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- RGC REPORT NO 111001/7

DAM INSPECTION – December 2007
• TAILINGS DAM REVIEW BOARD REPORT NO 7
• MARLIN PROJECT, GUATEMALA

Prepared by Dr. Andrew M. Robertson P.Eng.

Final Report submitted April 5, 2008

Upstream face with tailings spigot line

Downstream Phase 2B raise filter zones

1.0 TERMS OF REFERENCE

This Review Report summarizes the observations, conclusions and recommendations of the writer as a consequence of a site visit and inspection of the Tailings Storage Facility and appurtenant structures (TSF) and Waste Rock Facility (WRF) being operated at the Marlin mine, Guatemala. This report is the seventh in a sequence of review reports issued during on-going review of the evolution of the dam design and construction. It documents the results of a site inspection and review of dam raising, construction control, monitoring and 'as built' record preparation completed to the tine of the visit made from December 12 to 14, 2007. This report should be read in conjunction with Reports No 1 through 6 which document reviews performed during facilities investigation, design, initial construction and early operation.

Montana Exploradora de Guatemala, S.A. (MEG) operates an open pit and underground gold mine in northwestern Guatemala. The mine began processing of ore in October 2005 at an initial nominal rate of 4,100 tons per day and is progressively increasing production to a planned 5,000 tons per day in a conventional mill utilizing cyanide leach and Merrill-Crowe gold recovery. Tailings from the process are treated with sulfur dioxide to achieve cyanide destruction prior to deposition in a tailings impoundment formed by a 38 m high valley rockfill starter dam which is raised progressively from the Phase 1 crest at 1926 m to a final elevation of 1954 m (80 m ultimate toe to crest height) during the 10-year mine life using mine waste rock placed in downstream staged raises.

The tailings dam and appurtenant structures were designed by Marlin Engineering & Consultanting, (MEC) and the general design and construction specifications were reviewed during previous review meetings. The starter dam (Phase 1) had been constructed to elevation 1926 m in early 2006. Construction of the Phase 2A dam raise was under construction at the time of the previous dam inspection by the author (November 2006), when it had reached an elevation of 1936 m (see Report No 6).

In early 2007 the Engineer of Record for design and construction supervision changed from Mr. Rob. Dorey of MEC to Mr. Clint Stachan of MWH Consultants. MWH took over responsibility for further design and dam development supervision when the Phase 2A raise had reached elevation 1940. MEC continued to provide field supervision and instrumentation installation services during a period of transition and remains responsible for the decant structure until the completion of the Phase 2B dam raising. Phase 2A construction was completed in November, 2007, to a crest elevation of 1948 and Phase 2B is under construction.

The Phase 2B raise was previously intended to be to 1946 m elevation by June 2007 and the final Phase III construction phase intended to raise the crest to its ultimate elevation of 1952 m by 2011. Construction material shortfalls have resulted in modifications to the construction schedule, such that construction is essentially continuous with the crest being raised in a greater number of incremental steps to achieve adequate freeboard ahead of the raising pond elevation.

MEG has retained the writer as an independent expert to perform a review of the tailings impoundment constructed for the Marlin mine in compliance with the principles established in the IFC/World Bank guidance and operating principles OP 4.01 Annex D and OP 4.37.

In terms of OP 4.37, a Tailings Dam Review Board is required to review the development of the dam designs, construction and initial dam filling. The writer constitutes the Review Board to satisfy the terms of this OP.

The documentation provided to the writer for the purposes of this review was substantially the construction records available on site and discussions with the Mr. Clint Strachan, as well as MEG and MWH personnel responsible for tailings impoundment construction (Juan Vasques).

The site inspection and review comprised a three day site visit (December 12 to 14, 2007), and included an extensive tour of all TSF and WRF facilities. Photographs of key elements, taken during this site inspection, are included in Appendix A. In addition to meeting with Clint Strachan and Juan Vasques on tailings dam matters, meetings were held with MEG staff responsible for mine planning and waste rock construction material provision, waste rock acid rock drainage (ARD) classification, and water quality management (Andrew Tripp, Herman Paz and Lisa Wade) as well as a representative of the company (Veolia) designing the tailings pond water treatment plant.

