the federation for a sustainable environment

(Reg. No. 2007/003002/08)
NPO NUMBER 062986-NPO
PBO No. (TAX EXEMPT) 930 039 506
Postnet Suite 87
Private Bag X033
RIVONIA
2128

Comments on the Millsite Tailings Storage Facility Reclamation Project:

1. Wetland Sensitivity Mapping and Impact Assessment
    a. Freshwater Resource Assessment in the Vicinity of the Proposed Lindum Railway Decommissioning
    b. Freshwater Resource Assessment in the Vicinity of the Proposed Millsite Reclamation
2. Surface Water Assessment Report
3. Groundwater Assessment Report
4. Integrated Water Use Licence Application for the Sibanye-Stillwater Rand Uranium/Cooke Operations
5. Integrated Water and Waste Management Plan in support of the WULA

The following comments are submitted on behalf of the Federation for Sustainable Environment (FSE). The FSE is a federation of community based civil society organisations committed to the realisation of the constitutional right to an environment that is not harmful to health or well-being, and to having the environment sustainably managed and protected for future generations. Their mission is specifically focussed on addressing the adverse impacts of mining and industrial activities on the lives and livelihoods of vulnerable and disadvantaged communities who live and work near South Africa's mines and industries.

We refer to our previous comments on Sibanye's West Rand Treatment Project. We respectfully request that our previous comments be read in conjunction with the following comments.

In our previous comments, we expressed the following concerns:

- A number of cases have been identified where the re-mining of the dumps was not completed due to the lack of funding on the part of the mining company or due to the heterogeneity in the dumps which were mined.
- The granting and authorization for the reprocessing of individual residue deposits by the Department of Mineral Resources has allowed the selective extraction of value from portions of a site without ploughing some of that value back into the rehabilitation of the entire area.

- Radiometric surveys have in some cases shown elevated levels of residual radioactivity in the soils. Unrestricted development and inappropriate land-uses will exacerbate the risks to the mining industry and to the State.

We therefore recommended:

- The complete removal of the Tailings Storage Facilities (TSFs).
- Ploughing some of the value from the extraction of the gold into the rehabilitation of the entire area.
- Rehabilitation of the footprint/s.
- Soft land uses as opposed to high risk land uses such as grazing, residential developments and cropping.
- Pre-determined and agreed upon (with Interested and Affected Parties) **sustainable** future land use with associated resources (e.g. water).

Remobilisation of metals and the subsequent contamination of the downstream water courses

We understand from the Executive Summary of the Surface Water Assessment Report that the Millsite Complex is located within the Limpopo Water Management Area while the Cooke Plant and the Porge-, SRK- and Battery Pits are located within the Vaal Water Management Area and that the main or perennial rivers draining these areas are the Tweelopiespruit West/Bloubankspruit River and the Wonderfonteinspruit.

The associated contribution to water ingress into the mine void is likely to be considerable as the old tailings are hydraulically mined using high-pressure cannons containing mine water (Winde et al. 2011). This practice introduces air and water into anaerobic tailings, which not only contributes to acid mine drainage formation but there is also evidence for the remobilization of contaminants such as uranium and cyanides during disturbance of old tailings deposits. (Sutton & Weiersbye 2007; Winde et al. 2011).

It is anticipated that during the reclamation operations there will be the risk of contaminated runoff[1] into the Tweelopiespruit, Bloubankspruit and the Wonderfonteinspruit downstream of the reclamation operations. According to the Integrated Water and Waste Management Plan in support of the Water Use License Application (page 140) the Millsite TSF complex also drains towards the Robison Lake. It is common cause that the Robinson Lake, the Upper Tweelopiespruit and the Upper Wonderfonteinspruit have passed their thresholds and are not in the position to receive additional loads of metals.

[1] The Surface Water Assessment Report (page iii) recommends: *"Ensure that the surface profile is rehabilitated to promote natural runoff drainage and avoid ponding of water within the rehabilitated area. Surface inspection should be continuously undertaken to allow runoff to drain onto the natural streams until vegetation has fully established on the site."*

It is assumed that the runoff referred to in the above mitigation and management measure is the runoff after the footprint had been rehabilitated since there is the near certainty that runoff from the unrehabilitated footprint will contain elevated levels of sulphate, NORMs and a broad spectrum of metals.

