1. ENVIRONMENTAL IMPACTS OF GOLD MINING IN PENHALONGA

1.1 Research Material Compiled by; G.R Chimonyo Senior Lecturer, Africa University
J.V Mupfumi, Centre for Research and Development

1.2 Preliminary findings

1.2.1 Environmental Impact Overview

Gold mining in Penhalonga represents all methods of gold extraction from deep underground mining, to small-scale mining with mines only a few metres deep, through large-scale alluvial mining and the most infamous gold panning. The area therefore is affected by the environmental impacts of each of these mining methods. It is a fact that whichever mining method, gold mining has environmental impacts that one needs to be always aware of. What might differ is the extent of the impact from one method to another. In a rapid appraisal study of community members perception of environmental impacts it was clear that, as was expected the impacts that were said to be important were those that were visible and those with immediate impact. Other impacts that needed laboratory analysis to be identified and those with delayed effects were said to be not that important. People were more concerned with issues that had immediate and dramatic impact, which were visible to everyone. The impacts that were emphasised therefore were as follows:

1. Water resources degradation
2. Loss of biodiversity with emphasis on flora
3. Dust pollution
4. Effects of small-scale gold mining

Issues related to the exact nature of water resources degradation that would involve laboratory analysis of water samples drew little attention; issues related to the effects of more than a century of gold mining at Redwing were not of interest to most people except those who had lost employment because of the closure of underground mining. Similarly issues of groundwater depletion and changes in soil properties only became of interest when these possible environmental impacts were mentioned.

1.2.2 Water Resources Degradation

Water resources degradation is perhaps the most talked about form of environmental impact of gold mining in the Penhalonga area. Discussions have centred on the alluvial mining method by DTZ-OZGEO and the status of the Mutare River. The company is mining gold along the Mutare River in Penhalonga and considerable distances along the river have been replaced by deep excavations and large water impoundments where water is pumped into out of the area of interest.

Plate 3 gives an overview of the areal extent of water resources disturbances. Plate 4 is a close look at the impoundments asking the question of the role they play in local hydrology and the water resources of the Mutare River basin. It is clear that the Mutare River has been disturbed for a considerable distance with no sign of the activity stopping as mining continues to progress eastwards. Mine officials however have indicated that their Environmental Impact Assessment plan includes rehabilitation of the land. They pointed out at the rehabilitation that has taken place in the area they started mining (Plate 3a).

Despite the much criticised disturbance of the Mutare River hydrology it seems the concern is from people outside the Penhalonga community. There is divergent local thinking on the issue since the interpretation the local community took of water resources degradation relates to how their water uses were affected by the mining developments. In old Tsvingwe, situated far away from the Mutare River and with the Tsambe River nearby, they showed complacence on the effects of the mining activities on the water resources. Responses from groups that were interviewed in the old part of Tsvingwe Township indicated a greater concern over the destruction of the reeds and water turbidity in the Mutare River than over water resources degradation.

In the new sections of Tsvingwe however, residents were more conscientious of the effects of mining on water resources. Whilst the large-scale mining companies could be blamed for water resources degradation members of the community were concerned that the degradation caused by small-scale miners was rarely talked about. However, the truth is small-scale miners cause very high water resources degradation (Plate 5). There are many gold panners working in the Mutare River, and some of them working in DTZ-OZGEO area and there effects on water resources leaves a lot to be desired.

***Plate 3a**: A Satellite Photograph showing the area that has been affected by DTZ-OZGEO Gold Mining Operations in Penhalonga in its first phase of operation. Of note are the large impoundments that are now used as sources for water for irrigation by the mine owners and the large area that is now devoid of vegetation.*

The group of panners raised an interesting point. DTZ-OZGEO is licensed to mine to a depth of 20 metres along the river bed. Any depth beyond this would not be regarded as alluvial gold mining. The panners wanted to know whether there were two pieces of legislation, one applicable to them and the other to the large-scale miners such as DTZ-OZGEO. According to the Environmental Management Act no one is

allowed to mine within 30 metres of a water course (and hence gold panning in rivers being illegal) but DTZ-OZGEO was allowed to extract gold not only from the river bed but also from an extensive area away from the river bed (Plate 6).

