

REPORT OF 1965 SURVEY OF SEDIMENT AT WATERSHEDS 1, 2, and 3
ON THE H. J. ANDREWS EXPERIMENTAL FOREST

By Alfred Levno

This year's survey report covering the remeasurement of bedload accumulation from watersheds 1, 2, and 3 should be considered as unusual. The abnormally heavy rains received this year must be weighed heavily with watershed treatment in determining sediment cause. The 1964 Christmas flood triggered the scouring of the watershed 3 stream channel from the upper road to the bottom of the watershed. The slide deposition covered the entire sediment basin, including gagehouse and flume, with tons of saturated soil, logs, and rock. The watershed 2 sediment basin also received an abnormally large amount of sediment consisting mostly of pebble-sized material which must have come mainly from stream channel washing. No disturbance was detected in the watershed 1 drainage during the Christmas storm. However, the following storm of January 14 triggered several small slides near the head of the drainage and one large slide 500 yards above the gagehouse. This slide-deposited material consisted of very fine particles. Because of the abnormal conditions of these slides, this report is somewhat altered.

Logging activities on the watersheds during the past year were concentrated on watershed 1. The Wyssen Skyline Crane, employed in clear-cutting the watershed, had completed yarding on about 80 percent of the area at the time of sediment measurement. Timber felling was completed during this past year. Watershed 2 remains undisturbed, except for a small portion of blowdown on the upper trail adjacent to watershed 1. Activity on watershed 3 has been suspended now for 3 years and 6 years have passed since road construction.

Measurements

The average bottom elevation of the two remaining basins (watershed 1 and watershed 2) was determined by the technique established and used since 1961. One alteration in the procedure occurred on the watershed 1 survey. In logging the areas surrounding the gaging station, the original benchmark was destroyed. The supplementary spike established by Fredriksen^{1/} was used as the benchmark for this survey.

The procedure used in estimating the amount of debris accumulation in the watershed 3 basin was accomplished with the use of an abney, level

^{1/} See Sediment Report for 1962

rod, and a 100-foot cloth tape. First, the debris deposition was laid off in seven 50-foot sections starting from the Lookout Creek Road and running upstream past the flume. Next, abney level readings were taken at each 50-foot section to obtain the approximate height to which the debris was deposited. These readings were added to the approximate elevation of the old benchmark which was destroyed during debris removal. The approximate benchmark location was marked with red paint. The old stream channel floor was assumed to run in a straight line from the benchmark to the buried culvert, which was estimated to be about 10 feet below the new culvert installed this year. The cloth tape stretched across the channel at each 50-foot section gave an approximate width of the deposition.

Calculations

Sediment accumulation on the watershed 2 basin was determined by the procedure outlined by Sturgus in 1959. Established benchmark elevations at watershed 1 could not be used this year as the spike in the Hemlock was destroyed during logging. The auxiliary spike, which is 12.64 feet^{1/} above the old benchmark was used as a benchmark for this survey. The assumed elevation of the old benchmark (100 feet) was added to the elevation of the new spike and instrument elevations for each line were added to this sum. This produced a line of sight that could be subtracted from average rod readings and compared with last year's elevations.

Calculations of the watershed 3 accumulation are rough, with estimates rounded off to the nearest 1,000 cubic feet. A profile of the deposit in the watershed basin was drawn and each 50-foot section numbered. The sections were assumed to average out into a half-cylinder form and each section was drawn out in this fashion. The dimensions of each end section were averaged and the area of each end computed. The areas of both ends of each section were again averaged and multiplied by the length of each section to obtain a volume in cubic feet (see page 8). All volumes were added to give an estimated total volume of material deposited in the canyon.

Discussion

The watershed 2 pond was again cleaned in August, 1965 and a new pond area was computed to be 1,646 square feet. An 18-inch cedar log was embedded at the pond inlet to eliminate any shifting of the disturbed material between flume and pond. The log installation reduced the number of measuring points on the flood plain from 247 to 234 (see page 10).

