

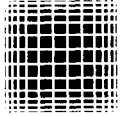
M E M O R A N D U M

DATE: January 5, 1989.
TO: Mr. R. Dujardin
FROM: R. Bradburn
SUBJECT: **CITY RESOURCES (CANADA) LIMITED**
CINOLA GOLD PROJECT
COMMENTS AND OBSERVATIONS

I have briefly reviewed the metallurgical reports which you gave me and my notes of the meetings we attended (Dec. 21/22 '88) with City Resources' personnel and their environmental consultants. You have identified five areas of concern, namely: **Environmental, Metallurgical, Reserves/Grade, Power Costs**, and the **Haida Indian Claims**. Following are my comments and observations:

- **Environmental Issues**

I am not an environmental expert but I must say I was impressed by the quality and quantity of work which City Resources and their consultants have completed. Both SRK and Norecol are very reputable companies and they seem convinced that all the issues have been addressed and are manageable. I do not believe they would risk their reputations on this project unless they felt comfortable. They claim to have designed a "zero discharge" tailings system although this was qualified by the term "during the operating life of the mine". In my opinion they are going to have to deal with an effluent at the end of the mine life. My concern would be for the quality of this discharge and whether a treatment process will be required. The Hazen report discusses the need for close control of reagents in the Arseno Process because of the potential for elevated nitrate levels in the tailings. These were several orders of magnitude greater than those anticipated by the environmental consultants.



Their wet lands disposal concept for reduction of nitrates may not be effective at high starting concentrations.

It goes without saying that one should be concerned about the levels of other potential contaminants. **I am not convinced that sufficient pilot plant testwork has been conducted to ensure that a typical effluent has been generated.** Without knowing more detail, I can only assume that the consultants are basing their conclusions on the limited pilot plant work completed to date.

A second environmental issue is the acid mine drainage and it appears the consultants have answered the issues here by incorporating a separate treatment plant prior to discharge. I would certainly want to see more information on this before accepting the plan.

- **Metallurgical Issues**

A great deal of testwork has been completed on this project but if I had to sum up my overall impressions, it would be that a great deal more remains to be done. **My main concern is that the process being advocated is commercially unproven and I do not believe the design and operating criteria have been firmly established.** From a brief review of the reports I offer these concerns:

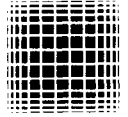
1. The pilot plan run used to establish the design criteria treated a total of 3.9 tonnes. **I maintain that this is insufficient to be representative of a 27,000,000 tonne orebody.**

2. The grade of the ore sample tested ranged between 0.103 and 0.143 opt Au while the overall orebody averages 0.062 opt. Although a lot of bench scale tests were completed on a wide variety of samples, I would prefer to see pilot plant work conducted on average ore.

On a large, low grade deposit such as this one I believe the ability to establish the likely final tailings grade is more important than quoting a recovery figure. In the pilot plant run a tailings of 0.01 opt was obtained on a head of 0.103 opt. This gives a 90% recovery. If, however, this same tailings loss is calculated on the orebody's average head grade of 0.062 opt then the recovery falls to about 85%.

This represents a very significant difference. **Given the orebody's three to four distinct ore types, I would want to see substantially more pilot plant work done to increase the confidence level of the recovery.**

3. The Hazen report quite clearly states the uncertainty of the cyanide consumption figures in their tests and recommends further work to establish this important number. Here again, more comprehensive pilot plant work would allow better estimation of this quantity.



The Hazen report gives cyanide consumption figures of 1.3 - 2.8 kg/t. Currently, cyanide costs approximately \$2/kg so you are looking at **operating costs of \$2.60 - \$5.60 per tonne of ore milled**. This is a very significant component of the overall plant costs. Of further concern is the availability of cyanide and the resulting pressure on price. Brenda's suppliers are talking of price hikes to the \$2.50 to \$3.00 per kg level.

4. **The Arseno Process is commercially unknown** and it will take a great deal more work to convince me that all of the design and scale up criteria are firmly established.

In the Hazen report, they discuss a need for close control of the process feed pulp density, nitric acid addition, and sulfide - sulfur analysis in order to ensure the oxidation reaction is complete while at the same time ensuring the nitrate level in the effluent is minimized. While the former two are straight forward measurements, an on stream measurement of the latter is not. This factor, too, leads me to want to see more pilot scale testing.

Finally, the Hazen report refers to potential jarosite and gypsum scaling problems which were encountered in their tests. The magnitude of this problem and its influence on plant design criteria should be studied in a more extensive pilot plant run.

To summarize the metallurgical concerns, the proposed process is commercially unproven and the work completed to date is, in my opinion, totally insufficient for the purpose of plant design. I would recommend more pilot scale tests be conducted on a volume of ore sufficient to approach what can be considered representative of the 27,000,000 tonne orebody.

- **Reserves / Grade Issues**

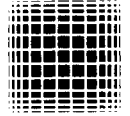
I have no comments about this issue as it is outside my area of expertise. I include it in this memo only for the sake of completeness.

- **Power Costs Issues**

The City Resources people claim that they will generate electrical power for \$0.03 per kilowatt-hour. This is extremely low given that BC Hydro charges a similar amount to Brenda. It is difficult to believe they could match that same price themselves. Given that power is such an important cost component of the milling operation, I would want to have this checked by an expert, perhaps two.

- **Haida Indian Issues**

Based on the environmental consultants' view, this represents the critical issue in the environmental impact study, and as such, deserves separate



comment. The public relations work which has been completed to date is impressive. It is quite clear that this is an emotional issue, but I came away from the meetings with the consultants with the impression that this is a winnable situation. It was suggested that someone talk to Macmillan Bloedel who are already working in the area to get their assessment.

I am tainted by the newspaper reports of previous Haida Indian confrontations in the Queen Charlottes, so my opinions are subjective. Given their apparent ability to allow or veto a production decision **I would suggest an independent evaluation of the likely acceptance by the Haida.**

In **summary**, there is probably six months to a year of pilot plant work that needs to be done to confirm the metallurgy of the deposit and to generate acceptable design criteria. In parallel to this, the environmental design criteria need to be confirmed. Some of the information from the pilot plant will be required for this.

I would suggest that engineering design would have to await the completion of most of the pilot plant work. This introduces a potential one year time delay in the project and there is no guarantee the results will be positive.

Any one of the risks associated with this deposit could prevent it from proceeding. I do not think these can be properly assessed without more time and money being spent, especially on the metallurgical questions. **I would suggest that any investment be limited until such time as the risks are reduced to an acceptable level.**

R. Bradburn