

MH Pelley

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PROGRESS REPORT NO.2

**CURRAGH RESOURCES INC.
FARO MINE
FARO WATER RECLAIM AND TAILINGS DEPOSITION PLAN**

JANUARY, 1991

Prepared By:

**KILBORN INC.
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PROGRESS REPORT NO.2
CURRAGH RESOURCES INC.

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SECTION 1.0

INTRODUCTION

**PROGRESS REPORT NO.2
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1.0 INTRODUCTION

This monthly Progress Report number 2 on the Faro Water Reclaim and Tailings Deposition plan study includes the four week period from January 6 to 31, 1991. During this period, a first Steering Committee meeting was held at the Faro mine site on January 10, 1991. Also during this period the outstanding mapping of the Down Valley tailings area was received in both hard copy and in digital tape format between January 15 to 21, 1991.

The progress report information which follows is given in the same format as in the first December 1990 monthly report.

SECTION 2.0

PROGRESS

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2.0 PROGRESS

2.1 GENERAL

In the four week period commencing January 6, 1991 there was much more active work on the Faro Water Reclaim and Tailings Deposition Plan study than was the case for the month of December.

The first week of this period was highlighted by the first Tailings Steering Committee meeting held at the Faro mine on January 10, 1991. The meeting agenda was prepared by Kilborn. The agenda closely followed the listing of options/tasks itemized in the original proposal terms of reference. Notes on the meeting are given in an Inter-office Memorandum dated January 16, 1991 prepared by Gerry Acott, Steering Committee coordinator.

Following the Steering Committee meeting both John Wells and Ted Jurgens on Kilborn remained on site for the period January 11 to 14, 1991 to carry on with discussions with mine site personnel to acquire further details on the practicality and costing basis of incorporating some of the water reclaim options reviewed at the meeting, and to examine available background mapping, and earlier internal and consultants reports on geotechnical and environmental subjects related either to the existing tailings area or the Faro open pit. While on site, John Wells also attended to discussions and work on a separate study on process instrumentation.

On January 15 and 16, 1991 brief discussions were held with Golder Associates and Steffen Robertson and Kirsten (SRK). The discussions were held with a look together of the very first unedited map sheet for the Intermediate Dam tailings area. Brief notes of the meeting held with Golder Associates were prepared and are included in Appendix A. Notes were not prepared on a similar review meeting with SRK since most of the discussion was centered around Mr. Andy Robertson providing an overview of the abandonment plan concepts. It was planned that a review meeting would be held in Vancouver, on January 21st, 1991 (Curragh/SRK) to fully discuss abandonment options. However this was changed to a telephone conference call on January 23, 1991. Notes on this conference call have been prepared by G. Acott and circulated to Steering Committee members by fax on January 30, 1991.

The final delivery of topographic mapping was received by Kilborn Inc. on January 21, 1991 in the form of digital tapes in Intergraph format. SRK similarly received Autocad format tapes direct from Orthoshop for their abandonment plan report.

2.2 TASK 1 - TAILINGS DISPOSAL OPTION - CURRENT FACILITY

With receipt of topographic mapping, infilling calculations began and options evaluated for operating the present tailings area for the balance of 1991. A plan and profile was developed to illustrate the rate of infilling, and its effect on remaining capacity in the basin, and the favoured SRK abandonment plan. Progress prints will be made available for the next Steering Committee Meeting on February 15, 1991.

The first observations coming out of the review of mapping are that it will be very difficult to avoid not carrying out at least a 2 metre raising of the Intermediate Dam this summer to contain 1991 tailings.

An order of magnitude cost estimate was prepared for the Intermediate Dam construction based upon incremental raisings of 1 meter. Individual embankment zones quantities were received from Golder Associates on January 22nd 1991. A summary of these quantities is given on a table in Appendix B. An approximate first estimate of the capital costs is provided on a handwritten table also included in Appendix B. This estimate will need to be revised to include spillway excavation quantities, and abutment excavation and backfill quantities, and a breakout to the extent possible for support work.

A brief look was made into the possibility of constructing a plug dam closely following the former plug dam location which can be seen as a trace outline in the September 1990 air photographs. At the location selected (and assuming the plug dam is constructed in the month of March), then to store seven months of tailings to the end of October, a seven meter high plug dam will be required. Only minimal work to quantify earthworks for a plug dam is being undertaken in light of the limited chances of a plug dam arrangement being incorporated into the abandonment plan.

A preliminary volume check was made of the unused capacity within the water pond adjacent to the Intermediate Dam. Based on the September 1990 mapping, with a surface area of 190,000 m² (19 hectares), and an estimated mean depth of 2.5 meters (this will need to be checked with an ice augured hole and soundings) the capacity available is equivalent to about 2 months of production.

Golder Associates supplemented the Kilborn examination with the development of capacity curves based upon determined in-place density values. Their letter of February, 1991 included in Appendix A, outlines in detail the projected remaining capacity in the Down Valley tailings storage area.

A preliminary volume check was of the infill volume of the Cross Valley polishing pond. The storage available assuming a settled submerged density of 1.75 t/m³ and a 2 m water cover is left is about 2.6 million tonnes of tailings or about 7 1/2 months production.

Further work has been undertaken to develop the concepts and cost of tailings thickening and new information will be presently at the progress review meeting in February 1991. Similarly, further work has been carried out on slimes splitting using gradation requirements provided by SRK.

2.3 TASK 2 - VOLUME DETERMINATIONS

For this task, two representative samples of Vangorda tailings were sent to Golder Associates in early January 1991. Unfortunately the samples were too small to carry out the settling and consolidation tests as scheduled. A subsequent request has been made by both Golder and Kilborn for an additional larger sample. The sample will likely be a blend of both Vangorda and Faro tailings as typical of current production. In the interim Golder have formulated the details of the testing program and a perspex column which allows for loose deposition and low load and large strain consolidation.

