



the federation for a sustainable environment

Registration Number: 2006/217972/23  
NPO NUMBER: 062986-NPO

Detailed Response  
To  
The Findings And Recommendations  
Of  
Report To The Inter-Ministerial Committee On Acid Mine Drainage (December  
2010)

The Report states:

*“...sufficient information does exist to be able to make informed decisions regarding the origins of the mine water, potential impacts, management strategies, treatment technologies, etc”.*

*It furthermore states that: “In recent months, media reports have highlighted the problems related to the flooding of the mining basins of the Witwatersrand, often sensationalising the risks faced in these mining areas.”*

### The FSE responds

We take ownership of what we had said in the past. The findings and recommendations of the Report, vindicate the FSE and substantiate its concerns.

### In terms of the **Report's** comments on the conduct of the mining industry

#### The FSE responds

The responsibility of what is happening now is a direct result of the current and historical commissions and omissions by the mining industry. We express little hope that it will change in the future.

Of relevance here are the recommendations of the DWAF's Integrated Mine Water Management Best Practice Guideline (Best Practice Guidelines for Water Resource Protection in the South African Mining Industry): For integrated mine water management to be successfully implemented at mine sites, it is necessary to establish a corporate culture where effective water management is viewed as a non-negotiable element of all mine decision-making. This requires extensive training of all mine staff and mine contractors in order that they fully understand not only the specific actions stipulated in the Integrated Water Management Plan (IWMP)<sup>1</sup> but that they understand, subscribe and adhere to the underlying principles.

The keys to success are training, rigorous enforcement of IWMP objectives and principles and application of punitive measures for non-compliance.

There is an urgent need for an extensive audit and performance review on the mining companies' actions in terms of their Environmental Management Programme Reports (EMPRs), water use licenses and closure plans, and the application of corrective actions to ensure that the EMPRs, WUL and closure plan objectives are complied with. Such

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<sup>1</sup> If the water use licence has been issued, it should be converted to an Integrated Water Management Plan

auditing and review system should cater for both internal review actions as well as regular independent external review<sup>2</sup>.

### The Report states

*“Two main recommendations to address the issue are made – being ingress control and the pumping and treatment of the pumped water.*

#### Ingress control

*Ingress of water into the voids is far higher than it should be due to, inter alia, the following conditions:*

- *surface streams that lose water to shallow mine workings,*
- *open surface workings,*
- *seepage from mine residue deposits,*
- *Groundwater, recharged by rainfall, which seeps into the workings owing to the disturbance of natural groundwater conditions by mining (Scott, 1995; Department of Minerals and Energy, 2008b),*
- *Surface streams that lose water directly to mine openings and to the shallow groundwater systems above zones of shallow undermining and historical surface operations,*
- *Where open surface workings exist, these often connect directly to the underground workings and provide a pathway for water to flow from the surface to the mine void. In the Western Basin the problem is exacerbated where mining companies allow acid drainage from their surface tailings reclamation operations to flow into abandoned open pits,*
- *The interactions between water and tailings can lead to contamination of the water and AMD production, resulting in the flow of contaminated water into the mine voids (Scott, 1995; Rosner et al., 2001).”*

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<sup>2</sup> Department: Water Affairs and Forestry. Best Practice Guideline. Integrated Mine Water Management. Best Practice Guidelines for Water Resource protection in the South African Mining Industry. Directorate: Resource Protection & Waste.

## The FSE responds

The Report fails to address why these basic pollution control measures to prevent ingress are not already in place on the mines. It would have been expected these would be the conditions prescribed in both the Environmental Management Programme Report (EMPR) and water use licenses or closure plans of these mines.

The numerous open pits in the West Rand goldfields have been identified as a source of ingress by the DMR's Regional Closure Strategy for the West Rand Goldfield (2008) (Council of Geoscience Report 2008-0175) with a study commissioned by the mining industry estimating that they contribute approximately 30% to the total ingress. These open pits intersect old mining operations providing direct continuity between the pit and the mine void. Notwithstanding the findings of the Report to limit ingress and the recommendations of the above-mentioned Regional Closure Strategy, the DWA and DMR recently authorised the mining company, Mintails to deposit uraniferous tailings in the West Wits Pit. The holings in the pit were not closed and the pit is not lined. This allows for significant ingress into the mine void.

The Report furthermore fails to recommend the immediate action that should be taken by the mines and/or state departments to address the most basic issues of pollution prevention.

The Report does not state whether the mines have water use licenses and whether there are non compliances with either their water use licenses, closure reports or EMPR<sup>3</sup>'s.

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<sup>3</sup> In the review of Sections 5 and 6 of the gold mining industry's EMPRs that describe the decommissioning and closure phases of the mine's operations, the following shortcomings were identified in the Water Research Commission Report 1215/1/05:

- While most mines recognise the fact that tailings dams generate acid mine drainage, it is generally and incorrectly assumed that the impact will decrease to acceptable levels when mining operations cease. The assessment of long-term risks from tailings dams can at best be described as subjectively qualitative in nature and no proper quantitative assessments were reported in any of the EMPRs.

It must be noted that mines must apply for a closure certificate upon the cessation of mining operations. Within 18 days from these situations occurring, the holder must complete and submit a prescribed closing plan, including an environmental risk report, to the Department of Mineral Resources' Regional Manager. Only after the chief inspector and DWA confirmed in writing that provisions have been complied with pertaining to health and safety, management of potential pollution to water resources; may a closure certificate be issued and may the financial contribution or part thereof be returned<sup>4</sup>.

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- It appears to be quite widely assumed that the larger particle size of waste rock dumps makes them a minor pollution risk. This view is erroneous as the waste rock dumps have very large inventories of fine material and they are much more permeable to oxygen than tailings dams. The secondary source of contaminants that remain in the soil after a dump has been removed appears to be universally ignored and it is assumed that removal of the dump removes all potential for pollution from that site.
  - Most mines appear to have some monitoring programme to evaluate shallow aquifer and surface water impacts from the surface residue deposits. However, the monitoring programs are not clearly stipulated in the EMPR documents and hence it is not clear if the extent of contaminant plumes is known.
  - Very few specialist investigations appear to have been done to identify the status of the geohydrological regime, the extent of contamination, preferential pathways and predictions regarding long – term migration. As a result there are very limited mitigation or management options described in the EMPRs that specifically deal with the containment / rehabilitation of contaminated groundwater.
  - The potential impact on the groundwater from other surface contaminant sources such as the metallurgical plants, domestic and industrial waste sites are not described. Many of the EMPR documents state that these structures will be removed / rehabilitated during decommissioning, but it is not stated if they had an impact and if groundwater rehabilitation is required.
  - Many of the older mines were subjected to amalgamations and changes in ownership and in many instances the surface infrastructure, including some tailings and rock dumps were sold to 3rd parties. Many of the current mine EMPR documents exclude infrastructure that has been sold and it is not clear if the new owners are required to address groundwater contamination and if it is in fact being done.

<sup>4</sup> The MPRD Regulations prescribes the requirements to obtain a closure certificate. An application for Mine Closure (regulation 57) must be accompanied by a closure plan and an environmental risk report. The closure plan (regulation 62) forms part of the EMP, and must include, inter alia:

- A description of the closure objectives and how these relate to the prospecting or mine operation and its environmental and social setting. Closure objectives (regulation 61) form part of the draft EMPR and are therefore established before mining commences, or on application for the mining right or permit, and must-
  - Identify the key objectives for mine closure to guide the project design, development and management of environmental impacts;
  - Provide broad future land objective(s) for the site; and
  - Provide proposed closure costs.
- A sketch plan drawn on an appropriate scale describing the final and future land use proposal and arrangements for the site;

### The Report states regarding the sources of AMD

*“The flooded mine voids are not the only sources of AMD in the Witwatersrand. Other sources, particularly mine residues, need to be monitored and appropriately remediated to reduce AMD impacts on the environment.*

*“The large volumes of AMD that flood the mine voids and will decant unless suitable steps are taken to reduce the recharge volumes and water is extracted from the mine voids to maintain an environmentally acceptable water level.*

*“The multiple smaller volumes of seepage and run-off from contaminated areas, largely mine residue deposits. The diffuse nature of this drainage poses specific challenges for treatment.”*

### The FSE responds

Mine residue deposits contain 6 billion tons of iron pyrite tailings. There are more than 270 tailings dams in the Witwatersrand Basin, covering approximately 400 km<sup>2</sup> in surface area (AngloGold Ashanti, 2004). These dams are mostly unlined and many are not vegetated, providing a source of extensive dust, as well as soil and water (surface and groundwater) pollution (AngloGold Ashanti, 2004).

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- A summary of the regulatory requirements and conditions for closure negotiated and documented in the EMPR;
  - A summary of the results of the environmental risk report and details of identified residual and latent impacts;
  - A summary of the results of progressive rehabilitation undertaken;
  - The mitigation or management strategy proposed to avoid, minimize and manage residual or latent impacts;
  - Details of any long-term management and maintenance expected as well as a proposed closure cost and financial provision for monitoring, maintenance and post closure management;
  - A record of interested and affected persons consulted, etc.

The unwillingness of the state departments to act against the mining industry to prevent, minimise or mitigate the pollution or to remediate polluted environments is, we must admit, perplexing.

It should not be passed over that in the KOSH goldfields, DWA and the NWDACERD recently authorised the mining company, First Uranium's (Mine Waste Solutions) construction of an unlined centralised tailings storage facility and the reworking of 15 old residue deposits. The EIA identifies pollution that will take place into the surrounding groundwater and the Vaal River system. While the EIA was conducted on the premise that a sulphuric acid plant will be constructed, the construction and subsequent use of the sulphuric acid plant will no longer form part of First Uranium's beneficiation process. As a result the impacts upon the surface and groundwater will be significant. In view of the aforesaid, it is evident that poor water management practices are perpetuated.

#### The Report states

*“The tailings and waste rock generated by mining are significant sources of AMD owing to their interactions with rainwater and surface streams. Research into their impact has identified them as an important source of AMD (Steffen, Robertson and Kirsten, 1989), but the total proportion of the pollution load which they contribute to the streams is not fully quantified.”*

#### The FSE's response

Although the afore-mentioned study is dated 1989, the total proportion of the pollution load has, at the time of writing, not been fully quantified and there has been no intervention in order to minimise or prevent the identified impacts since 1989.

#### The Report states regarding the supplying of information

*“The mining industry is involved in major initiatives to reclaim defunct tailings facilities containing recoverable gold resources. However, access to much of the work performed on behalf of the mining companies is restricted.*

*The body of knowledge about the volumes of water used and wastewater (volumes and quality) generated in the mining industry that is freely available is limited. However, it is likely that mining companies and/or individual mines own much more accurate and detailed knowledge of the volumes. It is imperative that all relevant information be assimilated from all available sources and utilised in the development of management solutions”.*

### The FSE responds

It has been argued by the gold mining companies and the DWA that it is unfair for the mining industry to bear the responsibility for the costs of the pumping and treatment of AMD before the inception of NEMA in 1999.

South Africa is not alone in having to address a legacy of contamination that precedes contemporary legislation designed to address harm caused to the environment. Much of the developed world has had to face precisely the same dilemma as that faced by the gold mining industry in the matter of AMD. When viewed generally the trend overseas appears to have been to adopt the retrospectively application of the polluter pays principle. While conceding that it is somewhat harsh to compel a company to incur substantial costs today for activities that were not considered particularly irregular 120 years ago, foreign jurisdictions appear to view the alternative solution as far more unpalatable, namely that ordinary taxpayers, who have no connection whatsoever to the pollution, and derived no benefit from it, will through the cleanup activities of their governments, be compelled to pay for the remediation of the affected environment. As a result, many foreign jurisdiction shave had no difficulty in holding parties who generally derived some direct or indirect financial benefit from the harmful activities, liable for



harm caused retrospectively, even where such harm occurred substantially prior to the enabling legislation.

The creation of NEMA came after similar legislation in foreign jurisdictions, and a comparison of such similar legislation with NEMA suggests that our drafters borrowed heavily from laws in other countries. NEMA furthermore identifies a wide, but connected (to the polluter) pool of responsible parties who are liable on a joint-and-several basis. The NEMA clearly uses retrospective type language. In a developing country such as ours, there is even less prospect of our government, through ordinary taxpayer's money, will be in the position to fund the massive clean-up operations and the AMD issue than there is in developed countries that apply similar laws retrospectively.

It could, and arguably should, be the case that the drafters of NEMA intended, in balancing unfairness towards parties connected to the polluter and who derived financial benefit from the pollution against the even greater unfairness that would result for ordinary taxpayers having to fund clean-ups, that the retrospective provision in Section 28 of the NEMA was intended to apply to activities that took place and to harm that arose at any time historically whether before or after the inception of NEMA in 1999<sup>5</sup>.

#### The Report states regarding ecological impacts

*“The decant of water in the Western Basin provides an example of the ecological impacts that could be expected downstream of a decant of AMD into a surface stream.*

*The downstream impacts of this water were assessed by Coetzee et al. (2005a), who reported a number of parameters far exceeding the DWA guidelines for stock watering and aquatic ecosystems (Department of Water Affairs and Forestry, 1996b), while aquatic biomonitoring results collected in 2000 and 2004 showed the deterioration of the*

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<sup>5</sup>Guest Essay. Ian Sampson. Environmental and Sustainability Law, Shepstone & Wylie Attorneys. The Enviropedia. 2006 – 2008.