Debris accumulations in this report should be considered unusual. The estimate for watershed 3 is only approximate since measurements made there could not include the total amount of material in the slide. Observations during the storm confirm the fact that there were at least

three pulses which added large depositions to the area behind the road fill in the watershed channel. The first pulse consisted mainly of supersaturated soil and logs. It was mostly contained within the area behind the fill. The second slide, consisting of the same type of material, occurred some 15 to 20 hours later. This pulse came down on top of the already-filled channel and spilled over the road into Lookout Creek. The last slide, consisting mostly of gravel and rock came to rest on top of the previous slides. This one did not spill over the road to the extent of the second pulse, possibly due to its smaller size and the heaviness of the material. The amount of material which went over the road bank would probably amount to a fourth of the material in the channel.

Sedimentation of this magnitude cannot be associated directly with logging or roadbuilding within the watersheds, but should be more closely described as geologic erosion. This year's sediment increases and ratios are added to those of previous years, but should be regarded as extremely unusual and associations of debris increases to treatment should not be attempted with this year's data.

SEDIMENT ACCUMULATION 1964-65

27,000 C.Y.
100+ C.Y.
733000.0 2932.4

Table 2

SEDIMENT ACCUMULATION SUMMARY SHEET

Bedload Volume

Increase Cubic Feet Per Acre

YEAR	Undisturbed			After Treatment		Ratio	
	W. S. #2	W. S. #3	W. S. #1	W. S. #3	W. S. #1	3/2	1/2
1957	2.56	1.52	2.30			.59	.90
1958	3.52	2.28	1.40			.65	.40
1959	.61	.26	.16			.43	.26
1960	.23		.08	.42		11.83*	.35
1961	11.82		.21	1.63		.90	.12
1962	.61			10.84 ^{2/}	1.23	17.77*	2.02
1963	.69			1.28	.13	1.86*	.19
1964	.11			.83	.10	7.55*	.91
1965	11.06			2932.40 ^{2/}	2.827	265.13*	.25 76

* Significant at the 95% level

^{2/} Both include material from mass soil movementsAV #1 1957-65
194

ELEVATIONS OF SEDIMENT ACCUMULATED IN CATCHMENT BASINS

RI- NW
SOIL STABILIZATION
Watersheds
Benchmark:
H.I.
Elev.

Date: 8-5-65
Party: Level bound
Rod W
Notes

Experimental Area: H.J. Andrews
Basin Location: 1

Station*	Transects (Designated in ft. starting at crest of dam)					
	1	2	3	4	5	6
	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.
00						
03						
06	4.44	4.75	4.92	4.83	4.81	4.93
09	5.65	7.10	7.32	7.59	7.26	6.70
12	7.52	8.77	9.25	9.01	8.69	8.78
15	8.73	9.76	10.13	10.33	10.09	10.12
18	9.34	9.83	10.40	10.59	10.77	10.64
21	9.24	10.03	10.56	10.34	10.21	9.91
24	9.34	9.28	10.25	9.70	9.15	9.26
27	8.65	9.12	9.60	9.40	9.05	9.19
30	8.70	8.87	9.35	9.16	9.26	9.30
33		9.29	8.79	9.13	9.29	9.43
36		8.01	8.73	9.15	9.31	9.46
39	(7)	7.89	8.58	9.00	9.26	9.45
42	61.52	6.95	8.38	8.60	9.19	9.45
45		6.87	7.82	8.39	8.99	9.16
48		46.655	7.50	8.15	8.52	8.71
51		6.49	7.49	7.82	7.91	8.38
54			7.46	7.53	7.26	7.52
57			6.05	6.95	6.83	7.00
60	(10)	5.12		6.37	6.44	6.68
63	90.06			5.78	5.82	6.51
66			(16)	5.42	5.23	6.15
69			141.61	5.39	5.45	6.06
72					5.11	6.22
75					5.29	5.15
				(19)	(22)	(22)
				162.99	179.09	183.98
	Rod on B.M.	1.848		End of line 5		
	Rod on B.M.	1.846		End of line 1		
	Spike on hemlock assumed			to be 100.00		
	Franklin's auxiliary spike*			12.64		
	Line of Sight for this survey is equal to the assumed					
	elevation of 100.000 plus elevation of auxiliary spike					12.640
	plus rod reading at the time of survey of each line					
	Line of Sight 144.488 for line 1					
	Line of Sight 114.486 for line 2					
	Line of Sight 114.489 for line 3					
	Line of Sight 114.492 for line 4					
	Line of Sight 114.489 for line 5					
Total	* established 1957	1952?	See Survey for that year			

Average
*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

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RI- NW
SOIL STABILIZATION
Watersheds

Benchmark:

H.I.

