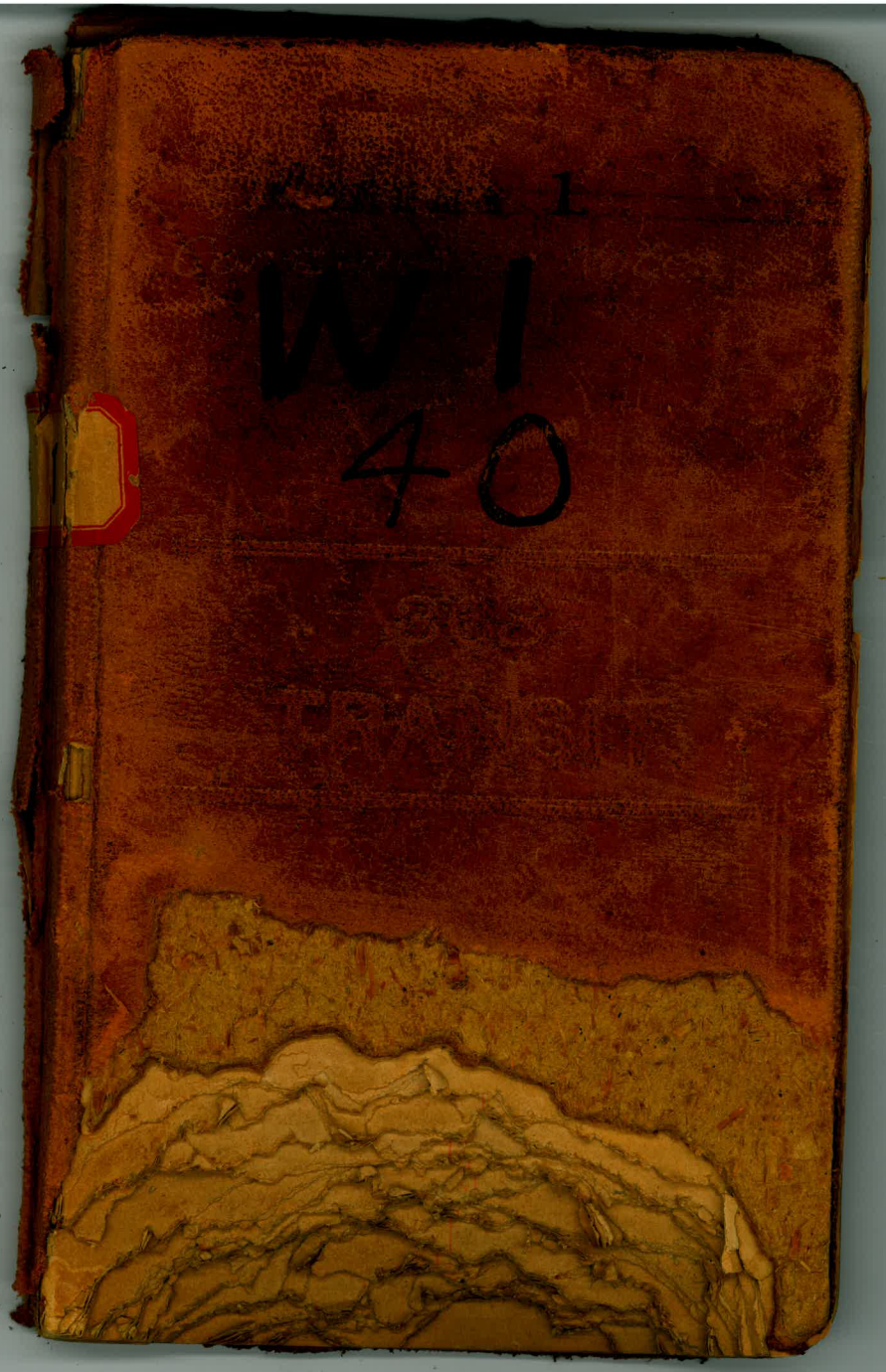
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Notes on opposite page are Triangulation on Axis of Morena Dam to establish points on Same -

Base line for Triangulation taken about the 200' Contour at Right angles to axis of Dam - Eastwards Base line 147' -

One angle (40° 40') taken on base of 125' -

Measurement from M to Intersection of Tunnel line 60' approximately

July 15. 1897

Axis of Dam

Angle to A = 82° 49'

" B = 82 38'

" C = 82 19'

" D = 81 56

Do Pt. E = 81 35 ✓ 993.5

" F = 81 16 957.0

" G = 80 53 916.0

above Cattle Pt H = 80 28 875.3

Big Rock = 79 08 ✓ 765.7

I = 77 48 approximately.

J = 76 36 617.0

150' Contour K = 74° 53 ✓ 544.2

TUNNEL LINE Intersection = approximate = 167.0

on Rock M = 40° 40 ✓ 107.4

Hub on Axis of Dam on = 125 / 147'

137.5

241.1

260.3

V

Levels on Wagon Road

Near Evans House for Change of Road

July 16, 1897

Station	B.S.	Int.	F.S.	H.I.	Elev.	Grade	Cut or Fill	
B.M.	5.43			105.43	100.			assumed Elev.
0		14.40			91.03	91.0	0.0	
+25		12.40			93.03	94.4	- 1.4	
+50		6.80			98.63	97.8	+ 0.9	
+75		2.60			102.83	101.2	+ 1.6	
Peg on Stone			0.53		104.90			
	11.92			116.82				
1.00		9.90			106.92	104.6	+2.3	
1+25		6.00			110.82	108.0	+2.8	
1+50		4.05			112.77	111.4	+1.4	
1+75		2.85			113.97	114.8	- 0.8	
Peg			1.87		114.95			
	12.26			127.21				
2.00		10.20			117.01	118.2	- 1.2	
on Root			1.20		126.01			
	8.46			134.47				
2+25		14.00			120.47	121.6	- 1.1	
2+47		7.30			127.17	124.8	+2.5	
2+55		5.30			129.17	125.1	+4.0	
2+75		2			131.95	128.8		
on Stone								

Levels on Wagon Road Near Grimes House Continued

Sta.	B.S.	Int.	F.S.	H.I.	Elev.	Grade	Cut or Fill	
	11.32			143.78	132.46			
3.00		8.50			135.28	132.2	+3.0	
+25		7.47			136.31	135.0	+1.3	
+50		5.50			138.28	138.0	+0.3	
+75		4.40			139.38	139.0	+0.4	
4.00		3.85			139.93	139.6	+0.3	
+25		3.25			140.53	140.2	+0.3	
+50		1.50			142.28	142.2	0.0	
Peg.			1.93		141.85			
	10.45			152.30				
+75		7.27			145.03	144.0	+1.0	
5.00		6.00			146.30	146.	+0.3	
+25		4.85			147.45	148.	-0.5	
on Rock.			3.56		146.74			
		3.90			148.40			Grade of Road off 5.25

4 Levels for Trolley Bench on North Side Morena Dam. Feby 17. 1897

Sta	B.S.	Int.	F.S.	H.I.		
	5.00			305.00	300.00	Assumed Elevation of Trolley Bench South side
Peg.			0.0		305.00	
	11.77			316.77		
Peg on Rock.			.57		316.20	
	10.97			327.17		
		2.17			325.00	Hub for Elev. of Bench. North side
		2.17			"	" " "
		2.17			"	Point on Rock
		2.17			"	Hub for Elev. "
		2.17			"	" " "
		2.17			"	" " on Earth point
			2.17		325.00	Point on Rock.
	6.34			331.34		
			6.34		325.00	Hub and B.M.

Note. Elevation of Trolley Bench on North side to be 25 feet above Trolley Bench on South side - See instruction given by Mr Russell

Feby 17th 1897

Notes for Bench North Side Morena Dam.