Bulk density estimate information has been provided by Golder Associates and back calculations of settled dry tailings densities made from historical records and production figures. A settled dry density of 1.9 t/m³ has been established for tailings above water; a dry density of 1.75 t/m³ was determined for submerged tailings.

The Faro pit inflow calculation has been refined to include the groundwater and surface water inflow volume estimates as provided by SRK this month.

2.4 TASK 3 - RECYCLE OF PROCESS WATER

The water recycle and water balance block diagram flowsheet, as discussed at the January 10th, 1991 review meeting have been modified to some extent as a result of comments at the meeting, and from subsequent analysis. A further set of diagrams and accompanying notes will be presented at the February meeting.

2.5 TASK 4 - FARO PIT FILLING

Some further work has progressed on this task mainly in terms of pipeline sizing for tailings delivery and water reclaim to the mill. A preliminary pumping system assessment has been made and order of magnitude cost estimates started.

SRK have provided Kilborn in late January 1991 with surface and groundwater hydrological information for purposes of predicting more accurately the time to infill the pit.

2.6 TASK 5 - REPROCESSING OF EXISTING TAILINGS

The first original order of magnitude capital and operating cost estimates prepared for the January 10th, 1991 review meetings have been updated to reflect simply a materials handling proposition with no attempt to recover base or precious metal values in the Faro mill.

2.7 TASK 6 - MINE CLOSURE IMPLICATIONS

All of the options, currently being examined in Task 1 in particular, are, or soon will be, subject to review with SRK in terms of water quality affects during the remaining months of operation and in the abandonment phase. Information on the abandonment strategies being proposed by SRK were discussed at a meeting held with their Mr. Andy Robertson on January 16, 1991.

SECTION 3.0

BUDGET EXPENDITURES

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3.0 BUDGET EXPENDITURES

A detailed expenditure summary for the month of December 1990 is given on the table on page 3-2. As of December 31st, 1990 approximately 8% has been expended of the original combined study budget of \$171,660.

An approximate summary estimate of expenditures is given on the table on page 3-3 and in summary form below for each firm to the end of January 1991:

<u>Firm</u>	<u>Manhours</u>	<u>Engineering</u>	<u>Disbursements</u>	<u>Total</u>
Kilborn *	246.5	\$19,130	\$5,600+	\$24,730+
SRK	85	\$5,783	\$100+	\$5,900+
Golder	<u>134.5</u>	<u>\$8,854</u>	<u>\$100+</u>	<u>\$9,000+</u>
Total	466.0	\$33,767	\$5,800	\$39,630+

*Hours reported to January 25, 1991 for January invoicing.

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The combined expenditure for the December and January period is estimated to be approximately \$53,400 representing about 31% of the original budget. Manhour expended represent some 28.5% of the original budget.

CURRAGH RESOURCES - FARD MINE - TAILINGS AND WATER RECLAIM STUDY.

Expenditure statement December 1990.

		DECEMBER 1990			ORIGINAL BUDGET			BUDGET REMAINING		
		KILDRN	GOLDER	SRK	KILBORN	GOLDER	SRK	KILBORN	GOLDER	SRK
TASK 1										
	FEES	\$340.00	\$388.75	\$1,960.00	\$19,050.00	\$18,000.00	\$8,920.00	\$18,710.00	\$17,611.25	\$6,960.00
OPTIONS - CURRENT	HOURS	4	4.5	27.5	232	N/A	136	228	N/A	108.5
FACILITY	DISBURS.	-	-	-	\$100.00	-	\$200.00	\$100.00	-	\$200.00
TASK 2	FEES	-	-	-	\$16,750.00	\$2,500.00	-	\$16,750.00	\$2,500.00	-
VOLUME	HOURS	-	-	-	196	N/A	-	196	N/A	-
DETERMINATIONS	DISBURS.	-	-	-	\$200.00	-	-	\$200.00	-	-
TASK 3	FEES	\$1,100.00	-	-	\$6,000.00	-	\$7,960.00	\$4,900.00	-	\$7,960.00
	HOURS	13	-	-	72	-	108	59	-	108
RECYCLE	DISBURS.	-	-	-	\$100.00	-	\$100.00	\$100.00	-	\$100.00
TASK 4	FEES	\$425.00	-	-	\$8,300.00	\$8,000.00	\$9,360.00	\$7,875.00	\$8,000.00	\$9,360.00
	HOURS	5	-	-	96	N/A	128	91	N/A	128
FARD PIT FILLING	DISBURS.	-	-	-	\$200.00	-	\$200.00	\$200.00	-	\$200.00
TASK 5	FEES	\$170.00	-	-	\$1,400.00	-	-	\$1,230.00	-	-
REPROCESSING	HOURS	2	-	-	16	-	-	14	-	-
EXISTING TAILINGS	DISBURS.	-	-	-	-	-	-	-	-	-
TASK 6	FEES	\$1,360.00	-	\$1,765.00	\$4,550.00	-	\$4,760.00	\$3,190.00	-	\$2,995.00
	HOURS	16	-	23	52	-	64	36	-	41
MINE CLDSURE	DISBURS.	-	-	-	-	-	-	-	-	-
TASK 7	FEES	\$3,081.70	-	\$960.00	\$12,950.00	\$6,000.00	\$3,200.00	\$9,868.30	\$6,000.00	\$2,240.00
MANAGEMENT	HOURS	35.5	-	12	148	N/A	40	112.5	N/A	28
PROGRESS REPORT	DISBURS.	\$2,109.54	-	\$98.15	\$9,300.00	-	-	\$7,190.46	-	-
MEETINGS -LIAISON	DISBURS.	-	-	-	-	-	-	-	-	-
TASK 8	FEES	-	-	-	\$9,000.00	-	\$13,360.00	\$9,000.00	-	\$13,360.00
	HOURS	-	-	-	144	-	200	144	-	200
PREPARE REPORT	DISBURS.	-	-	-	\$200.00	-	\$500.00	\$200.00	-	\$500.00
TOTALS	FEES	\$6,476.70	\$388.75	\$4,685.00	\$78,000.00	\$34,500.00	\$47,560.00	\$71,523.30	\$34,111.25	\$42,875.00
	HOURS	75.5	4.5	62.5	956	500	676	880.5	495.5	613.5
	DISBURS.	\$2,109.54	\$0.00	\$98.15	\$10,100.00	INCL.	\$1,000.00	\$7,990.46	\$0.00	\$901.85

CURRAGH RESOURCES - FARO MINE - TAILINGS AND WATER RECLAIM STUDY.