Elev.

ELEVATIONS OF SEDIMENT ACCUMULATED
IN CATCHMENT BASINS

6a
FORM RI-2

Date: 8-5-65
Party: Level
Rod: Whitmarsh
Notes: Sound

Experimental Area: H.J. Andrews

Basin Location: 1

Station*	Transects (Designated in ft. starting at crest of dam)									
	8	9	10	11	12	13	14			
	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.	H.I. Elev.			
00										
03										
06	4.79									
09	5.97	5.17	4.59	4.66						
12	8.24	7.34	6.40	5.64	4.42					
15	9.47	8.78	8.23	7.83	WE 12.5	5.48				
18	10.16	9.94	9.40	9.02	6.98	5.1100				
21	9.93	10.15	10.04	9.88	7.58					
24	9.40	9.69	9.85	9.05	5.73					
27	9.31	9.54	9.59	9.07	5.85					
30	9.22	9.20	9.20	8.64	5.37					
33	9.24	9.12	8.95	8.25	5.70					
36	9.50	9.21	8.44	8.04	5.67	5.08				
39	9.64	9.45	7.96	7.43	6.38	5.40				
42	9.68	9.27	7.52	7.07	6.93	6.65				
45	9.21	8.68	7.24	6.78	6.63	6.91				
48	7.95	7.47	7.02	6.74	6.59	6.68				
51	7.10	7.14	6.92	6.75	6.75	6.84				
54	6.87	7.10	7.06	6.82	6.90	6.79				
57	6.85	7.09	7.05	6.96	7.03	6.94				
60	6.99	7.22	7.15	7.03	7.09	6.99				
63	7.08	7.51	7.31	7.04	6.94	5.88				
66	7.42	7.52	6.92	6.66	WE 12.4	5.00				
69	7.00	6.94	6.25	6.00	4.23					
72	6.11	WE 7.20	5.85	4.98	(18)	58.68				
75	5.01	5.53	5.37	(19)	144.46					
	(22)	(21)	(20)							
182.34	Rod on	174.22	164.14							
	Rod on	R. M.	1849	8.5/15	1000					
	Rod on	R. M.	1.849	End of line 11						
	Rod on	R. M.	1.852	End of line 10						
	Rod on	R. M.	1.849	End of line 8						
	Line 1 to End				NO of points	837.11				
	Lines 1 to 2		Total	61.52	No of points	7				
	Lines 2 to 6		Total	573.75	No of points	67				
	Lines 6 to 9		Total	544.83	No of points	66				
	Lines 9 to 11		Total	338.36	No of points	42				
	Lines 11 to End		Total	375.32	No of points	55				
Total Average										

*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

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RI - NW
SOIL STABILIZATION
Watersheds

ELEVATIONS OF SEDIMENT ACCUMULATED
IN CATCHMENT BASINS

FORM RI-2

Benchmark:

H.I.
Elev.

