For Joan

020458

TAILINGS OXIDATION PROJECT

Government of Canada | Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

SECURITY - CLASSIFICATION – *DE SÉCURITÉ*	
OUR FILE – *N/RÉFÉRENCE*	
YOUR FILE – *V/RÉFÉRENCE*	
DATE	August 26, 1975

TO / À: Regional Manager, Water Resources

FROM / *DE*: Administrator, Pollution Control

SUBJECT / *OBJET*: Tailings Oxidation Project

Abstract

The Cyprus Anvil tailings dam washed out on March 19, 1975 depositing pyrite tailings in the Rose Creek valley. On August 5, 1975 a test plot was established on valley floor (site No. 4) covered with tailings. The plot was sampled for depth of tailings, pH of tailings and plant cover.

The tailings had an average depth of 1.74 inches and a pH of 3.64. No plants were observed growing solely in the tailings and the acid pH of the tailings threatened the plants growing through it. The rapid oxidation of the tailings has not yet resulted in measurable changes in the water quality of Rose Creek.

It is recommended that Cyprus Anvil recover additional tailings from the Rose Creek flood plain under the direction of the Controller. The water quality of Rose Creek continues to be monitored by Cyprus Anvil and that they add lime, if necessary, to keep the pH above 6.5. The volume and analysis of tailings deposited in bars in Rose Creek be determined.

INTRODUCTION

The Cyprus Anvil Mining Corp. tailing dam washed out on March 19, 1975. The tailings, containing pyrite, were deposited in the Rose Creek valley. B.C. Research (1) examined samples and found the tailings to be a potential acid producer. The following recommendations were made:

1. that the quantity and distribution of tailings in the valley be determined after the spring runoff,
2. that the tailings should be observed for signs of oxidation,
3. that Rose Creek should be monitored for pH, alkalinity and zinc, and
4. if tailings were being transported by Rose Creek, that areas of sediment deposition should be examined for oxidation.

An inspection of the area on July 17, 1975 revealed that the majority of tailings had remained in place during runoff. Areas of surface oxidation of the tailings were found and a crust had formed on the tailings. Cyprus Anvil was monitoring Rose Creek water quality on a bimonthly schedule.

