3.108	.95195	10
18	.3090	.3249	1.0515	3.236	3.078	.95106	72
10	.3118	.3281	1.0525	3.207	3.048	.95015	50
20	.3145	.3314	1.0535	3.179	3.018	.94924	40
30	.3173	.3346	1.0545	3.152	2.989	.94832	30
40	.3201	.3378	1.0555	3.124	2.960	.94740	20
50	.3228	.3411	1.0566	3.098	2.932	.94646	10
19	.3256	.3443	1.0576	3.072	2.904	.94552	71
10	.3283	.3476	1.0587	3.046	2.877	.94457	50
20	.3311	.3508	1.0598	3.020	2.850	.94361	40
30	.3338	.3541	1.0608	2.996	2.824	.94264	30
40	.3365	.3574	1.0619	2.971	2.798	.94167	20
50	.3393	.3607	1.0631	2.947	2.773	.94068	10
20	.3420	.3640	1.0642	2.924	2.747	.93969	70
10	.3448	.3673	1.0653	2.902	2.723	.93869	50
20	.3475	.3706	1.0665	2.878	2.699	.93769	40
30	.3502	.3739	1.0676	2.856	2.675	.93667	30
40	.3529	.3772	1.0688	2.833	2.651	.93565	20
50	.3557	.3805	1.0700	2.811	2.628	.93462	10
21	.3584	.3839	1.0711	2.790	2.605	.93358	69
10	.3611	.3872	1.0723	2.769	2.583	.93253	50
20	.3638	.3906	1.0736	2.749	2.560	.93148	40
30	.3665	.3939	1.0748	2.729	2.539	.93042	30
40	.3692	.3973	1.0760	2.709	2.517	.92935	20
50	.3719	.4006	1.0773	2.689	2.496	.92827	10
22	.3746	.4040	1.0785	2.670	2.475	.92718	68
10	.3773	.4074	1.0798	2.650	2.455	.92609	50
20	.3800	.4108	1.0811	2.632	2.434	.92499	40
30	.3827	.4142	1.0824	2.613	2.414	.92388	30
40	.3854	.4176	1.0837	2.595	2.394	.92276	20
50	.3881	.4210	1.0850	2.577	2.375	.92164	10
23	.3907	.4245	1.0864	2.559	2.356	.92050	67
10	.3934	.4279	1.0877	2.542	2.337	.91936	50
20	.3961	.4314	1.0891	2.525	2.318	.91822	40
30	.3987	.4348	1.0904	2.508	2.300	.91706	30
40	.4014	.4383	1.0918	2.491	2.282	.91590	20
50	.4041	.4417	1.0932	2.475	2.264	.91472	10

66

0							
24	.4067	.4452	1.0946	2.459	2.246	.91355	66
10	.4094	.4487	1.0961	2.443	2.229	.91236	50
20	.4120	.4522	1.0975	2.427	2.211	.91116	40
30	.4147	.4557	1.0989	2.411	2.194	.90996	30
40	.4173	.4592	1.1004	2.396	2.177	.90875	20
50	.4200	.4628	1.1019	2.381	2.161	.90753	10
25	.4226	.4663	1.1034	2.366	2.145	.90631	65
10	.4253	.4699	1.1049	2.351	2.128	.90507	50
20	.4279	.4734	1.1064	2.337	2.112	.90383	40
30	.4305	.4770	1.1079	2.323	2.097	.90259	30
40	.4331	.4806	1.1095	2.309	2.081	.90133	20
50	.4358	.4841	1.1110	2.295	2.066	.90007	10
26	.4384	.4877	1.1126	2.281	2.050	.89879	64
10	.4410	.4913	1.1142	2.268	2.035	.89752	50
20	.4436	.4950	1.1158	2.254	2.020	.89623	40
30	.4462	.4986	1.1174	2.241	2.006	.89493	30
40	.4488	.5022	1.1190	2.228	1.991	.89363	20
50	.4514	.5059	1.1207	2.215	1.977	.89232	10
27	.4540	.5095	1.1223	2.203	1.963	.89101	63
10	.4566	.5132	1.1240	2.190	1.949	.88968	50
20	.4592	.5169	1.1257	2.178	1.935	.88835	40
30	.4617	.5206	1.1274	2.166	1.921	.88701	30
40	.4643	.5243	1.1291	2.154	1.907	.88566	20
50	.4669	.5280	1.1308	2.142	1.894	.88431	10
28	.4695	.5317	1.1326	2.130	1.881	.88295	62
10	.4720	.5354	1.1343	2.119	1.868	.88158	50
20	.4746	.5392	1.1361	2.107	1.855	.88020	40
30	.4772	.5430	1.1379	2.096	1.842	.87882	30
40	.4797	.5467	1.1397	2.085	1.829	.87743	20
50	.4823	.5505	1.1415	2.073	1.816	.87603	10
29	.4848	.5543	1.1434	2.063	1.804	.87462	61
10	.4874	.5581	1.1452	2.052	1.792	.87321	50
20	.4899	.5619	1.1471	2.041	1.780	.87178	40
30	.4924	.5658	1.1490	2.031	1.767	.87036	30
40	.4950	.5696	1.1509	2.020	1.756	.86892	20
50	.4975	.5735	1.1528	2.010	1.744	.86748	10
30	.5000	.5774	1.1547	2.000	1.732	.86603	60
10	.5025	.5812	1.1566	1.990	1.720	.86457	50
20	.5050	.5851	1.1586	1.980	1.709	.86310	40
30	.5075	.5890	1.1606	1.970	1.698	.86163	30
40	.5100	.5930	1.1626	1.961	1.686	.86015	20
50	.5125	.5969	1.1646	1.951	1.675	.85866	10
31	.5150	.6009	1.1666	1.942	1.664	.85717	59
10	.5175	.6048	1.1687	1.932	1.653	.85567	50
20	.5200	.6088	1.1707	1.923	1.643	.85416	40
30	.5225	.6128	1.1728	1.914	1.632	.85264	30
40	.5250	.6168	1.1749	1.905	1.621	.85112	20
50	.5275	.6208	1.1770	1.896	1.611	.84959	10

