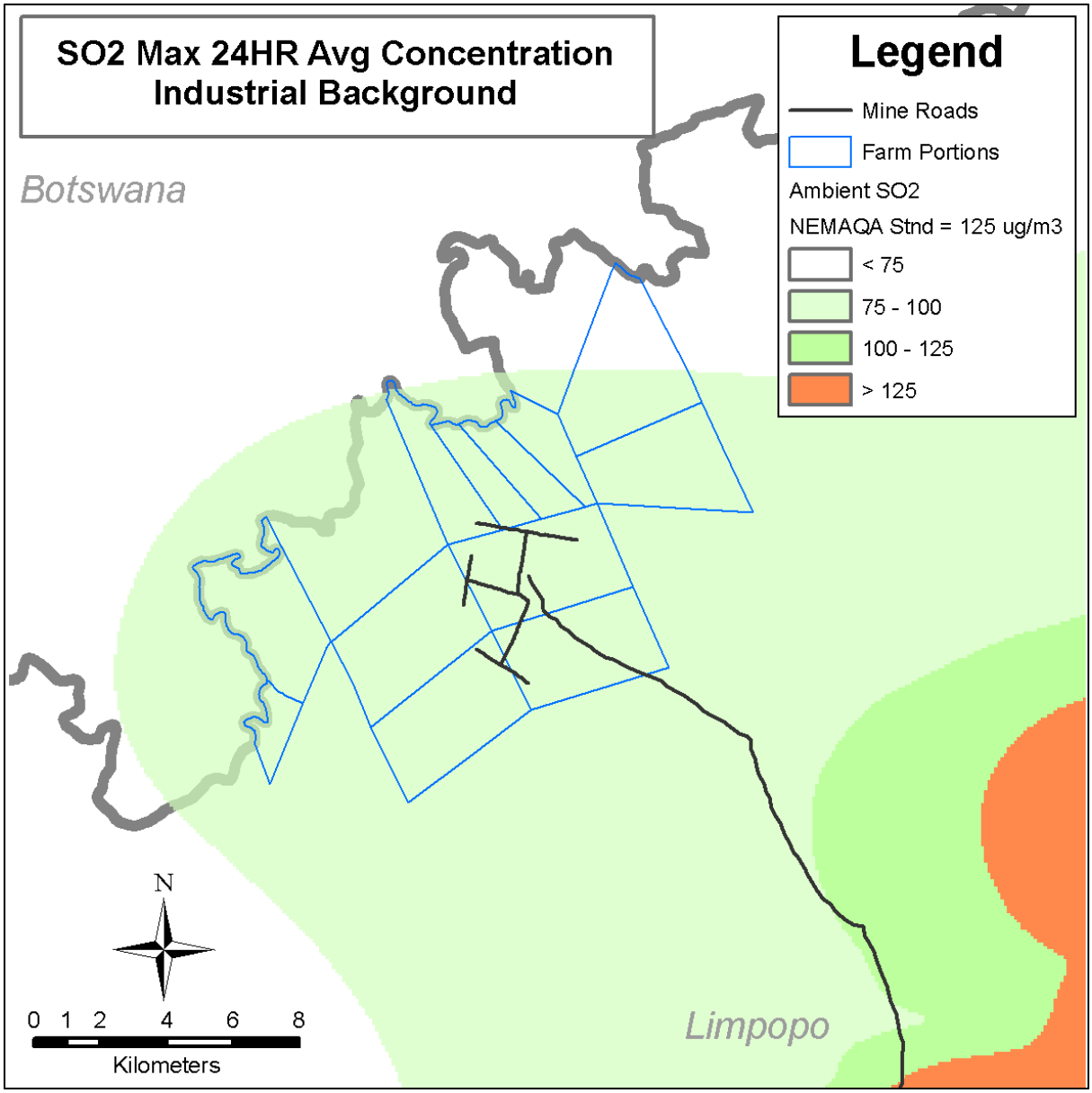

Figure 7-9: Maximum 24 hour average SO_2 ambient concentrations from background sources

7.4.9.5.2 SO_2

Comparing the existing SO_2 ambient concentrations with those expected after 2020 shows a substantial decrease in predicted concentrations in proximity to the site.

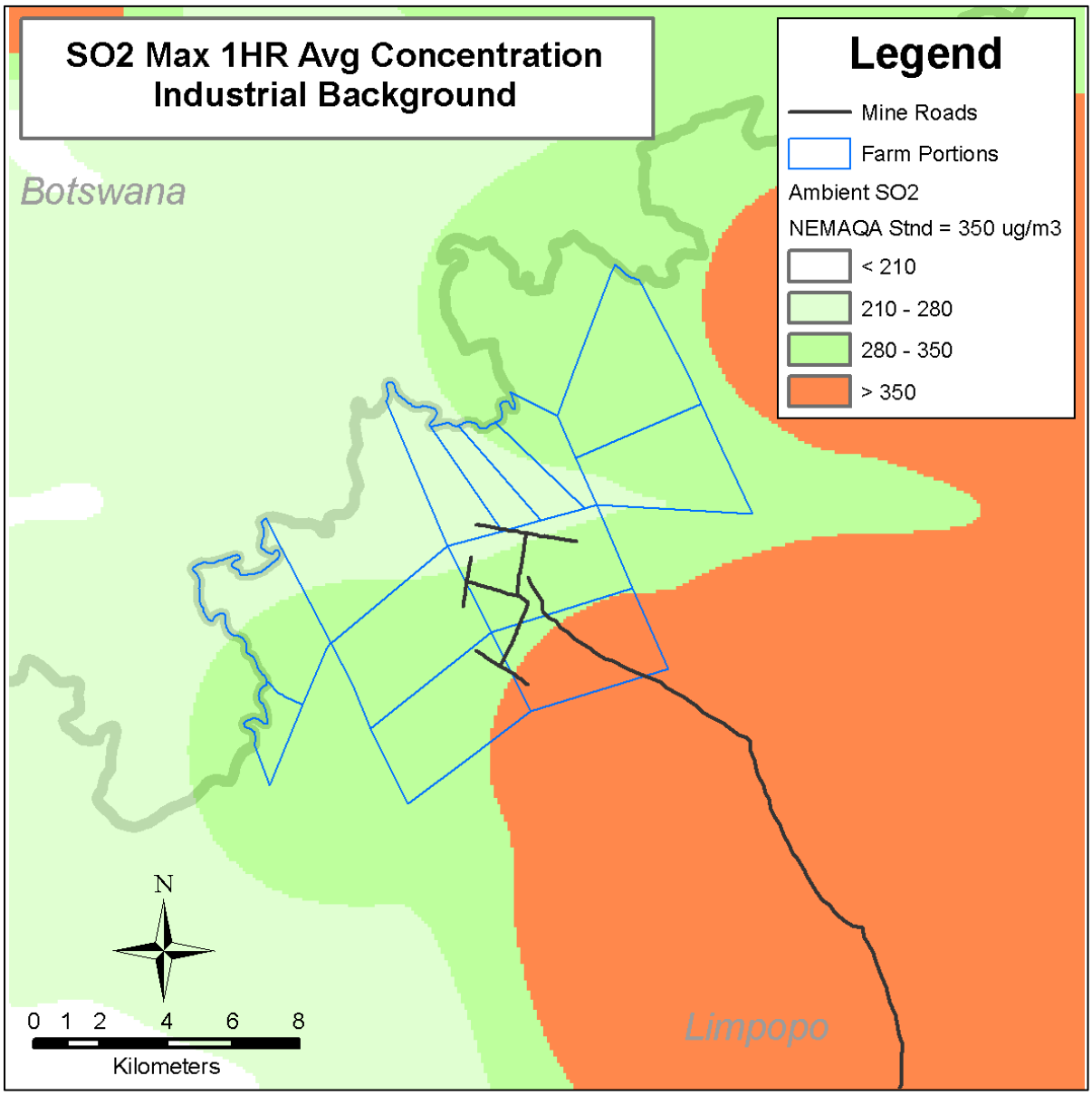

Figure 7-10: Maximum 1 hour average SO_2 ambient concentrations from current background sources

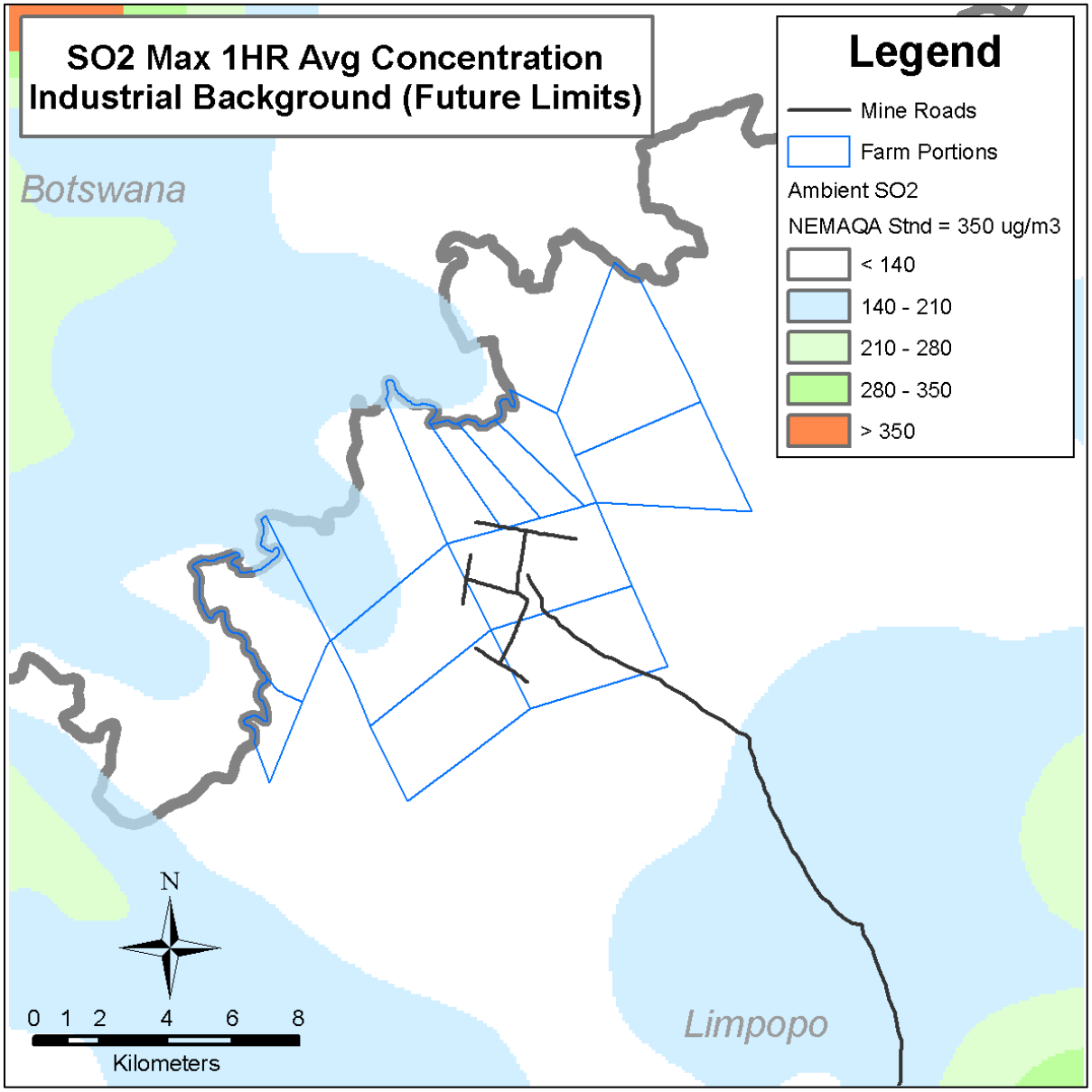

Figure 7-11: Maximum 1 hour average SO_2 ambient concentrations from future background sources

7.4.9.5.3 NO_x

The modelled results indicate that the impacts from background sources on ambient NO_x concentrations are not in exceedance of the ambient limits in proximity to the site, for the 1hr averaging period.