*system from one classified as Class C (in a good ecological condition) to a Class F (unsustainable and unable to support normal aquatic life).*

*The operators of the Game Reserve have subsequently reported a number of animal deaths which they believe are attributable to the poor water quality, as well as a dramatic decrease in the reproductive rates of animals in the Game Reserve. These effects are likely to be experienced downstream of any decant of AMD to the surface water environment, and will persist downstream until sufficient additional water is added to the stream to have a significant dilution effect.”*

### The FSE responds

#### DWA Directive History<sup>6</sup>

Although DWA was fully aware of the impending situation as far back as the middle 1990's, it took them until March 2005 to issue a Directive to the role-playing mines, in which decant water quality standard were legally enforced. The downstream water users welcomed this initial Directive, but the role-playing mines rejected it with reservations, as they did not have the technology to treat the water to the standards specified in the Directive, in spite of being aware of the situation since the middle 1990's. Briefly, this Directive stated that the water would be treated to a relatively high water quality standard and would then be pumped across the watershed to the Wonderfontein spruit, where it would be released for a limited period, which would give the role-playing mines time to implement more permanent treatment measures. The water quality standards used in the Directive were based on water quality claims made by the role-playing mines, once they had their permanent water treatment facility in place.

Although some of the conditions in this initial Directive were carried out, the water quality standards and the transferring of the water to the Wonderfontein spruit were, however, never adhered to and neither did the role-playing mines implement any of the

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<sup>6</sup> Personal Communication and Report by Garfield Krige.

other conditions of the Directive, in particular, no further plans were made to construct the permanent water treatment plant.

In July 2009 a second Directive was issued in which the quality of the water leaving the mining surface area was relaxed to a certain extent. In this second Directive, the role-playing mines were allowed to discharge the mine void water into the Tweelopiespruit and not into the Wonderfonteinspruit. The Tweelopiespruit has all along been the receiving water body notwithstanding the conditions set out in the first Directive.

As the dolomitic aquifer at the receiving end of the Tweelopiespruit was significantly more sensitive, due to its carbonate composition and its susceptibility to erosion by acidic water, as well as for its anthropological heritage, the chemical standards to which the mine decant water had to comply with could not be relaxed beyond those documented in the second Directive, as irreversible and potentially catastrophic, damage could occur to the dolomite. The most significant consequence of uncontrolled acidic water being discharged into the dolomite aquifer would result from accelerated karstification, which could lead to an increased risk of sinkhole formation in an area through which the N14 roadway passes. DWA could therefore not relax the water quality standards to a lower standard than specified in the second Directive.

As a result of the role-playing mines lodging an appeal with the Water Tribunal against the second Directive, DWA withdrew this second Directive in May 2010, and the mines also withdrew their appeal to the Water Tribunal. Simultaneously, DWA issued a third Directive. In terms of this Directive<sup>7</sup> the water quality of the mine water which could be

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<sup>7</sup> The Directive, dated 26 May, 2010 directed:

*“Therefore I, Hendrik Albertus Smit, in my capacity as Regional Head: Gauteng, in the Department of Water Affairs and acting under authority of the power delegated to me by the Minister of Water Affairs and Environmental Affairs in terms of Section 63 of the National Water Act, after taking all the representations made by Rand Uranium into consideration, hereby:*

- a) withdraw the Directive dated 24 July 2009, and;*
- b) direct Rand Uranium in terms of Section 19(3) of the National Water Act, subject to the terms and conditions set out below, to:*

*Pump and treat the Western Basin void water as stipulated in condition 2.4 prior to*

released into the Tweelopiespruit, was relaxed almost up to the quality of the water decanting from the underground mine workings. This was done to provide the role-playing mines a “period of grace” within which they could implement measures to comply with the more stringent water quality standards set out in the second Directive. This third Directive also directs the role-playing mines to put several monitoring and remediation plans into action. Most of these measures had to be implemented by 31 July 2010. As stated, it also provides more time for the role-playing mines to construct the water treatment plant that will treat the mine decant water to a quality that will not be detrimental to the receiving environment or to a (salable) quality that will be acceptable for another use.

Although both previous Directives were issued after liaison with the Western Basin Decant Technical Working Group Committee, the third (May 2010) Directive was issued without this committee’s knowledge or approval. This act by DWA also effectively excluded comments from interested and affected parties.

This third Directive is only valid until the role-playing mines obtain a water use licence in terms of Section 21 of the National Water Act of 1998 (Act 36 of 1998) as directed by

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*discharging into the Tweelopies (East) Spruit at a point above the Krugersdorp Game Reserve;*

*Implement pumping and treating facilities to comply with the Environmental Critical Level of the Western Basin void as stipulated in the Rison Report.*

*Submit to the Regional Head: Gauteng, in writing under reference 16/2/7/C231/C068, by 31 July 2010, the steps that will be taken for the development and implementation of technology and procedures for the approval of the Regional Head: Gauteng, that will become binding, to comply with the disposal of the treated water and values set out in this Directive.*

*2.4 Discharges to the Tweelopies (East) Spruit must comply with the following values:*

*PH 6.5-9.5*

*Conductivity (EC) (mS/m) 350*

*Sulphate (SO<sub>4</sub><sup>2-</sup>) (mg/L) <3000*

*Manganese (Mn) (mg/L) <10*

*Iron (Fe) (mg/L) < 1*

*Chemical Uranium (U) (ug/L) <50*

*Develop a remediation plan for implementation either concurrently with the discharge or after the discharged has ceased.”*

this Directive, which would automatically imply that they have performed all the issues discussed in the Directive, or 31 January 2011, whichever comes first.

At the time of writing the Directive no longer has any validity and the AMD is flowing uncontrolled and untreated into the receiving environment.

The general feeling among the majority of the members at the previous Western Basin Decant Technical Working Group Committee meeting, held on 23 May 2010, was that DWA were unnecessarily dragging its feet and stalling the process by not endorsing the construction of the treatment plant, as proposed by Western Utilities Corporation (hereafter referred to as WUC). This plant will be designed to treat all water decanting from the Western Basin and will also include the much larger water volumes that will decant from the Central and East Rand Basins in the near future. The funding for the construction of the plant required an endorsement by DWA. Without this plant it is highly unlikely that the conditions set out in the most recent (third) Directive issued by DWA will be met by the role-playing mines, by the time this third Directive lapses. In our opinion, the role-playing mines could use this issue (i.e. endorsement of the plant by DWA) to absolve themselves from complying with the current Directive or with Directive/s that will be issued in future.

Conversely, it is also our opinion that by relaxing the water quality standard to the standards as set out in the third Directive, DWA have given the role-playing mines a mandate to pollute. The water qualities for several of the determinants set out in the Directive far exceeded any acceptable water quality standards, in particular, the SA National Standard for Potable Water, SANS 241 and the SA Water Quality Guidelines series, published by DWA. It has been confirmed that most of the mine water flowing through the Krugersdorp Game Reserve recharges directly into the Zwartkrans aquifer, which is used extensively for drinking water and for the irrigation of edible crops, hence our reference to the Drinking Water Standard. We are particularly referring to the determinants, electrical conductivity, sulphate and manganese. We are furthermore concerned that most of the determinants mentioned in the first Directive were simply left

out of the subsequent directives. At present, only pH, electrical conductivity, sulphate, iron, manganese and uranium are specified in the Directive. In our opinion, and tested against the water quality guidelines from DWA themselves, the latest Directive now allows the role-playing mines to release water, which is known to be toxic, into the environment and into an aquifer used for drinking water and for the irrigation onto edible crops.

The role-playing mines claim that the modified uranium plant currently operated by Rand Uranium for the treatment of decanting mine water was supposed to be a temporary installation to bridge the period required for construction of the permanent, advanced desalination plant by WUC. As DWA are, however, reluctant to endorse the proposed plant by WUC, no further progress will be made in solving the problem experienced in the West Rand and which will soon also become a problem, on a much larger scale, in the Central and East Rand Basins. We are of the opinion that the process has reached a “stale mate” situation with each party blaming the other for the lack of progress made. On the one hand the mines are trying to force an endorsement of their plant technology out of DWA, while on the other, DWA is forcing the role-playing mines to treat the decanting water without a suitable plant.

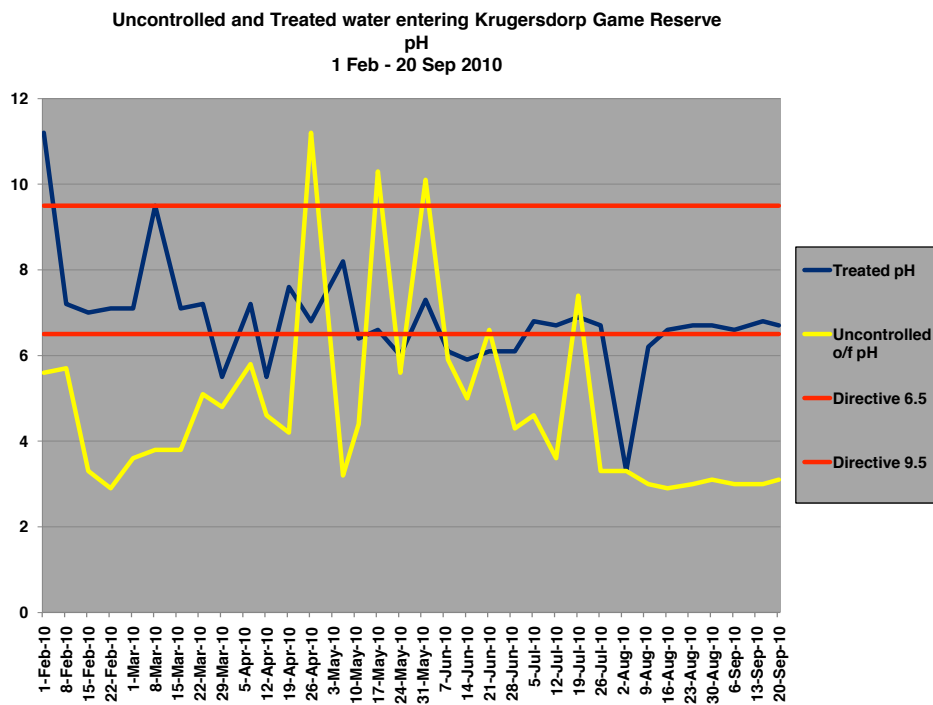
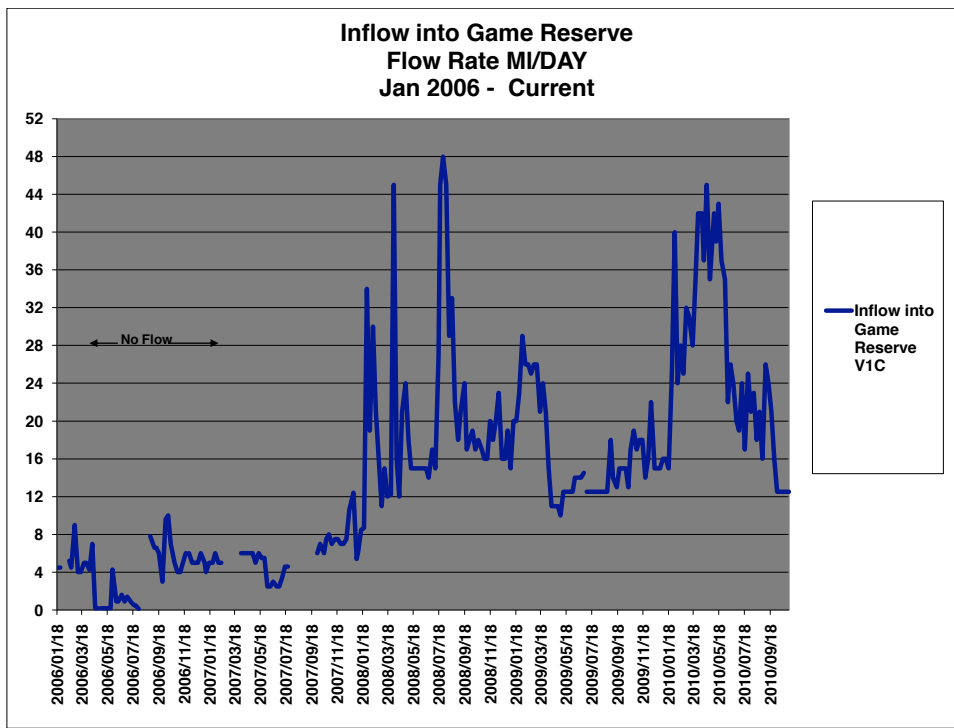
The present treatment plant, i.e. the modified uranium plant operated by Rand Uranium, can only at best reduce the sulphates in the mine water to approximately 2 500 mg/l. It is furthermore unable to treat the present volume of water decanting from the Western Mine Void Basin. A significant volume of this water subsequently bypasses the treatment plant untreated.