A debriefing on the writers findings from this review was presented on December 14, 2007, to the Mine Manager, Sergio Saenz, as well as the Engineer of Record, Clint Strachan, and a set of review meeting notes provided to MWH and MEG summarizing the writers observations and findings. A copy of these notes is attached as Appendix B. This report is essentially an expansion of these notes.

The meetings were held in an open and frank manner and all information available on site was made available to the writer. A number of reports and documents relating to design analyses and designs were not available on site and these are requested for review by the writer.

The TSF and WRF continue to be designed and operated in accordance with good international standards of engineering practice by a staff with adequate experience and under a management structure and oversight appropriate to structures of this nature.

Of critical importance is the requirement to complete a water treatment plant in a timely manner to allow discharge of treated tailings water in accordance with the dam water balance determinations. The design engineers responsible for facility design and construction supervision (Veolia) were present on site during the time of this inspection and indicated that a treatment facility, capable of appropriate treatment efficiency could be completed to the required.

2. SITE INSPECTION AND REVIEW ACTIVITIES

The writer flew to site on the 12th December and was briefed by Clint Strachan and Juan Vasques on the changes and progress on TSF development. This was followed by a site inspection of the TSF and an overview of the WRF, and then a review of drawings showing design changes and discussions regarding these changes as well as a review of construction QA/QC records. On the 13th, a second site inspection was made to complete of aspects of the TSF and the proposed new water dam location; the WRF including acid rock (ARD) disposal and the ARD field cell test location. This was followed by meetings with MEG staff on waste rock classification and water quality treatment. The rest of the day was spent reviewing construction drawing details and in the preparation of a set of notes on key observations and recommendations, a copy of which is included as appendix B. No additional design or analyses documentation was provided for review.

The reports documenting design changes and analyses, as well as as-built reports were not available on site or are under preparation. *The writer looks forward to receiving copies of all such reports prepared since December 2006 for review prior to the next site visit and inspection.*

A brief review of the field inspection and photographic record follows.

TSF

The tailings impoundment was reservoir was observed (Photo 1 – appendix A) and high algae content resulting from ammonia concentrations noted. Discharge of such water, without treatment for the ammonia, would result in algae blooms in the receiving stream and MEG is is in the process of having water treatment facilities designed and installed in time to achieve water treatment when discharge will be required. Water evaporators were operating (Photo 1 and 2) to reduce water accumulation, such that discharge can be avoid until treatment facilities have been installed.

The existing water reclaim intakes and pumps were observed. These will be replaced with pumps mounted on a floating barge (Photo 18) and the barge relocated in the next inlet on the right flank of the impoundment further from the tailings embankment. This change of location allows for more effective tailings beech development against the upstream face of the embankment and reduces the need for sediment control and flocculent addition required at the current location.

The crest of the dam at El 1948 was observed (Photo 4) with the installed tailings distribution line and spigots allowing uniform discharge along the entire face of the dam. The dam crest has been constructed to 2 m higher than originally scheduled to provide additional freeboard and storage. The absence of beach development was noted and this air drying is limited and this partly responsible for the low tailings densities being observed in the impoundment.

The decant intake was observed (Photo 5) with the stop-log sill set at 1939. The maximum elevation of sill that can be achieved with the current structure is 1942 and foundation preparation for extending the decant was observed. It was understood that this addition would be completed within 6 weeks to meet water storage capacity requirements and available as a result of the 2 m overbuild of the embankment.

Instrumentation installation had been completed in the form of survey monuments (Photo 6) and a seismometer (Photo 7) on the dam crest. A second seismometer is installed at the instrument hut on the right abutment. Installation of the fibre optic cables to the vibrating wire piezometers installed in the embankment (Photo 11) was observed. All installation measures and methods are considered appropriate.