Expenditure statement January 1991

		BUDGET REMAINING			JANUARY 1991			BUDGET REMAINING		
		KILBORN	GOLDER	SRK	KILBORN ⁽¹⁾	GOLDER	SRK	KILBORN	GOLDER	SRK
TASK 1										
	FEES	\$18,710.00	\$17,611.25	\$6,960.00	\$6,030.00	\$7,268.00	-	\$12,680.00	\$10,343.25	\$6,960.00
OPTIONS - CURRENT FACILITY	HOURS	228	N/A	108.5	78	108.5	-	150	N/A	108.5
	DISBURS.	\$100.00	-	\$200.00	-	-	-	\$100.00	-	\$200.00
TASK 2										
	FEES	\$16,750.00	\$2,500.00	-	\$3,125.00	\$1,586.00	-	\$13,625.00	\$914.00	-
VOLUME DETERMINATIONS	HOURS	196	N/A	-	46	26	-	150	N/A	-
	DISBURS.	\$200.00	-	-	-	-	-	\$200.00	-	-
TASK 3										
	FEES	\$4,900.00	-	\$7,960.00	\$1,840.00	-	\$715.00	\$3,060.00	-	\$7,245.00
	HOURS	59	-	108	21	-	11	38	-	97
RECYCLE	DISBURS.	\$100.00	-	\$100.00	-	-	-	\$100.00	-	\$100.00
TASK 4										
	FEES	\$7,875.00	\$8,000.00	\$9,360.00	\$1,360.00	-	\$3,510.00	\$6,515.00	\$8,000.00	\$5,850.00
	HOURS	91	N/A	128	16	-	54	75	N/A	74
FARO PIT FILLING	DISBURS.	\$200.00	-	\$200.00	-	-	\$96.22	\$200.00	-	\$103.78
TASK 5										
	FEES	\$1,230.00	-	-	\$175.00	-	-	\$1,055.00	-	-
REPROCESSING EXISTING TAILINGS	HOURS	14	-	-	2	-	-	12	-	-
	DISBURS.	-	-	-	-	-	-	-	-	-
TASK 6										
	FEES	\$3,190.00	-	\$2,995.00	\$1,750.00	-	\$240.00	\$1,440.00	-	\$2,755.00
	HOURS	36	-	41	20	-	3	16	-	38
MINE CLOSURE	DISBURS.	-	-	-	-	-	-	-	-	-
TASK 7										
	FEES	\$9,868.30	\$6,000.00	\$2,240.00	\$4,850.00	-	\$1,318.00	\$5,083.30	\$6,000.00	\$922.00
MANAGEMENT PROGRESS REPORT MEETINGS -LIAISON	HOURS	112.5	N/A	28	63.5	-	17	49	N/A	11
	DISBURS.	\$7,190.46	-	-	\$5,500.00 ⁽²⁾	-	-	\$1,690.46	-	-
TASK 8										
	FEES	\$9,000.00	-	\$13,360.00	-	-	-	-	-	\$13,360.00
	HOURS	144	-	200	-	-	-	-	-	200
PREPARE REPORT	DISBURS.	\$200.00	-	\$500.00	-	-	-	-	-	\$500.00
TOTALS										
	FEES	\$71,523.30	\$34,111.25	\$42,875.00	\$19,130.00	\$8,854.00	\$5,783.00	\$52,393.30	\$25,257.25	\$37,042.00
	HOURS	880.5	495.5	613.5	246.5	134.5	83	634	361	530.5
	DISBURS.	\$7,990.46	\$0.00	\$901.85	\$5,500.00	N/A	\$96.22	\$1,690.46	N/A	\$805.63
COMBINED TOTALS										
	FEES		\$148,509.55		\$33,767.00			\$114,742.55		
	HOURS		1,989.5		464			1,525.5		
	DISBURS.		\$8,892.31		\$5,596.22			\$3,296.09		

NOTE (1) KILBORN MONTH END JANUARY 25

(2) DISBURSMENTS INCLUDE \$ 2,814.07 FOR COMPUTER DESIGN FILES OF TOPOGRAPHIC MAPS AND CONTACT AERIAL PHOTOGRAPHS NOT INCLUDED IN ORIGINAL PROPOSAL BUT DEEMED IMPORTANT DUE TO LATE DELIVERY OF MAPPING.

SECTION 4.0

SCHEDULED REMAINING WORK

**PROGRESS REPORT NO.2
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4.0 SCHEDULED REMAINING WORK

The majority of the work carried out in January 1991 has been directed to Tasks 1 and 2 with further input to Tasks 3 and 5. In view of it's importance to the abandonment study, greater emphasis has been given to aspects related to the Down Valley tailings area as opposed to Faro pit infilling.

