561

F.B.561

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning
Roadway 16 feet wide. Side Slopes 1 on 1.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be 30.6+(20—16)÷2 or 2 ft. added to 30.6 =32.6. For slopes of 1 on 1½ see inside of back cover.

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MAY 30 1917 OCT 17 1967 OFF/MED

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The paper stock of this book is made of a **high grade 50% rag** paper having a **water resisting surface** and is sewed with Bing **Special Enamel Waterproof Thread.**

Made in U. S. A.

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" p. 41 — mgd. 10/10/46
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Alice

San Dieguito Dam

Cross Sections Below Dam

B.M.					250.00
	5.81	255.81			
0+50			8.6	247.2	
1+00			11.2	44.6	
			7.8	48.0	
			5.2	50.6	
			3.7	52.1	
			0.5	55.3	
1+50			17.6	238.2	
			12.6	43.2	
			11.0	44.8	
T.P.			11.34	244.47	
	0.08	244.55			
			4.63	239.92	
0+50			9.1	35.5	
1+00			16.0	228.6	
T.P.			13.03	231.52	
	0.75	232.27			
0+50			5.6	26.7	
1+00			15.8	216.5	
0+50			11.0	21.3	

2/1/39
Beermann
Coote
Stefanson

On Concrete - Top of Dam Buttress #13

Butt. #13 - On line with -

13' S of 1+00 Butt 13
25' " " "
13' S " 0+50
25 " "
But #13
13' S of 1+50 Butt 13
25' " " "
On Rock at Edge of Road -

Conc. Top SW Cor. Weir Box
Buttress #12 - On line with -
" "
On Rock

Buttress #11 - On line with
" " "
" #10 " " "
D.L. Opp 0+41.5 Butt #11

		232.27		
T.P.			11.2	221.06
	5.08	226.14		
0+12			0.0	26.1
0+00			+0.5	26.6
0+91			10.6	15.5
1+00			15.2	10.9
1+13			15.7	10.4
1+00			15.2	210.9
0+50			7.8	18.3
0+14			4.4	21.7
0+00			1.6	24.5
0+00			6.9	19.2
0+17			9.1	17.0
+50			11.6	14.5
1+00			16.7	09.4
T.P.			11.72	214.42
	0.23	214.65		
0+00			5.4	09.3
+19			6.6	08.1
+50			8.5	06.2
			8.7	06.0
+50			10.4	204.3
1+50			11.3	03.4

Buttress # 10

Edge Ditch

Butt # 9

End of Butt on S Side

Butt #8 on N End

Butt. #7 S. Side End

32' out to PL

12' N 1+50 = Streambed

1+89 Streamed Edge

Butt #8 1+65 Streambed

	214.65			
1+50		7.7	07.0	
1+00		9.3	05.4	
0+50		9.4	05.3	
+19		9.0	05.7	
0+00		6.5	08.2	
T.P.		1.15	213.50	
	11.98	225.48		
0+00		4.3	21.2	
+14		7.0	18.5	
+50		9.2	16.3	
1+00		7.9	17.6	
+50		7.8	17.7	
2		6.4	19.1	
+50		7.1	18.4	
3		8.7	16.8	
+50		11.6	13.7	
T.P.		0.44	25.04	
	12.04	237.08		
1+00		10.4	26.7	
0+50		10.1	27.0	
+10		6.9	30.2	
0+00		4.8	32.3	
0+50		0.8	36.3	
1+00		3.5	33.6	
+50		4.2	32.9	

Buttress #6

End of Butt.
S. Side

Butt. #5 S. Side

End

On Rock

Butt. #4

End
N Side

#3

237.08

1+50	11.2	25.9
2	12.2	24.9
+50	13.2	23.9
3	15.9	21.2
+50	20.7	16.4
3+50	15.0	22.1
3	12.0	25.1
2+50	9.3	27.8
2	6.8	30.3
2+00	1.3	35.8
+50	3.9	33.2
3	7.0	30.1
+50	10.8	26.3
3+50	6.2	30.9
3+00	2.6	34.5
T.P.	0.01	237.07

12.61 249.68

0+00	10.2	39.5
+65	11.0	38.7
0+00	5.7	44.0
+045	5.7	44.0
+50	7.4	42.3
1	9.1	40.6
+50	11.8	37.9

Butt. # 4

✓ ✓

✓ ✓

On SDID PL

Butt # 3

✓

✓

✓

Butt # 2

✓ ✓

✓ ✓

✓ ✓

Butt # 1

✓ ✓

Butt #3

✓ #2

✓ ✓

✓ ✓

✓ ✓

✓ ✓

		249.68			
1+50			5.6	44.1	
1+00			3.3	46.4	
0+50			1.6	48.1	
0+00			+0.3	50.0	
2+00			8.0	41.7	
			+0.30	249.98	250.00
T.P.					225.04
	1.49	226.53			
2+50			12.1	14.4	
2+00			16.0	10.5	
3			13.5	13.0	
+50			15.9	10.6	
			12.14	214.39	
	1.43	215.82			
2+00			12.7	03.1	
+50			5.4	10.4	
3			4.9	10.9	
3+50			7.5	08.3	
3+50			8.2	07.6	
3+00			5.8	10.0	
2+50			6.1	09.7	
2+00			13.5	02.3	

Buttress #1

Top of Dam

On Rock Pg. 4

Buttress #6

But #7

But #8

		215.82			
2+50			9.2	06.6	
2+00			13.8	02.0	
3			9.2	06.6	
+50			10.8	05.0	
3+50			14.2	01.6	
3+00			13.4	02.4	
2+50			13.0	02.8	
2+00			14.3	201.5	
2+50			15.9	199.9	
BM					250.00
	5.00	255.00			
			5.3	49.7	
			3.7	51.3	
			6.5	48.5	
			4.9	50.1	
			9.9	45.1	
			7.0	48.0	
			12.2	42.8	
			10.4	44.6	
			15.7	39.3	
			14.0	41.0	

Butt. # 9
✓ ✓
✓ ✓
✓ ✓
Butt # 10 — 15' S N. Edge Stream bed
✓ ✓ — 35' " " " "
✓ ✓
✓ ✓ — Edge Stream bed.
Butt # 11 — ✓ ✓ ✓

Top of Dam -

13'	N. of	0+50	But.# 1 (Fence)
25'	✓	✓	✓
13'	✓	1+00	✓
25'		✓	✓
13'	✓	1+50	✓
25	✓	✓	✓
13'	✓	2+00	✓
25'	✓	✓	
13'	✓	2+50	✓
25'	✓	✓	

		255.00		
BM				204.3
	9.4	213.7		
			11.4	202.3
BM				210.9
	3.2	214.1		
1+30			9.5	04.6
1+30			12.7	201.4
BM				216.5
	0.7	217.2		
1+30			10.9	06.3
1+38			13.5	03.7
1+40			17.2	200.0
1+50			18.3	198.9
2+00			Same	98.9

13' N of 3+00 Butt #1

On 1+50 Butt #7

+ Streambed 14' N 1+50
35' W

On 1+00 Butt #9

Butt #9

" 10

On 1+00 Butt #11

Butt #11

" 5.9' Edge Streambed

BM				228.6
	0.2	228.8'		
1+50			9.0	19.8
			13.2	215.6
	0.4	216.0'		
2+00			7.0	09.0
2+50			15.1	200.9
			17.1	198.9
3+00		Est.	Same	98.9
			5.9	210.2
BM				238.2
	9.8	248.0'		
2+00			17.0	31.0
2+25			19.5	18.5
			11.0	37.0
			7.6	40.4
			5.8	42.2
			2.6	45.4
				250.2

On 1+00 Butt # 12

Butt. # 12

✓	✓	15' N to Str. bed
✓	✓	
✓	✓	3' N to "
✓	✓	26' S then Uniform Slope -

1+50 Butt # 13

Butt # 13

✓	✓	
13' S of 2+00		Butt. 13
25' ✓	✓ ✓	✓ ✓
13' ✓	✓ 1+50	✓ ✓
✓	✓ ✓	✓ ✓

Butt. # 13 Ground

0+00	9.5	240.5
+07	11.0	39.0
0+00	17.0	233.0
+09	17.0	33.0
0+00	22.0	228.0
+12	23.5	226.5

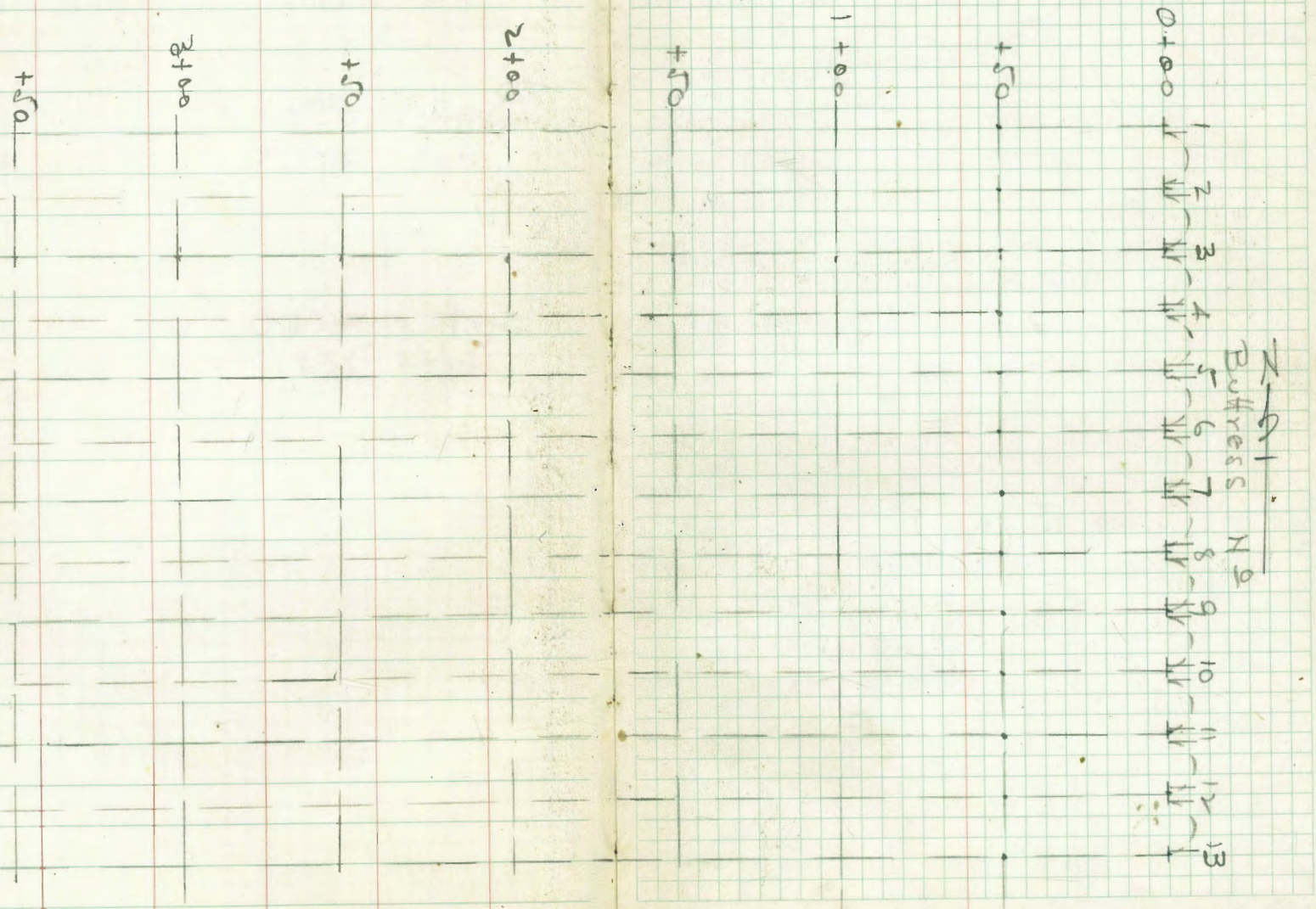
Buttress # 12

Butt # 11

Butt # 10

San Dieguito Dam

Showing Base for Cross Sections –

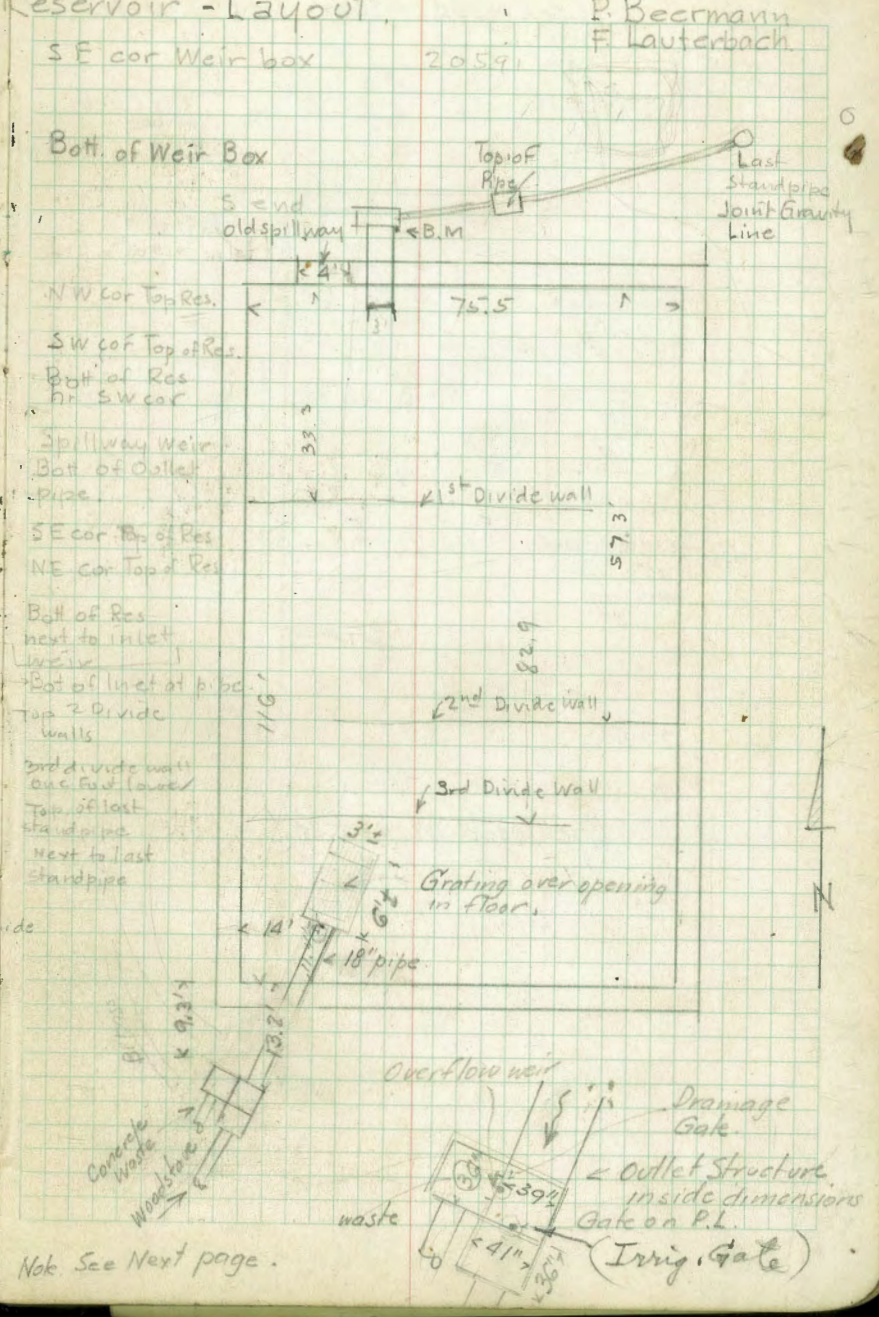


Lockwood Mesa Reservoir - Layout

6-21-39 12.

P. Beermann
F. Lauterbach

		H.I			
BM					205.91
	5.082	210.99			
			11.57	199.42	
			11.57	199.42	
			7.95	203.04	Lip of Inlet weir
			5.03	205.96	NW Cor Top of Res.
			4.92	206.07	SW cor Top of Res.
		Rod + Tag	13.21	197.78	Bott of Res. nr. Outlet
			8.00	202.99	Lip of Spill Weir
			17.21	193.78	Bottom of Outlet pipe
			5.12	205.87	SE cor Top of Res.
			5.15	205.84	NE cor Top of Res.
			13.19	197.80	Bot. of Res. next to inlet weir
			11.25	199.74	Bottom of inlet at jt. gr. Line
			8.38		Top of 2 Loose Divide walls
T.P.	5.49	211.40			205.91
			1.32	210.08	Top of Last Standpipe
			1.93	209.47	
			6.73	204.67	old spill 4' wide
			8.10	203.30	Top of pipe St gr line

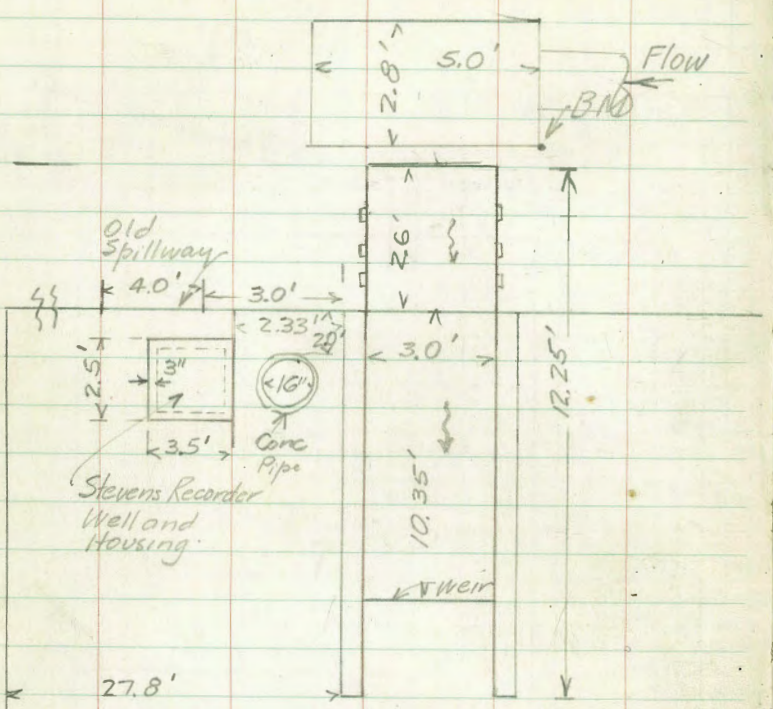


Note. See Next page.

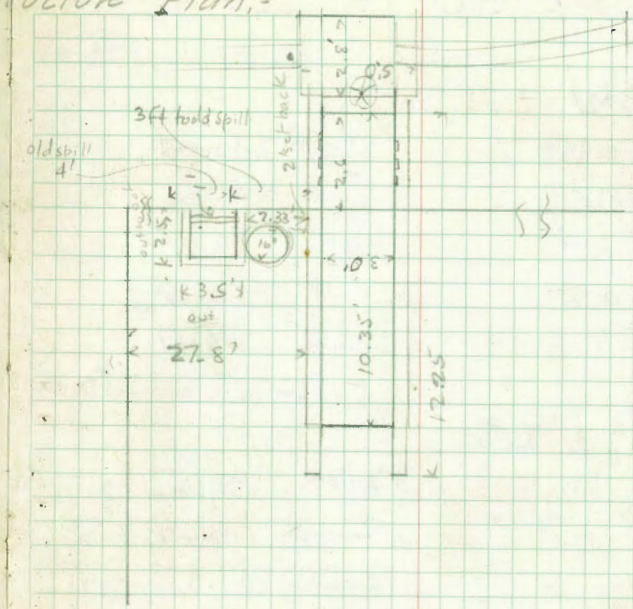
6-21-39

P. Beermann
F.R. Lauterbach

Lockwood Mesa Res. Inlet Structure Plan.



Lockwood Mesa Res.
Inlet Structure
Plan.



Res. gauge 3.70 = Elev. 201.8

[illegible] from Fred L.