Although the concentration of approximately 2 500 mg/l sulphate achievable by the mine treatment plant complies with the Directive, it is totally unsuitable for most other uses, particularly the uses in the receiving body of water. It must also be kept in mind that since January 2010, a significant stream of contaminated water flows on surface directly into tributaries of the Crocodile River, and that the negative impact of this water is likely

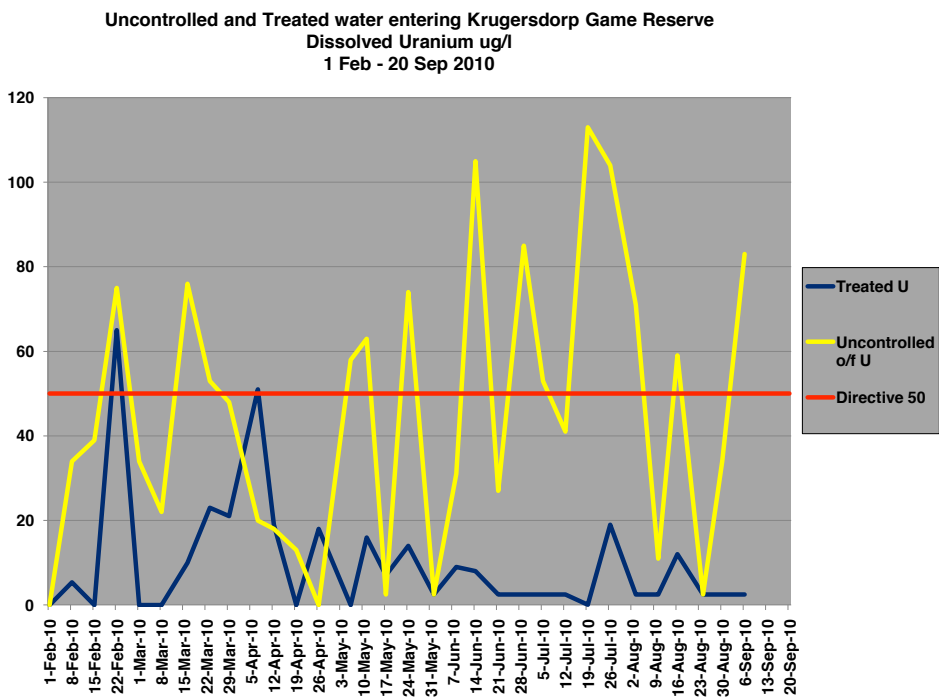
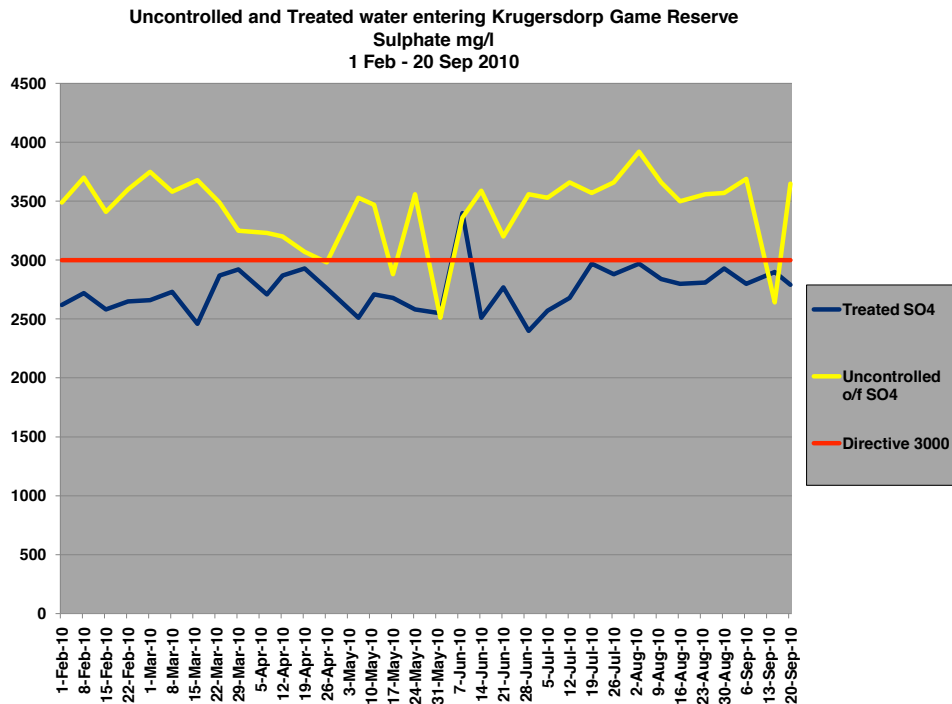
to spread rapidly beyond the previous boundaries of the Zwartkrans Dolomitic Compartment.

Whichever way the situation is viewed, it is the people of South Africa that are and will be bearing the consequences of the actions by the role-playing mines. These mines have been operating for over a century and have produced extensive wealth for themselves and for their shareholders. At the same time and now that there is no further wealth to be extracted for the Western Mine Void, the same mines are stalling the process of rehabilitating the legacy their gold mining has left behind. It becomes apparent that it was never their intention to redress the environmental damages in the first instance. The longer the problem is allowed to be stalled, the more difficult it will become to prosecute the offenders. The relaxation of water quality standards in the most recent Directive by DWA is in favour of the role-playing mines. We believe that the mines have had been given ample time to take action and have shown that it was never their intention to solve it. They did not even comply with most of the conditions in the previous two Directives. By affording the mines more time to get their “house in order”, DWA is merely allowing the role-playing mines to stall the process even further without actually doing anything about the situation.

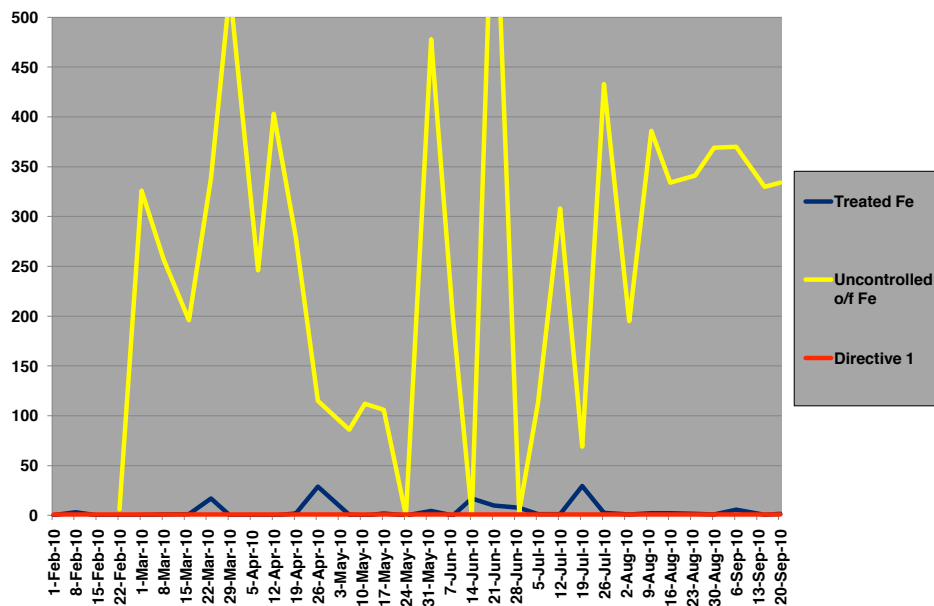
Surface Water Quality Data as presented at the Western Basin Decant Technical Working Group Committee on the 11<sup>th</sup> of November, 2010



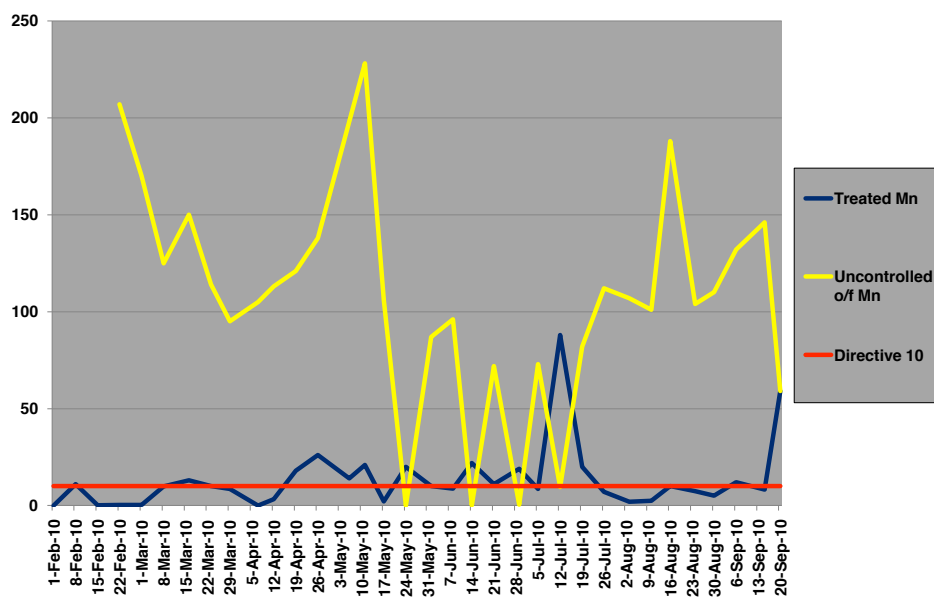




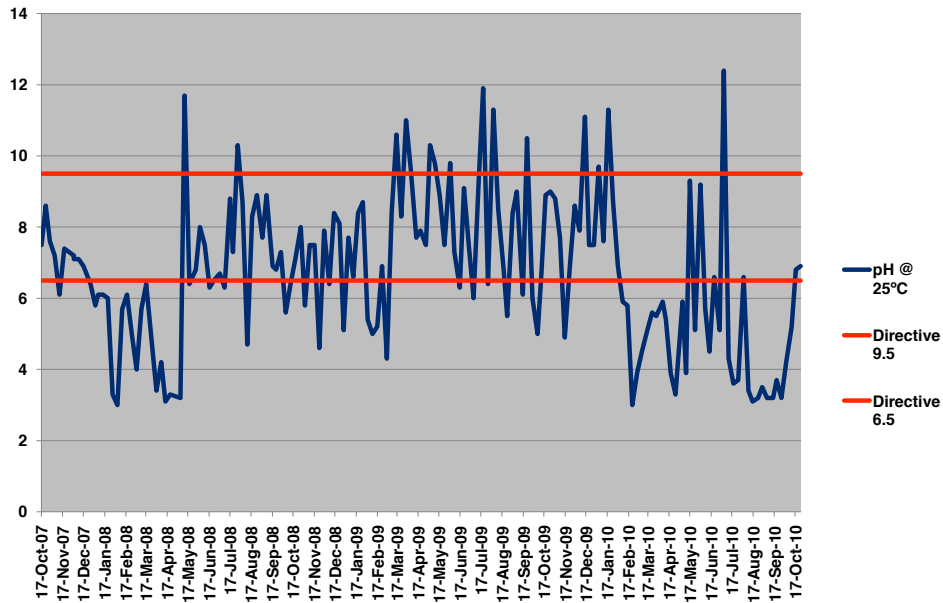
Uncontrolled and Treated water entering  
 Krugersdorp Game Reserve  
 Dissolved Iron  
 1 Feb - 20 Sep 2010



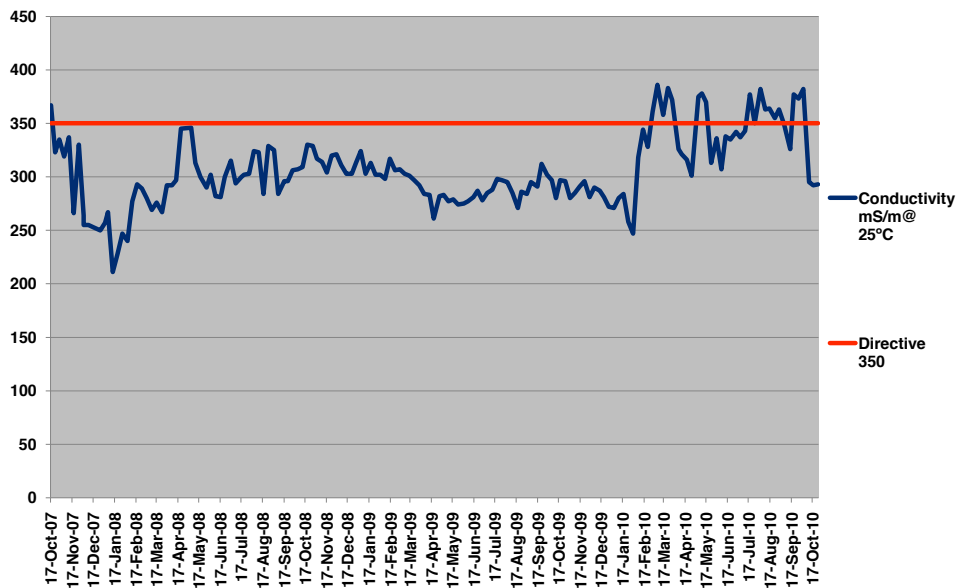
Uncontrolled and Treated water entering  
 Krugersdorp Game Reserve  
 Dissolved Manganese  
 1 Feb - 20 Sep 2010