The February 1991 Steering Committee Review meeting is considered by Kilborn as being the best and probably last opportunity on agreeing on a course of action for remaining tailings disposal in the Down Valley tailings area. Following this meeting it is intended that options will be finalized for input to SRK to their abandonment plan report. This work will be the priority tasks and then work will continue on Faro pit infilling details

APPENDIX A

NOTES ON MEETING WITH GOLDER ASSOCIATES

January 15, 1991

LETTER FROM GOLDER ASSOCIATES

February 1, 1991

MEETING WITH GOLDER ASSOCIATES - Calgary Office
January 15, 1991 10:30 a.m. - 3:00 p.m.

Present: J.G. Gilchrist
P. Wheeler
M. Gutwein
E. Jurgens - Kilborn

Purpose: To exchange progress information from work underway by both Kilborn and Golder, examine together a preliminary unedited map sheet of the Intermediate Dam area just obtained that morning from Orthoshop, and concur on immediate future work.

Discussion:

1. Ted Jurgens provided an overview of the Tailings Steering Committee progress review meeting of January 10th, 1991. The major points highlighted as they relate to Golder's activities included:
 - a) The commitment to suspend open pit mining in the Faro Pit as of October 31, 1991 this year, and the closure of the underground mine at the same time.
 - b) Curragh's reluctance to raise the Intermediate Dam in 1991 unless absolutely necessary to store 1991 tailings. The required raising of the dam, for purposes of tailings abandonment purposes, will come out of SRK's study.
 - c) Concurred that there was merit to a bathymetric survey carried out by ice augering at locations near the Intermediate Dam only. The matter of safety and a thin ice cover was noted.
 - d) Curragh are not prepared to dismiss "plug" dams immediately if it can buy some time and avoid 1991 dam raising. However the mapping will determine the feasibility of such an approval.
 - e) Infilling of the Cross Valley polishing pond was not an option to pursue for the remaining operating period. Some work, whether cleaning out slimes prior to breaching the Cross Valley Dam, or stabilizing with waste rock may be a requirement under the final abandonment scheme.
 - f) The likelihood of a thickener for water reclaim purposes was not too promising based on economics and water recycle quality.
 - g) Creating slimes by cyclones for the purposes of providing a surface cover of the original tailings area, was not a favoured option by Curragh. The problems foreseen related to the expense and effectiveness of developing paddocks. Curragh prefer a covering of imported till placed during the winter over a frozen surface.
 - h) Curragh prefer to reclaim water from means other than by a thickener requiring flocculant which could affect processing recoveries. Direct reclaim from a water filled Faro pit was favoured. Pumping from the Cross Valley Pond would be expensive and a short term situation only, unless thickener overflow, or cycloned slimes is directed to the tailings area for cover purposes. Faro pit reclaim was preferred.

- i) Curragh prefer to fill the Faro pit up with slurry and allow the water level to reach the point just below the Zone I/II separation before starting to reclaim. This will save pump barge and pipeline movements and unduly high pumping heads.
2. Glen Gilcrist raised a number of points related to the operation of the Down Valley tailings in the context of the Water License requirements.
 - a) No where is there any mention in the License spelling out a freeboard allowance for the Intermediate Dam. Conceivably, as long as the spillway can handle a 1 in 500 year return flood without overtopping the dam, then the controlling factor is the spillway depth.
 - b) In hydrology calculations Hydrocon/Acres/Diand comparison for flood flows it is important to know the basis for each method viz a viz watershed area and design purpose with or without storage etc.
 - c) If plug dams were contemplated then it would be advisable to notify the Water Board in advance to explain the requirements. If plug dam(s) was contemplated then it was best to relocate the tailings pipeline further down to allow the tailings in the locations of the former plug dam to drain and freeze. A trace of the former plug dam is visible on the September 1990 aerial photographs. Jack Bowers and Eric Soprovich are the best people to contact regarding accurately locating the plug dam.
 - d) The Cross Valley Dam berm construction is a requirement under the Water License and will need to be constructed this summer. It is best to schedule some Intermediate Dam raising either for short term remaining storage needs or a partial (full?) abandonment raising, to help offset mobilization costs.
 3. Some general comments were made related to the abandonment plans now well in progress by S.R.K.
 - a) Curragh and SRK are meeting in Vancouver on January 21, 1991 and the subject at abandonment slope stability analyses requirements (SRK memo of December 18, 1990 to Kilborn) will be reviewed and SRK will inform Golder of their requirements.
 - b) Golder are not aware of any final 4:1 slope for final abandonment, unless it refers to the Cross Valley Dam with a downstream berm.
 - c) Some consideration might be given to a suction dredge removing slimes within the Cross Valley polishing pond for use in a cover within the original tailings area.
 - d) There is a shortage of suitable till for a cover from the Faro area. Till may have to be imported from Vangorda.
 - e) Golder have maintained detailed performance records and data on the Rose Creek Diversion. The purpose has been to document the performance for use upon abandonment.
 - f) While the Faro pit fills (1991 - 1992) the Down Valley water quality can be sampled to see the effects of no discharge prior to final abandonment construction.

4. It was agreed that the immediate work that Golder Associates would carry out would be:
 - a) Confirm settled density values for Vangorda tailings when a new (larger) sample is received from Curragh
 - b) Check on the earthwork excavation, and location for a spillway for a short term raising and an abandonment spillway.



Golder Associates Ltd.
CONSULTING ENGINEERS

1 February 1991

Ref. No. 902-2413

Kilborn Limited
2200 Lakeshore Blvd West
Toronto, Ontario
M8B 1A4

via FAX to (416) 231-5356

Attention: Mr. E. I. (Ted) Jurgens, P. Eng.
Project Engineer

**RE: CURRAGH RESOURCES FARO MINE
TAILINGS AREA GEOTECHNICAL STUDIES
CAPACITY AVAILABLE U/S OF INTERMEDIATE DAM**

Dear Sir:

We have completed our determination of the capacity curve and computation of mean in-place density for tailings placed up to September 17, 1990, the mapping date for the area. Our results are discussed below and comparisons are made with prior similar determinations we have on file. Our results are as follows:

Capacity Curve

We have used 1982 ground survey data for determination of the capacity curve below elevation 1025 m (1990 mapping datum), 1985 mapping data from there to the 1050 m contour, and the 1990 data to complete it to elevation 1053 metres. We have determined the "master" curve by integrating the elevation - area curve at one meter accuracy and we have adjusted the volume curve to account for about 500,000 m³ of borrow excavation that has been abstracted from the terrace deposits in the tailings basin. The "master" curve relates elevation to volume, thus it presumes a horizontal tailings surface. It is provided in Figure 1 attached.

