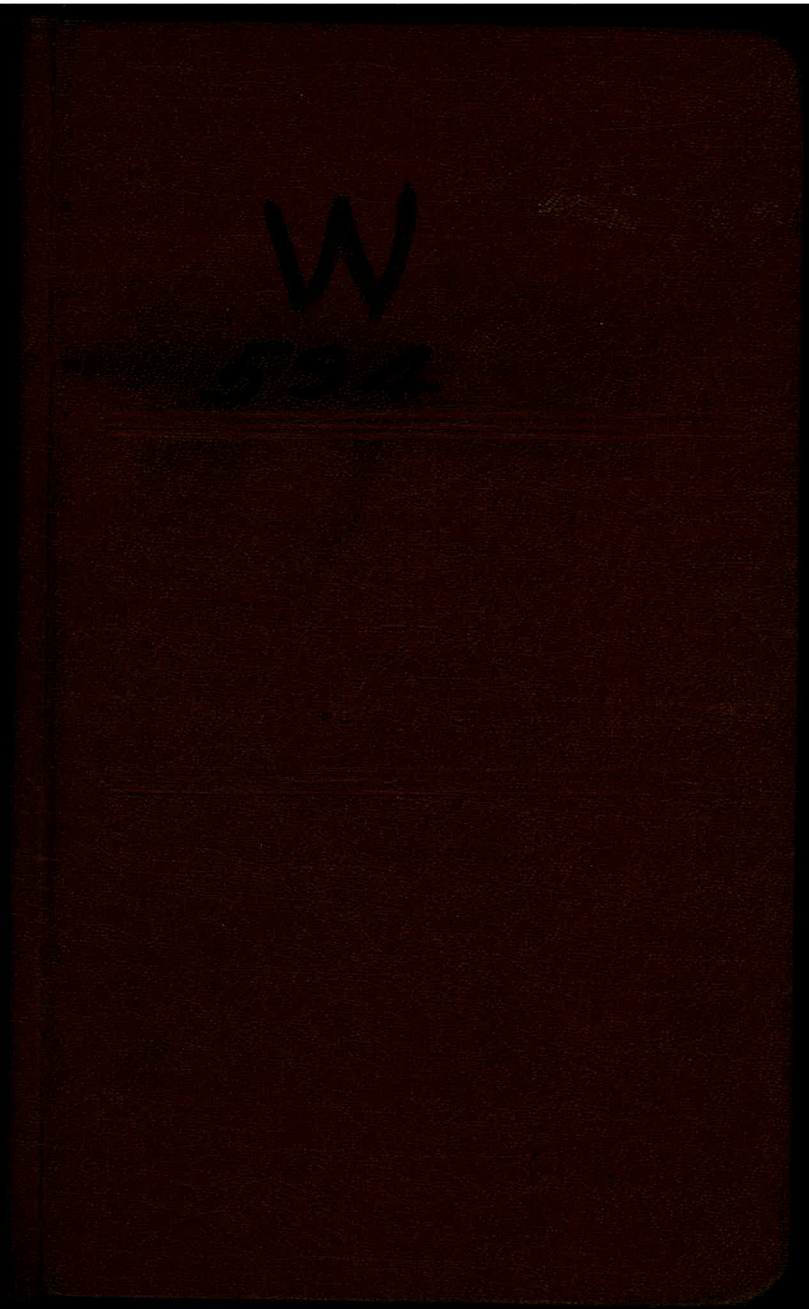
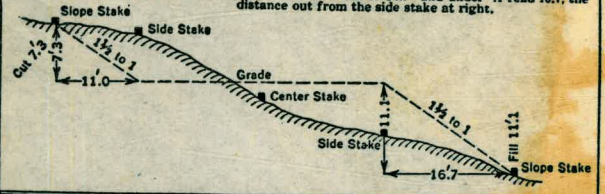


DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below: opposite 7 under "Cut or Fill" and under .3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2 4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59 7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

KEUFFEL & ESSER CO., N. Y.

10,892-2. y, cc, ys. cM.

Index

Stadia Survey through Pass East of Mission Gorge

41

Profile of Pipe Betwn Pump House & the Chamber on top of the Hill
El Monte

Pump Discharge Line
(Penstock)

BM	10.75	443.46		432.71
T.P.	11.79	452.88	2.37	441.09
T.P.	12.70	465.54	0.04	452.84
T.P.	12.15	477.56	0.13	465.41
T.P.	12.15	489.35	0.36	477.20
T.P.	12.15	501.03	0.47	488.88
T.P.	11.94	512.67	0.30	500.73
T.P.	12.52	524.56	0.63	512.04
T.P.	12.74	537.05	0.25	524.31
T.P.	12.12	548.74	0.43	536.62
B.M.	12.14	560.83	0.05	548.69
0+00			5.90	554.93
0+02			5.44	555.39
0+05			5.18	555.65
0+06.9			4.75	556.08
0+00 2			8.9	551.9
10'R			10.9	549.9

11-23-43 Hill-Darby King-Otten

U.S.G.S. BM - El Monte Pumping Plant

0-20 - Top Pipe -

Top existing Pipe 30"

" " " Begin Reducer 18"

" " " 18"

" " " 18" Bolted Coupling

Ground

"

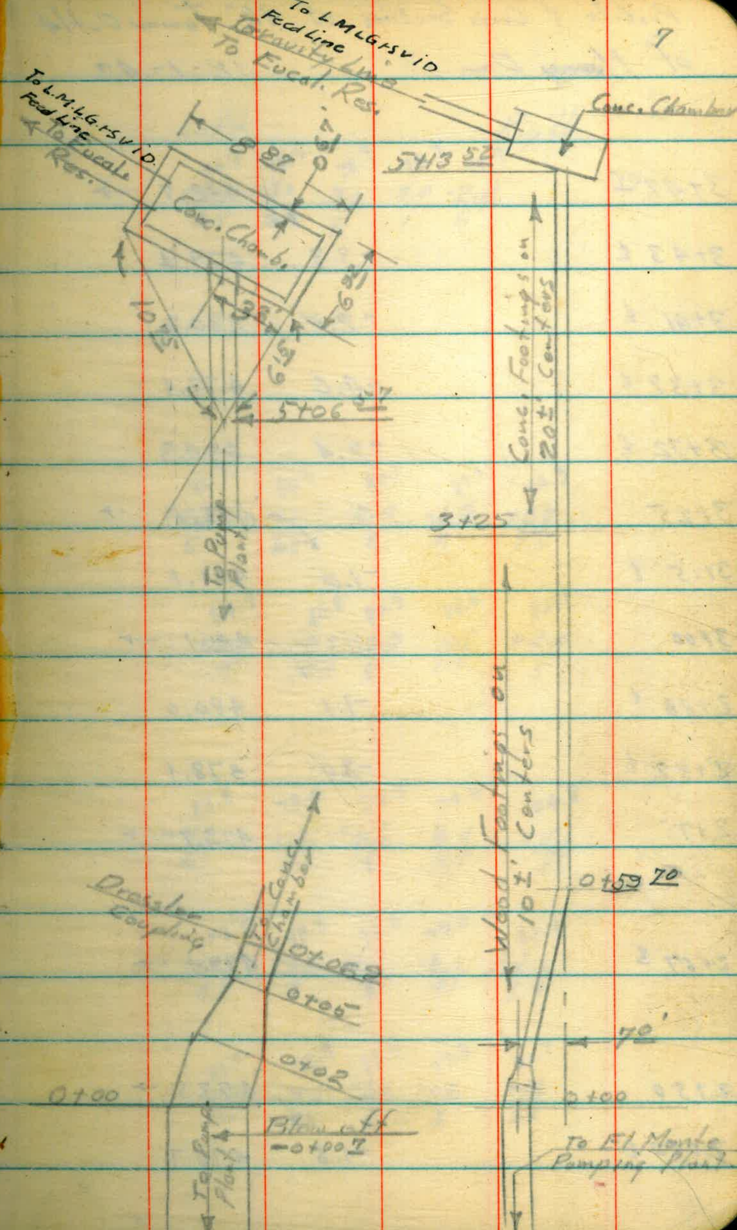
		560.87			
10' Lt			7.3	553.5 ~~552.5~~	Ground
T.P.	11.64	572.16	0.31	560.52	
0+50			8.60	563.56	Top Pipe
℄			11.0	561.2	Ground
10' Lt.			9.0	563.2	"
10' Rt.			14.9	557.3	" 0+56 Tel. P. 17' Lt.
0+64			4.4	567.8 ~~568.2~~	Top ℄ Conc. Blk. 5' Width x 4' L. x 3' Depth
T.P.	11.67	583.74	0.09	572.07	
1+00			6.14	577.60	Top Pipe
℄			8.3	575.4	Ground
10' Lt			6.5	577.2	"
10' Rt			9.8	573.9	"
T.P.	11.28	594.99	0.03	583.71	1+46 Tel P. 10' Lt
1+50			3.41	591.58	Top Pipe
℄			5.5	589.5	Ground
10' Lt			5.2	589.8	"
10' Rt			8.1	586.9	"

		594.99			
T.P.	12.41	607.17	0.23	594.76	
1+72.5			9.46	597.71	℄ Bolted Coupling
1+91			5.0	602.2	Conc. Blk. 5'w. x 4'L. x 1½' Depth
2+00			1.70	605.47	Top Pipe 2+00 Tel. P. 6.5' Lt
℄			3.8	603.4	Ground
10' Lt			3.2	604.0	"
10' Rt			4.4	602.8	"
T.P.	12.02	619.14	0.05	607.12	
2+50			0.10	619.04	Top Pipe
℄			1.9	617.2	Ground
10' Lt			2.2	616.9	"
10' Rt			1.4	617.7	"
T.P.	12.38	631.31	0.21	618.93	
T.P.	11.87	643.06	0.12	631.19	
3+00			8.71	634.35	Top Pipe
℄			10.6	632.5	Ground
5' Lt			11.2	631.9	"