San Dieguito Dam

				250.00
5.12	255.12			
5.05		5.05	250.07	
5.14		5.14	49.98	
5.07		5.07	50.05	
5.02		5.02	50.10	
5.1		5.15	49.97	
		5.12	250.00	250.00
0.23	250.23			
		12.28	37.95	
		12.03	38.20	
		12.88	37.35	
		12.02	238.21	
3.62	241.83			
		6.18	35.65	
		6.22	35.61	
				250.00
		36.85	213.15	

Buttress #12

9/19/39

✓	#11	Beermann
✓	6	Coote
✓	4	Steffanson.
Bay	3-4.	
✓	11-12	Above Outlet.

Lip of Weir to Lockwood (Jt. Gravity)
Top Gate Valve Flange - Top Bonnett ✓
Top 26" Jt. Grav P.L. - 7' W. of Gate

Bay 11-12

10" Valve, Sly, to S.Fe Pumps - Ctr. 10
Ctr. Nly 10" Valve to S.F. Pumps 10-12

-36.85 Top Pipe (B.O.) 4.7' Ely from Down Str Edge Coping -

250.00
36.85
213.15

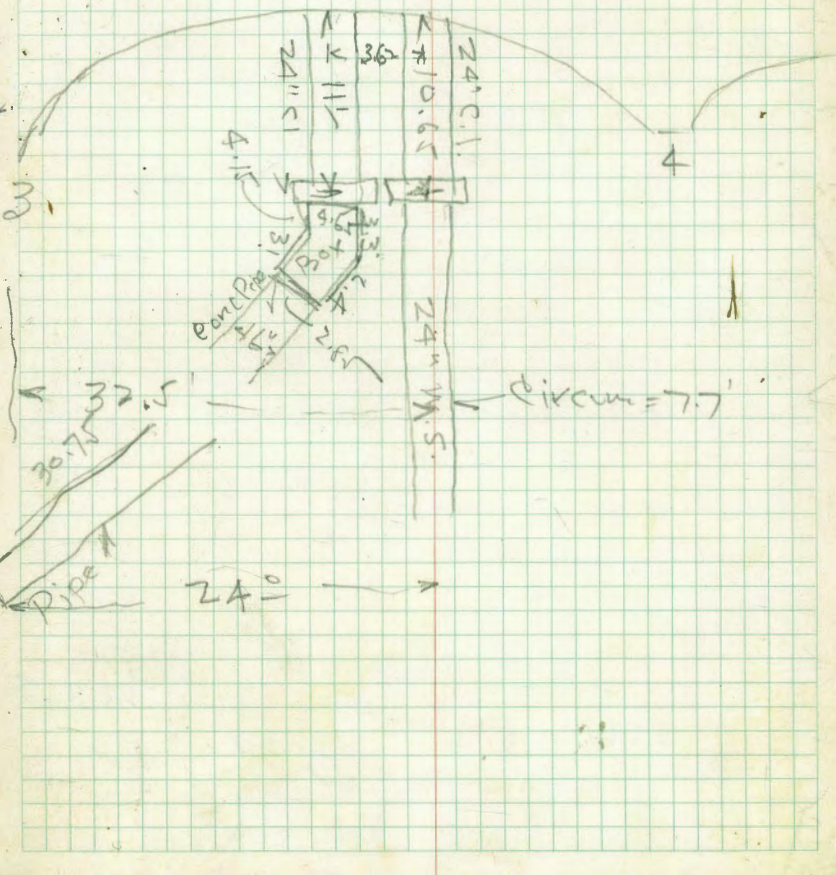
Bay 3-4.

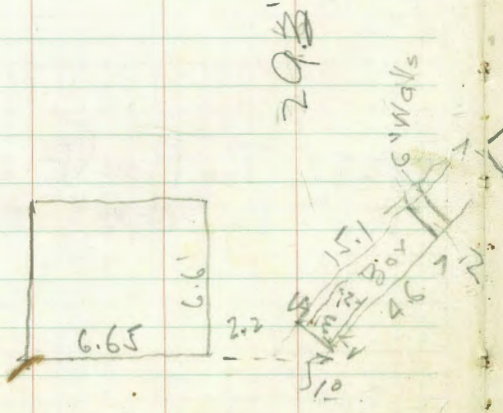
−13.1' = El. 236.9 Top Pipe.

Both Pipes same El.

2 - 24" Gates

San Diesuito





250.00

0.92 250.92

12.55 238.37

(12.55 + 1.42) 236.95

213.15

4.96 218.11

5.85 212.26

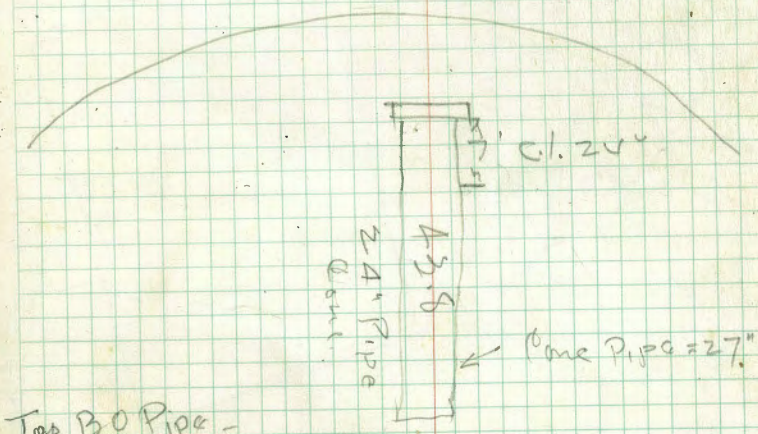
8.4 209.7

7.8 210.3

Bay 3–4

2' Weir Re. S.Fe. Top of Box

Bay 5–6 Blowoff



Top BO Pipe -

Top Cone Pipe Lower End

Flow line " " "

Top 10" S.FePL .5' West from End Cone Pipe -

℄ Highway

Δ = 16°00
R = 3000.
L = 837.76

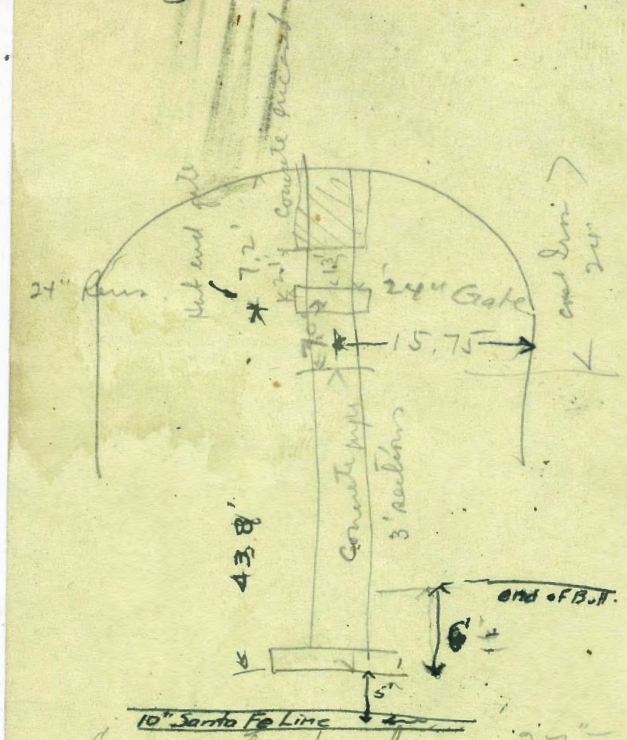
℄ P.P.C.

Δ = ~~14°32'30~~ 14°33'54"
R = 2970.
L = 755.
DEF. = .57874

10.86 7°16'57"

7°16'54"

San Dieguito Dam - Blow Off.



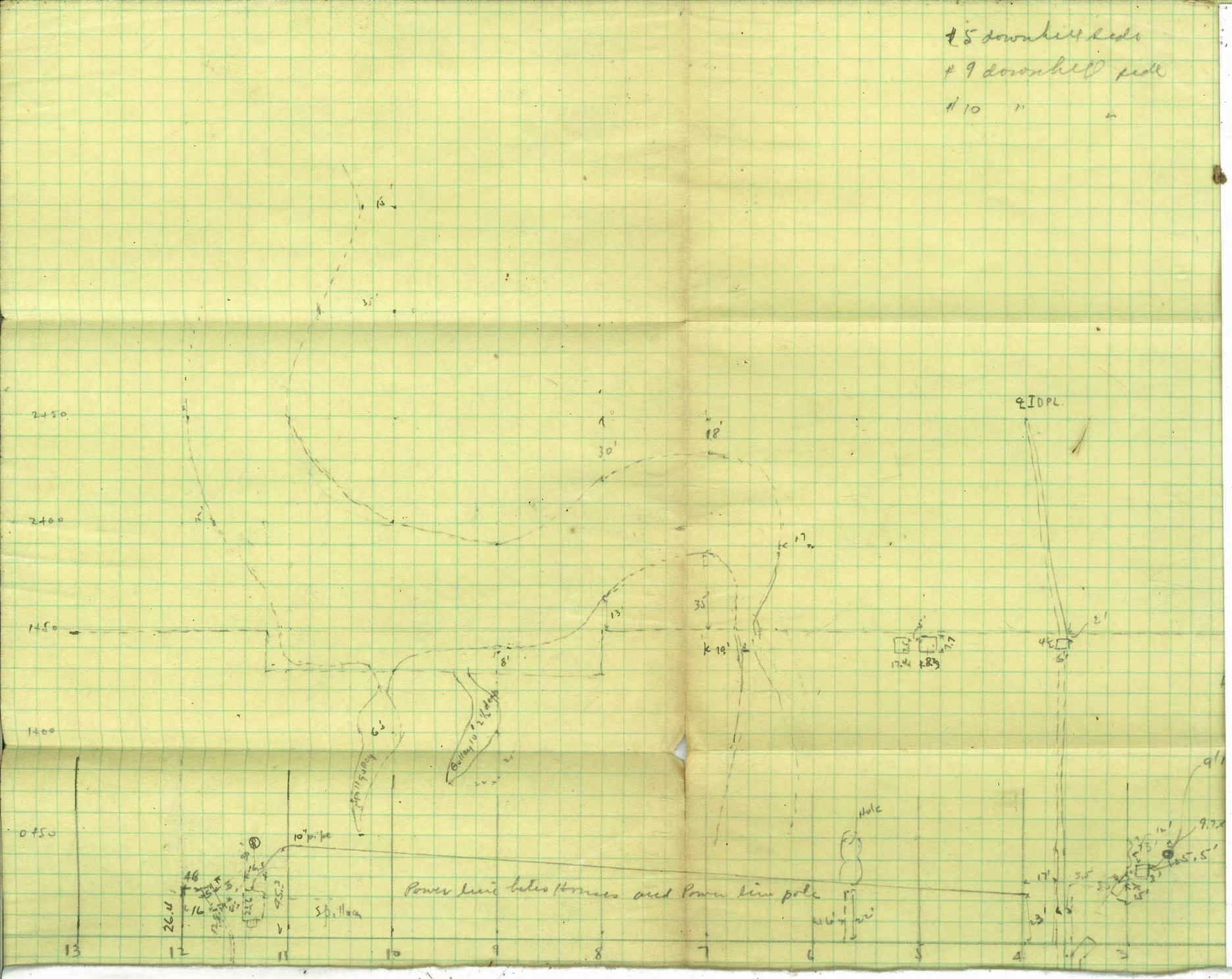
Concrete portion 27" ID

Cast Iron 24" ID

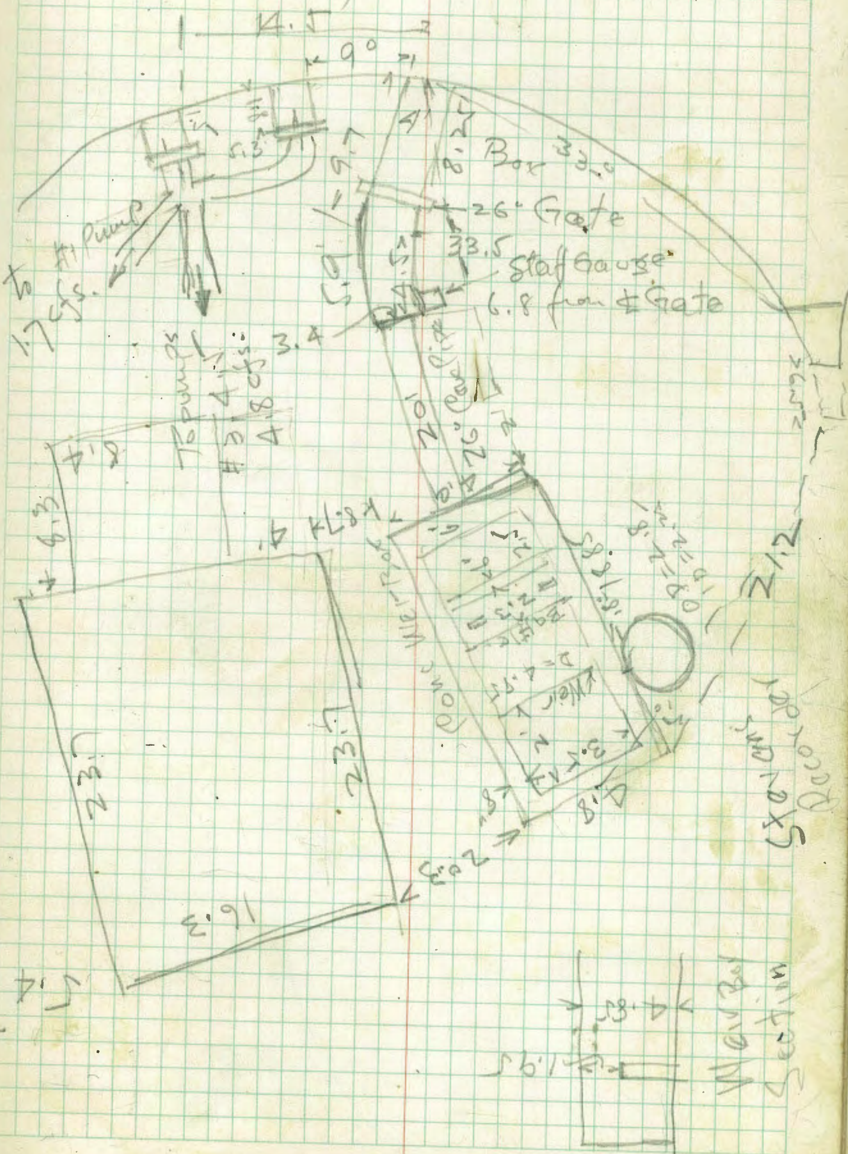
24 Rensselle Valve

FB 561/16

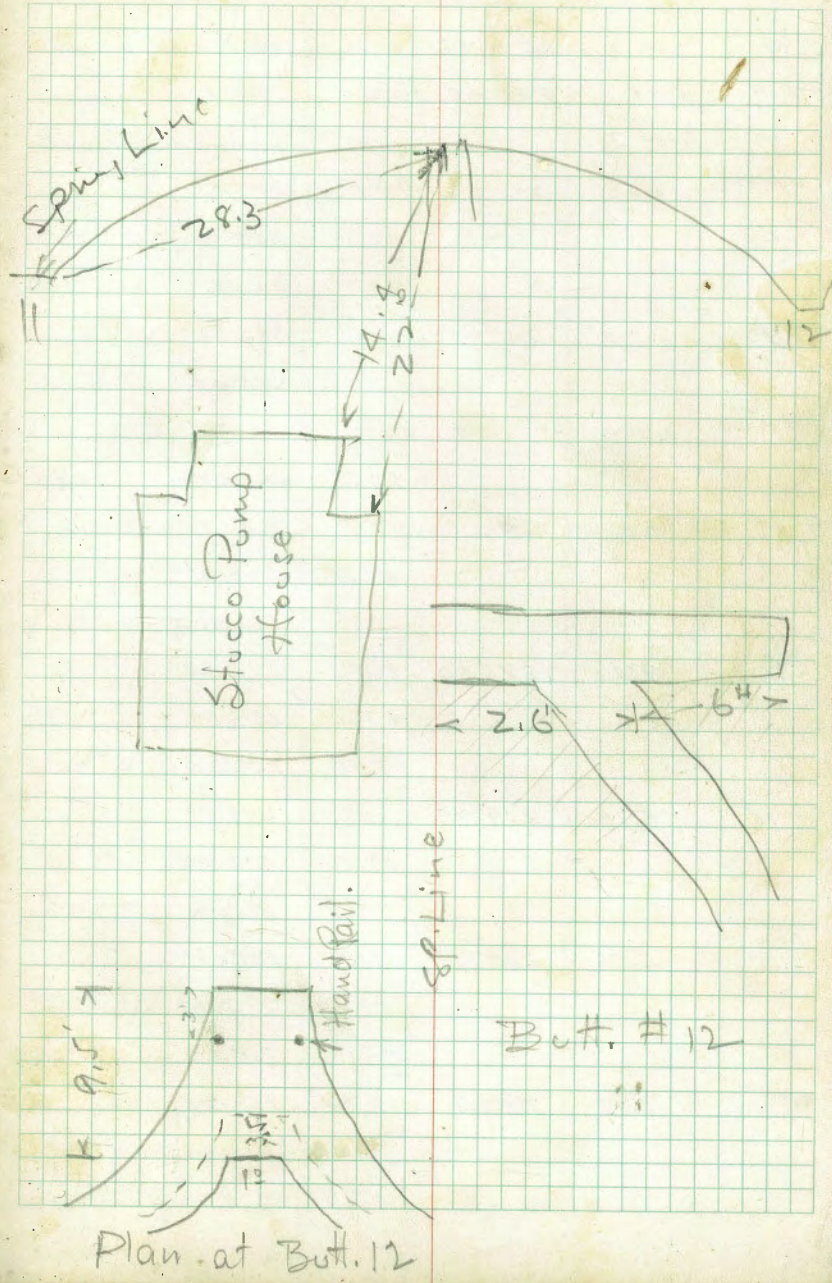
#5 downhill side
#9 downhill side
#10 " "



Bay 11-12



Buttress #11



Plan at Butt. 12

Elev. pts. near bottom of buttresses —
San Dieguito Dam.

B.M.	1.14	251.14		250.00
T.P.	5.73	247.45	9.42	241.72
			2.45	245.00
T.P.	5.42	242.89	9.98	237.47
			0.89	242.00
			2.89	240.00
T.P.	5.50	235.75	12.64	230.25
			0.75	235.00
T.P.	0.78	231.03	5.50	230.25
			+0.97	232.00
T.P.	8.10	229.25	9.88	221.15
			+1.75	231.00
			2.25	227.00
TP	8.61	226.40	11.46	217.79
			+1.60	228.00
			3.40	223.00
TP	5.18	219.43	12.15	214.25
			+2.57	222.00
			7.43	212.00
TP	2.36	210.67	11.12	208.31
			+2.33	213.00
			+0.33	211.00
TP	13.05	220.88	2.84	207.83
			8.88	212.00
			+3.12	224.00

Hill
Soper
Brooks

5/9/40

Top of lead plug But. #13

But. #12 S. side

But. #12 N. side

But. #11 S. side

But. #11 N. side

But #10 S. side

But #10 N. side

But #9 S. side

But #9 N. side

But #8 S. side

But #8 N. side

But #7 S. side

But #7 N. side

But #6 S. side

But #6 N. side

But #5 S side

(cont.)