The downstream construction of the Phase 2B shell was inspected (Photos 8, 9 and 12) as well as exposed Phase 2A shell material under the bolder surface (Photo 13 &14). The high fines content of the Phase 2A shell rockfill was noted. This has been discussed in previous review reports, and tests have previously been completed by MEC to demonstrate that the higher fines fill has shear strength properties which meet design requirements. The nature of rockfill being placed during the inspection is seen in Photo 12 and comprised large boulders with sand fines. The sand fines were generally less than that seen in the photo. Some of the boulders exceeded the specification limits and these would be pushed off the layer and onto the dam backslope, as is seen in photo 13. *The amount of large boulders included in thee fill being placed at the time of inspection was considered excessive and more selective loading, with exclusion of the boulders, is recommended at the quarry or mining site.* The transition zone material would not meet filter criteria against this coarse bolder rockfill. *Such coarse rockfill should only be placed well downstream from the transition layer.*

The Phase 2B core, filter and transition zones had been raised in advance of the shell zone material (Photo 10 and 11). Materials and placement methods were appropriate.

At the embankment toe seepage collection pond it was observed that drainage from the dam underdrain was very small (Photo 15) and it is apparent that the foundation grout curtain and dam core are effective in controlling seepage. Seepage flow through the V notch weir downstream from the dam was observed to be very small (Photo 17).

The seepage return pumpback system had been relocated from its original position near the downstream cut-off to pump directly from the seepage collection sump (Photo 16). *This pumping system should be upgraded to a permanent facility.*

During inspection of the tailings flume it was seen that the flume wall height had been increased and modifications made at drop box’s (Photo 19) to prevent spillage. Additional modifications were in progress to ensure the adequate function of this flume. It is noted that any spillage from this flume drains into the impoundment.

Water Dam

The proposed location for the water dam, in the valley adjacent to the right flank of the TSF, was inspected and the geotechnical investigation foundation drill that was in progress noted. An inspection of the creek bed at the centerline location (Photo 21) revealed the presence of shallow bedrock.

WRF

Inspection of the WRF indicated that the base drain had been constructed (Photo 23) and the WRD was being constructed in lifts (Photo 22). MEG is to be commended for the advances made since the last review meeting. Development was achieved under difficult access and production conditions, and is now effectively implemented.

Older side slope waste deposits appear in many locations to be marginally stable with some shallow slumps and deformation flows occurring (see Photo 24). MEG are controlling impacts of such slumps with toe berms and slumped material removal. Further slumping can be anticipated and this poses a hazard to traffic on roads located below such dumps, particularly during the wet season. *It is recommended that a detailed stability evaluation be made of all these side hill waste rock fills to ensure that they meet acceptable stability criteria and that adequate drainage is provided to prevent pore water pressure induced failures.*

The placement of acid generating waste rock in cells with clay encapsulation was observed (Photo's 25, 26 and 22). The clay cover was being compacted. While some cracking of the clay covers were observed (Photo 26) it expected that under the dump pressures and moisture conditions such cracking will 'heal'.

The site of the ARD field cells was visited (Photo 27) and it was noted that while cells are appropriately constructed, there was only a very small test program. *It is recommended that this program be expanded to better understand and characterize the waste ARD characteristics for this mine.*

3. TAILINGS STORAGE FACILITY

3.1 Change of TSF EOR and Designers

During 2007 the consultants responsible for TSF and WRF was transferred from MEC to MWH. Handover of site control was made in February 2007. Juan Vasques is the Responsible Engineer on site and provides continuity of dam construction supervision. The Engineer of Record for the dam has passed from Mr. Rob Dorey of MEC to Mr Clint Strachan of MWH.