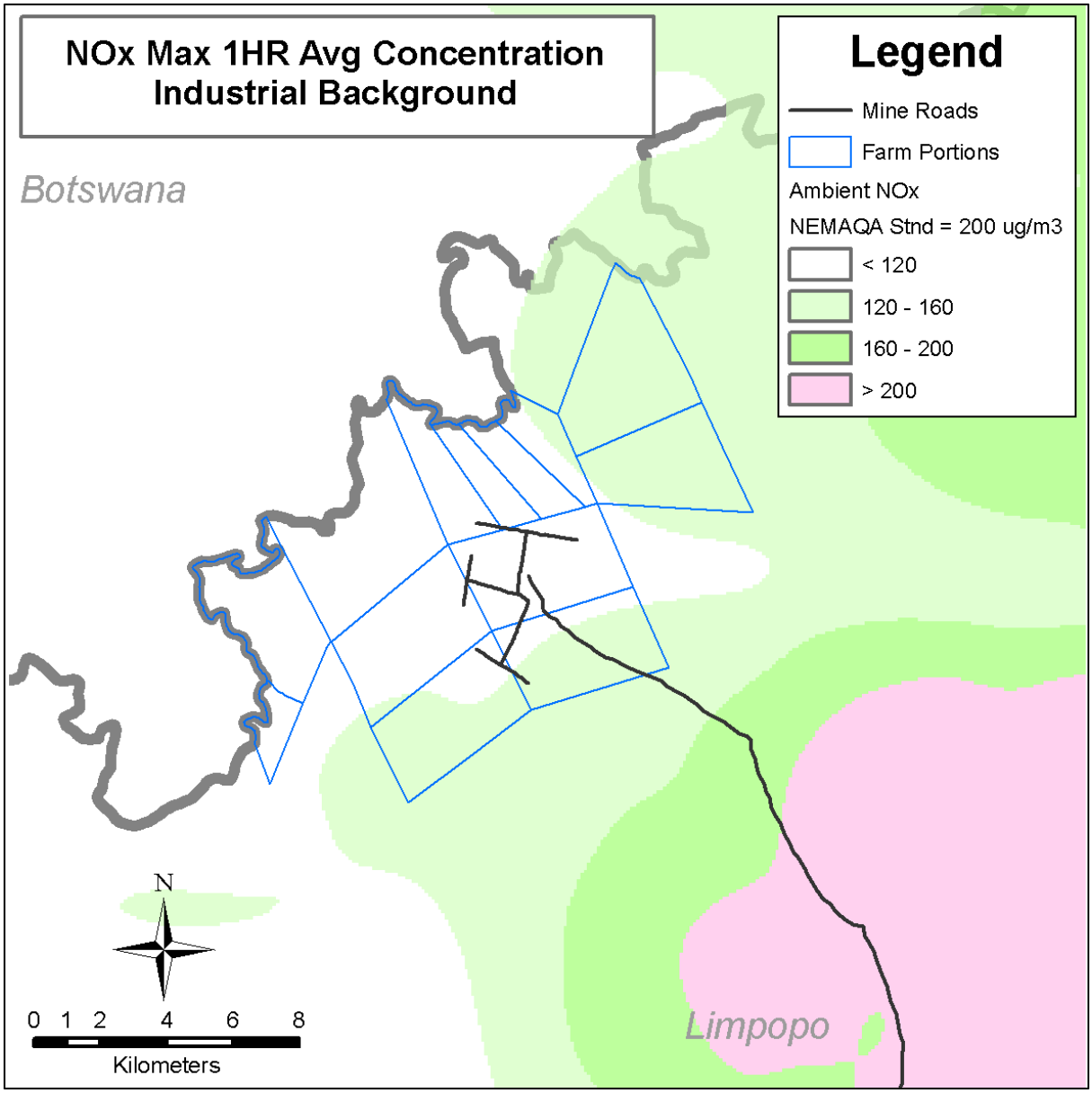

Figure 7-12: Maximum 1 hour average NO_x ambient concentrations from background sources

7.4.9.6 Conclusion

The contribution of background sources, in particular power generation, to the predicted ambient air quality is significant. It is however expected that these the modelled outcomes are conservatively high as the background sources are modelled at full capacity, which results in higher emission rates than normal operations. Maximum emissions have been modelled as it cannot be predicted how emissions from each source will vary through any given time period, and in view of the fact that these sources are permitted to operate at full capacity.

PM_{10} emission from the mining operation are predicted to have a significant impact, it must however be noted that these are low low level non-bouyant sources and that these emissions can be managed (in particular unpaved roads) by various mitigation means as per the mine's EMPR. The impact of PM_{10} emissions from the proposed boiler is insignificant and thus the predicted cumulative impact of PM_{10} emissions from the mine does not appreciably change with the addition of the power plant.

The ambient effect of SO_2 from background sources is substantial; however the implementation of GN 248:2010 will result in a substantial reduction in the impact of these listed sources. The SO_2 impact from the proposed plant is within acceptable limits (GN1210:2009) at the mine boundary, and the cumulative impact is also within the legislated ambient standards with the assumed successful implementation of the regulations. It is assumed that the regulators will ensure that background sources comply with the legislated minimum emission standards and that current emission from these sources should not constrain proposed economic development, particularly in view of the wider electricity deficit in the country.

NO_x emissions have been conservatively modelled as NO_2. Even with these conservatively high emission rates, it is clear that the predicted ambient concentrations are within the regulated ambient limits for NO_2.

In view of the above conclusions it is recommended that the proposed power plant proceed as assessed, and that emissions standards as per subcategory 1.1 of GN248:2010 be adhered to.

7.4.10 Archaeology

Based on the previous three studies, no visible heritage resources occur within the power station footprint. Nevertheless, the Phase 2 Archaeological Mitigation project (Nel 2012) did show that the expected archaeological sites in the project area are ephemeral with very low visibility. There may thus be similar sites in the power station footprint.

However, other studies (Van der Walt 2009, Fourie 2010, Nel 2011, Nel 2012) indicated that the physical environment within which the power station will be situated may not have been conducive for archaeological occupation.

Furthermore, no evidence of historic or contemporary settlement in the power station footprint area was found or is known, minimising chance finds for historic to recent burial grounds and graves.

Therefore there are no foreseen direct impacts on archaeology from the development of the power station, ash dump and construction camp.

7.4.11 Traffic

7.4.11.1 Construction phase

The main impact on traffic will be during the construction phase. Through the delivery of materials and components to site it will increase the traffic passing through neighbouring towns such as Lephalale, Tumbazimbi or Vaalwater. The transport of materials and components also put additional strain on the current degrading road system in the area. The impact will be of moderate significance, however it will be restricted to the construction phase.

7.4.11.2 Operational phase

During the operational phase traffic volumes will decrease, however additional traffic will still be traveling to the power station. Deliveries will be made of limestone and turbine oil which is likely to be on a monthly basis. The impact is seen to be low.

7.4.12 Socio-economic

7.4.12.1 Pre –Construction phase

Eviction of Farm Workers and Loss of Agricultural Jobs

There are a number of farm workers who currently live on the farms which have been purchased by Resgen for the proposed project. In some cases in the greater area surrounding the Boikarabelo Project, farm workers live with their families on farms mostly in houses provided by the land owners. In general the farms are their homes and they do not own a house anywhere else. In a few cases a land owner may purchase another farm and take his farm workers when they relocate however in most cases these farm workers will be evicted from the land and will need to find accommodation and work elsewhere. Lesedi has become a settlement to which many evicted farm workers settle and construct informal houses.

This creates additional cost, stress and concern for these farm workers, many of whom have been working on these farms for a number of years. If land owners do not evict their farm workers according to the correct procedure there may be repercussions. Resgen as the mining company and new land owner could face a delay or reputational risk if farm workers are not adequately compensated.

This impact has a pre-mitigation significance of *medium-high*.

7.4.12.2 Construction phase

Direct and Indirect Local Employment

Between 500 and 700 employment opportunities will be created for the construction of the proposed 45MW Power Station. Approximately 1500 employment opportunities will be created during the construction of the proposed 260MW Power Station and associated

infrastructure; consisting of approximately 45% skilled workers and 55% semi-to-unskilled workers.

Construction will take place over a period of 12 months for Phase 1, and 24 months for Phase 2. It is likely that Resgen will contract out construction of the power station to a construction company. Many construction companies bring the majority of their work force with them, only hiring a small percentage of workers locally. In general those who are locally hired are within the unskilled labour categories. It is therefore likely that local employment from Lesedi and Lephalale Town will be limited and only for a short period. Therefore the impact significance rating for local employment is *low*,

Local Procurement of Goods and Services

The proposed project will need to procure a wide variety of goods and services during the construction phase. The majority of these goods will be highly specialised mining equipment which will need to be sourced from outside Waterberg District Municipality or internationally. It is unlikely that these goods will be locally or regionally available. There will however be other needs such as products (fresh produce and meat) or services (catering, cleaning, housing and security) during construction. There is already some development within the Lephalale Municipality such as the Grootegeluk Coal Mine and the Matimba Power Station. There are also a number of mining companies undertaking exploration and feasibility studies in the area. As a result there will be some businesses and organisations within the Lephalale Municipality from which the proposed project can source local goods and services. There are also a large number of lodges with accommodation in the surrounding area which may benefit from contractors and consultants undertaking work during construction.

The impact of local procurement of goods and services is therefore considered to be *Medium-low* during the construction phase.

Increase in Crime and Social Ills

The construction of a power station in rural areas often results in an influx of job seekers. As Lesedi is the closest settlement to the proposed project it is likely many job seekers will move into this community. Other job seekers may move to Lephalale Town and settle in Marapong (section of Lephalale Town). It will not be possible for the power station to provide jobs to all the jobseekers. These jobseekers often need to find other ways to support themselves. Sometimes this leads to criminal activity such as theft.

The Steenbokpan Development Committee noted that alcohol abuse was currently a problem within the community. It is likely that a further influx of job seekers will exacerbate this problem with many of those who are unemployed spending their limited financial resources on degenerative behaviour. For those who do find employment at the power station, or who find other employment are likely to similarly spend their money on drinking, partying and in some cases drugs. Alcohol and drug abuse will often impair people's judgement and lead to conflict, domestic violence, social tension and criminal activity. Increased crime and other social ills may have serious consequences for the safety of those people who live in the area at Lesedi, Lephalale Town and neighbouring farmers.

Similarly construction workers, who are employed at the proposed project and therefore have money, do not have their families with them on site. Therefore they often find other forms of entertainment such as alcohol. They also turn to local women which has the potential to increase prostitution in the area and potentially the spread of sexually transmitted diseases (STDs).

This impact will take place throughout the life of the project from construction through operational phase. The significance rating of the increase of crime and social ills (pre-mitigation) is *medium-high.*

Increase in Informal Settlements and Associated Impacts

As discussed previously, there is a housing backlog within both Waterberg District and Lephalale Local Municipalities. It was also noted that there has been development of informal houses specifically around areas near mining activities. In particular it was noted that the population of Lesedi Village is increasing due to both job seekers and evicted farm workers. Mining and development in rural areas attracts potential job seekers and people often move from other municipalities or provinces of South Africa into areas of new development. It also often attracts immigrants from other countries bordering South Africa. As there are already a number of mining companies exploring within the Lephalale Municipality this movement of job seekers can already be noted. An influx of job seekers and expansion of informal settlements often has associated problems such as lack of sanitation facilities and potable water which results in diseases and the exacerbation of poverty. As the proposed project is located in close proximity to the Botswana Border development near this border may increase the numbers of illegal immigrants moving to South Africa in the hopes of finding employment. The pre-mitigation significance rating of the increase in informal settlements is *medium-high.*

Decrease in Road Surface Quality and Safety

The Traffic Assessment for the proposed project noted that in general tar roads from Lephalale and Steenbokpan to the site are in good condition but that road signs are limited. Taxis also use these roads, dropping off and picking up passengers and there are areas where pedestrians cross.

At present the estimated trucks and vehicles traveling to and from the proposed project site is unknown. Construction will however result in a period of increased traffic of both heavy and light vehicles. The potential impact of this increased traffic will be two-fold. Firstly the increase in traffic, especially heavy vehicles, will put additional pressure on road surfaces which are unlikely to have been constructed to withstand heavy vehicles. This will decrease the quality of road surface along these routes on a local and regional level and to some extent at district and provincial level. This may slow the speed at which traffic travels along this road and increase traveling time. It could also cause damage to other vehicles using these roads. Secondly the increase in traffic using these roads will increase the likelihood of traffic accidents which could cause damage to vehicles or harm to people. The reduction of road surface quality will also increase the pressure on local government to repair roads in these areas. This will require additional financial resources and capacity.

As construction is only during a limited period the impact will last for the construction period. The pre-mitigation significance rating *is medium-high*. Should the proposed mitigation measures be implemented it is possible that this impact will be positive post mitigation. Development and industry have the potential to collaborate to maintain and improve the quality of the road network.

7.4.12.3 Operational phase

Direct and Indirect Employment

It is envisaged that the Power Station will be fully operational by 2016 for approximately 40 years, after which it may be decommissioned. During the operation of the proposed 45 MW Power Station, it is proposed that 22 permanent employment opportunities will be created. It is expected that an additional 35 permanent employment opportunities will be created for the operation of the proposed 260 MW Power Station

As discussed previously the education and skills levels are relatively low within Lephalale Municipality. Although they are higher at Ward 4 level it is likely that many of the more educated population in this ward will include farmers who may relocate as the area develops. Those who are less educated will be farm workers or people living in settlements, such as Lesedi, who are hoping for employment at the power station. Therefore it is likely that the project will find mostly semi- and unskilled labour within Ward 4. There is a high possibility that skilled, supervisor and management roles will be filled from the Lephalale Municipality or Limpopo Province.

As a result of direct employment there will also be the creation of indirect employment through increased spending within the economy. With a multiplier of 1:6 this means that approximately 7,000 jobs will be created indirectly through the operations of the proposed project.

Local Procurement of Goods and Services

As discussed in Local Procurement of Goods and Service - Construction Phase Impacts, the power station once operational will need a wide variety of goods and services. Like construction many of these goods and services will be highly specialised and unlikely to be available locally or within the Lephalale Municipality and will need to be brought in from outside the district or from elsewhere in South Africa.

As there is already development and economic growth within Lephalale Municipality there may be other companies and businesses that can provide services to the power station such as lodges, catering, housing, security. The expected life of Boikarebelo Coal Mine, and possibly the power station as well, is in excess of 30 years. This will give businesses and organisations time to develop and meet the procurement and quality standards of the power station. It also means that companies may benefit from the plant over a long period of time. It is likely that the majority of these companies and businesses will be from Lephalale Town or from neighbouring farms. Very little in the way of goods and services will be sourced from settlements located closer to the power station. These are usually the communities who

experience most of the negative impacts, such as Lesedi. Despite this, however, local procurement of goods and services will likely benefit the local economy and may benefit people living in these settlements indirectly through an increase in employment opportunities from other companies and businesses in the wider project area.