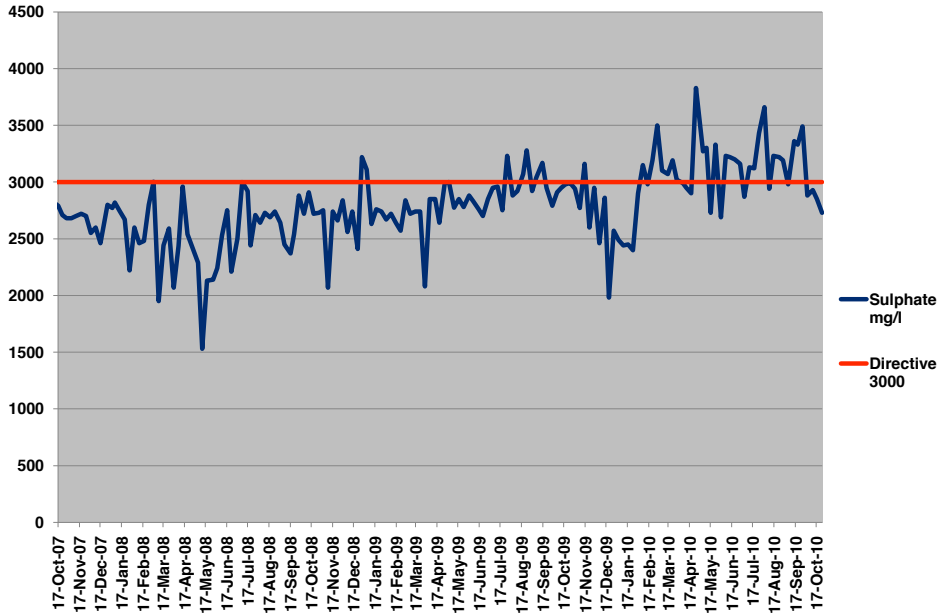
**Inlet to Game Reserve  
Weekly Oct 2007-Oct 2010  
pH Units**



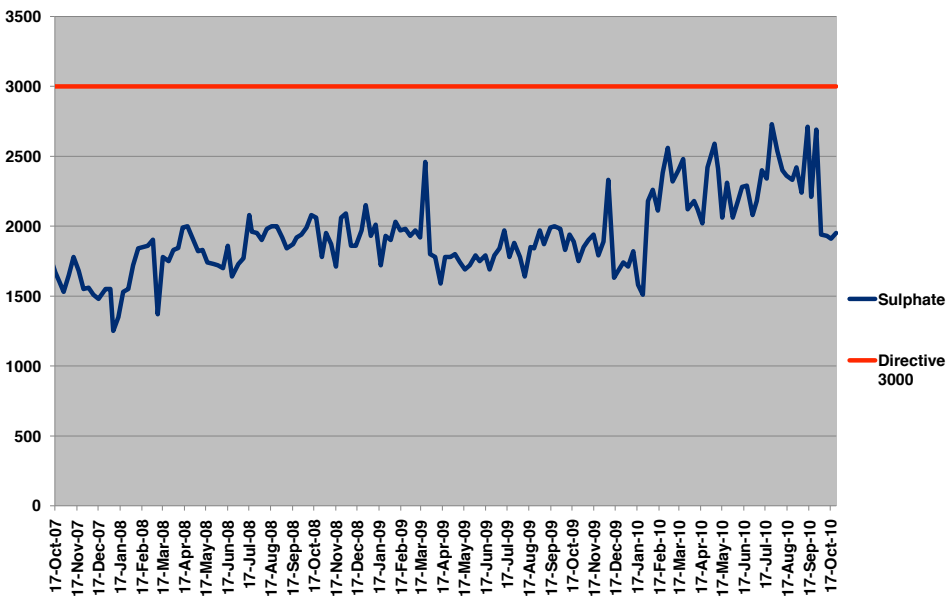
**Aviary Dam Game Reserve Outlet  
Weekly Oct 2007-Oct 2010  
Conductivity mS/m**



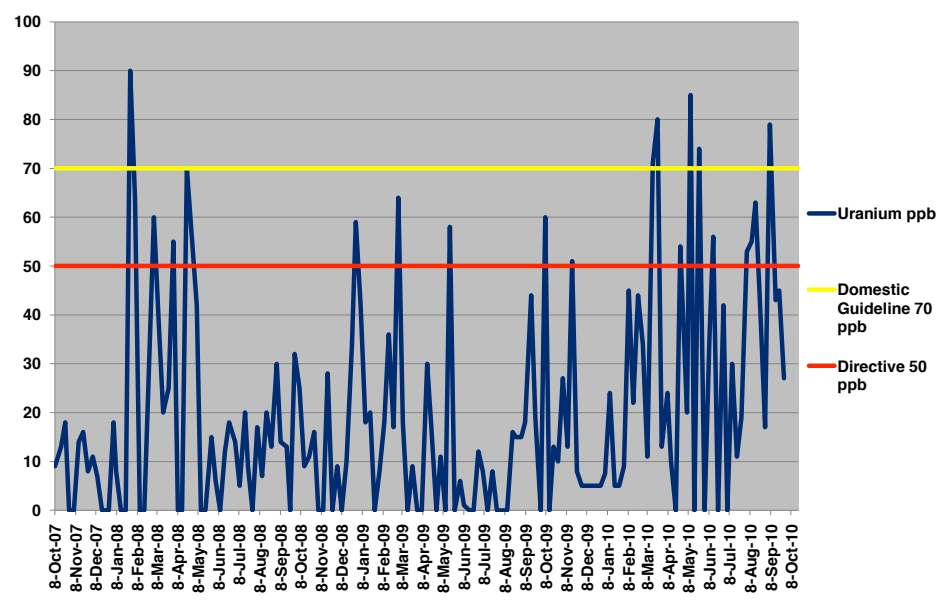
**Inlet to Game Reserve**  
**Weekly Oct 2007-Oct 2010**  
**Sulphate mg/l**



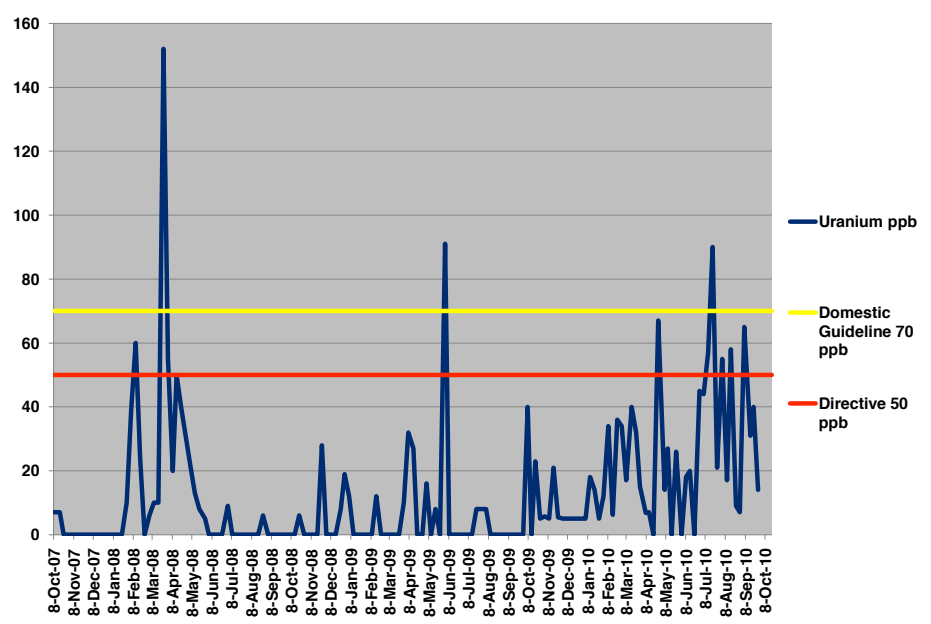
**Aviary Dam Game Reserve Outlet**  
**Weekly Oct 2007-Oct 2010**  
**Sulphate mg/l**



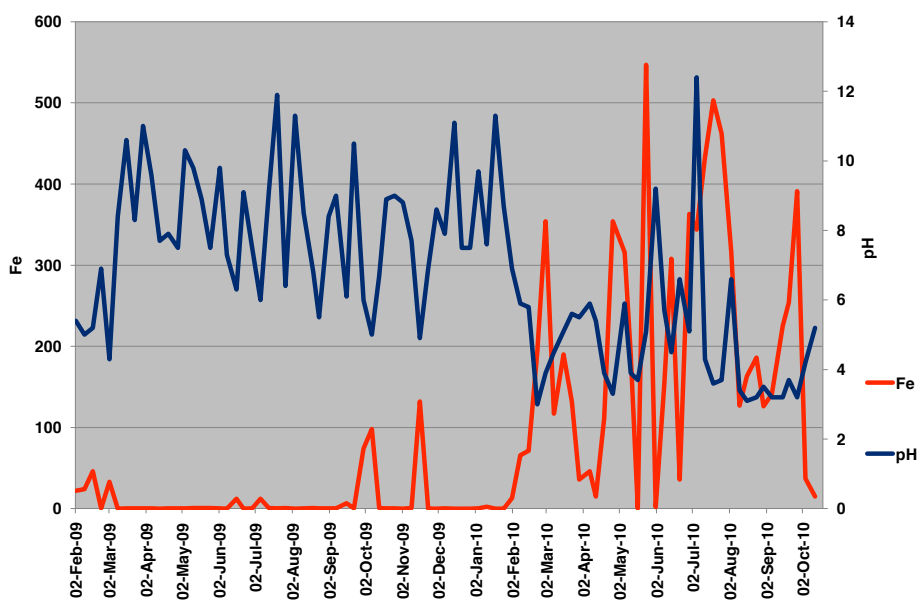
**Inlet to Game Reserve**  
**Weekly Oct 2007 – Sep 2010**  
**Dissolved Uranium ppb**



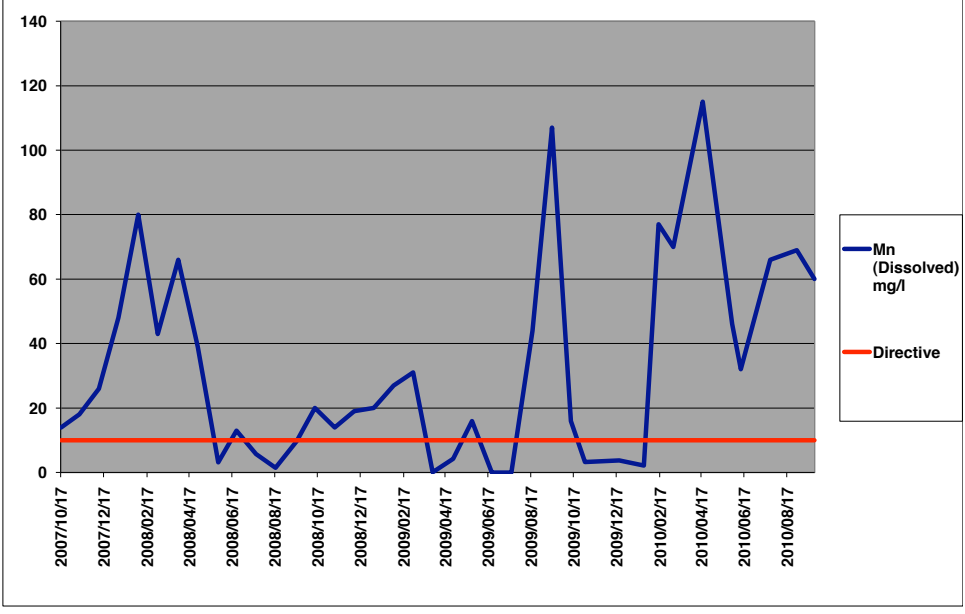
**Aviary Dam**  
**Weekly Oct 2007 – Sep 2010**  
**Dissolved Uranium ppb**



Mine Water Dissolved Iron Concentrations vs. pH into Tweelopies  
Weekly mg/L  
Feb 09 – Oct 10



V 1.C  
Entry into Game Reserve-Manganese  
Monthly Average Oct2007- Sep2010



### The Report states regarding the general impacts

*“Solutions to the problem should be approached from the point of view that in the short term, conditions should be no worse than those which were experienced during periods of active mining. Treatment during mining was limited to neutralisation and metal removal. This should be seen as a minimum requirement for any water that is discharged.”*

### FSE Comment

It begs the question why the status quo should not be changed.

If the actions and the impacts were not unduly serious, then this argument can be entertained. It is overwhelmingly evident that the impacts are unacceptably high for the receiving environment. The mining industry has not been willing to effectively mitigate the impacts.

Temporary solutions have a very bad habit of becoming permanent solutions, especially in view of the fact that no timetables has been set for the alternatives to come into place and the criteria set for the desalination will be unattainable.

The situation in the West Rand, which is and has been unacceptable to all, is now being held up as the accepted status quo as to what can be allowed.