To transition the responsibility handover from MEC to MWH, MEC and Dorey would complete Phase 2A construction and prepare the as-built report and Phase 2B would be by MWH. It is understood that MEC are preparing the Phase 2A as built report and *the writer requests a copy for review when this becomes available.*

3.2 Design

Additional FLAC analyses have been performed by MEC and MWH to check deformation with revised post failure yield criteria. Additional cyclic shear testing to check dynamic deformation parameters have been completed. Deformations reduced but are still substantial. There is some reduction in the required widening of filter/drain zones in Phase 2 and 3 dam. It is understood that MWH are proceeding with additional deformation evaluations. It is r*ecommend that the these analyses be review by Dr. Peter Byrne who has previously reviewed the deformation analyses induced by seismic events for this dam.*

MWH have reviewed and approved/accepted MEC design.

Some changes have been made by WWH to material grading specs. These were reviewed and considered appropriate except for the filter where fine limit below #100 mesh should not be relaxed unless the coarse part of curve has a greater coarse fraction. Inspection of the grading curves for provided filter material show both adequate coarse fraction and fines to meet the old spec. Inspection in the field shows high fines, and results in some concern regarding its permeability. The writer considers the old spec as preferable unless *permeability testing on high fines samples indicate these to be suitable..*

MWH have implemented a change to compaction criteria to what is effectively a method spec. This is considered appropriate subject to periodic in-situ density testing.

There has been a design change to return pond pumping system (Photo 16). The writer questions if the reliability the installed system and of standby capacity is sufficient for high precipitation events.

The proposed changes to the pond water reclaim system and location is appropriate (Photos 2 and 18). Consideration should be given to installing a skimming box around the pump intakes to allow return water to be skimmed from the top if the pond. New inlet OK, barge OK – consider decant box under pumps. Consider can also be given to cutting a trench up the center of the valley in which the barge is located allowing the barge to retreat up the trench as pond water level rises. This facilitates easy access to the barge and allows addition sediment control within the trench.

3.3 Construction

Stage 2A construction is complete (Photo 4) and Stage 2B is underway (Photos 8, 9, 10, 11). The writer has requested a copy of the Stage 2A as-built report, when available.

The TSF Monthly Reports were reviewed and found to be appropriate, are generated in a timely manner and include appropriate checks.

The Dam embankment has been raised to by 2 m more than Stage 2A design (to El 1948 by Nov 2007). Stage 2A decant sill (Photo 5) has a limit of 1942 and the extension needs to be constructed before advantage can be take of the 2 m of additional dam height. Stage 2B decant raise construction is scheduled to start January and be completed by April. *Timely completion is critical to having the additional 2 m capacity available for storage at onset of rains in 2008*.

Rockfill for shell is still a critical material supply constraint. Field observations show some benches on 2A raise are essentially soil fill (Photo 13 and 14). Some Rockfill is being provided from special quarry*. It is essential that a high level of effort be maintained to achieve rockfill requirements.*

Some rock fill is very poorly graded, large boulders with sand (Photo 12). More selection at quarry recommended. Lifts appeared in excess of 1 m specified (Photo 12). *More care in fill layer thickness is needed.*

The boulders pushed onto the back slope of the dam pose a work hazard, particularly during wet weather (Photo 9 and 13). *Safe working practices should be developed and implemented.*

The left abutment valley drain is very large and it was observed that the filter was not continuous adjacent to the core zone. *This needs to be evaluated and extend where necessary*

3.4 Performance assessment

Tailings density in the impoundment has been determined to be 0.83 t/m3 compared to 1.42 that was the design basis. This results in more entrained water, a higher mudline and shallower water cap. It requires more rapid dam construction, additional dam capacity and results in reduced water cap depth and volume for reclaim water management and contaminated water treatment management.