The pre-mitigation impact significance of local procurement of goods and services during operational phase of the proposed project is therefore *medium-high.*

Decrease in Road Surface Quality and Safety

As a result of operational phase of the proposed project there will be an increase in traffic of both light and heavy vehicles on regional and local roads. As discussed in Construction Phase Impacts, this will result in both a reduction in the quality of road surface and an increase in the potential for road accidents. This impact has the potential to be positive, should the power station contribute to the upgrade and development of local and regional roads. There will be additional impacts as a result of an increase in traffic namely noise and traffic congestion. This impact therefore has a pre-mitigation significance rating of *medium-high.*

7.4.12.4 Decommissioning

Loss of Economic Livelihood

The retrenchment of employees will be inevitable during the decommissioning phase. For those local community members who will have found employment at the power station, closure will have a serious consequence for their livelihoods and financial income stability. However, they will have developed skills and this will make it easier for them to find jobs at other mines or power stations in the Lephalale Municipality or in close proximity to the study area. In addition, the experience gained during work at the power station will give them a competitive advantage.

It is likely that over the 30 year life of mine associated with the power station there will be a number of local businesses benefiting from local procurement of goods and services on a regular basis. It is also likely that due to the multiplier effect of the power supply industry, those that benefited will have become heavily reliant on the power station for work. The closure of the power station will therefore have a serious cumulative impact on these local businesses and companies. Those businesses at a municipal level or strategically positioned to access other business with nearby mines and power stations may use this experience to procure contracts with other mines and power stations.

Due to the proximity of other developments and the ability of people to find other employment once the power station is decommissioned, this impact will not be high. The significance rating of the adverse impacts of a loss of economic livelihood during the decommissioning and closure phase of the proposed project is rated as *medium.*

7.5 Cumulative Impacts

7.5.1 Topography

The proposed Boikarabelo Power Station falls within the mining right application area of the proposed Boikarabelo Coal Mine. The impact of the proposed power station will add to the impact of the proposed mine, however, the impact of the proposed power station will be significantly less than the impact of the proposed mine.

The proposed Boikarabelo Power Station is situated in the Waterberg Coalfield area. This region is characterised by game farming and grazing. Currently there are no active power stations in the immediate vicinity of the proposed Boikarabelo Power Station. However, there are several proposed developments nearby. These developments include:

- Mining at the Boikarabelo Coal Mine, Sekoko and Temo Coal Mine (all in South Africa),
- Mining and a power station at Mmamabula (Botswana),
- Eskom developments,
- Sasol developments,
- Industrial developments, and
- Residential developments.

The combination of these proposed developments will result in high cumulative impacts for the surrounding area.

7.5.2 Soil and land capability

The environmental parametres potentially affected by the power station, related infrastructure and coal mines in the region are bio-physical, social, economic, agriculture and aesthetic.

The Waterberg area is known for commercial game and cattle farming because no arable agriculture is possible due to low annual rainfall. The areas available for game and cattle farming operations will be reduced in size due to a change in the land use from agriculture to industrial use.

The addition of animals that were reliant on the study area will further increase the pressure (stocking density) on remaining areas. The effect on a local scale where neighbouring farms are being negatively influenced will only be visible after a few seasons when available habitat is reduced to such an extent that local herbivore populations decrease. No cross border impacts are foreseen.

Direct impacts on soil are loss of the natural soil horizon sequences due to opencast mining and loss of soil volumes available for rehabilitation. Managing soil resources and rehabilitation however can change the land use back to pre-mining and pre-power station

cattle and game farming. However it will be essential to follow rehabilitation guidelines so as to minimize cumulative impacts

7.5.3 Flora and fauna

The cumulative effects of the planned development and infrastructure, in addition to the in addition to the current state of the ecology, will greatly reduce the available habitat and food which existing fauna in the area need for survival. The footprint of the proposed power station together with the mine footprint will remove the ecosystem services on site completely. The general functioning and provision of ecosystem services in the greater area ecosystem will be reduced and impaired. This is particularly of concern in consideration of the existing fauna on site which require shelter and food. The areas that will be lost were shown to be under a certain amount of pressure at the time of the survey, most notably from insufficient management measures in terms of stocking rates. However a large number of wild herbivores were found to be reliant on the vegetation but they will have to move away from the study site in search of food items. The remaining natural habitat on neighbouring farms can be assumed to be under the same type of management strategy as the farms assessed, purely because of the same farming method employed on all of them. The addition of animals that were reliant on the study area will further increase the pressure (stocking density) on these remaining areas. The effect on a local scale where neighbouring farms are being negatively influenced will only be visible after a few seasons when available habitat is reduced to such an extent that local herbivore populations decrease. No cross border impacts are foreseen.

In the wider area the increased urban development associated with the power station and associated mine in order to support and house workers will increase population numbers and densities within the area. Greater anthropogenic impacts will negatively affect the natural environment as the natural habitat will be reduced and ecosystem functioning will have increased pressure exerted upon it.

The exploitation of coal reserves in these parts of the Bushveld means that this vegetation and the avifauna it holds are under pressure. This project benefits from the fact that the far larger adjacent Boikarabelo Coal Mine is going ahead. Relative to the impacts of the coal mine, the impacts of this proposed power station cannot be determined to be of very high significance. However there is a danger that the use of this type of reasoning means that once the door is opened by the first project in an area such as this, it makes it possible for multiple other projects to proceed.

7.5.4 Hydrogeology

The proposed Boikarabelo Power Station falls within the mining right application area of the proposed Boikarabelo Coal Mine. The impacts of the mine dewatering (discussed by Digby Wells, 2011) will add to the impacts of the proposed power station and will result in higher cumulative impacts for the surrounding area.

Potential impacts of the coal mine which will be in addition to that of the power station on the groundwater are:

- Lowering of the water table due to open pit dewatering; and
- Seepage from the discard dump

The pit dewatering can have negative impact on private boreholes, rivers and natural ecosystem. However, due to the cone of depression that will be created by the dewatering process, groundwater flow will be directed towards the pit during the operation. This will force the contaminants to migrate towards the pit, and contain the plumes within the mine footprint. Even after mine closure this trend will be maintained until full groundwater recovery is obtained.

Following full water level recovery, however, the groundwater conditions will be similar to the pre-mining conditions and the flow will be directed towards the Limpopo River. The contaminants are also likely to migrate in the same direction towards the river. Due to natural processes (such as dispersion, dilution and sorption) however it is unlikely for the contaminants to reach the river at concentrations of concern.

7.5.5 Noise

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The proposed Boikarabelo Power Station will be located within the existing mining right area of the proposed Boikarabelo Coal Mine. When construction starts on the Boikarabelo Coal Mine, the construction of the power station will negligibly contribute to the increase of the ambient noise levels in the area. The cumulative noise levels from the Boikarabelo Coal Mine, Boikarabelo Power Station as well as proposed industrial developments in the area will significantly impact on the existing low ambient levels.

The existing noise sources in the area of the proposed Boikarabelo Power Station are limited to vehicles travelling on the various gravel roads. The significance of the impacts of the existing noise sources on the relevant receptors is of a low significance. The low significance is due to the intermittent nature of the vehicular traffic on the gravel roads. If the proposed activities of Boikarabelo Power Station commence, the cumulative impact will be more severe on the existing ambient noise levels in the immediate area.

7.5.6 Visual

The Waterberg Coalfield region is characterised by undisturbed Bushveld, game farming, hunting and agriculture. Currently, there is no mining activity in the immediate vicinity of the proposed Boikarabelo Power Station project area; however, the Boikarabelo Coal Mine received a mining right in 2011 and there are several new proposed mining developments nearby and a number of industrial developments proceeding in the municipal area. Thus, the potential cumulative impact of industrial development on this region is inevitable. The most pertinent impact of the construction of the Power Station will be the visual presence of the man-made structure in the Bushveld environment. As described in the report there are

already a number of recent large industrial developments (Medupi etc.) in the greater area extending toward Lephalale which have altered the original Bushveld character to one which is semi industrial. The visibility of these large structures and the associated activity and development has further contributed to the loss in scenic quality and sense of place. Therefore the proposed Boikarabelo Power Station will increase the extent of the existing transformation in landscape character of the area, and increase the extent of the visual impact of Industrial development in the natural bushveld area. The cumulative potential visual impact is moderate to high.

7.5.7 Air quality

7.5.7.1 PM_{10}

The cumulative impact of the proposed power generation and unpaved road emissions are only influenced in the case of PM_{10} emissions, as this is the only significant pollutant contribution from the mine operations. The contribution of the power plant is not discernible due to the insignificant PM_{10} impact from power plant.

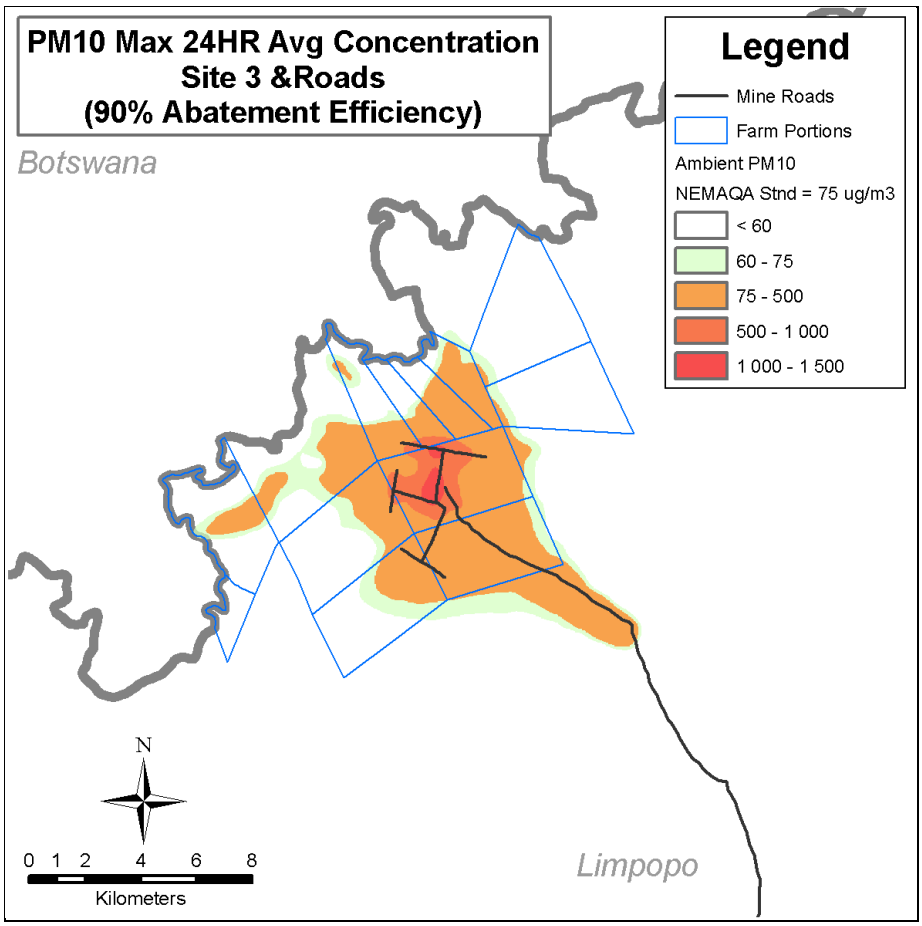

Figure 7-13: Maximum 24 hour average PM_{10} concentrations from baseline sources

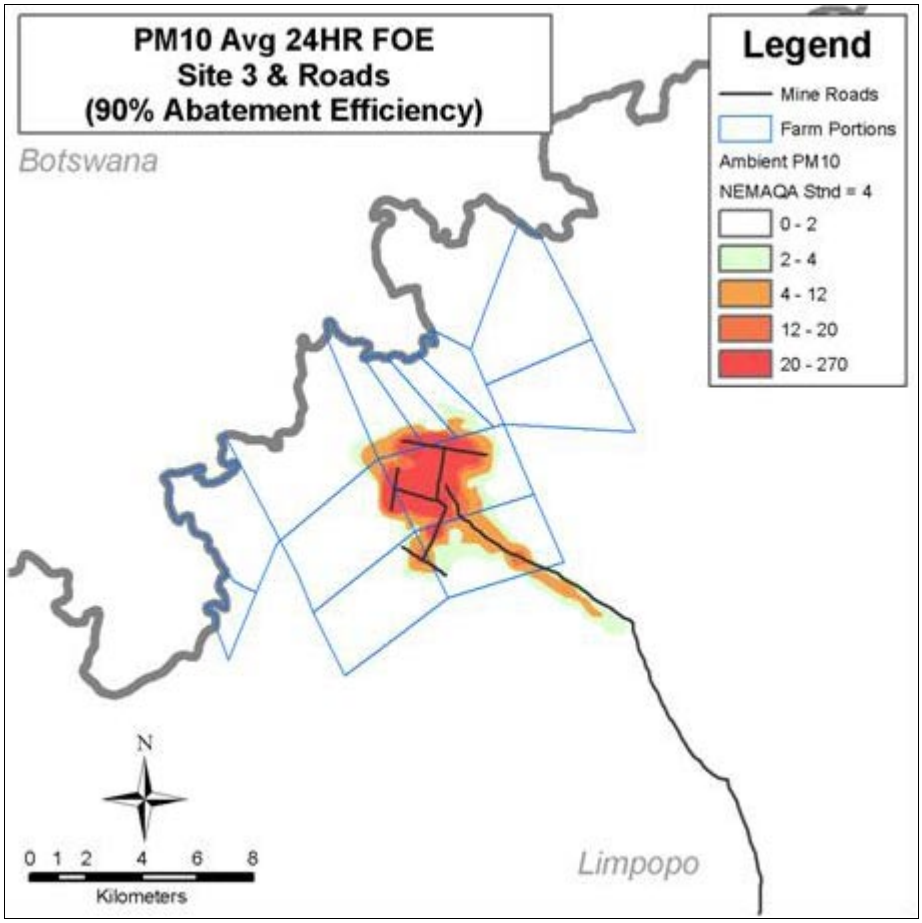

Figure 7-14: Frequency of exceedances of the maximum 24 hour average PM_{10} ambient concentration limits from baseline sources

The cumulative impact of the proposed plant on existing site emissions is insignificant. As with the roads by themselves, the FOE exceedances are mostly limited to the plant location, with the exception of the main road leading out of the site to the south east.