Secondary curves on Figure 1 account for the physical details of the tailings topography. These physical details are:

- a) The Submarine Profile which describes the free water body present just upstream of the Intermediate Dam. In the summer of 1988 three sounding sections were run perpendicular to the Intermediate Dam. These indicated that the "foreset" beds slope varied between $3\frac{1}{2}$ and $4\frac{1}{2}$ percent, the slope shape being concave upward. We also found that the mean slope on the submarine surface between beach edge and the face of the dam was as follows:

<u>Section Position Reference North Abutment</u>	<u>Slope</u>
167 m south (sta. 0+330 m)	3.7%
277 m south (sta. 0+440 m)	2.7%
448 m south (sta. 0+610 m)	2.1%

The survey also found that less than 20 percent of the submarine profile was horizontal. On the basis of this survey data the unused volume below water surface was computed to be $0.19 \times 10^6 \text{ m}^3$ at that time. In that the mean width of the free water surface was about 160 m, and if simple extrapolation is used, the 1990 free water surface width of 280 m would suggest an unused volume of $0.33 \times 10^6 \text{ m}^3$.

- b) Tailings Beach Storage adds considerably to storage capacity for a given water pond (or dam crest elevation) because it is storage volume above the pond volume abscissa for any ordinate elevation.

As of September 17, 1990, volume of stored tailings was $9.0 \times 10^6 \text{ m}^3$ as indicated on Figure 1 at point A.

Ultimate storage capacity for the Intermediate Dam is represented by Curve 3 on Figure 1 and would be realized when the free water area along the face of the dam is completely filled and the 0.4 percent beach grade meets the face of the dam at spillway invert elevation. The stored volume at that stage is $11.25 \times 10^6 \text{ m}^3$. In the process of reaching this condition the beach is steadily approaching the dam and in so doing, is consuming the currently available $0.33 \times 10^6 \text{ m}^3$ of storage below the water line. Ultimate storage for a raised dam can be determined by similar use of the appropriate curves of Figure 1, but noting that available volume below the revised water surface may be different than the volumes assumed above.

Study of Curve 2 and Curve 3 of Figure 1 suggests that it is better to maintain a high water level in the basin in the interest of retaining some supernatant water

storage, rather than to have the decant syphons submerged in tailings at an early date.

Tonnage of Tailings in Storage

With few exceptions, all of the Curragh tailings production has gone to the Down Valley storage area. From the figures you provided recently the following summary has been prepared:

<u>Calendar Year</u>	<u>Annual Tailings Production, mt</u>	<u>Cumulative Production, mt</u>	<u>Mean Monthly Production, mt</u>
1986 (1)	1,914,040	1,914,040	273,434
1987	3,553,400	5,467,440	296,117
1988	3,612,068	9,079,508	301,006
1989	3,891,974	12,971,482	324,331
1990 (2)	2,978,320	15,949,802	347,664

Notes to above table

1. Production start assumed to be June 1, 1986.
2. Production cutoff at Sept 17, 1990, the date of the photos used for photogrammetric mapping.

On the basis of the tailings capacity curve and accumulated stored tonnage, the computed dry bulk density for the deposit is 1.77 tonnes/m³. By comparison, the density value computed from 1988 ground survey and tonnages deposited to the date of that survey was 2.22 tonnes/m³. Similarly, the difference between the 1988 survey (15 July by Yukon Engineering Services) and a 1989 survey (26 June by Yukon Engineering Services) yielded a mean density of 1.90 tonnes/m³ for the tonnage placed during the period.

Accuracy

Possible errors and absolute accuracy of the computation should be noted because they will affect the confidence with which the derived density value can be used. Factors which contribute to the accuracy of computations are as follows:

- a) Storage Upstream - It is likely that a minor amount of storage has been derived from tailings discharge into areas upstream of the Down Valley project. This would have the effect of indicating a higher than actual bulk density because the tonnage actually stored in the Down Valley Project would be less than reported above. The impact would be about 2 percent (decrease) for every month the whole of the production was stored elsewhere. One reason for the high bulk density computed for 1988 would be the fact that more out-of-basin deposition occurred in the initial mining than in the recent past and so stored tonnage is over-estimated.
- b) Capacity Curve - The curve that has been developed reflects two photomapping datum adjustments using the mapped crest elevation of the dam for the elevation equation needed to access pre-1985 data. The transfer could be in error due to mapping accuracy and Orthoshop feels confident only to about 0.3 m accuracy. At current pond level this is equivalent to about 300,000 m³ of storage, or about 3 percent of storage volume. The impact on density would be similar. Using 1.74 tonnes/m³, the confidence would be 1.74 plus or minus 0.05 tonnes/m³.

Capacity Curve Zero-based to Sept. 17, 1990

The results of planimetering the Orthoshop plan of the Intermediate Dam storage area are provided in Figure 2. This figure takes the mapped topography as the new starting point for volume determination with adjustment only for the volume of unused space below water level immediately in front of the dam (0.33×10^6 m³ as noted above).