Plate 3b: *A middle section also showing water impoundments, loss of river course and bare ground that needs rehabilitation. Mining has stopped in this area.*

Plate 3c: *A Satellite photograph of the area that is currently being worked. Note that the river course has been completely destroyed (top right-hand corner) and the sizes of water impoundments*

Plate 4: *A Current water impoundment: underneath the body of water is the course of the Mutare River*

Plate 5: *Water Resources Degradation by Gold Panners in Mutare River*

Issues that came up after much probing during the interviews were the effect of alluvial gold mining on underground water and whether operations at Redwing have had at any point in time an effect on water resources. Most respondents were of the opinion that there was no correlation between underground water and the gold mining. Only a few acknowledged the dangers of the ground water reserves being quickly emptied. Similarly there was no agreement on whether or not mining operation in the form of reworking the mine dumps had an effect on water resources. The majority of respondents in the groups that were

interviewed indicated that the operations did not have an effect. The few pointed out that the chemical treatment might have an effect if the chemicals find their way into Mutare River. These observations support the claim that members of the community were more aware of visible impacts and impacts that had an immediate and often dramatic result. The creeping impact such as falling groundwater reserves and those related to the chemical composition of the water were not highlighted.

Plate 6: *DTZ-OZGEO is not extracting gold from the river bed only, but also from an extensive area away from the river bed destroying the whole river valley.*

1.2.3 Morphological Changes and Loss of Aesthetic Value

In all the four areas of Penhalonga were interviews were carried out, people complained about the heaps of earth that were created by the alluvial mining. Community members are also worried about the huge heaps of overburden (Plate 7) that are not only unsightly, but also pose a threat to water resources downstream in case of heavy rains and to life. The heaps are made up of loose material and they are a potential source of sediment that will silt up Mutare River and the rivers into which it is tributary. Related to the overburden heaps are the impoundments that have been created to hold the water back before it is released into the Mutare River. Respondents fill that they have potential for a disaster as the embankments might rapture if there is heavy rains upstream resulting in flooding downstream. It is interesting to note that the mine management is using the old impoundments for fish farming and for irrigation.

Whilst respondents have pointed out the unsightly nature of the heap of earth that alluvial gold mining created, there was no mention of the mine dumps at Redwing. A majority of those who participated in the group discussions were not aware of the unnaturalness of the mine dumps. There are two reasons for this: (i) most of the residents in Penhalonga are relatively new comers to the mine dumps and one has not been created in recent years, and (ii) the dumps are very old so that some are now colonised by vegetation and there look like part of the natural landscape. As shown in Plate 1, the mine dumps at Redwing have given the area a completely different morphology, which has affected the local ecological processes.

Plate 7: *Overburden heap in the background of an impoundment of water. Local communities fear that these can cause disaster downstream if rainfall is heavy.*

1.2.4 Biodiversity and Dust Pollution

Because settlements are township settlement types, most people who were involved in group discussions were not worried about loss of bio-diversity. A few old people in the old section of Tsvingwe mentioned the loss of fishing sites but a large number of women in all the nine group that were involved in discussions bemoaned the loss of reeds in the Mutare River. They reported that the reeds played an important economic role to many men and women, some coming from long distances away from Penhalonga to collect the reeds. This is the raw material that is used in basket and mat making. Land preparation for alluvial gold mining entails the complete removal of all surface material that is not connected to the extraction of the gold. It therefore means complete removal of the reeds (Plate 8). DTZ-OZGEO talks about restoration of the land after they have finished mining, but members of the community are asking whether it would be possible to introduce the reeds in this part of the river. It was pointed out that the first section that was mined and is said to have been rehabilitated has been fallow for three or four years, but there is no sign of the reed colonising again.

The issue of reeds is seems important to the local community since it is also pointed out that the destruction of the reeds has something to do with the decreased bird live. The birds' habitat is said to have been the Mutare River with its thick vegetation cover of reeds. The removal of the reeds, together with the noise and dust pollution has driven away the birds.