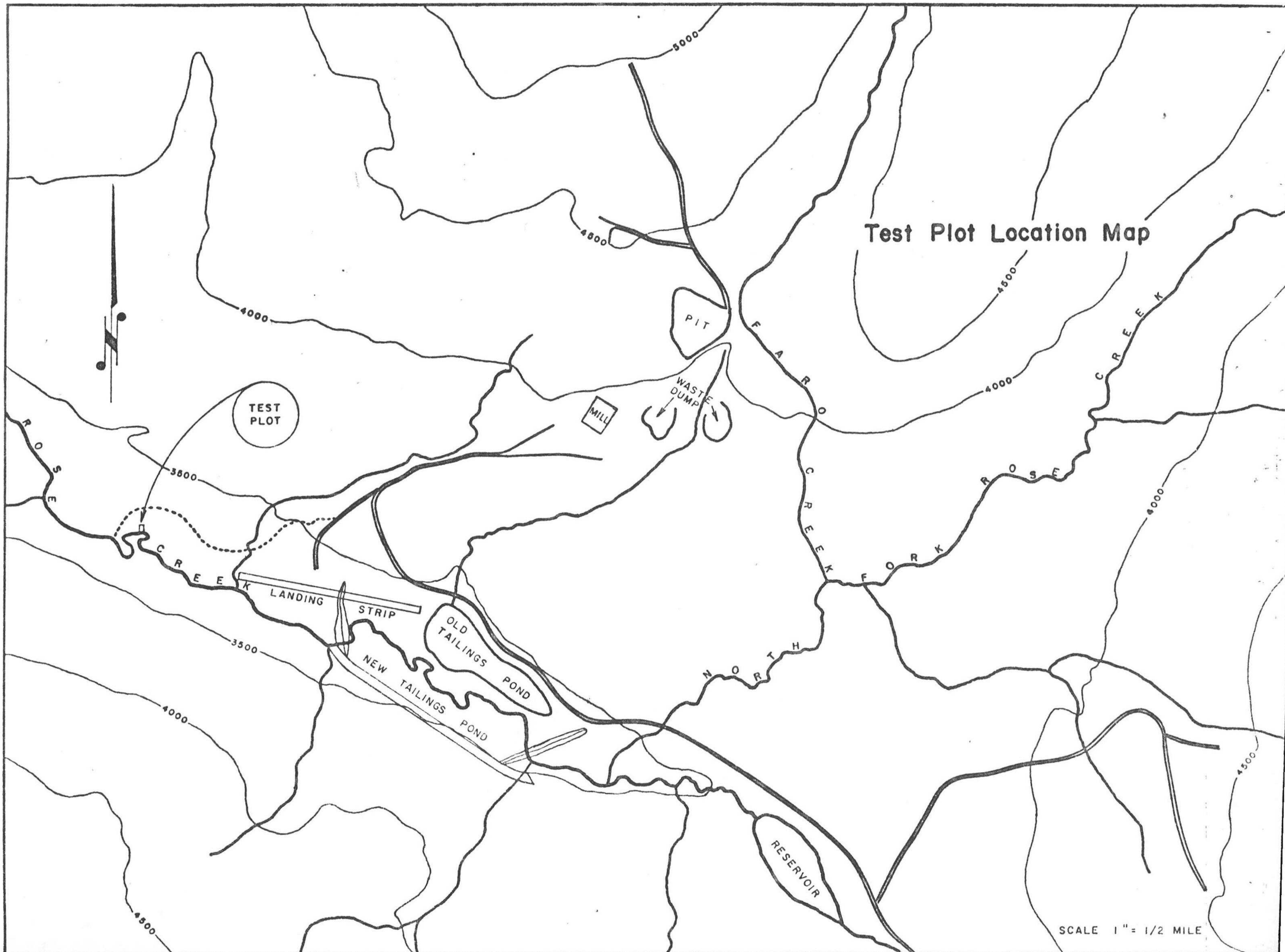
Objective

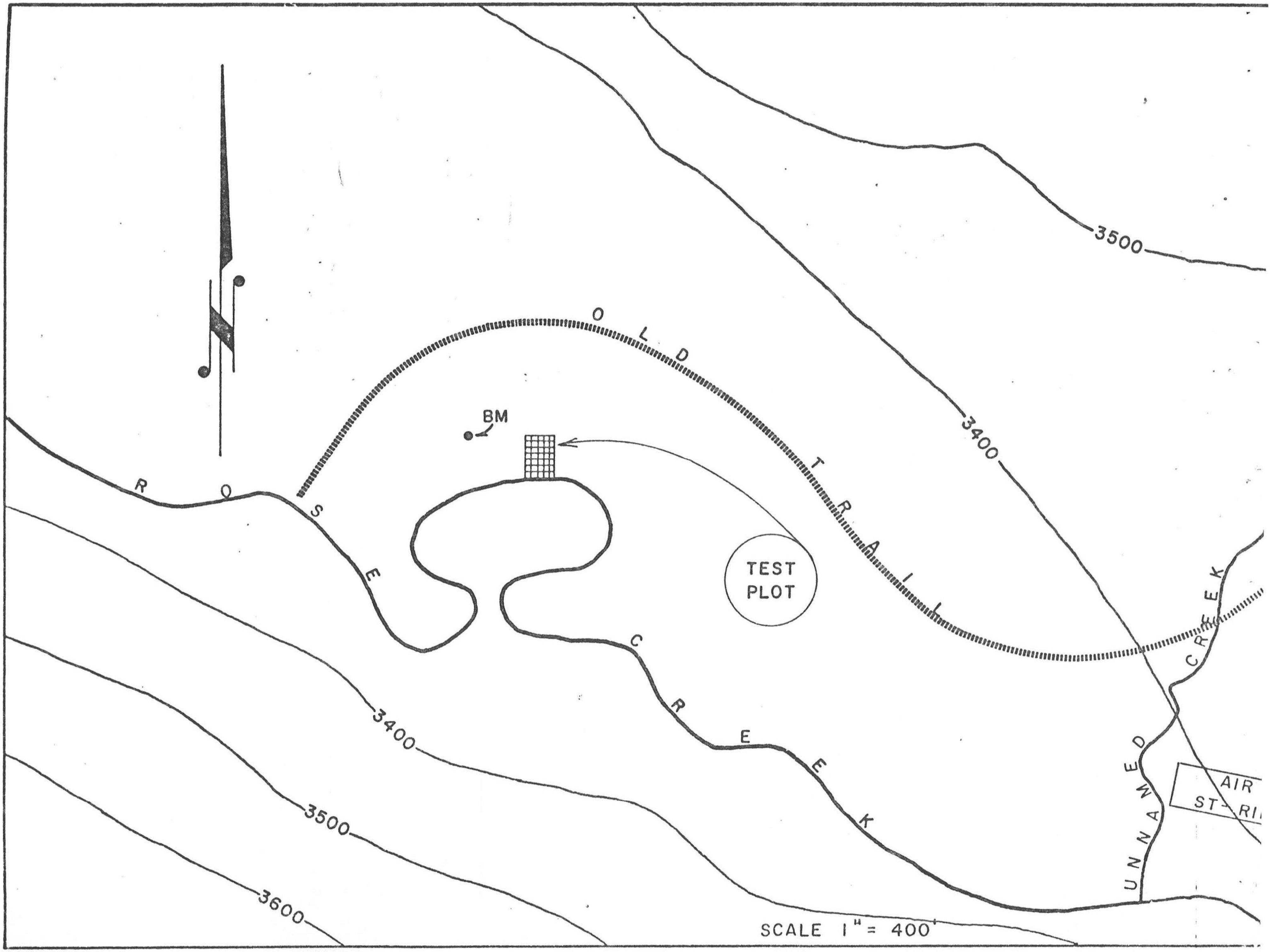
A project was initiated to determine the state of oxidation of the tailings and to set up a reference plot to determine the effects of the tailings on the plant life in Rose Creek valley.

Method

On August 5, 1975 a sampling grid of 100 feet by 140 feet was established approximately two miles below the dam break (fig.1). The grid was sampled at 20 foot intervals, a sample of tailings was taken and the depth of tailings measured. The pH of the tailings was determined using the 1:1 soil to water method for the determination of soil pH as described in the Standard Methods of Chemical Analysis.(2)

Test Plot Location Map




3500
3400
OLD TRAIL
BM
ROSE CREEK
TEST PLOT
3400
3500
3600
UNNAMED CREEK
AIR
SCALE 1" = 400'

Mr. Don Bayne, a botany research assistant, used representative sections of the grid to determine plant species density. In addition, Mr. Baynes compared the test plot with a similar site from which the tailings had been removed.

Results

The average depth of tailings was 1.74 inches over the site ranging from trace to seven inches thick (figs 2 & 3). The average pH of the tailings was 3.64 with a low of 2.9 and a high of 4.5. There was no correlation between the depth of tailings and pH.