The Wetland Sensitivity Mapping and Impact Assessment: Freshwater Resource Assessment in the Vicinity of the Proposed Millsite Reclamation informs us that the present ecological score is in the HGM Units 1, 4 and 5 a D and an E. Notwithstanding their PES scores, we are informed that they do still provide some hydrological importance services and habitat for various species. Page 28 (Figure 8-2) identified the distribution of NFEPA wetlands (we have noted that some were incorrectly categorised as NFEPA wetlands) within the Project area. NFEPA wetlands are categorized in terms of the Mining and Biodiversity Guidelines as high risk to mining and of Highest Biodiversity Importance.

The Wetland Sensitivity Mapping and Impact Assessment Report (page v) refers to transport of tailings and contaminated soils which has the potential to result in contamination and sedimentation and furthermore, that the disturbance of historical tailings and contaminated soils has the potential to result in increased oxidation of pollutants such as pyrites, which has the potential to increase impacts to water quality of the freshwater resources in the vicinity of the Millsite TSF. In addition to the management actions and targets recommended on page 64 and 65 of the Report we wish to propose the following recommendations with supporting information.

Tweelopiespruit and wetlands

According to the Harmony Environmental Impact Document titled *"Impact of the discharge of Treated Mine Water, via the Tweelopies Spruit, on the receiving Water body Crocodile River System, Mogale City, Gauteng Province"*[2], 2654 Ha are under irrigation using borehole water within the Zwartkrans Compartment and 458 Ha are under irrigation using river water. More than 11 491 people use the water for domestic purposes.

The Tweelopiespruit's path through the Krugersdorp Game Reserve and the Zwartkrans Compartment, which hosts the sensitive Cradle of Humankind World Heritage Site, assigns to it even greater ecological importance and sensitivity.

The above statements find support in the Integrated Water and Waste Management Plan in support of the WULA (page 104).

The decant of untreated mine water from 2002 to 2012 and the current discharge of neutralised mine water via the Tweelopiespruit have resulted in the contamination of receptor dams such as the Robinson Lake[3], the Hippo Dam and Aviary Dam within the Tweelopiespruit and its associated wetlands. The Dams, associated wetlands and streambed contain a yellow-orange solid colloquially known as yellow boy and other types of iron precipitates, including iron oxides and oxyhydroxides. All these precipitates discolour the water and smother plant and animal life on the streambed, disrupting stream ecosystems.

[2] DWAF 16/2/7/C221/C/24 (3 December 2006)

[3] Coetzee et al., 2003 reported a uranium concentration in a surface-water body next to the northern watershed of the headwater region of the Wonderfonteinspruit (Robinson Lake) of 16 mg/l after underground mine water decanting into the Tweelopiesspruit was pumped into the lake. This extreme concentration is believed to be the result of remobilisation of uranium from contaminated sediment by acidic water.

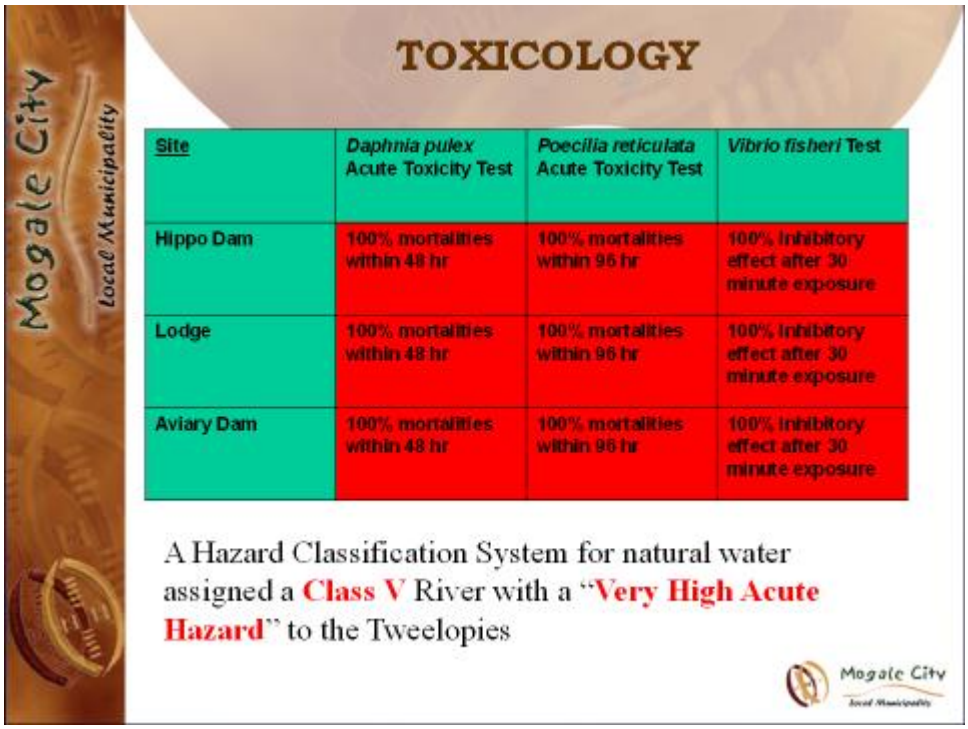
Precipitated metals within the Upper Tweelopiespruit downstream of the Hippo Dam