Experimental Area: H.T. Andrews
Basin Location: 2

Date: 8-5-65 + 8-6-65

Party: Level Whitmarsh

Rod Levno

Notes Whitmarsh

Station*	Transects (Designated in ft. starting at crest of dam)													
	1		2		3		4		5		6		7	
	H.I.	Elev.	H.I.	Elev.	H.I.	Elev.	H.I.	Elev.	H.I.	Elev.	H.I.	Elev.	H.I.	Elev.
00														
03			3.34		3.77		4.45		4.84	WE 5.1	5.06	WE 3.6	4.60	WE 4.8
06			4.58		5.34	WE 6.2	6.05	WE 4.6	6.28		6.36		6.28	
09			5.60	WE 7.8	6.48		7.08		7.31		7.22		7.06	
12			5.60	WE 12	7.41		7.60		6.87		7.02		7.52	
15			6.21		7.54		6.60		5.99		6.48		7.42	
18		WE 20.30	6.40		7.00		6.41		5.89		6.47		7.22	
21	5.91		6.97		6.91		6.56		6.15		6.28		7.53	
24	6.69		7.14		6.62		6.71		6.12		6.30		7.19	
27	6.68		6.97		6.96		6.92		6.75		7.31		7.45	
30	6.48		6.81		6.98		7.47		7.38		7.41		7.57	
33	5.84		6.56		6.83		7.25		7.31		7.27		7.06	
36		WE 33.6	5.68	WE 36	6.44	WE 38.4	7.01		7.01		6.03		8.64	
39			4.42		5.15		5.71	WE 39.6	5.73	WE 37.2	5.46	WE 38.4	5.15	WE 36
42			4.22		4.34		4.44		5.16		5.37		5.37	
45			3.95		4.15		4.12		4.23		4.41		4.41	
48			3.82		3.94		3.81		3.97		4.23		3.97	
51			3.80		3.75		3.62		3.82		3.84		3.97	
54			3.80		3.60		3.40		3.42		4.74		4.05	
57			3.76		3.64		3.31		3.63		2.75		3.89	
60														

(3) (18) (18) (18) (19) (19) (18)
19.00 96.29 103.13 103.96 107.86 109.97 109.25

Red on R.H. 7.810 1600 8/5/65
Red on R.H. 7.810 End of line 2

Red on R.M. 7.802 1100 8/6/65
Red on B.M.

Spike assumed elevation 100.000

Line of Sight 107.810 for line 1, to 3

Line of Sight 107.802 for line 3, to End.

Line 1, to 3 Total 115.29 # points 21 Avg rod reading 5.490

Line 3 to End Total 1,299.77 # points 226 Avg rod reading 5.751

Total
Average

*Numbered to right starting with 0 at borderline which extends upstream from left end of da

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RI - NW
SOIL STABILIZATION
Watersheds

ELEVATIONS OF SEDIMENT ACCUMULATED IN CATCHMENT BASINS

7a.
FORM RI-2

Benchmark:

H.I.

Elev.

Experimental Area: H.J.A.

Basin Location: # 2

Date: 8-6-65

Party: Level Whitmarsh

Rod Levno

Notes

[illegible]

Total

Average

*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

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ELEVATIONS OF SEDIMENT ACCUMULATED IN CATCHMENT BASINS

RI. 100 NW
SOIL STABILIZATION
Watersheds
Benchmark:
H.I.
Elev.

Date: 8-6-65
Party: Level Whitman
Rod Lervo
Notes

[illegible]

*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

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Benchmark:
H.I.
Elev.

Experimental Area: H.T. Andrews
Basin Location: # 2

Date: 8.30-65
Party: Level Ligno
Rod Mulkanch
Notes Ligno

Total

*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

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Benchmark:

H.I.
Elev.

Experimental Area: H.T. Andrews
Basin Location: # 3

Date: 8-30-65

Party: Level 6000

Rod Mylkunen

Notes Lucy

[illegible]

*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

Benchmarks:

H. I.

Elev.

Experimental Area: HJ. Andrews

Basin Location: #2

Date: 8-31-65

Party: Level *Level*

Rod Multanem

Notes Levin[illegible]

*Numbered to right starting with 0 at borderline which extends upstream from left end of dam.