Discussion

The low pH of the tailings indicates that considerable oxidation has occurred. Hawley (3) considers that at pH 3.0 the oxidation of pyrite is rapid and irreversible. In addition, the bacteria T. Ferroxidans, which accelerates the chemical reaction, thrives at pH 3.0 and 35°C. In summer, the tailings meet all the requirements for rapid oxidation. Low winter temperatures will stop the oxidation but will not kill T. Ferroxidans.(1)

The botanical report states that changes in the present plant community can be expected when sufficient acid leaches into the root zone. All plants on the site grew up through the tailings or were present before deposition; no plants were found germinating in the tailings on the site.

The water quality of Rose Creek will be effected as the oxidation products leach into the stream. The parameters likely to show a change would be alkalinity, pH, zinc, iron, manganese and sulphate. The extent of the change cannot be judged at this time but the faster the rate of oxidation of tailings, the more severe the changes will be.

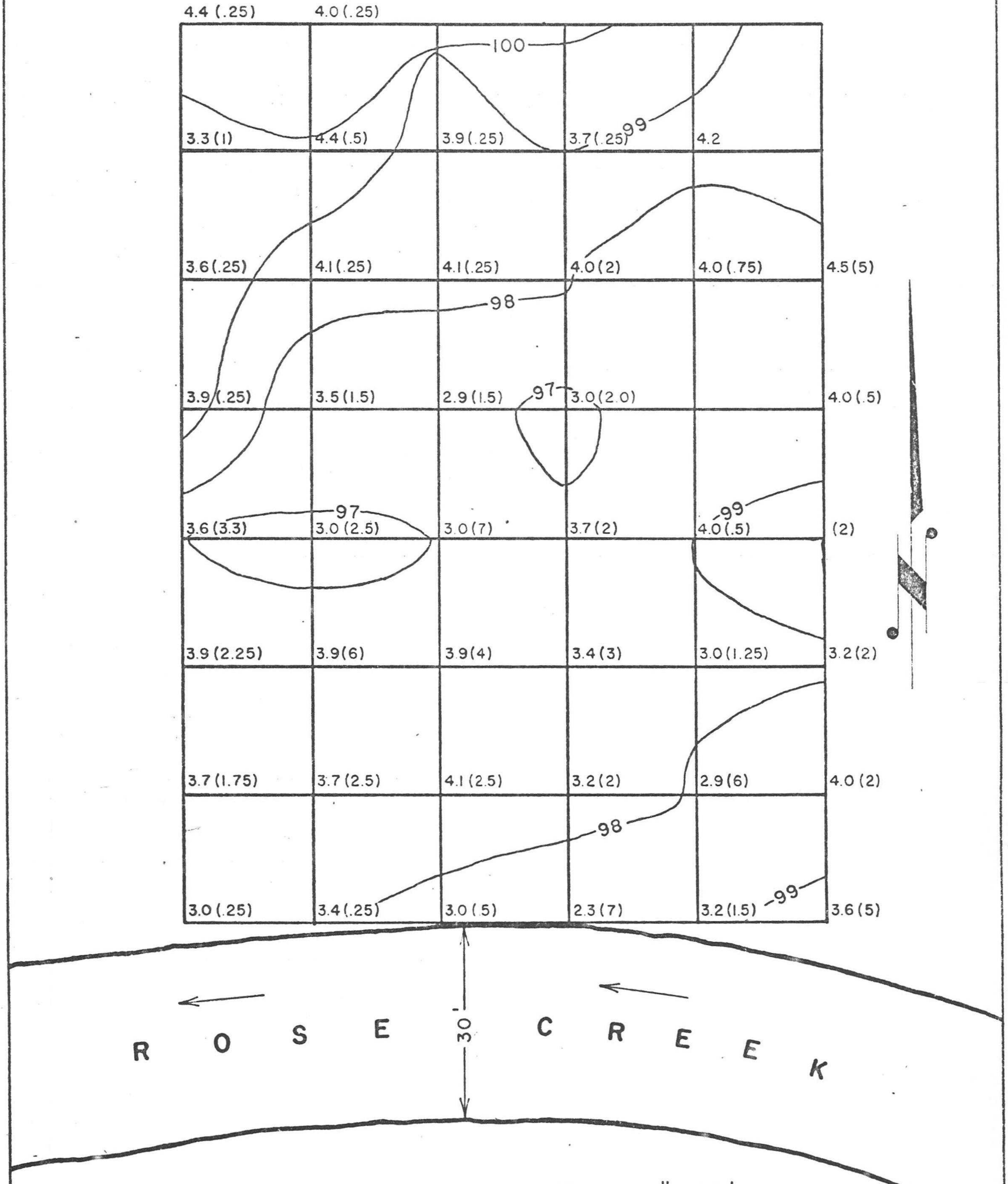
The water quality results for Rose Creek do not yet show signs of change (fig.4).

A large deposit of tailings was observed on a point bar approximately 10 miles downstream of the Anvil tailings dam on Rose Creek. Similar deposits of tailings were seen from the air between this site and the Cyprus Anvil tailings dam. The tailings appeared to be heavily oxidized.