Although members of the community appear not to be worried about loss of bio-diversity, they are very conscious of one product of mining that can lead to loss in bio-diversity, which is dust pollution. Nearly every member of the community in Penhalonga is aware of the dust pollution which is caused by the heavy machinery used in the mining (Plate 9). An analysis of the situation however shows that in the townships and areas away from the mining, dust pollution is the result of vehicular traffic. The roads in all sections of Tsvingwe are not tarred and with the soil type (brown earth) any vehicular movement raises a lot of dust. Dust pollution was said to be one of the biggest impact of mining in the Penhalonga area.

Some members of community during discussion pointed out the health hazards of dust pollution but the majority was concerned with the loss of aesthetic beauty of the area. All vegetation and other surfaces would be having a brownish colour. Some complained that it was a worst of time to paint one's house with a light coloured paint as this will soon turn into a brownish or reddish colour. Incidentally, whilst during the dry season the menace on the roads comes from the dust; during the wet season it is the puddles on the road and the effects of heavy vehicles in making the roads sleeper. Driving a small car is almost impossible.

Plate 8: *An area being developed showing the reeds that will be destroyed and the overburden in the background and along the fence*

***Plate 9**: Heavy machinery that is used in gold mining is said to cause dust pollution.*

1.2.5 DTZ-OZGEO Rehabilitation of Mining Sites

DTZ-OZGEO in their Environmental Impact Assessment report indicated that they were going to rehabilitate the mining area before abandoning it. One central issue which people who participated in group discussion were concerned with in relation to rehabilitation was the restoration of the Mutare River. People were felt that a degree of rehabilitation would have been done if the flow of Mutare River is restored. A majority of community members in all the nine groups that participated in the discussion felt that it was not possible to do this. They cite the failure of rehabilitation works that were done on the first sites of DTZ-OZGEO mining operations.

The rehabilitation that DTZ-OZGEO undertook received great publicity and citing the company as perhaps the only environmentally conscious mining company in the country. The Herald of the 13th October 2011 reports that the Environmental Management Agency (EMA) had commented DTZ-OZGEO for using environmentally friendly mining methods and rehabilitating over 60 hectares of land it mined in the past four years. The Herald of 8th May 2010 had also carried favourable comments about DTZ-OZGEO mining, pointing out that people were happy with the mining and that people are now farming on the reclaimed land. The Standard also carried an article claiming that the miners and mining methods had been applauded by Chief Mutasa **of Penhalonga**. However the Daily News of 5th February 2012 carries a story that the mining firms had upset Manicaland Communities: "Communities affected by mining operations in Manicaland province have confronted the Environmental Management Agency (EMA) for failing to adequately police environmental degradation caused by mining firms".

Community members in both Penhalonga and Tsvingwe residential areas expressed dissatisfaction with the rehabilitation works, pointing out that the rehabilitation works were a potential hazard. The main worry was the fact that the soil material that was piled back was loose and could be washed away by heavy rains should these occur. The second fear was that the loose sediment posed a threat to would be "gold scavengers" following behind what is believed to have been left behind by DTZ-OZGEO.

Furthermore, the rehabilitation did not take into account the fact that for the rehabilitated land, the soil that formed the top soil should be on top rather than being mixed with the subsoil.

1.2.6 Perception of Environmental Impacts of Shaft Mining at Redwing Mine

There was much comment on the alluvial mining by DTZ-OZGEO partly because it is a new company using new mining technology and partly because the environmental impacts are visible. Changes happening to the environment are seen by everyone and therefore anyone can critique the changes brought about by the mining venture. From the mining technology and the historical development of Redwing Mine the environmental impacts might not be that apparent. It is because of this that community members indicated that they did not think Redwing Mine has caused an environmental damage. The mine has stopped underground operations and the company is simply reworking the old mine dumps.

It is a pity that members of the community are not aware of the wider environmental implication of gold mining or any mining for that matter. The mine dumps that are found at Redwing Mine are not viewed as features of concern since they were made a long time ago. However, although Redwing has suspended underground mining it is involved in reworking the mine dumps. What then becomes of importance is the method of beneficiation that is being used. At the same time, it should be realised that the mine dumps are artificial features with a different chemical composition to the surrounding. Members of the community should therefore be aware of such issues and this requires environmental education at the local level.