58

97-55-40 111.65

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

34.031

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

XII

Natural Trigonometrical Functions

Angle. Sin. Tan. Sec. Cosec. Cotg. Cosin.

375-09-05

Angle	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.
32	.5299	.6249	1.1792	1.887	1.600	.84805
10	.5324	.6289	1.1813	1.883	1.590	.84650
20	.5349	.6330	1.1835	1.879	1.580	.84495
30	.5373	.6371	1.1857	1.861	1.570	.84339
40	.5398	.6412	1.1879	1.853	1.560	.84182
50	.5422	.6453	1.1901	1.844	1.550	.84025
33	.5446	.6494	1.1924	1.836	1.540	.83867
10	.5471	.6536	1.1946	1.828	1.530	.83708
20	.5495	.6577	1.1969	1.820	1.520	.83549
30	.5519	.6619	1.1992	1.812	1.511	.83389
40	.5544	.6661	1.2015	1.804	1.501	.83228
50	.5568	.6703	1.2039	1.796	1.492	.83066
34	.5592	.6745	1.2062	1.788	1.483	.82904
10	.5616	.6787	1.2086	1.781	1.473	.82741
20	.5640	.6830	1.2110	1.773	1.464	.82577
30	.5664	.6873	1.2134	1.766	1.455	.82413
40	.5688	.6916	1.2158	1.758	1.446	.82248
50	.5712	.6959	1.2183	1.751	1.437	.82082
35	.5736	.7002	1.2208	1.743	1.428	.81915
10	.5760	.7046	1.2233	1.736	1.419	.81748
20	.5783	.7089	1.2258	1.729	1.411	.81580
30	.5807	.7133	1.2283	1.722	1.402	.81412
40	.5831	.7177	1.2309	1.715	1.393	.81242
50	.5854	.7221	1.2335	1.708	1.385	.81072
36	.5878	.7265	1.2361	1.701	1.376	.80902
10	.5901	.7310	1.2387	1.695	1.368	.80730
20	.5925	.7355	1.2413	1.688	1.360	.80558
30	.5948	.7400	1.2440	1.681	1.351	.80386
40	.5972	.7445	1.2466	1.675	1.343	.80212
50	.5995	.7490	1.2494	1.668	1.335	.80038
37	.6018	.7536	1.2521	1.662	1.327	.79864
10	.6041	.7581	1.2549	1.655	1.319	.79688
20	.6065	.7627	1.2577	1.649	1.311	.79512
30	.6088	.7673	1.2605	1.643	1.303	.79335
40	.6111	.7720	1.2633	1.636	1.295	.79158
50	.6134	.7766	1.2661	1.630	1.288	.78980
38	.6157	.7813	1.2690	1.624	1.280	.78801
10	.6180	.7860	1.2719	1.618	1.272	.78622
20	.6202	.7907	1.2748	1.612	1.265	.78442
30	.6225	.7954	1.2778	1.606	1.257	.78261
40	.6248	.8002	1.2808	1.601	1.250	.78079
50	.6271	.8050	1.2838	1.595	1.242	.77897

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

Angle. Sin. Tan. Sec. Cosec. Cotg. Cosin.