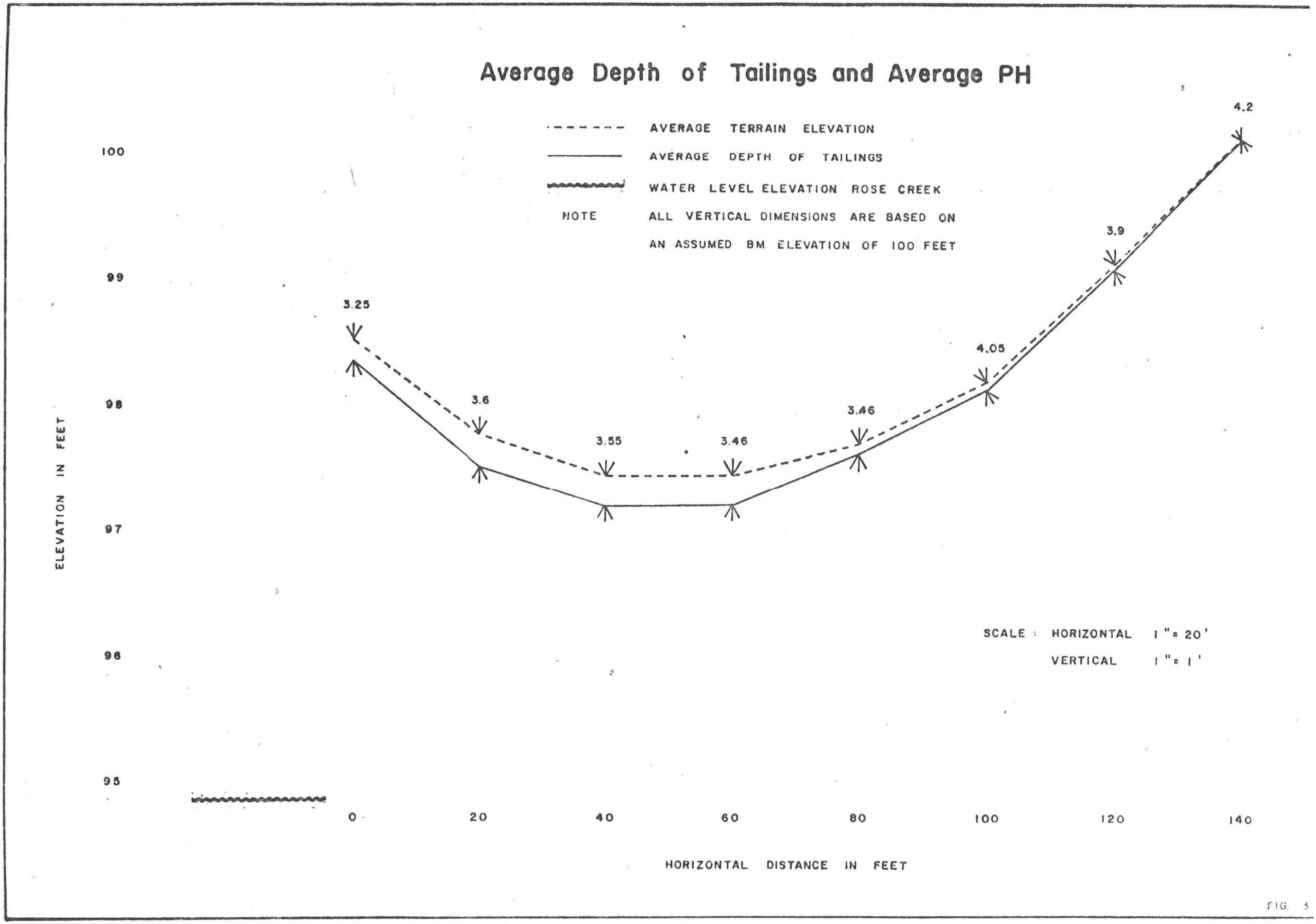
FIG 3

Tailings Oxidation Project

PH and (Depth of Tailings)



SCALE 1" = 20'



Average Depth of Tailings and Average PH
AVERAGE TERRAIN ELEVATION
AVERAGE DEPTH OF TAILINGS
WATER LEVEL ELEVATION ROSE CREEK
NOTE
ALL VERTICAL DIMENSIONS ARE BASED ON
AN ASSUMED BM ELEVATION OF 100 FEET
ELEVATION IN FEET
100
99
98
97
96
95
3.25
3.6
3.55
3.46
3.46
4.05
3.9
4.2
SCALE : HORIZONTAL 1" = 20'
VERTICAL 1" = 1'
0
20
40
60
80
100
120
140
HORIZONTAL DISTANCE IN FEET

FIG. 3

Fig. 4 Cyprus Anvil Analyses

Rose Creek at mouth - 9BC S10

		May 26	June 11	June 26	July 8	July 24
	pH	7.8	7.7	7.75	7.6	8.0
Suspended solids	mg/l	384	214	84	11	11
	Temp. deg.C	5.5			14.5	10.5
Ammonia	M H_3 (total) mg/l	.13	<0.1	<0.1	<0.1	<0.1
Lead	Pb(extractable) mg/l	.2	0.06	0.1	<0.2	<0.1
Zinc	Zn(extractable) mg/l	.07	0.03	0.05	<0.01	0.01
Silver	Ag(extractable) mg/l	.01	< .01	<0.1	<0.01	<0.1
Manganese	Mn(extractable) mg/l	-	-	-	0.10	0.16

Recommendations

1. Cyprus Anvil continue to monitor the water quality of Rose Creek and report the results to the Controller of Water Rights.

2. Extra lime be added by Cyprus Anvil to the tailings pond effluent to keep the pH of Rose Creek at the mouth above 6.5 if necessary.

3. The maximum possible amount of tailings should be removed from the immediate spill area by Cyprus Anvil under the direction of the Controller of Water Rights.

4. A recommendation to remove tailings from bars and point bars in Rose Creek cannot be made, however, these areas should be sampled for the volume and the analysis of tailings present.