		643.06			
10' Lt			12.4	630.7	Ground
10' Rt			9.4	633.7	"
T.P.	12.29	654.96	0.39	642.67	3+33 Tel.P - 6' and 13' Lt.
3+40.5			7.09	647.87	℄ Top bolted coupling
3+47			5.65	649.31	Conc. Blk 4'L x 5'W x 2' Deep
3+50			3.81	651.15	Top Pipe
℄			5.9	649.1	Ground
10' Lt			6.6	648.4	"
15' Lt			9.4	645.6	"
3' Rt			5.9	649.1	"
4' Rt			3.0	652.0	"
10' Rt			1.4	653.6	"
T.P.	11.52	666.47	0.01	654.95	
T.P.	12.18	678.44	0.21	666.26	
4+00			7.82	670.62	Top Pipe
℄			10.0	668.4	Ground
6' Lt			10.5	667.9	"

		678.44			
15' Lt.			15.1	653.3	Ground
3' Rt			9.1	669.3	"
5' Rt			6.5	671.9	"
10' Rt			6.0	672.4	
T.P.	11.93	690.19	0.18	678.26	
T.P	12.35	702.45	0.09	690.10	
4+50			10.04	692.41	Top Pipe
℄			12.1	690.3	Ground
10' Lt			13.0	689.4	"
15' Lt			16.1	686.3	"
2 Rt			11.9	690.5	"
5' Rt			9.2	693.2	"
10' Rt			8.9	693.5	"
B.M. #69	12.00	713.87	0.58	701.87	4+69 N. 1X Tel. Pole 6.5' Lt.
T.P	12.26	724.65	1.48	712.39	
5+00			10.23	714.42	Top Pipe
℄			12.8	711.8	Ground

		724.65 ✓			
10' Lt			11.0	713.6 ✓	Ground
Rt			11.6	713.0 ✓	"
5+01.8			9.5	715.13 ✓	Top Bolted Coupling
5+04			9.4	715.2 ✓	Top Conc. Blk 1.5'L x 4'W. x 1.5' deep
5+13.52			4.50	720.15 ✓	Top pipe as it enters Conc. Chamber
B.M.			2.00	722.65 ✓	Set BM
					Top Conc. Step Nor side " "
				+5.97	Top Conc. Chamber
				-1.85	Top pipe inside Chamber (Inlet)
				-6.21	Bottom of Chamber (inside)
				-3.63	Flow Line Outlet Pipe
	Cont.	12-3-43			
BM	3.66	726.31		722.65	Top Conc. Step Conc. Chamber.
			7.29	719.02	Flow Line of Outlet of Chamber
TP.	4.41	725.25	5.97	720.84	
TP.			8.57	716.68	Flow Line of Upstream End of Tunnell


To L.M.L.G.I.S.V.I.D.
Feed Line
To Gravity Line
To Eucal. Res.
Conc. Chamber
5+13 52
To L.M.L.G.I.S.V.I.D.
Feed Line
To Eucal. Res.
Conc. Chamb.
5+06 57
To Pump Plant
Conc. Footings on 20'± Centers
3+25
Wood Footings on 10'± Centers
0+59 70
Dresser Coupling
To Conc. Chamber
0+06
0+05
0+02
0+00
Blow off
To Pump Plant
To El Monte Pumping Plant

Profile & Cross Sections of 48" Tower Outlet of Murray Dam. 12-1-43

3+47.65		482.7 →
	↘	
3+43 ℄	-3.3	479.4
3+41 ℄	-2.5	480.2
3+37 ℄	-4.6	478.1
3+32 ℄	-2.4	480.3
3+25		482.1 →
	↘	
3+15 ℄	-1.0	481.1
3+00		481.1 →
	↘	
2+88 ℄	-1.1	480.0
2+82 ℄	-3.0	478.1
2+75		479.7 →
2+67 ℄		479.1 →
2+50		477.5 →
	↘	
2+40 ℄	-1.8	475.7

Left				Right
76.7 -6.0 8.5	78.9 -3.8 3.5	78.9 -3.8 ℄	78.9 -3.8 1	79.9 -2.8 6'
82.9 +0.3 6	80.6 -1.5 2.5	80.1 -2.0 ℄	81.1 -1.0 4	84.3 +2.2 7.5
84.9 +3.8 5'	80.8 -0.3 2.2	80.3 -0.8 ℄	80.6 -0.5 2.3	85.1 +4.0 5'
83.8 +4.1 6'	78.4 -1.3 3.2	78.5 -1.2 ℄	79.3 -0.4 3.5	84.8 +5.1 5'
83.0 +3.9 4.8	78.3 -0.8 3	78.0 -1.1 ℄	79.0 -0.1 4.1	83.7 +4.6 5.7
81.7 +4.2 5.5	76.9 -0.6 4.2	76.5 -1.0 ℄	77.3 -0.2 3'	81.7 +4.2 3.5

(Cont'd) 12-1-43

2+25				475.1 →
B.M.	3.2	453.1 ✓		449.9
0+65 ℄			11.2	41.9
0+77 ℄			10.5	42.6
0+85 ℄			7.7	45.4
0+89.5 ℄			6.3	46.8
0+93 ℄			1.8	51.3
T.P.	10.7	463.8 ✓	0.0	453.1
1+00 ℄			12.0	51.8
1+03 ℄			9.1	54.7
1+11 ℄			7.2	56.6
1+17 ℄			4.5	59.3
1+17.5 ℄				62.7
T.P.	10.3	472.9 ✓	1.1/2	462.6 ✓
1+22 ℄			10.4	62.5
1+23 ℄			8.3	64.6
1+36 ℄			4.7	68.2
1+60 ℄			3.8	69.1
△			0.7	72.2

Left				Right
80.1	73.9	73.9	74.4	80.1
+5.0	-1.2	-1.2	-0.7	+5.0
4.2	2.6	℄	4	4.6

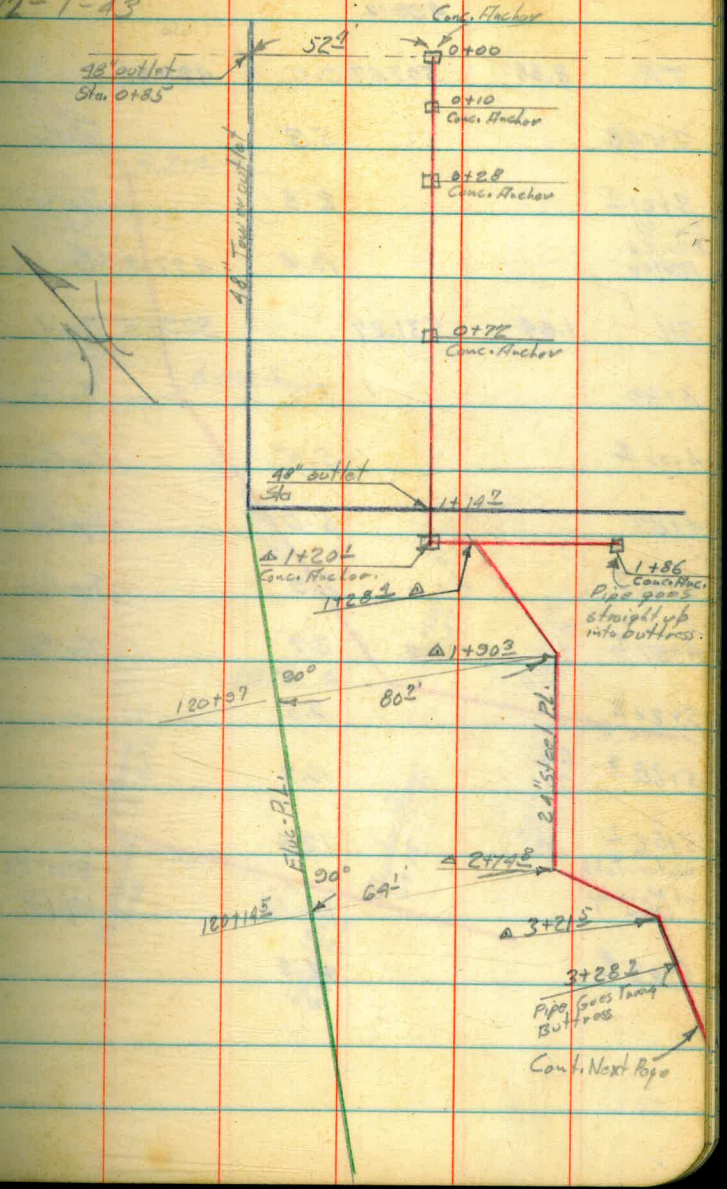
Location and Elev. of 24" Steel Pipe
Line outlet of Murray Dam.

					0+68 - 4 R
B.M.	12.81	453.43		440.62	Murray Pipe Line
0+00			4.9		Top Pipe
T.P.	11.33	464.41	0.35	453.08	
0+08 E			6.9		Top Pipe
0+10 E			4.8		Top Pipe
T.P.	11.34	476.14	0.21	464.20	
0+26 E			8.2		Top Pipe
0+29 E			7.1		Top Pipe
T.P.	11.25	486.88	0.51	475.63	
0+70 E			7.0		
B.M. Check			4.89	482.04	Conc. Anchor 40' Left 1+50 48+97
0+74			6.1		Top Pipe
1+17			1.5		Top Pipe
1+22 3			0.9		Top Pipe
T.P.	12.49	499.12	0.25	486.63	
1+28 1 Δ			12.6		Top Pipe
1+90 3 Δ			0.1		