		220.88		
TP	10.02	230.82	0.08	220.80
			5.82	225.00
TP	4.20	234.62	0.40	230.42
			+6.38	235.00
TP	7.72	241.44	0.90	233.72
			5.44	236.00
			+0.56	242.00
TP	6.94	245.95	2.43	239.01
			2.95	243.00
			+1.05	247.00
TP	10.29	254.97	1.27	244.68
			4.95	250.02

But #5 N. side

But #4 S. side

But #4 N. side

But #3 S. side

But #3 N. side

But #2 S. side

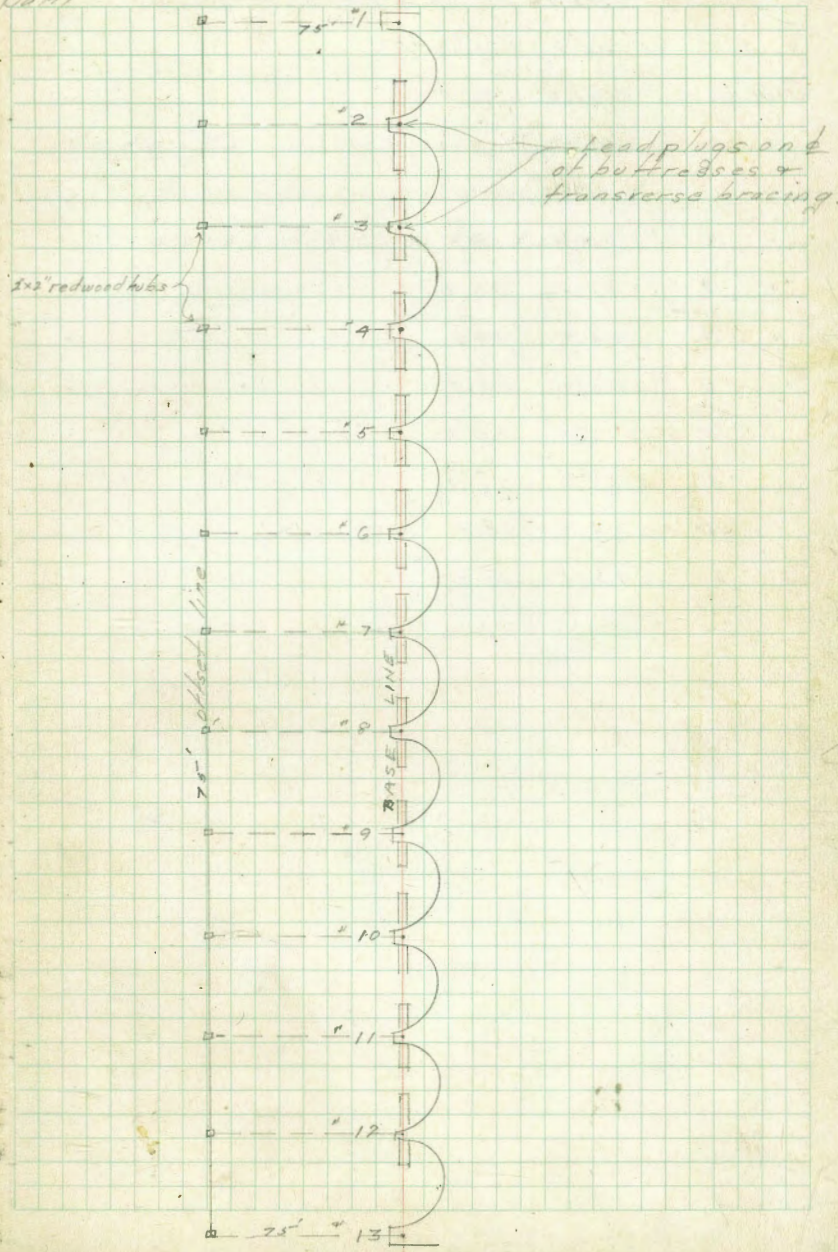
Top of lead plug But #13 - El. 250.00

Station of buttresses - San Dieguito Dam

0+00	But. #1
0+50	" 2
1+00.05	" 3
1+50.05	" 4
1+99.88	" 5
2+49.88	" 6
2+99.87	" 7
3+49.81	" 8
3+99.71	" 9
4+49.76	" 10
4+99.74	" 11
5+49.70	" 12
5+99.70	" 13

Hill
Soper
Brooks

6/10/40



Slope stakes at toe of buttresses

	Elev.	Dist. out
But. # 12	240.0	15.0
" 11	229.9	23.1
" 10	225.6	25.1
" 9	220.7	28.5
" 8	215.5	32.1
" 7	206.7	38.2
" 6	205.1	39.4
" 5	217.4	30.8
" 4	228.9	22.7
" 3	238.4	16.1
" 2	243.5	12.6

Hill 5/1/40
Soper
Brooks

Note - Distance out for slope stakes taken from base line on ℄ of transverse bracing. (lead plugs)

Groundelers alongside of buttresses - San Dieguito Dam

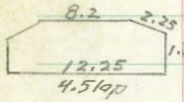
But #12	Transv. bracing	239.2
	3' E.	239.0
	15' W.	240.0
" 11	Tr. bracing	232.0
	3' E	231.5
	10 W	231.7
	23' W	229.9
" 10	Tr. bracing	228.0
	4' E	228.4
	12' W	228.4
	25 W	226.6
" 9	Tr. bracing	224.3
	7 E	224.4
	14 W	222.5
	28.5 W	220.7
" 8	Tr. bracing	218.5
	10.5 E	218.0
	16 W	217.0
	32 W	215.5
" 7	Tr. bracing	208.4
	18' E	207.6
	20 W	208.0
	38 W	206.7

(cont.)

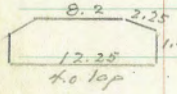
But. " 6	Tr. bracing	208.0
	19' E	207.0
	21' W	205.9
	39' W	205.1
" 5	Tr. bracing	221.4
	9' E	222.0
	16' W	218.6
	31' W	217.4
" 4	Tr. bracing	231.0
	3' E	231.0
	11' W	230.3
	23' W	228.9
" 3	Tr. bracing	239.2
	7' W	238.6
	16' W	238.4
2	Tr. bracing	244.0
	5.5' W	244.0
	13' W	243.5

Reinf steel at Chollas - 5/15/40

Soper



17 pcs. 1" □ steel 32' long



10 pcs 3/4" □ steel 31' long

13 pcs 3/4" □ steel 10' long

Approximately 150' of 1" □ steel in lengths of from 2' to 6'

" 300' of 5/8" ϕ steel. Very crooked and bent

Hill
Soper 5/21/40

Loc. of Santa Fe 10" pipe line along d'n. str. side of dam

But. # 11	10" pipe	46' out				
" 10	"	"	42.8	"		
" 9	"	"	39.5	"		
" 8	"	"	36.1±	"		Pipe buried - depth not known.
" 7	"	"	33.0	"	207.8 El. top pipe	
" 6	"	"	30.7	"	208.0 " " "	
" 5	"	"	27.5	"	217.5 El. top of ground - pipe 2'± lower	
" 4	"	"	24.0±	"	228.2 " "	" " " 2'± "

Xsec. at N. end of San Dieguito Dam

B.M.	5.5	255.5		250.0
But 1-50'W			7.5	248.0
	5.5	253.5		
" 1-75'W				248.0
" 1-100'W			7.1	246.4
" 1-50'E				250.0
B.M.	5.5	255.5		250.0
TP	5.5	260.0	1.0	254.5
But. 1-50'N			3.6	256.4
	6.1	262.5		
But 1-110'N			0.3	262.2
" 1-50'E of 50'N			6.1	256.4
" 1-50'W of 50'N			7.9	254.6
	6.4	261.0		
" 1-75'W of 50'N			6.1	254.9
" 1-100'W of 50'N			6.5	254.5
	5.5	267.7		262.2
But. 1-50'E of 100'N			4.7	263.0
" 1-50'W of 100'N			5.9	261.8
	5.8	267.6		
" 1-75'W of 100'N			5.5	262.1
" 1-100'W of 100'N			5.5	262.1

Hill 5/21/40
Soper

248.0
6.7
241.3 Bot " 2-75'W

Steel rail to parapet of arch = 2.8

DITCH alignment from intake ditch south around San Dieguito Lake

S 54° 45' W

P.I
5+10 Δ = 12° 22' R

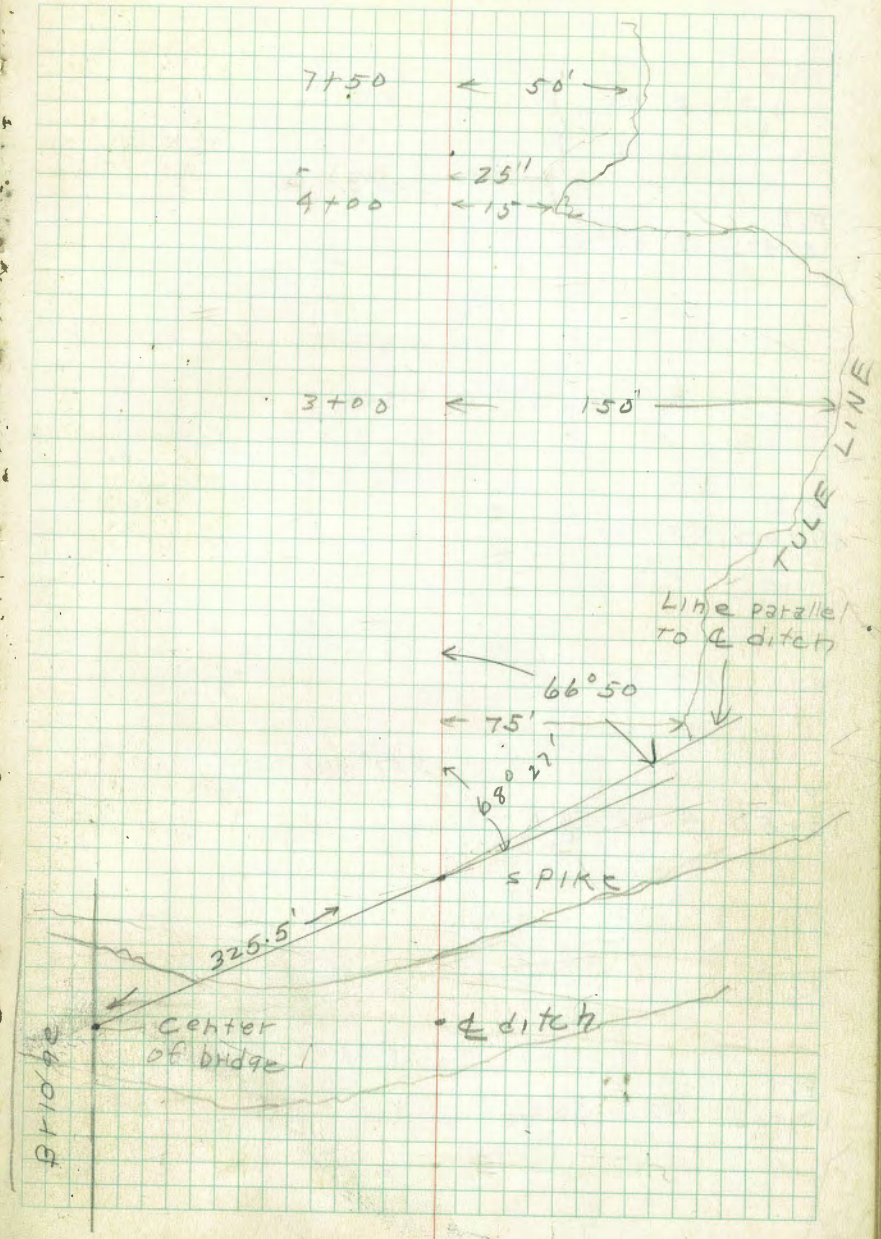
S 43° 15' W

P.O.T
0+10

0+00

9-19-46
Clear-Cool

Nelson T
Leonard
Phillips



N 26° 30' W

P.I
22+75 Δ = 23° 45' R

N 48° 30' W

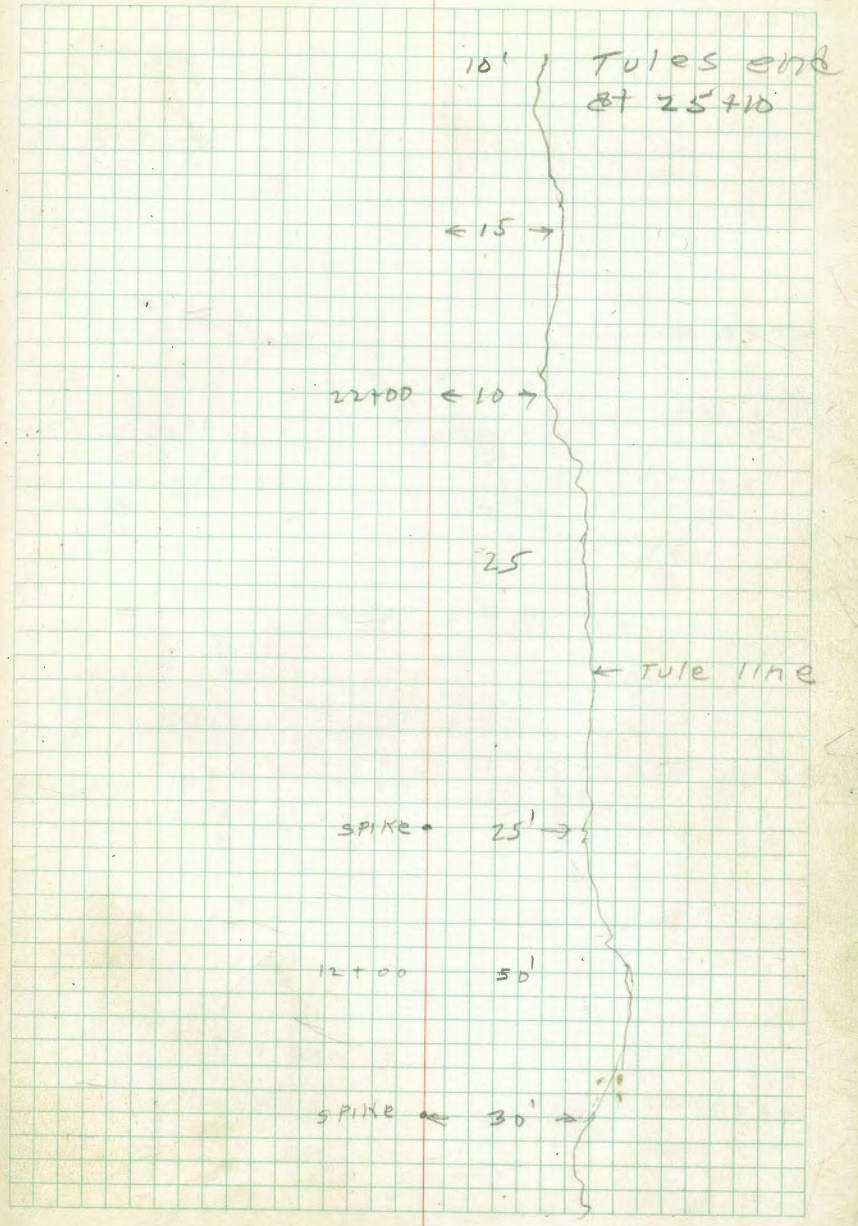
P.I
19+00 Δ = 7° 33' R

N 57° 00 W

P.I
13+50 Δ = 83° 58' R

S 38° 30 W

P.I
10+25 Δ = 16° 53' L



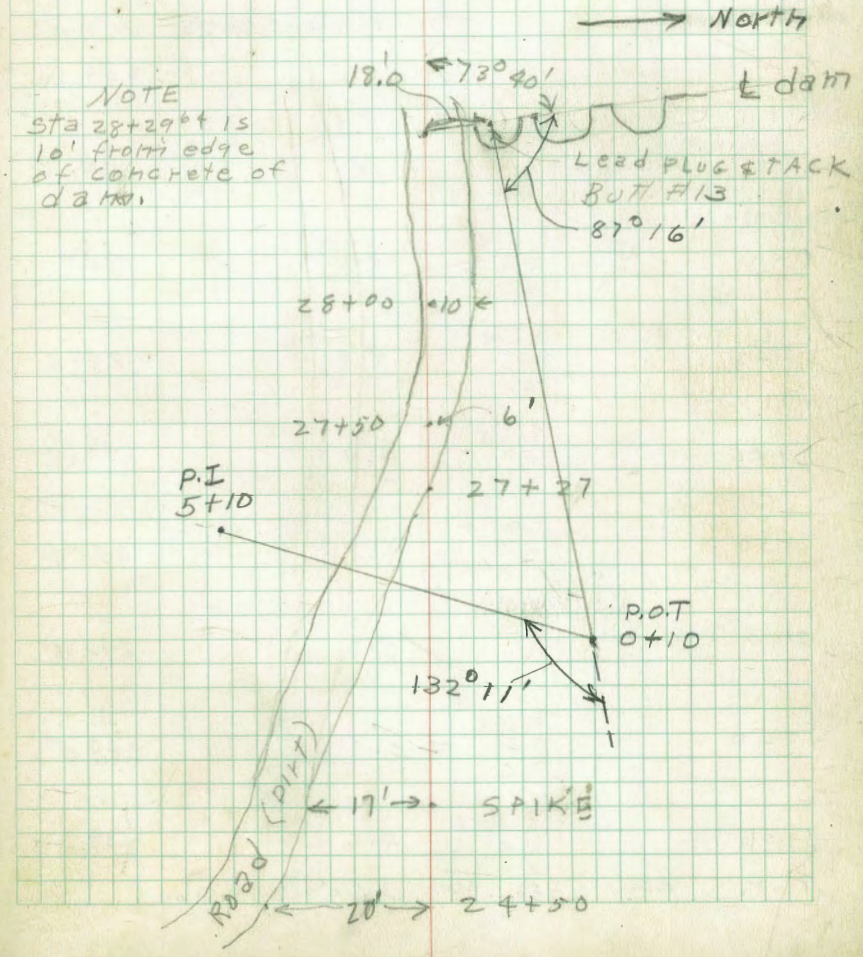
END
28+29 $\frac{64}{}$

S 70° 30' W

P.I
26+80 Δ = 28° 47' L

S 40° 00 W

P.I
25+00 Δ = 15° 07 L



cross sections ditch south around
San Dieguito Lake

	4.97	254.97			250.00
T. P.	5.27	254.71	5.53	249.44	
T.P B M	2.81	254.67	2.85	251.86	
T. P	8.98	256.02	7.63	247.04	
T. P B. M	4.53	256.98	3.57	252.45	
T. P.	2.19	257.02	2.15	254.83	
set B.M.			3.76	253.26	
	3.85	257.11			253.26
T. P	4.11	251.92	9.30	247.81	
0+00	℄ ditch		10.9		241.0
0+10			4.9		247.0
+50			4.8		247.1
1+00			4.9		247.0 ~~.2~~
+50			4.8		247.1
2+00			5.8		246.1
+50			3.4		248.5
3+00			4.6		247.3
T. P.	4.40	252.46	3.86	248.06	

9-20-46
clear-warm

Nelson, π-Notes
Leonard 31
Phillips

Lead plug top Butt #13

Spike in P.P. 80' Left sta 17+75

Hub ft of Euc Tree 100' Left 7+25

South west abut conc bridge

242.4	241.7	241.0
9.5	10.2	10.9
200	100	50
251.1	249.7	246.7
0.8	2.2	5.2
200	100	50
	249.6	245.9
	2.3	6.0
	50	25
	247.7	247.3
	4.2	4.6
	50	25
	248.1	246.7
	3.8	5.2
	50	25
	249.2	246.9
	2.7	5.0
	50	25
	249.5	247.9
	2.4	4.0
	50	25
	249.3	248.3
	2.6	3.6
	50	25

NOTE
X sections at P.I.s Rt & to back tang unless otherwise noted

		252.46			
3+40			4.1		248.4
+50			5.5		247.0
4+00			6.6		245.9
+50			7.5		245.0
5+00			6.3		246.2
P.I 5+10			5.6		246.9
+50			8.2		244.3
6+00			6.9		245.6
+15			5.4		247.1
+50			5.7		246.8
7+00			6.0		246.5
T.P.	8.07	255.24	5.29	247.19	
OKB.M			2.80	252.44	252.45
+50			8.7		246.5

		248.3		247.2
		4.2		5.3
		50		25
		248.2		247.4
		4.3		5.1
		50		25
247.4	247.5		245.5	
5.1	5.0		7.0	
50	15		20	
		247.6		244.3
		4.9		8.2
		20		13
		248.9		244.5
		3.6		8.0
		50		18
248.0	247.7	246.2		245.2
4.5	4.8	6.3		7.3
50	25	15		20
		248.0		245.8
		4.5		6.7
		50		25
		247.6		245.9
		2.9		6.6
		50		15
		249.4	246.3	244.8
		3.1	6.2	7.7
		50	20	30
		48.5	47.3	245.1
		4.0	5.2	7.4
		50	18	28
		46.3	43.6	43.1
		6.2	8.9	9.4
		50	18	25

		255.24			
8+00			7.5		247.7
+50			8.6		246.6
9+00			8.7		246.5
+50			8.8		246.4
10+00			8.7		246.5
T.P.	6.20	253.03	8.41	246.83	
+25			6.2		246.8
+50			6.9		246.1
11+00			6.7		246.3
+50			6.5		246.5
12+00			6.3		246.7
+50			6.7		246.3
13+00			6.0		247.0
+50			6.8		246.2

255.2

		249.6	45.8	
		5.6	9.4	
		50	25	
		249.5	45.3	
		5.7	9.9	
		50	25	
50.1	50.2	47.4	47.2	
5.1	5.0	7.8	8.0	
50	36	15	25	
		49.8	44.8	
		5.4	10.4	
		50	25	
		50.0	44.9	
		5.2	10.3	
		50	25	
		49.8	46.7	44.6
		3.2	6.8	8.4
		50	8	25
		49.6	44.6	
		3.4	8.4	
		50	25	
		49.4	45.1	
		3.6	7.9	
		50	2.5	
		49.8	45.1	
		3.2	7.9	
		50	25	
		50.5	45.3	44.7
		2.5	7.7	8.3
		50	12	25
		51.5	45.1	44.7
		1.5	7.9	8.3
		50	10	25
	52.9	50	46.9	45.1
	1.1	3.0	6.1	7.9
	50	20	14	25
	48.9	47.6	45.8	
	4.1 *	5.4 *	7.6 *	
	10.0	50	15	

x sections taken 135° from back tang along bottom of draw.