William Gerald Whitley

W. G. Whitley, B.Sc.
Administrator, Pollution Control

Bibliography

1. Project 1682. The potential for Acid Drainage in Rose Creek as a Result of the Break of the Anvil Tailing Dam. Report Mo.2 July 1975 B. C. Research.

2. The Standard Methods of Chemical Analysis Vol 2B D. Van Nostand Co. 1963 P2328.

3. Hawley, John R. Mine Waste Control in Ontario, Ministry of Environment, Ontario

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MEMORANDUM **NOTE DE SERVICE**

TO / À	W. G. Whitley Administrator - Pollution Control
FROM / DE	Don Bayne
SECURITY - CLASSIFICATION — DE SÉCURITÉ	
OUR FILE — N/RÉFÉRENCE	14-03-83 Anvil app.
YOUR FILE — V/RÉFÉRENCE	
DATE	August 11, 1975

SUBJECT / OBJET: Consequences of Tailings Spill Cleanup

The tailings spill which occurred from the Cyprus Anvil Mine in March of 1975 may have severe damaging effects on the vegetation in the area. As an experiment, one small portion of the spill area was scraped clean of snow, tailings, and most of the vegetation. The area affected by the spill is compared with the area of attempted cleanup.

The vegetation in the spill area showed good growth. The main tree species, Picea glauca (White Spruce) had continued its growth since the spill and young saplings appeared to be thriving. There was a dense shrub cover consisting of Salix glauca (Blue-green Willow) and Betula grandulosa (Scrub Birch), with some Potentilla fruticosa (Shrubby Cinqfoil). The shrubs were doing well as witnessed the presence of flowers on the cinqfoil and birch. The shrub layer was in the order of 1.5 to 2.0 meters in height and reasonably thick. The density of the taller vegetation precluded the existence of any extensive herb layer. Some grasses were present but not in abundance.

The area which was cleared had a much lower profile since the vegetation present was of only one year's growth. The species were the same in this area with an increase in the numbers and variety of herbs. Distinctly absent were any spruce saplings. The overall height of the community was between 0.5 and 1.0 meters. Growth appeared to be reasonably good.

The clearing of the spill area had some advantages. Clearing away the older plants allowed the shooting of young plants which grow faster. This means that the production of biomass for the first growing season will be more in the cleared area than in the area left unaltered. The removal of the taller species also allowed the herb layer to thrive, increasing the biological diversity of the area.

Disadvantages in clearing were also seen. The removal of the vegetation obviously set back the progression of the community to the climax spruce forest. Picea glauca, being the shade tolerant species, requires the shade of taller plants for germination and growth of saplings. All the saplings were removed, and they will not re-establish themselves until the

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YOUR FILE — *V/RÉFÉRENCE*

DATE

SUBJECT / *OBJET*

shrub layer has reached a height sufficient to shade most of the ground. The absence of mature species means that reproduction of new individuals next growing season is less likely, though Salix glauca does reproduce vegetatively.

The conclusion of this study, based solely on the first season, is that the clearing scheme was beneficial in some ways, though it set back the progression of the community to climax by many years. However, for a true picture of the worth of clearing, the long range consequences of leaving the tailings on the surface should be considered. The acid nature of the tailings (less than 4 pH) indicates that there will likely be severe alteration of the soil environment in the future. Once the effects of the acidity of the tailing are transported into the soil below there will be a drastic change in the microbial population, soil animal population, soil chemistry, and possibly soil structure. No plants appeared to have germinated this season and the acidity of the substrate may very well prevent any new plants from germinating at all. The change in soil pH which is likely to occur, as well as the low infiltration and percolation rate of the tailings may cause the existing plants to die.

Therefore the final conclusion is that the clearing of the area, removing the acidic tailings as well as the older plants, is much more advisable than allowing the tailings to alter the soil environment in the future.

Don Bayne

VEGETATION IN FIVE TEST PLOTS

SPECIES	COMMON NAME	PLOT #22 #	Density	Height	Cover	PLOT #13 #	Density	Height	Cover
conitum delphinifolium	Monkshood	100*	0.25	0.5dm	1%	1	<0.01	0.5dm	<1%
etula grandulosa	Scrub Birch	7	0.02	6.0dm	1%	28*	0.07	4.0dm	3%
arex spp.	Sedge	400*	1.00	1.0dm	2%	50*	0.12	2.0dm	<1%
estuca rubra	Red Fescue	5	0.01	7.0dm	1%	6	0.01	3.0dm	<1%
ragaria glauca	Wild Strawberry	8	0.02	0.5dm	<1%	7	0.02	0.5dm	<1%
eocaulon lividum	Bastard Toadflax	80*	0.20	2.0dm	30%	30**	0.08	2.5dm	40%
oa alpina	Alpine Blue Grass	5	0.01	2.5dm	<1%				
otentilla fruticosa	Shrubby Cinqfoil	240*	0.60	2.5dm	20%	125*	0.31	2.5dm	30%
alix glauca	Blue-green Willow					4	0.01	4.0dm	1%

LOW SHRUB PLOTS

PLOT #27

SPECIES	COMMON NAME	#	Density	Height	Cover
conitum dephinifolium	Monkshood	200*	0.50	1.0dm	2%
chillea borealis	Yarrow	13	0.03	1.0dm	<1%
etula grandulosa	Scrub Birch	21**	0.05	10.0dm	40%
arex spp.	Sedge	50*	0.12	2.0dm	<1%
Festuca rubra	Red Fescue	5	0.01	5.0dm	<1%
Fragaria glauca	Wild Strawberry	40*	0.10	0.5dm	<1%
Geocaulon lividum	Bastard Toadflax	40*	0.10	2.5dm	20%
Poa alpina	Alpine Blue Grass	7	0.02	2.0dm	<1%
Potentilla fruticosa	Shrubby Cinqfoil	160*	0.40	3.5dm	15%
Solidago multiradiata	Goldenrod	1	<0.01	2.0dm	<1%

INTERMEDIATE HEIGHT SHRUB PLOT

Density is decribed in individuals / sq. ft.