Metal precipitate in the sediment of the Tweelopiespruit

It was found that the following determinants in the mine void water exceeded the Maximum Allowable Limits (Class II) of the SABS 241 Drinking Water Standard, in many cases by several orders of magnitude: pH, EC, TDS, So4, Fe, Mg, Ca, Mn, Al, Pb, Co and Ni[4]. While the current short term treatment of AMD is removing most of the metals, it should be noted that the metals have not simply disappeared but that they have merely changed to a different oxidation state, which changed them from a soluble form to a solid form. The process could be reversed and the contaminants mobilised, should the water become acidic.[5]

The subjoined results of Mogale City Local Municipality's toxicity test of the Tweelopiespruit were presented on the 9 November 2011. The results assigned a Class V River status to the Tweelopiespruit.

[4] Harmony Environmental Impact Document titled "Impact of the discharge of Treated Mine Water, via the Tweelopies Spruit, on the receiving Water body Crocodile River System, Mogale City, Gauteng Province" (DWAF 16/2/7/C221/C/24) (3 December 2006)
[5] Ibid



The Upper Tweelopiespruit remains a Class V River notwithstanding the current short term treatment of mine water. This statement finds support in the Surface Water Assessment Report (page ii), which states: *"The Bloubankspruit/Tweelopiespruit West parameters such as Uranium, Manganese and Sulphate levels are mostly above the proposed Bloubankspruit RQO's."*

Wonderfonteinspruit and wetlands

According to the Integrated Water Use Licence Application (IWULA) and the Integrated Water and Waste Management Plan in support of the IWULA (page vii), underground fissure water from the ingresses into the mine void is collected and eventually discharged into the Wonderfonteinspruit. This discharge will continue until a final closure plan is decided upon and implemented.

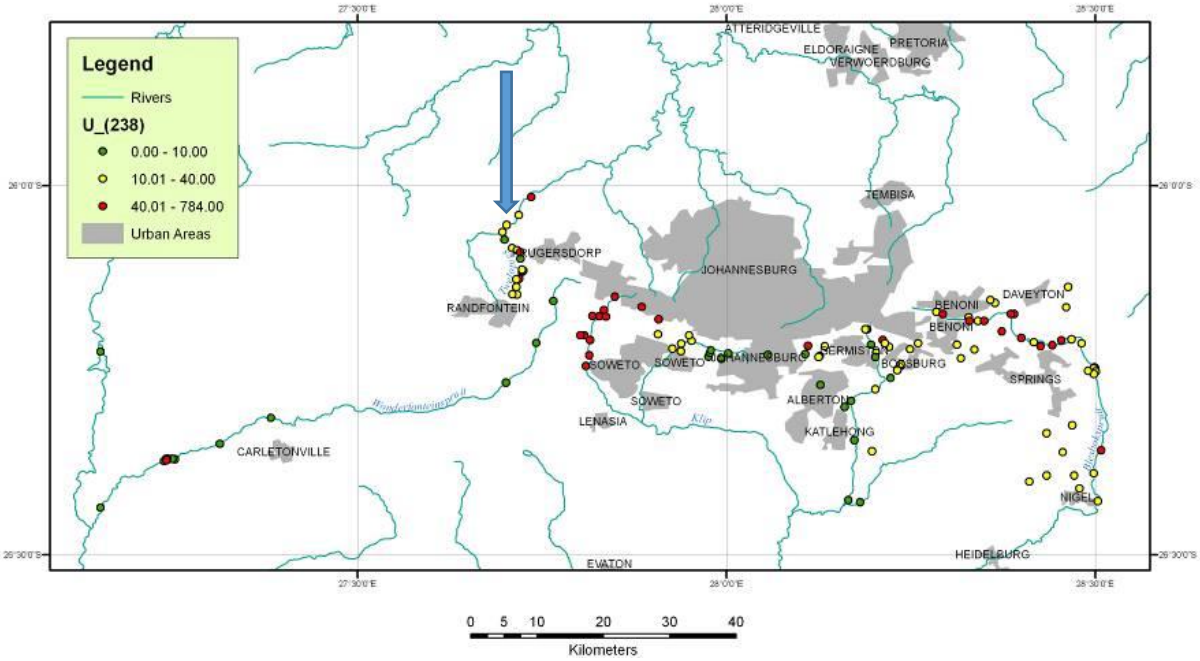
The Wonderfonteinspruit valley is densely populated because of its agricultural value and presence of gold mines. Potchefstroom is located downstream of the Wonderfonteinspruit, from which more than 400 000 people derive their drinking water via the Boskop Dam.