		253.03			
T. P.	7.71	254.73	6.01	247.02	
14+00			8.9		245.8
+50			8.0		246.7
15+00			7.7		247.0
+50			7.6		247.1
16+00			8.7		246.0
+50			9.1		245.6
17+00			9.1		245.6
+50			9.0		245.7
T. P. CK B.M.	2.65	254.49	2.89	251.84	251.86
18+00			9.2		245.3
+50			8.7		245.8
19+00			8.0		246.5
+50			8.1		246.4

254.7

49.8	48.6	46.2	44.7
4.9	5.9	8.5	10.0
50	25	9	25
	50.9		45.9
	3.8		8.8
	50		25
	9.2		45.2
	5.5		9.5
	25		25
	48.8		44.7
	5.9		10.0
	25		25
	47.9		44.6
	6.8		10.1
	25		25
	47.5		44.3
	7.2		10.4
	27		20
	47.6		44.2
	7.1		10.5
	25		20
	47.6		44.3
	7.1		10.4
	25		20
	47.3		44.3
	7.2		10.2
	25		15
	47.9		44.5
	6.6		10.0
	25		15
	49.1		44.5
	5.4		10.0
	25		25
	49.6		44.6
	4.9		9.9
	25		16

		254.49			
20+00			7.8		246.7
+50			7.6		246.9
21+00			8.2		246.3
T.P	6.79	253.70	7.58	246.91	
+50			8.2		245.5
22+00			8.5		245.2
+25			7.6		246.1
+57			5.6		248.1
+75			7.4		246.3
23+00			8.4		245.3
+50			7.0		246.7
24+00			6.3		247.4
+50			7.2		246.5
T.P	5.53	254.93	4.30	249.40	=249.44

		49.9 4.6 20	44.3 10.2 19
	51.1 3.4 16	48.8 5.7 12	44.5 10.0 20
0 M Highway Eind	51.1 3.4 16	48.7 5.8 12	44.5 10.0 15
	50.1 3.6 19	47.7 6.0 15	44.1 9.6 12
		46.7 7.0 15	44.1 9.6 15
		46.9 6.8 15	44.9 8.8 15
	48.2 5.5 25	47.6 6.1 15	45.2 8.5 15
		48.5 5.2 15	45.0 8.7 13
	47.4 6.3 25	46.2 7.5 13	44.5 9.2 13
		48.4 5.3 15	44.2 9.5 15
		49.2 4.5 15	44.3 9.4 25
		48.7 5.0 15	43.9 9.8 18

		254.93			
25+00			9.2		245.7
+50			9.6		245.3
26+00			9.2		245.7
+50			10.0		244.9
P.I. 26+80			8.7		246.2
27+00			7.8		247.1
+27			4.1		250.8
+50			3.4		251.5
T.P. CK B.M.	12.42	262.38	4.97	249.96	= 250.00
28+00			9.2		253.2
28+29.69			8.7		253.7

254.9

	50.1	47.8	42.6		
Edge Road	4.8	7.1	12.3		
	19	14	12		
	49.8	46.7	44.4	41.1	
edge Rd	5.1	8.2	10.5	13.8	
	14	7	6	23	edge water
	50.2	48.1	44.6	41.1	
edge Rd	4.7	6.8	10.3	13.8	
	14	9	6	19	
	50.0	46.7		41.1	
edge Rd	4.9	8.2		13.8	edge water
	14	8		19	
	49.9	47.9	44.7	41.1	
edge Rd	5.0	7.0	10.2	13.8	edge water
	17	12	7	19	
50.1		50.2	44.6	41.1	
edge Rd 4.8		4.7	10.3	13.8	edge water
20		edge Rd 10	13	30	
	57.5	50.6	47.8	44.4	
	2.4	4.3	7.1	10.5	
	13	10	5	24	
54.9	53.4	51.3	51.6	48.1	46.2
0.0	1.5	3.6	3.3	6.8	8.7
13	9	5 edge Rd	5 edge Rd	13	21
	57.5	55.5	53.2	52.5	49.5
	4.9	6.9	9.2	9.9	12.9
	10	4	8	10	22
	57.5	56.4	52.8		
	4.9	6.0	9.6		
	12	8	8		

Profile ℄ Hway west of Hodges
Dam 373+00 TO

10-9-46
Clear-warm

Nelson
Phillips
Griffith

	11.42	159.42			148.00
T.P.	12.58	171.93	0.07	159.35	
T.P.	12.64	184.27	0.30	171.63	
T.P.	12.61	196.58	0.30	183.97	
T.P.	6.21	202.23	0.56	196.02	
373+00			0.9	201.3	
374+00			6.6	195.6	
375+00			10.8	191.4	
T.P	0.99	190.54	12.68	189.55	
376+00			2.4	188.1	
377+00			5.1	185.4	
378+00			6.6	183.9	
379			8.6	181.9	
380			10.3	180.2	
T.P.	1.25	182.05	9.74	180.80	
381			3.7	178.3	
382			5.7	176.3	
383			7.7	174.3	
384			9.8	172.2	
385			12.0	170.0	
T.P.	0.47	170.39	12.13	169.92	
386			2.4	168.0	
387			4.8	165.6	
388			7.1	163.3	
389			9.6	160.8	

U.S.G.S. B.M. H 28 1938 on hdwll
North side rd

		170.39			
390			12.2	158.2	
T.P.	0.88	159.17	12.10	158.29	
391			3.3	155.9	
392			5.8	153.4	
393			8.6	150.6	
394			10.9	148.3	
395			13.4	145.8	
T.P.		CORR HI.			
CK BM	0.68	148.68	11.15	148.02	148.00
396			5.6	143.1	
397			7.9	140.6	
398			9.6	139.1	
399			10.4	138.3	
T.P.	6.25	145.03	9.90	138.78	
400			6.8	138.2	
401			6.2	138.8	
402			4.9	140.1	
403			3.9	141.1	
404			4.8	140.2	
405			7.1	137.9	
406			9.4	135.6	
T.P.	0.77	137.40	8.40	136.63	
407			3.3	134.1	
408			4.4	133.0	
409			4.8	132.6	
410			4.5	132.9	

		137.40			
411+00			3.9	133.5	
412			3.2	134.2	
413			3.0	134.4	
T.P	4.11	139.08	2.43	134.97	
414			4.8	134.3	
415			4.7	134.4	
416			4.5	134.6	
417			4.2	134.9	
418			4.3	134.8	
419			5.1	134.0	
420			6.9	132.2	
421			8.2	130.9	
T.P	7.87	138.56	8.39	130.69	
422			7.9	130.7	
423			6.6	132.0	5
424			5.1	133.5	
425			3.5	135.1	
426			2.3	136.3	
427			1.2	137.4	
428			0.3	138.3	
T.P	8.53	146.62	0.47	138.09	
429			7.8	138.8	
430			8.0	138.6	
431			8.3	138.3	
432			8.7	137.9	

		146.62			
433			9.2	137.4	
434			8.4	138.2	
435			6.3	140.3	
436			3.1	143.5	
T.P.	12.56	158.36	0.82	145.80	
437			10.5	147.9	
438			4.7	143.7	
T.P.	11.77	169.91	0.22	158.14	
439			10.4	159.5	
440			4.4	165.5	
T.P.	12.56	182.20	0.27	169.64	
441			10.9	171.3	
442			4.9	177.3	
T.P.	13.10	195.00	0.30	181.90	
CK BM			13.03	181.97	= 182.3
443			12.0	183.0	
444			6.1	188.9	
445			0.2	194.8	
T.P	12.36	207.11	0.25	194.75	
446			6.4	200.7	
447			0.5	206.6	
T.P.	11.69	218.42	0.38	206.73	
448			5.9	212.5	
449			0.6	217.8	
T.P.	10.44	228.76	0.10	218.32	

U.S. B.M cross on hdwll culvert

	228.76			
450		6.8	222.0	
451		4.0	224.8	
452		1.9	226.9	
453		0.7	228.1	
T.P.		0.40	228.36	RD 1-7-47

5

EXTENSION OF CROSS SECTIONS
south around San Dieguito Lake see PAGE 31

	5.89	259.15			253.26
0+10	south bank of ditch				
0+50					
1+00					
2+00					
3+00					
T.P	4.40	256.86	6.69	252.46	
4+00					
5+00					
6+00					
7+00					
T.P CK B.M.	4.53	256.98	4.41	252.45	= 252.45
8+00					
9+00					

10-17-46
clear-warm

Nelson Notes
Leonard T
GRIFFIN ϕ

B.M. conc abut of bridge

5.4
313 Fenceline

4.3
300 Fence

	4.3	6.7	10.4
Fence	277	200	100
	5.5	6.6	9.8
Fence	254	200	100
Fence	6.9	7.8	9.0
	229	200	100
		3.3	6.9
Fence		200	100
		3.9	6.6
Fence		165	100
		3.1	6.8
Fence		150	100
		2.7	3.6
Fence		140	100
		3.3	5.5
Fence		122	100
		1.9	4.0
Fence		109	100

256.98

10+00

11+00

11+50

12+00

12+50

T.P 9.90 257.52 9.36 247.62

13+00

13+50 RT ∠s BACKTAN

13+50 135° TO BACKTANG

Cross section across draw 300' from 13+50

13+50 RT ∠s Fwd TANG.

14+00

T.P. 4.70 259.69 2.53 254.99

+50

14+85

4.3 5.3
Fe 107 100

4.6
Fe 93

3.6 4.6
Fe 87 84

2.9 4.3
Fe 82 70

1.6
Fe 99

1.8
Fe 80

2.9
Fe 83

4.6 7.0
300 200

0.5 4.6 0.0
Fe 65 95 12 41 25 Fe

0.8 5.0 7.6 9.9
Fe 163 159 147 100 50

0.3 3.9 5.5
Fe 136 126 100

1.9 6.0
Fe 115 100

7.0 8.3
78 62

P. Pole brace wire

		259.69			
15+00					
+50					
16+00					
+50					
17+00					
+50					
+77		corrected H.I.			
T.P.					
CK BM	4.87	256.73	7.89	251.80	= 251.86
18+00					
+50					
19+00					
+50					
20+00					
+50					

2.5 5.4
Fe 107 99

2.9 4.9
Fe 107 100

3.0 5.4
Fe 109 100

3.8 6.4
Fe 113 100

4.3 6.6
Fe 115 100

4.5 6.8
Fe 118 100

7.2 8.7
Guy wire 94 81
P. Pole

0.9 3.0
Fe 108 100

1.3 3.9
Fe 88 80

1.5 4.9
Fe 66 56

1.3 5.6
Fe 50 38

1.1
Fe 36

Fe 1.2
28

		256.73		
T. P.	10.60	257.55	9.78	246.95
21+00				
+50				
22+00				
+50				
22+75				
23+00				
+50				
24+00				
T.P	7.50	259.88	5.17	252.38
+25				
+50				
25+00				
+50				

2.9
Fe 27

3.2
Fe 32

4.2 9.5
Fe 39 27

4.0 8.3
Fe 53 40

3.8 7.1
Fe 62 50

2.8 7.4
Fe 105 100 42

3.3 7.7
Edge Rd 60 36

3.1 5.4 5.5 6.2
60 45 34 32
ER E.R

6.0
P. Pole 49

5.5 9.4 9.3
50 30 20
ER ER

4.0 10.2
50 28

9.7 4.0
23 50

$\Delta = 16°00'$

R 2950

.577

2975 / 1718.87

14875

23137

20825

23120

20825

22950

.57777

755

288885

288885

404439

$\boxed{7°16}$

43621635

420

16 12.

14° 32' 30

.2538

2975 / 755.0

5950

16000

14875

11250

8925

23250

.57874

755

289370

289370

405118

436.94870 = 7°16'57" =

420

16 5688

Δ = 14°33'54"

EC 31 + 44.33
BC 23 + 06.57

L = 8 37.76

OK

.2792527
3000

837.7581000

℄ Highway

3000.0
25.4 ±

2974.6 = Rad.

14°32'30 = Δ
2975. = RAD
755. = L

177+10.4
169+55.4

755

		259.88			
26+00					
+50					
27+00					
+50					
28+00					
CK BM			9.89	249.99	=250.00

3.4		9.6
50		23
1.9	7.4	9.7
50	27	24
3.6	7.6	10.0
38	23	18
	0.9	
	28	
	0.0	
	17	

Alignment Lockwood Mesa - Torrey Pines Pipe Line

Bliss
King
Phillips
Nenow 1/13/47
Cloudy. Threatening Rain

R28.8' Tangent

3+15.22 E.C.

2+30.72 P.I.

Δ 23°07'00"
R. 425
Tan. 86.92 ← From MAP
L. 171.42

1+43.8 BC-Rt

31.3 BV to CV
35.4 CV to outside Diversion Box

15+67.79	E.C.	
14+90 P.I.		Δ 28°00'00 Lt R 325' T 81.03 ← From Map L 158.82
14+08.97	B.C. Lt	
		803.85' Tangent
6+05.12	E.C.	
5+74.65	P.I.	Δ 10°00'00 Lt R 350' T 30.62 ← From Map L. 61.09
5+44.03	B.C. Lt	

29+20 3 L. Lt 32°-03' = -4+77

21+87 3 = +7+10 Valve Chamber + Meter

21+60 3 = -7+37 Connect Cast Iron + Steel Pipe Lines

21+37 ± ℄ Co. Hiway

19+66 1 Connect Wood Stave + Steel

17+26 Meter in Gas Co's Prop

L. Rt 60°-00 ±

53+48 L. Rt 10°-33'-00

+48 18" Gate valve + Valve Chamber. Main Gate Fair Grds

49+21 6" Line To Fair Grounds. Main Gate

44+97.3 4" Drain from Blow off

43+97.3 EE

34+37 Fair Grds Gate 6"

+58 Del Mar Line 8" Dia.

+21 6/8 E. rail of RR

61+15.6 L Rt 22°-00'-00" ±

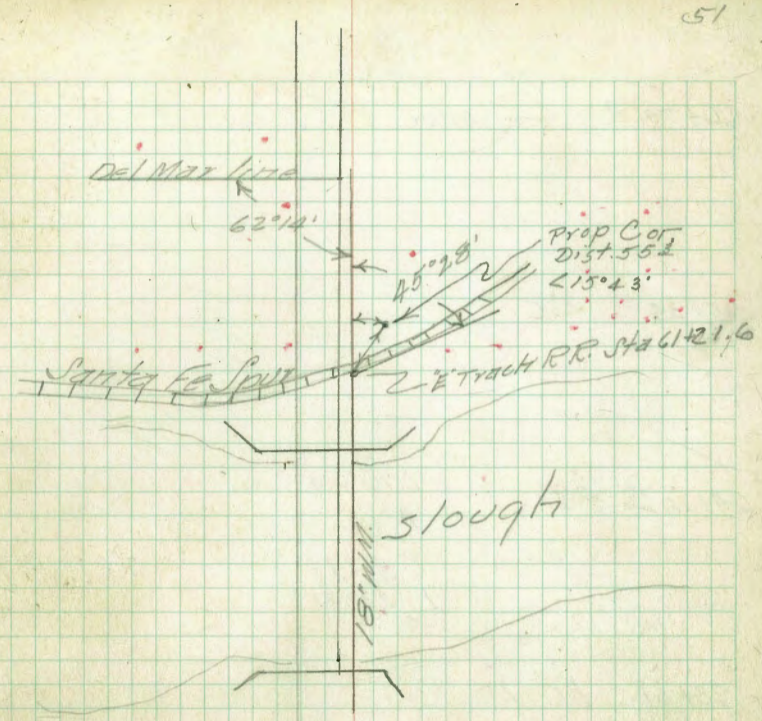
+97 8/8 Blow off

+85 7/5 Vac Valve

60+84 5/8 Air valve + Last Piling on Bridge

58+21 ℄ First Piling on Bridge

56+21 5/8 Connect Cast iron + Steel



66+74.9 Air valve OK

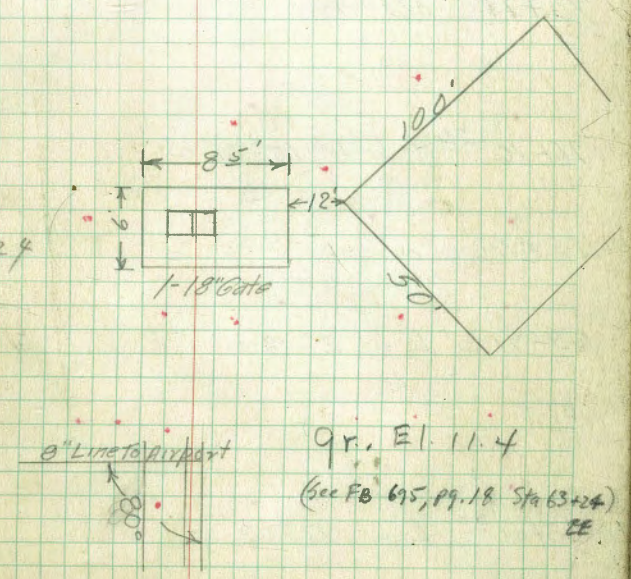
65+34.87 EC.

64+18.78 P.I. Δ 16° 45'.00
R. 800
T 117.78
L. 233.87

63+01 BC. Lt

62+37 Main 18" Shut off valve + Valve Chamber } Sta. 63+24

61+97 8" Line to Airport



Gr. El. 11.4
(See FB 695, pg. 18 Sta 63+24)
EE

83+03.04 EE.

82+13.04 EE.