195-03-34

Angle	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.
39	.6293	.8098	1.2868	1.589	1.235	.77715
10	.6316	.8146	1.2898	1.583	1.228	.77531
20	.6338	.8195	1.2929	1.578	1.220	.77347
30	.6361	.8243	1.2969	1.572	1.213	.77162
40	.6383	.8292	1.2991	1.567	1.206	.76977
50	.6406	.8342	1.3022	1.561	1.199	.76791
40	.6428	.8391	1.3054	1.556	1.192	.76604
10	.6450	.8441	1.3086	1.550	1.185	.76417
20	.6472	.8491	1.3118	1.545	1.178	.76229
30	.6494	.8541	1.3151	1.540	1.171	.76041
40	.6517	.8591	1.3184	1.535	1.164	.75851
50	.6539	.8642	1.3217	1.529	1.157	.75661
41	.6561	.8693	1.3251	1.524	1.150	.75471
10	.6583	.8744	1.3284	1.519	1.144	.75280
20	.6604	.8796	1.3318	1.514	1.137	.75088
30	.6626	.8847	1.3352	1.509	1.130	.74896
40	.6648	.8899	1.3386	1.504	1.124	.74703
50	.6670	.8952	1.3421	1.499	1.117	.74509
42	.6691	.9004	1.3456	1.494	1.111	.74314
10	.6713	.9057	1.3492	1.489	1.104	.74120
20	.6734	.9110	1.3527	1.485	1.098	.73924
30	.6756	.9163	1.3563	1.480	1.091	.73728
40	.6777	.9217	1.3600	1.476	1.085	.73531
50	.6799	.9271	1.3636	1.471	1.079	.73333
43	.6820	.9325	1.3673	1.466	1.072	.73135
10	.6841	.9380	1.3711	1.462	1.066	.72937
20	.6862	.9435	1.3748	1.457	1.060	.72737
30	.6884	.9490	1.3786	1.453	1.054	.72537
40	.6905	.9545	1.3824	1.448	1.048	.72337
50	.6926	.9601	1.3863	1.444	1.042	.72136
44	.6947	.9657	1.3902	1.440	1.036	.71934
10	.6967	.9713	1.3941	1.435	1.030	.71732
20	.6988	.9770	1.3980	1.431	1.024	.71529
30	.7009	.9827	1.4020	1.427	1.018	.71325
40	.7030	.9884	1.4061	1.422	1.012	.71121
50	.7050	.9942	1.4101	1.418	1.006	.70916
	.7071	1.	1.414	1.414	1.	.70711

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

Cosin. Cotg. Cosec. Sec. Tan. Sin. Angle

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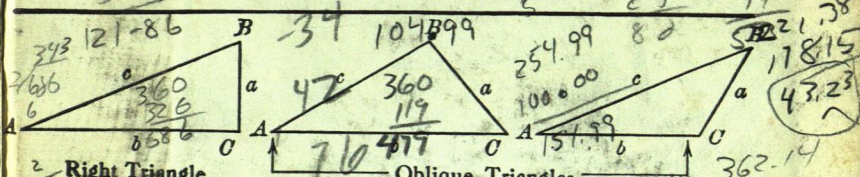
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TRIGONOMETRIC FORMULAE



Right Triangle

Solution of Right Triangles

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

Given A, b Required A, B, c

$$\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = a \sqrt{1 + \frac{b^2}{a^2}}$$

Given A, c Required A, B, b

$$\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c+a)(c-a)} = c \sqrt{1 - \frac{a^2}{c^2}}$$

Given A, a Required B, b, c

$$B = 90^\circ - A, b = a \cot A, c = \frac{a}{\sin A}$$

Given A, b Required B, a, c

$$B = 90^\circ - A, a = b \tan A, c = \frac{b}{\cos A}$$

Given A, c Required B, a, b

$$B = 90^\circ - A, a = c \sin A, b = c \cos A$$

Solution of Oblique Triangles

Given A, B, a Required b, c, C

$$b = \frac{a \sin B}{\sin A}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$$

Given A, a, b Required B, c, C

$$\sin B = \frac{b \sin A}{a}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$$

Given a, b, C Required A, B, c

$$A + B = 180^\circ - C, \tan \frac{1}{2}(A - B) = \frac{(a - b) \tan \frac{1}{2}(A + B)}{a + b}$$

Given a, b, c Required A, B, C

$$c = \frac{a \sin C}{\sin A}$$

Given a, b, c Required A, B, C

$$s = \frac{a + b + c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}}$$

Given a, b, c Required A, B, C

$$\sin \frac{1}{2}B = \sqrt{\frac{(s - a)(s - c)}{ac}}, C = 180^\circ - (A + B)$$

Given a, b, c Required A, B, C

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

Given A, b, c Required a, A, B, C

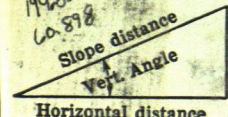
$$\text{area} = \frac{b \cdot c \sin A}{2}$$

Given A, B, C Required a, b, c

$$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$$

REDUCTION TO HORIZONTAL

Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = $5^\circ 10'$. From Table, Page IX, $\cos 5^\circ 10' = .9959$. Horizontal distance = $319.4 \times .9959 = 318.09$ ft. Horizontal distance also = Slope distance minus slope distance times (1 - cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. Cosine $5^\circ 10' = .9959$. $1 - .9959 = .0041$. $319.4 \times .0041 = 1.31$. $319.4 - 1.31 = 318.09$ ft.



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