The mean values for the Wonderfonteinspruit samples were found to exceed not only natural background concentrations, but also levels of regulatory concern for cobalt, zinc, arsenic, cadmium and uranium, with uranium and cadmium exhibiting the highest risk coefficients. (Ref. WRC 1214/1/06)

The most important lesson learnt from the studies in the Wonderfonteinspruit is that no short-cuts exist which would allow certain pathways to be ignored in a study of radioactive contamination within these mining areas.

The Surface Water Assessment Report (page ii) confirms elevated levels of *inter alia* sulphate and manganese. It states: "*...Suspended Solids, ...Sulphates, Manganese etc. most of the parameters have indicated quality which is above the discharge limits as provided in the Water Use license*."

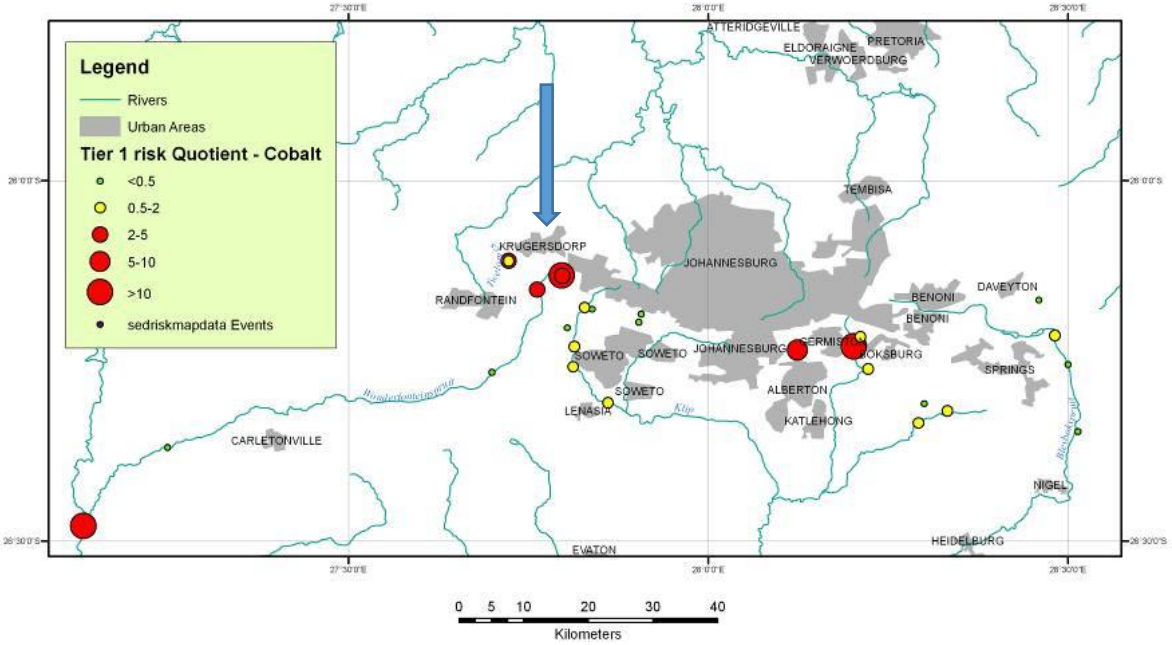
While the wetlands system associated with the Tweelopiespruit and the Wonderfonteinspruit was historically successful in adsorbing and sequestrating the metals, the wetlands no longer have the ability to cope with the pollutant loads flowing into them. The wetlands have historically acted as metallic pollutant sinks. There is the identified risk of the remobilisation – under plausible environmental conditions - of metals from the sediments within the wetlands.



