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Mr. Bill Dunn, P.Eng.
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Dear Mr. Dunn:

Re: Geotechnical Review of Faro and Vangorda Pits

INTRODUCTION

As requested, Piteau Associates Engineering Ltd. has completed a review of geotechnical concerns in the Faro and Vangorda Pits. This review and letter report follow similar reviews conducted in the past; the most recent letter report is dated July 5, 1992.

Mr. A. Stewart visited the mine site on July 30 and 31, 1992. During that time, geologic mapping was reviewed, inspections of the pit walls were made, and results of ongoing pit monitoring were reviewed. Discussions were held with mine personnel regarding these matters.

The following summarizes the results of the geotechnical review. Some general aspects which have already been covered in previous letter reports will not be repeated herein.

FARO PIT

General

At the time of the site visit, mining had been completed in the Faro Pit and some flooding of the pit bottom was occurring. The only activity in the pit was that related to servicing the underground mining, which is due to cease operations at the end of August 1992. Preparations were being made to commence depositing tailings into the mined out pit. Since the previous site visit, spring runoff had reached its peak and flows had receded considerably.

Slope Monitoring

Since our July 1992 report, only five prisms have been monitored on a regular basis. In this regard, one prism in the calc-silicate area and four prisms in the south slump area have been monitored every two or three days on average.

Results of monitoring in the south slump area indicate that Prisms 27, 30, 32, 33 and 35 experienced peak movement rates of about 75 to 125mm/day in the last week of June. Since that time, movement rates have decelerated to between about 30 and 75mm/day. It is understood that the frequency of rockfalls has also decreased noticeably in the last few weeks. In the calc-silicate area, movement of Prism 19A has gradually slowed from a maximum of about 50mm/day to about 30 to 35mm/day since late June.

Based on the monitoring results, and on the lack of mining in the pit, it is recommended that the monitoring frequency be reduced even further. A frequency of about every seven to ten days for a few key prisms is probably adequate to maintain a general record of slope movement on the east wall.

"AY" and "M" Targets

Other than the apparent likelihood that it will not be economically feasible to mine the "M" target, no new information regarding these two target areas was obtained. The comments and recommendations contained in our report of July 5 are still valid.

VANGORDA PIT

General

At the time of the site visit, mining in the Vangorda Pit had been completed to the 1092m elevation and was progressing on the 1086m level. Overburden mining was complete. While flow in the Vangorda Creek diversion flume had decreased markedly since the last site visit in mid-June, some leakage was observed from the flume. Considerable seepage was being intercepted by sumps along the western side of the pit bottom. Mr. Dennis Brown was continuing detailed geologic mapping of the pit walls. However, as it is understood that he will only be at the mine until the end of August, it is recommended that another geologist be assigned geologic mapping duties.

With regard to the pit design, it is understood that a minor change has been made to the safety berms. Rather than tapering the benches where elevation changes were to be incorporated, the benches have now been altered such that full bench widths are maintained at any given bench level. The north and east walls of the pit will have a continuous safety berm at the 1086m level. It is also understood that the pit completion date has been revised to the middle of February 1993.

Cross Fault

No additional information beyond that discussed in our July 5 report is available for the Cross Fault. Thus, the comments and recommendations contained in the previous report are still considered to be valid.

Northwest Fault

Since our last letter report of July 5, additional mapping in the area of the Northwest Fault has determined that two separate faults actually exist. Based on the recent site inspection and discussions with Dennis Brown, it would appear that the originally defined fault is a strike slip fault that strikes approximately north/south and dips subvertically to the east. While the fault is characterized as a highly broken fault zone that is estimated to be an average of 50m wide, it is likely that the fault pinches and swells, both down dip and along strike. As previously determined, this fault intersects the bench on which the Vangorda Creek flume is located at the point where the relocated portion of the flume joins the original flume alignment. However, the fault now appears to intersect the west wall of the pit 50 to 100m further south than originally thought. As previously observed on the west wall, downward movement of the eastern fault block has dragged and folded the phyllite such that the S2 foliation now dips up to 30 to 35° eastward (i.e. out of the west wall) rather than about 20 to 30° westward as is typical of the regional S2 foliation dip.

The second fault in the area appears to strike subparallel to the north wall of the pit and dip about 60° into the pit, having an estimated dip direction/dip of about 125/60. This fault, which to date has only been seen to cause breakback of a few bench faces on the north wall, is thought to be the dip slip fault that truncates the Vangorda orebody at the north end of the pit. The width of the fault is estimated to be about 20m; however, as for the other fault, it likely pinches and swells along strike and down dip. Field observations indicate that this fault is older than the subvertical strike slip fault.

Within and northwest of the two fault zones, the rock appears to be relatively broken, with the orientation of the S2 foliation being erratic and contorted. Two dominant orientations are a 30° to 40° dip into the pit and a 15° to 40° northeast dip along the north wall. This area of the pit also appears to be very wet.