The cumulative impact of the site and background emissions were investigated for SO_2 under two scenarios. The first is the current expected emissions, taking into account the Botswana power station emissions. The second scenario is the future expected, considering the projected reduction in existing background emissions form South African sources after 2020, as required by regulations.

7.5.7.2 Background emissions

The maps show that the site emissions, in either case, do not play a significant role on ambient air quality but that the background emissions are dominant. Annual emissions were not plotted as they showed no exceedances for the area of interest. FOE plots could not be made as differences in modelling domain sizes would not allow it.

Other pollutants were not plotted as contribution form background emitters to PM_{10} and NO_x were insignificant.

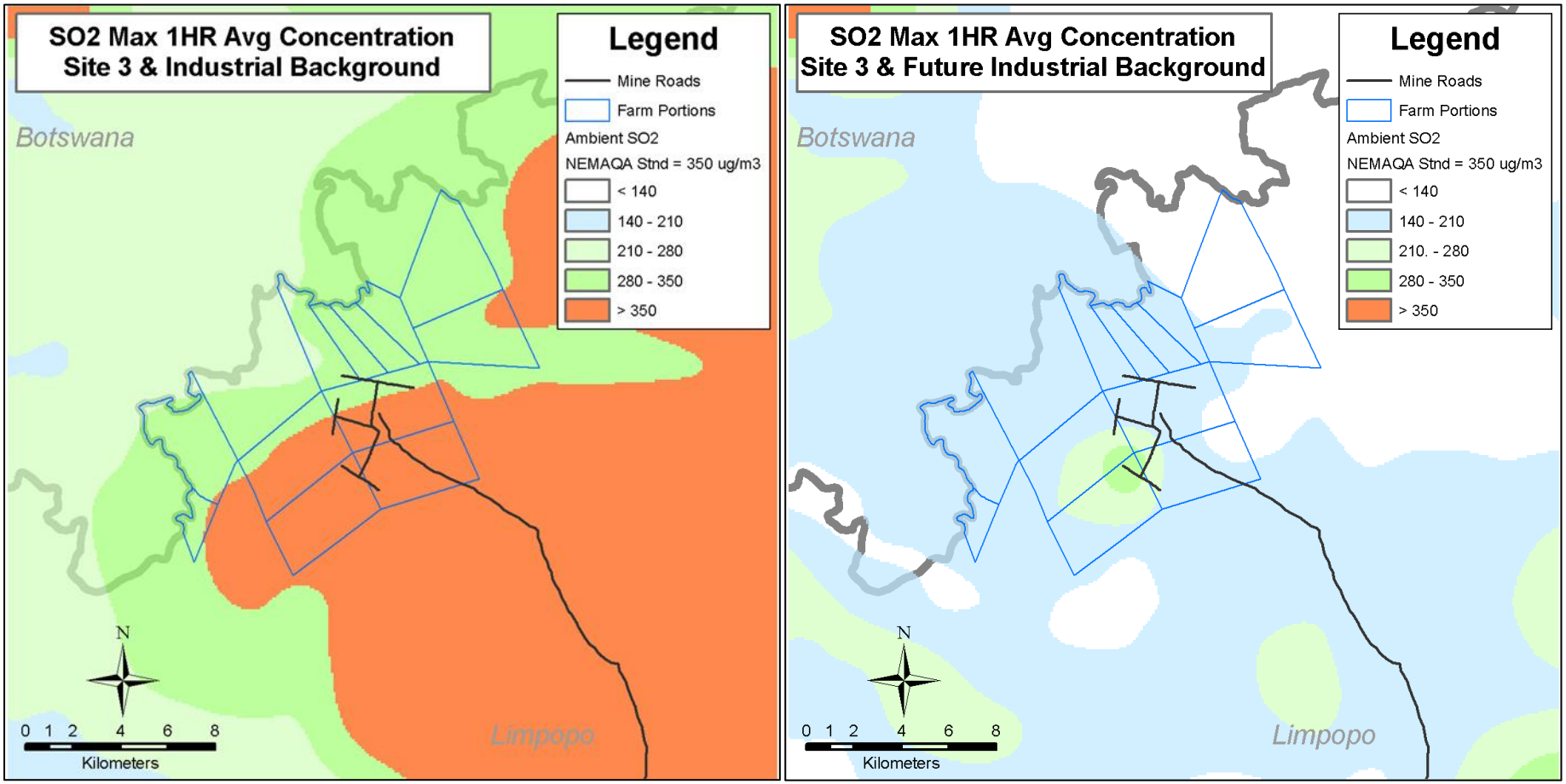

Figure 7-15: Maximum 1 hour average SO_2 concentrations from expected cumulative emissions vs expected cumulative emissions after 2020 reductions

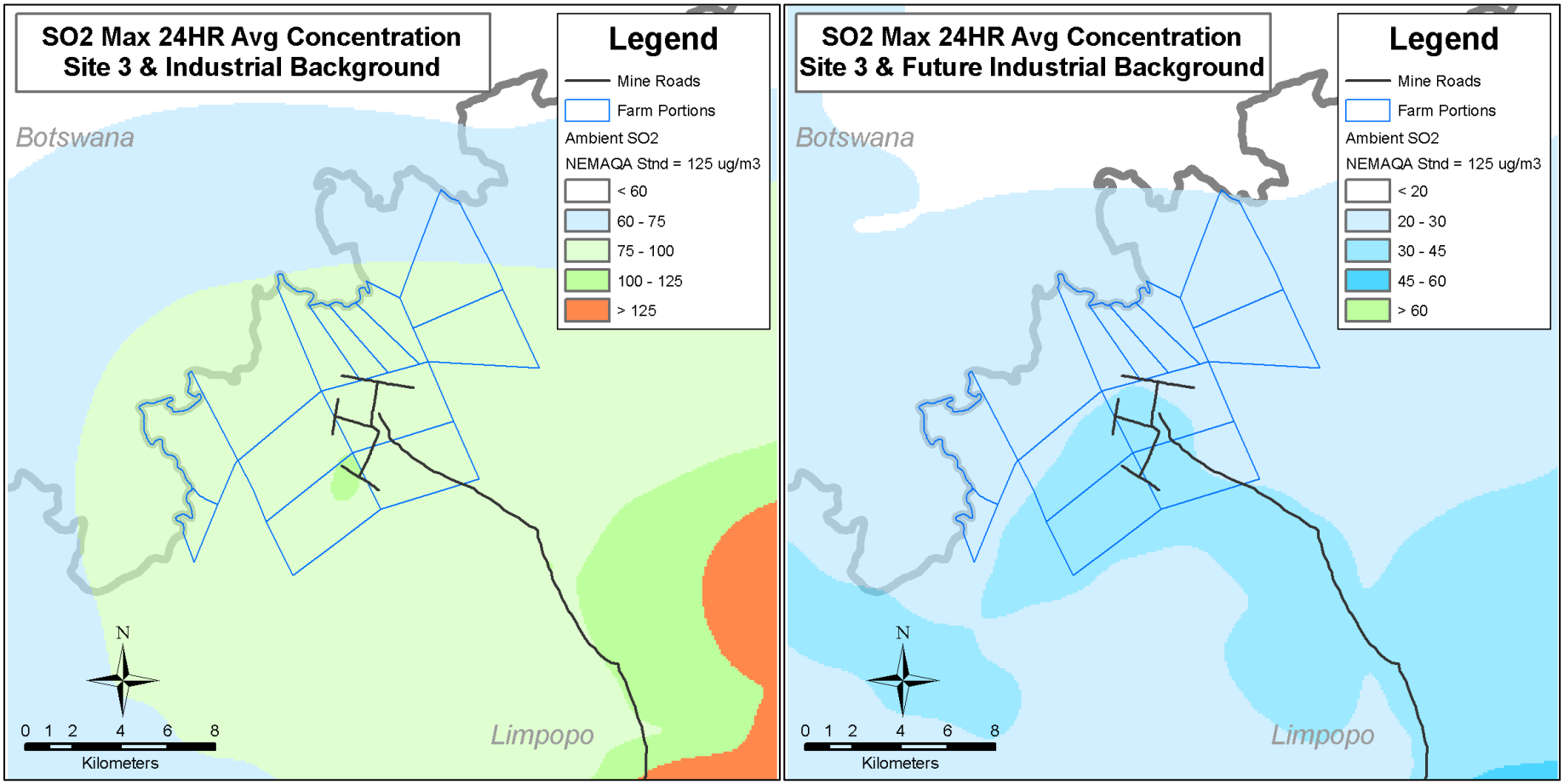

Figure 7-16: Maximum 24 hour average SO_2 concentrations from expected cumulative emissions vs expected cumulative emissions after 2020 reductions

The predicted cumulative effect of the site and background emissions is dominated by background sources; this is evident when comparing the current and post 2020 scenarios in which the footprint of the site emissions is not significantly discernible for the current scenario.

7.5.8 Socio-economic

The Lephalale Municipality is experiencing development of both mining and energy sectors as listed in Section 5.2 of the SIA. In some cases such as the construction of the Medupi Power Station, development has commenced. In other cases the projects have yet to be approved such as Sasol and Exxaro.. Many of the identified impacts of the SIA will be exacerbated due to other developments or planned developments and are therefore known as cumulative impacts. These cumulative impacts are described below.

7.5.8.1 Increase in crime and social Ills

Development in rural areas attracts job seekers who move in hoping to find employment. Development in the Lephalale Municipality has already attracted job seekers to the area. Other potential developments will attract more job seekers and therefore the proposed project will not be solely responsible for the influx of job seekers. The influx of job seekers will therefore be a cumulative impact as a result of a number of developments in the Lephalale Municipality in close proximity to the Boikarabelo Project. This will result in an increase in social ills such as crime, STD's, alcohol and drug abuse. As this impact will occur due to the presence of other development, it is a cumulative impact.

7.5.8.2 Increased pressure on infrastructure

There is potential for a large increase in mining and energy development in the Lephalale Municipality, specifically in close proximity to Lephalale Town and Steenbokpan. Development requires infrastructure such as sanitation, energy and water. Similarly those job seekers moving into the area will need housing and basic services. This will place additional pressure on services within Lephalale Town, Steenbokpan and rural areas within Lephalale Municipality. Additional pressure on these resources will mean that the municipality will have to upgrade these services or consequently not meet the demand. This will have financial and capacity implications for the municipality and may mean that basic services are not available for the local communities. This is a cumulative impact as people will move to the area for other developments as well, either as job seekers or as those already employed by new developments. The farm workers evicted from farms will also be from a variety of farms due to other developments, including mines and power stations.

7.5.8.3 Increase in informal settlements

The Waterberg and Lephalale Municipalities are experiencing a housing backlog. In particular it was evident that Lesedi residents did not have adequate housing. As there are many other mining and energy developments taking place within the Waterberg coal field and the Lephalale Municipality, job seekers will not be attracted by the proposed project

alone but will come due to the all the developments as a whole. Job seekers are likely to settle outside of towns or in informal settlements such as Lesedi, Marapong or other settlements near developments, exacerbating the backlog within the district and local municipalities. This will also exacerbate the indirect impacts of informal settlements and the spread of disease. Therefore this is a cumulative impact due to increased economic activity and development in the wider project area.

7.5.8.4 Decrease in road surface quality and safety

The construction and operation of mines, power stations and other development will require the transport of construction material. The most common and likely form of this transport will be by road. Usually construction material will need to be transported by road in heavy vehicles but there will also be an increase in light vehicles. Therefore there will be an increase in the number of vehicles using the regional and local roads which will increase the degradation of road surfaces. If the mines and power stations work together with municipality to address this impact there is a potential for the quality of roads to improve. If however mining and energy companies do not manage this impact, this will add pressure on the financial and human resource for the local and district municipalities.