* Approx. number of shoots; actual number of individuals not discernabl

** Estimated number of individuals based on clumping of shoots

SPECIES	COMMON NAME	PLOT #36 #	Density	Height	Cover	PLOT #8 #	Density	Height	Cover
chillea borealis	Yarrow	1	<0.01	0.5dm	<1%				
etula grandulosa	Scrub Birch	16**	0.04	15.0dm	60%	21**	0.05	13.0dm	40%
quisetum arvense	Field Horsetail	10	0.03	0.5dm	< 1%				
estuca rubra	Red Fescue	1	0.01	2.0dm	1%				
ragaria glauca	Wild Strawberry	11	0.03	0.6dm	< 1%				
eocaulon lividum	Bastard Toadflax	20**	0.05	2.0dm	10%	75*	0.19	2.0dm	20%
edum groenlandicum	Labrador Tea	1	<0.01	3.0dm	<1%				
icea glauca	White Spruce	1	<0.01	7.0dm	<1%	6	0.02	3.0dm	1%
oa alpina	Alpine Blue Grass					42**	0.10	2.0dm	2%
olemonium acutiflorum	Tall Jacob's Ladder	3	0.01	0.5dm	<1%				
otentilla fruticosa	Shrubby Cinqfoil	17**	0.04	4.0dm	5%	68*	0.17	4.0dm	20%
alix glauca	Blue-green Willow	4**	0.01	15.0dm	10%	2	0.01	2.0dm	<1%
alix vestita	Rock Willow	5**	0.01	0.6dm	<1%				

HIGH SHRUB PLOTS

Density is described in individuals / sq. ft.

* Approx. number of shoots; actual number of individuals not decernable

** Estimated number of individuals based on clumping of shoots

Project Report No. 2

THE POTENTIAL FOR ACIDIC DRAINAGE IN ROSE CREEK AS A RESULT OF THE BREAK OF THE ANVIL TAILING DAM

Project 1682

July, 1975

Prepared for:

Controller of Water Rights
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SUMMARY

The majority of the tailing released when the Cyprus Anvil tailing dam broke were deposited in the first two miles downstream. The solids carried further downstream (< 4% by volume and < 1% by weight) had a low apparent density suggesting they were low in sulfides. The material deposited within two miles of the break had a particle size distribution similar to a 16 hr composite collected at the mill on January 23, 1975. The densities and apparent densities of the two samples were similar, the site 4 and 5 composite being a little lighter if anything. There was no significant segregation of the tailing as it moved downstream.

The composite tailing sample collected downstream of the break was an excess acid producer but the rate of acid production was slightly slower than the rate observed with the 16 hour composite. The probability of acidic drainage being produced beyond two miles downstream of the break appears remote; between the break and two miles downstream the possibility is real. The alkaline nature of the rock in the area and of the surface waters may inhibit acid production.

It is recommended that the valley be resurveyed after breakup and freshet to ascertain the distribution of the tailing at that time. Rose Creek should be monitored for acid production and areas of significant tailing deposition should be observed for signs of pyrite oxidation. Increasing the alkalinity of the tailing decant water may neutralize any acid produced; alternatively deposits of reactive tailing may have to be buried or moved upstream of the tailing dam.

OBJECTIVE

To evaluate the existing data concerning the distribution of tailing in the valley of Rose Creek with regard to the potential for the formation of acidic drainage.

To make recommendations concerning the necessity for clean up of the spilt tailing and for monitoring the creek waters for acidic drainage.

INTRODUCTION

BACKGROUND

On March 19th, 1975 the tailing dam at the Cyprus Anvil mine near Faro, Y.T. was broached and an estimated 600 acre feet of tailing water was released into Rose Creek. Signs of the released water could be detected 10 miles downstream (about 1 mil^ above the confluence with Anvil Creek). The creek was frozen over at the time and the wave of water filled the creek flood plain and froze in place.

On April 3rd, staff from the Controller of the Water Rights Office, Northern Natural Resources and Environment Branch, Department of Indian Affairs and Northern Development conducted a survey of Rose Creek and collected data concerning the location of significant quantities of tailing slurry; the depth of the frozen slurry; the percentage of tailing in the slurry; and made an estimate of the total amount of material in place.

The results of this survey, which are presented in Appendix I, indicate that approximately 200 acre feet of tailing slurry was frozen in place from the tailing pond to the mouth of Rose Creek with most of the tailing being contained in pockets within two miles of the tailing dam.

To assist in estimating the impact the tailing may have on Rose Creek and the downstream streams the A/Controller of Water Rights has requested that B. C. Research review the available data in light of their experience concerning the microbiological oxidation of sulfide minerals and particularly with regard to their experience regarding the microbiological oxidation of Anvil tailing and make recommendations as to the necessity of clean up and/or monitoring.

MATERIALS AND METHODS

A composite sample of tailing taken at sites 4 and 5 (see Appendix I) was submitted. This sample, which was known to have the potential for producing excess sulfuric acid (1), was examined for its acid producing potential using the procedures outlined in Appendix II. This sample and the composite tailing sample examined in the previous study were wet screened through Tyler sieves and their densities determined. The apparent density was determined by placing a weighed portion in a graduated cylinder and measuring the volume after gently tapping the cylinder to settle the sample. The density was determined by measuring the volume of water displaced by a known weight of tailing.