Using this "new" curve in conjunction with a mean density of 1.77 mt/m³, the capacity of the area to spillway level is about 2.21×10^6 tonnes of tailings. At production rates typical of the first half of 1990 (347,664 mt/month), the space would be exhausted in about 193 days plus or minus a week, i.e. by about the last week of March, 1991. Continuation of discharge to the end of October would raise the tailings level to about 1045.9 m, i.e. tailings level at the face of the Intermediate Dam would exceed crest elevation by about 0.1 metres. However, should the 1988-1989 incremental deposit density of 1.9 tonnes/m³ be used, filling to the spillway invert would occur about 2 weeks later, and the end of October level would be approximately 0.1 m below the crest of the dam, i.e. 0.2 m lower than when using a density of 1.77mt/m³ for the computation.

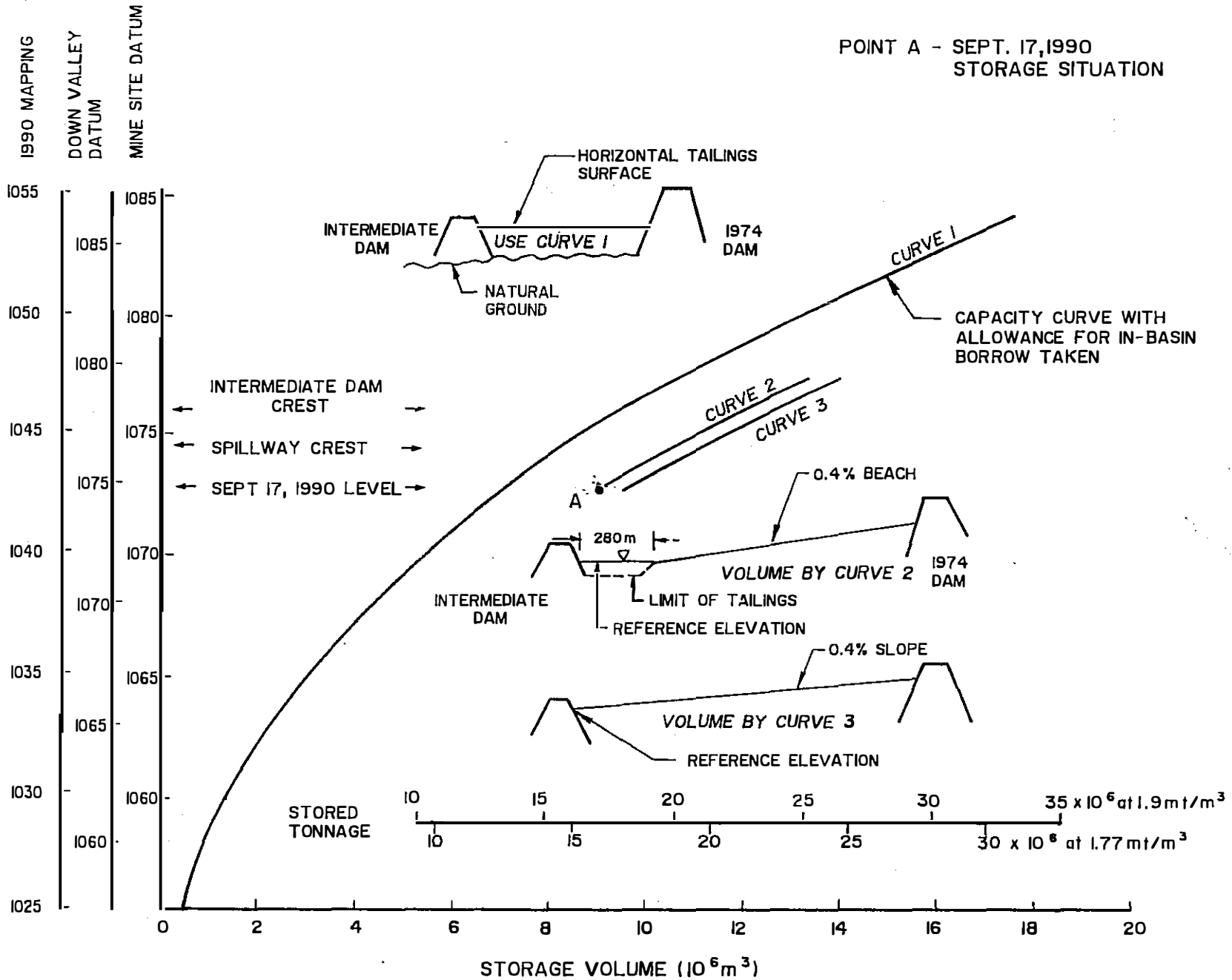
Conclusions

Integration of all the topographic and tonnage data for the basin indicates that mean bulk density of the tailings deposited to September 17, 1990 is about 1.77 tonnes/m³. High confidence data from the filling increment July 15, 1988 to June 26, 1989 indicates a density of 1.9 tonnes/m³ for that period. The trend of the data would suggest that tonnage extrapolation for remaining storage should use a density value not higher than 1.9 tonnes/m³ because of both incremental storage evidence (1988-89) and the fact of the computed lesser mean density for the whole of the deposit.

Yours truly,
GOLDER ASSOCIATES LTD.