The increase in development in the Lephalale Municipality will increase the number of heavy and light vehicles using the regional and local roads. The proposed project will create additional road traffic and will exacerbate the number of vehicles currently using these roads. The deterioration in road surface quality and decrease in safety will therefore not be restricted to the proposed project

7.5.9 Spatial development

The proposed Boikarabelo Project (Coal Mine and Power Station) is situated in the Waterburg Coalfield area. This region is characterised by undisturbed bushveld and agriculture. Currently there is no mining activity in the vicinity of Boikarabelo Coal Mine. However, there are several proposed developments nearby. These developments include:

- Mining of Boikarabelo Extension on the neighbouring farm Koert Louw Zyn Pan 234 LQ;
- Eskom developments on the following sites:
  - Site A consisting of the farms Taaiboschpan 320 LQ, Minnaarspan 322 LQ, Zyferbult 324 LQ, Doornlaagte 353 LQ, Zandheuvel 356 LQ, and Leliefontein 672 LQ;
  - Site B consisting of the farms Mooipan 325 LQ, Pyppan 326 LQ, Schulpadfontein 328 LQ, Rooibokbult 330 LQ, and Knopjesdoorn 351 LQ; and
  - Site C consisting of the farms Vaalboschhoek 285 LQ, Witkop 287 LQ, Giftboschpan 288 LQ, Dwars In De Weg 289 LQ, Haakdoornhoek 333 LQ, and Haakdoornpan 673 LQ.

- Sasol developments on the farms Houwhoek 267 LQ, Geelbult 276 LQ, Dansfontein 282 LQ, Rooiboklaagte 283 LQ, Groote Zwart Bult 290 LQ, and the remaining extent of Slangkop 296 LQ;
- Industrial developments on the remaining extent of Vangpan 294 LQ, portion 1 of Steenbokpan 295 LQ, and portion 1 of Slangkop 296 LQ; and
- Residential developments on the farms Grootdoorn 292 LQ, Theunispan 293 LQ, Oxford 334 LQ, the remaining extent of Zetland 278 LQ, and the remaining extent of Paardevlei 329 LQ.

The combination of these proposed developments will result in high cumulative impacts for the surrounding area. Boikarabelo Coal Mine and the other proposed developments are depicted in Plan 19.

The cumulative impact of the proposed project at hand together with the above mentioned project as well as possible future mining project will result in a significant cumulative impact of the area. It is likely that this area will change from an area where the current economic activities been game farming and tourism to one of mining and industrial development (whether or not the Power Station project proceeds). Future proposed developments must be kept within a demarcated development area in order to minimise the area of disturbance. In the event that this area does expand it would be recommended that an environmental framework be put in place by the provincial authorities to manage the environmental impacts as a whole to help mitigate possible cumulative impact occurring from this development area. As the development area expands it needs to be ensured that buffer zones are placed around conservation areas and that development does not expand into such conservation areas.

Various recommendations have been made in the Limpopo Growth and Development is assist in management of this development area from a more holistic approach. It has been recommended that a Coal and Petrochemical Working Group be formed comprising of major business, labour and government role players within the cluster. Its purpose should be to create a platform for stakeholders to identify and deal with matters at a strategic level. Within the report it is also recommended that a strategic environmental assessment should be undertaken for the entire coal and petrochemical cluster in which the cumulative impacts are assessed. Such a study should be facilitated by LDEDET and a formula for cost-sharing could be agreed upon by the Cluster Working Group. Furthermore it has also been recommended that future zoning of spaces for mega-conservation projects should be agreed with competing land-users, such as agriculture, mining and settlement development agencies (LGDS, 2009.

Plan 19

Boikarabelo Power Station

Proposed Developments for the Area

Movement Corridors	
5	P16/2 - Vaalwater / Ellisras
4	P84/1 - Vaalwater / Ellisras/ Botswana Link
1	R33/N1 - Lephalale Link (1st order corridor)

BOTSWANA

Development Node - Local Service Point

Proposed Development Area 2

Boikarabelo Coal Mine

Proposed Development Area 1

SOUTH AFRICA

Provincial Growth Point

27°10'0"E 27°20'0"E 27°30'0"E 27°40'0"E

23°30'0"S 23°40'0"S 23°50'0"S

Environmental Management Zones	
Zone 1	Protection of the natural vegetation, landscape and rock painting areas, with limited, appropriate tourism
Zone 4	Mining focus areas
Zone 5	Potential large industrial and related activities focus areas
Zone 7	Urbanisation focus areas
Zone 10	Agricultural priority areas with a commercial focus (intensive)
Zone 11	Major infrastructure corridor areas

Legend

- Boikarabelo Coal Mine
- Minor Route
- Secondary / Main Route
- Major Intersections
- International Boundary

Spatial Development Framework

- Industrial Corridor
- Movement Corridor 1 & Tourism and Logistic
- Movement Corridor 4
- Movement Corridor 5
- Road Upgrade - Upgrade to Tare

Environmental Management Zones

- Zone 1
- Zone 4
- Zone 5
- Zone 7
- Zone 10
- Zone 11

Existing & Proposed Developments

- Industrial
- Residential
- Eskom Site A
- Eskom Site B
- Eskom Site C
- Grootegeluk Mine
- Sasol
- Sekoko Proposed Mine
- Temo Coal Mine

resource generation

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 27°E

Ref #: scc.RES1065.201108.074
Revision Number: 3
Date: 24/07/2012

N

0 2.5 5 10 15

Kilometres

1:270 000

8 ENVIRONMENTAL MANAGEMENT PLAN

The success of an EMP is dependent upon the commitment of the organisation, at all levels, to environmental excellence (EPA, 1995). Commitment to structured and effective EMPs will benefit both the organisation's business success and the local communities. This commitment requires that the organisation provides the necessary resources for employee training, reference material and reporting and response procedures.

Senior executives and line managers will be held responsible and accountable for the health and safety of personnel while on duty, as well as the environmental impacts caused by mining activities. The competence of the workforce will be ensured through selection, training and awareness in health, safety and environmental matters. Continuous evaluation measures must be implemented to ensure that performances with regard to social, health and well-being are improved and environmental management is effectively implemented throughout the lifespan of the proposed project. Regular reviews of the company's performance are necessary during and after operations to ensure that procedures are appropriate and to ensure the desired environmental outcomes are being achieved.

The EMP has been described according to the project activities in order to provide an understanding of what objectives and recommended management measures are required to minimise the environmental, socio-economic and cultural/heritage impact arising from these activities. To facilitate implementation and compliance auditing, the EMP has been separated into the various project phases.

8.1 Responsibilities

The holder of the environmental authorisation (Resgen) will be responsible for the implementation of all mitigation and management measures as well as compliance with this EMP (during all phases of the project) by delegating responsibilities to an in house Environmental Manager. The Environmental Manager will work towards compliance with the EMP and will therefore appoint a Contractor's representative, to be responsible for the on-site implementation of the EMP (or relevant sections of the EMP).

The Contractor's representative can be:

- The site agent;
- Site engineer;
- A dedicated environmental officer; or
- An independent consultant.

The Contractor will ensure that the Contractor's Representative is suitably qualified to perform the necessary tasks and is appointed at a level such that he/she can interact effectively with other site contractors, labourers, the Environmental Control Officer (ECO) and the public. The Contractor's Representative ensures that all sub-contractors working under the Contractor abide by the requirements of the EMP.

In the event of the Contractor appointing an Environmental Officer, or officers, their primary role will be to coordinate the environmental management activities of the Contractor on site. The environmental officer may also be required to perform the following roles:

- Support the Environmental Manager & ECO in the monitoring and execution of the EMP by maintaining a permanent presence on site;
- Inspect the site as required to ensure adherence to the management actions of the EMP;
- Complete Site Inspection Forms on a regular basis (e.g. daily or weekly);
- Provide inputs to the regular (e.g. monthly) environment report to be prepared by the ECO;
- Liaise with the construction team on issues relating to implementation of, and compliance with, the EMP;
- Maintain a record of environmental incidents (spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken; and
- Maintain a public complaints register in which all complaints are recorded.

The roles and responsibilities will be defined by the Resgen Environmental Manager prior to the initiation of construction.

The conditions of the authorisation, licence and EMP must be brought to the attention of all persons (employees, workers, consultants, contractors etc.) associated with the undertaking of these activities and the applicant must take such measures that are necessary to bind such persons to the conditions thereof (contracts with penalties for non-compliances).

The licence and authorisation holder or developer can further enforce this by running workshops with all employees in order to raise environmental awareness. These workshops should cover aspects such as fire prevention, strict use of ablution facilities and general duty of care.

Table 8-1: Environmental management plan

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
Noise			
Site clearing, transport of infrastructure and infrastructure assembly as well as construction of ash disposal facility.	To prevent the noise emanating from the construction machinery from impacting on the sensitive receptors.	Related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers. Switching off equipment when not in use. Limiting transport activities to daylight hours. Limiting construction activities to daylight hours where possible. The following could also be included: <u>Equipment noise audits:</u> Standardized noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.	Noise monitoring programme to be followed.
Power generating activities.	To prevent the noise emanating from the power station from impacting on the sensitive receptors.	No additional mitigation is necessary other than the existing boiler casing, steam turbine enclosure, ventilation fan silencers and placing of pumps in enclosures.	Noise and Vibration monitoring.

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
Flora and Fauna			
Site clearing.	Limit the footprint of the disturbed areas. Limit degradation and destruction of natural environment to designated project areas. Initiation of rehabilitation plan from the onset of construction. Restrict alien invasive plant recruitment. Retain biological properties of soil.	Standard construction environmental best practices must be followed in order to minimize as far as possible the impacts of the project on the natural environment. A site specific construction EMP must be developed and implemented by an on-site environmental control officer during construction. This EMP should include the findings of an avifaunal walk through conducted by a qualified ornithologist. In this way the impact can be mitigated to an acceptable level. If any bat roosts are discovered a suitably qualified specialist must be contacted for help in dealing with this. Once a preferred site is decided upon a bat detector can be used in the middle of the site to record a few nights' activity. This will give a good idea of the bat activity on site. This should ideally be done in summer. Make use of existing roads and/or areas and roads designated for the mining operation. Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Save plants of reasonable size and transport to nursery. Removal of vegetation during stripping and dump operation will be minimised to reduce the risk of open areas occurring. Stockpile soil in the correct layers, avoid excessive height, and slope	Development of a rehabilitation plan. Planting of indigenous plants will aid rehabilitation of exposed areas. Nursery plants will ensure quick and effective rehabilitation of the areas post decommissioning. Continuous inspection and management of the removal process to detect issues.

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
Infrastructure Construction and use of Construction Camp.	Avoid impacts to vegetation and soil through spillages and leaks. Limit the negative effects of excessive dust. Limit degradation and destruction of natural environment to designated project areas, avoiding buffer zone of red data plant species. Limit the erosion potential of the site.	Proper maintenance of operating vehicles and regular vehicle inspections. Remove loose earth from the road sides. Periodic spraying of roads with water or dust inhibitor. Keep the footprint of the disturbed area to the minimum and designated areas only, avoiding the red data plant species buffer zone Make use of permeable materials for pavements and walk-ways. Introduce a storm water management programme and create lawns, and indigenous plant areas. It is advisable that the lighting needs of the project be carefully considered and minimal lighting be used if possible. Low pressure sodium lamps are recommended, or UV filters should be fitted to other types of light. This will decrease the attraction of insects and thus to bat species. There should be no large scale lines of lights as these can act as barriers to bat movement. Lights could also attract other.	
Power Plant and Ash Dump.	Limit further loss of Natural Bushveld in the surrounding area of the Power Station. Prevent excess dust creation, that could	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate areas of construction activity. Limit vehicular speed and amount of activity particularly around Ash Dump. Adhere to speed limit when driving.	

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
	spread ash and other unnatural materials which would inhibit plant growth and disturb surrounding ecology. Prevent injury or death of animal species.	Since a typical electrical switch yard or substation contains multiple positions on hardware where birds could be electrocuted, it is recommended that any mitigation be applied reactively only. If an electrocution problem is detected at the site once operational, case specific mitigation can be recommended by an ornithologist. This will be a far more effective utilization of resources than trying to ensure up front that the switch yard is 100% bird friendly. In this case where Red Listed species are unlikely to be at risk, a reactive management approach is deemed adequate.	
Post Construction of Power Station	Reduce areas available for alien infestation. Limit the erosion potential of exposed areas and restore Bushveld ecology. Restore water infiltration, and reduce surface water runoff. Restore water infiltration, and reduce surface water runoff. Avoid spillage of	The footprint of the area disturbed by the mining operation will have natural vegetation restored. Exposed areas will be re-vegetated. Sowing of indigenous grasses and initiating restoration. Appoint a registered specialist to advise on the seeding of indigenous grasses. Re-vegetated areas will form seepage areas which will help aid infiltration. Re-vegetated areas will form seepage areas which will help aid infiltration. The correct and careful handling of the infrastructure housing pollutants and toxicants to prevent spillages and leaks.	