### The Report continues

*“In the longer term it will be desirable to reduce the salt load emanating from these discharges into the already stressed Vaal River System.*

*Where impacts are limited to localised areas, alternatives that address these localised impacts should be sought.”*

### The FSE responds

No specifics are put forward and no time frames are proposed. This, it is inferred, will become the permanent solution and is unacceptable. The Report identifies certain local impacts, yet fails to address them.

### The Reports states on the impact of the Western Basin decant on downstream surface water

*“The decant of AMD and the discharge of partially treated mine water have had severe negative impacts on the aquatic ecology and the large mammal population in the Krugersdorp Game Reserve immediately downstream of the decant and discharge points. Impacts have also been experienced in streams further downstream, notably the Riet Spruit. However, the Bloubank Spruit as main stem in this drainage system itself has not exhibited any significant impact from AMD in the past 8 years since the start of decant in late-August 2002.”*

### The FSE responds

In terms of the CSIR Report No CSIR/NRE/WR/ER/2007/0097/C, entitled “A Hydrogeological Assessment of Acid Mine Drainage Impacts in the West Rand Basin, Gauteng Province” by P.J. Hobbs et al, and section 10.2 of the Harmony Gold EIA Document (JFA, 2006) “... *an unqualified volume still escapes downstream into the Zwartkrans compartment via the Tweelopiespruit, mostly subsurface.*” It should be acknowledged, because of the uncertainty of the subsurface flow of AMD and its foreseeable adverse impacts upon the Zwartkrans compartment, which hosts the sensitive Cradle of Humankind World Heritage Site as well as providing 11 491 persons with drinking water, water for irrigation and water for watering of cattle, that the precautionary principle or risk averse principle ought to apply.



It is clear that the system is not well understood, yet the Report recommends discharging significant volumes of salt into this system after neutralisation.

#### The Report states regarding the surface water losses to groundwater

*“The latter phenomenon is an intrinsic characteristic of dolomitic environments, and raises concern for the impact of poor quality surface water on the receiving groundwater resources.*

*Because of the ongoing input of contaminated water, the dolomitic aquifer will require monitoring. Should poor water quality be detected, remedial action will be required to improve the quality of water in the system”.*

#### The FSE Responds

The impact on the receiving environment is passed over and the impact is not being taken into consideration when recommending the neutralization instead of desalination.

To exemplify: There are 2654 Ha under irrigation using borehole water in the Zwartkrans Compartment, 458 Ha under irrigation using river water. There are 11 491 people living on dolomite using 250 l/person/day groundwater. (CSIR Report No CSIR/NRE/WR/ER/2007/0097/C, entitled “*A Hydrogeological Assessment of Acid Mine Drainage Impacts in the West Rand Basin, Gauteng Province*” by P.J. Hobbs et al, and section 10.2 of the Harmony Gold EIA Document (JFA, 2006.))

The impacts upon the aforesaid downstream water users have not been taken into consideration and there has been no compensation proposed for damages.

#### The Report states regarding untreated water impacts

*“It poses potentially severe environmental and safety impacts on the receiving water environment and concomitant surface areas.*

*It could incur devastating ecological impacts.*

*Conclusions indicate that serious environmental challenges exist, which, if not adequately addressed, could lead to crises such as have already occurred with the decant of acid mine drainage in the Western Basin in 2002 and the premature closure of Stilfontein Gold Mine in the KOSH area in 2005.*

*Lowering of the pH of water to a point where it is unsuitable for domestic or other uses (Department of Water Affairs and Forestry, 2006)... will have long-term effects on materials with which it comes into contact and will not support normal aquatic life.*

*The acidity of the water liberates metals, including toxic metals and radionuclides from the rocks with which it interacts. This may result in acute and chronic toxicity to both human users and the environment, and will generally render water unfit for most uses (Coetzee et al., 2006; Wade et al., 2002).”*

### The FSE Responds

Notwithstanding the aforesaid facts, the State is allowing and has allowed the mines to decant this water from both the East and Western basins for prolonged periods into the Blesbokspruit and the Tweelopiespruit respectively. In the NWA there is provision for the State to act and recover the costs. It begs the questions why did the State failed to do it and whether the State is of the intention to do it now.

### The Report states regarding neutralised water

*“The reactions which produce acid mine drainage result in a high sulphate content in the resultant water that will remain high even after the acidity is neutralised. This renders*

*the water unfit for domestic use, may make it unfit for agricultural and some industrial uses and will increase the salinity of the receiving aquatic environment”.*

### The FSE responds

It is important to note that neutralisation will not significantly decrease the sulphates levels of the AMD. In the flooded West Rand, neutralization of AMD results in the discharges of water into the receiving environment of between 1 500 and 3 700 mg/l sulphates<sup>8</sup>.

### The Report states

*The water in the Eastern Basin is characterized as follows:*

*“ ...contribute to the production of a better quality of water with higher pH and lower sulphate levels than has been observed in the other basins. However, the water is not fit for uncontrolled discharge to the environment, as it contains significant sulphate and iron concentrations.”*

*“The associated high concentrations of sulphate and iron also pose serious water quality problems if they enter the surface environment.”*

### The FSE responds

It should be noted that the sulphate levels in this water, shown in table 7.5 on page 67 of the Report are significantly lower (30%) of what was and is released from the neutralised water from the Western Basin and what is predicted with reference to the Central Basin.

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<sup>8</sup> The World Health Organisation’ standard for sulphates is 200mg/l; the environment requires < 100 mg/l and animals can tolerate up to 1000 mg/l. Irrigation requirements are < 150 mg/l, that is, for total salts.)

If water with these levels of sulphate and iron, which is not shown in table 7.5, but which is significantly elevated, is not suitable for release, then it begs the question why the water from the treatment plants in the other basins will be suitable for release.

This is the single biggest flaw in the predictions report: it does not state what will be the impact on the environment of the neutralised AMD, yet recommends it for release and somehow invokes the precautionary principle to be upheld.

### The Report states regarding the regional impacts on major river systems

*“[AMD] has a major impact on South Africa’s major river systems .... is an important contributor to the salinity of the Crocodile and Vaal River Systems. This has far reaching implications, as the DWA currently manages water quality in the Vaal System via the discharge of clean water from upstream sources, including the Lesotho Highlands Water Project. The addition of saline water to the system requires large volumes of clean water to be discharged to maintain water quality at acceptable levels. The Vaal River Reconciliation Strategy of the DWA (Department of Water Affairs and Forestry, 2009) identifies the point sources of mine water as sources that can be removed from the system by desalination. The pollution from the mine discharges form the most concentrated salt stream entering the Vaal System and therefore represent one of the areas where desalination of a waste stream could be achieved efficiently. Other discharges to the Vaal System, including diffuse pollution from mining sites, pollution from coal mines, and discharges from sewage works and industries will also need to be addressed to ensure water security in the Vaal System.”*

### The Report states regarding the Impact of the Central Basin on downstream surface water

*“In the Central Basin, it is possible to gauge the effects of the mine water discharges on the downstream environment by examining water quality before and after the cessation of pumping by ERPM in October 2008*

*“It is evident that at the Klip River sampling site the sulphate concentration decreased by approximately one half after the cessation of pumping by ERPM, suggesting that other sources of sulphate in the water are approximately as significant as the water which was pumped and discharged from the Central Basin.*

*“The impact of the salt load from the underground mine water in the Central Basin is therefore an important source of salts entering the Klip River System and subsequently the Vaal Barrage...”*

The Reports states regarding the impact of the Eastern Basin on downstream surface water

*“The high sulphate concentrations suggest that water contaminated by mining is entering the system, but, as in the case of the Central Basin, the lack of flow data prevents the identification of the exact contribution of the discharge of pumped water to this stream”.*

The Report states regarding the impacts on surface water, with reference to the development of solutions

*“Perusal of DWA water quality data suggests that although the impacts of mine discharges have only a localised impact on surface water in the Western Basin, groundwater pollution is likely to increase in the future. In the Central and Eastern Basins measurable impacts occur in the downstream rivers. In the Eastern Basin it is not possible to distinguish the effect of the discharge of water pumped from the mine void by Grootvlei Mine, while in the Central Basin, the water pumped by ERPM accounts for approximately half of the sulphate concentration measured downstream. Unfortunately, the lack of available flow data precludes the calculation of salt loads, which would be more indicative of the total input of pollution to the Vaal River System...”*

The FSE’s Response

Desalination is the preferred option in the Vaal Reconciliation Strategy and in the National Desalination Strategy of DWA, yet it is not recommended in the Report due to the cost. The dilution of these salts, which will be in the “*treated water*” after neutralization, is not without cost. This was, however, not quantified in the financial assessments and only direct cost was compared.

Should these externalized costs have been taken into account, a different recommendation would have followed. This is contrary to the spirit and letter of the NEMA, the NWA and the MPRDA.

The water from the Lesotho Highlands project was paid for by the taxpayer and the operations thereof cost money, yet the water is now being utilized to pay for the pollution of another industry by the taxpayer.

The water is also needed for future socio–economic development and there is no excess water available for such development.

The Report therefore recommends that the taxpayer not only pay for the cost of the treatment and capital associated by with the treatment, but also stops other socio-economic developments in order to use expensive water from the Lesotho Highlands Project, paid for by the taxpayer, in order to mitigate the pollution of an industry that is, according to the Report, not even willing to share information.

There is absolutely no explanation in the Report pertaining to the positive implications would have flowed from the complete desalination of the mine water. To exemplify:

- No water will be required for dilution,
- There will be a positive impact on the reserve,
- There will be a positive impact on water users,

- Lower volumes of water will be needed by other industries due to lower pollution levels,
- There will be increased socio-economic benefits from the additional water, etc.

This should have been taken into account in the assessment of the financial implications. It was not, for reasons unknown to us. We trust that it is not to protect the mining industry from the cost of desalination and thereby externalising the cost onto non-polluters downstream.

### The Report states regarding other impacts of mine's flooding

#### Seismic activity

*“Risk analysis suggests that the probability of slightly larger magnitude seismic events occurring cannot be ignored when compared with the activity during active mining.*

*Serious safety risks to deep underground mining ventures and some risk to safety and property on the surface in the vicinity of the mines.*

*Such events have in the past caused structural damage and disruption throughout the Witwatersrand region, including the Johannesburg urban area. The occurrence of an event of similar magnitude owing to mine flooding, which could lead to serious consequences if it struck a densely populated urban area or a key business interest, can at present not be excluded.”*

#### The FSE responds

We hope it is not cynical asperity to state that when the news media and/or NGOs reported on the aforesaid foreseeable impacts, NGOs and the news media were lambasted by honourable Ministers of the South African government and the DWA as being alarmist and sensational. It seems but reasonable, if we are to apply the standard of our

critics, that the learned authors of the Task Team too should be censured for “sensationalism”.

The Report states regarding damage to infrastructure and buildings

*“...the shallower underground tourist facilities at Gold Reef City will be flooded. The shallow groundwater resource associated with the dolomitic strata located to the southeast of Johannesburg will be compromised, ERPM in Boksburg and Durban Deep in Roodepoort.*

*“...mine water will rise to its decant level and decant in or close to the CBD of Nigel on the East Rand. Further rise in water level would impact on higher lying areas across the Central Basin — from Roodepoort, through Johannesburg to Boksburg (Figure 4.6).*

*“...result in geotechnical impacts that may jeopardise the integrity of urban infrastructure. Flooding may result in inter-mine water migration and may threaten neighbouring operational mines, limiting access to economic reefs.*

*“...Uncertainty exists around the risk that rising water levels could lead to the reactivation of solution features in dolomite, resulting in subsidence and possibly even the formation of sinkholes. This is a particular concern in the dolomitic areas associated with the Far Western, Western and Eastern Basins including Cradle of Humankind World Heritage Site).”*

*“Subsidence at the outcrops could occur owing to the mobilisation of poorly compacted fills within steeply dipping slopes.*

*“Acid mine water could result in the chemical corrosion of building foundations, but this aspect has not been well studied and site-specific studies are necessary.*

*“Foundations, basements and municipal services could be flooded as a result of rising groundwater levels driven by the flooding mine void, if water levels are allowed to rise*



*high enough to impact on these structures. These effects may be localised to low-lying areas.*

*“The area where severe negative impacts are of greatest concern is the Central Basin, because of its proximity to Central Johannesburg and, particularly, in the presence of abandoned near-surface workings in the city centre the Eastern Basin, although impacts are possible in Nigel if pumping stops.*

*“While many of these impacts are relatively unlikely in the Central Basin, because of the elevation differences between the decant level and the CBD of Johannesburg, they may occur in lower-lying areas, such as parts of Boksburg and areas to the south of the CBD. .. the water level rises to its decant level.*

### The FSE responds

We presume the Government will allow the news media and NGOs the same liberty to be as candid and transparent in disclosing the aforesaid risks to the public, without being lambasted for being sensationalists and alarmists.