81+90.^{84} L. Rt 3°-20'-00

77+68.^{92} L. Rt 2°-12'-00"

75+14 Manhole

71+16.^{50} L. Lt 15°-31'-00

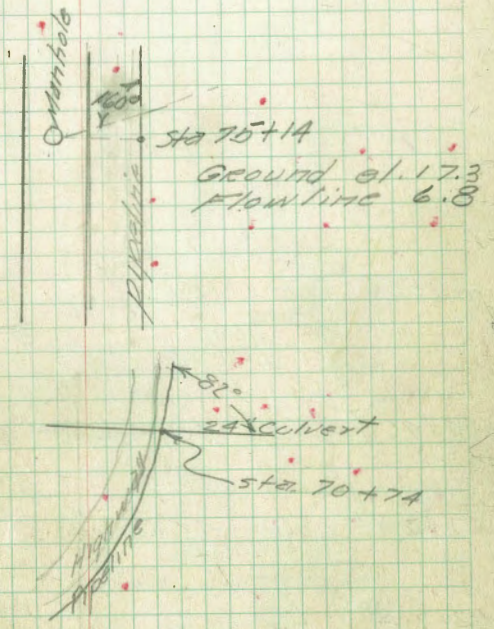
70+74 Culvert

69+71.^{25} L. Lt 2°-18'-00

68+01.^{90} L. Lt 17°-03'-00

S. side Delmar Bridge EE.

N. Side Delmar Bridge EE.



98+94 6" Sewer C.I. 0.4 above top main

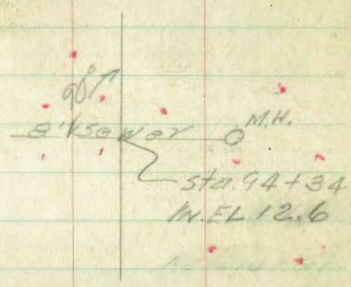
98+58 4" Drain from depot 1' above top pipe

98+17 L Lt 2°-50'-00 ± Gr. El. = 36.2 Tel. Pole 5' E of line Sta 98+39

98+00 Gr. El. = 35.7 begin Oil

97+66 Int Sewer

94+38 4 Blow off



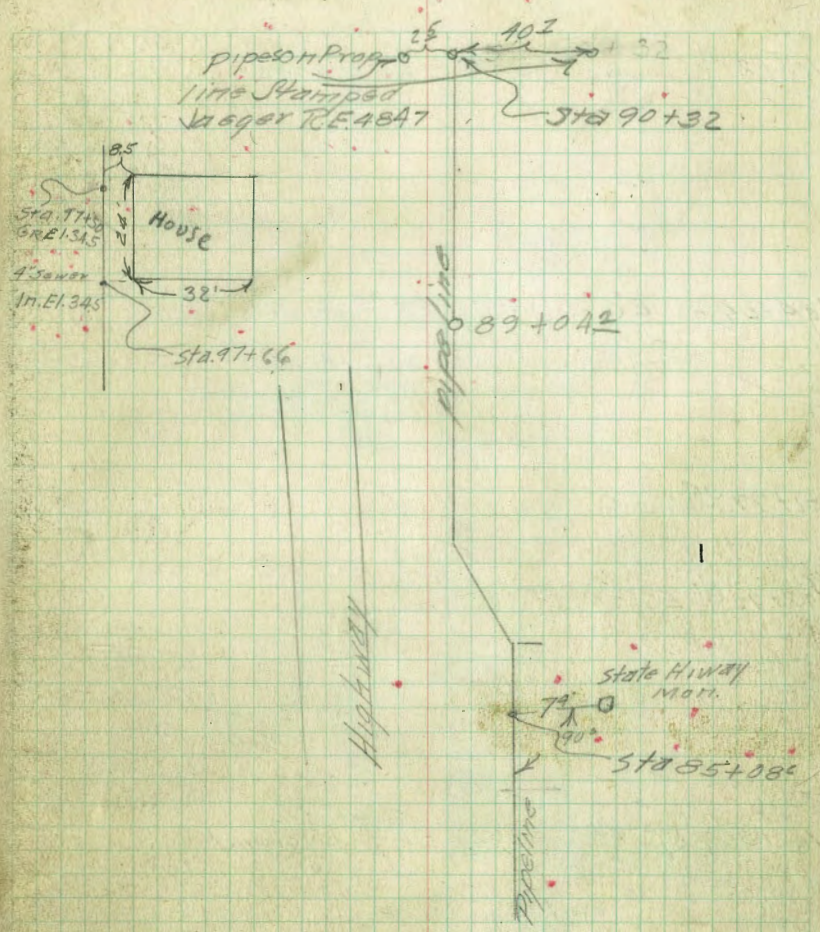
89+04 2 Air valve

85+46 1 L Rt ~~45°-00'-00~~ 49°30' ± ~~[illegible]~~

85+28 1 L Lt 45°-00'-00 END Conc. pipe EE

83+75 35 Air Valve

82+51 04 Jct. with Con. Pipe Near Del Mar Bridge



106+21.6 Begin C.I. under old Highway

104+04.06 EC = 105+48.03 original

Δ 22°-14'-00 Lt
R 325 ← From Map
T 63.86
L 126.12

102+77.94 B.C.

102+72.82 EC

58°-38'
Δ 31°-04'-00 35°-01'
R 325 ← From Map
T 90.33
L 176.22

100+96.5 BC Lt = 102+40.57 original

100+37.4 End C.I. L Rt to BC 8° Rt +

FRR
100+30
+96.7 L Rt To Meet C.I. Across Del Mar Steam Tunnel

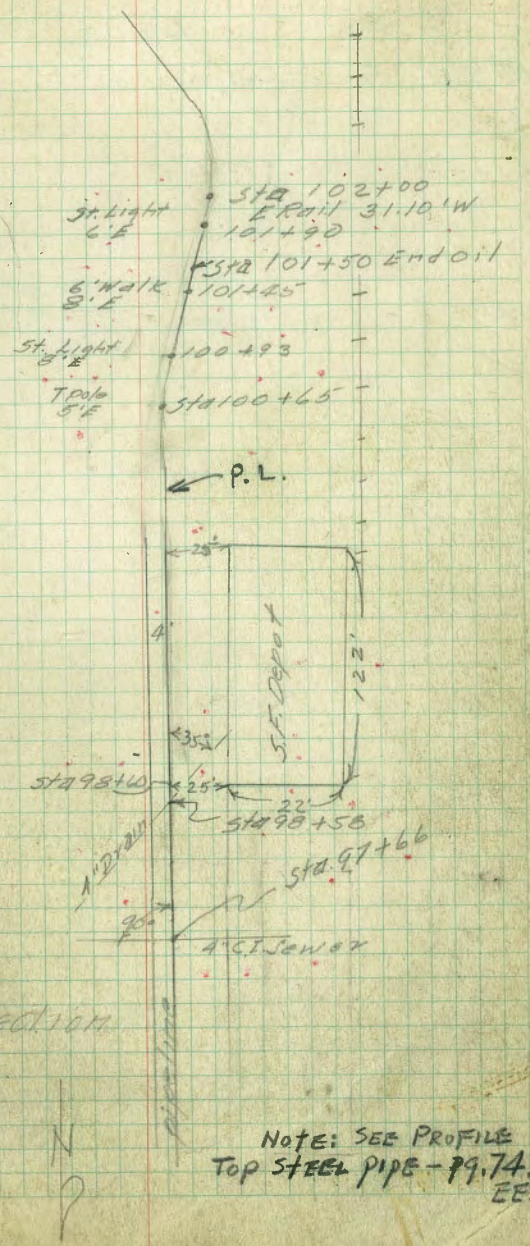
11°-10'-00

Δ 17°-46' From Map
R 325
T 50.80
L 100.78

2°-33'-00 Det to E

99+57 B.C. = 100+87.52 Original

20" C.I. pipe - 16' Long EE



Note: SEE PROFILE
Top Steel Pipe - 99.74.
EE.

118+05 End 18" begin 20"

117+35 Air valve (Note: Al Schroff checked 18" pipe at Sta. 116+83 on 5/31/56 R.L.E.)

115+41.76 L. Rt 59°-17'-00

114+70 80 L. Lt 59°-17'-00 # Note 18" pipe from 114+70 80 to 118+05

70.86

72.06

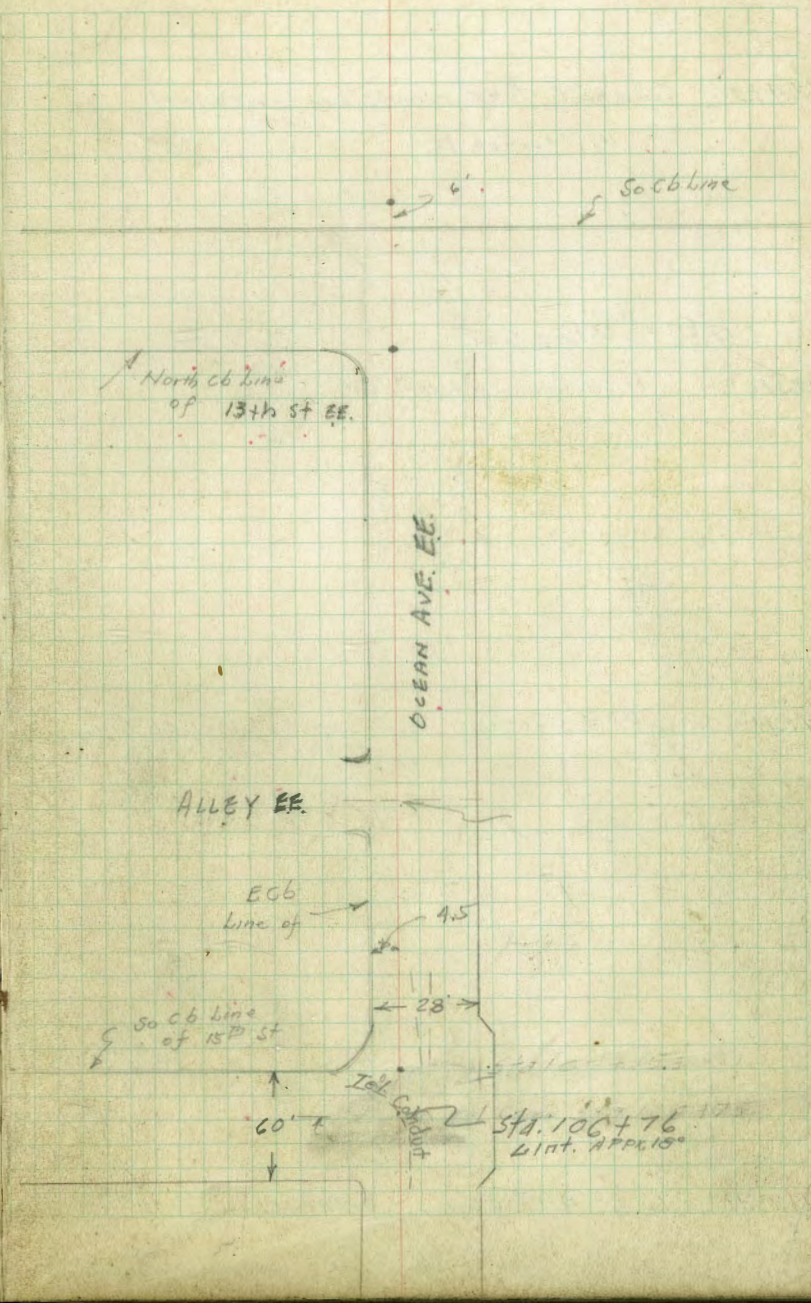
108+75 8 int 4" water

108+65 " 4" H.I. Press Gas 3.2 From Top Ground

108+58 int Tel Cable in Alley So. of 15th

107+15 3 So. Cb Line of 15th St

106+70 4 End C.I. under Highway



124+91. Connect to ex. Wood-stave encased in concrete

+17 ℄ 1". H. Press. Gas

123+08. N. Cb Line of 11th St

119+64.1 L. Rt 45°-00'-00" 9.2 West of the E Cb Line of Stratford Court

119+33 L. Lt 45°-00'-00" 8' N of S Cb Line of 12th St

132+47.63 L. Lt 30°-00'-00

131+52.97 L. Rt 38°. +-

131+51 2. Air valve

See F.B. 695, pg 73 EE.

130+67.70 L Lt 7°38' Lt. EE.

Continued on Page 66

19°48 Rt. EE (old 149+00.7)

148+46 30 L Rt. Connect ex Steel Line

(old 147+41.65)

146+86 80 L Lt 19°45 Lt EE.

(97?)

136+37 Air valve.

Profile of Ground Cuts for Construction — Lockwood Mesa Torrey Pines P.L.

	+	⊼	−	Elev	Elev Grade L.P. NW	
BM.	5.27 ✓	117.85 ✓		112.69 ✓	cb. 9th	Stratford Court
× 131+55 03	L. Lt		6.9	110.9		
" "	cut stake		7.6	110.2 ✓	107.2 ✓	3.0 ✓
132+0 ℄			8.1	109.7 ✓		
" "	cut stake		8.4	109.4 ✓	106.4 ✓	3.0 ✓
+50 ℄			8.4	109.4 ✓		
" "	cut stake		8.6	109.2 ✓	105.5 ✓	3.7 ✓
133 ℄			8.7	109.1 ✓		
"	cut stake		8.8	109.0 ✓	104.6 ✓	4.4 ✓
25			9.3	108.6 ✓	104.20 ✓	4.4 ✓ Brk
+50 ℄			9.7	108.2 ✓		
" "	Cut stake		10.0	107.9 ✓	104.20 ✓	3.7 ✓
134			10.1	107.8		
" "	" "		10.3	107.6 ✓	104.20	3.4
+25			10.0	107.9 ✓	104.20 ✓	3.7 ✓ Brk
+50			8.7	℄ 109.1 ✓		
"			9.4	108.4 ✓	105.0 ✓	3.4 ✓
135 ℄			6.6	111.2		
"	" "		7.4	110.4 ✓	106.7 ✓	3.7 ✓
+50			4.6	113.2 ✓		
"	cut stake		5.5	112.3 ✓	108.4 ✓	3.9 ✓
T.P.	8.39 ✓	120.73 ✓	5.51	112.34 ✓		

			120.73					
136 ℄				5.2	115.5			
"	cut stake			6.5	114.2	110.1	4.1	
+50 ℄				1.8	118.9			
"	" "			4.8	115.9	111.8	4.1	
+75	Brk			4.3	116.4	112.6	3.8	
137 ℄				0.6	120.1			
"	" "		0.2 Below	3.9	116.8	112.6	4.2	
			011					
+50			0.5 " "	1.4	119.3			
"	" "			4.1	116.6	112.6	4.0	
+80	Brk			4.6	116.1	112.6	3.5	Brk
138 ℄			0.3 Below	2.5	118.2			
			011					
"	" "			5.0	115.7	112.1	3.6	
+50				4.3	116.4			
"	" "			6.3	114.4	110.8	3.6	
139 ℄				6.5	114.2			
"	" "			8.0	112.7	109.5	3.2	
+25				8.3	112.4	108.8	3.6	Brk
+50 ℄				6.7	114.0			
"	cut stake			8.3	112.4	109.4	3.0	
140 ℄				5.6	115.1			
"	" "			7.2	113.5	110.5	3.0	
+50 ℄				4.3	116.4			
"	" "			6.0	114.7	111.6	3.1	
141 ℄				3.1	117.6			
"	" "			4.6	116.1	112.7	3.4	
+50 ℄				1.5	119.2			
"	" "			3.3	117.4	113.8	3.6	
+75				2.9	117.8	114.4	3.4	Brk
T.P.		11.47	128.34	3.26	117.47			

π
12894

142 ℄			9.1	119.9 ✓			
	cut stake		10.9	118.0 ✓	114.4 ✓	3.6 ✓	
+50 ℄			9.6	119.3 ✓			
" "	" "		11.0	117.9 ✓	114.4 ✓	3.5 ✓	BrK
143 ℄			9.4	119.5 ✓			
"	" "		10.8	118.1 ✓	115.2 ✓	2.9 ✓	
+50 ℄			8.2	120.7 ✓			
"	" "		9.2	119.7 ✓	116.0 ✓	3.7 ✓	
+75			8.4	120.5	116.4 ✓	4.1 ✓	BrK
144 ℄			7.0	121.9 ✓			
"	" "		8.0	120.9 ✓	116.4 ✓	4.5 ✓	
+50 ℄			6.5	122.4 ✓		4.7 EE	
"	" "		7.8	121.1 ✓	116.4 ✓	4.5 ✓	
+75			7.9	121.0 ✓	116.4 ✓	4.6 ✓	BrK
145 ℄			7.0	121.9 ✓			
"	" "		8.0	120.9 ✓	116.6 ✓	4.3 ✓	
+50 ℄			7.2	121.7 ✓			
" "	" "		8.1	120.8 ✓	116.9 ✓	3.9 ✓	
146 ℄			7.4	121.5 ✓			
"	cut stake		8.0	120.9 ✓	117.2 ✓	3.7 ✓	BrK
+50 ℄			6.4	122.5 ✓			
"	" "		6.5	122.4 ✓	118.7 ✓	3.7 ✓	
146+80 .03 L ℄			5.3	123.6 ✓			
	" "		5.6	123.3 ✓	119.5 ✓	3.8 ✓	
147 ℄			4.4	124.5 ✓			
"	" "		4.6	124.3 ✓	120.1 ✓	4.2 ✓	
T.P.	12.65 ✓	136.94 ✓	4.65 ✓	124.29 ✓			

		136.94	11.0	125.9	121.6
147+37.5				127.1 EG	
147+50	℄		9.8	122.7	
	Cut stake		10.6	126.3	122.6
148	℄		6.8	130.1	
"	"	"	8.2	128.7	126.7
148+39.53	Top ex	Steel pipe	5.22	131.72	130.0

43 Brk

3.7

2.0

1.7

Bliss
King
Phillips
Nierow
1/20/47

Cont'd from pg. 77

Profile of Ground Cuts for Construction Lockwood Mesa Torrey Pines Pl.

	6.22	95.66		89.44	Elev Grade	
112+64	cut stake		13.0	82.7	78.9	
	℄		13.0	82.7		
				84.3 EE		
113			11.4	83.3	79.5	4.8 EE
				84.3 EE		3.8
"	℄		11.4	83.3		
+50			9.2	86.5	82.8	3.7
"	℄		9.1	86.6		
114			7.5	88.2	84.6	3.6
"	℄		7.3	88.4		
+50			5.8	89.9	86.2	3.7
"	℄		5.7	90.0		
+70 80			4.8	90.9	87.2	3.7
"	℄		4.9	90.8		
115			3.3	92.4	88.9	3.5
"	℄		3.2	92.5		
Δ 115+41.76			0.7	95.0	91.1	3.9
	℄		0.2	95.5		
T.P.	6.58	101.53	0.71	94.95		
116			6.1	95.4	92.1	3.3
+50			5.7	95.8	92.5	3.3

					Cuts
	101.53 -				
117		5.8	95.7 -	92.5 -	3.2 -
+50		5.6	95.9	- 92.0 -	3.9 -
118	OK	6.0	95.5 -	91.6 -	3.9 -
	contd. pg. 78				
+50	*Note Grades forward from 118+00 on South	6.6	94.9	91.2 -	3.7
119		7.1	94.4		
△ 119+09.60	Void	8.8	92.7		
	See				
△ 119+64.19		7.2	94.3		
T.P.		7.06	94.47		

177+09.3

177+41.4 L to Lt Tan to Curve 86°+ — 23+81 St Hiway sta 74: From Row Mons on EC or BC