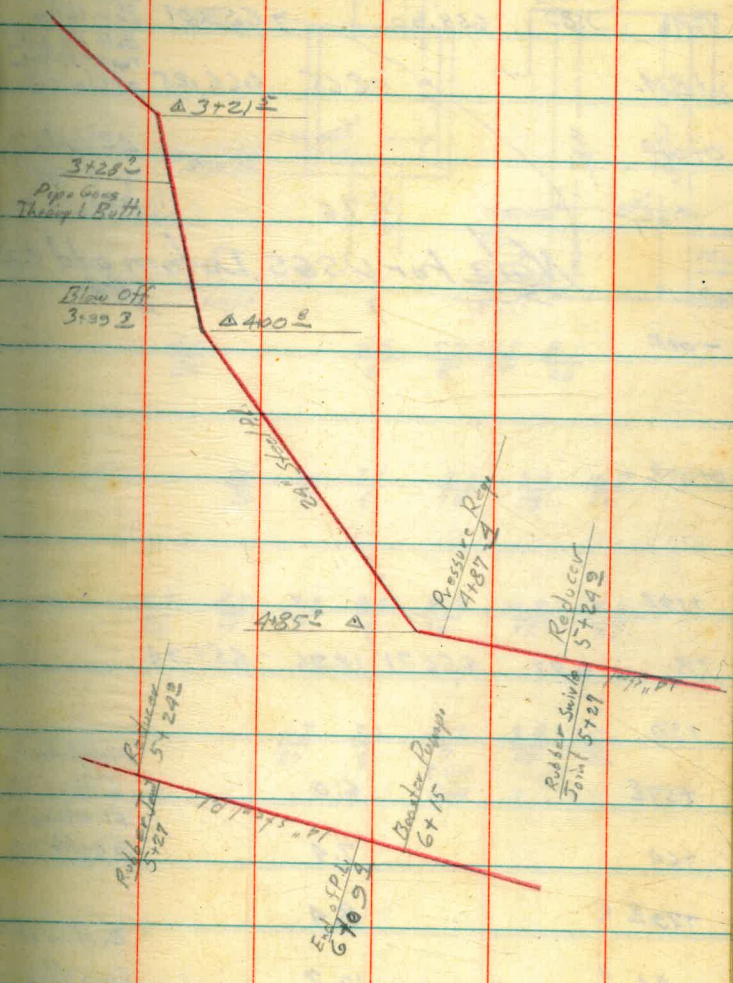
Davey - King - O'Hern

12-1-43

10



		499.12			
T.P.	8.66	507.67	0.11	499.01	
2+74 ±			5.3		Top Pipe
3+21 ±			2.8		Top Pipe
Euc. Rl. Elev. Ck. 120+00			10.4	497.3	℄
BM	1.64	531.27		529.63	Bolt H.
3+30			5.5		Top Pipe
4+00 ±			5.5		Top Pipe
4+83			6.0		Top Pipe
4+85 ±			2.9		Top Pipe
4+87 ±			2.7		Top Pipe
5+21 ±			9.5		
5+28 ±			10.3		
5+56 ±			12.8		
Water Table of Murray Dam			14.19		3:00 P.M. 12/1/43
6+09 ±			12.8		



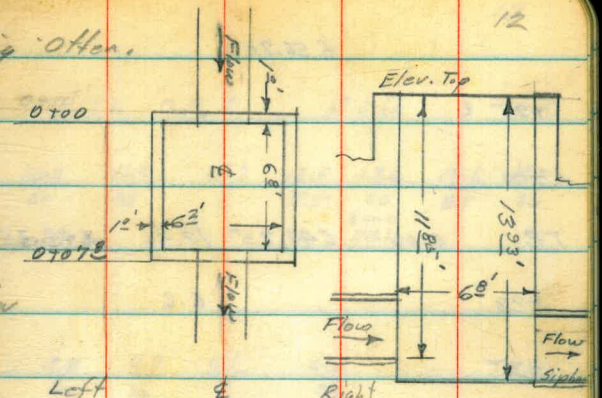
Profile & Sections of Ground over Sweetwater Syphon.

BM.	9.89	668.90		659.01	Chamber Inlet - Flow Line Elev
Set B.M.			2.65	666.25	Bolt 4½' below Top of N-E Cor of Chamber
0+01½					4½' Left
+10⅝			7.6		Top 2" Pipe 8½' Left
					Note for U.S.G.S. Datum add 8.25' M.S.L.
−01½					
0+07⅝					
+19⅝					
T.P.	0.77	656.71	12.96	655.94	
+50					
+57⅝			6.0		Flow Line 1' Rt
+64			7.4		Flow Line 9' Left
+73⅝ ℄			8.4		
+84 ℄			10.2		Bottom of Conc. Ditch.
+87½ ℄			9.6		

12-2-43

12

Darby - King - Otter.



4.6/20' 4.5/℄ 5.7/8' 7.5/13' 8.5/20

5.0/20 7.0/11' 7.1/℄ 7.7/10' 9.4/13 10.5/20

6.7/20 8.5/17 9.3/8 8.4/℄ 9.7/10 11.2/12' 12.9/20

1.7/20' 3.0/℄ 5.3/7 ℄ Dist Ditch 3.4/13 5.0/20

Culvert 24" Steel

Culvert 24" Steel

		656.71				
+95 ℄			9.7			
1+00						
T.P.	0.00	649.25	12.96	649.25		
+23			6.6		Flow Line 5' Rt	
+35						
+50						
+60			11.6		Flowline 5.5 Rt	
+63						
T.P.	0.69	632.36	12.58	631.67		
2+00						
+18						
+50						
T.P.	0.25	619.96	12.65	619.71		
3+00						

Left ℄ Right

10.9 / 20	11.4 / 4.5	10.3 / ℄	12.5 / 5.5	13.6 / 7.0 & Conc. Ditch	12.6 / 8.5	14.0 / 20
4.8 / 20	4.7 / 16	6.1 / ℄	6.6 / 20			
	7.6 / 20	7.9 / ℄	7.7 / 10'	9.9 / 20'		
		9.7 / ℄	9.9 / 3'	12.0 / 5.5 & Conc. Ditch	10.8 / 10.5	11.6 / 20
4.0 / 20	4.6 / 8.5	3.7 / ℄	4.0 / 3.5	5.2 / 6	6.3 / 7.5 & Conc. Ditch	5.3 / 9	5.8 / 20
	6.9 / 20	7.4 / ℄	8.2 / 7.5	9.5 / 9.4 & Conc. Ditch	8.4 / 11.	8.8 / 20
	14.4 / 20	11.2 / ℄	13.0 / 20			
5.2 / 20	5.3 / 13	4.8 / ℄	7.2 / 20			

Culvert 24" Steel

Culvert 24" Steel

		619.96		
3+33				
+37	℄		10.8	
+47	℄		11.5	
+50				
T.P.	1.20	608.62	12.54	607.42
+56.5	℄		3.4	
+66.5				
+71.5	℄		5.4	
+77.3	℄		5.3	Edge of Pavement
4+00				
+20			9.8	
Set B.M.	0.15	596.57	12.20	596.42
4+50				
5+00				

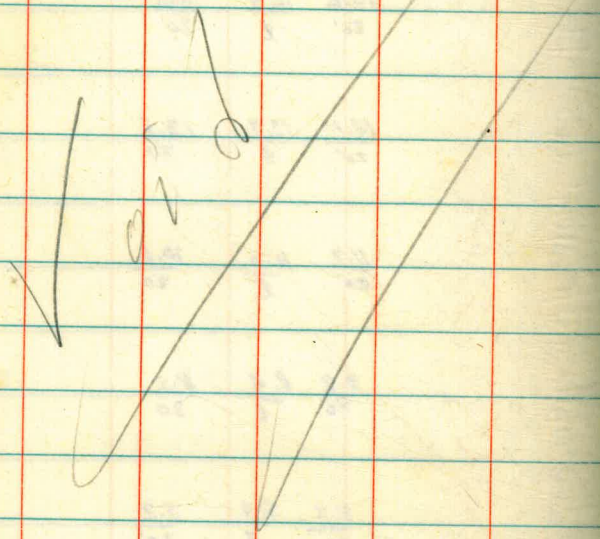
Left		℄		Right
	8.8 / 20	8.5 / ℄	10.5 / 4'	10.3 / 16'	12.3 / 23
11.3 / 22	12.7 / 18	12.6 / ℄	15.3 / 23		
	2.5 / 20'	2.7 / ℄	5.1 / 6.5	4.6 / 17.5 Edge of Road	4.5 / 20
	6.7 / 20'	6.02 / ℄ edge of Pavement		6.6 / 14	6.9 / 20

Nail in Tree Stump (6' High) 45' Left Sta 4+50

1.4 / 20'	1.4 / ℄	2.2 / 20
6.1 / 20'	6.4 / ℄	7.7 / 20

		596.57		
5+50				
6+00				
+50				
7+00				
+50				
8+00				
+50				
T.P.	11.83	607.87	0.53	596.04
9+00				

Left	℄	Right
9.7 / 20'	10.1 / ℄	11.5 / 20
12.5 / 20'	12.9 / ℄	14.0 / 20'
14.2 / 20'	14.4 / ℄	14.8 / 20'
14.1 / 20'	13.9 / ℄	13.6 / 20
11.7 / 20'	11.0 / ℄	10.6 / 20
9.2 / 20	8.9 / ℄	8.5 / 20
5.3 / 20	5.4 / ℄	5.2 / 20'
10.7 / 20	11.2 / ℄	11.7



		607.87			
9+50					
T.P.	11.90	619.21	0.56	607.31	
10+00					
+20					
TBM	12.15	630.19	1.17	618.04	10+40 15' Rt. Rock
+50					
11+00					
+04					
T.P.	13.12	692.68	0.63	629.56	
+37					
+50					
T.P.	11.69	654.25	0.12	642.56	

Left & Right

+1.1/20 0.3/9.5 4.5/5' 4.0/℄ Top Exist. Pipe 4.7/20'

4.2/20 5.1/17 7.8/℄ 8.4/20'

5.4/20 5.6/8' 4.6/5' 4.5/℄ 5.5/7 4.9/20

(Continued 12-3-43)

10.8/20 11.5/℄ 12.0/11 11.1/20

8.0/20 3.1/12 3.0/℄ 2.9/20

2.0/20 2.4/6' 3.4/℄ 2.4/6 1.8/20

6.4/20 6.1/8 9.1/4 9.2/℄ 6.2/12 8.0/20

3.7/20 2.9/18 6.7/8 6.5/℄ Top of Exist. Pipe 7.0/9.5 5.8/13 5.5/20

		654.25			
11+71					
+78					
12+00					
T.P.	12.60	666.17	0.68	653.57	
+19					
12+33 ℄					
12+42 ℄					
12+33 ℄ Set BM			3.15	663.02	BM on SW side of Chamber E-Face.
Chamber outlet flow			8.51	657.66	Point Elev 657.30