Axis of Dam

Line at Right angles to axis of dam near Face of Trolley Bench

July 22 - 1897

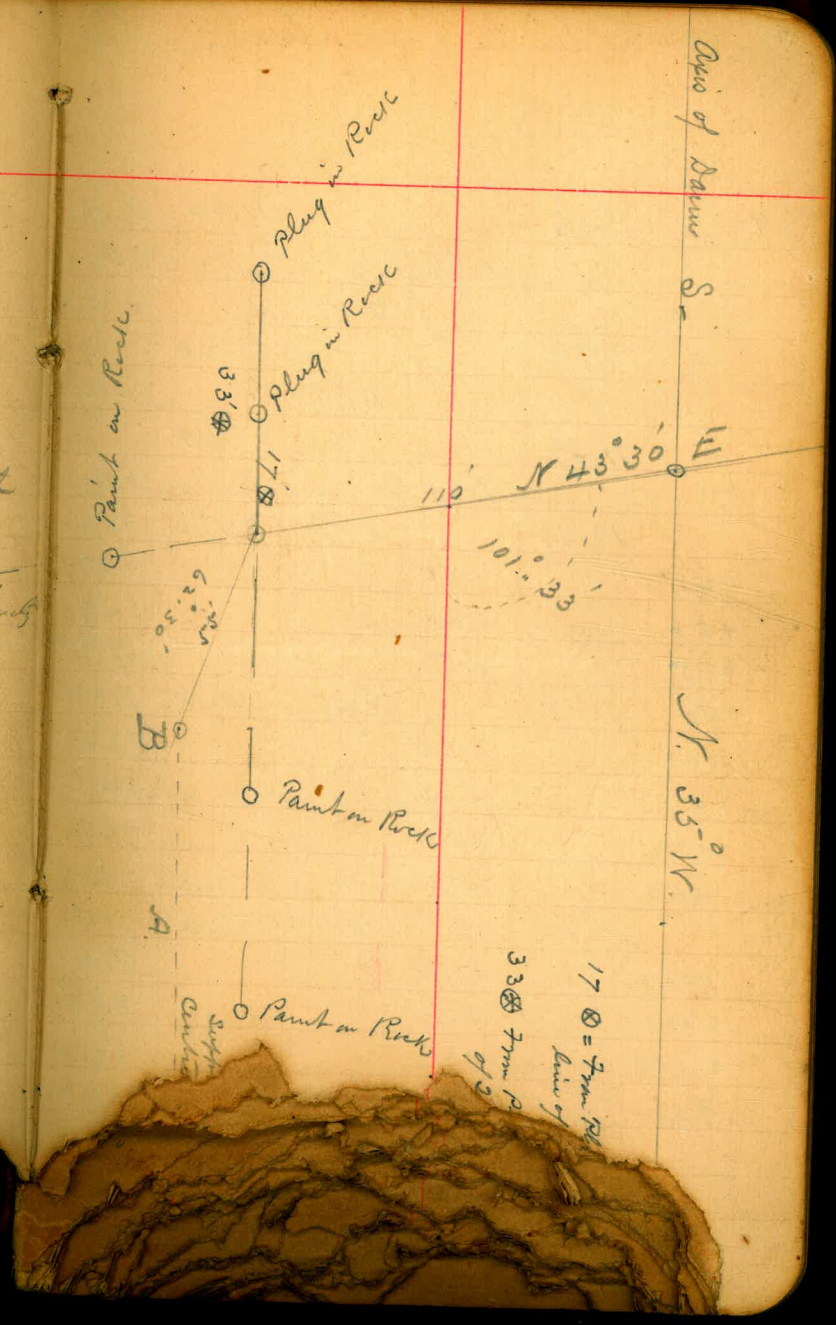
Giving points for entrance to tunnel at upper end -

Line A. = Supposed centre line of Concrete Wall at Toe of Slope

B = point where wall will connect with Solid Rock. -

Angle from Tunnel entrance to B = 62°30' distance 55 ft approximately

Hub R.P. opposite side of creek about 800 ft -



Levels over Tunnel Line

Feby 22-97

B.M.	5.06			41.99	36.93
		11.99			30. = 30' Contour point from
			0.17		41.82
	9.38			51.20	
			0.98		50.22
	11.47			61.69	
0.0		1.60			60.09 Hub at entrance to Tunnel
	10.87		0.83	71.73	60.86
+25		6.80			64.93
+50		6.80			64.93
+75		3.50			68.23
+90	9.39		0.37	80.75	71.36 Solid Rock on Rock boulder
1+00		8.20			72.55
1+10		6.60			74.15
+20		4.60			76.15 Cross axis of dam
+50		1.70			79.05
Pig	7.60		0.94	87.41	79.81 on Boulder
1+80		5.50			81.91
2+00		7.20			80.21
2+50		3.20			84.21
3+00					82.01

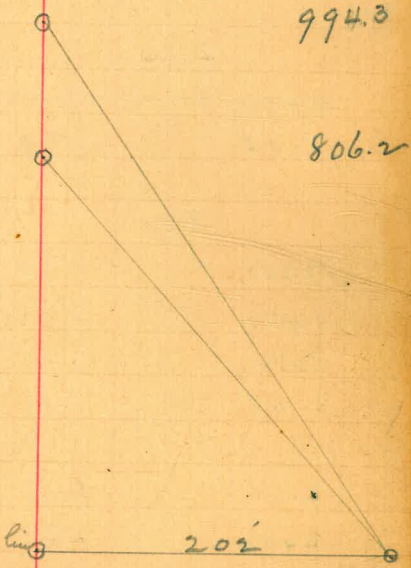
Feby 23 99

Setting point in North Trolley Bench and Triangulating
& Same also checking on point E on axis of dam above Trolley Bench -

{Old point on axis of dam Top of Hill = Same as (E) 78°.31' 994.3
{Former measurment made this 993.5

Hub in Trolley pit North side at Grade 75°.56' 806.2

Hub on axis of dam about 200' Contour Turned Rt angle for Base line 202'



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Levels for Wagon Road leading from North Trolley pit

Hand Level

	0.0	8.80			108.80	100.00		
	+25		2.40			106.40		
	+50		2.60			106.20		
Rg.				0.60		108.20		
		12.20						
	+75		10.00			110.4		
	1.00		1.30			119.1		
				0.50		119.90		
		8.00			127.90			
	1+25		0.80			127.1		
	1+50		7.00			120.9		
	1+80		6.30			121.6		
	2.00		3.30			124.6		
Rg on Stone		7.70		0.10	135.50	127.80		
	2+20		0.50			135.0		
	2+50		1.20			134.3		
Rg.		12.50		11.70	136.30	123.80		
				0.60		135.70		
		11.30			147.00			
	3+00							
	3+30					145.50		
	3+5					480		
						60		

elbow of new wagon Road into

Feby 25. 1897

Corr

100.2	- 0.2	
104.0	+2.4	
8.0	0.0	Stake moved 1.8 up hill
		" " 1.6
112.00	0.0	Stake moved 1.6 up hill
116.00	+3.1	
118.00	+9.1	
120.0	+0.9	
121.6	0.0	
124.0	+0.6	
127.0	+9.0	
131.0	+3.3	
		on High point of Rock — not part in —
143.0	+2.5	Foot of Rock point
		Trolley pit

Check levels on B.M.° on tunnel line

			33.67
7.82	41.49		
		4.56	36.93
		7.02	34.47
0.39	34.86		
		1.49	33.37
		6.11	28.75
		7.76	27.10

levels to establish roof of tunnel - lower end

			27.10
14.67	37.77		
		8.17	29.60
		0.67	37.10

levels to set grades on face of trolley foundations 340°

			325.00
11.34	33		

March 13th 1897

ele of signal B.M. north side of creek

B.M. at up stream end (chuck)

B.M. at down stream end (33.27 signal ele) dif 0.10

T.P. on rock at entrance of spillway down stream end

new B.M. on bid rock down stream end

March 13th 1897

New B.M. at down stream end

Grade

Roof of tunnel

North side. March 12th 1897

in hub set by J.H. Sykes.

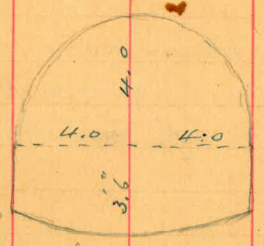
11

29th March

Grades for Commencement of Tunnel -

Sta	B.S.	Intr	F.S.	H.I.	Ele
B.M.	6.26			33.36	27.10
			3.76		29.60

Grade of Tunnel	Rod Reading	
		On Rock. Mouth of Tunnel
29.6	3.76	Points given at Entrance of Tunnel -



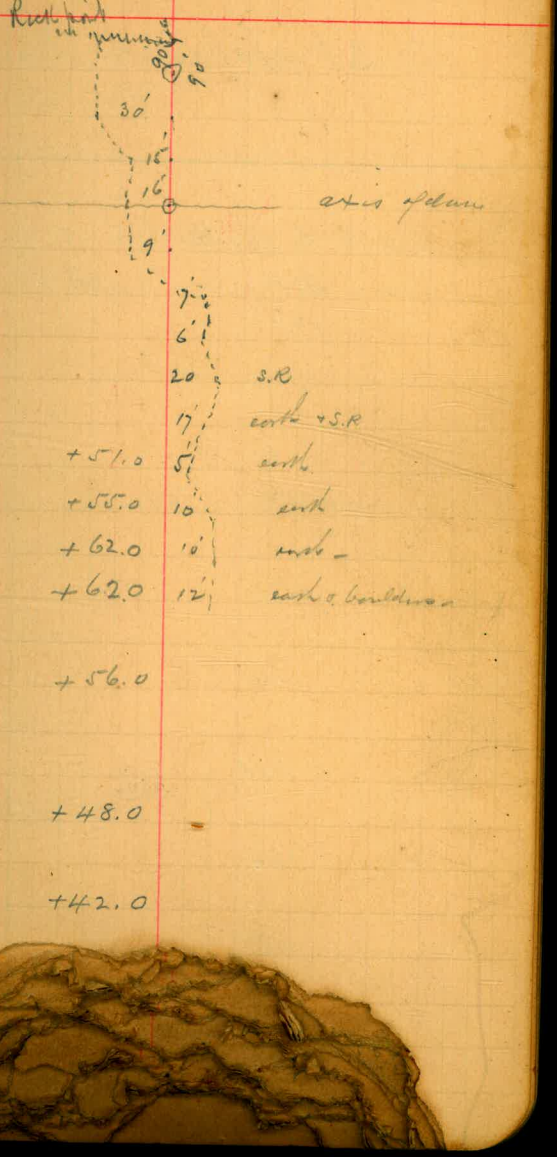
Hole drilled in Rock in front of Tunnel average of face 2.8 in from line of plug holes -

Hole drilled in Rock in front of Tunnel

March 30, 1897

12

Sta	B.S.	Int.	F.S.	H.I.	Elev
on N. Bench	12.00			356.00	344.0
on Rock			2.0		356.00
	12.30			368.3	
on Rock			0		368.3
	12.40			380.7	
on Rock			0.1		380.6
	12.30			392.9	
	5.00				
on Rock			1.5	396.4	391.4
	8.0		4.4	401.0	392.0
	4.0		8.0	397.0	392.0
391.0	-2.0				395
390.	0				399.
394	+ 5.2				406.
392.2	1.00				406.
391.0	1+50				400.
Sta. 2.	391.4			392.7	392.0
	1.3				
	392.7 H.I.		0.7		
	6.0				
	386.7				
	4.6				
2+50.	391.3 H.I.		5.3		386.0
	1.6				
	389.7				
	12.0				
3.00					1.0



Set stakes in Cameron's place for fence line above 175' Centers March 30 1897.