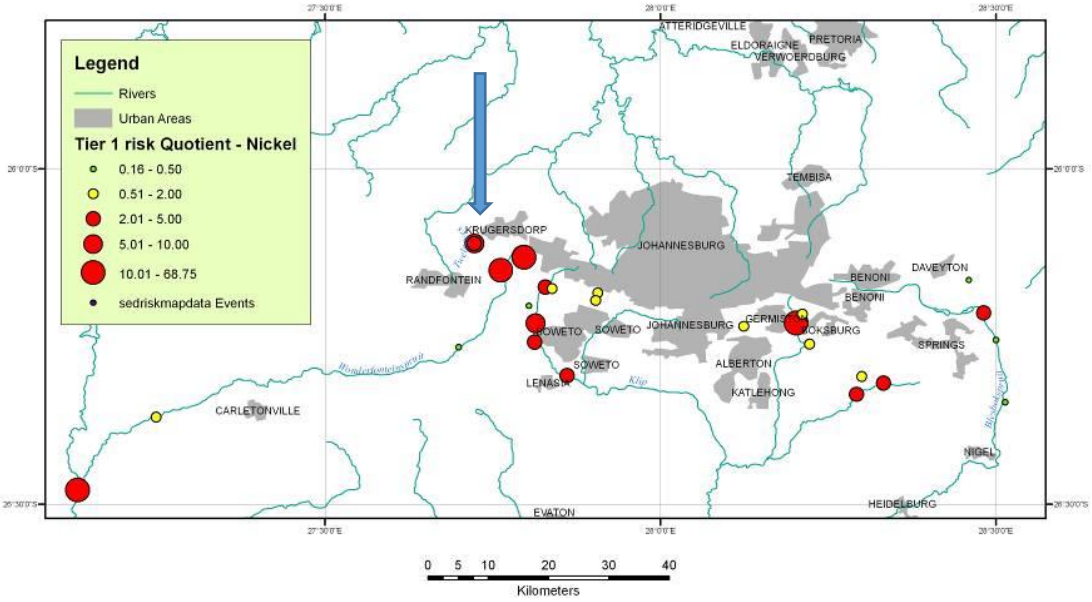
Localities of the water sampling points, showing the Tier 1 risk classes[6] for uranium with the blue arrow pointing to the Tweelopiespruit to the north and Wonderfonteinspruit to the south

[6] The approach used for this risk assessment has been implemented in South Africa by, among others, Wade et al. (2002) and Coetzee et al. (2002). The basis of the method is the comparison of measured concentrations with legislative or regulatory standards or guidelines. The comparison is performed by calculating a Tier 1 risk quotient by dividing the measured concentration in a sample by the guideline or limit. Values greater than 1 therefore indicate that a risk is present.

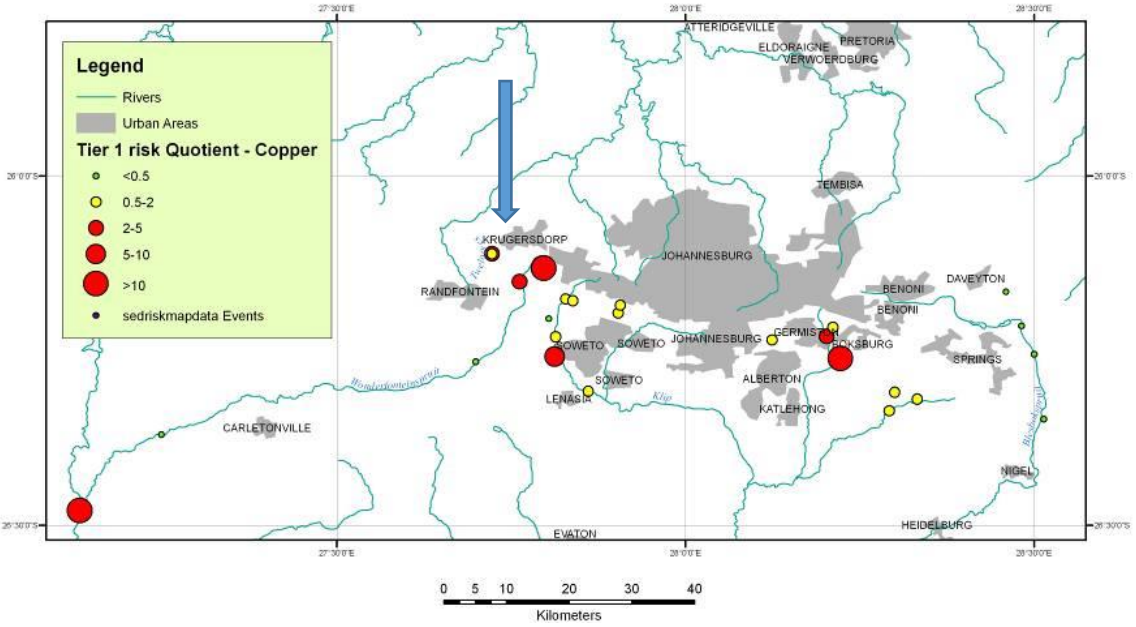
A colour coding was used to present Tier 1 risk quotients. The yellow colour coding may represent a risk, allowing for analytical and other uncertainties while the red colour represents an environmental risk.