Left ℄ Right

6.9/20 Rock; 8.7/11 Rock; 12.5/℄; 14.9/3; 13.0/6; 10.6/8 Rock; 9.8/20 Rock

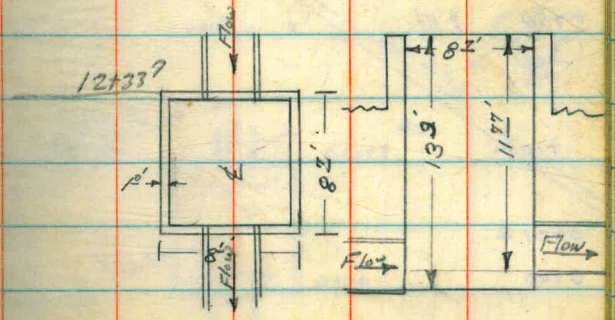
7.6/20; 9.9/℄; 10.0/7; 7.6/55 Rock; 6.9/20 Rock,

2.0/20; 3.0/℄; 3.2/20

7.8/20; 6.9/3; 8.0/℄; 8.0/5; 6.9/6; 7.8/14; 9.0/20

5.6/20; 4.5/11; 5.2/℄; 2.6/7.5; 4.9/20

3.9/20; 2.7/℄; 4.9/20

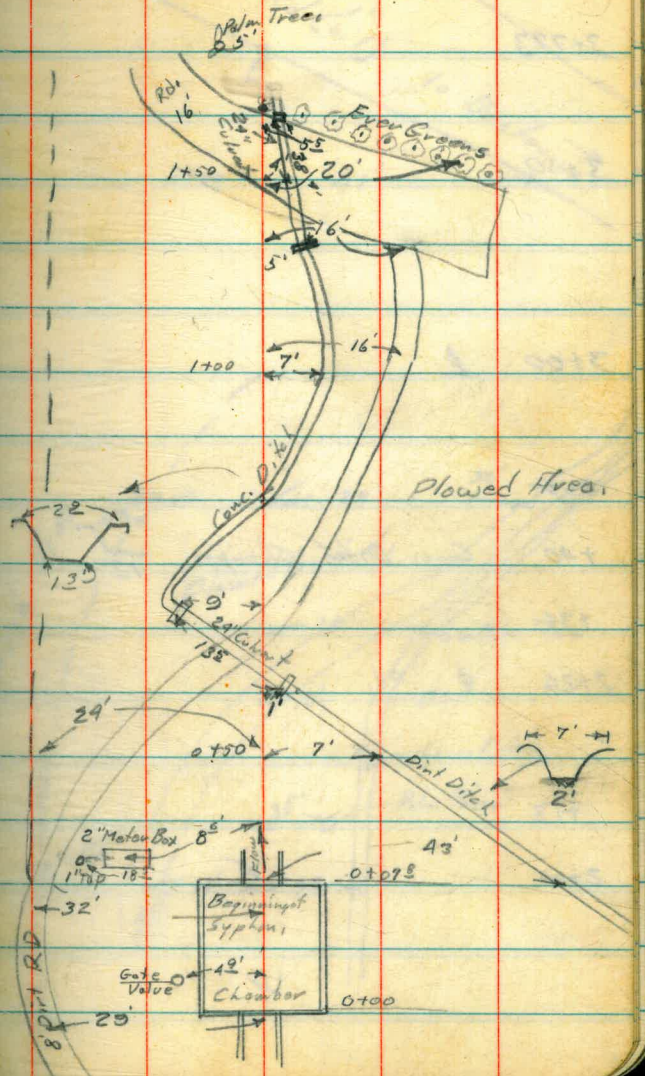


Topography of Area Around Exist. Sweetwater Syphon.

12-3-43
Darby - King - Otten.

19

+83	
1+64	℄ Ever Greens
1+60	5' ℇ Rt
1+50	20' Rt.
1+23	5' Rt
1+00	7' Rt & 16' Rt.
+84	℄
+64	9' Left
+57.5	1' Rt.
+50	9' Rt.
+10 ℄	
0+01 ℄	
0+00	



4+00

3+773

3+50

3+00 ℄

+50

+40 Conc. Ditch Changes

+36

2+26 ℄ Rd.

+13

2+00

4+00

38' 20' Paved Rd (Coral) to Boston

℄

3+50 41'

32'

2+50 22'

Brush H=0

Plowed Ground

18' Palm Tree

10' 18' Conc. Ditch

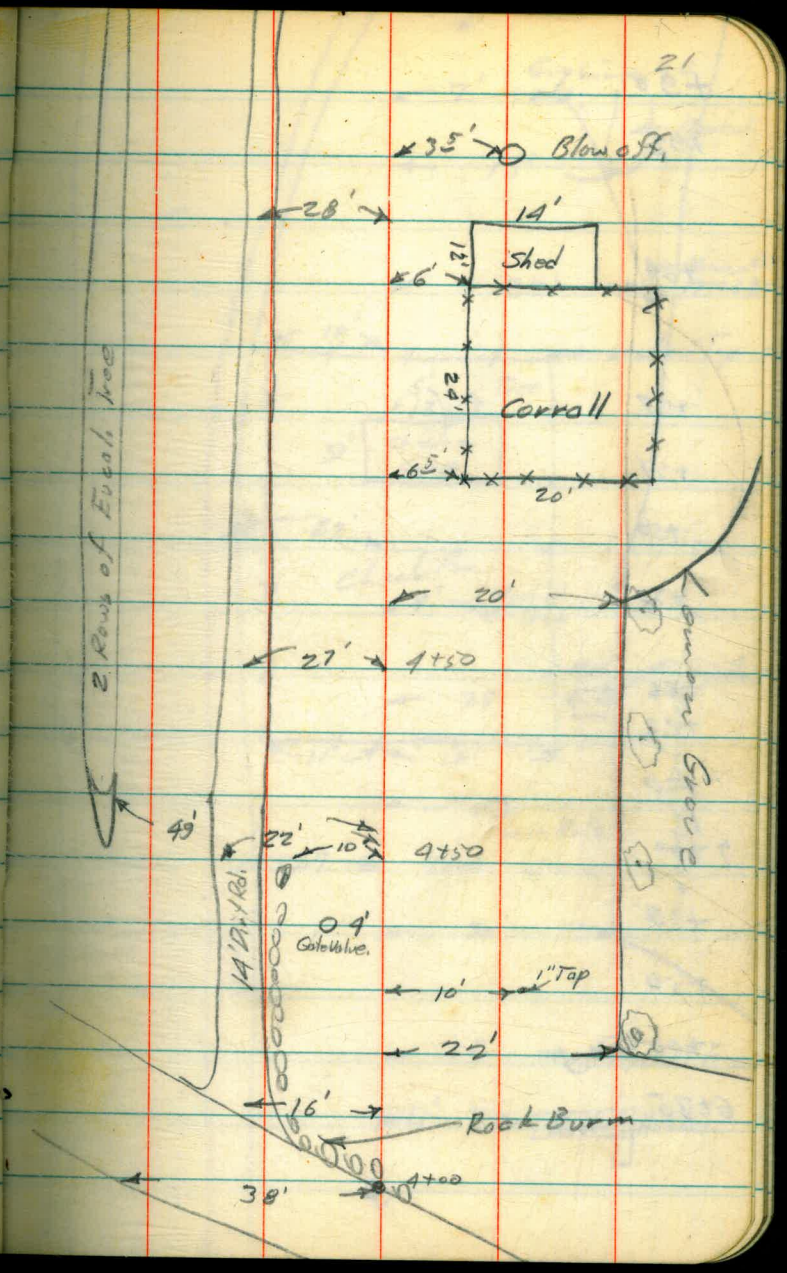
35' Palm Tree

26'

2+00 14' 75'

12'