H. G. Gilchrist, P. Eng.
Principal



**DOWN VALLEY PROJECT
 BASIN CAPACITY CURVE
 (INTERMEDIATE DAM TO 1974 DAM)**

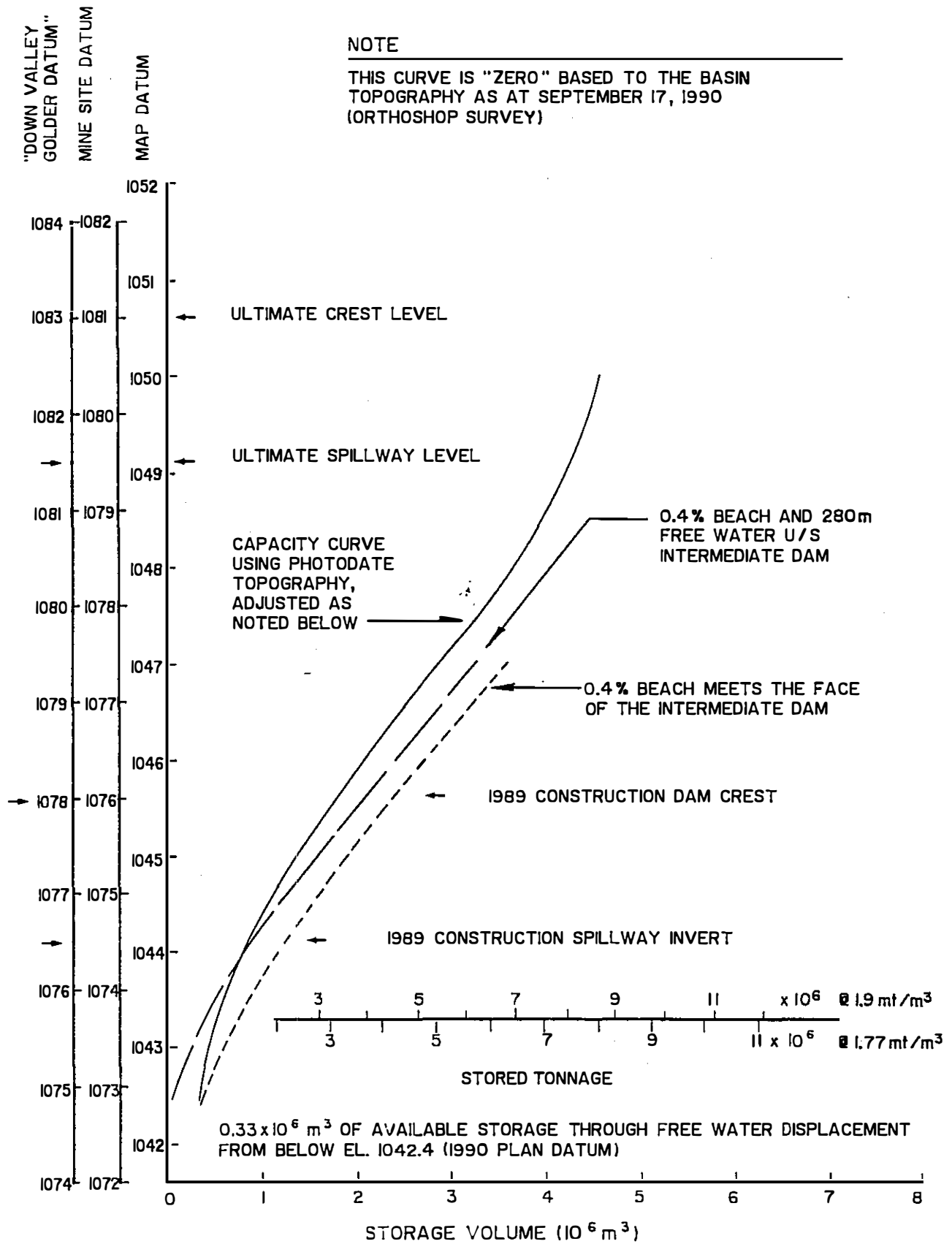
Figure 1

DOWN VALLEY TAILINGS PROJECT NEW CURVE FOR BASIN CAPACITY

Figure 2

NOTE

THIS CURVE IS "ZERO" BASED TO THE BASIN TOPOGRAPHY AS AT SEPTEMBER 17, 1990 (ORTHOSHOP SURVEY)



PROJECT No. 2412 DRAWN CG REVIEWED [Signature] DATE JAN 91

APPENDIX B

INTERMEDIATE DAM

- . INCREMENTAL RAISING VOLUMES**
- . APPROXIMATE FIRST ESTIMATE
CAPITAL COST INTERMEDIATE DAM RAISINGS**

INTERMEDIATE DAM
FARO MINE, Y.T.

INCREMENTAL RAISING VOLUMES

DAM CREST RAISED BY:

	1 #	2 #	3 #	4 #	5 #
CLASS VI CORE (m3)	7,800	15,600	23,450	31,300	39,250
CLASS VIII D/S SHELL (m3)	28,850	60,550	95,100	132,400	173,000
CLASS VIII A TRANSITION (m3)	1,750	3,500	4,900	6,300	7,700
CLASS X D/S FILTER (m3)	3,150	6,250	9,400	12,550	15,750
CLASS XI U/S FILTER (m3)	2,750	5,450	8,600	11,700	14,900
CLASS XII DRAINAGE (m3)	1,700	3,350	5,050	6,750	8,400
CLASS III ARMOUR (m3)	500	950	950	950	950
ROADWAY (m3)	2,800	2,800	2,800	2,800	2,800

1. Present dam crest elevation 1078 #.
2. Volumes do not include material in spillway
3. Volumes do not include excavation on abutments.
4. Abutment preparation not included

INTERMEDIATE DAM
FARO MINE, Y.T.

TABLE 2
APPROXIMATE SPILLWAY VOLUMES

	2 m DAM RAISING	5 m DAM RAISING
EXCAVATION VOLUME	200 m3	27000 m3
FILL VOLUME	1550 m3	5650 m3
CLASS II ARMOUR	600 m3	950 m3
CLASS IV ARMOUR	1100 m3	1850 m3
CLASS V ARMOUR	-	200 m3

Notes:

1. Spillway raising of 2 m maintains the current centreline position of the spillway (see Figure 1).
2. Spillway raising of 5 m is based on a northward diverging of spillway centreline from spillway channel elevation 1075.3 m to spillway crest.