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
	hazardous materials, thereby protecting vegetation and soil.		
Visual			
Clearing of vegetation for Power Station and associated development sites	To keep as much of the vegetation as possible to act as a screen.	Only the minimum amount of vegetation that is required for the servitude and the substation area should be cleared. An effort should be made to ensure that no additional trees are cut down.	Delineate servitude areas and define which trees/clumps of vegetation are absolutely necessary to be cleared
Presence and operation of facilities	To minimise the visual intrusion and exposure of Power Station.	The Power Station should be constructed in such a way that they have as little negative visual impact as possible. Metal structures could be painted with a matt finish and camouflage pattern should be considered in an effort to blend into the Bushveld surroundings.	Use materials that are less visually obtrusive when constructing the Power Station or paint the features with a matt coat/finish.
Demolition of infrastructure and	To minimise the visual intrusion and exposure	Although the means for demolition are fairly standard, once the structures have been demolished the rubble should be transported	Ensure an efficient removal system of

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
management of dangerous materials.	of the transmission line and substation site waste.	quickly and efficiently to the waste site. Trucks and other forms of transportation should therefore collect the towers/lines/rubble as soon as possible after it is decommissioned.	waste rubble as soon as possible after the Power Station is demolished.
Social			
Employment.	Maximise local employment, particularly for those closest to the project site.	Implement measures to increase local eligibility for employment, e.g. providing training and ensuring that contractors employ local people.	Maximise local training and employment. Target to be developed by Resgen.
Site development.	Implement strategies to minimise or prevent informal settlement.	Provide formal accommodation for contract employees. Advertise job opportunities and specifications locally so as to manage expectations.	Make proof of accommodation for contract employees compulsory. Implement HR policy to advertise jobs and specs locally.

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
Infrastructure construction.	Implement strategies to minimise the occurrence of crime and social ills. Maintain road surfaces in order to promote safety on the roads.	Partner with community organisations to monitor crime. Employ local people so that they genuinely benefit from the project. Develop a joint road maintenance fund with other mining companies and local government.	Develop relationships with community organisations. Implement local recruitment strategy.
Use of construction camp	Contain the influx of people into the project area and surrounds.	Accommodate contract staff in a construction camp so as to manage disturbance to local residences.	Make it compulsory for contract staff to live at the construction camp.
All construction activities	Make it possible for local suppliers to be procured by the power station.	Implement a procurement policy for local and HDSA suppliers.	Ensure that staff know how to implement the policy.
All operational activities	Maximise local employment, particularly for those closest to the project site. Make it possible for local	Take a long term approach to employing and training staff from the local area. Implement a procurement policy for local and HDSA suppliers. Contribute to a joint road maintenance fund (established during the construction phase) with other mining companies and local	Maximise local training and employment. Target to be developed by

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
	suppliers to be procured by the power station. Maintain road surfaces in order to promote safety on the roads.	government.	Resgen.
Decommissioning.	Prepare staff and suppliers well in advance for the imminent loss of livelihood from the power station.	Set out policies and procedures to guide staff and suppliers as to how they should engage with the decommissioning process.	Where possible, assist staff and suppliers to find alternative work at other operations of Resgen and provide references.
Groundwater			
Site Clearing.	Ensure clearing takes place above the water table.	Site clearing should take place above the water table. If the area is low-lying and is below the water table, backfill the low-lying area so that the operation takes place above the groundwater table.	Site clearing should take place at least 1 m above the water table.
Coal stockpile.	Ensure contaminants will not seep from the stockpile to the groundwater.	Compact the ground before depositing. Re-vegetate the soil to minimise infiltration. Monitor groundwater to detect any changes in water quality.	Compacted foundation and re-vegetated cover

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
Hydrocarbon spillage from storage or during transportation.	Ensure hydrocarbons are not released or spilled.	All storage areas containing hazardous substances need to be bunded, with the necessary spill prevention and emergency response measures in place. Contain and clean up all spills immediately. Remove contaminated soil and dispose of appropriately. Monitor groundwater to detect any changes in water quality. Apply liners/bunds.	Lined or compacted foundation.
Ash dump.	Ensure contaminants will not seep from the ash dump to the groundwater.	Monitoring of groundwater quality and water levels is recommended with continuous refining and updating of the monitoring network based on the results obtained The compaction of the dump and coal stockyard to minimise or avoid infiltration; Manage the shape of the dump to control the ease with which water can run off from the dump.	Lined or compacted foundation.
Soil			
Site Development.	Ensure effective stripping and storing of the topsoil.	The topsoil should be stripped and stored separately from all other soil stockpiles to prevent mixing. These stockpiles must be clearly marked and mapped for later use in rehabilitation.	Topsoil stockpile <5m high. 500mm of topsoil stripped from all construction areas.
Infrastructure	To store excavated soil	The excavated soil should be stripped and stored separately from all	

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
construction.	from building foundations.	other soil stockpiles to prevent mixing.	
Use of construction camp.	To keep vehicles on roads.	Vehicles should be kept on the roads to minimise damage to the sites.	Road maintenance plan.
Operation of all facilities.	To keep vehicles on roads.	Vehicles should be kept on the roads to minimise damage to the sites.Well marked and maintained roads.	
Waste management.	To minimise and prevent soil pollution by oils	Any spills must be reported and cleaned up using spill kits as soon as possible. Drip trays underneath vehicles must be used in appropriate areas. Parking areas near often visited facilities must be paved.	
Surface Water			
Site Development.	Minimize the disturbed footprint. Minimize siltation from dust deposition and surface water runoff. Minimize the loss of run-off surface water.	Vegetation clearing to be restricted to demarcated sites only. Isolate and fence off topsoil stockpiles with berms and trenches to divert dirty water and clean water separately to the water management facilities.	

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
Infrastructure development.	Restore the surface run-off capture of the catchment. Minimize contamination of surface water resources.	The water associated with the stockpile will be dirty water and therefore has to be channelled and contained in the recycle pond. An ongoing storm water management plan is required that can be regularly reviewed with the progression of the mining operation in order to effectively manage the separation of clean and dirty water.	
Ash Dump	Minimize contamination of clean water	The placement of berms and trenches around the ash dump will improve the separation of dirty and clean water, and these should be constructed as outlined in the GN R 704 of the Water Act. Maximize separation of clean and dirty water on site by placement of berms and trenches around the dirty areas (ash dump, coal stock piles) that will channel the dirty water to the recycle pond, and the clean runoff to the clean catchment. The design, operation and maintenance of a wastewater treatment should be conducted in such a manner that it can accommodate the number of people it is designed to service be in line with stipulated requirements of the GN R 704 of the Water Act. The effluent should be treated to the acceptable levels (quality and temperature) prior to disposal. Due to the stressed nature of the catchment and water scarcity all water must be re-used where possible to decrease the volume of water required on site.	Zero discharge. Water Management Plan.

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
		Lining of the PCD dam floors, maintaining a minimum freeboard of 0.8 m above the full supply level. All PCD's should be able to contain the effects of a flood in a 1:50 year 24 hour storm event. All channels leading the PCDs should be lined with impermeable materials to minimize seepage or leakages of waste slurry.	
Dirty Water Management.	Minimise the loss of run-off surface water. Minimise contamination of surface water resources.	Placement of stockpiles and limestone on hard park areas. Isolating stockpiles (topsoil and overburden) by means of trenches to contain dirty water associated with them and diversion berms to allow the clean water to report to the clean catchment. The water associated with the stockpile will be dirty water and therefore has to be channelled and contained in the recycle pond. An ongoing storm water management plan is required that can be regularly reviewed to effectively manage the separation of clean and dirty water.	
Waste Management.	Minimize contamination of clean water.	The waste sites should be placed on hard park area and isolated from the clean water catchment. Removal vehicles should be covered appropriately to prevent spillages of waste. Hazardous waste should be stored in impermeable containers prior to	Waste Management Plan.

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
		removal from site.	
Sewage Handling.	Minimize contamination of clean water.	The effluent should be treated to the acceptable levels prior to disposal. A zero-discharge approach will be adopted. Inspection of the treatment facility must occur to ensure no leakages or spillages.	Water Management Plan.
Air Quality			
Site development & infrastructure development.	To prevent the dust fallout and particulate matter emitted from the construction activities from impacting on the sensitive receptors.	Working areas will be sprayed with water whenever necessary. Dirt road surfaces, especially those used by heavy vehicles, will be treated with a dust binding agent. The form of dust-binding agent will determine the type of watering; but allowance will be made for sufficient road spraying. Vehicle speeds will be kept below the critical speed required to raise excess dust within the vicinity of the complex. In addition to dust suppression and road watering, good housekeeping measures will be practiced in the project area. Light vehicles and equipment will undergo routine cleaning to remove excess dust.	Dust fallout monitoring programme Fallout dust < 250mg/m2/day > 500m from site. Fallout dust <600mg/m2/day adjacent to construction site.
Power Station.	To control SO_2, NO_x and CO emissions from the	GN 248:2010 must be implemented which will result in a substantial reduction in the impacts.	Air Quality Monitoring

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
	stack	It is recommended that an online stack monitor be implemented at the boiler stack to measure PM, SO_2 and NOx emissions, temperature and oxygen. Annual stack emission testing should be conducted to verify the continuous emissions monitoring system. Install and operate a PM_{10} and $PM_{2.5}$ monitoring station on site prior to the operation of the power station in order to obtain accurate background/baseline data. The fine ash which is entrained in the flue gas and must be captured by high efficiency dust collectors, such as cyclones, bag filters or electrostatic precipitators. Continued use of limestone as an absorbent of SO_2 which reduces the amount of SO_2 emitted in the flue gas. Proper burner maintenance, inspections, operation, or utilizing an oxygen control package are additional methods for the control of the formation of carbon monoxide.	programme (GN1210:2009)
Ash dump	Minimise fugitive dust.	Ensure that the ash being transported to the ash dump has a sufficient moisture content to reduce occurrence of windblown distribution. Ensure ash is compacted on the dump. Dust control on the ash storage dump through the continuous rehabilitation of the areas not actively worked. This can be through rock cladding or any other binding material that will ensure the wind	Rehabilitation Plan

Activity	Objectives	Mitigation/Management measure	Recommended Action Plans
		erosion potential of the ash dump is minimised.	

9 ENVIRONMENTAL RECOMMENDATIONS AND MONITORING

Environmental monitoring will be undertaken for the greater Boikarabelo Coal Mine area which will include the power station. The following recommended monitoring plan is for the greater project area.

9.1 Flora & Fauna

It is recommended that before and during the construction phase an ecological audit is undertaken to ensure that -

- Red Data breeding sites are not within the construction areas. Red Data species should be avoided where possible. If avoidance is not probable then relocation is obligatory.
- All burrowing animals have moved away from the disturbance
- All fauna that might be harmed are relocated

Other mitigation measures can also be applied to prevent or reduce the impact on fauna, during the operational phase. The fact that natural habitat will be lost due to construction and operational activities cannot be avoided, but there is an opportunity to enhance the biodiversity in the area.

In order to achieve these benefits the remaining natural habitat must be managed to enhance its ecological integrity.

On site monitoring must take place to identify negative trends in the ecosystem, adaptive management will then be applied to correct these negative trends, included here are bush encroachment and alien invasive plant species.

Off-site this can be achieved through the establishment of conservancies in the surrounding area where sound conservation values can be practiced and the biodiversity of the area conserved.

On the conservancies the establishment of research facilities, subsidised by the mining company and operated by tertiary institutions must be investigated. By doing this the knowledge of the ecosystem will be enhanced through species and habitat level studies. The linking of these facilities to existing facilities must be researched in order to build partnerships and share information. The local inhabitants must form part of this initiative in order to address not only the biodiversity loss but also the loss of local knowledge.

The on-site effects that the power station and related infrastructure have on the flora of the area can be quantified with continuous monitoring of natural areas on the project site. Such a monitoring program must concentrate on the Red data species management, alien invasive species management, and bush encroachment management. The latter two being the major negative effects on flora apart from total removal. A monitoring program will include seasonal assessments to identify areas where intensive management in the form of bush and alien invasive clearing will have to be applied; furthermore the management of the

red data species will have to take place. Follow up surveys of the identified problem areas will have to be conducted in order to adapt management plans to suit specific areas. Annual monitoring of the effects of the mine and its operations on fauna and flora in the general area must be conducted, this can be accomplished through information sharing with local land owners and surveys conducted on the surrounding farms. Fauna should be monitored annually and flora bi-annually in terms of the seasonal variation.

The major management measure to be employed with regards to the Red data species will be exclusion of all activities within the buffer zone of 40 metres. The buffer zone prescribed was chosen after consideration was given to the health of the current populations of Aloe littoralis, which was positive as the plant is widespread in the xeric savanna woodland. Further consideration was given to the habitat/vegetation type that the plant prefers, which was also widespread and common.

9.2 Aquatic Ecosystem Monitoring

In order to directly measure, assess and report on the health, status and trends of the aquatic ecosystem associated with a particular development, an aquatic monitoring programme is required. An additional purpose of a monitoring program is to assess the compliance of a water-user with the Resource Quality Objectives of the water resource, identified by means of a reserve determination.

To ensure that the future resource quality objectives, to be designated for the catchment, are attained, it is recommended that a responsibility-driven approach towards the management of the aquatic ecosystem associated with the study area be followed. The purpose for such a monitoring strategy will be to examine the long-term environmental trends of the aquatic resources associated with the mining activities in a practical and achievable manner.

The proposed indices for the monitoring strategy include IHI, IHAS, SASS5, FAII and basic *in situ* water chemistry. In addition to this, toxicant screening should also be implemented and where toxicants are identified definitive analysis carried out. The frequency for such a monitoring programme should be implemented bi-annually during the construction and operation phase of the project, and then annually after closure of the mine until rehabilitation of the area is satisfactory. Thereafter, any non-compliance with the Resource Quality Objectives should be identified and mitigated accordingly.