Levels to Reestablish 30 m 150' Centers

B.S.		F.S.		33.67
9.95			43.62	
	11.4			32.2
		0.05		43.57
11.85			55.42	
	4.90			50.52
		0.05		55.37
11.98			67.35	
		0.17		67.18
11.84			79.02	
		0.28		78.74
11.54			90.28	
		0.09		90.19
12.22			102.41	
		0.16		102.25
10.50			112.75	
				112.7

March 30th 1897

B.M. on North side creek above toe wall

Set stake on South side above wall

B.M. On Boulder near Cement House

				122.93	
	11.71		134.64		
		0.32		134.32	
	11.82		146.14		
		0.08		146.06	B.M. On Rock in old trail near Blacksmith Shop
	9.97		156.03		
		6.05		149.98	Set hub beside old trail

	Sta	dist	dif	
1st	1	15.00	0.37	
	2	30.	1.14	
	3	45.	1.51	1.47 for 45'
	4	60.	2.28	
2nd	1	15	0.36.6	
	2	30	1.13.2	
	3	45	1.49.8	
	4	60	2.26.4	
3rd	1		0.35.3	
	2		1.10.6	
	3		1.46	
	4		2.21	
4th	1		0.34.5	
	2		1.09	
	3		1.43.5	
	4		2.18	

Inside Track for South Trolley Bench

" " " "

8°.15

Second Track

8°.09

7°.57

7°.41

16

Grades for Tunnel

5.60		32.70	27.10
	3.10		

Abs Centre given

Grades for Tunnel

5.98		33.08	27.10
	3.48		

Grade for Tunnel
April 12.97

6.32		33.42	27.10
	3.82		
7.02		34.12	2710
	4.52		
6.91		34.01	27.10
apl 15.	1.76		32.25
2.71		34.96	
apl 17.			27.10

Grade

april 5. 1897

29.60

Plug in Roof for angle
is 4" above Roof grade } angle 38°.28.L

29.6 Plug in Roof for angle is 4" high

29.6

29.6

5.36

29.6 Plug [illegible] Grade

B.M.

Levels from North Trolley Bench up to stream alongside of Wagon Road for supply of water

Sta	BS	Int	FS	H.I	Elev	
	12.00			357.00	345.00	Level of North Trolley Bench
Pig			0.35		356.65	on path
	11.95			368.60		
			2.90		365.70	On Big Rock
	10.33			376.03		
			0.90		375.13	on Rock
	7.45			382.58		
			12.10		370.48	
	6.70			377.18		
			0.30		376.88	
	12.28			389.16		
			0.95		388.21	
	12.36			400.57		
			0.18		400.39	
	9.77			410.16		
			0.09		410.07	
	12.10			422.17		
		4.67			417.50	
		6.67	6.67		415.50	Water Elev in Creek above Inv
		14.47			407.70	Water " " below Inv
	94.94		24.44			
	24.0					
	70					

Levels from

0	5.97			421.47	415.50	at upper Res.
+50		10.70			410.8	lower "
+72		13.70			407.8	lower.
1+00		19.00			402.5	
1+50		19.00			402.5	
2.00		16.50			405.0	
	3.22		9.00	416.69	413.47	
2+50					395	in gully about 10' below 2.00
3.		13.00			403.7	
3+50		10.00			406.7	
4.		12.60			404.1	
Pvg			11.94		404.75	
	1.61			405.36		
4+50		3.46			401.9	} crosses Road
5		9.80			395.6	
5+50		14.00			391.4	
Pvg			12.02		394.34	
	0.50			394.84		
6.		7.15			386.7	
6+50		10.80			383.0	
7		10.90			383.0	
7+50					383.4	
Pvg					388.46	

Sta	B.S.		F.S.		
	10.33			393.79	383.46
8		11.1			382.7
+50		11.3			382.5
9		10.5			383.3
+50		5.6			388.2
10		9.50			384.3
+50		9.50			384.3
11		14.1			379.7
Tp.			11.04		382.75
	0.50			388.25	
11+50		5.40			377.8
12		9.60			373.6
-50		8.00			375.2
13		8.80			374.4
+50		10.00			373.2
14		9.40			374.8
+50		8.60			375.6
15		7.20			376.0
+50		2.90			380.3
16		5.30			378.0
+50		7.75	7.75		376.50
	5.0			380.52	
17					373.1
					369.7
					366.0

amongst big Rocks

30.27
15.85
14.42

Top of Ridge

Levels from South Trolley above Trolley Bench

11.27			311.27	300.00
		0.47		310.80
10.55			321.35	
		0.09		321.26
11.87			333.13	
		0.11		333.02
12.20			345.22	
		0.12		345.10
11.49			356.59	
		0.12		356.47
11.38			367.85	
		0.00		367.85
10.82			378.67	
	4.20			374.47
	12.35			366.12
		0.05		378.62
79.58		.96		
96				
78.62				

Bench to find Elevation of Reservoir

April 16. 1897

Elev. South Trolley Bench =

looking across just strikes North Trolley B.

on Big Stone Top of Reservoir West side

bottom of Reservoir

B.M. on Big Rock North side of Reservoir

Levels over Line for dam above Chennings

Flume to Water Ram to Blacksmith shop.

April 16. 1896.

	7.43			40.08	32.65	B.M. on peg near Chennings House at edge of Water
0+0		3.68			36.40	Notch at top next to dam = grade
+50		3.70			36.38	36.32 +0.06
1.00		4.68			35.40	36.24 - 0.84
+50		5.30			34.78	36.16 - 1.38
1.95		3.10			36.98	36.08 +0.90 point of R.
2.00		3.30			36.78	36.08 +0.70
2+50		4.81			35.27	36.00 +0 - 0.73
3.		4.97			35.11	35.92 - 0.81
3+50		5.27			34.81	35.84 - 1.03
4.		6.10			33.98	35.76 - 1.78
+35		4.78			35.30	35.70 - 0.40 point of R.
Tp.			2.42		37.66	
	2.89			40.25		
B.M.		1.98			38.27	
4+50		5.30			34.95	35.68 - 0.73
5.00		5.22			35.03	35.60 - 0.57
5+50		6.60			33.65	35.52 - 1.87 R
6.00		5.83			34.42	35.44 - 1.02
6+50		6.80			33.45	35.36 - 1.91
Peg in Stump			5.30		34.95	R
	3.[illegible]			38.76		
7.					36.81	35.28
7					34.16	35.[illegible]

	13.83		7.72					
7+88		1.87		38.76	36.89	35.14	+ 1.75	point R
8.00		3.47			35.29	35.12	+ 0.17	
+50		3.30			35.46	35.04	+ 0.42	
9.00		3.62			35.14	34.96	+ 0.18	
+50		4.05			34.71	34.88	-0.17	
10.		4.15			34.61	34.80	-0.19	
Peg on Slope			4.24		34.52			
	4.12			38.64				
10+25		3.57			35.17	34.76	+ 0.41	point R
+50		3.40			35.24	34.72	+ 0.52	
11.		3.30			35.34	34.64	+ 0.70	
+50		7.20			31.44	34.56	-3.12	
+80		3.12			35.52	34.51	+ 1.01	point R.
+97		2.50			36.14	34.48	+ 1.66	" "
12.50		8.30			30.34	34.40	-4.06	
			6.71		31.93			
	9.16			41.09				
13.00		5.58			35.51	34.32	+ 1.19	R
+50		4.63			36.46	34.24	+ 2.22	
14.		5.20			35.89	34.16	+ 1.73	
+50		6.33			34.76	34.08	+ 0.68	R
15		6.28			34.81	34.00	+ 0.81	
					36.77			

over.	0.23			37.00	36.77				
15+50		3.03			33.97	33.92	+0.05		
16.		3.63			33.37	33.84		-0.47	
+50		4.20			32.80	33.76		-0.96	
17.		3.30			33.70	33.68	+0.02		
+06		2.85			34.15	33.67	+0.48		
+50		2.76			34.24	33.60	+0.64		
18.		3.55			33.45	33.52		-0.07	
Peg-			3.03		33.97				
	2.45			36.42					
18+50		5.90			30.52	33.44	-2.92		
19		6.57			29.85	33.36		-3.51	
+50		7.58			28.84	33.28		-4.44	
20		6.00			30.42	33.20	✓	-2.78	
+50		11.80			24.62	33.12		-8.50	
+80		2.75			33.67	33.07	+0.60		
+78		2.12	2.12		34.30	33.07	+1.23		Highest part of R
	2.62			36.92					
21		4.72			32.20	33.04		-0.84	
+50		4.60			32.32	32.96		-0.64	
22		5.45			31.47	32.88		-1.41	
+50		5.6[illegible]			31.32	32.80		-1.48	
23					30.12	32.72			
Peg					32.30 ✓				

17
16
102
17
2.72

36.40
2.72
33.68

33.28
28.84
5.44

36
20
3.20

36.40
3.20
33.20

9.77
5.30
4.47

	3.68			35.98	32.30
23+50		4.95			31.03
24		3.60			32.38
+50		6.40			29.58
25		5.40			30.58
+50		6.53			29.45
26.		6.90			29.08
pg.			2.20		33.78
	0.0			33.78	
26+40		3.00			30.78
26.50		5.20			30.78
Inn			11.21		22.57
	3.55			26.12	
27		6.90			20.22
+22		10.40			15.72
27+62		7.60			18.52
28.00		5.90			20.22
		10.40			15.72
28+22		8.30			17.82
+50		9.90			16.22
29.		7.75			18.37
+40		9.47			16.65
		[illegible]		[illegible]	25.46
				[illegible]	32.42
					43.57
					[illegible]0.21

On Tree

32.64	-1.61
32.56	-0.18
32.48	-2.90
32.40 ✓	-1.82
32.32	-2.87

25
16
150
25
400
3600

Rock point

32.40
30.78
1.62

on S.R

in Collinwood
on Rock in stra
on big Rock " "
in bed of Stra 27+72

30.78
16.65
14.13

X on stone for Rane.