6+35~
6+00
5+94
4+70
4+50
4+33
4+50
4+50
4+48
4+18
4+13
4+10
4+00



+98

+92

+84

+62

+57

+50

+38

+26

+22

+20

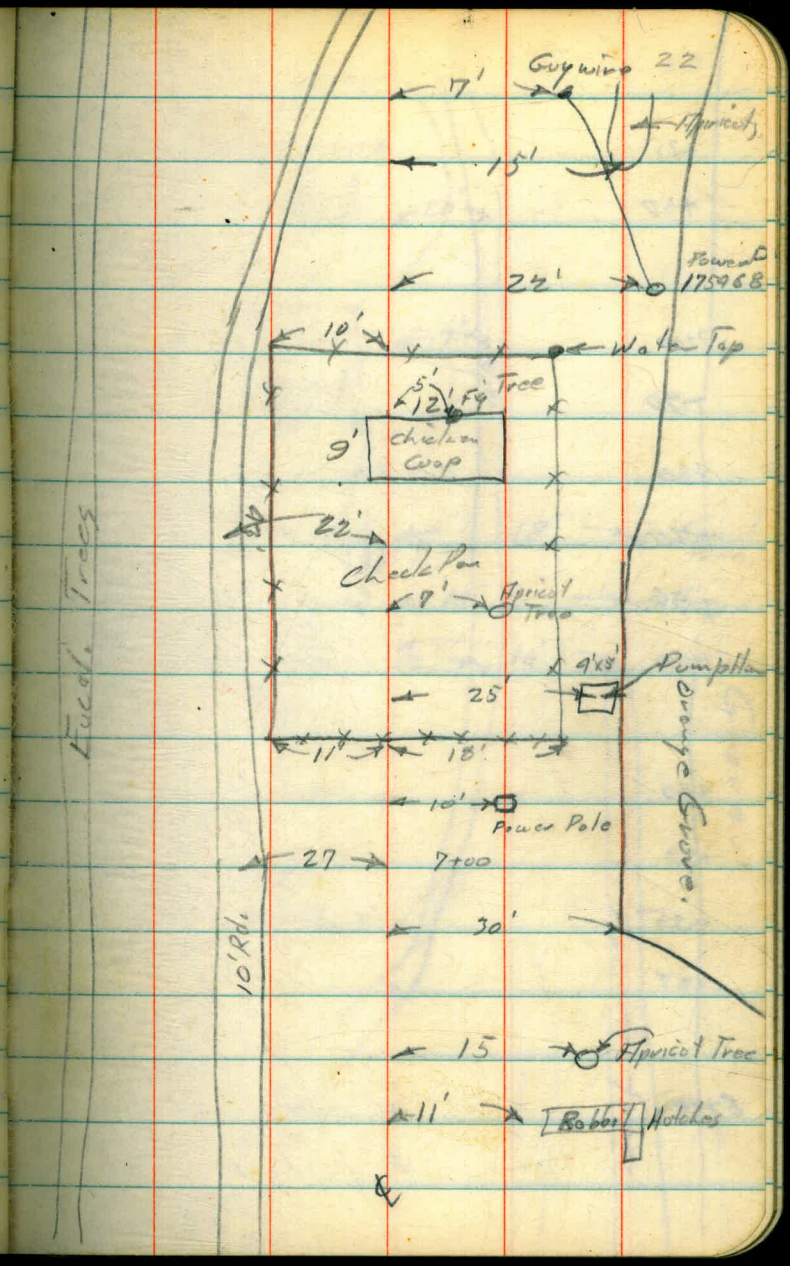
7+00

+78

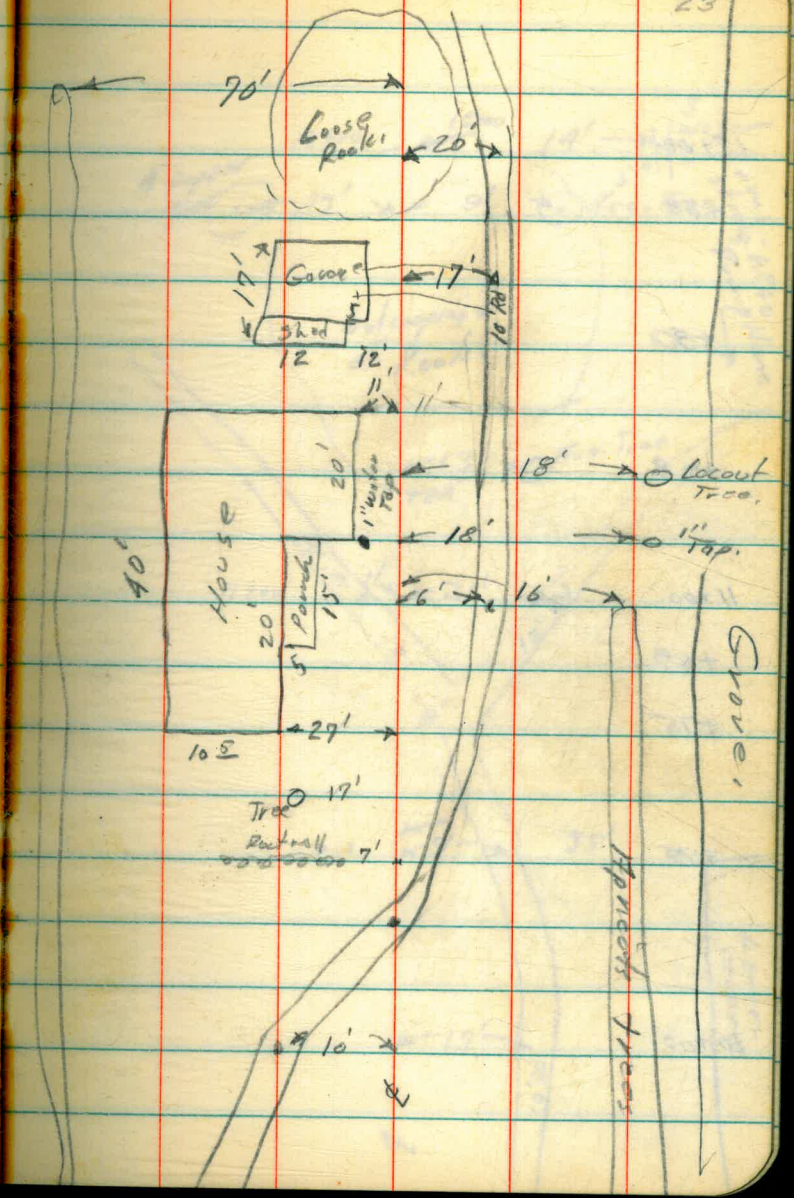
+50

+40

6+35



+75
+50
9+00
+90
+80
+70
+56
+50
+40
+32
+35
+27
8+00



12+00

+88

+50

+28

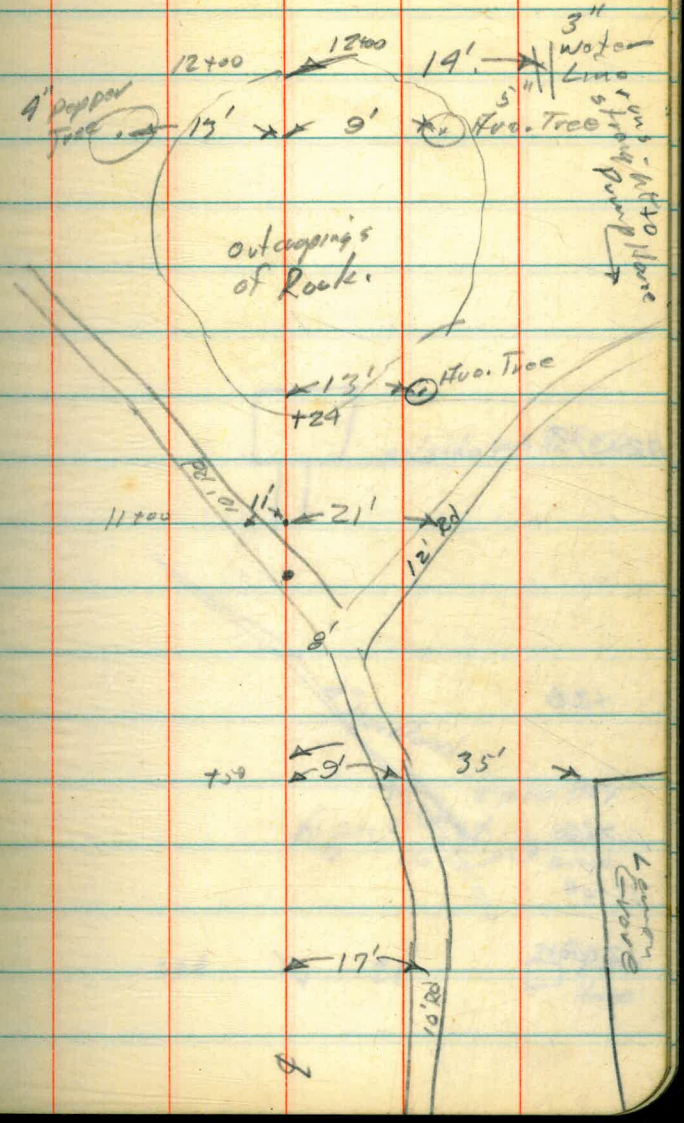
11+00

+89

+75

+50

10+00



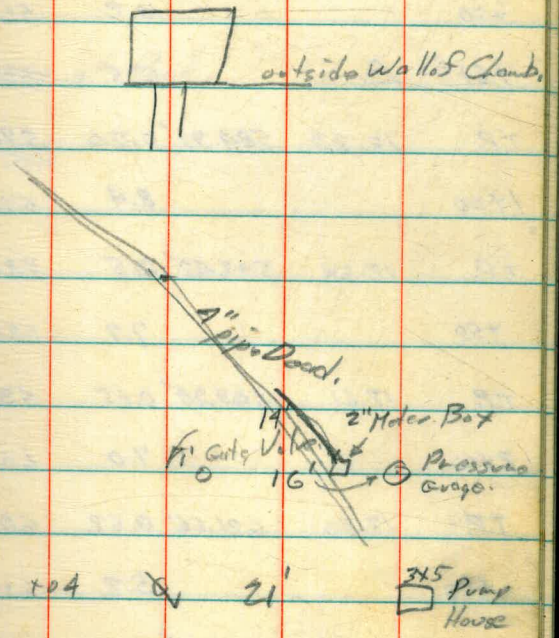
12+397

+26

.416

12+04

12+00



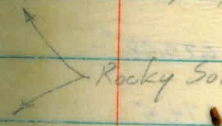
Profile of Proposed Location of Additional Pump Discharge Line (Penstock)

12-17-43
Darby - King - Otten.

BM	12.63	561.32 ✓		548.69
0+00			9.4	551.9
+08 5	△		7.9	553.4
+17 3			8.0	553.3
+22			5.6	555.7
T.P.	11.83	572.83 ✓	0.32	561.00 ✓
+50			10.2	562.6
+61 5	△		6.5	566.3
T.P.	12.28	584.91 ✓	0.20	572.63 ✓
1+00			8.4	576.5
T.P.	12.66	597.42 ✓	0.15	584.76 ✓
+50			7.7	589.7
T.P.	12.61	609.38 ✓	0.05	597.37 ✓
2+00			7.0	603.0
T.P.	12.30	621.66 ✓	0.62	609.36 ✓
+50			5.2	616.5
T.P.	13.05	634.31 ✓	0.40	621.26 ✓

0-20 - Top Pipe

Slight outcroping of Rock.