+20.4 Culvert

170+00.4 State Highway BC. Lt

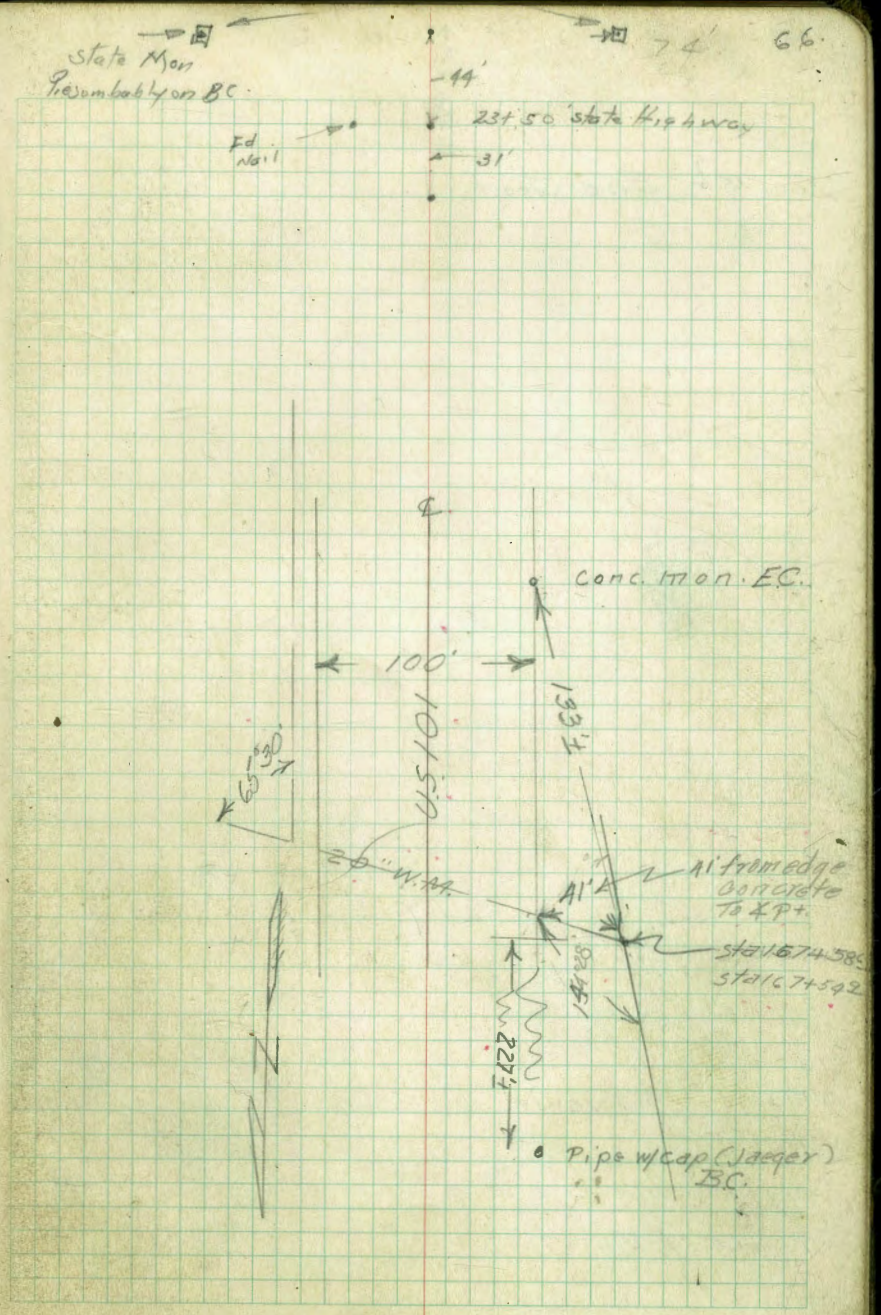
E of E EE

168+56.6 L Rt.? 5' So. of So. Line State High Paving

167+97 W. Side Paving

167+58.6 L Lt 30°+ —

Continued from Page 59



4093

197+21

200+14 7 End steel ✓

177+45.5'

177+74 7 Air valve

177+34.76

177+64 L.R.L 70°-10+ -

31'

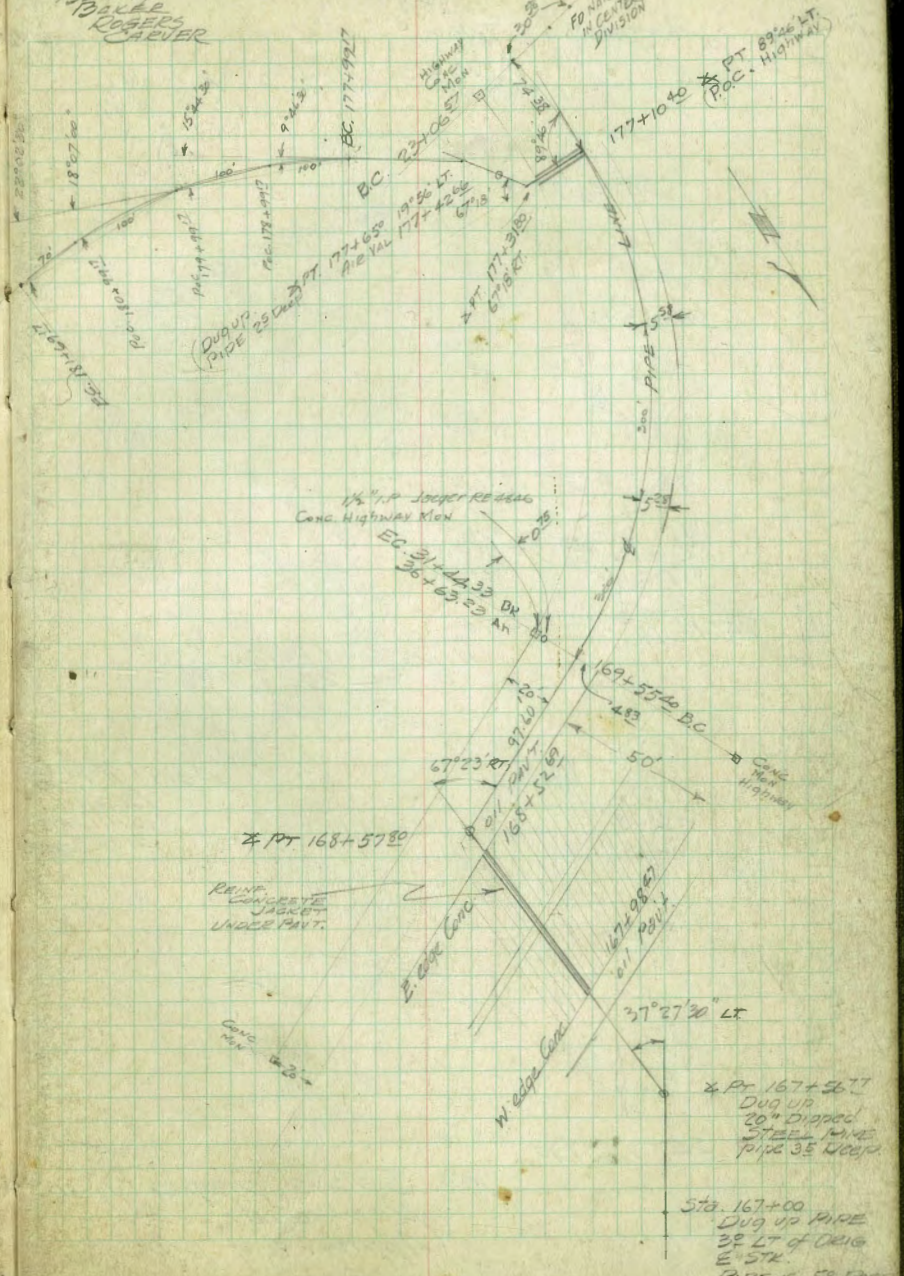
V.A. 44°-30 = 22.6 Reduced

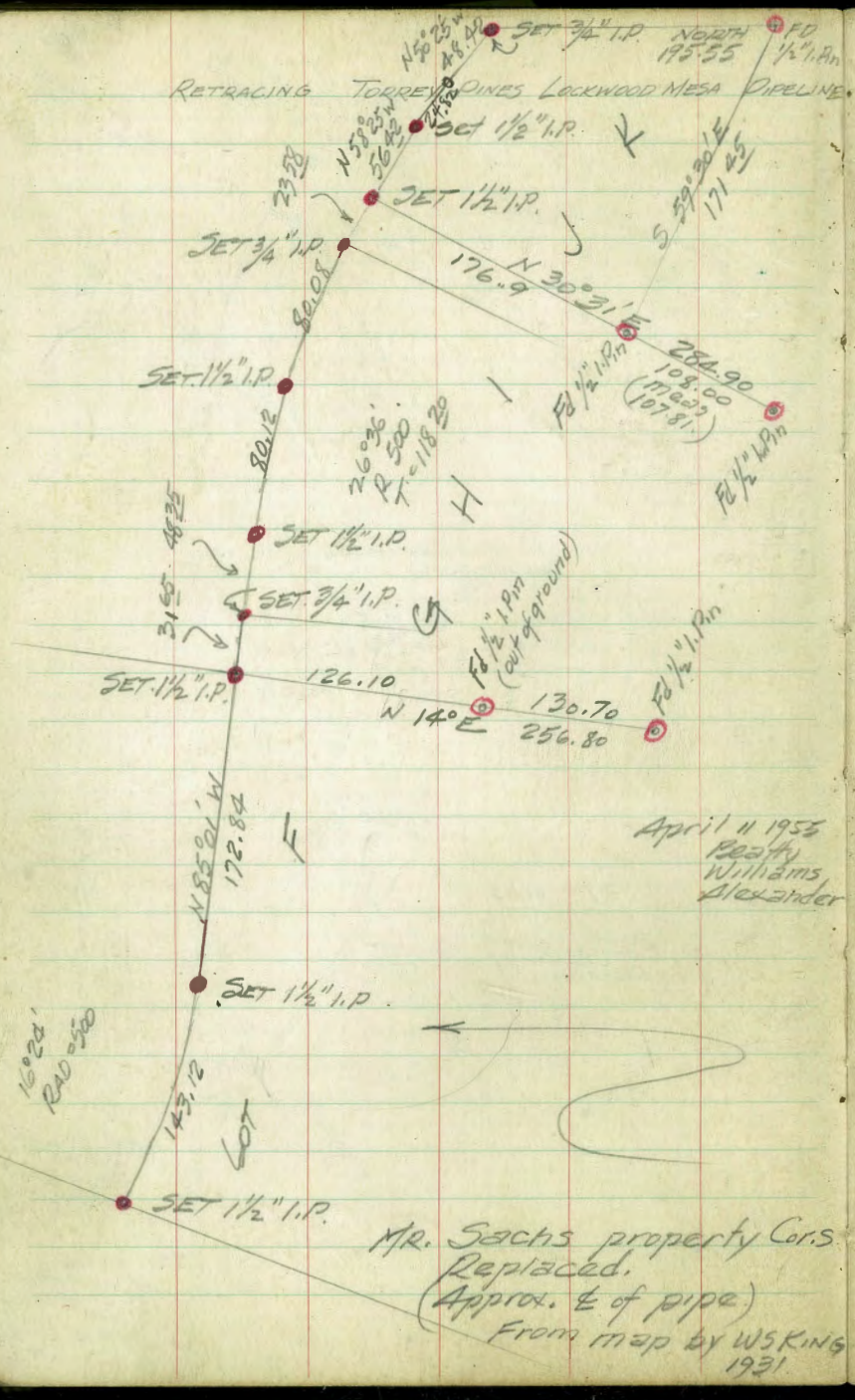
24/to 7 Begin C.I.

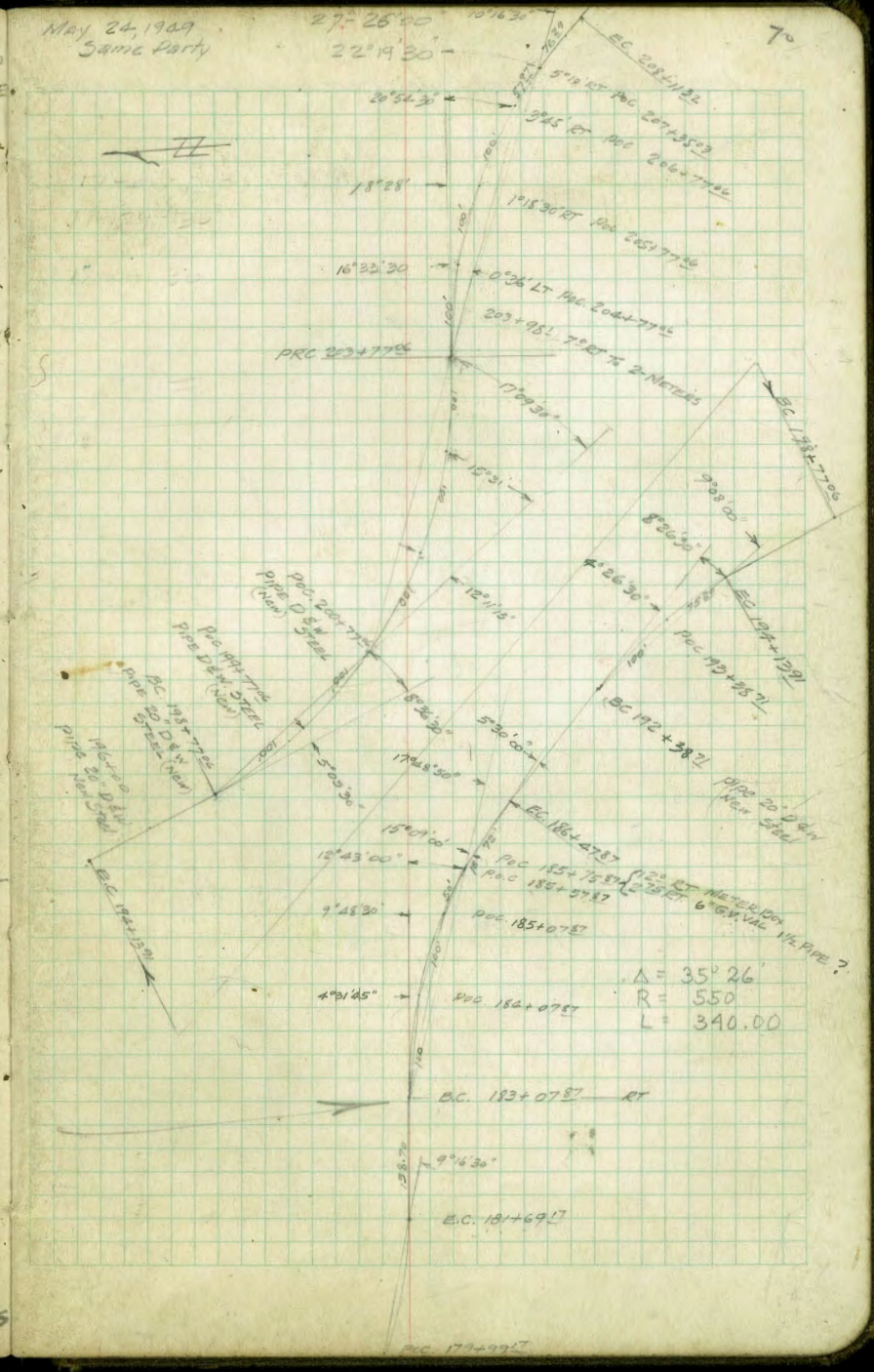
4093 Wood stove

Retracing Pipeline - Torrey Pines - Lockwood Mesa
(See page 66)

May 23 1949
Beatty
Baker
Rogers
Carver




RETRACING TORREY PINES LOCKWOOD MESA PIPELINE
SET 3/4" I.P.
NORTH 195.55
FD 1/2" I.Pin
N 50°25' W 48.42
Set 1 1/2" I.P.
N 58°25' W 56.42
SET 1 1/2" I.P.
SET 3/4" I.P.
S 59°30' E 171.45
176.9
N 30°31' E
284.90
108.00 (meas 107.81)
Fd 1/2" I.Pin
Fd 1/2" I.Pin
80.08
80.12
SET 1 1/2" I.P.
26°36' R 500 T=118.20
SET 1 1/2" I.P.
SET 3/4" I.P.
Fd 1/2" I.Pin (out of ground)
Fd 1/2" I.Pin
SET 1 1/2" I.P.
126.10
N 14° E
130.70
256.80
N 85°01' W 172.84
SET 1 1/2" I.P.
16°24' RAD=500
143.12
SET 1 1/2" I.P.
April 11 1955
Beatty
Williams
Alexander
MR. Sachs property Cor.s
Replaced.
(Approx. ℄ of pipe)
From map by W.S. King
1931

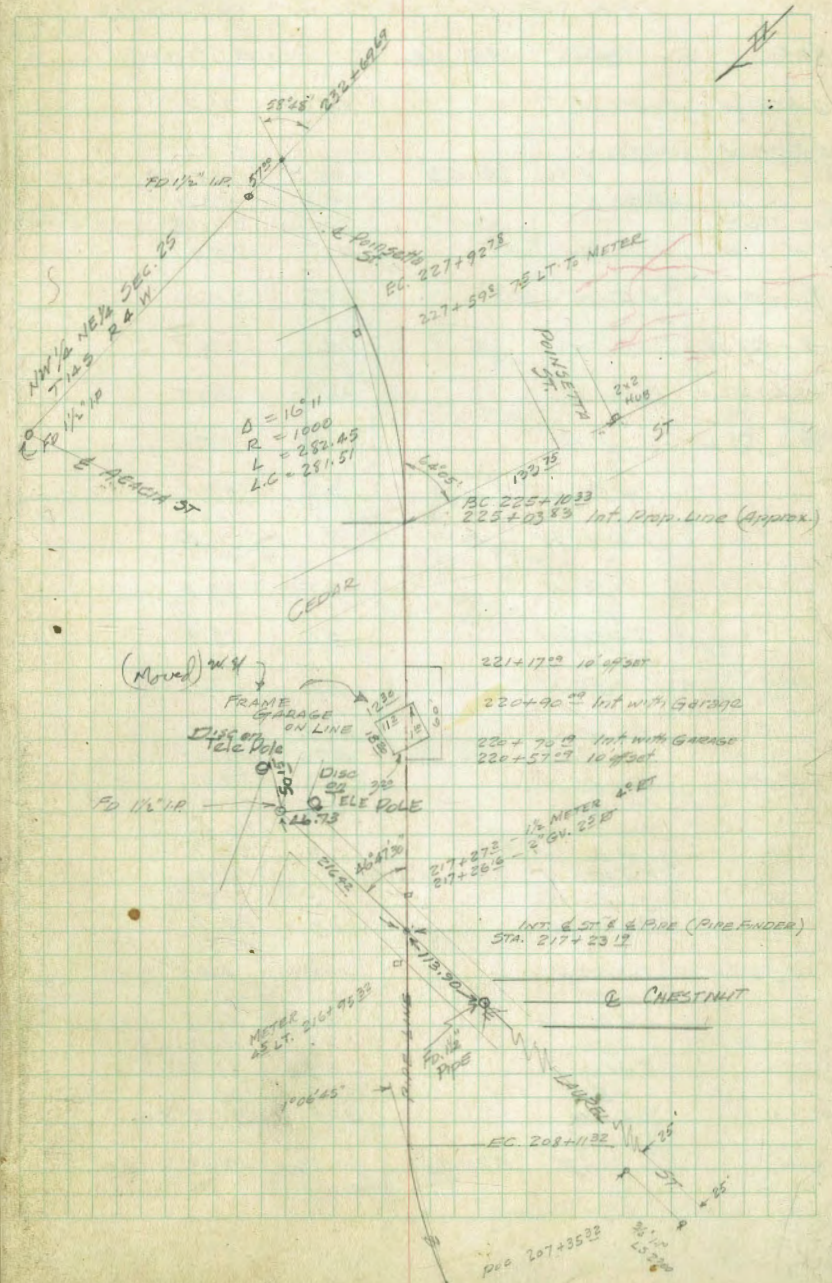

May 24, 1949
Same Party
7°
27°26'00"
22°19'30"
10°16'30"
E.C. 208+11.32
5°18' RT POC 207+35.03
3°45' RT POC 206+77.06
20°54'30"
18°28'
1°18'30" RT POC 205+77.06
16°33'30"
0°36' LT POC 204+77.06
203+98.1 7° RT TO 2-METERS
PRC 203+77.06
17°09'30"
15°31'
BC 198+77.06
9°08'00"
8°26'30"
4°26'30"
EC 194+13.91
POC 193+38.71
BC 192+38.71
12°11'15"
POC 200+77.06 PIPE D&W STEEL (New)
POC 199+77.06 PIPE D&W STEEL (New)
BC 198+77.06 PIPE 20" D&W STEEL (New)
196+00 PIPE 20" D&W New Steel
8°36'30"
5°30'00"
17°48'50"
5°03'30"
PIPE 20" D&W New Steel
EC 186+47.87
15°09'00"
12°43'00"
POC 185+75.87
POC 185+57.87
12° RT METER BOX
2.75 RT 6" G.V. VAL 1 1/2 PIPE ?
9°48'30"
POC 185+07.87
4°31'45"
POC 184+07.87
Δ = 35°26'
R = 550
L = 340.00
B.C. 183+07.87 RT
9°16'30"
E.C. 181+69.17
POC 179+99.17