34.74
16.83
17.91
36.40
16.65
19.75

✓ B

Grades for flume line

Sta	F. S.	Int.	F. S.	H. I	Elev.
	2.42			38.82	36.40
+ 0.50		2.50			36.32
1.00		3.40			35.41
1.50		4.01			34.81
1+95		1.83		~~36.99~~	36.99
2.		2.11			36.71
2+50		3.52			35.30
3.		3.71			35.11
3+50		4.06	4.06		34.76
	4.98			39.74	
4.		5.68			34.06
+18		6.14			33.60
+35		2.39			37.35
4+50		4.42			35.32
5.		4.69			35.05
+50		6.08			33.66
6.			5.50		34.24
	4.04			38.28	
+50		4.87			33.41
7.		4.09			34.19
+50		4.52			33.76
+88			5.21		33.07
	5.68			38.75	
8.					34.11
+5					34.96

for Chevrings to opp. Camp

Grade		
36.40		Bottom of flume at dam.
36.32		
36.24	-0.82	
36.16	-1.35	
36.09	+0.90	Earth — angle R
36.08	+0.63	Rock.
36.60	-0.70	
35.92	-0.81	
35.84	-1.08	
35.76	-1.70	
35.73	-2.13	— angle R
35.70	+1.65	
35.68	-0.36	
35.60	-0.55	
35.52	-1.86	
35.44	-1.20	
35.36	-1.95	angle R
35.28	-1.09	
35.20	-1.44	
35.15	-2.08	angle R
35.12		
35.		

Sta	B.S.	Int.	F.S.		
9.		3.72		38.75	35.03
+50		4.57			34.18
+80.		4.35			34.51
+82		4.67			34.08
10.		5.03			33.72
+50		5.25			33.50
11.			5.18		33.57
	1.21			34.78	
+50		4.00			30.78
12.0		3.01			31.77
+22		6.35	6.35		28.43
	10.35			38.78	
+29		4.06			34.72
12+50		9.22			29.56
13.		8.61			30.17
+50			6.28		32.50
	7.74			40.24	
14		7.98			32.26
+50		6.92			33.32
15.		5.29			34.95
+50		6.18			34.06
16.		6.88	6.88		33.36
	5.61			38.97	
+50					32.82

34.96	+0.07		
34.88		-0.70	
34.80			B.M.
34.83		-0.75	angle L
34.80		-1.08	
34.72		-1.28	-1.22
34.64		-1.07	
34.56		-3.78	
34.48		-2.71	
34.45		-6.02	angle R
			angle
34.43			point R.
34.40		-4.84	
34.32		-4.15	
34.24		-1.74	
34.16			
34.16		-1.90	
34.08		-0.66	
34.00	+0.95		
33.92	+0.14		
33.84		-0.48	
33.76			

17.00		4.61		38.97	34.36	33.68	+0.68		
+50		4.67			34.30	33.60	+0.70		
18.		4.85			34.12	33.52	+0.60		
+50			7.93		31.04	33.44		-2.40	angle R
	4.48			35.52					
~~19+00~~		5.50			30.02	33.36		-3.34	
19+50		6.95			28.57	33.28		-4.71	
20.00		5.16			30.36	33.20		-2.84	angle L
+50		10.88			24.64	33.12		-8.48	
BM.		1.30			34.32	33.07			
20+80		2.84			32.68	33.07		-0.39	angle R
	2.80			35.48					
21.		4.50			30.98	33.04		-2.06	
+50		3.00			32.48	32.96		-0.48	
22		2.84			32.64	32.88		-0.28	angle L
+50		2.85	2.85		32.63	32.80		-0.17	" L
	3.68			36.31					
23.		5.35			30.96	32.72		-1.76	
+50		5.72			30.59	32.64		-2.05	
24.		4.87			31.44	32.56		-1.12	
+37		5.16		~~1.15~~	31.15	32.50		-1.45	angle L
+50		6.01			30.30	32.48		-2.18	
25.					30.71	32.40			
					34.81				

Grades & Centres for Tunnel

3.28		34.91		31.63
	5.31			
3.35			34.98	31.63
	5.38			
3.47			35.10	31.63
	5.50			
3.73			35.36	31.63
	5.66			
3.51			35.14	31.63
	5.44			
3.63			35.26	31.63
	5.56			
3.56			35.19	31.63

April 17. 1897

B.M.

29.60 = grade — Centres given

April 20.

96

29.60 — 1° high in batter in 44 feet

29.60 — O.K. apl 22

26 ft in from angle 38°

29.70 — O.K. Centre & grade apl 24

32' beyond angle } 54'
22

29.70 — in 36' beyond angle A.M. apl 27th 97

Grades & cen

May 1st 1897

29.70 + centre — 44 ft beyond angle

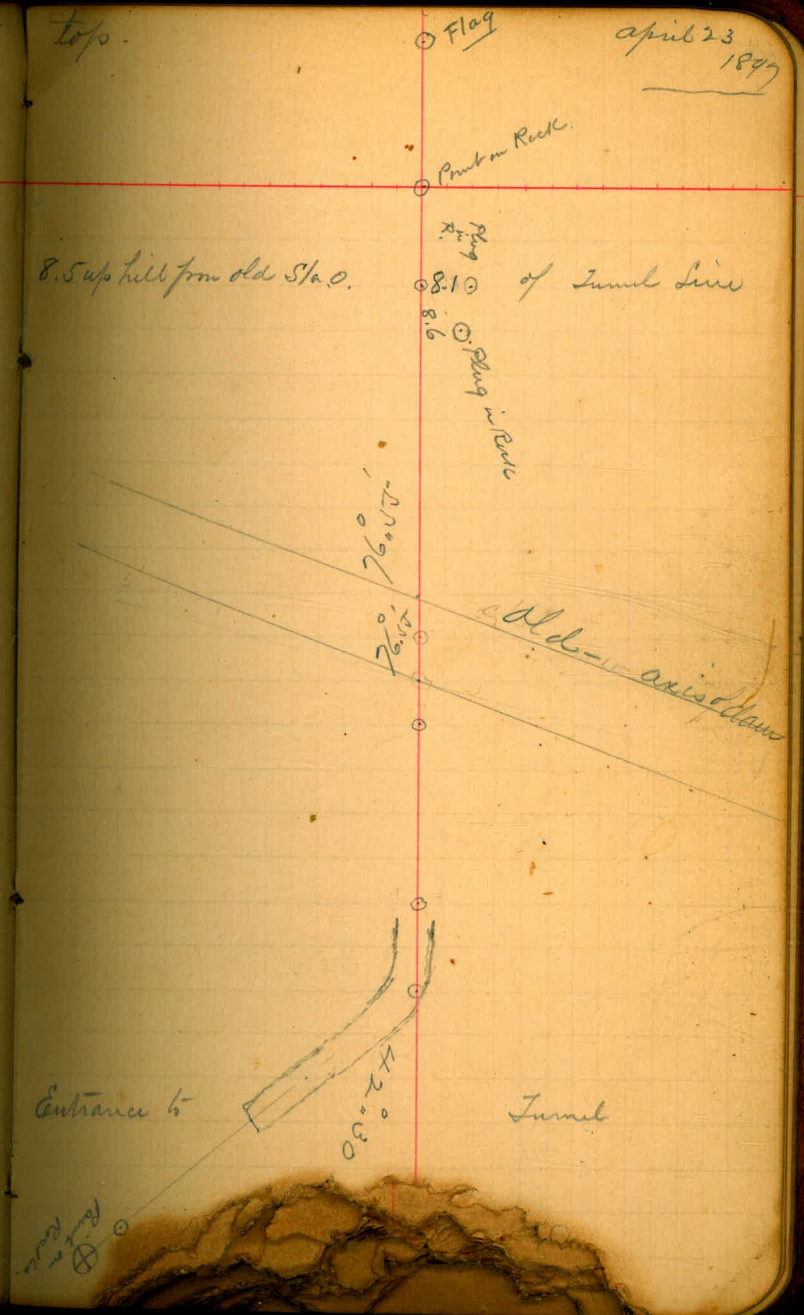
May 4th

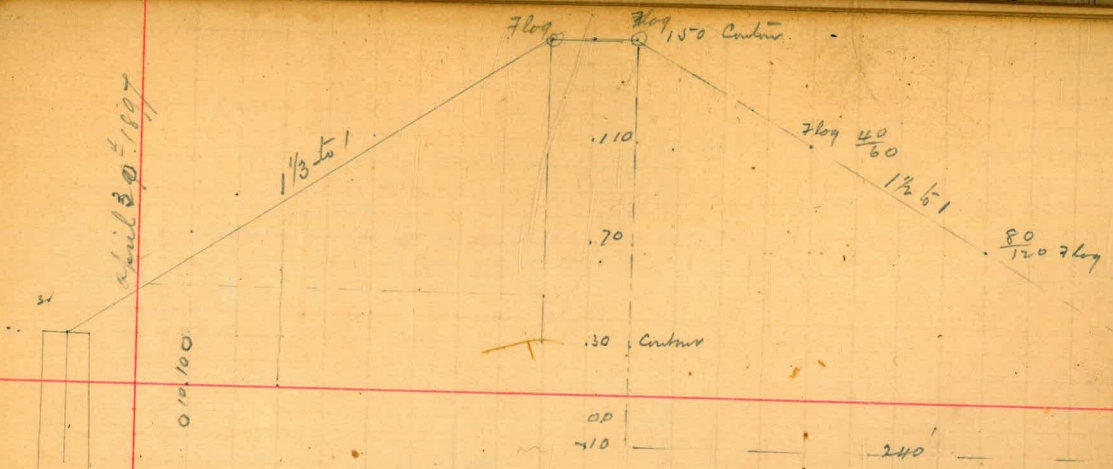
29.70 — beyond angle

Tunnel Line on top.