Tailings tested for design and those produced to date have different properties. Now that production tailings are available *new testing of settling and consolidation characteristics are recommended followed by finite strain consolidation modeling to more accurately model final tailings densities and dam raising and capacity requirements..*

As beaches develop, advantage can be taken of evaporative drying on beaches to improve deposit density. The potential beach sizes vary with water management and tailings deposition strategy. *Hence there is a need for the optimization of the discharge pattern and water retention and treatment strategies and these should be developed by MWH.*

Flattening of tailings was observed during the recent earthquake. *The potential effect of liquefaction and flattening should be taken into consideration for establishing operating procedures and the final closure surface.*

Water balance modeling currently being done is not calibrated for all known parameters and changes from design values*. Coordination between the MEG Goldsim modeller and MWH water balance modeller, and incorporation of measured tailings/water delivery and reclaim water flows is urgently required.* A calibrated model will allow future performance to be more realistically modeled and this is needed for dam and decant raise planning as well as final dam capacity determination.

Water quality indicates concentrations above discharge limits of CN and Hg. Treatment is required – see section 6.

The intense algae bloom in the tailings pond was noted (Photo 1 to 4). *The potential for the discharge standard of 10 ppm Nitrates in discharge water being an issue for downstream stream appearance should be investigated.*

The dam instrumentation indicates good performance, well within design limits. The most recent earthquake felt at the mine site did not trigger the seismometers*. A reset of the seismometers to record lower intensity events should be considered.*

Extension of the tailings pipeline to left abutment should be done to allow beach development.

4. WATER DAM

4.1 Responsibility

The need for a water storage dam (WSD) has been identified by MEG. The Responsible Engineer is Juan Vasques. This will be located adjacent to the TSF in the valley adjacent to the right flank ridge. The EOR for dam design is Clint Strachan and the designers MWH.

3.2 Investigation

The proposed program of geotechnical and hydrogeological site investigation was reviewed. It is considered appropriate for geotechnical engineering purposes but packer testing for *Hydrogeological testing should be expanded to determine the need and nature of a grouted cut-off.*

2.3 Design

It is understood that the design will allow storage of contaminated treated water and possible future tailings storage. The water balance will be integrated with the TSF. The lessons learned for grouting at the TSF should be applied to the WSD.

5. WASTE ROCK FACILITY

5.1 Responsibility

The Responsible Engineer is Carlos Batista (MEG). The designer is MEC. The EOR is Clint Strachan. A geotechnical engineer is joining the staff of MEG in January and will be responsible for WRF stability assessment.

5.2 Failures

A slump of upper dump has been experienced (Photo 24) and no further dumping or toe excavation will be made without an ngineering assessment.

Some cracks were observed in the ditch terrace draining water from mine entrance terrace to the right the valley flank*. These cracks should be periodically observed to determine if they develop further. If they progress then slope stabilization may be required*.

The slope behind the mine shops has been evaluated for stability and design developed for cutting it back. This was being implemented during the site visit and is considered appropriate.

5.3 Construction

MEG are to be commended for the improvement in dump development. The base drain (Photo 23) is in place. The dump is being constructed in benches (Photo 22).

The placement of acid generating waste in cells and covering with compacted clay layers was observed (Photos 25 and 26). Modest cracking in the clay cover is expected to heal under the load and moisture conditions that will develop in the WRF. The encapsulation work is considered to be excellent.

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6. WATER TREATMENT PLANT

6.1 Water Treatment Management

Water quality management is the responsibility Herman Paz and Lisa Wade (MEG).

A water treatment plant is being designed and installed by Veolia. It is understood that they are developing designs that can be implemented in a manner that will provide treatment capability and capacity at the time when first discharge is required. The basis for design and schedule was not reviewed by the writer. The urgency for the completion of this plant is well understood by MEG.

6.2 Design

Veolia have prepared conceptual designs for water treatment plant for CN oxidation and Hg removal by co-precipitation during clarification or carbon loading circuit.

6.3 Construction

Foundation slab construction is to commence January 2008 and construction of the treatment plant by February 2008. Plant is to have treatment capacity by April and be completed by June 2008

A contingency treatment plan is recommended with Aquasil addition and a pumped discharge to either a settling/polishing pond or to the treatment plant facilities prior to discharge..