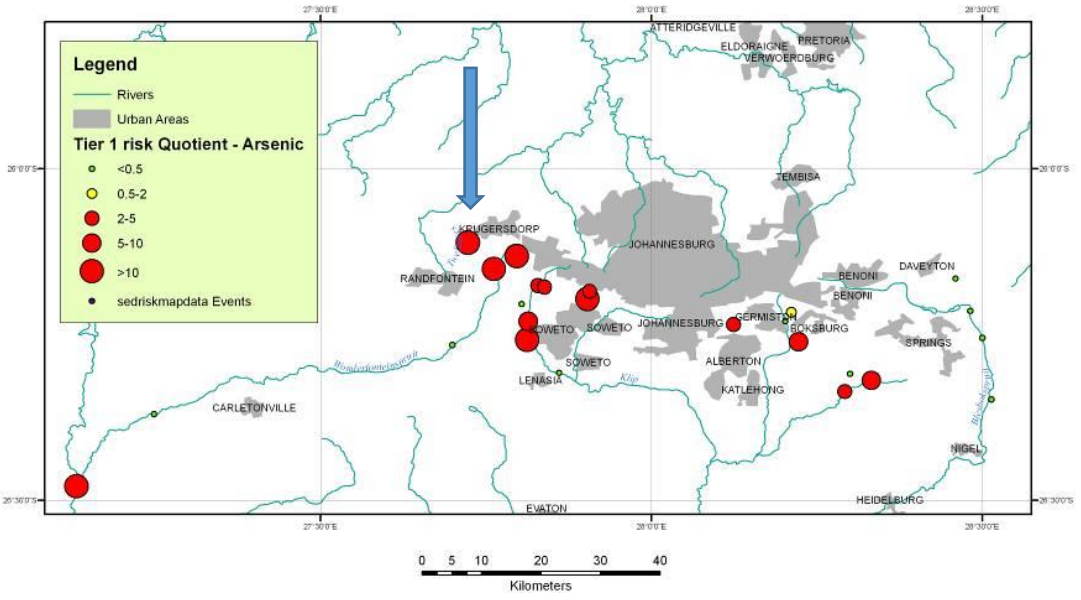
Tier 1 risk quotients for the maximum cobalt concentration for each wetland sampling site with the blue arrow pointing to the Tweelopiespruit to the north and Wonderfonteinspruit to the south



Tier 1 risk quotients for the maximum nickel concentration for each wetland sampling site with the blue arrow pointing to the Tweelopiespruit to the north and Wonderfonteinspruit to the south



Tier 1 risk quotients for the maximum copper concentration for each wetland sampling site with the blue arrow pointing to the Tweelopiespruit to the north and Wonderfonteinspruit to the south



Tier 1 risk quotients for the maximum arsenic concentration for each wetland sampling site with the blue arrow pointing to the Tweelopiespruit to the north and Wonderfonteinspruit to the south

Recommendations

In the light of the aforesaid, we recommend that the Surface Water Assessment Report should include in its potential surface water impacts the risk of the remobilisation of metals in the sediment of the wetlands into the water bodies of the Wonderfonteinspruit and

Tweelopiespruit as a result of oxidizing and/or acidic conditions.