April 23 1897

S/a.		
Hub.	0	
	+45	
	+95	
	1+12.5	old axis
Hub.	1+36.5	
	1+60	New axis
Hub.	1+77.6	
	209	
Hub.	268.2	
Hub.	3372	42°.30′ R
	360.0	




7 log
7 log 150 Contour
1 1/3 to 1
.110
7 log 40/60
1 1/2 to 1
80/120 7 log
.70
.30 Contour
0.0
-10
240'

Measurement across Canon

May 5. 1899

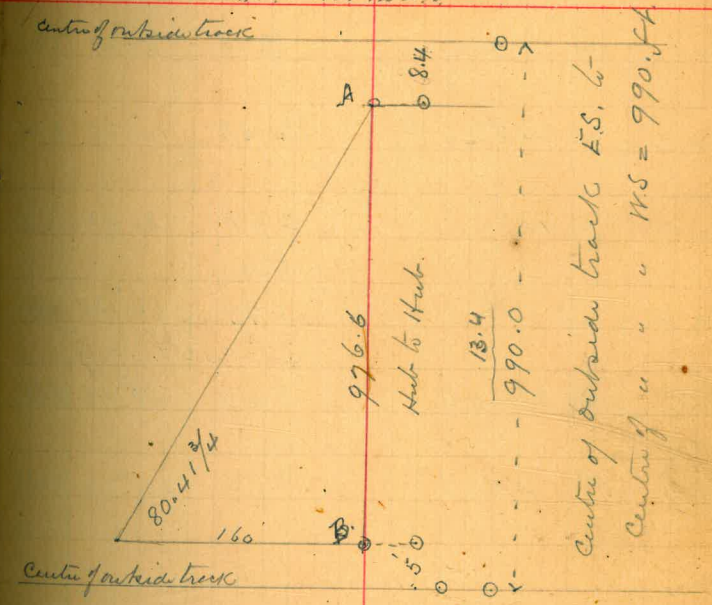
S	80°.42'	80.42
	161.23	80.41.20
	242.04	80.41.20
	322.47	80.41.45
	403.30	80.42
	43.	

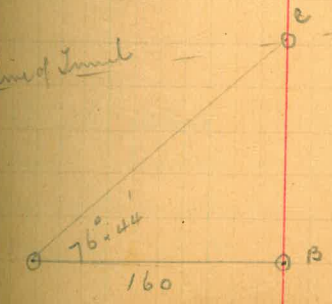
80°.41 3/4 = 976.6

80°.41' 3/4 = 976.6.

	976.6
From A to Centre of outside track S. Branch	8.4
" B " " " " N. "	5.0
	990.0

From Hub on W.S. to Hub on E.S.

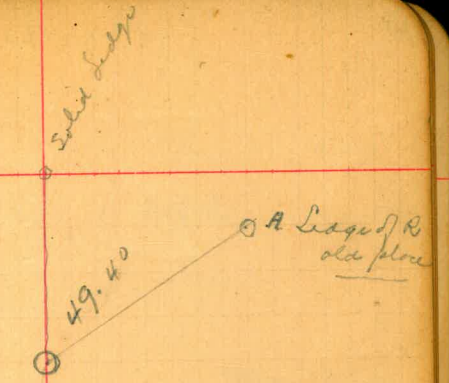




32

Notes for Derrick Guys

			Rod	Vert.	dist.
No 1 =	A	0.0	2.84	7°30'	281
No 2 =	B.	49°40'	2.38	10°00	232
No 3 -	C	105°15'	3.28	3°40	328
No 4 -	D	165°10	1.99	16°30	184.
No 5	E	205°45'	1.47	30°00	111.
No 6	F	270°30	1.73	24°20	145.



Measurements across Canyon for Stationary Cable

Sta.	1			
	2	0.32	-	11.70 -
"	3			
	4	0.35 -	-	11.65 -

35 ft below Newaxis - in line with back truck of North Trolley - and on Solid Rock back of South Trolley bench -

Grades & Centres in Tunnel

3.71			35.34	31.63	
	5.64				
3.67			35.30	31.63	
	5.60				
3.71			35.34	31.63	
		5.64			
3.67			35.30	31.63	
	5.60				
3.70			35.33	31.63	
		5.63			
3.60			35.23	31.63	
		5.53			
3.65			35.28	31.63	
		5.58			
3.66		5.29		31.63	
			35.34		

3.71 5.54 35.34 31.63 Grade 29.80 June 26. 1897

May 7. 1897

in 55 ft from angle

29.70

Grade & Centre O.K.

May 11.97

29.70 in 64 ft from angle

Centres given May 14th 97

29.70 – 4" high in Roof

May 21. 1897 ft. 72 28 9 101

29.70 Centres &c.

May 28. 1897

Centres given

29.70 116 ft in

May 31.

29.70 Grade given

Bottom 3' high – Centres given

29.70 June 10. 128' in from angle – 148 full

[illegible] 1897 – & centres

29.70

29.80 [illegible] centres

Levels from Wards Reservoir to South Bench

Sta					
	4.66			284.66	280.00
		8.66			276.00
Peg			11.79		272.87
	0.48			273.35	
Peg			11.95		261.40
	0.14			261.54	
Peg on Big Rs			11.93		249.61
	1.03			250.64	
Peg on Stone			11.36		239.28
	0.68			239.96	
			11.51		228.45
	0.21			228.66	
			0.94		227.72
	12.00			239.72	
Peg on Stone			0.67		239.05
	11.25			250.30	
			0.32		249.98
	10.68			260.66	
			0.04		260.62
	11.37			271.99	
Peg on Stone			0.57		271.42
	12.12			283.54	
			[illegible]0.6		283.48
	64.[illegible]				

Approximate Elev. Wards Reservoir
1st Joint outside of Wards fence 80' fr Res.

on Road near Paradise flat

North side of Road West of P Flat

Levels from Woods Reservoir

Continued

6.45			289.93	283.48	✓
		1.63		288.30	on point near Trolley B.
8.66			296.96		
		10.73		286.23	on Point of Rock near Trolley B.
5.59			291.82		
	9.82	~~9.82~~		282.00	B.M on Rock 20 ft East of Pipe –
	11.82			280.00	Mark on Rock = Elev Woods Reservoir
		0.47		291.35	Near pipe
11.26			302.61		
	2.71			299.90	on South Trolley Bench.

36

Derrick No 2.
Notes for Guys &c

May 17

			Vert. ° ′			
No 1	A	00	7.10	- 3.20	720	- 41
No 2.	B.	48°.00	8.58	- 1.50	865	- 27
No 3.	C.	122.62	3.40	+ 12° 30′	300	+ 63
No 4.	D.	172.10	1.92	+ 31°.20	141	+ 85
No 5	E	242.35	1.50	+ 34°.10	120	+ 20 + 75
No 6.	F	284.40	1.36	+ 14.40	388	+ 33 } less 8′ back 12′ to R and 14′ down
+		1°.0 R.	+ 2.67	+ 4.0		

37

Foundation for Trestle work
South Bench.