7. ARD CHARACTERIZATION

While the field cell (barrel tests) were observed, time did not permit a detailed review of the ARD classification program and results. Some revisions in procedures were discussed and a brief review was made of results. *In addition to the parameters of concern identified previously by MEG, the writer suggests that concentrations of F and Mo be evaluated.*

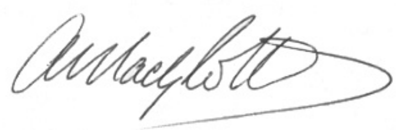
8.0 NEXT REVIEW MEETING

It is recommended that the next review meeting be undertaken in approximately six months. This will allow time for the development of the water dam design, implementation of the water treatment plant etc.

A inspection and review meeting has been tentatively scheduled for August 14 to 16, 2008.

We would welcome the opportunity of answering any questions you may have with respect to this report.

Yours truly



Dr. A. MacG. Robertson. P. Eng.
President – Robertson GeoConsultants Inc.

APPENDIX A – PHOTOGRAPHS

PHOTO 1 – Tailings impoundment from right flank. Embankment at right, mid-height.

PHOTO 2 – Current tailings water reclaim pumps and intakes

PHOTO 3 – Vaporizing tailings water to reduce water accumulation

PHOTO 4 – Upstream crest (1948 m) of dam with tailings line and discharge spigots

PHOTO 5 – Left abutment with stop-log decant sill set at 1939 (max 1942) with foundation preparation for construction of extension. Adjacent test tank for water treatment testing

PHOTO 6 – Survey monument on dam crest

Photo 7 – Container housing seismometer on dam crest

Photo 8 – Downstream toe showing Phase 2B raise rockfill (grey) over valley base under drain

Photo 9 – Rockfill layer (grey) being placed on downstream shell zone

Photo 10 – Phase 2B core, fine filter and transition zone on bench ahead of d/s shell