APPROXIMATE FIRST ESTIMATE
INTERMEDIATE DAM RAISING

ITEM	1988 CONSTRUCTION S.M. RAISING			1989 CONSTRUCTION S.M. RAISING			≥ 1991 CONSTRUCTION 1 M RAISING			2 M RAISING (INCL. 15% ESCALATION ON UNIT RATES)			3 M RAISING			4 M RAISING			5 M RAISING					
	QUANTITY	UNIT COST	TOTAL	QUANTITY	UNIT COST	TOTAL	QUANTITY	UNIT COST	TOTAL	QUANTITY	UNIT COST	TOTAL	QUANTITY	UNIT COST	TOTAL	QUANTITY	UNIT COST	TOTAL	QUANTITY	UNIT COST	TOTAL			
① MOB/BENVOIS	L.S.		\$82,000	L.S.		\$25,000			25,000			30,000			35,000			40,000			45,000			50,000
② DAM PILE BLANKET DAM TOP REINFORCE		HOURLY RATE	\$11,750						5,000			10,000			15,000			20,000			25,000			30,000
			\$30,010						35,000			35,000			35,000			35,000			35,000			35,000
			\$47,060						50,000			50,000			50,000			50,000			50,000			50,000
③ BOTTOM PIT PREPARATION		HOURLY RATE	\$76,225						50,000			50,000			50,000			50,000			50,000			50,000
④ HAUL ROADS		HOURLY RATE	\$31,500						30,000			30,000			30,000			30,000			30,000			30,000
⑤ DECAY/SPILLWAY REPAIR & CONSTR.		HOURLY RATE	\$113,530						100,000			10,000			20,000			150,000			150,000			150,000
⑥ FILL																								
- CLASS VI CORE				37,111	\$4.70/m ³	\$174,420	7,800	\$5.40	\$42,120	15,600	\$5.90	\$91,920	23,400	\$5.40	\$126,360	31,300	\$5.40	\$169,020	39,250	\$5.40	\$211,950			\$211,950
- CLASS VIII OF SH.				85,315	\$4.70	\$400,990	28,850	\$5.40	\$155,790	60,150	\$5.40	\$324,810	95,100	\$5.40	\$513,540	132,400	\$5.40	\$715,760	173,000	\$5.40	\$934,200			\$934,200
- CLASS VIIIA TRENCH				7,850	\$3.90	\$30,735	1,700	\$3.90	\$6,615	3,500	\$3.90	\$13,650	4,800	\$3.90	\$18,720	6,300	\$3.90	\$24,570	7,700	\$3.90	\$30,030			\$30,030
- CLASS IX OF FINE WITH STRIKE				650	\$3.90	\$2,535		\$3.50			\$3.50			\$3.50		\$3.50		\$3.50		\$3.50			\$3.50	
- DAY STABILIZING WITH SCREEN				4,352.4	\$10.50	\$45,699	3,150	\$12.90	\$40,635	6,250	\$12.90	\$80,625	9,900	\$12.90	\$128,110	12,550	\$12.90	\$161,895	15,750	\$12.90	\$203,175			\$203,175
- CLASS II OF FILL				13,376	\$3.90	\$52,176	2,750	\$3.90	\$10,725	5,950	\$3.90	\$23,205	8,600	\$3.90	\$33,540	11,700	\$3.90	\$45,630	15,900	\$3.90	\$62,100			\$62,100
- CLASS III DRAINAGE				6,366	\$10.50	\$66,843	1,700	\$12.90	\$21,930	3,310	\$12.90	\$42,699	5,000	\$12.90	\$64,500	6,750	\$12.90	\$87,125	8,400	\$12.90	\$108,360			\$108,360
⑦ ARMOUR BANK				1,227	\$6.00	\$7,362	500	\$6.90	\$3,450	950	\$6.90	\$6,555	950	\$6.90	\$6,555	950	\$6.90	\$6,555	950	\$6.90	\$6,555			\$6,555
- CLASS II				900	\$6.00	\$5,400																		
- CLASS III																								
- CLASS IV																								
STORMWATER				1,554	\$7.00	\$10,878																		
LOCAL STORMWATER				1,274	\$5.00	\$6,370																		
SCOURING				1,558	\$10.00	\$15,580																		
- CLASS V, VI, VII				799	\$8.00	\$6,392	2,500	\$5.90	\$14,750	2,500	\$5.90	\$14,750	2,500	\$5.90	\$14,750	2,500	\$5.90	\$14,750	2,500	\$5.90	\$14,750			\$14,750
- ROADWAY																								
⑧ SCOURING OF MOB/BENVOIS MATERIAL EQUIPMENT	L.S.		\$45,000																					
			\$50,500																					
			\$59,625																					
⑨ OVERCUT			NIL	33,671	0.57/m ³	\$19,192																		
SUBTOTAL			\$2,731	\$16.77	\$459,230	157,433	\$2.60	\$409,325	49,300	\$11.95	\$588,170	98,400	\$12.85	\$1,264,310	130,200	\$12.74	\$1,650,558	209,700	\$7.27	\$1,520,555	242,750	\$7.00	\$1,699,125	
⑩ SUPPLIES/OTHER																								
• ENGINEERING																								
• SURVEYING																								
• INSPECTION/ INSTRUMENTS																								
• PUMPING																								
• FUEL																								
• MINE ROCK																								
• NEXT YEAR'S PREP. WORK																								
SUBTOTAL																								
TOTAL			\$14.22	\$1,318,550	\$10.03	\$1,579,458	\$16.00	\$789,170	\$12.89	\$1,249,310	\$12.06	\$1,661,515	\$7.96	\$1,939,555	\$7.29	\$1,740,125								

HOURLY RATE EQUIV }
HOURLY RATE }
HOURLY RATE }
HOURLY RATE }

NOT AVAILABLE
ASSUME }
\$200,000