In the unlikely event of any pollution event occurring, the frequency of the monitoring strategy should be adjusted accordingly. This will help to identify the source of the event and mitigation can be formulated accordingly. It is strongly recommended that an assessment of the aquatic ecosystem be conducted as soon as possible after such an event. This will help to identify the magnitude and severity of such an event on the health of the aquatic ecosystem. A follow-up survey should be conducted approximately two months after the event in order to determine the effectiveness of the applied mitigation measures.

9.3 Surface Water Monitoring

9.3.1 Objectives of monitoring programme

To monitor the impact of the mining operations through the continuous analyses of water quality and quantity (where possible).

9.3.2 Monitoring point locations

Surface water monitoring will be conducted at strategically identified locations as follows (Plan 30)

- Upstream of mining operations to determine baseline water quality prior to mining
- Downstream of potential sources of pollution such as downstream decant points
- Downstream of stockpile areas
- Downstream of the mining pits to establish likely pollution to water resources
- Downstream of infrastructures (offices, storage facilities, workshops) where contamination from such facilities is likely to occur, and
- Any other points likely to be impacted upon by the mining/power station activity.

9.3.3 Monitoring frequency

Baseline sampling will be undertaken prior to commencement of construction;

Thereafter, sampling will be conducted monthly during the first year of mining to establish seasonal trends, and

Quarterly sampling will be conducted after the first year of mining if appropriate, although the frequency can be increased depending on the arising impacts from the mining activities of the surface water.

9.4 Groundwater Monitoring

9.4.1 Objectives of the monitoring programme

The main purpose of a monitoring system is concerned with the control of pollution and the migration of hazardous liquids ones mining commence, are to -

- Provide reliable and irrefutable data on the quality and chemical composition of both surface and groundwater;
- Detect and quantify the presence and seriousness of any polluting substances in the surface and groundwater at the very earliest stage possible;
- Detect the possible release or impending release of contaminants from the opencast mine works;

- Provide a rational comparison between the predicted and actual flow and solute transport rates; and
- Provide an ongoing and reliable performance record for the design and control system(s) for effectively controlling pollution.

9.4.2 Monitoring location and frequency

The proposed location of monitoring boreholes and surface water points at Boikarabelo Coal Mine was determined after a detailed hydrocensus was conducted as part of the EIA-EMP. Two surface water monitoring points have been identified and twelve groundwater points that will give a good representative of the hydrological and geohydrological conditions at the area of interest (Plan 20).

Groundwater points should be sampled every three months initially (quarterly) and depending on the results a medium to long term sampling frequency can be decided on. Electric Conductivity, pH and temperature should preferably be sampled continually by means of a logger. When sampling for chemistry, pumping should occur to remove at least 3 times the volume of the borehole/well to get an indication of the aquifer chemistry.

Once the data has been collected, it is important to ensure that the data is stored in a suitable database system (WISH) that is flexible enough to cater for anticipated future requirements and future additions/refinements to the monitoring program.

Quarterly Monitoring reports should be completed; this will help to recognize any pollution that may occur as soon as possible. An annual monitoring report should be compiled and submitted to the relevant authorities.

9.5 Noise Monitoring

It is recommended that the monitoring plan be implemented to determine potential sources of noise, increases and decreases in noise levels, and determine level of mitigation required. Components to be included in the proposed monitoring plan are discussed below.

Baseline noise monitoring is to be conducted on a monthly basis throughout the construction phase and during the first year of the operational phase to determine the impact of the noise levels on the relevant receptors as well as determine the level of mitigation required. Once it is established that the mitigation measures have decreased the specific noise levels from the mining activities, the noise monitoring should be carried out on a bi-annual basis thereafter throughout the life of mine. A report must be compiled monthly/quarterly, depending on the intervals of the monitoring programme then submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. The measurement points must take into account noise sensitive receptors, such as farmsteads, schools, hospitals, churches etc. and only sensitive areas within a radius of two kilometres from the mining activities will be taken into account. The reason for the two kilometre buffer zone is in accordance to the Concawe method (SANS 10357) of calculating noise propagation. At each

measurement point the ambient noise level will be sampled in terms of the following parameters:

The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.

Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00).

9.6 Air Quality Monitoring

Based on the predicted impacts on the surrounding environment it is recommended that ambient PM_{10} monitoring be done and a dust fallout monitoring network established as soon as possible. A dust fallout and PM_{10} monitoring network can serve to meet various objectives, such as:

- Compliance monitoring
- Validate dispersion model results
- Use as input for health risk assessment
- Assist in source apportionment
- Temporal trend analysis
- Spatial trend analysis
- Source quantification
- Tracking progress made by control measures.

9.6.1 Dust fallout monitoring network

It is imperative that the dust fallout monitoring network be established before the start of any mining activities in view of the uncertainty regarding predicted dust-fall impacts. This will aid in the management of potential impacts as well as inform a possible relocation schedule.

It is recommended that a dust fallout network comprising of at least 5 single dust fallout buckets be established on mining area boundaries to conservatively determine impact on adjacent properties.

Dust deposition measurement should be carried out by method ASTM 1739- 98 recommended in SANS 1929-2004. This involves exposure of a standard bucket for a month, with weighing (and chemical analysis, if necessary) of the dust collected. Again, the changing of the bucket can be done by on-site personnel while the weighing can be carried out at a suitable off-site or on-site laboratory.

The single bucket dust monitors are deployed following the American Society for Testing and Materials standard method for collection and analysis of dust-fall (ASTM D1739). This method employs a simple device consisting of a cylindrical 5 L container half-filled with de-ionised water exposed for one calendar month (30 ±3 days). The water is treated with an

inorganic biocide to prevent algal growth in the buckets. The most common reagent used for this is a 10% copper sulphate solution (approximately 3 ml per liter of water bucket).

The bucket stand comprises a ring that is raised above the rim of the bucket to prevent contamination from perching birds as well as a wind shield. The bucket holder is connected to a 2.1 m galvanized steel pole, which is either directly attached to a fence post or can be attached to a galvanized steel base plate, which is buried to a depth of 500 mm. This allows for a variety of placement options for the fallout samplers. Analysis of the contents of the bucket involves rinsing with deionised water to remove residue from the sides of the bucket, and the bucket contents filtered through a coarse (>1 mm) filter to remove insects and other course organic detritus. The sample is then filtered through a pre-weighed paper filter to remove the insoluble fraction, or dust fallout. This residue and filter are dried, and gravimetrically analysed to determine the insoluble fraction (dust fallout).

9.6.2 PM_{10} Monitoring

Based on predicted impacts and considering the prevalent wind direction recorded in the area it is recommended that the PM_{10} ambient monitoring be done at least one location around the proposed mine, preferably to the west. It is essential that the monitoring station also record basic hourly average meteorological parameters namely wind speed (at the standard elevation of 10 m above ground level), wind direction, temperature and rainfall. It is however recommended that relative humidity, pressure and solar radiation also be measured, as the apparatus is relatively cheap and the information will contribute materially to future dispersion studies.

The most suitable sampler type depends on the specific objectives of monitoring. Pertinent monitoring objectives in the case of the proposed Boikarabelo mining operation are expected to include: on-going compliance evaluation, on-going estimation of contribution to airborne particulate concentrations, and evaluation of the effectiveness of dust control measures implemented at the mine.

Plan 20

Boikarabelo Power Station

Proposed Environmental Monitoring Points

Legend

- Noise Monitoring Points
- Biomonitoring Points
- Dust Buckets
- Electronic Logger Boreholes
- Groundwater Monitoring Points
- Surface Water Monitoring Points
- Project Area
- Mining Right Boundary
- Power Station Infrastructure
- Main Road
- Secondary Road
- Minor Road
- Track
- Contour (20m)
- Non-perennial Stream
- Perennial Stream
- Dam / Lake
- Perennial Pan
- Non-Perennial Pan / Stream
- Wetland
- Farm Boundaries
- International Boundary

resource generation

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 27°E

Ref #: scc.RES1065.201207.110
Revision Number: 2
Date: 03/09/2012

N

0 0.5 1 2 3

Kilometres

1:70 000

9.7 Archaeological and Heritage Monitoring

Ideally, site monitoring should be conducted by an experienced and qualified archaeologist or heritage specialist. However, due to human resource and often budget constraints, this may not be a viable option. The following may be implemented to ensure an adequate degree of competence in site monitoring by Environmental Officers or other responsible persons takes place.

Induction training: Responsible staff identified by Resgen should attend a short course on heritage management and identification of heritage resources. It is assumed that this person/s will be the Environmental Officer/s (EO);

Site monitoring and watching brief: as most heritage resources occur subsurface, all earth moving activities must be monitored to record any resources accidentally exposed. The largest environmental impact on heritage resources is the initial soil stripping or earthworks associated during construction. The EO should monitor all such activities on a daily basis. In the event that any heritage resources are found, all work should be immediately suspended in that area. The EO must contact the relevant authorities, archaeologist or heritage specialist and where possible, the local museum. In the event of human remains being exposed, the local police department must be informed immediately; and

An archaeological assessment must be conducted on the affected site by a qualified archaeologist. This may include analyses by relevant specialists. Sites of significance will be assessed and documented for records. Recommendations may be made for further studies.

9.8 EIA/EMP Performance Assessments

Performance assessments will be conducted by professional consultants on an annual basis throughout the life of mine, to monitor performance compliance to the EIA and EMP process and the rehabilitation process and advice on any mitigation measures which need to be added to the existing programmes.

An assessment of compliance to applicable legislation will be included in the assessment and will take into consideration the management principles and strategies stated in the EMP, and assess whether this strategy is providing the required results. Any flaws found in the EMP process will be included in the report along with the recommended mitigation measures.

A report will be compiled on an annual basis to mine management, who may then decide the appropriate actions to be taken, along with an updated financial provision.

10 WASTE MANAGEMENT PLAN

The waste generated will be managed in line with the mines waste management plan for continuity. The following is based on the waste management plan proposed for the Boikarabelo Coal Mine

10.1 Waste Handling

The effective management of the waste streams can be achieved if the following waste management procedures are followed for each waste stream. The three major areas for the flow of waste are:

10.1.1 The Activity Area

The activity areas, are areas within each of the facilities at Boikarabelo Coal Mine where waste is generated.

In order to facilitate waste disposal and separation at source (where required), each activity area must have a designated waste storage area. The storage areas are to be demarcated and designed in accordance with the relevant waste management procedure

10.1.2 Central Waste Collection Site

Central waste collection sites are to be positioned to function as collection areas from the various activity areas. At the central collection sites, waste from the activity areas will be transferred into larger waste containers (e.g. wheelie bins or skips).

Each central collection area should include a demarcated area for the placement of waste containers (e.g. bins and skips) and must include areas for all the waste types generated at the facility. Each waste collection area is to be signposted as a ‘waste collection site’ and designed and demarcated according to each waste type (colour coded and labelled) in accordance with the procedure for each waste type generated at the respective generation point e.g. impermeable bunding at waste collection points where used oil waste is placed.

10.1.3 Waste Transfer Site

The Waste Transfer Site (WTS) is a proposed facility that will be a strategically located consolidation point for waste from the various collection areas.

Figure 10-1 shows the recommended flow of waste a to ensure effective management.

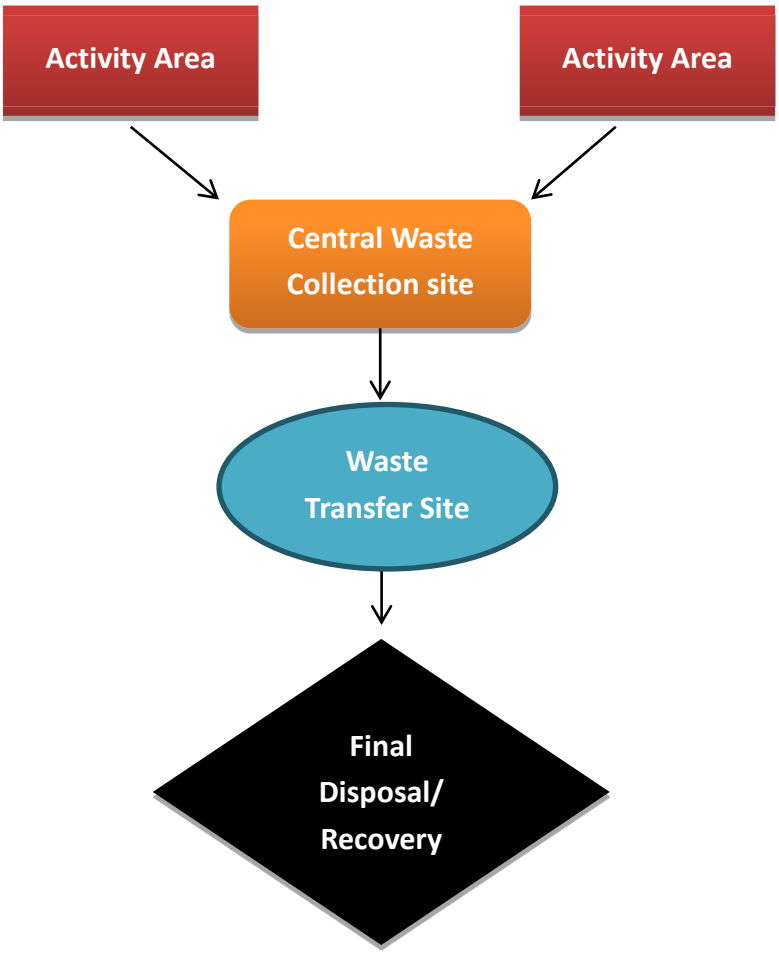

Figure 10-1: Waste management flow diagram

10.2 Waste Management

Waste management of each waste type is described below (Table 10-1 to Table 10-5).