### The Report states regarding management strategies

*“Immediate intervention is required in the three basins around Johannesburg due to the:*

- *imminent threat in proximity of densely populated areas and*
- *before the threat becomes more critical.*

### “Types of intervention

*“The body of work available on minimising the impact of mining wastes on the environment and on treatment of such wastes indicates that the technological solutions are already available to the country.*

“Decant prevention (Pumping)”

*“Pumping must be done in all three of the basins in order to prevent decant from the EB and CB.*

*“In the western basin increased pumping must commence to lower the water levels to below decanting levels.*

“Ingress control”

*“... Isotopic studies undertaken by the Council for Geoscience have indicated that a significant component of the water is groundwater that infiltrated rapidly after recharge by rainfall (Horstmann et al., 2004a, 2004b)*

*“Water flowing into the basins come[s] from various sources and some of the ingress of some of these pathways can be lowered by various methods to lower the ingress.*

*‘The ingress however cannot be stopped all together and there will still be ingress and decant even with all of the measures taken to lower the ingress.*

“Treatment of water”

*“It is recommended that neutralisation plants be established in the Western and Central Basins to treat the volumes of water required to be pumped.*

*“Construction of the plant for the Western Basin must commence as soon as possible, with the aim of supplementing the existing treatment capacity of the plant currently operated by Rand Uranium. A plant with a capacity of 20 MI/d will be required to supplement the existing treatment capacity in the basin. Ultimately a plant will be required to treat the full volume of AMD pumped.*

*“Construction of a plant in the Central Basin to treat 60 MI/d (Scott, 1995) must commence as soon as is necessary to treat the water that will be pumped (this volume could be reduced in the medium to long term if ingress prevention measures are put in place).*

*“In the Eastern Basin, the current treatment infrastructure at Grootvlei Mine must be maintained.*

*“The proposed steps of neutralisation and metal removal will still result in the discharge of saline water. While this will maintain the status quo that prevailed during active mining, it may prove necessary to complement this with steps to reduce the salinity of the discharges in the medium to long term. This could be achieved via desalination or direct consumptive use of the water that does not result in a discharge of saline water to the Vaal River System.”*

### The FSE responds

It must be observed that it will not be possible to maintain the current pumping and treatment infrastructure at the Grootvlei Mine since the last pump has been removed by Aurora Empowerment Systems and most of the infrastructure has been scavenged. This is perfectly amazing that the DWA has allowed the last pump station in the East Rand, notwithstanding copious warnings, to be flooded<sup>9</sup>.

Mintails, one of the three operational mining companies in the West Rand goldfields, owns a water treatment facility which has the capacity to pump and treat the proposed volumes of mine void water. How astonishing is it, again, that the DWA did not direct Mintails to operate the water treatment facility in order to prevent or minimise significant pollution of the surface and groundwater within the West Rand goldfields and irreversible ecological impacts.

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<sup>9</sup> 75 - 95 ML per day was pumped from Grootvlei Mine to prevent the flooding of the East Rand basin. Grootvlei Mine was managing water influx into the entire East Rand at 800 m below ground level. Water cascades down into Grootvlei from other mines because of mine interconnections.

### The Report states

*“Neutralisation of water is recommended and not treatment of water to levels that make it usable for the receiving body and water users in that receiving body.*

*“The neutralisation option is preferred due to the following reason:*

*“Neutralisation of mine water and discharge to the environment will produce conditions similar to the status quo during periods of active mining. In the medium to long term this may not be sustainable as it could result in excessive salt loads on the receiving water bodies, which will require the release of clean water for dilution, particularly in the Vaal River System.*

*“The aim of these recommendations is to avert impending crises and stabilise the situation, as well as addressing current gaps in the understanding of AMD problems in the priority areas and their potential impacts on the environment. It is therefore recommended that the process of assessment, risk appraisal and the recommendation of remedial measures be continued with ongoing assessments.”*

### The FSE responds

To industriously justify the neutralisation of AMD on the grounds of historical (inadequate) management of AMD during active mining is, by analogous reasoning, the same as justifying an apartheid system on the grounds that it existed in the past.

This release is also recommended notwithstanding the fact that there is not a single quantified impact assessment in the report as to the impacts it will have on the receiving environments and the downstream water users.

This is a flagrant anomaly to the precautionary principle which is upheld in the report namely that the precautionary principle be adopted in areas where significant uncertainty exists in order that prudent action can be taken to minimise latent hazards

The report states

*“The options of direct consumptive use of neutralised mine water or desalination and sale of the water to local users must be investigated.”*

The FSE responds

This is conceived as non-sensical in the light of the Report’s statement that the water from the Eastern and Western basins, will, possibly, be of no use and, furthermore that no user has as yet expressed an interest in the Eastern basin’s water.

The Report states regarding **government’s** assistance and intervention

*“The Eastern basin situation*

*“The situation here is critical and despite government help pumping has ceased in this basin.*

*“Whilst continuation of this pumping regimen is at risk of failure owing to financial constraints, an early casualty of the situation was the treatment of the raw mine water prior to its release into the Blesbok Spruit and a Ramsar-listed wetland. Treatment of the mine water has not occurred for some time. The cessation of pumping will result in flooding of the pump station within 30 days, after which the mine water will rise to its decant level and decant in or close to the CBD of Nigel on the East Rand.*

*Recent financial limitations have resulted in the Grootvlei Mine discharging untreated water, thereby failing to meet the discharge standards as per their water use license. The*

*substandard effluent is being discharged into the Blesbok Spruit, which flows through a Ramsar-listed wetland.*

*“Given Grootvlei Mine’s financial position, the pump station will be flooded within 30 days, should their pumping operations cease, whereupon the water level will continue to rise until it decants into the surrounding dolomitic aquifers and, eventually, to the surface, with the predicted decant point being within the town of Nigel*

*“Current pumping infrastructure needs to be maintained in the Eastern Basin to allow access to the underground workings. If necessary, State assistance to Grootvlei Mine should be continued to allow pumping to continue and the infrastructure to be maintained.”*

### The FSE responds

The Report omits to state that there are impacts upon the Marievale Bird Sanctuary, an important former Ramsar site<sup>10</sup>, nor does it elaborate on why government had allowed this to happen despite having the authority to continue pumping and to recover the costs as per , inter alia, s19 of the NWA. There are similar provisions in the MPRDA and the NEMA<sup>11</sup>.

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<sup>10</sup> Salinity standards in the Blesbokspruit should be met in order to re-establish conditions for Ramsar Wetland status. The salinity should not exceed 300mS/m. The normal range should not exceed 200mS/m. Salinity should be kept low (40mS/m) for long enough (3 – 4 months) in summer to permit germination and establishment of macrophyte species. Flushing should be implemented to effectively regulate the accumulation of salts and water quality should meet the requirements of aquatic life.

<sup>11</sup> *“It is clear that mining operations, even after they have been discontinued, are still having a major impact on the water quality in the Vaal Barrage catchment, to the extent that it can no longer be compared with other natural water systems...the underlying problems of this catchment are largely due to heavy metals, which should be identified and removed at sources by targeted rather than blanket remediation procedures, in order to control costs...the overall results show that although water samples from 17% were persistently cytotoxic, only 21% of the sites surveyed showed no evidence of cytotoxicity at any time. This suggests a failure on the part of those agencies responsible for the enforcement of existing regulations and is an unacceptable situation, bearing in mind that source water from this survey area impacts directly upon the Vaal Barrage, a national water resource.”* (WRC Report No 1397/1/07. “Monitoring Environmental Water for the Presence of Toxic Agents: A Pilot Study in the Vaal Barrage Catchment”. JM Whitcutt et al. 2007.)

The Report fails to recommend how government should intervene in order for it not to be another failure. This is critical since the two interventions have proved to be wholly unsuccessful and failed to mitigate the situation.

### The Report states

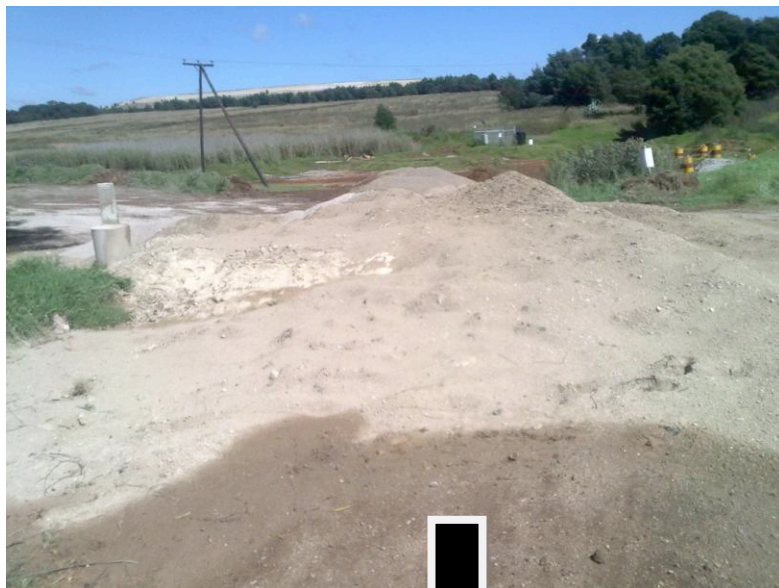
*“The Western Basin situation*

*“The seriousness of the situation and concerns regarding the impacts on the receiving environment (Hobbs and Cobbing, 2007), notably the Cradle of Humankind World Heritage Site, resulted in an intervention by the DWA who granted a subsidy of R6.9 million over a three-month period in early 2010. This measure was aimed at reducing acidity and removing some heavy metals in the water through in-stream lime dosing.*

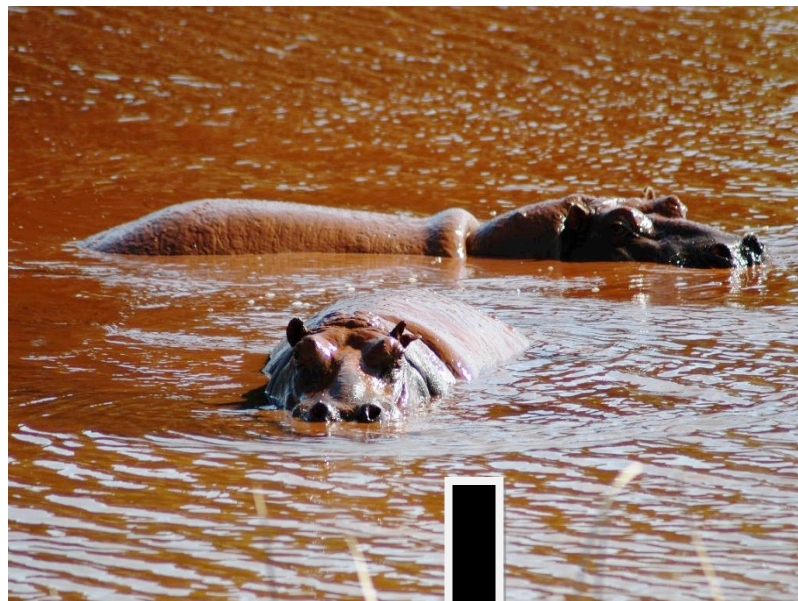
### The FSE’s response

This statement awoken all our reflection and attention.

On the 18<sup>th</sup> of March, 2010, the former Minister of Water Affairs, Minister Sonjica Buyelwa (2009 – 2010) donated R6.9 million for the purchase of lime to ostensibly ameliorate the impacts of the uncontrolled, untreated AMD from the West Rand Basin. Lime was added to the uncontrolled, untreated AMD which flowed from the Rand Uranium property into the receiving Krugersdorp Game Reserve. As a result of the neutralisation of the AMD with lime, the toxic and radioactive heavy metals precipitated in the receptor dams (Hippo Dam and Aviary Dam) and the Tweelopiespruit within the Krugersdorp Game Reserve. The heavy metal sludge has coated the two resident hippopotami. The neutralisation caused the formation of a heavy metal crust on the bottom of the Tweelopiespruit. (Please see subjoined photographic evidence.)









In June, 2010 the lime dosing was stopped. The untreated uncontrolled AMD once more flowed into the Tweelopiespruit, mobilising and solubilising the precipitated heavy metals in the receptor dams and Tweelopiespruit. The current volume of untreated AMD that is flowing uncontrolled into the Tweelopiespruit is approximately 30 to 40 million litres per day. Please see subjoined photograph.



The authors must give an opinion and whether similar interventions in the future should be done. If this is the type of intervention recommended then the situation is completely lost.

The lime dosing is conceived a desperate action by a desperate department that had lost complete control of the situation within the West Rand goldfields.

It should not be omitted that in addition to the decant to the Tweelopie Spruit to the north, the seepage of water to the Wonderfonteinspruit to the south has been observed during periods of heavy rainfall. This catchment is also extensively impacted on by seepage from mine residue deposits within the catchment, has been shown to have poor water quality and is of particular concern as it is an important local water source, feeding the City of Potchefstroom downstream.

In the Wonderfonteinspruit catchment wetlands play an important role in reducing the dissolved pollutant content, with uranium and cadmium being the main contaminants, within the water column. This occurs due to the adsorption and precipitation of pollutants from the water into the solid phase. However, it is important to note that research has shown that the processes which sequester pollutants in the sediment bodies may be reversed by a number of processes including the discharge of acid mine drainage and the drying out of sediments due to a reduction in water flow<sup>12</sup>.