The most likely processes are:

1. Acidification
   a. Acid rain
   b. Acid mine drainage
2. Oxidation
   a. Drying out of sediments during droughts.
   b. Drying out of sediments during draining of wetlands for mining of rehabilitation purposes.
3. Fire, which could lead to the burning of raised peat-beds.

It follows hence that precautionary measures should be recommended to prevent these conditions from developing during the reclamation of the Millsite TSF.

Access to Data

The Surface Water Assessment (page i) informs us that Sibanye has been conducting surface and ground water monitoring over a long period of time (ranging from 2012 to 2017) on their existing operations and the surrounds.

Recommendations

It is strongly recommend that these monitoring results be made available to downstream water users and key stakeholders on request, and be presented at the Wonderfonteinspruit- and the Magaliesburg Catchment Management Forums.

Since mine water contains a broad spectrum of metals it is furthermore recommend that the Applicant should continue to sample all such metals including long living cyanide metal complexes, etc.

Monitoring

In view of frequently drastic short-term fluctuations of pollution levels caused by day-night rhythms of discharging mine effluents, natural diurnal fluctuations of water chemistry as well as events such as rainstorms and spillages weekly sampling intervals are inadequate. This is illustrated by the fact that U-levels in samples used in IWQS (1999) from identical sites (normally sampled at the same day of the week and the more or less the same time of the day) at some locations fluctuate by up to an factor of 1000 (i.e. 100000%).

Recommendations

In view of such fluctuations the temporal representativity of the data used is insufficient and we recommend continuous monitoring.

Deposition in Pits

According to the IWULA and the Integrated water and Waste Management Plan in support of the WULA (page ix) four of the six open pits is currently used for the disposal of the residue tailings material which have an underground mining connection and are contributing to the AMD problem of the Western Basin.

This statement finds support in the Department of Minerals and Energy's 2008 Regional Mine Closure Strategies for the Witwatersrand gold fields. According to the Report, the numerous open pits in the West Rand Goldfield have been identified as a source of ingress, by a study commissioned by the mining industry estimating that they contribute approximately 30% of the total ingress[7].

It is therefore common cause that there is a hydraulic connection between the open pits and underground mine workings.

The FSE acknowledges that one of the positive impacts associated with the discharging of alkaline tailings into the pits, is the increase in pH. It should be noted, however, that the dissolved metals which precipitate with the adjustment of the pH, have not simply disappeared but that they have merely changed to a different oxidation state, which changed them from a soluble form to a solid form. The process could be reversed and the contaminants mobilised, should the water become acidic in future.

Recommendations

The Integrated Water and Waste Management Plan in support of the WULA (page 128) informs us that *"tailings material is currently being placed in Porges pit as this pit has yet to seal and is taking a lot more tailings than originally thought. Investigations have shown that the tailings material is entering the lined underground mine voids which is the reason why the pit has yet to reach the calculated capacity while the volume disposed has far exceeded the calculated capacity"*.

In view of the above statement, it can be inferred that there are uncertainties regarding pit backfilling as part of geowaste disposal. Pit backfilling does not only involve uncertainties, but it also involves risks that must be evaluated on the basis of hazards, probabilities, consequences and the selection of mitigation measures e.g.:

- While it is noted that the abovementioned Plan suggests that the backfilling operations are improving the overall stability of the pits, some pit walls may be unstable and may deteriorate and fail to function with time -the slopes of the pit may as a result of decay of rock anchors, rock weathering or the rise of the local

[7] Department of Minerals and Energy. Regional Mine Closure Strategy for the West Rand Goldfield. 2008.

water table fail;

- The non-symmetrical properties of some pits may cause runoff from the higher slope, which may impact on the water quality;
- Contaminants in the pit may pass deep into the local groundwater and impact on its quality;
- The tailings may fail to settle evenly across the pit;
- At time the tailings may settle and expel contaminated pore water. This may affect the quality of the water.

While we concur that the complete backfilling of the pits may result in the reduction of water ingress, there is a need to assess the impacts of the backfilling on the water levels in the void and contribution to decant volumes of mine water (in this regard, we refer to page ii of the Groundwater Assessment Report which confirms that notwithstanding the pumping of the Western Basin mine void water since April 2012 "*to date the water level has not been dropped substantially but has been kept a few metres below the decant point*", the migration pathways of the tailings, and the impacts on groundwater and downstream water users.

