GENCAPD PROJECT

MINERS' ENVIRONMENTAL OFFICER'S REPORT
On
FIELD TRIP TO MAHDIA MINING DISTRICT

10 June to 16 June 2003

By
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Georgetown

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1. INTRODUCTION

Mahdia is designated Mining District No. 2 within the demarcation system established by the Guyana Geology and Mines Commission (GGMC) for the gold and diamond mining industry. This area occurs within the Administrative Region No. 8 of the Regional Democratic Council.

The journey (by mini-bus on good all weather roads, via the Linden-Mabura route) to Mahdia on Tuesday, June 10, 2003 represented the beginning of my first trip as the "Miners' Environmental Officer". At Mahdia, I linked up with Mr. Peter Hutson, Mine Engineer with responsibility for "Tailings Pond Management", GGMC, in order to establish a mutually beneficial programme.

Among the intentions of this programme was to have discussions on environmentally friendly tailings management systems with as many miners as possible that were working the placer and alluvial gold deposits among the tributary creeks to the Mahdia River. Unfortunately, this field trip which was scheduled to last unto June 21 was terminated on June 16 due to the lack of guaranteed transportation to outlying mining operations, as this was not budgeted for.

In addition to visiting two operations at "White Hole" and St. Elizabeth, major time was spent with GGMC's personnel on the setting up of their experimental tailings dam and on the "closed-circuit" water system established (with the aid of GGMC's engineers) at the operation at "Block 27".

2. OBJECTIVES

The following defines the main objectives of this field trip:

To become familiar with the gold mining activities and its effect on the environment, especially as it relates to mining methodology, topography of the land and the types of soil encountered.

To continue the process of increasing miners' level of awareness of the environmental issues related to the gold and diamond mining industry and the need for working towards making a positive impact on same.

To make an assessment of the impact of mining on our waterways, particularly in relation to the visible effect of turbidity due to the uncontrolled discharge of tailings effluent.

Along with GGMC's "Tailings Management" Engineer on location, hold discussions with area miners to assess/implement innovative measures to reduce the impact of turbidity on the environment.

To make a meaningful input to GGMC's tailings management programme in the Mahdia mining district.

To check on miners' utilization of the modified sluice boxes (re: Demonstration project by Mr. Randy Clarkson, October 1999).

To assess utilization of GGMC/GENCAPD's mercury retort in this mining area.

3. SUPPORT

Collaborated closely with Mr. Peter Hutson, GGMC's Engineer on location, integrating field activities with his schedule since GGMC's vehicle was the intended mode of transportation. This was specifically important since, generally, GGMC's Mines Division was the resource base for the identification and location of active mining pits.

Unfortunately, I was unable to secure the services of a technician from within GGM C's Environmental Division (to complete turbidity readings and mercury retort demonstrations) as was previously arranged, due to their involvement in a training programme (week of June 09, 2003).

4. ACTIVITIES

Two (2) land dredging gold operations were visited and lengthy discussions, consistent with the project objectives, were held miners and other personnel on location. The operation of one (1) "Cutter-Suction" dredge was observed for the methodology of operation and its effects on the environment.

Major time was spent with GGMC's personnel on the setting up of their experimental tailings dam as the experience gained would be beneficial in adopting this procedure to mining operations of suitable topography and circumstances.

The mining operation at "Block 27", where a "closed-circuit" water system established with the aid of GGMC's engineers, was investigated for technical appreciation and in order to evaluate the flexibility of adopting this system to similar or other suitable situations.

The mining areas visited were:

Wednesday, June 11, 2003	-	Block 27 and GGMC's Experimental Dam
Thursday, June 12, 2003	-	White Hole and St. Elizabeth
June 13 to Sunday, June 15, 2003	-	Block 27 and GGMC's Experimental Dam

5. OBSERVATIONS

There was a degree of willingness by miners to cooperate with and accept suggestions for working towards a better environment.

The lack of refined geological data (particularly for the definition ore body) would make it difficult for permanent positioning of tailings pond, pit design and configuration and planning of pit life.

There is a great possibility that the environmental problems and their associated solutions are site specific, with the probability of successful tailings management being dependent on the level of mechanization available.

It may be easier to design tailings impoundment with "closed-circuit" (recycled) water system in previously mined locations, as mined-out pits serve as areas for immediate confinement of tailings and often provide adequate area and catchment to aid in the settlement of tailings solids.

Where applicable, whether for current operations or for remedial action, tailings dams with designed spillways (decant level) should be constructed to prevent the uncontrolled spread on tailings over the landscape thereby having a positive impact on the environment.

Turbid waters were visible in streams around the Mahdia area, a serious environmental concern, as sectors of the community depended on these water resources for domestic purposes.

Solutions to the turbidity problem in the gold and diamond mining districts may not be classic but would involve a degree of technical knowledge to allow robust, innovative and cost effective solutions to counter lack of available mechanization.

The time spent (by the M.E.O., Mines Engineer or the Mines Officer) at any mining operation, will ultimately affect the level of cooperation and emphasis placed on implementation of suggested plans.