Although there are two faults in the north wall of the pit, rather than just one as originally anticipated, the influence that these faults could have on the stability of the pit slopes does not appear to be significantly different than that discussed in our last report. That is, one or both of these faults is

expected to intersect the north and northwest portions of the main haulroad from about elevation 1074m to about elevation 1060m. In terms of pit wall stability in this area of the pit, it is likely that the portion of the slope below the haulroad will deteriorate rapidly, possibly resulting in some breakback of the haulroad. However, as this portion of the pit slope is only in the order of 30 to 40m high and will not be developed until the late stages of mining, the consequences of instability are felt to be manageable. For example, it may be necessary to restrict traffic to single lane in the northwest corner for a short period of time, or to slow mine development in that corner of the pit until the ground freezes in winter. Above the haulroad in the northwest corner of the pit, the overburden slope has been dozed to a relatively gentle angle. While instability in this area and in the north wall underneath the creek flume does not appear to have been a significant problem to date, about 30 to 35m of slope height is still to be exposed before the haulroad is established. As the rock mass in this area is expected to be highly fractured, possibly with adverse S2 orientations, continued mapping of this portion of the pit slope is recommended. To minimize instability in this area, it will be most important to use careful control blasting and excavation techniques and to avoid overdigging the bench faces. Every effort should be made to establish a full width safety berm at the 1086m elevation, as this berm will be the last catchment above the main haulroad.

The potential for either of the two Northwest Faults and the Cross Fault to intersect and form a large scale wedge failure appears low.

West Wall Overburden Slope

As previously discussed, the glacial till overburden/bedrock contact on the west wall of the pit is between about the 1104 and 1110m elevations, resulting in a benched overburden slope up to about 30 to 35m high. The northernmost portion of the west wall overburden has been dozed to a relatively flat angle and should not pose any stability problems. However, the west wall in the area between about Sections 2E and 7E has not been flattened and remains oversteepened and susceptible to slope failures in the overburden, particularly where the phyllite has been folded by the Northwest Fault and the S2 foliation dips into the pit at 30 to 35°.

North of Section 4E, a berm has been established at the 1110m level, while south of Section 8E, there is a safety berm at the 1104m elevation. Between Sections 4E and 8E, no effective safety berms have been established between the pit crest and the 1092m level, and it appears that the slope has been steepened slightly since the last site visit. However, a 12m wide safety berm is to be left along the west wall at the 1092m elevation, which is about 10 to 20m above the main haulroad that will be in use throughout the remaining life of the pit. Some

cracks and settlement were observed in the overburden along the west wall, although most did not appear to be fresh.

The provision of a safety berm at the 1092m level should provide reasonable catchment for small failures from the overburden, particularly after freeze up. However, the potential for a failure large enough to spill over the safety berm onto the haulroad cannot be discounted. Thus, it is recommended that visual monitoring of the overburden slopes be conducted on a regular basis. In this regard, the survey base station at the crest of the west wall should be a suitable location to conduct such monitoring. Depending on the results of the visual monitoring, and access to the slope, the use of prisms could also be considered.

East Wall

The east wall of the Vangorda Pit appears much the same as that observed during previous site visits. While a portion of the slope seems somewhat ragged, and berm widths are limited in some areas, it also appears that the recently established 1104m safety berm is performing well. The steeper than average S2 foliation that is present on some of the benches (i.e. up to about 50° dip), and to which some of the bench faces are breaking back to, appears to be continuing, rather than flattening as anticipated during our last site visit. Some blasting difficulties, in the form of hard toes, have been experienced; however, blasting damage to the east wall appears to have been kept to a minimum.

Since the last site visit, the loose boulders that were observed near the pit crest have been scaled from the slope. The only potential bench scale failure that was noted is a 20 to 30m long wedge between about the 1110 and 1120m levels. This feature appears to have an apparent plunge of about 45° to 50°, and would likely fail as a number of small blocks, starting at the southern end of the wedge. While it is anticipated that most, if not all, of the debris from this wedge would be retained on the 1104m safety berm, it is possible that some rubble would spill to the pit bottom. Thus, it is recommended that the wedge be monitored. If possible, Prism 5, that is presently positioned upslope of the wedge, should be relocated to the top of the wedge near its southern end. Visual monitoring of this block should also be conducted on a regular basis, particularly following blasts in the area and if access is not sufficient to allow Prism 5 to be relocated.

Vangorda Creek Diversion Bench

As discussed in our letter report of July 5, the bench on which the Vangorda Creek diversion flume is located generally appears to be in good condition. No specific stability concerns are apparent at this time.

Slope Monitoring

Five prisms were installed between the 1130 and 1152m elevations on the north and east walls of the pit in early July. While initial monitoring results indicate that no slope movement is occurring, very little data has been collected on which to base this preliminary conclusion. As previously discussed, visual inspections of the pit walls, particularly of the flume bench and of the west overburden slope, should be carried out on a regular basis and after any blasts. The need for additional prisms should be evaluated on an ongoing basis.

I hope the above is sufficient for your needs at this time. If you have any questions concerning the above, please do not hesitate to contact us.

Yours very truly,

PITEAU ASSOCIATES ENGINEERING LTD.

Alan F. Stewart, P.Eng.

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