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<sup>12</sup> “Results indicate that U-levels in water resources of the whole catchment increased markedly since 1997 even though U-loads emitted by some large gold mines in the Far West Rand were reduced. This apparent contradiction is explained by the contribution of highly polluted water decanting from the flooded mine void in the West Rand.

“800kg of U per year flowing into Boskop Dam as Potchefstroom’s main water reservoir...Of particular concern is the fact that U-levels in the WFS are comparable to those detected in the Northern Cape which had been geostatistically linked to abnormal haematological values related to increased incidences of leukaemia observed in residents of the area”.

In both of the above-mentioned basins the government had already intervened to a certain extent, yet both interventions had been a failure. The report does not address the reasons why these failures occurred, nor does it make recommendations as to how the government should intervene in the future in similar situations which are predicted for the Mpumalanga coal fields, KOSH, Far West and Free State goldfields. There are no management plans in place to address the flooding of the mining basins and decant.

The Report states regarding the polluter pays principle

*“Other countries*

*“Acid mine drainage is a significant and costly environmental impact of the mining industry worldwide. The legacy of mining continues to affect surface and groundwater resources long after mining operations have ceased.*

*“Acid Mine Drainage In Australia*

*“As part of the guideline acid generation should be predicted and incorporated in the mine closure plan (ANZMEC, 1995).*

*“Acid Mine Drainage In Canada*

*“Mines in Canada were required to establish trust funds to cover the cost of the effect of AMD from mine wastes*

*“Acid Mine Drainage In The USA*

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*(Uranium Pollution of Water resources in Mined-Out and Active Goldfields of South Africa – A Case Study in the Wonderfontein spruit Catchment on Extent and Sources of U- Contamination and Associated Health Risks. Prof. Dr. Frank Winde. North West University, South Africa.)*

*“In the USA abandoned mines are rehabilitated under the National Abandoned Mine Land Programme under the Office of Surface Mining Reclamation and Enforcement (OSMRE) of the US Department of the Interior. Funds are raised via a levy on active coal mines and deposited into the Abandoned Mine Lands (AML) fund — a trust administered by the U.S. Treasury (Office of Surface Mining, 2006) to pay for reclamation of mines abandoned before the passage of the Surface Mining Control and Reclamation Act of 1977 (Wikipedia, 2007).*

*“Managing Uranium Mining Legacies In Germany*

*“To this end a fund of €6.6 billion (later revised to €6.2 billion) was established under the 'Wismut Act, passed by the Federal Parliament in 1991 (Hagen and Jakubick, 2006).”*

The FSE responds

It is evident that the polluter, or at least the industry, is paying for pollution caused in the aforesaid countries. In Germany, the old coal companies are still in existence, and they are importing coal for the power stations, and making a profit on the imports in order to pay for the cost of water treatment. That means that South Africans are subsidising the water treatment in Germany, yet South Africa is not prepared to pay for the cost of treatment in our own country.

The NWA, NEMA and MPRDA impose obligations upon the polluter to remove pollution from the environment and to rehabilitate the affected areas. The MPRDA, NEMA and the NWA include historical contamination as one of the triggers for the obligation. As such, it was the intention of the drafters of the legislation to require reasonable measures to be taken not only where activities are currently causing pollution or where they may in future cause pollution, but also where past activities have caused contamination, which contamination remains evident in our environment today.

The Report however fails to recommend desalination due to the DIRECT costs involved but ignored any INDIRECT costs associated with it. It recommends neutralisation. Neutralisation EXTERNALISES the costs on the receiving environment, water users and the taxpayer of South Africa.

### The Report states

#### “Current situation

*“Currently two plants are treating AMD to potable quality in South Africa at full scale. The costs of this treatment are estimated at around R11 per cubic metre, with a capacity of treating 20 MI/d (20 000 m<sup>3</sup>/d) at each plant, including amortisation of the capital costs of the plant (several hundred million Rand) over the projected 20 year design life of the plant. This is not economically self-sustaining and relies on a subsidy from the mining companies. Therefore, it is foreseen that there will be a shortfall between the cost of clean water produced in a plant and the revenue recoverable from the sale of water. Some of the water treatment methods identified can recover further costs via the sale of other by-products, such as gypsum, sulphur, sulphuric acid, explosives and fertilisers. The remaining shortfall may be made up using the Waste Discharge Charge System and water use charges; however, care needs to be taken to ensure that the costs of pollution by historical mining activities are not unfairly passed on to other water users.”*

### The FSE responds

This is the essence of the Report, namely: If water desalination it is not self sustainable, the mines cannot be expected to pay. Until such time as it pays, pollution and the externalisation of the costs are justified.

It begs the question whether there will be equitable treatment of all the other polluters in the country. It furthermore fails to answer to the principles of equity, justice and

morality since the National Desalination Strategy states that the shortfall between the cost of treatment and the price of the water must be made up by the consumer.

#### The Report states

*The cost of desalination projects will have to be recovered from the water users in accordance with the principles of the National Water Pricing Strategy. A desalination project will typically be one of several schemes to supply water to a region, city or community. The water tariff must reflect the cost of the total water supply system, including the desalination project(s) and the specific users of the desalinated water must not be charged a differential rate or tariff.*

#### The FSE responds

This is conceived as inequitable and unfair since the cost of the treatment of water is R11/m<sup>3</sup> in eMalahleni whilst the cost from the Witbank dam is only R2-20 /m<sup>3</sup>. The consumer will be expected to pay. We submit that it is unconstitutional and contrary to the principles of the NEMA, MPRDA and the NWA.

#### The Report continues

*“Acid mine drainage has significant economic and environmental impacts owing to both the corrosive effects of acid water on infrastructure and equipment, and the severe environmental impacts related to the low pH and high metal and salt loadings. In most cases, AMD will not be suitable for direct use or discharge into the environment. These impacts continue long after mine closure and can have adverse impacts on the ecology of streams, affecting the beneficial use of waterways downstream of mining operations.”*

#### The FSE responds

The impact of the neutralized water and associated externalised cost ought not have been passed over or omitted from the Report.

The Report states regarding the advantages and disadvantages of the polluter pays principle

*“Table 9.1 deals with the governance issues.*

*“...polluter pays principle is an incentive for mining companies not to pollute in future.*

The FSE responds

The statement regarding the difficulty to apportion liabilities is anomalous to the statement in the Report that apportionment studies, performed by the CGS on behalf of the DMR, have found that while a number of the mines in the area are derelict and abandoned, the mines cannot necessarily be classified as ‘ownerless’. Liability for the impacts of these mines, in terms of Section 46 of the MPRDA, can therefore not be automatically assigned to the State.

Firstly, in terms of the MPRDA, the holder of a prospecting or mining right is responsible for any environmental damage, pollution or ecological degradation arising from the prospecting or mining operations and occurring inside and outside the area to which the right relates. Liability for environmental damage, pollution or degradation continues until such time as a closure certificate is issued by the Minister of Mineral Resources.

Further, directors of a company or members of a close corporation are jointly and severally liable for any unacceptable impact on the environment irrespective of whether such damage was done intentionally or through negligence.

Secondly, s 19 of the NWA obliges any person (i.e. not only those who hold a water use authorization) who has occupied or used land on which any activity or process was performed that caused (or is likely to cause) pollution of a water resource, to take all



reasonable measures to prevent such pollution from occurring, continuing or recurring. Where a person fails to take such measures, the relevant catchment management agency may direct that specified reasonable measures be taken.

Where a person fails to comply with such a directive, the catchment management agency can carry out such reasonable measures as are required and recover the costs from the person responsible.

Section 28 of NEMA establishes a similar but at the same time more general obligation on every person who has or may cause significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring. Where the pollution or degradation is authorized by law or cannot reasonably be avoided or stopped a person must take reasonable measures to minimize and rectify the pollution or degradation.

The Director-General of the national department responsible for environmental affairs or a provincial head of department can direct a person to take reasonable measures and, where they fail to comply, can cause the measures to be carried out and recover costs from the responsible person.

#### The Report states

*“It would be difficult proving and enforcing liability will be costly and time consuming.*

*“According to table 8.2 on page 76 (Lime treatment for industrial water) the cost of the treatment of the 175 ML per day will be R840 000 per day and the cost over the year equal to R306 million.”*

#### The FSE responds

It begs the question who will pay the R840 000 per day or the R306 million per year?

The Report states

*It would be difficult to manage regionally.*

The FSE responds

It begs that question what is more difficult – managing a neutralisation process or monitoring it to see that it is done.

Nothing prevents the state from pumping and treating the mine void water and thereafter recovering the cost from the liable companies. We refer to NWA s 19, NEMA s28 and 30 and the MPRDA s 38, 45 and 46.

The Report states

*The polluter pays principle is “practised for currently operating mines in most mining countries” but that it is not viable due to the fact that it is “unlikely to be effective as most mines are not operative in the priority areas”*

The FSE responds

It must be noted that the mines do not have to be operative any more. They can still operate in another area and still be liable, or have a new owner that had profited from the pollution. The state must recover as much as possible of the money that it is spending

The Report further states

*In the mining basins of the Witwatersrand two major classes of AMD sources exist*

- *The large volumes of AMD that flood the mine voids and will decant unless suitable steps are taken to reduce the recharge volumes and water*

*is extracted from the mine voids to maintain an environmentally acceptable water level.*

- *The multiple smaller volumes of seepage and run-off from contaminated areas, largely mine residue deposits. The diffuse nature of this drainage poses specific challenges for treatment.*

### FSE Comment

No proposals are made as to the mitigation and cleanup of these by the mining companies.

### The Report continues

#### *Available Technologies For The Treatment Of Amd*

*Several technologies have been identified for the treatment of AMD. These include active, passive and in situ methods (Table 8.1).*

#### *Pre-treatment-Partial treatment for neutralisation and metal removal*

*The following criteria have to be met:*

- *Partial treatment (neutralisation and metal removal) has to be applied as soon as possible to address the immediate problem*
- *Chemical costs need to be kept to a minimum*
- *Construction costs need to be kept to a minimum*
- *Construction time needs to be kept to a minimum*

*Lime or limestone/lime can be used for partial treatment of the decant water from the Western Basin. This will offer the most cost-effective short-term management option.*

### The FSE responds

The emphasis in the recommendations of the Report is on cheap costs without taking into consideration the costs of the high salinity<sup>13</sup> of the water that will be discharged and the fact that the costs will be borne by the taxpayer and other users who did not benefit from the mining operations. The Report fails to mention the externalised costs.

### The Report states

“ *Desalination*

*Desalination — the removal of salts from water — is a serious consideration because of the need to reduce the salt loads entering river systems. In the case of desalination the following criteria need to be met:*

- *Minimum running cost*
- *Minimum capital cost*
- *Minimum sludge/brine disposal cost*
- *Maximum value of treated water and by-products...*”

### The FSE responds

This is analogous to buying a Mercedes at the price of a bicycle which needs no fuel and has no maintenance care. It is impossible.

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<sup>13</sup> “It is clear that mining operations, even after they have been discontinued, are still having a major impact on the water quality in the Vaal Barrage catchment, to the extent that it can no longer be compared with other natural water systems...the underlying problems of this catchment are largely due to heavy metals, which should be identified and removed at sources by targeted rather than blanket remediation procedures, in order to control costs...the overall results show that although water samples from 17% were persistently cytotoxic, only 21% of the sites surveyed showed no evidence of cytotoxicity at any time. This suggests a failure on the part of those agencies responsible for the enforcement of existing regulations and is an unacceptable situation, bearing in mind that source water from this survey area impacts directly upon the Vaal Barrage, a national water resource.” (WRC Report No 1397/1/07. “*Monitoring Environmental Water for the Presence of Toxic Agents: A Pilot Study in the Vaal Barrage Catchment*”. JM Whitcutt et al. 2007.)

What is recommended is to take the complete cost of desalination and compare it with the complete cost, including the externalized cost of neutralisation, and then come to a conclusion. The deliberate refusal of the authors to do it, despite the need for it as is in the Constitution, NEMA, MPRDA and NWA, is astonishing.

The risk assessment and impact predictions (see BPG G4: Impact Prediction) must be fully documented in a comprehensive technical report that sets out the detailed methodology that must, as a minimum, include the following information:

- Financial provision for construction, operation and maintenance of post-closure water management measures where required and for as long as predicted to be required.

While the DMR has prepared a guideline for determining financial provisions, there is no standardized formula or factor that can be applied to determining what the financial provisions for water management should be, as each mine site will have very site specific requirements.