It was pointed out above that one of the biggest environmental problems with mine dumps is the formation of sulphuric acid especially if the dump contains sulphide. In a report by EMA at a Workshop that discussed community participation in resource governance, it was reported that water tests had indicated greater degree of contamination for water upstream of DTZ-OZGEO than the water downstream. The reason for this could be because of the chemical recations in the mine dumps. However, as far as communities were concerned, their failure to think of the mine dumps as features with an adverse environmental impact is due to the fact that the majority of those living in Penhalonga are newcomers who have not seen anything else other than the mine dump-riddled landscape. As one respondent commented, “This land appears natural. What can bring all that soil from underground?”

1.2.7 Environmental Impacts of Small-scale Gold Mining and Gold Panning

Similar to small-scale gold mining and gold panning elsewhere in the country, the activities in the Penhalonga area and in the Mutare River and its tributaries have received a lot of criticism from policy implementers and environmentalist. For example, it is reported in The Herald of 14th October 2011 that whilst DTZ-OZGEO can be commended for doing a good job in rehabilitating the area they had mined small-scale miners can be blamed for causing massive environmental degradation. Members of the community are divided on the effects of small-scale gold mining and panning on the environment. The activities of small-scale miners and gold panners were not considered as having negative environmental impacts since they are carried out in pursuit of livelihood options. The group of panners who participated in the discussions on environmental impacts of their activities found it strange that ‘when it is being on a small scale, it is environmental degradation and when it is done on a grant scale as is being done by DTZ-OZGEO then it is not environmental degradation. Small-scale miners in particular were dismayed with the 14th October 2011 Herald report that praised DTZ-OZGEO for good mining practices but blaming the small-scale miner and panner for environmental degradation using mercury in the gold recovery. The miners pointed out that it was misrepresentation since millers were found some 20 to 30 kilometres away at Odzi and if there was any use of mercury, this is where it is used and not in Penhalonga.

Women, especially those in the old section of Tsvingwe felt that despite their protestations, small-scale miners and panners were causing a lot of environmental degradation. The scale of small-scale mining has

far exceeded acceptable levels since large areas on slopes of hills around Penhalonga are now scarred with trenches and deep depressions. One has to be very careful when looking for firewood in these areas as one risks falling into these trenches. Although the slopes of mountains surrounding Penhalonga used to be well-wooded, they are now bare because of the wide-spread small-scale mining (Plate 10, 11 and 12).

***Plate 10**: Extent of environmental damage due to small-scale gold mining; light coloured areas show locations where there is mining while slopes have been burnt to facilitate prospecting*

***Plate 11**: A hill slope showing the extent of small-scale mining to the north of Penhalonga*

***Plate 12**: Huge trenches made by small-scale miners on hills to the east of Penhalonga*

Apart from degrading the environment through mining methods, small-scale miners are also blamed for other activities that cause environmental degradation. In discussion groups an issue that was discussed at length was the issue of clearing the land by fire before going in to prospect for gold. Some members of the discussion groups were of the opinion that most of the loss in vegetation was through veld fires purposefully started in order to clear prospecting land.

***Plate 13:** A veld fire during field work that was said to have caused by small -scale miners*

The issue of gold panners is also a contentious issue amongst members of the community as some supports the activity while others point out that the gold panners are no better than DTZ-OZGEO. Despite the fact that this might be the only means of subsistence for the gold panners, their action is considered harmful to the river ecosystem. Those deriving a livelihood from gold panning have defended the activity pointing out that all they do is working the sediments in the river and not diverting the river as is the case with DTZ-OZGEO. From such arguments, it is clear that there is a lot of animosity between members of the community and DTZ-OZGEO, which if not carefully handled might result in confrontation. There is a strong feeling amongst the gold panners that the company, because of having the capital and government connections took away their source of livelihood.