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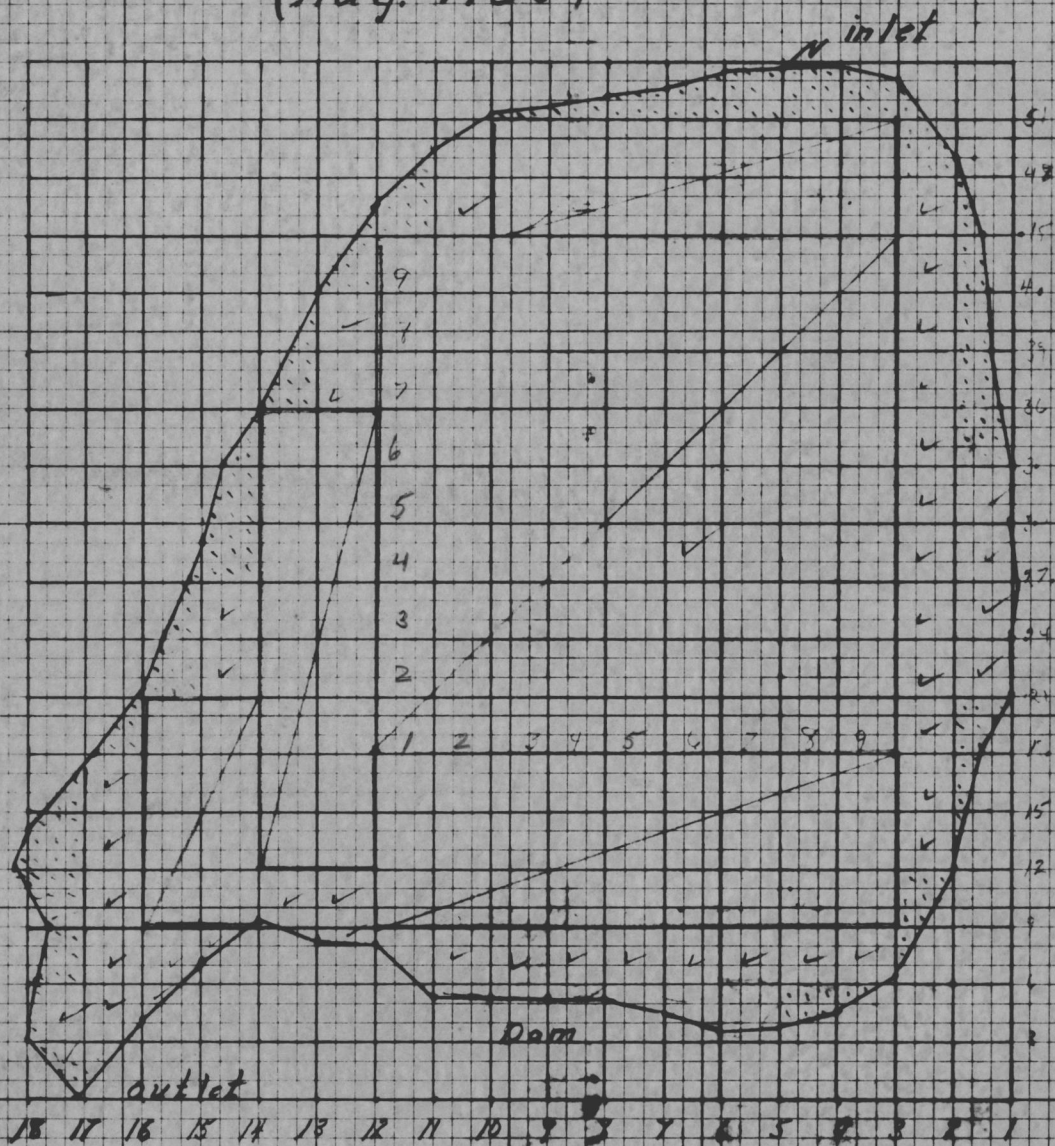
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Watershed #23

Remeasurement after cleaning

(Aug. 1965)