The Groundwater Assessment (page 88) recommends the rehabilitation of the pits by properly shaping and capping it with a soil/weathered material layer that will prevent ponding and minimise infiltration of rain water. Page 74 of the said report describes the process as follows: "*After the pits have been backfilled, the tailings will be left to dewater and consolidate. The tailings backfill should be domed, shaped, profiled and capped with a soil/weathered material layer…*"

The FSE recommends, in order to prevent any contact of the surrounding groundwater with the pit backfill material, which because of the uraniferous nature of the waste may comprise radioactive tailings, to **surround the backfill with a filter/drain** in addition to the covering of the backfill with an **impermeable** cover.

Rehabilitation

The wetland Sensitivity Mapping and Impact Assessment Report (page iv) refers to the long-term benefits of the proposed reclamation and rehabilitation, which have the potential to result in improvements of the biodiversity and ecological health and integrity.

The improvement of the ecological integrity and functioning of the wetland ecosystems are, however, dependent on the diligence with which the Applicant will implement the recommended management and mitigation measures proposed in the Wetland Assessment Reports. (See e.g. page v of the Freshwater Resource Assessment in the Vicinity of the Proposed Lindum Railway.)

The FSE is of the opinion that the main pollution sources of void water are perhaps not located underground but on surface. This includes the un-rehabilitated Tweelopiespruit stream bed and its associated wetlands.

The FSE concurs with the statement on page iv of the Groundwater Assessment Report that "*a rehabilitation strategy that encompasses the nearby mines and municipal treatment activities is required for a lasting improvement within the regional footprint.*" Such a consolidated approach will, however, be difficult in view of:

1. Mintails Mining SA (Pty) Ltd in business rescue, with environmental liabilities of R340 million and a rehabilitation trust fund of R25 million, and the proposed placing of its open pits under care and maintenance; and
2. Financially beleaguered local and district municipalities, deterioration in wastewater treatment infrastructure and systemic non-enforcement by the DWS of non-compliances.

Recommendations

In view of the above-mentioned, we strongly recommend that some of the value from the reclamation of the Millsite Complex be ploughed back into the rehabilitation of the entire area, that is, the Robinson Lake, the Hippo Dam, the Aviary Dam, the stream bed of the Upper Tweelopiespruit and the associated wetlands.

Since it can be anticipated that most of the adverse impacts of the project during its construction and operational phases will be downstream, we recommend that the costs and benefits of the project on the wetlands downstream (Tweelopiespruit and Wonderfonteinspruit wetlands) be assessed, that is, both the ecological as well as the economic impacts.

The costs/benefits of the project should be assessed grounded upon the direct values (fisheries and hunting, water supply livestock grazing, fibre, aesthetics) and the indirect values (flood reduction and streamflow regulation, groundwater recharge and discharge, water purification and chemical cycling, erosion control and biodiversity conservation) of the downstream wetlands.

Dust Fallout

Strong dust emissions from tailings storage facilities occur during wind events. Pollution related to Witwatersrand mines poses a number of hazards to surrounding communities.

Two of the major primary pathways by which contamination can enter the environment from a mine site are the airborne pathway, where radon gas and windblown dust disperse outwards from mine sites and by living in settlements directly adjacent to mines.

Due to the small particle size of the slimes, particulate matter can be transported over relatively long distances to agriculturally used land in the surroundings. The deposition of radioactively contaminated dust on leaves of vegetable and forage plants can cause radiation exposures exceeding those from the inhalation of contaminated dust substantially.

Stormwater drainage systems, into which windblown dust from adjacent slimes dams is flushed by run-off are also likely to constitute a major source of potential water pollution.

Recommendations

There is the potential that the reclamation operations will result in the additional liberation of the dust. Notwithstanding the fact that the hydraulic mining of the dry tailings ameliorates the dust fallout to some extent, it is nonetheless recommended that strong management and mitigation measures be employed to minimise the dust fallout.

With reference to silicosis: exposure to alpha quartz is recognised as a major risk by the South African gold mining industry. The industry considers the occupational risk to be largely associated with underground workers exposure to particles from the blasting of rock, and to be negligible from public exposure to TSF dust. However, alpha particle concentrations in gold mine tailings dust can exceed regulatory limits, and this is of concern due to the large volumes of dust generated over long periods by unprotected tailings (total erosive losses can reach 500 t /ha / annum, of which a significant portion is airborne).

.

SUBMITTED BY:

Mariette Liefferink.

CEO: FEDERATION FOR A SUSTAINABLE ENVIRONMENT.

1 February 2018.