Elevations for Trestle on South Bench

	Rod
Top of Rail	2.17
Height of Rail	0.30
	2.47

Tie 5½
Str 15½
Cap 11½ 32½ = 2.71
5.18

First bent in centre of bent 9.93 = 4.75 =

Second bent 13.03 = 7.85 =

2.17
.30
2.71
4.75
9.93

2.17
3
2.71
7.85

9.93
3.21½
6.71½
6.31½
13.03
5.18
7.85

Tie 6"
Str 16
Cap 12
34 =

Rod 3.95
2.85
6.80
Rod 6.80

9.93
3.21½
6.71½
6.31½
13.03

6.31½

+5.5

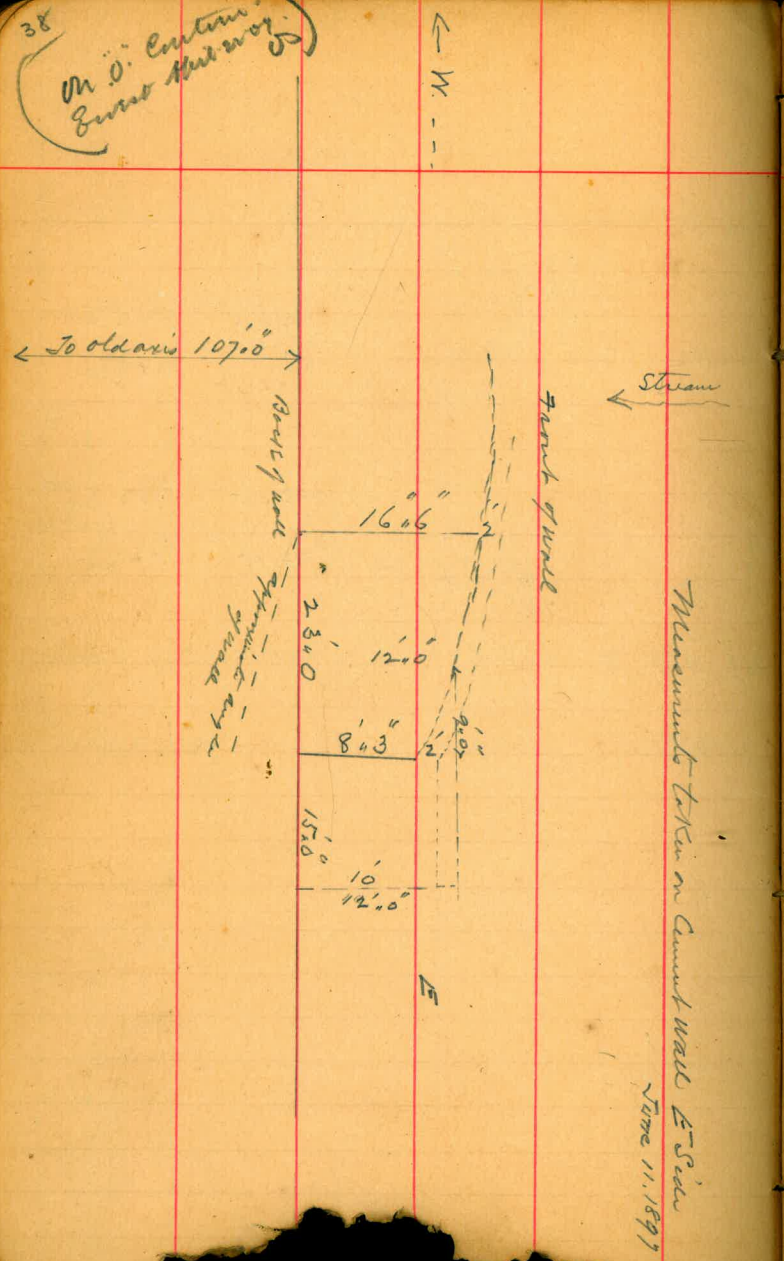
4'9"

7'10¼"

+2.25 +2.25
+2.35 +2.30

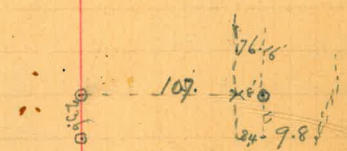
+2.15 +2.30
+2.15 +2.35

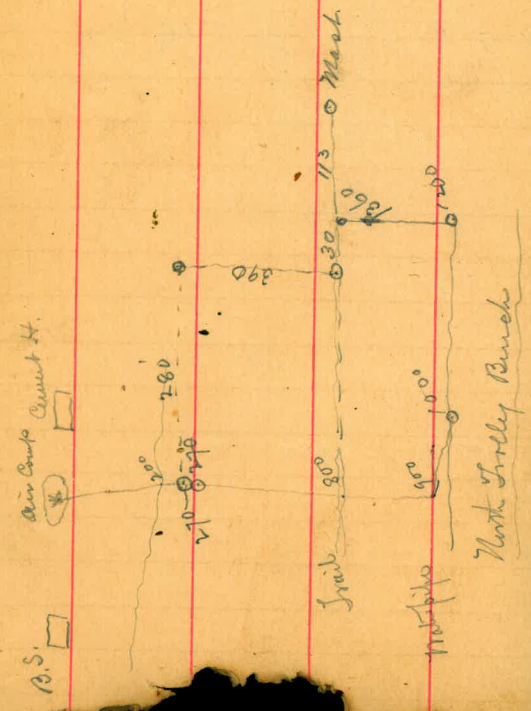
(On "O" Contour Ewest Heil-way)



Measurements taken on Cement Wall E Side
June 11. 1897

From old axis
To back of wall 107' to
Hub on Rock.





Measurement of Loose Rock on Head

Trolley Car — June 8th 1897.

9.3 × 14. × 5.4	=	703.08	
16 × 3 × 5.8	=	278.40	
9.5 × 16 × 5.8	=	881.60	= 1863.08
3 × 5 × 2 1/2	=		37.00
			1900.08
Less 6 × 3 × 4	= 72		144.
" 6 × 3 × 4	= 72		
		Cubfut	1756.08

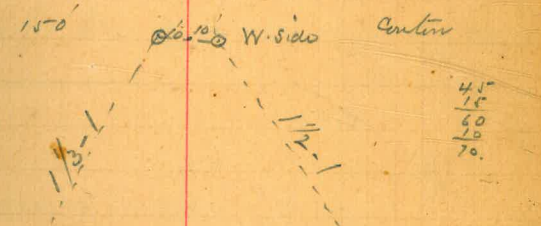
1756 Cf = 65 Cyds. = 97 Tons.

Levels to give 150' Contour on Axis of dam

11.76			161.76	150.00
	.0	0.46		161.30
12.50			173.80	
		0.98		172.82
7.50			180.32	
		11.40		168.92
0.65			169.57	
		12.35		157.22
0.10			157.32	
		12.6		144.7
0.0			144.7	
0.7		12.1	133.3	132.6
0.2		11.7	121.8	121.6
0.2		11.8	110.2	111.0
0.0		5.0	105.2	105.2
0.6		12.4	93.4	92.8
0.8		12.4	81.8	81.0
0.3		11.8	70.3	70.0
0.0		11.7	58.6	58.6
0.0		11.4	47.2	47.2
		10.3		37.0

Levels taken from B.M. on peg on trail opp. B. Shop, on Rock

7.3 - gave 150'



177.6 of Tunnel line 1' low and 4' south of Centre

41

Levels to give heights for building Cribbing for Cement wall –

B.S.	Int	F.S.		
0.20			33.87	33.67
		8.04		25.83
1.27			27.10	
	9.80			17.30
	8.04			19.06
0.40			34.07	33.67
	9.07			25.00
0.54			34.21	33.67
	9.21			
	9.40			
0.42		11.95	22.68	22.26
0.58		11.88	11.38	10.80

B.M on big boulder Original B.M.

Top of 2nd post of Cribbing – 30.00
" 17.30
12.8½ = 12.70

= Height given for Elev. top of wall at grade of asphalt.

34.07
25.00
9.07

34.21
25.
9.21

on edge of board – 0.19

30.
19.06
10.94

30
17.30
12.70

12.8½

42 Levels on Pipe Line from South Trolley Bench towards Wards Reservoir to find air bound places

	5.60			287.80	282.		B.M. on Rock near Water pipe on Line from Wards Res.
	0.46		11.71	276.35	275.89		
32+10		9.00			267.35	No. 1	Corner where pipe turns down hill
			9.62		266.73		In
	3.21			269.94			
~~120~~ 30+30		3.20			266.74	No 2.	around point of Rock
200' 29+60			1.25		268.79	No 3.	opposite big boulder
	6.16			274.95			
260' 29–		7.25			267.70	No 4 –	in bend –
~~300~~ 28+60		6.00			269.	No 5	"
~~550~~ 26+35			1.40		273.55	No 6.	in bend –
	3.63			277.18			
~~600~~ 25.00		6.25			270.93	271. No. 7	on smooth Rock face opp. Bath House
~~640~~ 24+70		5.25			271.93	No. 8	" " "
Tun 24+15			7.95		269.23	No 9	" " "
	2.61			271.84			
23+50		3.35			268.50	No 10	" " "
22+50		0.30			271.5	No 11	in bend beyond "
~~1100~~ 20+95			1.27		270.57	No 12	near big R beyond Sawyers tent
	4.47			275.04			
19+60		4.7	~~4.70~~		270.3	No 13	
18+30			4.52		270.52	No 14	on point West of Paradise plat –
	6.32			276.84			
			11.94		264.90		

16

Assumed 276 as water Elev. in Reservoir —

	1.14			266.04	264.90		
15+80		4.54			261.5	No 15	
15+03			10.32		255.72	No 16	at angle where pipe turns down to Green Hare
Paradise	0.34			256.06			14+55 Top
Flats 14+05			11.87		244.19	No 17	Near big Rock between 2 tents
	0.16			244.30			
			10.63		233.67		beyond P. F
	1.22			234.69			
			11.04		223.64		
	4.17			227.81			
11		5.9			221.9	No 18	East of Paradise Flat.
10+40		5.			222.8	No 19	
9+60		9.			218.8	No 20	Near fence East of Paradise flat
pigeon Rock			3.65		224.16		
	10.13			23429			
			0.07		234.22		on flat Rock near Road to Wards
	11.93			246.15			
			0.04		246.11		
	6.92			25303			
5+60		1.1			251.9	No 21	Near Wards House
	9.85		1.02	261.86	252.01		
3+25	11.73		0.33	272.26	261.53	No. 22	
1.50	10.72		0.16	282.82	272.10	No. 23	
		8.7			274.1	No 24	at Shut off Valve near Wards
					278.52	Water	[illegible]