		634.31		
3+00			3.1	631.2
T.P.	12.78	646.82	0.27	634.04
+30			4.4	642.4
T.P.	12.13	658.75	0.20	646.62
+50			10.5	648.2
+65			6.6	652.2
T.P.	12.04	670.49	0.30	658.45
4+00			2.8	667.7
T.P.	12.20	682.68	0.01	670.48
+20			8.2	674.5
T.P.	12.42	695.01	0.09	682.59
+50			5.8	689.2
T.P.	12.19	707.06	0.14	694.87
T.P.	11.26	718.28	0.04	707.02
5+00			6.4	711.9
+04	△		4.6	713.7
T.P.	9.84	727.12	1.00	717.28

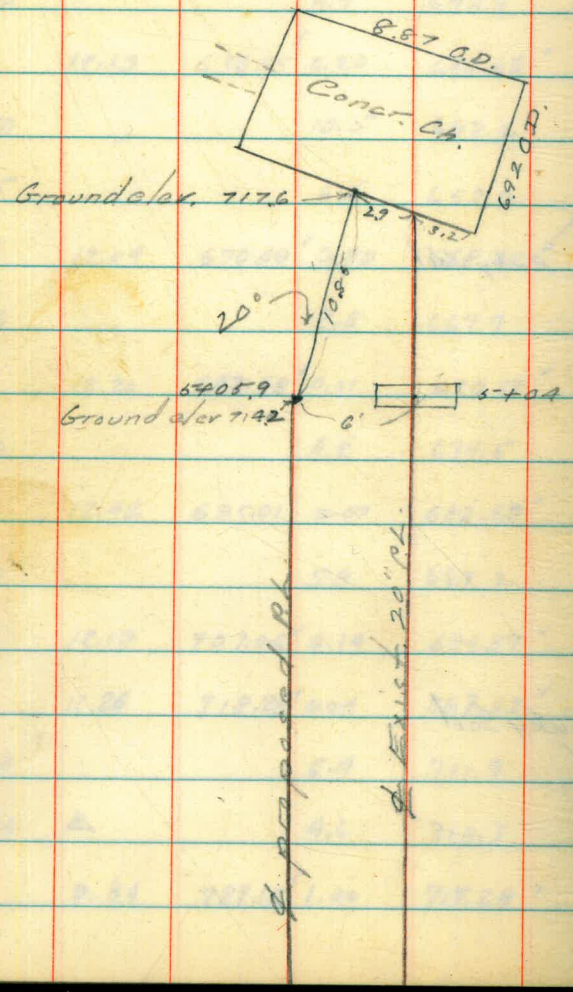
Rocky Soil

Rocky Soil

727.12

B.M.		4.45	722.67	722.65

Top Conc. step of Chamber.



FINAL X-SECTIONS - Murray Tower P.L.

B.M.	1.00	482.97		481.97
1+95			10.6	72.4
1+74			12.2	70.8
1+65			12.9	70.1
T.P.	0.85	471.69	12.13	470.84
1+55			3.4	68.3
1+50			3.3	68.4
1+44			3.9	67.8
1+40			5.0	66.7
1+39			5.8	65.9

KING
Otten
12-24-43

30

17.1	10.8	10.8	16.7
+6.3	00	00	+5.9
5.4'	3.0'	5.4'	5.2'
+6.2 16.3	00 10.1	00 10.1	+5.7 15.8
5'	3.6'	6'	6.5'
15.4	68.6	67.9	14.8
+7.0	+0.2	-0.5	+6.4
6.7'	5.1'	3.4'	6.1'

4

		471.69			
1+34			6.3	465.4	
1+31			6.9	64.8	
1+27			8.5	63.2	
1+20			12.2	59.5	
T.P.	0.96	459.90 ✓	12.75	458.94 ✓	
1+145			2.2	57.7	
1+05			6.2	53.7	
0+90			11.9	48.0	
T.P			8.74	451.16 ✓	451.14

10.7	65.2	65.9	70.4	31
+5.3	-0.2	+0.5	+5.0	
6.3'	5.0'	4.1'	5.5'	
68.0	59.9	60.2	65.5	
+8.5	+0.4	+0.7	+6.0	
4.6'	3.8'	4.8'	5.8'	
60.3	54.0	53.7	56.4	60.0
+6.6	+0.3	0.0	+2.7	+6.3
5.4'	4.7'	3.7	3.9	6.0'
53.5	47.3	47.0	52.5	
+5.5	-0.7	-1.0	+4.5	
6.0'	4.6'	4.2	7.0'	

X ON Rock 5'Lt. 0+90

Murray Tower 12-28-43

B.M. #2	4.04	546.55		542.51
			0.05	546.50
	3.03	545.54		542.51
			12.92	532.62
	2.32	534.94		
			11.10	523.84
	2.60	526.44		

USGS. Top Wall - Sidewalk East end Room

" Floor of Tower

(541.62 = 100 Murray DAM DATUM
541.62 − 526.44 = 15.82
100 − 15.82
= 84.82 Murray DAM DATUM)

1-26-43 Final X-sections of ditch for 48" pipe Murrar Tower Outlet

Byler
King
Otten

	1.51	442.13		440.62
0+00			1.0	41.1
+12			13.2	28.9
+18			14.2	27.9
+24			14.7	27.4
+30			15.4	26.7
+42			16.1	26.0

R. Hand & L. Hand

Nail in Abutment

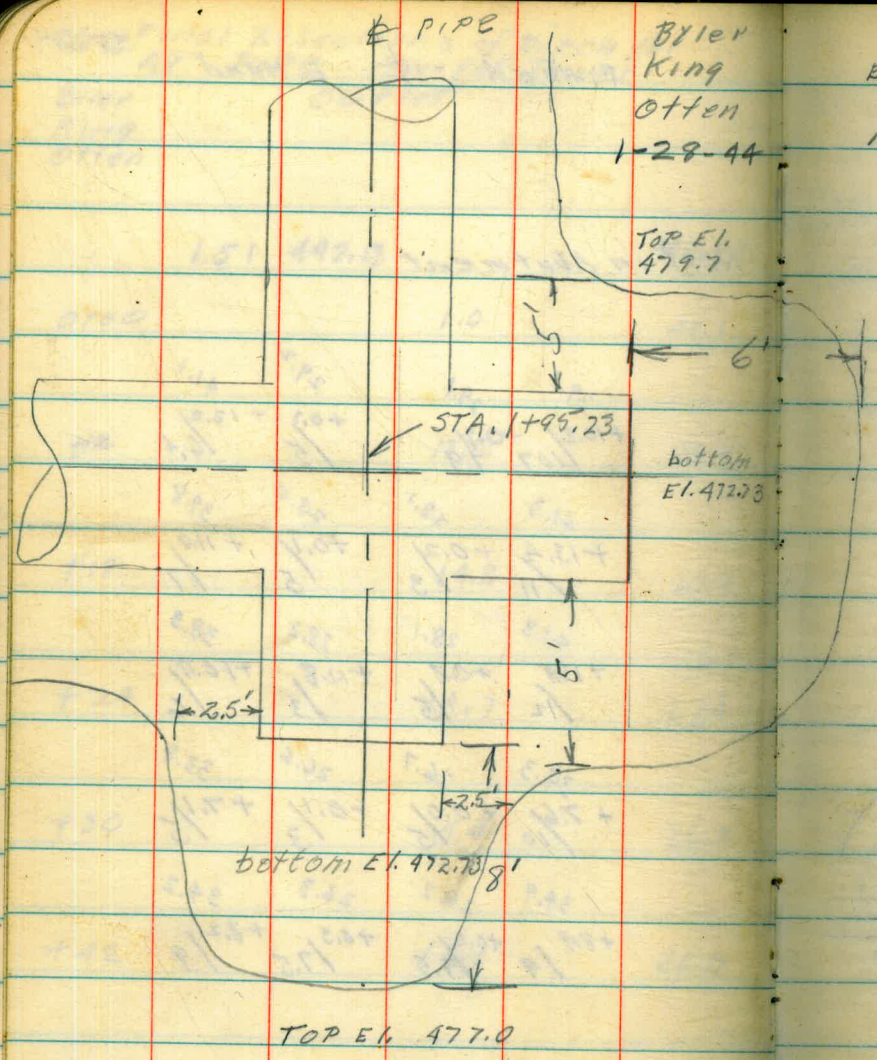
R. Hand		L. Hand	
39.1	29.1	29.2	41.1
+10.2/107	+0.7/9	+0.3/5	+12.2/6.4
41.3	28.1	28.0	39.8
+13.4/11	+0.2/3	+0.1/5	+11.9/7
41.3	28.1	28.2	38.3
+13.9/12	+0.7/5	+0.8/3	+10.9/6
34.3	26.7	26.6	33.8
+7.6/10	+0.0/5	-0.1/3	+7.1/5
34.9	26.2	26.3	34.2
+8.9/9	+0.2/7.5	+0.3/7.5	+8.2/9

Byler
King
Otten
1-28-44

EXCAVATION for CROSS

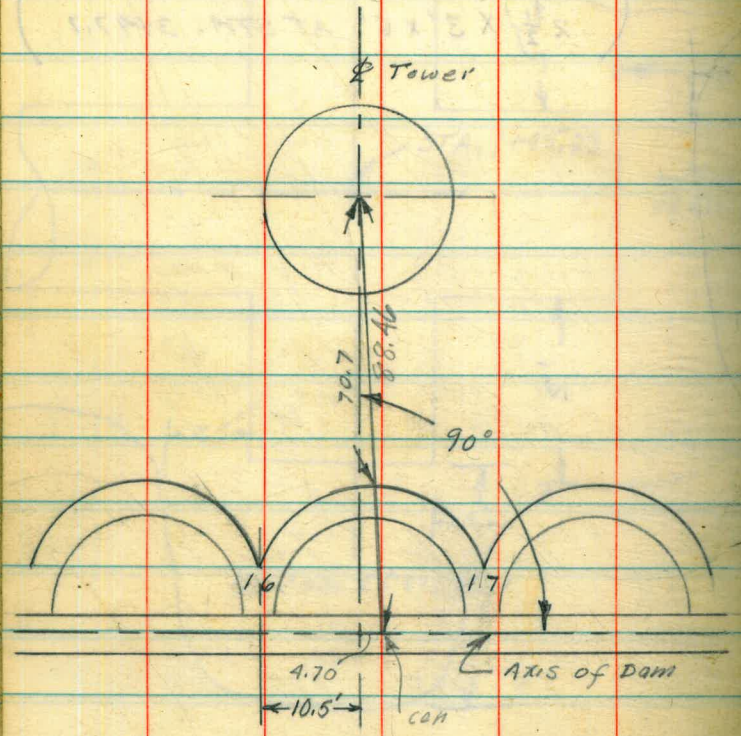
MURRAY TOWER PIPE LINE

(Excavation for Anchor block
2½' X 3' X 6' AT STA. 3447.7)



Location of Intake Tower in Relation to Axis of Murray Dam

Byler
King
Otten
1-29-44



area for profile on page 40

℄ Profile Murray Tower
48" Pipe Line

Baylor
King
Otten

1-4-44

	1.72	442.34 ✓	440.62
0+00		0.81	41.5 ✓
+12		11.9	30.4 ✓
+18.5		13.9	28.4 ✓
+24		15.0	27.3 ✓
+30		15.9	26.5 ✓
+42		16.0	26.3 ✓
+56		12.5	29.8 ✓
+61		8.6	33.7 ✓

B.M. Nail in Abutment.