1.2.8 Other Environmental Considerations

Unfortunately members of the community seem not aware of any other environmental issues from gold mining apart from those with visible impact and those that affect their lives directly. For this reason, the issues of chemical contamination of water and soil were not important. However these are issues that should be examined in the laboratory. The fact that there are no longer any fish in Mutare River was attributed to water turbidity rather than possible chemical pollution of the water. Furthermore most members of the community are of the opinion that since Redwing Mine has stopped underground operations, its contribution to environmental degradation is negligible. Whilst it might be possible that the current activity of reworking the mine dumps might not contribute as much to environmental damage as active mining, there is a possibility that the century or so of mining activities can continue to damage the environment for some time. This is because of the possibility of acid drainage from the mine dumps. It was pointed out above that mine dumps are a source of sulphuric acid especially when the dumps contain sulphide. Perhaps this is the reason why EMA at a Workshop by CRD on "Management of Natural Resources: A Community-based Approach" in 2012 reported that water tests had revealed water with less chemical contamination downstream of DTZ-OZGEO than upstream, which is downstream of Redwing Mine. The chemical contamination might be the result of acid drainage. At the same time one would expect little or no chemical contamination from DTZ-OZGEO since it uses the placer method of gold extraction that does not require chemicals such as mercury and cyanide.

It was noted during the surveys that views on environmental impact depend on social class with the less educated emphasising livelihood issues and loss of area from which to obtain resources or to produce crops and the more educated and the affluent emphasising health issues and issues such as those pertaining to aesthetic beauty. The Rural District Council argues that it was not involved in the issuing of the mining licences and therefore it cannot interfere. EMA has maintained its stance, similar to what was said at the 31st January 2012 Workshop on "Natural Resource Management: A Community-based Approach," that they can only act within the legal framework established by the Environmental Management Act and also the Mines and Minerals Act, two legal instruments which are sometimes in conflict.

If one compared the situation in Penhalonga and what is happening elsewhere throughout the world, one would notice that the environmental issues are similar to those confronting communities in developing countries. It seems where the mining interest is foreign,there is a tendency not to take into account environmental considerations and to neglect local communities apart from seeking labour from them. The Penhalonga situation is reminiscent of the Marlin Gold Mine, San Marcos, Guatemala which McBain-Haas and Bickel (2005) coined an abuse of human rights and destruction of the environment. The issue of groundwater drawdown has also been observed as a big environmental problem. The Environmental Law Alliance Worldwide (2010) had this to say about groundwater drawdown:

"Groundwater drawdown and associated impacts to surface waters and nearby wetlands can be a serious concern in some areas. Impacts from groundwater drawdown may include reduction or elimination of surface water flows; degradation of surface water quality and beneficial uses; degradation of habitat (not only riparian zones, springs, and other wetland habitats, but also upland habitats such as greasewood as ground water levels decline below the deep root zone); reduced or eliminated production in domestic supply wells; water quality/quantity problems associated with discharge of the pumped ground water back into surface waters downstream from the dewatered area. The impacts could last for many decades. While dewatering is occurring, discharge of the pumped water, after appropriate treatment, can often be used to mitigate adverse effects on surface waters".

Whilst the problems associated with big mines will continue to confront communities in the Penhalonga area, the environmental issues raised by small-scale miners and gold panners will continue. The United Nations Development Programme (2002) pointed out that although there have been many attempts to improve the economic and social status of small-scale and artisanal miners, this has met with little success. Very little has come out of the many meetings that have been held worldwide in order to minimise environmental damage from small-scale and artisanal mining. The main reason for this being that the increasing poverty is making environmental considerations take second place to livelihood issues.

1.2.9 Environmental Considerations of the Mines and Minerals Act

The Mines and Minerals Act Chapter 21:05 is the main instrument controlling mining in Zimbabwe. It however has to be read in conjunction with other pieces of legislation especially when it comes to issues of environmental protection considering the extent of environmental damage that mining causes. Out of the 30 or so pieces of legislation that must be considered in conjunction with the Mines and Minerals Act, 11 are concerned with environmental matters one way or another as follows:

1. *Environmental Management Act Chapter 20:27* administered by the Ministry of Environment and Tourism and providing for the establishment of the Environmental Management Agency (EMA)
2. *Mining (Management and Safety) Regulations SI 109 of 1990*
3. *The Hazardous Substances and Articles Control Act Chapter 15:05* administered by the Ministry of Health also deals with the use and control of hazardous substances in mining.
4. *The Mining (Health and Sanitation) Regulations SI 182 of 1995* administered by the same Ministry makes provisions for adequate hygiene in and around mines.
5. *The Mining (Alluvial Gold) (Public streams) Regulations, 1991* deals with small scale gold panning and places restrictions on the miner and the minimum distance he/she can work from a river-bank.
6. *The Water Act Chapter 20:22* makes provision for the prevention of water pollution and the preservation of water resources and is controlled by the Ministry of Lands, Agriculture and Water Development.
7. *The Natural Resources Amendment Act (1975)* deals generally with the conservation of natural resources and is administered by the Natural Resources Board.
8. *The Atmospheric Pollution Prevention Act Chapter 20:03* is the responsibility of the Ministry of Health and is concerned with the prevention and control of air pollution by gases, dust, fumes, and smoke.
9. *The Forest Act Chapter 19:05* is designed to protect forests and trees and is controlled by the Forestry Commission.
10. *The Parks and Wildlife Act (1975)* is administered by the Department of National Parks and Wildlife and deals with the preservation of plants and animals, including specially protected animals and indigenous plants.

11. *The National Museums and Monuments Act (1972)* provides for the protection of sites of historic or cultural interest.

There has been much talk about the degree of environmental damage emanating from mining activities especially alluvial gold extraction, gold panning and small-scale gold mining. It is alleged the Environmental Management Agency which was supposed to police environmental degradation was doing nothing about it. The main problem is how these pieces of legislation are related and the degree of interaction. The pieces of legislation are administered by too many different ministries with different and sometimes conflicting agendas. It then becomes impossible to implement the provisions of one Act to a ministry that has a different agenda. For example, EMA's duty is to see to it that mining is done in a way that minimises environmental degradation, but EMA is not involved in the licensing of the mining operations. It then becomes difficult for EMA to enforce environmental regulations as it is ignorant of the agreement between the miner and the Ministry of Mines.

ZINWA is said to be responsible for water issues in the country including establishing water quality and therefore assessing pollution levels. ZINWA might obtain the water test results but it has little use for them since EMA has the responsibility of ensuring certain environmental standards, failure of which the perpetrator will be fined. All in all it has been said that the pieces of legislation governing good mining practices are fragmented and difficult if not impossible to implement. This is the reason why environmental degradation goes on unchecked in mining. It is seen that an activity that is condemned by one piece of legislation is condoned by another: disturbing river flow and therefore the water resources of an area is condemned by EMA (reason for crying out loud against gold panners). However, what can EMA do when a company has been issued with a license by the Ministry of Mines to do alluvial gold extraction on a grant scale from a river?

2. Bibliography

Gauteng Department of Agriculture, Environment and Conservation (2008) *Mining and Environmental Impact Guide*, Digby Wells and Associates, Growth Lab and Council of Geoscience, Johannesburg

Government of Zimbabwe *Mines and Minerals Act Chapter 21:05*, Government Printers, Harare

Jerie, S. and Sibanda, E. (2010) "The Environmental Effects of Effluent Disposal at Gold Mines in Zimbabwe: A Case Study of Tiger Reef Mine in Kwekwe, *Journal of Sustainable Development in Africa* (Volume 12, No.3, 2010) *ISSN: 1520-5509* Clarion University of Pennsylvania, Clarion, Pennsylvania

Maponga, O. and Ngorima, C. F. (2003) "Overcoming Environmental Problems in the Gold Panning Sector through Legislation and Education: The Zimbabwean Experience", *Journal of Cleaner Production* 11 (2003) 147–157

McBain-Haas, B. and Bickel, U. (2005) *Open Pit Gold Mining: Human Rights Violations and Environmental Destruction - The Case of the Marlin Gold Mine - San Marcos, Guatemala*, FIAN International (FoodFirst Information and Action Network) and Misereor, Heidelberg, Germany.

Ogola, J. S., Mitullah, W. V., and A. Omulo, M. A. (2002) "Impact of Gold Mining on the Environment And Human Health: A Case Study in the Migori Gold Belt, Kenya", *Environmental Geochemistry and Health* 24: 141–158, 2002. *Kluwer Academic Publishers. Printed in the Netherlands*