316.42
13.70
330.32

330.32
216.42
113.90

RETRACING TORREY PINE LOCKWOOD MESA PIPELINE

MAY 25 1949
Same Party

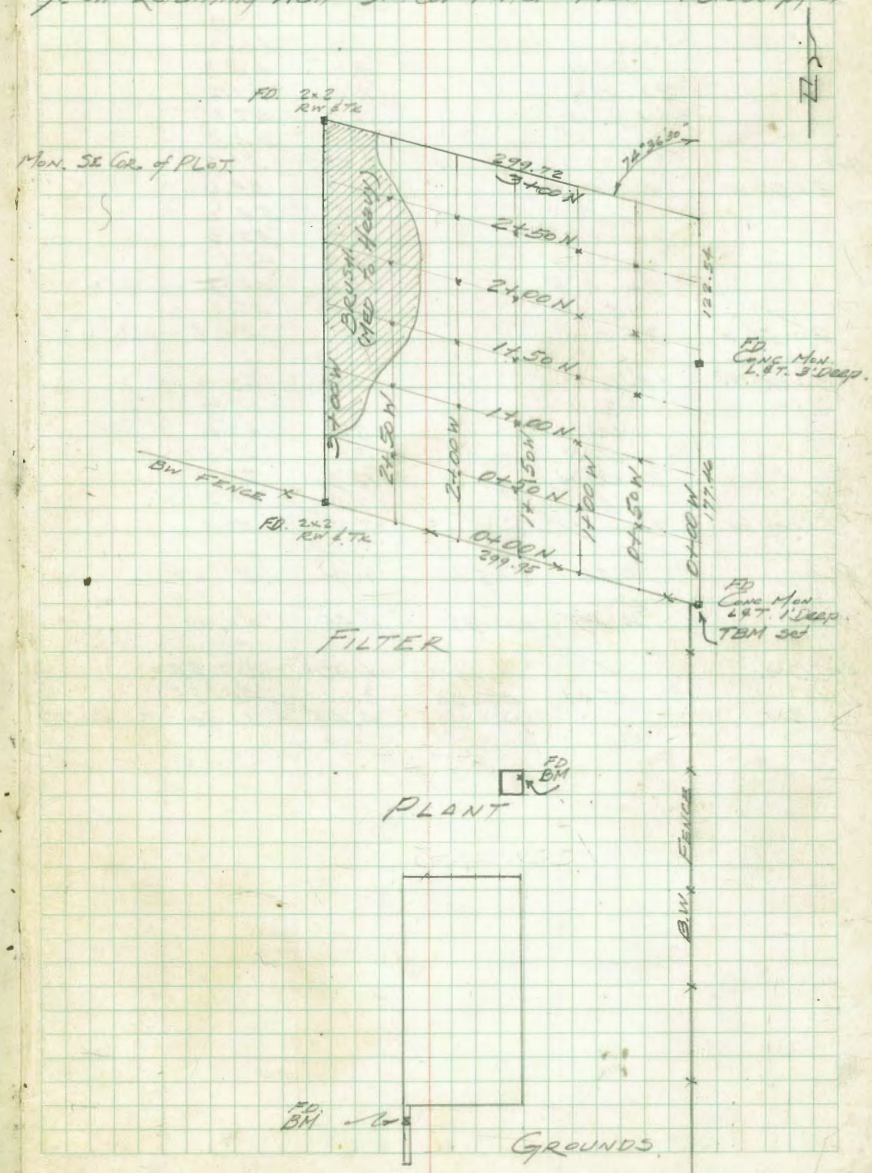


TORREY PINES FILTER PLANT
GRID X-SECTIONS of 300'x300' PLOT
NOR OF FILTER PLANT GROUNDS

BM.	3.45	45.24		41.79	
0+00W, 0+00N.			14.00	31.2	
0+00W, 0+50N.			16.0	29.2	
H	0.76	36.45	9.55	35.69	
0+00W 1+00N			9.6	26.9	
SET TBM.			6.26	30.19	on Conc.
0+00W 1+50N			11.3	25.2	
0+00W 2+00N			12.5	24.0	
0+00W, 2+50N			14.0	22.5	
0+00W, 3+00N			16.0	20.5	
0+50W 0+00N			1.4	35.1	
" +50N			3.4	33.1	
" 1+00N			5.1	31.4	
" +50N			6.7	29.8	
" 2+00N			7.6	28.9	
" +50N			9.2	27.3	
" 3+00N			11.4	25.1	
H	7.27	42.96	0.76	35.69	
1+00W. 0+00N			3.1	39.9	
" 0+50N			5.5	37.5	
" 1+00N			6.6	36.4	
" 1+50N			8.3	34.7	
" 2+00N			9.1	33.9	
" 2+50N			11.5	31.5	
" 3+00N			14.3	28.7	
1+50W 0+00N			+1.6	44.6	
" +50			0.4	42.6	
" 1+00			2.2	40.8	
" +50			2.8	40.2	
" 2+00			4.8	38.2	
" +50			7.9	35.1	
" 3+00			11.8	31.2	
H	11.65	53.78	0.83	42.13	

Nov. 27 1953
BEATTY
SHOREY
MARTELL

CH15 BM
X on Retaining Wall SW Cor Filter Plant FB 538 pg 37



TORREY PINES. FILTER PLANT (Cont'd.)

		53.78			
2+00 W	0+00 N		4.6	49.2	
"	+50 N		5.9	47.9	
"	1+00 N		7.6	46.2	
"	+50 N		9.0	44.8	
"	2+00 N		12.6	41.2	
"	+50 N		16.7	37.1	
"	3+00 N		19.3	34.5	
4	11.77	63.04	2.51	51.27	
2+50 W	0+00 N		7.1	55.9	
"	+50 N		8.8	54.2	
"	1+00 N		10.7	52.3	
"	+50 N		14.9	48.1	
"	2+00 N		16.3	46.7	(4' lower 15' Ely)
"	+50 N		15.8	47.2	
2+50 W	3+00 N		18.5	44.5	(4' lower 25' Ely)
3+00 W	0+00 N		0.0	63.0	
"	+50 N		1.6	61.4	
"	1+00 N		2.4	60.6	
"	+50 N		+4.5	67.5	
"	2+00 N		+12.3	75.3	
"	+50		+7.3	70.3	
3+00 W	3+00 N		11.2	51.8	
4	6.27	51.54	11.77	51.27	
4	4.43	42.52	11.45	40.09	
CK BM.			6.97	37.55 =	x NE Cor Wash Water Sump curb.
4	5.44	46.29	3.67	40.85	
CK. BM.			4.49	41.80 = 41.79.	x on Ret. wall SE Cor of Filter Plant

Profile of Steel Line Replacing Woodstave Lockwood Mesa Torrey Pines Pipe Line

100+50	Top Pipe		8.4	36.8	
" "	Ground		6.7	38.5	
T.P.	4.40	45.20	1.31	40.80	
100+37 4	Top Pipe		7.3	34.8	End C.I.
	Ground		3.7	38.4	
100+24 3	Top Pipe		5.8	36.3	Begin C.I.
	Ground		3.8	38.3	
99+96 7	L Top Pipe		6.0	36.1	
"	Ground		4.1	38.0	
99+57	B.C. Top Pipe		6.5	35.6	
"	Ground		4.3	37.8	
99	Top Pipe		6.6	35.5	
"	Ground		4.7	37.4	
98+50	Top Pipe		7.2	34.9	Top Pipe
"	Ground		5.1	37.0	
98+17	L Top Pipe		8.1	34.0	Top Pipe
"	Ground		6.0	36.1	
98+00	Top Pipe		9.1	33.0	Top Pipe
"	Ground		5.6	36.5	
97+50	Top Pipe		11.3	30.8	Top Pipe
" "	Ground		7.7	34.4	Ground
97+17	Top Pipe		13.2	28.9	Top Pipe
97+17 = 98+08 King	Ground		8.1	34.0	Ground
BM	3.94	42.11	38.17		

34.8 Top Stl. Pipe
−1.7 20¾ O.D. pipe
33.1 = Bot. Stl. pipe. EE.

Bliss
King
Phillips
Nienow
1/17/47

cont'd. from F.B. 695, pg. 77

T.P.	3.0	53.82	1.23	50.82
104+23	Top Sewer ¢"		5.1	47.0
104+00	E.C.		7.8	44.3
" "	Ground		5.1	47.0
103+99	Elec Conduit to st Lt 2' above			
103+71			8.8	43.3
" "	Ground		6.6	45.5
T.P.	763	52.05	0.78	44.42
103+50	Top pipe		2.7	42.5
" "	Ground		1.1	44.1
103	Top pipe		4.7	40.5
"	Ground		3.7	41.5
102+77 9	BC Top Pipe		55	39.7
" "	Ground		41	41.1
102+72 82	EC Top Pipe		56	39.6
" "	Ground		42	41.0
102+50	Top Pipe		6.2	39.0
" "	Ground		4.5	40.7
102+0	Top pipe		6.8	38.4
"	Ground		5.0	40.2
101+50	Top Pipe		7.5	37.7
" "	Ground		5.9	39.3
100+96 6	BC Top Pipe		8.1	37.1
"	Ground		6.4	38.8
		4520		

107+85	6" Sewer Top	11.3	70.8
"	Ground	8.6	73.5
+74.5	6" Sewer top	12.0	70.1
"	Ground	9.4	72.7
107+50		11.5	70.6
" "	Ground	10.6	71.5
107+23	St Light Conduit	15.0	67.1 ? BF.
" "	Ground		
107		14.8	67.3
"	Ground	13.1	69.0
TP	11.56 ~ 82.12 ~	12.5 ~	70.56 ~
+87.4	Top 6" Sewer	7.59	64.22
+87.4	"	5.60	66.21
"	Ground	2.1	69.7
+77.4	Top Tel Conduit	9.7	62.1
+70.4	Connect End C.I.	7.50	64.31
" "	Ground	4.9	66.9
106+21.5	Begin C.I. under Hwy	11.5	60.3
" "	Ground	9.5	62.3
T.P.	10.36 ~ 71.81 ~	0.54 ~	61.45 ~
105+50		5.7	56.3
" "	Ground	3.5	58.5
105		9.7	52.3
"	Ground	7.0	55.0
TP.	11.17 ~ 61.99 ~	3.0 ~	50.82 ~
104+50		5.6	48.2
"	Ground	2.4	51.4
	53.82		

Cont'd. pg. #64

+50	Top pipe	2.0	80.1
"	Ground	0.3	81.8
112	Top pipe 3.4 Lt	3.6	78.5
"	Ground	2.0	80.1
+50	Top pipe 3.4 Lt. to cb	5.3	76.8
"	Ground	3.5	78.6
111+00	Top pipe 3.4 Lt to cb	5.9	76.2
"	Ground	4.2	77.9
+70	Top. W. Main	6.2	75.9
+70	Top conduit St Light	5.3	76.8
+50	3.7 Lt to curb	6.2	75.9
"	Ground	4.0	77.7
+33	6" Sewer	8.1	74.0
"	Ground	4.6	77.5
110	3.9 from curb	6.4	75.7
"	Ground	4.7	77.4
+50	4.5 From curb	6.8	75.3
"	Ground	5.1	77.0
109		7.6	74.5
"	Ground	6.0	76.1
+25.8	4" water Main Top	7.2	74.9
+62	4" Gas Top pipe	9.7	72.4
+50	Top Pipe	7.8	74.3
"	Ground	6.7	75.4
108		9.1	73.0
108	Ground	8.0	74.1

82.12 ←

+50	Top Pipe	6.8	93.2
"	Ground	4.3	95.7
122	Top Pipe	6.9	93.1
	Ground	4.5	95.5
+50		7.2	92.8
"	Ground	4.8	95.2
121		7.5	92.5
"	Ground	5.0	95.0
+50	Top Pipe	7.4	92.6
"	Ground	5.0	95.0
120		7.7	92.3
"	Ground	5.2	94.8
T.P.	6.39 ✓ 99.97 ✓	8.48 ✓	93.58 ✓
+64.10	L. Rt 45° Top Pipe	12.7	89.4
"	Ground	7.6	94.5
119+33 L.	Lt 45° 200 W	12.7	89.4
"	Ground	9.1	93.0
119+22	Top Pipe	12.7	89.4
" "	Ground	8.5	93.6
119+00	Top Pipe	11.5	90.6
"	Ground	8.3	93.8
TP	9.80 ✓ 102.66 ✓	1.71 ✓	92.26 ✓
TP	12.42 ✓ 93.97 ✓	0.57 ✓	81.55 ✓
	8212 ✓		

cont'd. from pg. 65

L

L

Note Bottom of Pipe 2" above Sewer

Check		5.61 ✓	94.36 ✓	
124+91	Connect Shelt Cor	5.7	94.3	✓
"	Ground	1.8	98.2	✓
+50		7.5	92.5	✓
"	Ground	3.7	96.3	✓
124		7.3	92.7	✓
"	Ground	3.1	96.9	✓
+90	Gas J. Top. Pipe	4.8	95.2	✓
	Ground	3.3	96.7	✓
+50	Top. Pipe	7.7	92.3	✓
"	Ground	4.1	95.9	✓
+17 6	1" Hi Pressure Gas	6.9	93.1	✓
"	Ground	4.2	95.8	✓
123	Top. Pipe	7.5	92.5	✓
"	Ground	4.4	95.6	✓
	99.97			

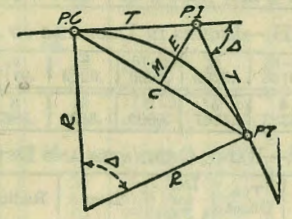
Cut Stake at 119+0. See page 65

117+35 Airvalve 118+05
End 18" begins 20

DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

125+06

Copyright, 1914, by Eugene Dietzgen Co., New York City



17' from 118+64.10
To S.Cb 12th st

20" To L
13th
18" from L
To 118+05

CURVE FORMULAS

Radius$=R=\frac{50}{\sin. D/2}$ (1) Degree of Curve$=D$ and $\sin. \frac{D}{2}=\frac{50}{R}$ (2)

Tangent$=T=R\tan\frac{\Delta}{2}$ (3) Length of Curve$=L=100\frac{\Delta}{D}$ (4)

Middle ordinate$=M=R(1-\cos. \frac{\Delta}{2})$ (5) $=R\text{vers}\frac{\Delta}{2}$ (6)

External$=E=T\tan\frac{\Delta}{4}$ (7) $=R\div\cos.\frac{\Delta}{2}-R$ (8) $=R\text{exsec}\frac{\Delta}{2}$ (9)

Long Chord$=C=2R\sin.\frac{\Delta}{2}$ (10) Δ=Central Angle

EXPLANATION AND USE OF TABLES

Stations.—Given P. I.=Sta. 161+60.35 to find Sta. of P. C. and P. T. $\Delta=62° 10'$ $D=8° 20'$. From Table IV for 1° curve T=3454.1 and $\div 8\frac{1}{3}=414.49$ ft. From Table V correction=.36 or T=414.85 ft. P. C.=Sta. P.I.—T=157+45.50. Also from (4) L=746.00 and P. T.=Sta. P. C.+L=164+91.50.

Offsets.—Tangent offsets vary (approximately) directly with D and with square of the distance. Thus tangent offset for Sta. 158 on above curve is 2.16 ft. found as follows. From Table III tangent-offset for 100 ft.=7.27 ft. Distance=158—Sta. P. C.=54.50, hence offset$=7.27\ (54.50\div 100)^2=2.16$ ft. Also square of any distance divided by twice the radius equals (approximately) the distance from tangent to curve. Thus $(54.50)^2\div(2\times 688.26)=2.16$ ft.

Deflections.—Deflection angle$=\frac{1}{2}$ D for 100 ft., $\frac{1}{4}$ D for 50 ft., etc. For c ft.=(in minutes) $.3\times C\times D°$ or=defl. for 1 ft. from Table III x C. For Sta. 158 of above curve$=.3\times 54.5\times 8\frac{1}{3}=136.2'$ or 2° 16.2′, or$=2.50\times 54.5=136.2'$ from Table III. For Sta. 159 deflection angle$=2° 16.2'+8° 20'\div 2=6° 26.2'$, etc.

Externals.—May be found in similar manner to tangents. Thus E for curve above is 91.37. For from Table IV for 1° curve E=960.6 for 8° 20′$=960.6\div 8\frac{1}{3}=91.27$ and from Table V correction=.10 or E=91.37 ft. Or suppose $\Delta=32°$ and E is measured and found to be 42 ft. What is D? From Table IV E=230.9 and $\div 42=5.5$ or D=5° 30′.

Table I.—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 II.—Inches in Decimals of a Foot.

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

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

Table III.—Radii, Ordinates and Deflections.

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

Note. Chord Deflection=2 times tangent deflection.

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Table IV.—Tangents and Externals to a 1° Curve.

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

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

FOR SUB-CHORDS ADD										Excess of arc per 100 ft.	LONG CHORDS				
D	10	20	30	40	50	60	70	80	90		D	200	300	400	500
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02	1	199.99	299.97	399.92	499.85
6	.00	.01	.01	.02	.02	.02	.02	.01	01	.05	2	199.97	299.88	399.70	499.39
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08	3	199.93	299.73	399.32	498.63
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13	4	199.88	299.51	398.78	497.57
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18	5	199.81	299.24	398.10	496.20
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25	6	199.73	298.90	397.26	494.53
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33	7	199.63	298.51	396.28	492.57
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41	8	199.51	298.05	395.14	490.31
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51	9	199.38	297.54	393.86	487.75
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62	10	199.24	296.96	392.42	484.90
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74	12	198.90	295.63	389.12	478.34
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86	14	198.51	294.06	385.22	470.65
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00	16	198.05	292.25	380.76	461.86
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15	18	197.54	290.21	375.74	452.02
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31	20	196.90	287.94	370.17	441.15
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48	22	196.32	285.44	364.06	429.30
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66	24	195.63	282.71	357.43	416.53
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86	26	194.87	279.76	350.30	402.89
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.06	276.59	342.69	388.42
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

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

Table VII.—Middle Ordinates for Rails in Feet.

Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS.						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.366	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.067	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

SLOPE REDUCTIONS.

When distances are measured on a slope they may be reduced to the equivalent horizontal distance by the following approximate rule:—subtract from the slope distance the square of the rise divided by twice the slope distance. Thus for a slope distance of 250.3 ft. and a rise of 15 ft. correction$=15^2\div2\times250.3=.45$ (by slide rule) or horizontal distance$=250.3-.45=249.85$. When vertical angle=V. A. is measured horizontal distance=slope distance—slope distance (1—Cos. V. A.). Thus for slope distance of 248.7 ft. and V. A. of 4° 20′ from Table VIII Cos=.99714 and correction=1—.99714=.00286 per foot or total of .286× 2½ (near enough)=.57 and horizontal distance=248.7—.57=248.13 ft.

TRIGONOMETRICAL FORMULAS.

See fig. (a).

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

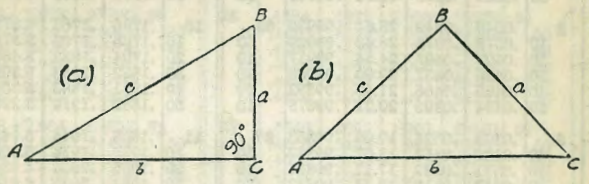
cos. $A=\frac{b}{c}$

tan. $A=\frac{a}{b}$

cot. $A=\frac{b}{a}$

sec. $A=\frac{c}{b}$

cosec. $A=\frac{c}{a}$



Formula for Solving Triangles.