Profile (Cont.)

		442.34		
TP.			2.75	439.59
	11.69	451.23		
0+76 [09]			10.7	40.5 / 41.6

Byker King often 1-4.44

Recheck ON Murray Tower guage (see page 32 for originals)

	0.75	543.26		542.51	B.M. U.S.G.S. Top Wall - Sidewalk E. End dam
TP.			8.75	534.51	
	3.35	537.86			Note - 541.62 U.S.G.S. = 100 guage.
			96.10		96.24 Reading on guage
TP.			12.49	525.37	
	0.74	526.11			
			84.36		84.49 Reading on guage
TP.			12.39	513.72	
	0.86	514.58			
			72.85		72.96 Reading on guage
			10.58	504.00	ontop of intake saucer (check)

Check levels to tower gauge

Murray Res. 2/28/44 39

Hill
Rommen

Level adjust.

	+S.	4.93	E end
Level midway	−S	4.91	W. end
Level at W end		4.93	
		4.95	E end

BM.	0.67	543.18		542.51
TP.	1.42	532.61	11.99	531.19
TP.	1.23	527.24	6.60	526.01
			0.31	526.73 =
			2.08	525.16

→ Mark on tower elev. 525.0 ?

X painted on curb at walk near E end of dam

85.0 on res. gauge.

0 on res. gauge = 526.73 − 441.62 = 85.11

Note 85.0 on gauge is elev. 85.11

4-1-44
By Tel
Kipp
Otten

Profile on ground opposite tower Murray Dam

0+00	1.1	492.24 ~~492.24~~		491.14 ~~492.11~~
+41			2.0	490.2
+78			6.4	485.8
+86			5.5	486.7
+96			10.4	481.8
1+15			10.9	481.3
1+24			14.7	477.5
1+39			17.0	475.2

541.54
Top of walk = ~~542.51~~ el.
(50.4 = distance from top of walk to ground)
under walk at center of arch between 16 & 17

spoil pile

solid rock

solid rock in wash

Stadia survey through pass East of mission gorge

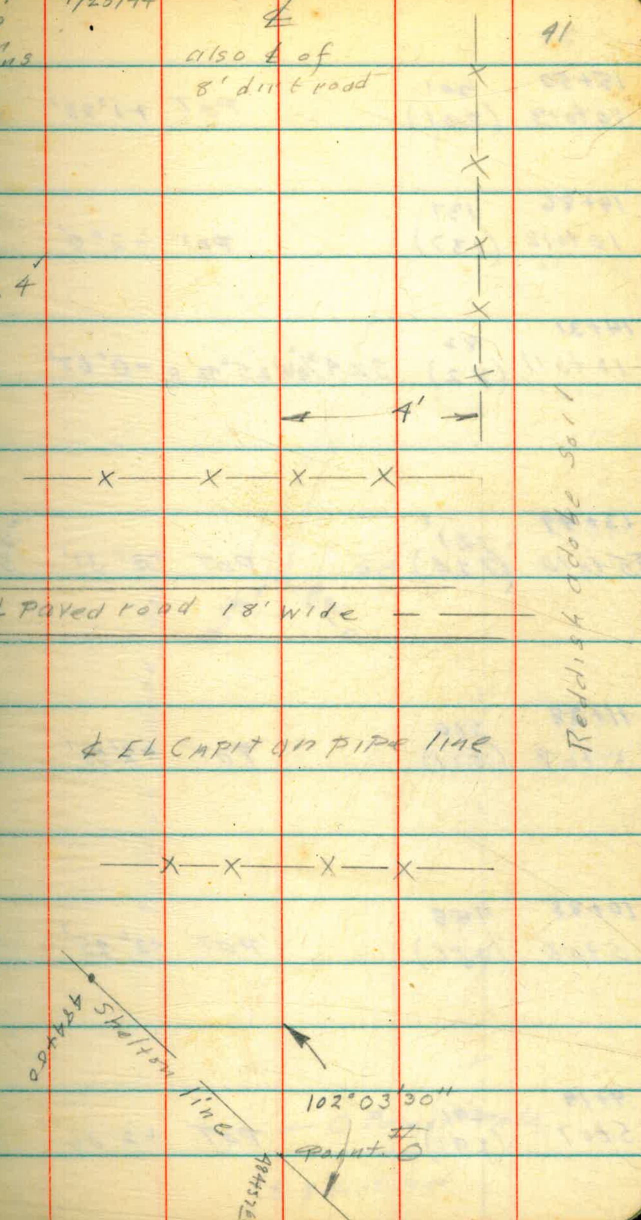
Byler
King
often
Stevens

4/25/44

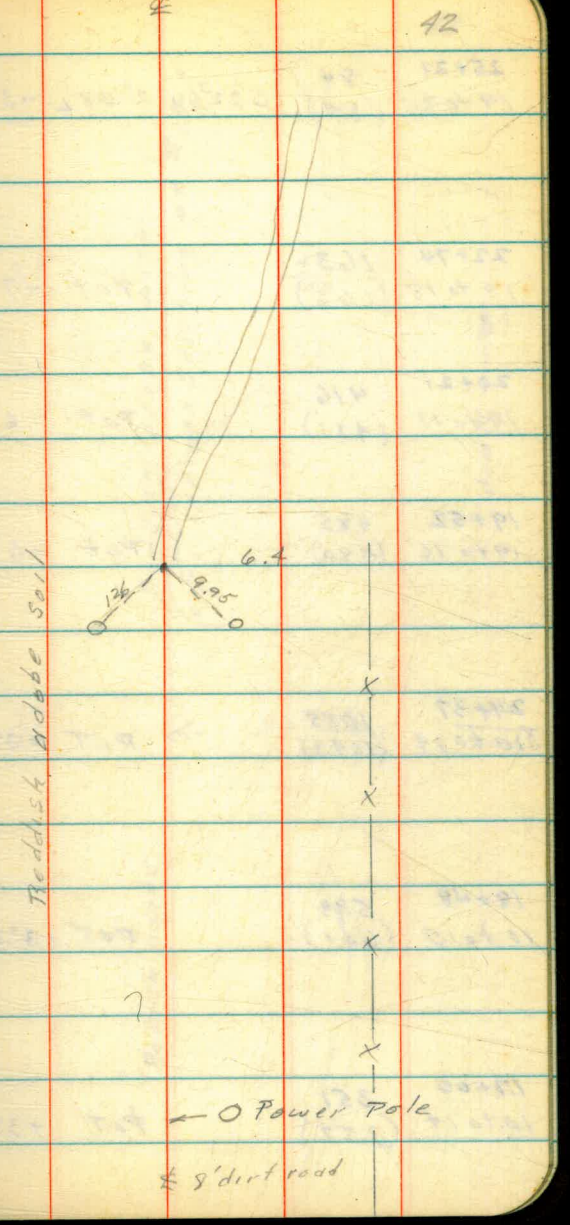
7+75 5 to 6	147 (147)		POT +2°39'	5.0 5.0	359.0
6+28 △ 0 to 5	628' (630)		POT +3°24'	5.1 5.1	el. 352.4
3+34 0 to 4	334 (335)		POT fence		
3+00 0 to 3	300 (301)		POT +3°29'	5.1 5.1	333.3
2+78 0 to 2	278 (279)		POT +3°49'	5.1 5.1	333.6
2+72 0 to 1	272 (273)	S	POT +3°49'	5.1 5.1	333.2

Point 0 = 484+37.67 Shelton line   5.1 H.I

El. Point 0 = 315.1



15+50 10 to 13	201 (201)		POT	+1°28'	5.1 5.1	401.8
14+86 10 to 12	137 (137)		POT	-2°0'	5.1 5.1	391.9
14+31 10 to 11	82 (82)	S24 3/4°W	25°42' R	-0°07'	5.1 5.1	395.1
13+49 5 to 10	721 (724)		POT	+3°31'	5.0 5.0	el. 396.7
11+38 5 to 9	510 (511)		POT	+2°58'	5.0 5.0	378.8
10+83 5 to 8	455 (456)		POT	+2°25'	5.0 5.0	371.6
9+19 5 to 7	291 (291)		POT	+2°06'	5.8 5.0	363.0



92.5
1088.0

25+21 19 to 20	84 (84)	S 22 3/4° W	2°08' L	→ 3°40'	5.1 5.1	466.4					
22+74 19 to 18	163 (166)		Pot	-7°28'	5.2	450.4	+3° / 125'			-4° / 150'	
20+21 19 to 17	416 (421)		Pot	-6°29'	5.2	425.2					
19+52 19 to 16	485 (490)		Pot	-6°12'	5.2 5.2	419.2					
24+37 π10 to 19	1088 (1093)		POT	+3°57'	5.1 5.1	el. 471.8	+4° / 200		←	30'	-9° / 200'
19+48 10 to 15	599 (601)		POT	+3°20'	5.1 5.1	431.5	?				
17+00 10 to 14	351 (352)		PoT	+3°32'	5.1 5.1	418.3					