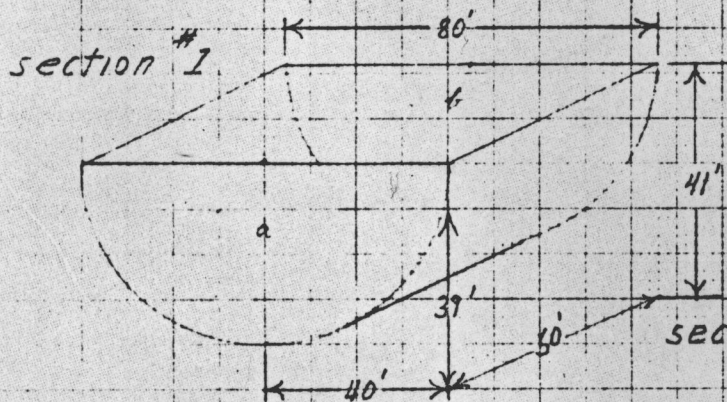
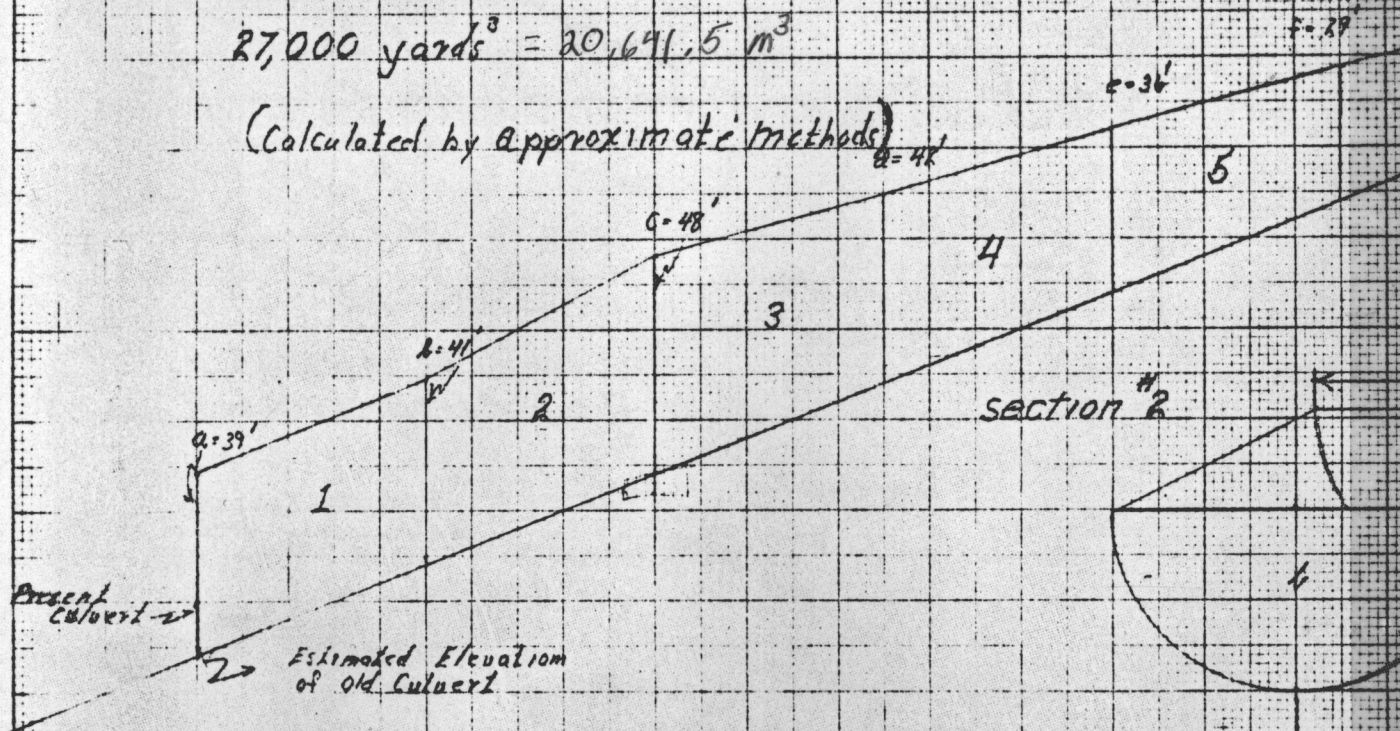
$$\text{Area} = (\# \text{ large squares} \times 9) + \# \text{ small squares} =$$

$$(158 \times 9) + 224 = 1,646 \text{ ft}^2$$

Yardage estimate of debris in W.S.#3 channel Christmas Storm 1964

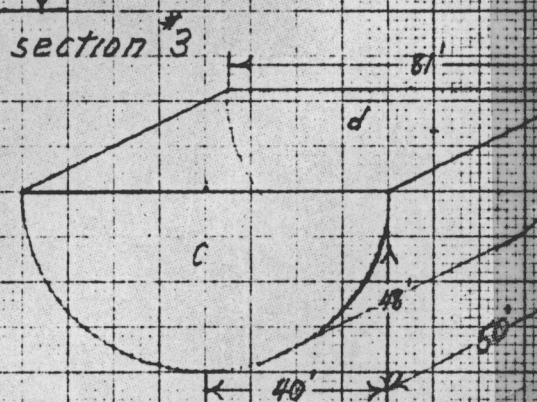
$$27,000 \text{ yards}^3 = 20,691.5 \text{ m}^3$$