Given	Sought.	Right triangles. See fig. (a).
a, c	A, B, b	$\sin. A=\frac{a}{c}$, $\cos. B=\frac{a}{c}$, $b=\sqrt{(c+a)(c-a)}$
a, b	A, B, c	$\tan. A=\frac{a}{b}$, $\cot. B=\frac{a}{b}$, $c=\sqrt{a^2+b^2}$.
A, a	B, b, c	$B=90°-A$, $b=a \cot. A$, $c=\frac{a}{\sin. A}$.
A, b	B, a, c	$B=90°-A$, $a=b \tan. A$, $c=\frac{b}{\cos. A}$.
A, c	B, a, b	$B=90°-A$, $a=c \sin. A$, $b=c \cos. A$
Given	**Sought.**	**Oblique triangles. See fig. (b).**
A, B, a	b	$b=\frac{a \sin. B}{\sin. A}$
A, a, b	B	$\sin. B=\frac{b \sin. A}{a}$
a, b, C	$A-B$	$\tan. \frac{1}{2}(A-B)=\frac{(a-b) \tan. \frac{1}{2}(A+B)}{a+b}$
a, b, c	A	If $s=\frac{1}{2}(a+b+c)$, $\sin. \frac{1}{2}A=\sqrt{\frac{(s-b)(s-c)}{bc}}$; $\cos. \frac{1}{2}A=\sqrt{\frac{s(s-a)}{bc}}$, $\tan. \frac{1}{2}A=\sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$; $\sin. A=\frac{2\sqrt{(s-a)(s-b)(s-c)s}}{bc}$
A, B, C, a	area	$\text{area}=\frac{a^2 \sin. B \sin. C}{2 \sin. A}$
A, b, c	area	$\text{area}=\frac{1}{2} bc \sin. A$
a, b, c	area	$s=\frac{1}{2}(a+b+c)$, $\text{area}=\sqrt{s(s-a)(s-b)(s-c)}$

Table VIII.—Natural Trigonometrical Functions.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
° ′						° ′					
0	0	0	00	1	90	8	.1392	.1405	7.115	.99027	82
10	.0029	.0029	343.8	1	50	10	.1421	.1435	6.968	.98986	50
20	.0058	.0058	171.9	.99998	40	20	.1449	.1465	6.827	.98944	40
30	.0087	.0087	114.6	.99996	30	30	.1478	.1495	6.691	.98902	30
40	.0116	.0116	85.94	.99993	20	40	.1507	.1524	6.561	.98858	20
50	.0145	.0145	68.75	.99989	10	50	.1536	.1554	6.435	.98814	10
1	.0175	.0175	57.29	.99985	89	9	.1564	.1584	6.314	.98769	81
10	.0204	.0204	49.10	.99979	50	10	.1593	.1614	6.197	.98723	50
20	.0233	.0233	42.96	.99973	40	20	.1622	.1644	6.084	.98676	40
30	.0262	.0262	38.19	.99966	30	30	.1650	.1673	5.976	.98629	30
40	.0291	.0291	34.37	.99958	20	40	.1679	.1703	5.871	.98580	20
50	.0320	.0320	31.24	.99949	10	50	.1708	.1733	5.769	.98531	10
2	.0349	.0349	28.64	.99939	88	10	.1736	.1763	5.671	.98481	80
10	.0378	.0378	26.43	.99929	50	10	.1765	.1793	5.576	.98430	50
20	.0407	.0407	24.54	.99917	40	20	.1794	.1823	5.485	.98378	40
30	.0436	.0437	22.90	.99905	30	30	.1822	.1853	5.396	.98325	30
40	.0465	.0466	21.47	.99892	20	40	.1851	.1883	5.309	.98272	20
50	.0494	.0495	20.21	.99878	10	50	.1880	.1914	5.226	.98218	10
3	.0523	.0524	19.08	.99863	87	11	.1908	.1944	5.145	.98163	79
10	.0552	.0553	18.07	.99847	50	10	.1937	.1974	5.066	.98107	50
20	.0581	.0582	17.17	.99831	40	20	.1965	.2004	4.989	.98050	40
30	.0610	.0612	16.35	.99813	30	30	.1994	.2035	4.915	.97992	30
40	.0640	.0641	15.60	.99795	20	40	.2022	.2065	4.843	.97934	20
50	.0669	.0670	14.92	.99776	10	50	.2051	.2095	4.773	.97875	10
4	.0698	.0699	14.30	.99756	86	12	.2079	.2126	4.705	.97815	78
10	.0727	.0729	13.73	.99736	50	10	.2108	.2156	4.638	.97754	50
20	.0756	.0758	13.20	.99714	40	20	.2136	.2186	4.574	.97692	40
30	.0785	.0787	12.71	.99692	30	30	.2164	.2217	4.511	.97630	30
40	.0814	.0816	12.25	.99668	20	40	.2193	.2247	4.449	.97566	20
50	.0843	.0846	11.83	.99644	10	50	.2221	.2278	4.390	.97502	10
5	.0872	.0875	11.43	.99619	85	13	.2250	.2309	4.331	.97437	77
10	.0901	.0904	11.06	.99594	50	10	.2278	.2339	4.275	.97371	50
20	.0929	.0934	10.71	.99567	40	20	.2306	.2370	4.219	.97304	40
30	.0958	.0963	10.39	.99540	30	30	.2334	.2401	4.165	.97237	30
40	.0987	.0992	10.08	.99511	20	40	.2363	.2432	4.113	.97169	20
50	.1016	.1022	9.788	.99482	10	50	.2391	.2462	4.061	.97100	10
6	.1045	.1051	9.514	.99452	84	14	.2419	.2493	4.011	.97030	76
10	.1074	.1080	9.255	.99421	50	10	.2447	.2524	3.962	.96959	50
20	.1103	.1110	9.010	.99390	40	20	.2476	.2555	3.914	.96887	40
30	.1132	.1139	8.777	.99357	30	30	.2504	.2586	3.867	.96815	30
40	.1161	.1169	8.556	.99324	20	40	.2532	.2617	3.821	.96742	20
50	.1190	.1198	8.345	.99290	10	50	.2560	.2648	3.776	.96667	10
7	.1219	.1228	8.144	.99255	83	15	.2588	.2679	3.732	.96593	75
10	.1248	.1257	7.953	.99219	50	10	.2616	.2711	3.689	.96517	50
20	.1276	.1287	7.770	.99182	40	20	.2644	.2742	3.647	.96440	40
30	.1305	.1317	7.596	.99144	30	30	.2672	.2773	3.606	.96363	30
40	.1334	.1346	7.429	.99106	20	40	.2700	.2805	3.566	.96285	20
50	.1363	.1376	7.269	.99067	10	50	.2728	.2836	3.526	.96206	10
					82						74
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

Table VIII.—Natural Trigonometrical Functions.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
° ′						° ′					
16	.2756	.2867	3.487	.96126	74	24	.4067	.4452	2.246	.91355	66
10	.2784	.2899	3.450	.96046	50	10	.4094	.4487	2.229	.91236	50
20	.2812	.2931	3.412	.95964	40	20	.4120	.4522	2.211	.91116	40
30	.2840	.2962	3.376	.95882	30	30	.4147	.4557	2.194	.90996	30
40	.2868	.2994	3.340	.95799	20	40	.4173	.4592	2.177	.90875	20
50	.2896	.3026	3.305	.95715	10	50	.4200	.4628	2.161	.90753	10
17	.2924	.3057	3.271	.95615	73	25	.4226	.4663	2.145	.90631	65
10	.2952	.3089	3.237	.95545	50	10	.4253	.4699	2.128	.90507	50
20	.2979	.3121	3.204	.95459	40	20	.4279	.4734	2.112	.90383	40
30	.3007	.3153	3.172	.95372	30	30	.4305	.4770	2.097	.90259	30
40	.3035	.3185	3.140	.95284	20	40	.4331	.4806	2.081	.90133	20
50	.3062	.3217	3.108	.95195	10	50	.4358	.4841	2.066	.90007	10
18	.3090	.3249	3.078	.95106	72	26	.4384	.4877	2.050	.89879	64
10	.3118	.3281	3.048	.95015	50	10	.4410	.4913	2.035	.89752	50
20	.3145	.3314	3.018	.94924	40	20	.4436	.4950	2.020	.89623	40
30	.3173	.3346	2.989	.94832	30	30	.4462	.4986	2.006	.89493	30
40	.3201	.3378	2.960	.94740	20	40	.4488	.5022	1.991	.89363	20
50	.3228	.3411	2.932	.94646	10	50	.4514	.5059	1.977	.89232	10
19	.3256	.3443	2.904	.94552	71	27	.4540	.5095	1.963	.89101	63
10	.3283	.3476	2.877	.94457	50	10	.4566	.5132	1.949	.88968	50
20	.3311	.3508	2.850	.94361	40	20	.4592	.5169	1.935	.88835	40
30	.3338	.3541	2.824	.94264	30	30	.4617	.5206	1.921	.88701	30
40	.3365	.3574	2.798	.94167	20	40	.4643	.5243	1.907	.88566	20
50	.3393	.3607	2.773	.94068	10	50	.4669	.5280	1.894	.88431	10
20	.3420	.3640	2.747	.93969	70	28	.4695	.5317	1.881	.88295	62
10	.3448	.3673	2.723	.93869	50	10	.4720	.5354	1.868	.88158	50
20	.3475	.3706	2.699	.93769	40	20	.4746	.5392	1.855	.88020	40
30	.3502	.3739	2.675	.93667	30	30	.4772	.5430	1.842	.87882	30
40	.3529	.3772	2.651	.93565	20	40	.4797	.5467	1.829	.87743	20
50	.3557	.3805	2.628	.93462	10	50	.4823	.5505	1.816	.87603	10
21	.3584	.3839	2.605	.93358	69	29	.4848	.5543	1.804	.87462	61
10	.3611	.3872	2.583	.93253	50	10	.4874	.5581	1.792	.87321	50
20	.3638	.3906	2.560	.93148	40	20	.4899	.5619	1.780	.87178	40
30	.3665	.3939	2.539	.93042	30	30	.4924	.5658	1.767	.87036	30
40	.3692	.3973	2.517	.92935	20	40	.4950	.5696	1.756	.86892	20
50	.3719	.4006	2.496	.92827	10	50	.4975	.5735	1.744	.86748	10
22	.3746	.4040	2.475	.92718	68	30	.5000	.5774	1.732	.86603	60
10	.3773	.4074	2.455	.92609	50	10	.5025	.5812	1.720	.86457	50
20	.3800	.4108	2.434	.92499	40	20	.5050	.5851	1.709	.86310	40
30	.3827	.4142	2.414	.92388	30	30	.5075	.5890	1.698	.86163	30
40	.3854	.4176	2.394	.92276	20	40	.5100	.5930	1.686	.86015	20
50	.3881	.4210	2.375	.92164	10	50	.5125	.5969	1.675	.85866	10
23	.3907	.4245	2.356	.92050	67	31	.5150	.6009	1.664	.85717	59
10	.3934	.4279	2.337	.91936	50	10	.5175	.6048	1.653	.85567	50
20	.3961	.4314	2.318	.91822	40	20	.5200	.6088	1.643	.85416	40
30	.3987	.4348	2.300	.91706	30	30	.5225	.6128	1.632	.85264	30
40	.4014	.4383	2.282	.91590	20	40	.5250	.6168	1.621	.85112	20
50	.4041	.4417	2.264	.91472	10	50	.5275	.6208	1.611	.84959	10
					66						58
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

Table VIII.—Natural Trigonometrical Functions.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
° ′						° ′					
32	.5299	.6249	1.600	.84805	58	30	.6225	.7954	1.257	78261	30
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	78079	20
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	10
30	.5373	.6371	1.570	.84339	30						
40	.5398	.6412	1.560	.84182	20	39	.6293	.8098	1.235	.77715	51
50	.5422	.6453	1.550	.84025	10	10	.6316	.8146	1.228	.77531	50
						20	.6338	.8195	1.220	.77347	40
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	30
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	20
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	10
30	.5519	.6619	1.511	.83389	30						
40	.5544	.6661	1.501	.83228	20	40	.6428	.8391	1.192	.76604	50
50	.5568	.6703	1.492	.83066	10	10	.6450	.8441	1.185	.76417	50
						20	.6472	.8491	1.178	.76229	40
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	30
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	20
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	10
30	.5664	.6873	1.455	.82413	30						
40	.5688	.6916	1.446	.82248	20	41	.6561	.8693	1.150	.75471	49
50	.5712	.6959	1.437	.82082	10	10	.6583	.8744	1.144	.75280	50
						20	.6604	.8796	1.137	.75088	40
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	30
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	20
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	10
30	.5807	.7133	1.402	.81412	30						
40	.5831	.7177	1.393	.81242	20	42	.6691	.9004	1.111	.74314	48
50	.5854	.7221	1.385	.81072	10	10	.6713	.9057	1.104	.74120	50
						20	.6734	.9110	1.098	.73924	40
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	30
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	20
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	10
30	.5948	.7400	1.351	.80386	30						
40	.5972	.7445	1.343	.80212	20	43	.6820	.9325	1.072	.73135	47
50	.5995	.7490	1.335	.80038	10	10	.6841	.9380	1.066	.72937	50
						20	.6862	.9435	1.060	.72737	40
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	30
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	20
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	10
30	.6088	.7673	1.303	.79335	30						
40	.6111	.7720	1.295	.79158	20	44	.6947	.9657	1.036	.71934	46
50	.6134	.7766	1.288	.78980	10	10	.6967	.6713	1.030	.71732	50
						20	.6988	.9770	1.024	.71529	40
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	30
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	20
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	10
							.7071	1.	1.	.70711	45
											° ′
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

Table IX.—Calculation of Earthwork.

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

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

+ 763 | H.I. 71.34 | Elev. 63.71

107+23 + Top Conduit | 11.0

107+74.5 6" Sewer | 8.0 | 63.3
" Ground | 5.4

107+95 6" Sewer | 7.3 | 64
" Ground | 4.6

2.7

11.3
2.7
8.6

75.4
60.3
15.1

75.3
64
11.3

75.3
60.3
15.0

75.3
63.3
12.0
2.6
9.4

W. Sev 123+97

Sewer 124+04

64.96
1.25
63.71

97+16=
89+50

9.7 Top Tel Con

107+23
51
107.74

3.8
1.7
2.1

7.29
1.67
5.62

9.17
7.27
1.90

7.29
3.
7.59

3.8
1.7
2.1

1.9
15

1.
.1266
Tan 15) 1.9
15
40
30
100
9.

7.27
1.67
5.60

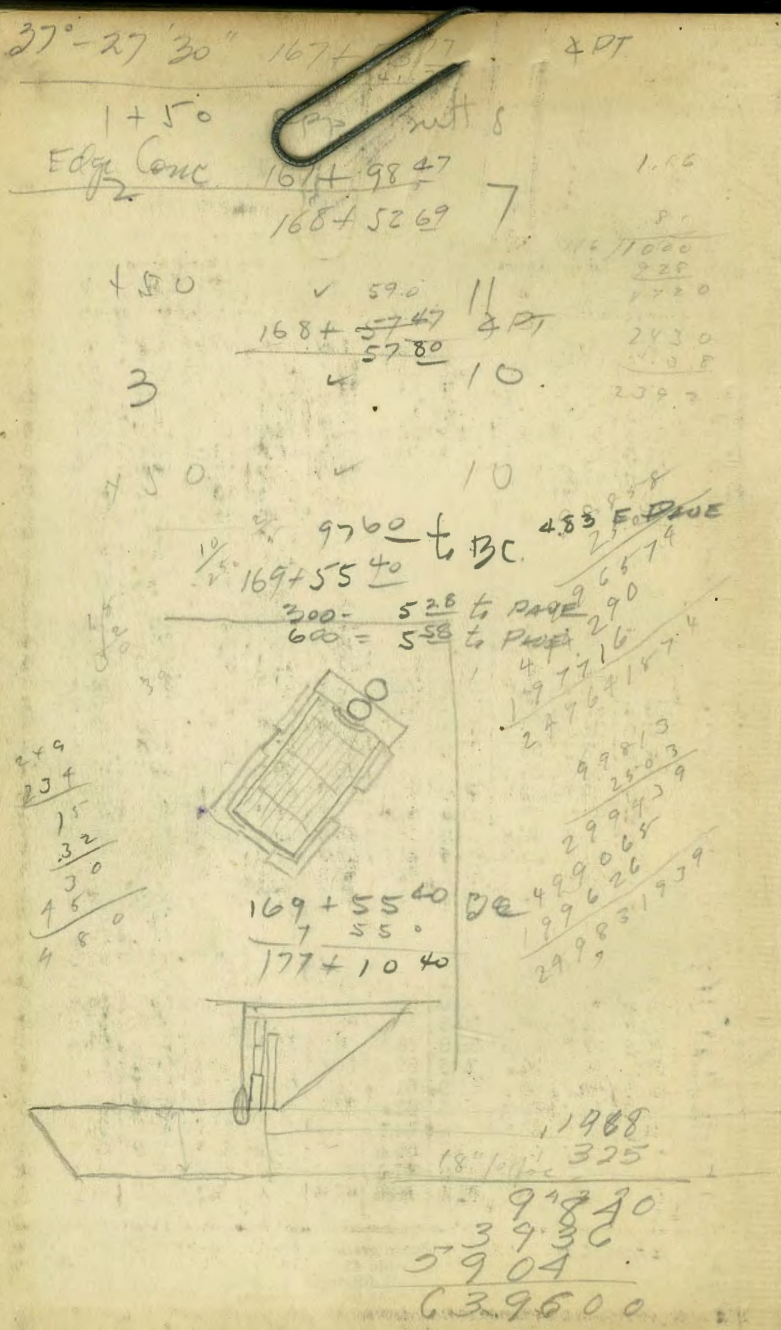
9.17
51
4.1

9.17
4.9
4.8

9.17
1.67
7.50

9.17
1.67
7.50

107+23
51.5
107.745



DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

Roadway 16 feet wide. Side Slopes 1 on 1½

For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.2	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	0
1	9.5	9.7	9.8	10.0	10.1	10.3	10.4	10.6	10.7	10.9	1
2	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	2
3	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.9	3
4	14.0	14.2	14.3	14.5	14.6	14.8	14.9	15.1	15.2	15.4	4
5	15.5	15.7	15.8	16.0	16.1	16.3	16.4	16.6	16.7	16.9	5
6	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4	6
7	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.9	7
8	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.4	8
9	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	9
10	23.0	23.2	23.3	23.5	23.6	23.8	23.9	24.1	24.2	24.4	10
11	24.5	24.7	24.8	25.0	25.1	25.3	25.4	25.6	25.7	25.9	11
12	26.0	26.2	26.3	26.5	26.6	26.8	26.9	27.1	27.2	27.4	12
13	27.5	27.7	27.8	28.0	28.1	28.3	28.4	28.6	28.7	28.9	13
14	29.0	29.2	29.3	29.5	29.6	29.8	29.9	30.1	30.2	30.4	14
15	30.5	30.7	30.8	31.0	31.1	31.3	31.4	31.6	31.7	31.9	15
16	32.0	32.2	32.3	32.5	32.6	32.8	32.9	33.1	33.2	33.4	16
17	33.5	33.7	33.8	34.0	34.1	34.3	34.4	34.6	34.7	34.9	17
18	35.0	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	18
19	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6	37.7	37.9	19
20	38.0	38.2	38.3	38.5	38.6	38.8	38.9	39.1	39.2	39.4	20
21	39.5	39.7	39.8	40.0	40.1	40.3	40.4	40.6	40.7	40.9	21
22	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1	42.2	42.4	22
23	42.5	42.7	42.8	43.0	43.1	43.3	43.4	43.6	43.7	43.9	23
24	44.0	44.2	44.3	44.5	44.6	44.8	44.9	45.1	45.2	45.4	24
25	45.5	45.7	45.8	46.0	46.1	46.3	46.4	46.6	46.7	46.9	25
26	47.0	47.2	47.3	47.5	47.6	47.8	47.9	48.1	48.2	48.4	26
27	48.5	48.7	48.8	49.0	49.1	49.3	49.4	49.6	49.7	49.9	27
28	50.0	50.2	50.3	50.5	50.6	50.8	50.9	51.1	51.2	51.4	28
29	51.5	51.7	51.8	52.0	52.1	52.3	52.4	52.6	52.7	52.9	29
30	53.0	53.2	53.3	53.5	53.6	53.8	53.9	54.1	54.2	54.4	30
31	54.5	54.7	54.8	55.0	55.1	55.3	55.4	55.6	55.7	55.9	31
32	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1	57.2	57.4	32
33	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6	58.7	58.9	33
34	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	34
35	60.5	60.7	60.8	61.0	61.1	61.3	61.4	61.6	61.7	61.9	35
36	62.0	62.2	62.3	62.5	62.6	62.8	62.9	63.1	63.2	63.4	36
37	63.5	63.7	63.8	64.0	64.1	64.3	64.4	64.6	64.7	64.9	37
38	65.0	65.2	65.3	65.5	65.6	65.8	65.9	66.1	66.2	66.4	38
39	66.5	66.7	66.8	67.0	67.1	67.3	67.4	67.6	67.7	67.9	39
40	68.0	68.2	68.3	68.5	68.6	68.8	68.9	69.1	69.2	69.4	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 41.9. For same slopes but other widths of roadbed correct above figures by one-half difference in width of roadbed; thus in example above for 20 ft. roadbed distance will be 41.9+(20—16)÷2 or 2 ft. added to 41.9 =43.9. For slopes of 1 on 1 see inside of front cover.

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