PHOTO 11 – Trench in core zone carrying optical cables from piezometers

Photo 12 – Large boulders and sand fines in rockfill

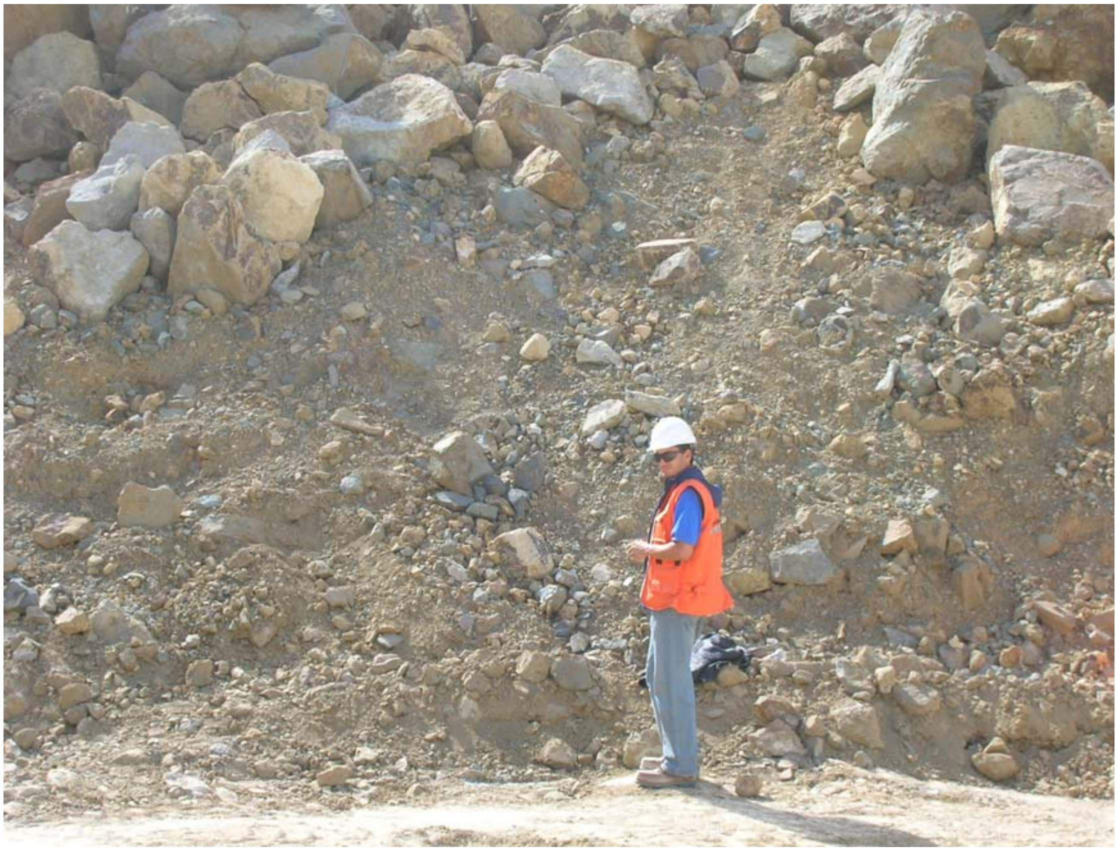


PHOTO 13 – Typical d/s shell fill after stripping of surface boulders

PHOTO 14 – High fines content of d/s rockfill

PHOTO 15 – Seepage return pond showing low drainage rate from dam drain system

PHOTO 16 – New seepage return pump system

PHOTO 17 – Very low flow through V notch weir at d/s cut-off wall

PHOTO 18 – Barge for replacement tailings water reclaim system

PHOTO 19 – Tailings flume with raised side walls and improved drop boxes

PHOTO 20 – Geotechnical investigation drill on proposed water dam centerline

PHOTO 21 – Bedrock exposed in stream on water dam centerline

PHOTO 22 – Waste Rock Facility (WRF) being developed in benches from bottom up

PHOTO 23 – Toe drain for WRF

Photo 24 – Slump of waste rock slope on upper bench

PHOTO 25 – Zone of clay covered acid generating waste rock

PHOTO 26 – Additional layer of ARD rock being placed. Note cracking of clay cover

Photo 27 – ARD of field cell (barrel) ARD testing.

APPENDIX B

SITE SUMMARY NOTES
MARLIN MINE – ANNUAL TAILINGS DAM & WASTE DUMP REVIEW
December 12 to 14, 2007

1. TAILINGS STORAGE FACILITY

1.1 Change of TSF EOR and Designers

- Responsible Engineer is Jan Vasques
- TSF design transferred to MWH
- EOR for TSF transferred to Clint Stachan

- Handover from MEC to MWH and Dorey the Strachan complete and effective (Phase 2A by MEC - Phase 2B by MWH) *Request Phase 2A As-Built report by MEC for review.*

1.2 Design

- Additional FLAC analyses performed by MEC and MWH to check deformation with revised post failure yield criteria. Additional cyclic shear testing to check dynamic deformation parameters. Deformations reduced but still substantial. Need for widened filter/drain zones in Phase 2 and 3 dam reduced. *Recommend review by Dr. Peter Byrne. In addition MW to do deformation evaluation.*

- MWH reviewed and approved/accepted MEC design.

- Some changes made to material grading specs. OK except filter where fine limit below #100 mesh should not be relaxed unless coarse part of curve has more coarse fraction. Inspection of grading curves show both adequate coarse fraction and fines meeting old spec. Inspection in field shows high fines, some concern with permeability - old spec probably ok. *Suggest permeability test on high fines sample.*

- Change to compaction criteria – OK – field placement essentially based on a method spec.

- For water treatment plant design see 4. below

- Seepage return pond pumping system change – standby may not cope with high precipitation events – check quality and discharge criteria

- Reclaim water system change – new inlet OK, barge OK – consider decant box under pumps. Consider reclaim trench.

1.3 Construction

- Stage 2A complete – Stage B starting. Stage 2A as-built report by MEC complete but still to be reviewed – have requested a copy.

- Monthly reports appropriate and generation rates timely with appropriate checks.