A tailings dam, which had a large catchment area, had suffered a failure after a night of heavy rainfall. This failure had resulted in extreme turbidity of the water in "Gloria Creek". Probable cause of failure of the dam was a combination of over-topping of the dam, which had a decant positioned over the dam; improper construction, where tree trunks and limbs were visible across the width of the dam; and the operator's inability to properly pin or anchor the base of the dam as the base "catchcow" material was difficult to penetrate. The operator was advised of the need to rebuild the dam properly which should be constructed of fill material free of trees and vegetation; where it is advisable that the spillway be placed over in-situ ground; and to utilize readily available tree trunks to support the structure.

5.1 GGMC'S EXPERIMENTAL TAILINGS DAM

GGMC Mines Division had established a small ground sluicing operation on the periphery of Block 27, in order to test the integrity of their experimental dam. Notes were made in relation to:

- Dam design and construction
- Selection of core material
- Strength and stability of dam, particularly the effect of compaction and settlement
- Practicality and applicability of design

5.1.1 DAM DESIGN AND CONSTRUCTION

Two sheets of locally manufactured synthetic silt fence material were pinned, in vertically parallel rows by wooden stakes, to bridge the flat between adjacent higher grounds which defined the impoundment area.

Core material was placed and confined between the filter fences, with special efforts made to prevent failure at the abutments with the high grounds.

A spillway was excavated in in-situ ground to one side of the dam.

5.1.2 SELECTION AND PLACEMENT OF CORE MATERIAL

Available clay, clayey-sand material, which some gravel inclusions was utilized as the core material. The manual method of excavating and transporting the core material over uneven terrain resulted in the critical criterion for selection of the core material to be best material at the closest location.

Ideally, a more cohesive, impervious clay type core material would have been preferred.

5.1.3 STRENGTH AND STABILITY

Since the core material was manually placed, inadequate compaction was only achieved by the weight of the material and workers traversing over this core. This lack of compaction resulted in saturation of the core by the percolation of tailings effluent through the core.

There were evidences of slight bulging of the dam under the lateral pressures of the retained tailings effluent. This condition could have been improved by:

- Excavation of a shallow "cut-off" trench throughout the length of the dam before placement of the core material, in-order the increase the resistance to the lateral pressure of the tailings effluent.
- Extending a portion of the slit-fencing material within the cut-off trench such that it is anchored below the weight of the core fill.
- Improved anchoring of the silt-fences by driving the stakes, used to pin them, deeper into the base.
- The greatest deficiency in the construction this dam was the lack of a realistic means of compacting the dam. Given time and manpower, manual tamping of fill material is one crude alternative under this scenario.

5.1.4 PRACTICALITY AND APPLICABILITY

Small tailings dams constructed by confining core material between two rows of silt-fence material is acceptable and practical, but improved compaction hence strength could be achieved by sequential placement of tailings solids by directing tailings discharge directly between silt-fences with allowances made for the displacement of water, clays and silts.

Retaining the basic design, with coarse sand and gravel type previous core fill will allow this structure to function as a filtration dam.

6. CONCLUSION

Initial indications are that the design modifications to sluices boxes as demonstrated by Mr. R. Clarkson (specifically, use of expansion mesh with Nomad mat) has proven to be more efficient when working lithologies consisting predominantly of sand and gravel, but not as efficient for predominant clay type soils.

The application of filter-fence dam as initiated by GGMC has some merit and a joint investigation would be continued. Configuration of fence, method of placing core material and the acquired degree of compaction are key issues.

The operations at "Block 27" proved that improvement in the turbidity of effluent discharge to the waterways would be reduced with some effort, innovation and willingness on behalf of the miners. However, tailings impoundment may not represent the total solution; stripping of waste material, overburden, (identified form geological exploration data) by **dry methods** could make an enormous impact.

Based on information from GGMC's personnel, utilization of mercury retorts is limited.

7. RECOMMENDATIONS

Investigation into the use of "**filtration dams**" to reduce the level of turbidity of mine discharge water should be done. This is applicable as an intermediate step in turbidity control at current operations, to be integrated in closing plans of mining (tailings) operations or as a remedial action in abandoned mining operations. Dam design could entail permeable core media (graded gravel) with permeable synthetic filter linings or any combination of indigenous material that could adequately replace this design.

Environmental control as applied to gold and diamond mining, specifically threshold limit of turbid discharge to the waterways should be integrated into mine planning and design.

Further interviews should be conducted to ascertain the applicability and the composition of "**Environment Self Monitoring Groups**" in the mining districts.

An **environment incentive or credit scheme** (based on efforts made by and associated to the cost to the miner) should be investigated.

An identification tag (and probably an introductory letter) should be provided to the "Miners' Environmental Officer", especially critical if to function without an accompanying GGMC personnel.

Lloyd Stephen
Miners' Environmental Officer

APPENDIX A

EXPENDITURE

This cost represents direct expenditure, overhead cost not included.

Budgeted cost for trip	- G$113,400.00
Actual cost	- G$ 63,855.00
Cash returned	- G$ 49,545.00

APPENDIX B

Photo 1 - GGMC's EXPERIMENTAL DAM - Core Material Manually Placed

Photo 2 - **GGMC's EXPERIMENTAL DAM - Core Fill Between Filter Linings**

Photo 3 - **GGMC's EXPERIMENTAL DAM - Filter Linings Pinned by Wooden Stakes**

Photo 4 - GGMC's EXPERIMENTAL DAM - Water Trapped Behind Dam