The available data concerning the character and distribution of tailing in Rose Creek Valley, supplied by the A/Controller of Water Rights (Appendix I), was evaluated in light of the writer's experience with the oxidation of sulfide minerals.

RESULTS

The tailing sample provided was screened to ascertain its particle size distribution in comparison to the composite tailing sample obtained from the Anvil mine in a previous study. As shown in Table 1 there was little difference in size distribution with both samples being about 50% -400 mesh. Moreover the samples had similar density characteristics. When the composite sample taken from areas 4 and 5 was subjected to the microbiological oxidation test it was observed that the sample was an excess acid producer but the rate of acid production was slightly lower than the rate observed for the 16 hour mill composite collected on January 23. It required some 430 hours before the pH dropped below 2 as compared to about 300 hours in the previous study. The pH tended to stabilize at 1.9 whereas with the samples examined previously the pH dropped to as low as 1.4.

The data collected by the Department of Indian Affairs and Northern Development staff (Appendix I) indicated that better than 96% of the volume of tailing and better than 99% of the weight of tailing documented in Rose Creek Valley occurred in pockets within two miles below the break. Approximately 5,160 tons of tailing were involved in this area. The material deposited further downstream had a low apparent density.

Clean up procedures initiated by the mine have picked up a significant but unknown percentage of this material and returned it upstream of either existing or proposed tailing impoundment structures.

DISCUSSION

The field data (Appendix I) indicates that the majority of the tailing was deposited within two miles of the break whereas the tailing slurry that froze further downstream contained less than 2% tailing. The apparent density data implies that there was a segregation of the tailing with the denser fraction (1.60 to 1.85 tons/cu yd) settling within two miles of the break and the lighter fraction (0.76 to 1.10 tons/cu yd) being transported downstream. However, the significance of this apparent segregation is not great due to the small volume of the lighter material.

Sieve analysis of the sample representing the material at sites 4 and 5 indicated that the particle size distribution and particularly the percentage of -400 mesh (0.037 mm) material is very similar to that of a 16 hour mill composite collected on January 23, 1975. Density and apparent density determinations also indicated that the samples were similar with the site 4 and 5 composite being a little less dense than the 16 hour mill composite.

The similarity between the site 4 and 5 composite and the mill composite suggests there was no significant segregation as the tailing flowed downstream. The composite sample of tailing collected at sites 4 and 5 was amenable to microbiological attack and produced excess acid although it did not appear to be as reactive as the mill sample collected on January 23.

The distribution of tailing over a wide area enhances the rate at which they could be oxidized by increasing their contact with oxygen in the air. However, distributing a relatively small volume of tailing over a wide area does reduce the quantity of sulfuric acid which could be produced per area (or volume) of country rock. The country rock in the area, and it is assumed, the native sediments in the valley bottom are moderately alkaline and thus they may provide sufficient buffering capacity to inhibit the development of active microbiological populations. In addition the surface water in the area appears to be moderately hard which should aid in maintaining the alkaline environment which inhibits the activity of Thiobacillus ferrooxidans (It requires a pH of less than 6). The intermingling of the sulfide particles with the exisiting deposits on the valley bottom would reduce their access to oxygen and thus reduce the potential for oxidation and acid production. The amount of intermingling should be established by coring or other appropriate means.

Based on the data available the probability of acid production originating beyond two miles downstream of the break is remote. The possibility of acid production occurring between the break and the downstream end of site 4 is real and will in part depend on the quantity and distribution of sulfide bearing tailing in the area after freshet.

Assuming that tailing remains in the area after freshet as discrete concentrations of sulfide bearing sediments, these deposits can be microbiologically oxidized, particularly during the warmer summer months. The cold winter temperatures will probably stop all microbiological activity but they will not not kill all the bacteria. When the bacteria thaw in the spring they will resume activity. Therefore, the valley bottom and Rose Creek should be monitored for signs of biological or chemical oxidation of pyrite and the production of excess acid. If oxidation is indicated remedial action would include the following possibilities: increasing the concentration of lime in the water decanting from the tailing pond so that it will neutralize the acid produced downstream; burying the reactive pockets of tailing under alkaline and/or impervious fill material; or collecting the tailing material from selected areas and placing it upstream of the tailing dam.

RECOMMENDATIONS

The ultimate action to be taken will depend upon the distribution of tailing in the valley of Rose Creek after breakup and freshet. The possibility exists that the spilled material will be washed downstream and deposited in such a manner that the problem it creates is minimal or alternatively it may be deposited in such a manner that it could be collected more readily than is anticipated based on its initial distribution throughout the valley bottom. Therefore, it is recommended that Rose Creek Valley be resurveyed to establish the quantity and distribution of pyrite after freshet. It may be necessary to repeat this survey in subsequent years. If this survey indicates significant quantities of tailing have remained in Rose Creek Valley the pH and alkalinity of the water of Rose Creek should be monitored for any changes indicating acid production. If there is a significant drop in pH, i.e., below 5, the water should be monitored for zinc ions.

If microbiological action is going to occur, the rate of oxidation will probably only be significant during the summer and possibly into the early fall. Therefore, in the fall of 1975 any areas containing significant quantities of tailing should be observed for the development of brown iron stains indicative of iron oxidation. The frequency and extent of areas indicating iron oxidation will govern the corrective action that needs to be taken. As mentioned above, burial or removal upstream of the tailing dam are probably the only practical solutions to the problem. It is not possible to inhibit microbiological action with any convenient additive.