Reddish adobe with outcropping starting at π15

draw →

Reddish adobe

32+20 25 to 27	316 (317)		POT	+2°42'	5.1 5.1	500.1	+15° 200'				−6° 225'
30+63 25 to 26	159 (159)		POT	−2°27'	5.1 5.1	482.8	+10° 200'				−4° 200
29+04 19 to 25	467 (468)		POT	+2°11'	5.1 5.1	el. 489.6	+8° 200'	+10° 40'	20'		−13° 150'
28+37 19 to 24	400 (460)		POT	+1°17'	5.1 5.1	480.8					
27+99 19 to 23	362 (363)		POT	+1°42'	5.1 5.1	482.5	+6° 200				−10° 200
26+32 19 to 22	195 (195)		POT	−1°28'	5.1 5.1	466.8					
25+98 19 to 21	161 (162)		POT	−3°47'	5.1 5.1	461.1	+5° 150				−8° 150

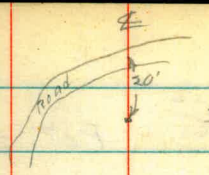
Redish adobe few outcrops

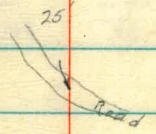
45+11	540.0		POT	+5°39'	5.1	el. 625.9	-4° / 4.0	0° / 40	←	300'	-16° / 175 →
29+37	(545)				5.1						
42+11	240		POT	+5°30'	11.1	589.5	+5° / 50	-1° / 60			-17° / 75'
29+32	(242)				5.1						
41+19	148		POT	+5°16'	5.1	586.0	-4° / 100	+1° / 50			-15° / 75'
29+34	(149)				5.1						
40+22	51	S14°W	8°36'L	-7°49'	5.1	565.4 ~~572.4~~		+10° / 100'			-4° / 250'
29+30	(52)				5.1						
39+71	308.8		POT	+1°59'	5.1	~~571.8~~ 572.4		+7° / 200'	← 100' →		-7° / 200
28+29	(311)				5.1						
36+62	758.0		POT	+4°13'	5.1	el. 545.5		+14° / 200	40'		-5° / 250
25+28	(762)				5.1						

							℄	
47+32 37 to 40	221 (221)	Pot	+2°00'	13.0 5.0	625.5		+6° 100	−9° 125
47+02 37 to 39	191 (191)	POT	+2°22'	5.0 5.0	633.7		+7° 200	−10° 175
45+69 37 to 38	58 (58)	POT	+0°15'	12.0 5.0	619.1		+10° 100	−7° 175
44+50 37 to 36	61 (63)	Pot	−9°50'	5.0 5.0	615.2		+8° 75	−16° 125
43+96 37 to 35	115 (119)	Pot	−10°29'	12.0 5.0	597.5		+8° 75	−10° 100
43+60 37 to 34	151 (155)	POT	−9°40'	11.0 5.0	594.1		+11° 100	−10° 75
43+09 37 to 33	202 (206)	POT	−8°08'	15.0 5.0	596.9		+10° 100	−10° 75

Reddish adobe no outcroppings

60+09 T45to46	376 (376)		Pot	−2°01′	1.8 1.8	El 734.8	+1° 200		+8° 150	
53+82 45to44	251 (255)		Pot	−7°33′	9.8 4.8	709.8		+20° 150	+10° 200	
53+17 45to43	316 (321)		Pot	−6°55′	8.8 1.8	705.6		+20° 150	−20° 40	+15° 100
56+33 T37to45	1122 (1135)		Pot.	+6°13′	5.0 5.0	El. 748.0	+10° 200′	−6° 75	+6° 150	
49+19 37to42	408 (410)		Pot.	+3°33′	15.0 5.0	641.1		+9° 200	−10° 200	
48+11 37to41	300 (300)		Pot	+2°02′	5.0 5.0	636.4		+8° 200	−8° 200	





72+46 58 to 52	223 (230)		Pot	-10°24'	17.0 5.0	594.0		+4° / 150	+15° / 150		
71+46 50 to 51	123 (126)		Pot	-9°12'	5.0 5.0	614.9		-7° / 150	-30° / 75	+30° / 75	
70+23 49 to 50	(209 / 213)	S 16½° W	1°41'30" R	-7° 20'	5.0 5.0	el. 634.8 ✓		+4° / 100	-4° / 20	-24° / 60	+25° / 50
68+14 46 to 49	(805 / 812) ✓		Pot	-5° 11' 30"	5.0 5.0	el. 667.8 ✓		+9° / 150	-9° / 50	+9° / 100	
64+55 46 to 48	446 (450)		Pot	-5° 22'	15.0 5.0	682.9		+6° / 200	+5° / 150		
61+09 46 to 47	100 (100)	S 14° W	1° 34' 30" R	-4° 03'	5.0 5.0	727.8		+3° / 200	+4° / 150		

Reddish adobe few small out croppings

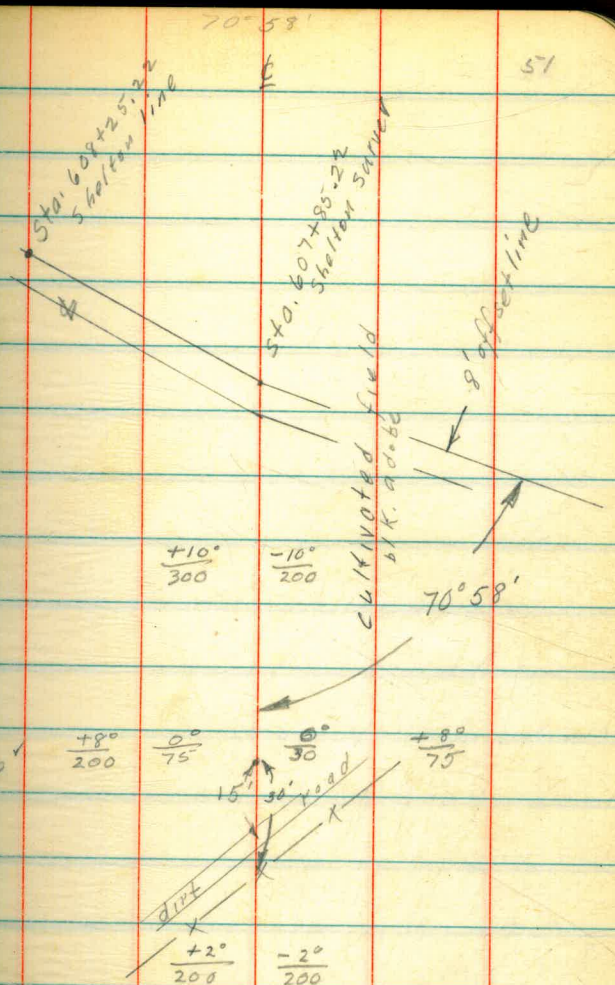
								℄		
83+50 57 to 58	93 (95)	S 39½° W	8°04'30" R	-8°09'	5.1 5.1	478.6	+20° 50'	-22° 100	+18° 200	
81+41 57 to 56	116 (117)		Pot	+4°21'	5.1 5.1	500.9	+14° 80	-17° 40	+20° 200	
82+57 ⊼53 to 57	542 ✓ (548)		Pot	-6°00'	5.0 5.0	el. 491.9 ✓	+12° 50	-14° 75	+15° 200	
78+17 53 to 55	102 (103)		Pot	-6°45'	5.0 5.0	536.9		-4° 200	+12° 150	
77+72 53 to 54	57 (60)	S 31° W	14°46'30" R	-12°30'	6.0 5.0	535.2		-4° 150	+14° 100	
77+15 ⊼50 to 53	692 ✓ (703)		Pot	-7°04'	5.0 5.0	el. 548.9 ✓	+15° 100	-19° 50	+2° 50	+10° 60'

Reddish adobe heavy out croppings

150 12° ℄

95+98 64 to 65	240 (240)			-2°31'	5.0 5.0	367.6		+2° / 300	-2° / 150	
93+58 ⊼ 61 to 64	712 ✓ (718)		Pot	-5°22'	5.1 5.1	✓ el. 378.1	← 50' →	+1° / 200	-2° / 200	
92+82 61 to 63	636 (646)		Pot	-7°20'	15.1 5.1	353.1		+6° / 200	+10° / 150	
89+86 61 to 62	340 (346)	S 59° W	20°25'30" R	-7°37'	5.1 5.1	399.4		-2° / 150	-4° / 60	+8° / 150
86+46 ⊼ 57 to 61	389 ✓ (395)		Pot	-6°53'	5.1 5.1	✓ el. 444.9	last of outcroppings	-16° / 200	+16° / 200	
85+40 57 to 60	283 (288)		Pot	-7°55'	5.1 5.1	452.6		-16° / 150	+16° / 200	
84+06 57 to 59	149 (156)		Pot	-12°0'	16.1 5.1	449.1	+18 / 100	-22° / 50	+22° / 200	

			Pot		7.0 5.0	
110+43 68 to 70	1018 ✓ (1019)		Pot	-1°55'	5.1 5.1	342.6
105+51 68 to 69	526 (526)	S79½°W	20°8'30" R	-1°15'	5.1 5.1	360.9
100+25 64 to 68	667 (667)		Pot	-86'	5.0 5.0	cl. 376.9 ✓
98+04 64 to 67	446 (447)		Pot	-1°59'	5.0 5.0	362.6
97+45 64 to 66	387 (388)		Pot	-3°18'	7.0 5.0	353.8



401.1

546.40

541.62 = 100

4.78

507 + 85

484 + 37

12,3 48

11 0 43

13 05

545.54

6,86

546,40

49,58

548.6

7.8

556.1

1 2 8

554.8 8

5486

7.6

556.1

1 2 5

554.85

1300

282

1018

532.62

2.32

534.94

11 10

523.84

2 60

526.44

628

489.6

55.9

545.5

26.9

572.4

53.4

625.8

122.2

748.0

the

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30' =

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4 ft.,

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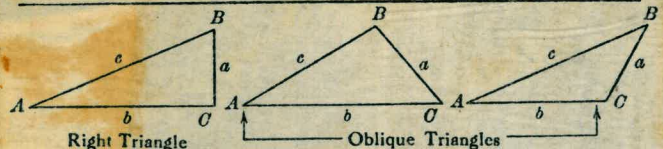
S. A.

TRIGONOMETRIC FORMULÆ



Right Triangle — Oblique Triangles

Solution of Right Triangles

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

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

Solution of Oblique Triangles

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

REDUCTION TO HORIZONTAL

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

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

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

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