The following section describes the types of waste expected from the operation, what waste management equipment is needed, handling at each site as well as the final disposal site per waste stream.

It will need to be investigated in the use of the small volume of sewage sludge processed for rehabilitation.

Table 10-1: General waste management

General Waste	
Consistency	Non-recyclable general waste; Garden refuge Food waste; and Kitchen Fats.
Materials Needed	Standard bins, Black bags, Green Wheelie bins labelled 'GENERAL WASTE', and Skips labelled 'GENERAL WASTE"
Handling at source	General domestic waste to be disposed of in standard bins with black bag lining. Once full, general cleaning staff to empty these bins into Green Wheelie Bins (on concrete bases) at the waste collection area
Handling at central waste collection site	Once the wheelie bins are full, these are to be Transferred to the onsite general landfill.
Final disposal	The general waste is to be collected by the waste management contractor and disposed of at the onsite landfill weekly.

Table 10-2: General industrial waste

General Industrial Waste	
Consistency	Metal Waste; Rubber Waste; Wood waste; and Reusable Waste
Materials Needed	Blue Wheelie bins labelled 'GENERAL INDUSTRIAL WASTE'; and Skips labelled 'GENERAL INDUSTRIAL WASTE'
Handling at source	Disposal to blue wheelie bins or directly into blue skips. Clearly labelled 'GENERAL INDUSTRIAL WASTE'
Handling at central waste collection site	Full wheelie 'GENERAL INDUSTRIAL WASTE' bins to be emptied into the nearest blue 'GENERAL INDUSTRIAL WASTE' waste skip. Waste skips are to be loaded and secured prior to transfer to the WTS. (Contractor to check levels three times per week).
Handling at waste transfer site	Tipped and separated into: Metal (separate grades); Wood, rubber, and refurbishables; and Non-recoverable materials
Final disposal	Metal –To be collected by scrap merchant for reprocessing; Rubber, and wood- collected by recycling contractor; Refurbishable materials- to refurbishment area. Non-Recoverable Material- general on-site or off-site landfill.

Table 10-3: Recyclable waste

Recyclable Waste	
Consistency	Paper, cardboard, plastic, tin
Materials Needed	General bins labelled 'RECYCABLE WASTE' and Orange Wheelie bins labelled ' RECYCABLE WASTE'
Handling at source	Disposal to standard bins marked “RECYCABLE ". (No need for lining)
Handling at central waste collection site	Full bins to the nearest yellow wheelie bins, Labelled RECYCABLE WASTE (Daily). Full wheelie bins to be collected directly by waste recycling contractor.

Table 10-4: Used oil waste

Used Oil Waste (liquid)	
Consistency	Used liquid; Used Lubricant; Hydraulic Oils; and Hydrocarbon based solvents
Materials Needed	Red Steel Drums, labelled 'HAZARDOUS WASTE- USED OIL'.
Handling at source	Disposal to labelled red steel drums (Contractor to inspect levels weekly). Full used oil containers offloaded in the designated used oil waste storage area.
Handling at waste transfer site	Used oil waste should be pumped directly from the used oil waste containers to the waste oil collection vehicle.
Final disposal	Sell to contractor / recycle.

Table 10-5: Oil contaminated waste management

Oil Contaminated Waste (Solids)	
Consistency	Contaminated soil; Oil contaminated cloths; Empty oil and/or grease containers; All oil contaminated solids; Batteries- Nickel Cadmium rechargeable or 'secondary' batteries and Lead automotive, commercial, truck and industrial batteries.
Materials Needed	Red Wheelie Bins, labelled 'HAZARDOUS WASTE', Red waste skips, labelled "HAZARDOUS WASTE'
Handling at source	Disposal to labelled red wheelie bins (contractor to inspect levels weekly). Full used oil containers offloaded in the designated used oil waste storage area. Batteries- Placed directly into small sized containers (e.g. lidded 5 litre buckets).
Handling at central waste collection site	Full wheelie bins to be emptied into sealed and lidded, labelled red waste skip.
Handling at waste transfer site	Waste skips offloaded in the designated oil contaminated waste storage area.
Final disposal	Hazardous Landfill (H:h or H:H) Batteries- Recycling contractor /Hazardous Landfill (H:h or H:H)

11 HEALTH AND SAFETY

A comprehensive Occupational, Health & Safety (OH&S) plan will be developed before commencement of operations to ensure the well-being of all staff in the workplace. It is intended that this plan will not only deal with occupational health issues, but will aim at world's best practice levels of safety in terms of minimal medical treatments and zero lost time injuries. Part of this plan will be the implementation of general safe working standards and appropriate training in safe work practices for all staff.

Special attention during the mobilization period will be necessary to achieve the required standard and inculcate a safety culture; during the commissioning phase when the Operations and Maintenance contractor commences at the site, standards for safe working will be required which are consistent with good industry practice.

A fully equipped first aid facility will be considered. It is recommended that an integrated approach be developed with the mine project for joint response to serious emergencies. In recognition of the special risks involving the power station, comprehensive standards and training packages will be developed, and competencies developed and tested for the following areas:

- Safety Rules and Safe Working Practices for Work on High Voltage equipment,
- Safety Rules for Work on Low Voltage or Mechanical Plant requiring isolation for maintenance,
- Safety Requirements for Entry into Confined Spaces,
- Safety Requirements for Performing Hot Work, and
- Safety Requirements for Working on Elevated Platforms
- Only those persons who can demonstrate competency will be certificated to work or control work in these areas.

12 LIMITATIONS

12.1 Visual

The Viewshed analysis does not take into account the vegetation or man-made structures that are present in the area or that will be developed or constructed for other projects, and the visibility of the proposed routes and substations is therefore a worst case scenario.

12.2 Air Quality

Upon investigation of the modelled wind speeds it became clear that the meso-scale (WRF) and consequently the micro-scale model (CALMET) were over predicting wind speeds in the study domain. To remedy the situation further meso-scale data was acquired from an external source, Lakes Environmental. Lakes Environmental developed the Calpuff View software package and provide 5th generation Meso-scale Model (MM5) global data

expressly for dispersion modelling purposes. Calmet was rerun with the MM5 data (predecessor to WRF) and wind speeds were shown to be lower than WRF-Calmet results (Figure 12-1). However, wind speeds were still over predicted for the study domain. The MM5 dispersion model results did not show a significant difference in pollutant concentrations and was therefore not implemented for all scenarios . Thus, all results are from WRF-Calmet derived wind speeds.

The implications of increased wind speed is evident in Figure 12-1 where the impact of Matimba power station extends further than expected, implying elevated background concentrations at the proposed site.

Comparison of measured ambient results versus modelled shows that modelled results clearly over predict ambient impact from the Matimba power station (Figure 12-2). It is thus concluded that the results for the proposed site are indicative of a worst case and are expected to over-predict rather than under-predict ambient impact. Modelled concentrations from the proposed site indicate that concentrations fall well within the limits of ambient air standards .

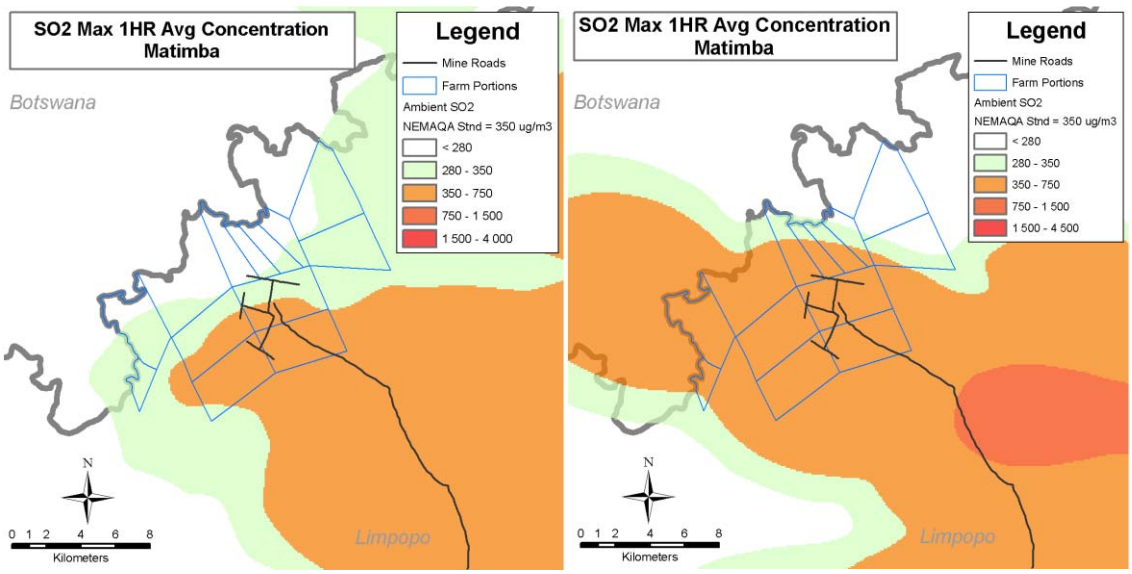

Figure 12-1: Calpuff results using WRF-Calmet and MM5-Calmet for Matimba power station only.

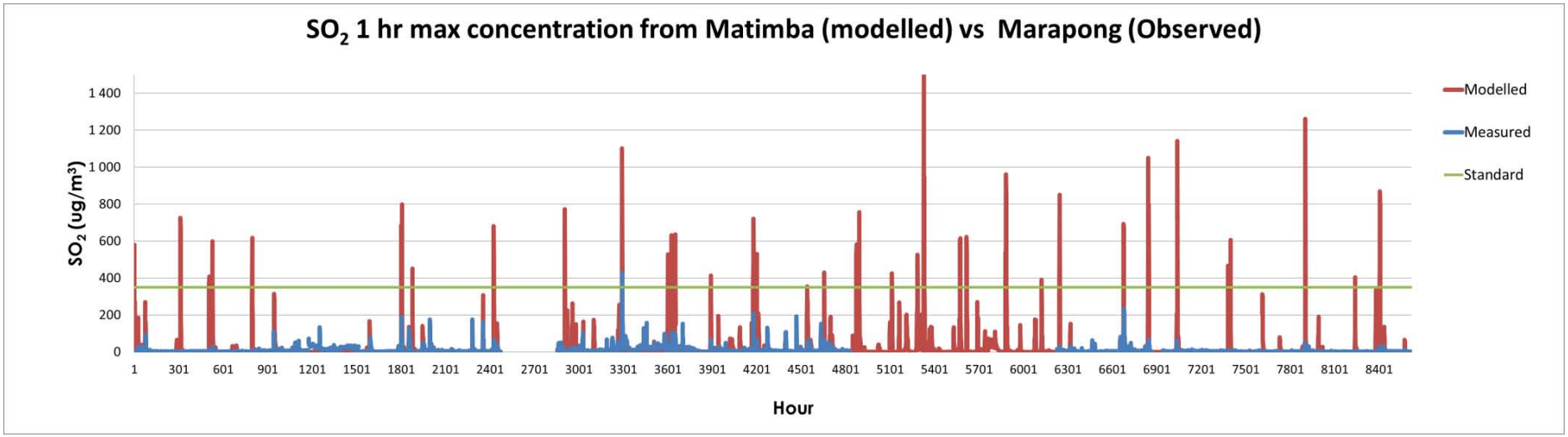

Figure 12-2: Comparison of calpuff (Matimba only) and observed (Marapong) SO2 hourly concentrations shows that the model is over predicting the impact of the power station

13 CONCLUSION

The proposed Boikarabelo Power Station will initially provide power to the Boikarabelo Coal Mine by developing a 45MW coal power station. As the development will occur in the in the area of disturbance of the proposed coal mine the initial impact of the development of power station will have little effect on the receiving environment, however it will increase the cumulative impact of the project collectively. The most significant impact of the proposed development will be the reduction of air quality due to the release of emissions into the atmosphere. The environmental management of the proposed power station must be undertaken in conjunction of that of the mine in order to have an integrated management system.

The proposed power station is required to ensure the optimal operation of the Boikarabelo Coal Mine. Since the onset of the project, Resgen has been able to secure an initial supply from Eskom, however this supply is not sufficient for the full operation of the processing plant as well as the use of electrical mining shovels. The preferred option would be to obtain a sufficient supply from the Nation grid which will allow for the optimal operation of the mine. Resgen requires a stable source of power to ensure optimal operation of the mine. The construction of the power station will ensure the continued viability of the mine and ensure stability of employment for local workers, to continue to support the local economy.

Appendix A: Ash Classification

Appendix B: Ash Dump Design Report

Appendix C: Soils

Appendix D: Fauna and Flora

Appendix E: Avifuna Report

Appendix F: Bat Study

Appendix G: Hydrology & Monitoring Reports

Appendix H: Hydrogeology Report

Appendix I: Noise Assessment

Appendix J: Air Quality Impact Assessment

Appendix K: Visual Impact Assessment

Appendix L: SAHRA Permits

Appendix M: Traffic Assessment

Appendix N: Socio Impact Assessment

Appendix O: Sustainability Report

Appendix P: Impact Matrix

Appendix Q: PPP