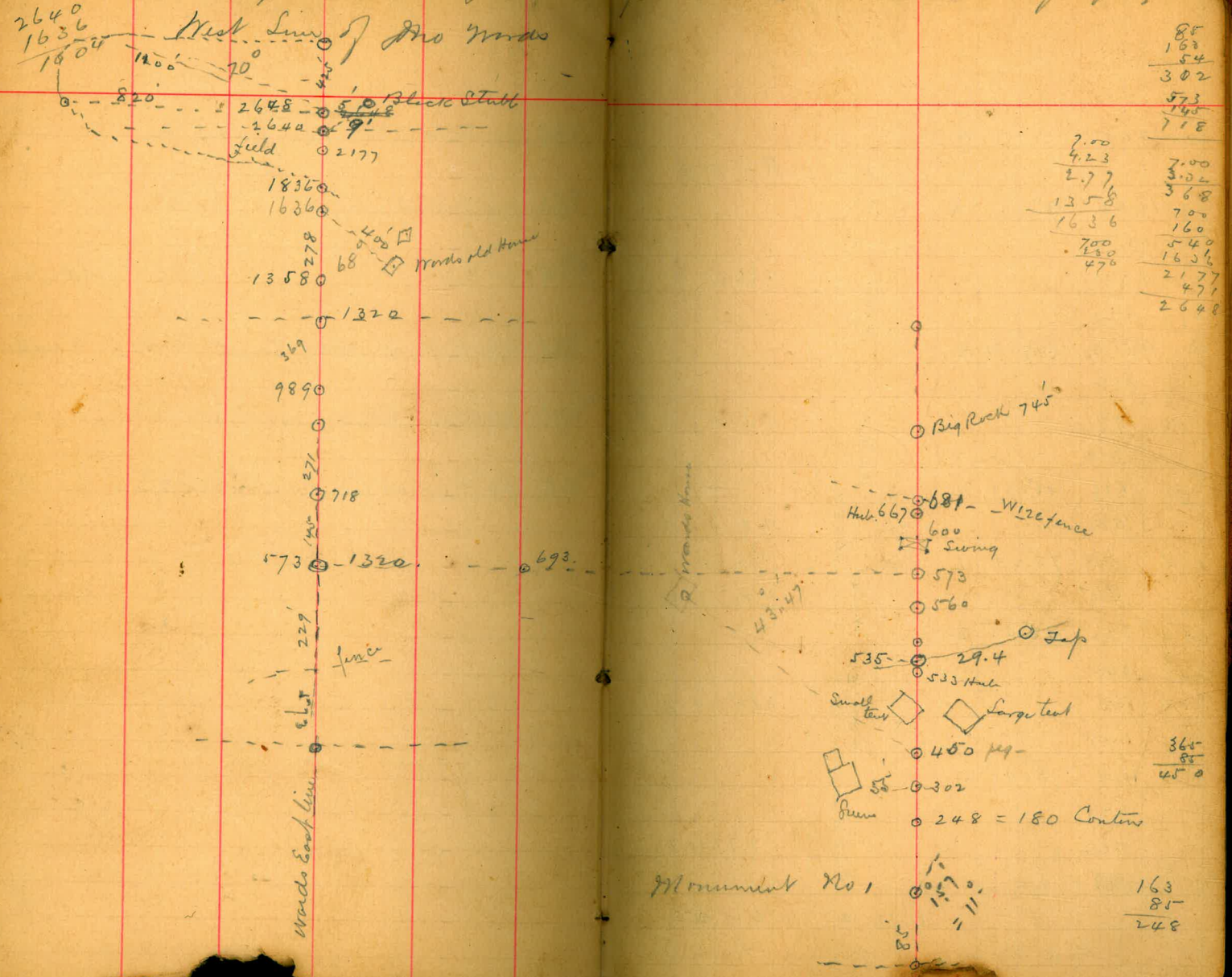
Derrick No 3

2.84

	Angle	Rod	Vert	dist	
No 1	0.0	2.84	+ 8°.00'	290	On Same Rock as Guy No 1 Derrick No 1 } ~~add 3'~~
" 2	83°.30'	1.72	+ 30°.20'	138	north end of Rock where ⊙ is " 2'
" 3	163.00	2.75	+ 7°.40	280	add 3'
" 4	218°.00'	3.55	10°.40'	355	on Rock with ⊙ above Tunnel add 2'
" 5	253°.10'	2.86	16°.20'	275	on boulder Near Flag (110) cut " 1
" 6	295.00	3.12	12°.00'	315	on boulder as Guy No 6 Derrick No 1

Extending Line between Jno Wards place and E. S. Babcocks property

West Line of Jno Wards



46 Meander of Woods Fence line

△	1201		R.				2.7	1201
				N. 74° E	N. 75 17 E			113
	1088	9° 41'	R.	P			1.0	1088
	1084							4
	1037				N. 66.05 E		0.6	1084
	970			N. 64½ E				47
⊙	951.6	107°.54	R				⊙ 0.0	1037
	828						1.0	67
								970
	771				N. 41°.51 W		2.0	18.4
	719			N. 43¼ W.				951.6
⊙	676	33°.37	L				5.0	12 3.6
	586				N. 8°.14 W			828
△	508	78°.29	L	N. 9½ W.			74	51
	505							771
				N. 69½ E	N 70°.15 E		7.8 ⊙	57
△	336	23°.25	L					719
	275						@3.5 ⊙	43
	198				S 86°.20 E		2.0	676
	149			N. 87½ E				90
△	128	8°.40	L				at fork 3.0 ⊙	586
	77							78
	+20			S. 78° E	S. 77.40 E			508
667	= 0 =	64°.30	L				1.0	
				S. 13° E	S. 13°.05 E		3.5	172
								336
							29.0	61
								275
							16.0	77
								198
							5.0	149
								49
							2.3	21
								128
							1.5 ⊙	
							18 ⊙	
							In line of section ⊙ 15' ⊙ ⊙ Offset to fence	

And meanding around fence line
Commencing at point 667 feet South of ½ Corner on West line land

~~1941~~
~~247~~
~~2188~~

92.52

1661
247
1908

			N. 13° W.					
△ 1419.0	56°.0'	R.				To Connection with Land line	⊙ at 50' South of Monument	
			N. 69 3/4 W	N 68.46	W			14190
△ 1210.6	35°.40'	R.						208.4
				S. 75°.34	W			12106
1069	62°.35	L					⊙	141.6
								1069
⊙ 1034				N. 41.51	W			35 10340
								82.4
Return to Hub Sta 951.6 & Contin						back Tangent		951.6
~~2188~~								
2141						~~Wards line~~	13'.	
1941			92°.53' to Wards Chny ⊙				10'.	1941
1908						Wards Line		280 1661
1717							1.8	1717
							92°.53'	
⊠ 1661							⊙ 2'.0	56 1661
							86°.40' ⊙ Wards House	100
⊙ 1561	1°.23'	L				Angle 86°.40 from Back Tang.	1.6	1561
⊙ 1361							2.4	200
			N. 76 1/2 E	N 77.33				1361
△ 1201	2°.16'	R.					2.7	160 1201