- Dam raised to by 2 m more than Stage 2A design (to El 1948 by Nov). Stage 2A has limit of 1942 on decant and needs to be raised before advantage can be take on additional dam height. Stage 2B decant raise scheduled to start January and be completed by April. Timely completion is critical to having the additional 2 m capacity available for storage at onset of rains in 2008.

- Rockfill for shell still critical material supply. Field observations show some benches on 2A raise essentially soil fill. Rockfill being provided from special quarry - Essential that high level of effort be maintained to achieve rockfill requirements.

- Fill placement observed. Some rock fill very poorly graded, large boulders with sand. More selection at quarry recommended. Lifts appeared in excess of 1 m specified. More care in fill layer thickness needed.

- Safe working conditions – bolder hazard

- Side valley drain massive – filter not continuous under core zone – need to evaluate and extend where necessary

1.4 Performance assessment

- Tailings measured at 0.83 t/m3 compared to 1.4? which was the design basis. More entrained water and higher mudline, shallower water cap. Requires more rapid dam construction, potentially additional dam capacity and results in reduced water cap depth and volume for reclaim water management and contaminated water treatment management.

- Tailings tested for design and those produced to date have different properties. Now that production tailings are available new testing of settling and consolidation characteristics are recommended followed by finite strain consolidation modeling to more accurately model final tailings densities.

- As beaches develop, advantage can be taken of evaporative drying on beaches to improve deposit density. The potential beach sizes vary with water management and tailings deposition strategy. *Hence there is a need for the optimization of the discharge pattern and water retention and treatment strategies – to be developed by MWH.*

- Flattening of tailings observed during

- Water balance modeling not calibrated for all known parameters changed from design values. Coordination between MM Goldsim modeler and MWH water balance modeler with measured tailings/water delivery and reclaim water flows urgently required. Calibrated model will allow future performance to be more realistically modeled and this is needed for dam and decant raise planning as well as final dam capacity determination.

- Water quality indicates concentrations above discharge limits of CN and Hg. Treatment required – see section 4.

- Note intense algae bloom. Question – will 10 ppm Nitrates in discharge water be an issue for downstream stream appearance? – investigation needed.

- Instrumentation indicates good performance – seismometer reset?

- Tailings delivery line performance – extension of pipeline to left abutment for beach generation. Beach location influence on discharge water quality

2. WATER DAM

2.1 Responsibility

- Responsible Engineer is Juan
- WD designers are MWH
- EOR is Clint Strachan

2.2 Investigation

- Planned OK but suggest more permeability testing

2.3 Design

- Design should be good for both contaminated (treated) water and future tailings
- Water balance to be integrated
- May not need such an extensive grout curtain

3. WASTE FACILITY

3.1 Responsibility

- Responsible Engineer is Carlos Batista
- WF designer is MEC
- EOR is Clint Strachan
- New Geotech Engineer coming January

3.2 Failures

- Slump of upper dump – no further dumping or toe excavation without engineering assessment
- Cracks near ditch
- Stabilization behind truck shop

3.3 Construction

- Excellent improvement
- Pleased to see bottom drain

- 35 m rock drain can be shrunk to 10 top drain connected with toe drain.
- PAG encapsulation excellent

4. WATER TREATMENT PLANT

4.1 Water Treatment Management

- Water quality management responsible person Herman Paz and Lisa Wade
- Water treatment plant designers Veolia

4.2 Design

- Veolia have prepared conceptual water treatment plant for CN oxidation and Hg removal by co-precipitation during clarification or carbon loading circuit. Water treatment capability

4.3 Construction

- Foundation slab to commence construction January 2008 and treatment plant by February 2008. Plant to have treatment capacity by April and complete by June 2008

- *Contingency treatment plan recommended with Aquasil addition to pumped stream to either a settling/polishing pond or to treatment plant facilities.*

5. ARD CHARACTERIZATION

- Barrel test comments – more – some revisions in procedures
- Watch F and Mo