### The Report states

*The generic approach that would underpin the determination of the water management financial provisions is as follows:*

- *If, even after application of an appropriate water management option, the agreed water management closure objectives are not met, then provision must be made for interception of the source of water contamination (diffuse and point sources) and treatment of the intercepted water in order that the closure objectives can be met (Reference: BPG H4: Water Treatment).*
- *Determine the capital and operating costs for the full period over which the water treatment needs to be applied and incorporate this into the closure financial provisions.*

*With the scarcity of water in South Africa and the future implementation of the Waste Discharge Charge System, mine closure management options that result in the interception and evaporation of contaminated water are not acceptable, and management measures should be implemented to eliminate this water use.*

*Where the need for water management and treatment actions is envisaged after mine closure, appropriate arrangements must be made for financing and managing the water management / water treatment operations for the designated period of time (in terms of the MPRDA and various regulations defined in R527) after mine closure.*

*Closure (and future land use) objectives and how these relate to the mining operation and its environmental and social setting must be included in the environmental management programme (EMP) developed during the planning stages of the mining operation (section 48(1)(a)). Further, in line with section 24(a) of the Constitution, 1996 (Act 108 of 1996), any environmental damage or residual impacts identified during the environmental risk assessment (ERA) process must be acceptable to all involved Interested and Affected Parties (IAPs) (section 42(1)(d)). It is therefore essential that any decisions on closure requirements and whether proper closure has taken place, be done co-operatively with government representatives who have the responsibility for the protection of the environment (water, soil, air, etc.) and social issues, as well as any other IAPs.*

### The FSE responds

It begs the question why the aforesaid provisions are not implemented

We alleged that the aforesaid principles have not been applied in any of the coal mine applications that we have been involved with. Furthermore, all of our objections have

been ignored and the mine has been given approval. The DWA is currently issuing licenses to coal mines who are not complying with their own guidelines as far as public participation and closure assessments are concerned. Notwithstanding our objections, DWA is continuing with this practice.

It perplexes why are the authorizing departments are reticent to implement their own guidelines and laws.

The Report purports to follow the aforesaid guidelines

*“The objectives of AMD management for the Witwatersrand stem from the DWA Best Practice Guidelines, in particular the highest priority issues in terms of the hierarchy defined above, i.e. the prevention of pollution and the minimisation of impacts. The implementation of the principle of water reuse and reclamation is essential and must be applied, either via direct reuse of water or via discharge and indirect reuse by downstream water users. In either case, water would need to be treated to a quality suitable for the intended use or point of discharge.”*

#### The FSE responds

There is overwhelmingly evidence that the aforesaid is not the case.

#### The Report states

##### *“Apportionment of liability*

*“Apportionment studies, performed by the CGS on behalf of the DMR, have found that while a number of the mines in the area are derelict and abandoned, they cannot necessarily be classified as ‘ownerless’. Liability for the impacts of these mines, in terms of Section 46 of the MPRDA, can therefore not be automatically assigned to the State.*

*“The apportionment procedure for all basins needs to be verified.”*

### The FSE responds

This needs to be done as a matter of urgency in order to recover the costs of this intervention for the responsible mining companies.

### The Report states

*“Other areas of priority*

*“The Free State, KOSH, Far West Rand and Evander Gold Fields, are currently being mined actively and water is pumped from these basins. It is recommended that a risk assessment of these areas be carried out to determine their vulnerability to the premature closure of specific mines and shafts.*

*“Mpumalanga*

*“There is a need for a birds-eye-view environmental risk assessment of the entire Witwatersrand gold-mining basin, focussing on the impacts of mining on the environment and the health and safety of communities. A similar study must also be conducted for the Mpumalanga Coal Fields*

*“Severe water related problems, including numerous AMD decants (Figure 5.2), have been reported in the Mpumalanga Coal Fields. These must be regarded as serious and in need of follow-up action and assessment, particularly in view of the expansion of coal mines in the area and the regional-scale impacts already reported.”*

### The FSE responds

It begs the following questions:



1. When is this going to be done?
2. Will the applications be halted pending the outcome of such a report?
3. When will an audit be done on the financial provision of the coal companies to deal with this AMD that is already there and predicted?

### The Report states

#### *“Far Western basin*

*“Most of the mines in this basin are still operational and AMD problems owing to flooding are not regarded as urgent at this stage. There is, however, uncertainty with regard to the quality of water filling the mine voids after mining has ceased, indicating that attention must be paid to potential impacts on the overlying dolomitic aquifers. This poor quality water is believed, at least in part, to originate from tailings facilities that were historically located over cavernous dolomite to encourage the drainage of the tailings, without regard for the underlying groundwater quality. A contributory factor is the historical practice of filling sinkholes in the dolomite with mine tailings.”*

### The FSE responds

In terms of gold mine closure planning, the Far West Rand mines can be divided into three geohydrological management units viz. the eastern, central and western sub-basins. These sub-basins include the Gemsbokfontein (eastern sub-basin), Venterspost, Bank and Oberholzer (central sub-basin) and Turffontein (western sub-basin) groundwater compartments. While dykes, which are considered impermeable separate the compartments, there is still interaction between different compartments due to spillage from one compartment to the next in the form of “eyes” or fountains.

Furthermore, some of the upper portions of the dykes are weathered causing flow from one compartment to another.

The groundwater is found in two distinct aquifers. The gold mines in this area are mainly situated underneath the deeper dolomitic aquifers. The deeper aquifer is significant in terms of future water supply sources and is vulnerable to contamination with poor mine water upon filling. The upper perched aquifer is at risk of contamination from surface waste residues and seepage from backfilled sinkholes. This contamination is however not thought to pose a serious threat to the lower aquifer. The dewatering of the dolomitic compartment and the subsequent lowering of the groundwater levels has resulted in significant sinkhole formation and widespread ground stability problems. Decanting is likely once mining ceases in this area. Poor decant water quality will impact on surface water resources. Groundwater stability levels will be dependent on the adequate sealing of the dykes.

There are no proactive management plans to address the flooding of the Far Western basin and decant.

#### The Report states

##### *“Klerksdorp, Orkney, Stilfontein and Hartbeesfontein (KOSH) Basin*

*Continued mining operations in the KOSH Gold Field depend on the pumping infrastructure at Margaret Shaft (Stilfontein Gold Mine).*

*Stilfontein Gold Mine was declared insolvent in 2005, resulting in the temporary abandonment of all the mine workings, including the pumping station at Margaret Shaft. In order to prevent the flooding of all of these workings, the other active mining companies in the area took over the pumping operations at Margaret Shaft and have been operating the pump station under transitional arrangements with the DMR and the DWA. A water utility company has been formed to operate the pumping station and it has been proposed that revenue can be generated from the water pumped”.*

#### The FSE responds

### KOSH area

KOSH area is underlain by dolomite. The goldfield can be subdivided into four groundwater compartments, but due to the interconnections existing between the mines, a closure water management strategy should be integrated across all the KOSH mines. The mine workings, after flooding are likely to decant. There are also significant surface groundwater interactions that impact on water quality in terms of pumpage of water from the mines to surface water, recirculation of water in the mines, continuous seepage from surface tailings dams and return water dams, eye flow and seepage. The high sulphide ores in this area result in potentially high long-term risk of water pollution from both the underground workings and surface residue deposits. Pollutant prevention management strategies need to be included and transport of pollutants properly evaluated. Sinkhole formation and backfilling of these sinkholes also need to be addressed in the closure planning process.

There are no proactive management plans in place to address decant.

It should not be passed over that in the KOSH goldfields, DWA and the NWDACERD recently authorised the mining company, First Uranium's (Mine Waste Solutions) construction of an unlined centralised tailings storage facility and the reworking of 15 old residue deposits. The EIA identifies pollution that will take place into the surrounding groundwater and the Vaal River system. While the EIA was conducted on the premise that a sulphuric acid plant will be constructed, the construction and subsequent use of the sulphuric acid plant will no longer form part of First Uranium's beneficiation process. As a result the impacts upon the surface and groundwater will be significant. In view of the aforesaid, it is evident that poor water management practices are perpetuated.

### The Report states

#### *Free State Gold Field*

*Most mines in the Free State are still operating and pumping is active.*

*However, a number of challenges result from the closure of some shafts and the need to increase pumping capacity at the remaining shafts. It is also necessary to isolate the remaining mining areas by installing plugs between them and the closed areas. In the latter case, seismicity and the rate of the water level rise will have to be monitored.*

*The current main concern pertains to the large number of evaporation and return-water dams in which the partially treated mine water has a high concentration of heavy metals and salts, impacting surface water bodies in the area.*

*The possibility of treating mine water and selling it to the local bulk water supplier has been raised, but has not been undertaken yet as water demand is not high enough in the area.*

*Some tailings facilities have been shown to be responsible for contaminating borehole water in the area. Most of the reclaimed tailings facilities have not been rehabilitated yet, and they are sources of both groundwater and surface water contamination.”*

## The FSE responds

### Free State goldfields

It was established that the Free State goldfields should be further subdivided into 5 sub-basins as set out below.

The Theunissen sub-basin consists of Joel and Beatrix gold mines, situated between the De Bron and Stuurmanspan Faults. These mines are not interconnected through mining, but hydraulic connectivity does exist through geological structures. Beatrix gold mine has pumped in the order of 30 megalitres per day (Ml/day) from the Witwatersrand aquifer during the 1990's. This has resulted in a dewatering cone developing in the aquifer, which has dewatered part of Joel mine as well, to the extent that groundwater inflows into Joel seldom exceeded 10 Ml/day during that time. Groundwater abstracted from the

mines is evaporated on the mine property as well as piped to Welkom, where it is also evaporated.

The Oryx sub-basin consists of Oryx gold mine. This mine is isolated from the other mines and the Stuurmanspan Fault in the east and the Border Fault in the west mark its boundaries. This mine has been plagued by large groundwater inflows (~60 Ml/day). This water is also derived from the Witwatersrand aquifer and temperatures of as high as 60° Celsius are recorded. Groundwater pumped from the mine is evaporated.

The Virginia sub-basin consists of the Harmony gold mines (Harmony original, old Virginia, old Saaiplaas, old Erfdeel and old Merriespruit). These mines are all interconnected and the De Bron Fault marks its western boundary. The distal depositional environment and the disappearance of economical reef horizons form the eastern boundary of this sub-basin.

The Welkom sub-basin consists of the President Steyn (south), St. Helena, Harmony (President Brand and Unisel), Freegold (Matjhabeng, and Bambanani) and ARM gold mines. The Border Fault forms the western boundary and the Welkom goldfield is separated from the Virginia sub-basin by the De Bron Fault structure.

The Odendaalsrust sub-basin consists of the Freegold (Tshepong and Jeanette), President Steyn (north) and Target gold mines. The Border structure forms the western boundary and mining to the east is restricted by the Dagbreek fault.

For the Free State sub-basins a regional approach to dewatering may be more effective in reducing the groundwater levels to the benefit of all mines concerned. Pumping rates generally range from 2- 23 Ml/day. It does not seem likely that water will decant from any of the gold mine shafts in this region after cessation of mining and flooding of mine workings.

However, the serious threat of contamination of the shallow, good quality water, the Karoo aquifer, through the residue deposition on surface or through the large-scale evaporation of saline water pumped from the deep Witwatersrand aquifer, needs to be addressed.

An urgent financial liability, legal compliance and EMPR compliance audits need to be undertaken on all of the mines to make provision for their post closure treatment.

### The Report states

#### *“Evander Basin*

*“... there is evidence that the evaporation dams and tailings facilities contaminate the local shallow aquifers hosted in alluvial and/or Karoo sediments. Water management in the area is further complicated by the presence of underground coal mines located directly above the gold mines.”*

### The FSE responds

#### Evander goldfield

The Evander goldfield groundwater management strategy will need to be integrated across the area since all the gold mines in Evander belong to one mining group and all the shafts are linked through underground workings. There may be three aquifers present in this area that may or may not be interconnected. They include an unconfined Karoo perched aquifer close to the surface; a confined or semi- confined aquifer within the underlying dolomite and the possibility of a confined Witwatersrand connate aquifer. The latter is usually characterised by saline water. A critical issue here is the presence of the Ventersdorp lava within this basin, which would form a barrier between the overlying aquifers and the mined out barrier.

An urgent financial liability, legal compliance and EMPR compliance audits need to be undertaken on all of the mines to make provision for their post closure treatment.

### The Report states

*“Other*

*“Considering the commodities mined, AMD impacts can also be expected in the Waterberg, Molteno and Limpopo Coal Fields and the South Rand Gold Field. As no serious problems are known to have developed yet in these areas, they cannot be regarded as high priorities, but the individual circumstances need to be assessed and monitored in order to provide timely information on possible future problems*

*“A number of AMD impacts have been identified in the O’Kiep Copper District (Figure 5.3) in the Northern Cape by the CGS during the investigation of derelict and ownerless mines and other research activities (Coetzee et al., 2008). These appear to have a localised impact, although potential long-term impacts have also been identified.”*

### The FSE responds

Impacts are expected. Current governance by DWA, DEAT and DMR have not and are not preventing the same issues from arising, and they are not acting decisively when they do arise., that is clear from the report. Government had failed miserably.

Taking into account the vast areas under application in the Limpopo province for coal mining , it is imperative that a detailed study of the cumulative impacts ( birds eye view) is done and that the minimum requirements of financial liability and provision for that in the planning stages already are shown and that this is incorporated into the EMPR for perusal of all. If this is not done (interpolation: it was not done in the Mapungubwe application of Coal of Africa for example), then we shall be faced with a new crisis every

few years when the governance had failed yet again and the impacts overwhelm the industry and government departments as it has in the Witwatersrand goldfields.

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8 March 2011.