247'2

75.17
2.16
77.33

4.87
1.60-
3.22

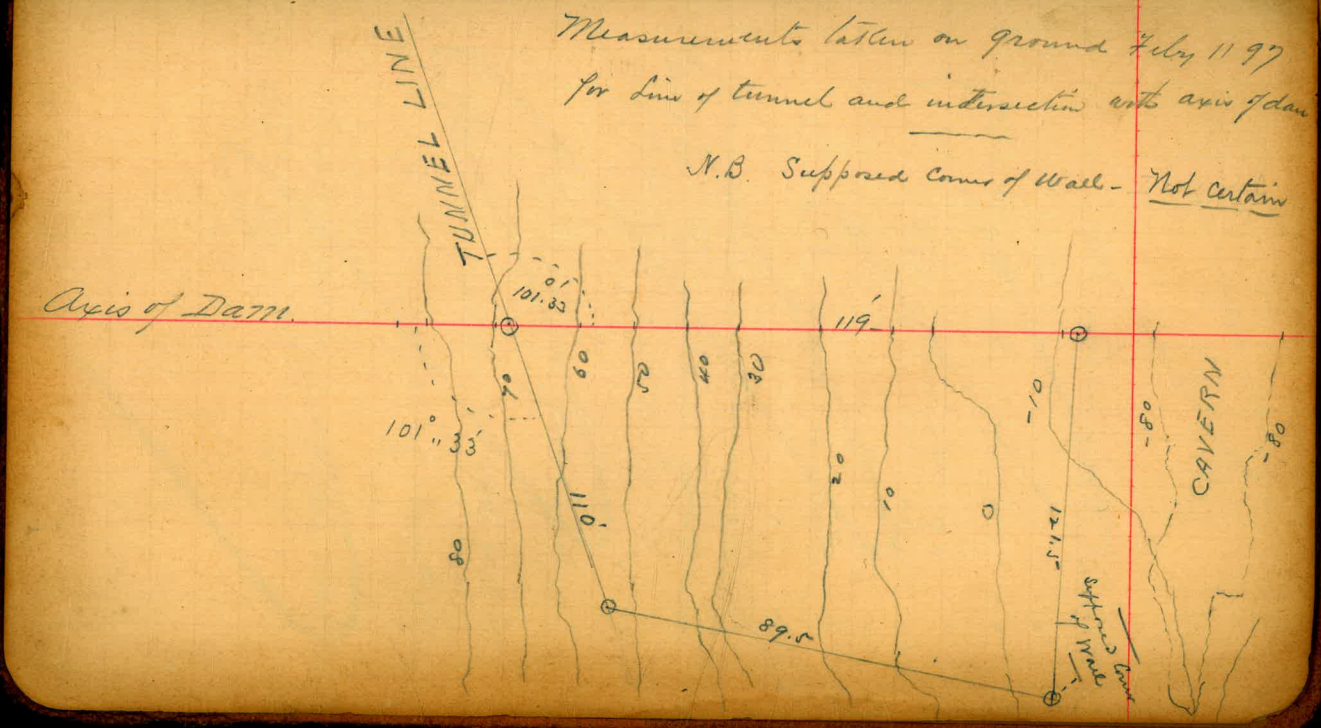
A = 5.85
B. 6.70
1.65-

B. 4.87
A- 3.22

Measurements taken on ground July 11 97

For Line of tunnel and intersection with axis of dam

N.B. Supposed corner of Wall - Not certain



1 Miners Inch of water = 9 Gals per Minute
1 " " = 1440 Gals per day
1 " " = 192 Cub. ft per day -

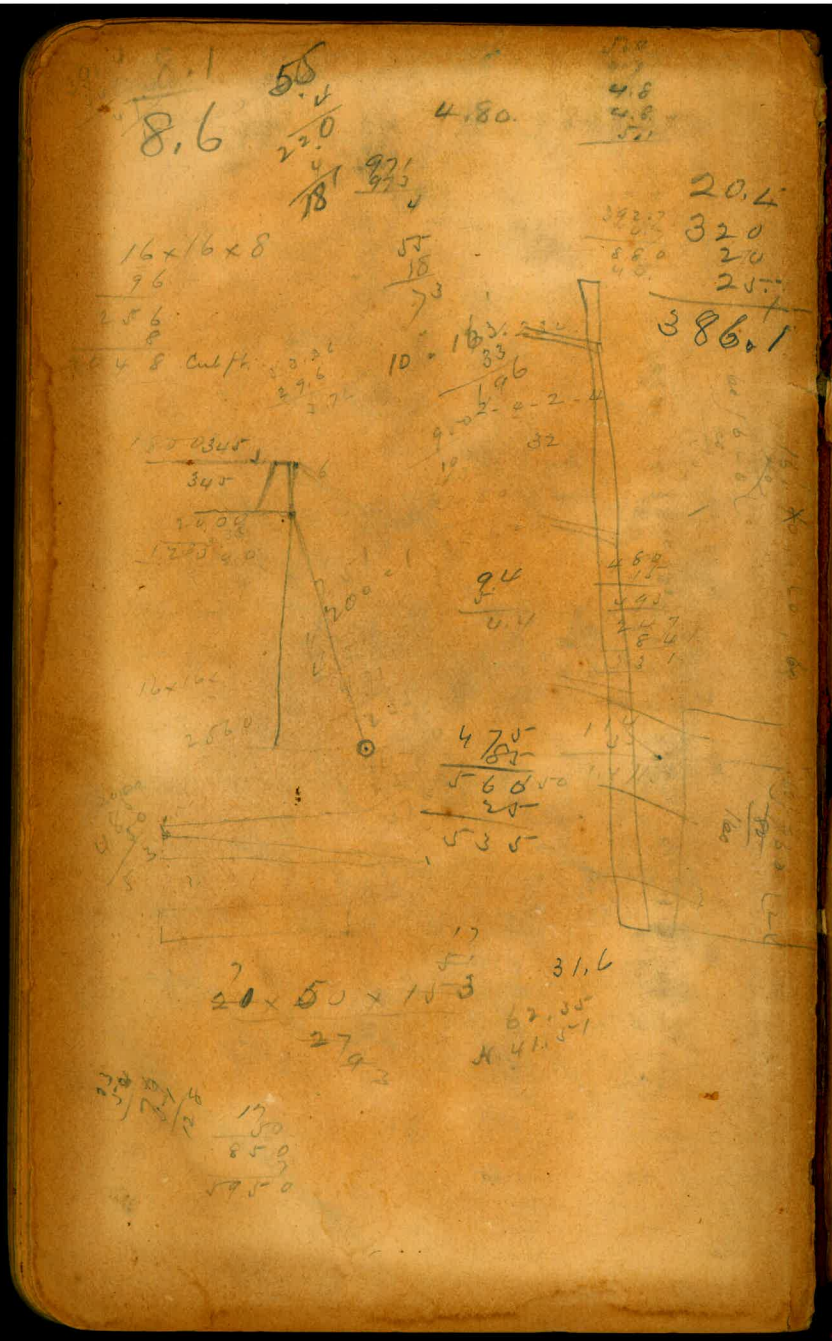
2 Caps 12×12 - 24
4 Stns 7×16 - 24
2 Posts 12×12 - 10
2 " " 6
2 Braces 3×12 22
2 " " 10
for Trestle work South Bench

24 Fittings
94 2 90° ells
36

1-16×12 c.d. reducers
1-12" vitrified all 90°
1-16" " "
16" c.d. pipe amplen?

6'10" Suction pipe
23'
1 90° Ell flanged.
Hole in side well will
take 8" SS pipe if needed.

1 check valve & gate valve
2 45° ells



TRAVERSE TABLE FOR TRANSIT BOOK.

From 1° to 90° for a distance of 100.

Degrees.	DEGREES.		¼ DEGREE.		½ DEGREE.		¾ DEGREE.		Degrees.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
0			100.00	0.44	100.00	0.87	99.99	1.31	89
1	99.98	1.75	99.98	2.18	99.97	2.62	99.95	3.05	88
2	99.94	3.49	99.92	3.93	99.91	4.36	99.88	4.80	87
3	99.86	5.23	99.84	5.67	99.81	6.10	99.79	6.54	86
4	99.76	6.98	99.73	7.41	99.69	7.85	99.66	8.28	85
5	99.62	8.72	99.58	9.15	99.54	9.58	99.50	10.02	84
6	99.45	10.45	99.41	10.89	99.36	11.32	99.31	11.75	83
7	99.25	12.19	99.20	12.62	99.14	13.05	99.09	13.49	82
8	99.03	13.92	98.97	14.35	98.90	14.78	98.84	15.21	81
9	98.77	15.64	98.70	16.07	98.63	16.50	98.56	16.93	80
10	98.48	17.36	98.40	17.79	98.33	18.22	98.25	18.65	79
11	98.16	19.08	98.08	19.51					
12	97.81	20.79	97.72	21.22	97.99	19.94	97.90	20.36	78
13	97.44	22.50	97.34	22.92	97.63	21.64	97.53	22.07	77
14	97.03	24.19	96.92	24.62	97.24	23.34	97.13	23.77	76
15	96.59	25.88	96.48	26.30	96.81	25.04	96.70	25.46	75
16	96.13	27.56	96.00	27.98	96.36	26.72	96.25	27.14	74
17	95.63	29.24	95.50	29.65	95.88	28.40	95.76	28.82	73
18	95.11	30.90	94.97	31.32	95.37	30.07	95.24	30.49	72
19	94.55	32.56	94.41	32.97	94.83	31.73	94.69	32.14	71
20	93.97	34.20	93.82	34.61	94.26	33.38	94.12	33.79	70
21	93.36	35.84	93.20	36.24	93.67	35.02	93.51	35.43	69
22	92.72	37.46	92.55	37.86	93.04	36.65	92.88	37.06	68
23	92.05	39.07	91.88	39.47	92.39	38.27	92.22	38.67	67
24	91.35	40.67	91.18	41.07	91.71	39.87	91.53	40.27	66
25	90.63	42.26	90.45	42.66	91.00	41.47	90 81	41.87	65
26	89.88	43.84	89.69	44.23	90.26	43.05	90.07	43.44	64
27	89.10	45.40	88.90	45.79	89.49	44.62	89.30	45.01	63
28	88.29	46.95	88.09	47.33	88.70	46.17	88.50	46.56	62
29	87.46	48.48	87.25	48.86	87.88	47.72	87.67	48.10	61
30	86.60	50.00	86.38	50.38	87.04	49.24	86.82	49.62	60
31	85.72	51.50	85.49	51.88	86.16	50.75	85.94	51.13	59
32	84.80	52.99	84.57	53.36	85.26	52.25	85.04	52.62	58
33	83.87	54.46	83.63	54.83	84.34	53.73	84.10	54.10	57
34	82.90	55.92	82.66	56.28	83.39	55.19	83.15	55.56	56
35	81.92	57.36	81.66	57.71	82.41	56.64	82.16	57.00	55
36	80.90	58.78	80.64	59.13	81.41	58.07	81.16	58.42	54
37	79.86	60.18	79.60	60.53	80.39	59.48	80.13	59.83	53
38	78.80	61.57	78.53	61.91	79.34	60.88	79.07	61.22	52
39	77.71	62.93	77.44	63.27	78.26	62.25	77.99	62.59	51
40	76.60	64.28	76.32	64.61	77.16	63.61	76.88	63.94	50
41	75.47	65.61	75.18	65.93	76.04	64.94	75.76	65.28	49
42	74.31	66.91	74.02	67.24	74.90	66.26	74.61	66.59	48
43	73.14	68.20	72.84	68.52	73.73	67.56	73.43	67.88	47
44	71.93	69.47	71.63	69.78	72.54	68.84	72.24	69.15	46
45	70.71	70.71			71.33	70.09	71.02	70.40	45
Degrees.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Degrees.
	DEGREES.		¾ DEGREE.		½ DEGREE.		¼ DEGREE.		

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