(Calculated by approximate methods)



V Section #1 = $A \cdot h$
 $A_{ab} \approx \frac{\pi r^2}{2} \approx \frac{3.1416 (40)^2}{2} \approx 2,510$
 $V = A \cdot h = 2,510 (50) \approx 125,500 \text{ ft}^3$

V Section #2 = $A \cdot h$
 $A = \frac{\pi (40)^2}{2} + \frac{\pi (48)^2}{2}$
 $\text{radius } C = \frac{40 + 48}{2} = 44$

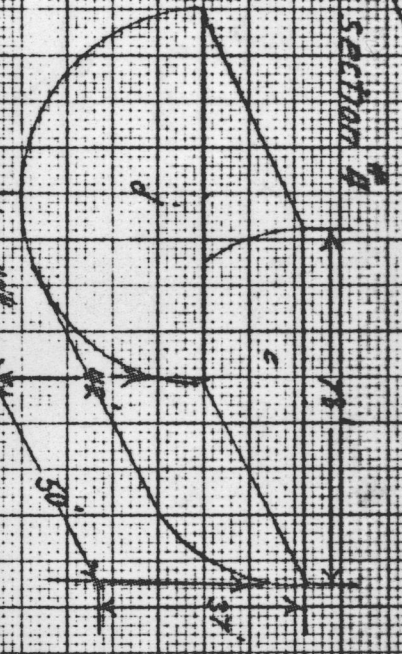


A Section 3 = $\frac{\pi (40)^2}{2} + \frac{\pi (48)^2}{2} = \frac{3.1416 (40)^2}{2} + \frac{3.1416 (48)^2}{2}$
 $\text{radius } d = \frac{40 + 48}{2} \approx 44$
 $V \text{ Section } \#3 = A \cdot h = 2,906 (50) \approx 145,300$

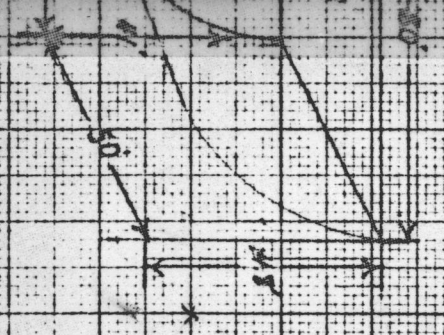
2730

Section # 6

1	185,500
2	139,000
3	145,000
4	186,000
5	102,100
6	24,000
Total	822,000
	133,100 ft³
	77,000 yd³

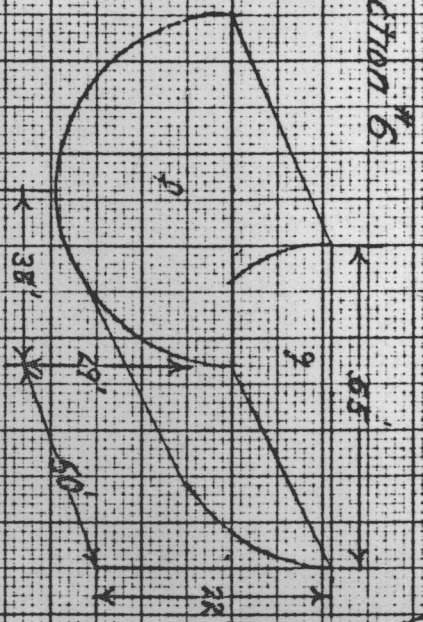


Volume Section #4 = 102,100 ft³



$$\frac{1.14 \times 10^6 + 3.44 \times 10^6}{2} \approx 3040 + 2510 = 2775$$

$$2775 \times 100 = 277,500 \text{ ft}^3$$



Volume Section #7 = 102,100 ft³

$$100 \times 1.44 = 1440$$

$$100 \times 24,000 = 2,400,000 \text{ ft}^3$$