If there are indications that tailing are moving downstream, sediment cores taken in areas of sediment deposition along the course of Rose Creek could be used to monitor the travel of the tailing downstream. Depending on the degree of mixing of the pyrite with the alakline sediments these deposit areas may become areas where microbiological leaching will occur most readily because they are damp and may be quite porous, providing good aeration. Moisture and aeration are essential conditions for active microbiological oxidation of sulfides.

REFERENCES

1. B. C. Research. 1975. Leachability of Anvil Ore, Waste Rock and Tailings. Project Report No. 1, prepared for Arctic Land Use Research Program, Department of Indian Affairs and Northern Development, Ottawa.

D. W. Duncan
Group Leader, Mineral Microbiology
Division of Applied Biology

On behalf of B. C. Research

C. C. Walden
Head, Division of Applied Biology

TABLE 1

PARTICLE SIZE DISTRIBUTION OF ANVIL TAILINGS

Mesh Size (Tyler)	Anvil 16 hour Composite (January 23, 1975)		Site 4 and 5 Composite	
	% by weight	Cumulative % by weight	% by weight	Cumulative % by weight
+ 65	2.20	2.20	3.36	3.36
- 65 +100	2.44	4.64	2.10	5.46
-100 +150	7.70	12.34	4.78	10.24
-150 +200	9.70	22.04	6.00	16.24
-200 +270	13.26	35.30	12.80	29.04
-270 +325	8.00	43.30	11.20	40.24
-325 +400	7.44	50.74	10.00	50.24
-400	49.26	100.00	49.76	100.00
Apparent Density (tons/cu yd)	1.65		1.62	
Density (tons/cu yd)	3.37		3.12	

APPENDIX I

CYPRUS ANVIL MINING CORP. LTD. TAILING SPILL 19 MARCH 1975

Report on amount of tailing slurry frozen in the Rose Creek flood plain.

INTRODUCTION

On 19 March 1975 a tailing dam at the Cyprus Anvil Mine near Faro, Yukon Territory was washed out. An estimated 600 acre feet of tailing water was released into Rose Creek. Signs of the released water could be detected ten miles downstream (about one mile above the confluence with Anvil Creek). The Creek had been frozen over&the wave of water filled the creek flood plain and froze in place.

OBJECTIVE

A survey of Rose Creek was undertaken on 3 April. The objective of the survey was to determine if some clean-up should be undertaken. The procedures included identifying "pockets" along Rose Creek where a significant amount of tailing slurry was deposited; determining the depths of the frozen slurry; determining the percentage of tailing in the slurry; and estimating the total amount of material in place. A 3" Shelby tube was used to collect the samples and five cross-sections of Rose Creek were analyzed.

RESULTS

An estimated 200 acre feet of tailing water slurry is presently frozen in place from the tailing pond to the mouth of Rose Creek. This material contains an estimated ten acre feet of tailing.

The most significant area is within the first two miles below the tailing dam where the tailing consists of approximately 6% of the total volume of frozen material.

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Within this region four "pockets" were identified to have significant tailing slurry deposits.

The following is a summary of the volumes of material contained in these "pockets":

Site No	Av. Depth (in.)	Volume of Material (cu.yd.)	Volume of Tailing (cu.yd.)	Weight of Tailing (tons)
4	15	13,320	990	1,580
4a	15	23,230	1,725	2,750
5	9.5	4,027	225	415
5a	9.5	4,027	225	415

The remainder of the data is summarized in the attached Table.

RECOMMENDATIONS

The above information was presented and discussed with the Whitehorse Fisheries Service and E.P.S. staff on 11 April 1975.

It was agreed that no effective action could be taken to clean up the tailings because of the small concentration of tailing in comparison to the total volume of frozen slurry. In addition, accessibility and the requirement to rip up the vegetation within the flood plain were also considered as problems for clean-up.

In view of the above, the A/Controller of Water Rights advised that, because of the high leachability of the tailings, he would be prepared to require the Mine to monitor the Rose Creek Flood Plain for acid development.

C N Williams

C. N. Williams, P. Eng.,
A/Controller of Water Rights
Northern Natural Resources &
Environment Branch

11 April 1975

ESTIMATE OF QUANTITIES OF TAILINGS DEPOSITED IN ROSE CREEK

19 MARCH 1975 (Surveyed 3 April 1975)

Site No. (ref. to map attach.)	Average depth of frozen slurry (ft)	Area of Site (sq.yd)	Volume of frozen slurry (cu.yd)	Density of slurry (tons/cu.yd)	Percent. by wt. of Tailings (%)	Density of Tailing (tons/cu.yd)	Volume of Tailing (cu.yd)	Av. Depth of Tailing (in.)
1 (9.5 miles below break)	0.84	7,744	1,548	0.37	1	0.90	6	0.03
2 (7.[illegible] miles below break)	0.72	15,490	3,717	0.50	1	0.76	24	0.06
3 (~~6.6~~ 3.3 miles below break)	1.35	29,040	13,068	0.36	2	1.10	86	0.10
4 (2 miles below break)	1.29	30,976	13,319	0.54	22	1.60	988	1.15
4a (1.5 miles below break)		46,464	23,232				1725	
5 (0.8 miles below break)	0.78	15,488	4,027	0.49	21	1.85	224	0.51
5a (0.2 miles below break)		15,488	4,027				224	


ANVIL CREEK
ROSE CREEK
FARO CREEK
ROSE MTN.
MOUNT MYE
6761
6671
6608
TAY
2
3
4
4A
5
5A
R
A
NEPE